AEOLIAN SCRIPTS
NEW IDEAS ON THE LITHIC WORLD
STUDIES IN HONOUR OF VIOLA T. DOBOSI

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EDITED BY
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FOUR AND A HALF DECADES TOGETHER IN THE HUNGARIAN NATIONAL MUSEUM, NEAR AND FAR

TIBOR KOVÁCS†

As we proceed in time and increase our wealth of knowledge, humanity attempts to know more about the universe and the role of man within.

Thousands of specialists, researchers capable of looking at the totality as a whole pose questions, waiting for the answer from themselves and from others. This is a world-wide process, fortunately, unstoppable, sometimes pursued on high standards, sometimes just a farce.

It is gratifying to know that Hungarian research is claiming a space for itself in this 'versatile terrain'. What is it worth? In fact we do not know; the same as we cannot follow how the ideas and results of a fellow Hungarian researcher are used, by whom, where and how. The same relates to Viola T. Dobosi, whose professional partners, close and distant scholarly friends and students compiled this precious volume as a tribute to her scientific achievements, museological activity and not the least, human qualities.

The wide range of professional qualifications of Viola T. Dobosi, her universal openness and high standards had raised her above the average 'just diligently working' colleagues. Just a few data to support this opinion is mentioned below.

Her university thesis was prepared on the basis of the stone artefacts of the world-famous Late Neolithic settlement Zengővárkony. Her doctoral dissertation was the evaluation of the bone tools found at the Vértesszőlős Lower Palaeolithic site. Her professional career was started as student and associate of László Vértes, a prominent personality in Hungarian Palaeolithic research. His complex approach to prehistoric problems and the methodology he applied had a lasting effect on the theme selection and subsequent professional activity of Viola T. Dobosi.

One of the possible highlights of her work is undoubtedly the 'Vértesszőlős monograph', written together with a wide range of excellent scholars and edited in co-operation with Miklós Kretzoi.[1]

Obviously, Viola is not a 'dryasdust'. She has completed, according to a deliberate professional plan, scores of excavations up to quite recent times and many surveys and colleting trips. Some of her most prominent excavation sites are: Madaras, Bodrogkeresztúr, Mogyorósbánya, the Jászság region, the environs of Pilismarót and Tata-Porhanyó.

For over two decades she has been actively involved, together with Katalin T. Biró, in collecting and publishing a comparative collection of raw materials over large areas.[2]

Following the best traditions of Hungarian Palaeolithic archaeology, interdisciplinary research and its system of connections is highly represented in the oeuvre by Viola T. Dobosi. This is still the main feature of her role in her scientific and public organising activities, as deputy leader of the Archaeological Department, later on the director of the extended Department. The author of this short introduction has to acknowledge her invaluable help in this respect. She undertook this task on my personal request, and was my real partner even in the most difficult issues.

The most important, however, were always the informal conversations, chattering over a cup of coffee or wine, when we had a reason to celebrate, e.g. the publication of a new book or some important family event.

In such instances we could feast together, old and young colleagues, opening their minds and the representatives of different generations could seamlessly pass the baton, which could be probably the strongest

[1] T. DOBOSI, V.: Description of the archaeological material. In: KRETZOI, M.–T. DOBOSI, V. (ed.): Vértesszőlős, Man, Site and Culture. Budapest 1990. 311–395.

[2] T. BIRÓ, K.–T. DOBOSI, V.: Lithotheca. Comparative raw material collection of the Hungarian National Museum. Budapest, 1991. 1–268.

bond within the Hungarian National Museum, up till our days and hopefully in the future as well.

We all wish further successful work to Viola T. Dobosi, also as member of international professional bodies like the International Quaternary Association and its Hungarian regional committee (INQUA MNB) and the Union of Proto-and Prehistoric Research (UISPP Commission 8 / Upper Palaeolithic).

A MODERN CARYATID: VIOLA T. DOBOSI

GÁBOR TOMKA

On the façade of the Hungarian National Museum, white columns support the triangle of arts and sciences. In fact, it is not the white columns that uphold the Museum but the individual researchers, scientists. Those who have consecrated their life's work to the accumulation of tiny bits of knowledge, putting them together, synthesizing art and history and sharing them with the public, both as scholarly information and basic elements of everyday knowledge.

As she works among us in her emblematic white lab coat, dr. Viola T. Dobosi (the 'T.' stands for her married name, Mrs Gyula Tolnai), is one such pillar of the Hungarian National Museum.

Her complete *oeuvre* is closely connected to this Museum. She began her professional career as a trainee in the here and has climbed nearly all the rungs of the career ladder. After her retirement, she has continued to serve the museum actively, continuing her scientific research.

Specialised in much younger archaeological periods I have always looked with respectful admiration at scholars dealing with the Palaeolithic period, archaeologists who measure time in ten-thousands, sometimes hundred-thousand years.

Viola T. Dobosi has set a standard to all of us. She has shown how using a sequence of acute observations, careful interdisciplinary analyses and stringent iron logic we can reconstruct worlds on the basis of minimal archaeological traces. Her diverse professional activity covered most geographical regions in Hungary, the Transdanubian Mid-Mountains, the valleys and hills of the Northern Mid-Mountains, the northern and southern margins of the Great Hungarian Plain (Alföld), even the Southern parts of the Alföld. Her dedicated excavation work recovered, among many wonderful sites, a major surface of the 19,000 years old settlement at Mogyorósbánya–Újfalusi-dombok. The unique richness of the 16,000 years old hunters' camp at Esztergom–Gyurgyalag is another reward for her decades of intensive research.

Viola T. Dobosi has set an example for generations of archaeologists not only in the field but also in the evaluation of finds and their scientific publication.

Her contribution to the scientific aspects of archaeology is manifested in a series of smaller and larger monographs, most of them published in English to render them accessible to the international research community as well. She has been an active and esteemed member of international bodies and associations related to Palaeolithic studies and set guidelines in the constructive application of interdisciplinary methods in archaeology. Using scientific methods for dating, sedimentology, petrography and palaeontology in the service of archaeological interpretation was evident to her. Her interest began at a time when interdisciplinary research in archaeology belonged to the privileges of a few. From a methodological point of view it is necessary to mention the application of mathematical and statistical methods in the analysis of the Palaeolithic finds. She also initiated the scientific study of raw materials of stone artefacts. Another pioneering work was the analysis of Lower Palaeolithic bone tools from Vértesszőlős, elaborated in the manner traditionally used in the study of lithic artefacts.

In addition to the minutious scientific studies, Viola T. Dobosi has always paid special attention to the information disseminated to the general public. Exhibition guides and the popular booklet on Palaeolithic sites in the valley of the Által-ér (a right bank tributary of the Danube near Tata) are wonderful examples demonstrating that the task of the archaeologist does end with excavation and cataloguing the artefacts. Archaeologists are also responsible for conveying scholarly information to the widest possible audience in a subtle but comprehensible manner.

Work at the world-famous site of Vértesszőlős has accompanied her life: she participated in the excavations personally and had the lion's share in the publication of the site monograph as one of the editors and authors. She has conscientiously managed the *in situ* open-air exhibition for over forty years, often in the face of unworthy circumstances.

Viola served as head of the Archaeological Department (including the Prehistoric, Roman and Migration period collections at that time) between 2004 to 2011. Following the re-organisation of the Hungarian National Museum she has undertaken the task of directing the extended Archaeological Department, incorporating the Mediaeval Department as well. As a junior colleague supervised by her I could personally experience her human as well as managing qualities. Her perfectionism was apparent even in undertaking administrative duties; in spite of its large size, the Archaeological Department became one of the most precisely operated units of the Hungarian National Museum. Her official duties were performed with the same meticulous orderliness that characterise her scientific achievements and even the clear-cut disposition of her working room.

Viola has a special talent for an extremely simple, clear way of approaching problems; taking into consideration the opinion of colleagues and applying an ample dose of empathy for those who work for, and with, her. These qualities have ensured that she has always been not only a useful but also a beloved head of the Archaeological Department.

This volume is a tribute for the scholar investigating the roots of Humankind: but we honour not only the scientist, but also the person.

Dear Viola, we all wish you a continuation of successful scholarly activity, good health, much happiness in your life and family. We count on your honourable presence and magnanimous help for a long time in the Hungarian National Museum.

Budapest, 15.10. 2014.

NEANDERTHALS AT THE SOUTH-EASTERNMOST EDGE: THE SPREAD OF LEVALLOIS MOUSTERIAN IN THE INDIAN SUBCONTINENT

PAOLO BIAGI – ELISABETTA STARNINI

Keywords: *Levallois Mousterian, Middle Palaeolithic, Homo neanderthalensis dispersal, Sindh, Indian Subcontinent*

Preface

Several main intriguing questions are of major interest studying the prehistory of the early humans. After the spread of *Homo ergaster* from Africa northwards into Europe, and eastwards into Asia,[1] the next challenging enigma regards the dispersion of Neanderthals from Europe to the east. Despite the fact that skeletal remains of *Homo neanderthalensis* are rare in Central Asia[2], the Levallois Mousterian lithic technology[3] that characterises the Middle Palaeolithic chipped stone industries produced by Neanderthals and, regarding the Levant, also by early modern humans,[4] is known indeed, starting from the Iberian Peninsula, to Siberia and China.[5]

Anatomical distinctiveness and relative early divergence from other *Homo sp*., supported by mtDNA evidence, suggest that Neanderthal lineage probably began its evolution as far back as 600 ky ago,[6] although classical Neanderthals are considered only those living during the last Ice Age in Europe, from roughly 100 ky to 35 ky ago, or more broadly in Eurasia from some 200 ky, "*before mysteriously disappearing some 28,000 years ago*".[7] At present the Mousterian assemblages thought to have been produced by Neanderthals have been subdivided into 20 different facies.[8]

According to recent climatic reconstruction,[9] during the Pre-Hengelo cold/dry events of the OIS 3, southern Europe was covered with a grass steppe. This means that two main routes were possibly utilised by human groups living in Europe to reach the easternmost Eurasian regions and the Indian Subcontinent: the land bridge connecting the Balkans to Anatolia, and/or the corridor along the northern Black Sea shore, although also a southern route, across the plain of the -at that time dissected Persian/Arabian Gulf,[10] should be taken into consideration, given the increasing evidence of Palaeolithic discoveries along the Yemen-Oman coastal belt,[11] which suggest that the Middle Palaeolithic human dispersal was much more complicated than previously suggested.[12] However, a question mark constantly recurs on the maps depicting our current knowledge of the Indian Subcontinent[13] in relationship to the spread of *Homo sp*.

The present paper is an attempt to discuss the current evidence of human occupation in a region of the Indian Subcontinent, the Lower Sindh (Pakistan) during the Middle Pleistocene, which is demonstrated by the recovery of chipped stone assemblages with evident Levallois Mousterian characteristics (***Fig. 3.***).[14]

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[1] CAVALLI SFORZA–PIEVANI 2013.
[2] VIOLA 2009.
[3] SELLET 1995.
[4] SHEA 2006; BAR-YOSEF 2006, 317.
[5] BAR-YOSEF–PILBEAM 2000; BAR-YOSEF–WANG 2012
[6] KRINGS et al. 1997.
[7] ZILHÃO 2010a.
[8] CLARK–RIEL-SALVATORE 2006, Table 1.
[9] DAVIES et al. 2000.
[10] ROSE 2007; ARMITAGE et al. 2011.
[11] ROSE 2004; AMIRKHANOV 2006.
[12] PETRAGLIA 2007; SCERRI et al. 2014.
[13] HENKE 2006, Abb. 4.
[14] BIAGI–STARNINI 2014.

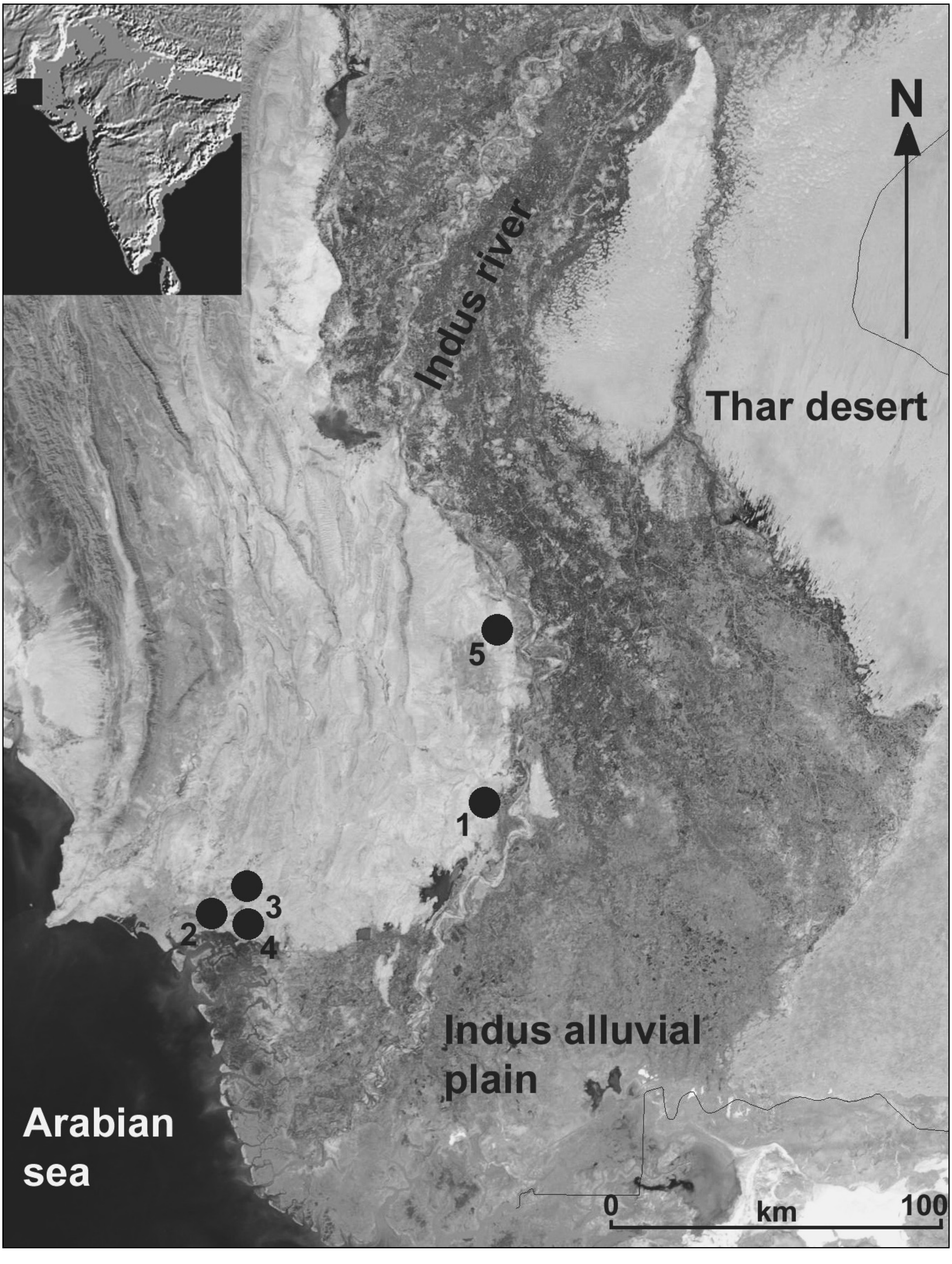

Fig. 1. *Distribution map of the Levallois Mousterian sites, or single tools, so far discovered in Lower Sindh. Ongar (1), Mulri Hills, Karachi (2), Deh Konkar (3), Landhi (4), Arzi Got (5)*

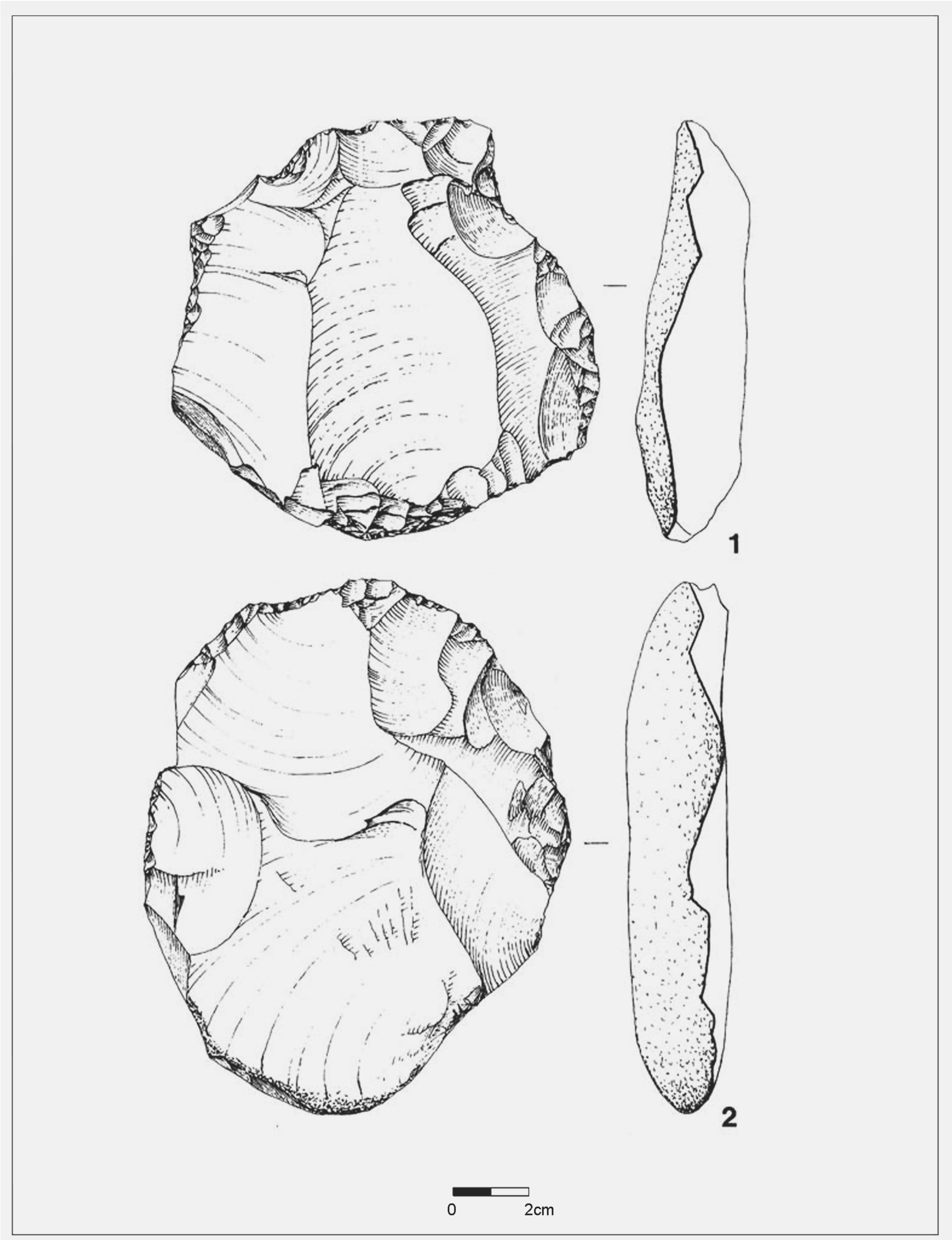

Fig. 2. *Ongar: Levallois cores from A.R. Khan's collection (from* B*IAGI 2006, fig. 2.)*

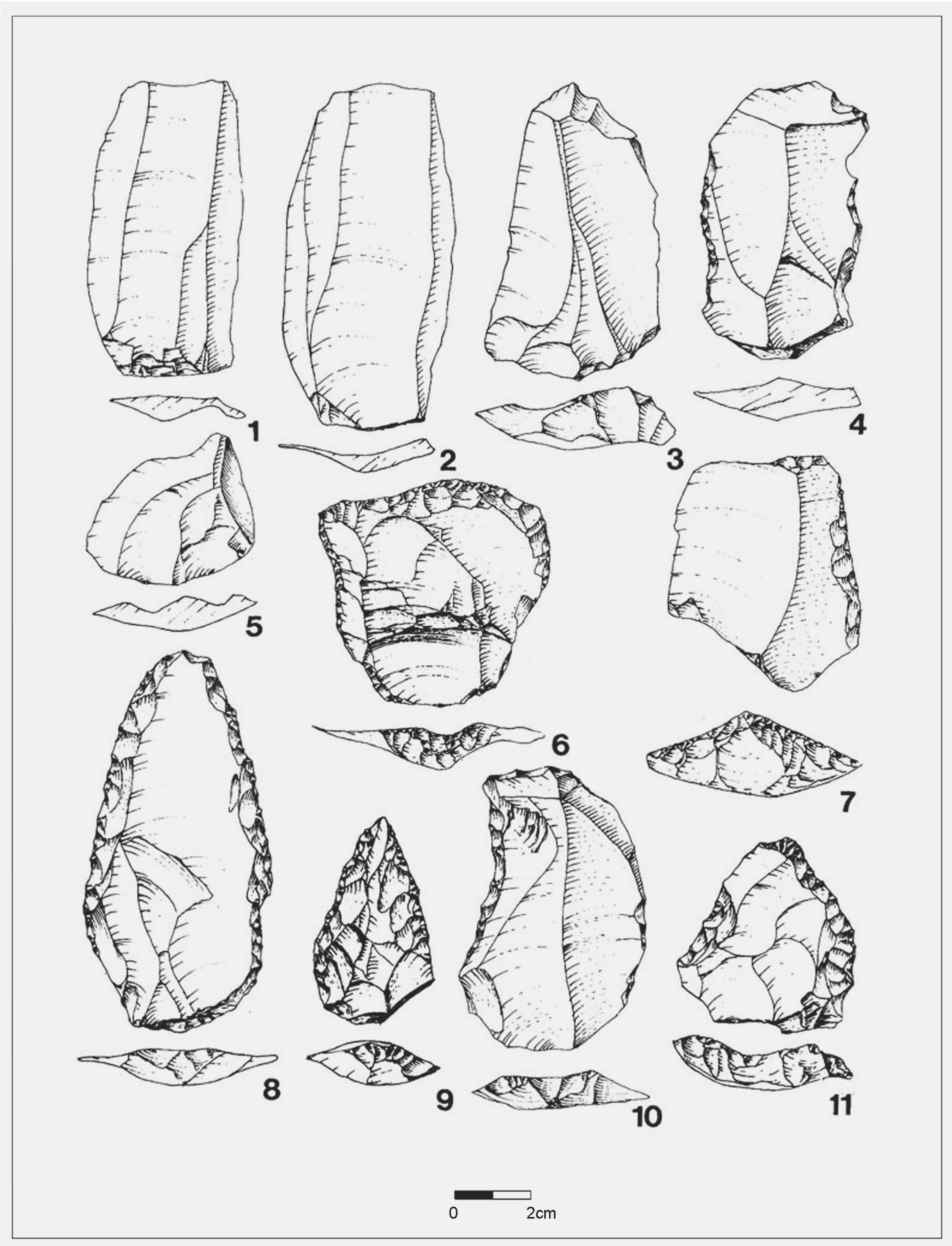

Fig. 3. *Ongar: Levallois artefacts from A.R. Khan's collection (from* BIAGI *2006, fig. 4)*

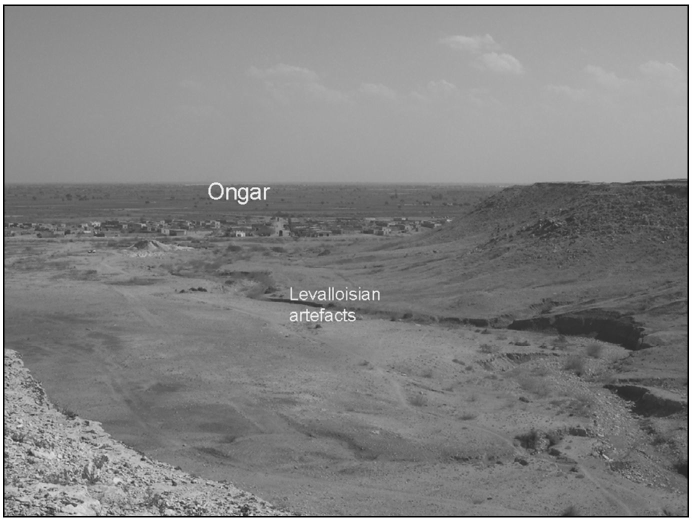

Fig. 4. *Ongar: the area that yielded Levallois artefacts (re)discovered in 2006 (photograph by P. Biagi)*

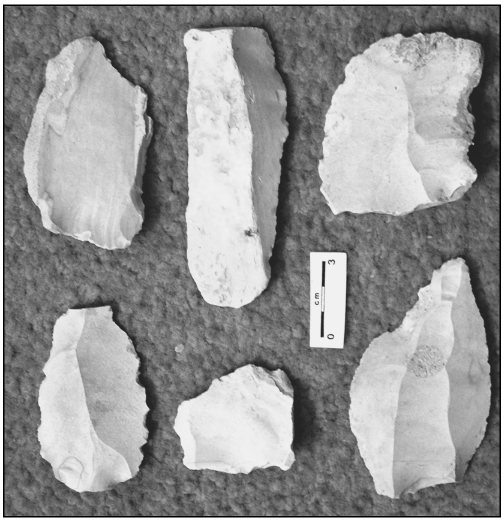

Fig. 5. *Ongar: Levallois flakes and blades from the 2006 (re)discovered area (photograph by P. Biagi)*

Middle Pleistocene lithic technology in the Indian Subcontinent

The research carried out during the last decade in the Indian Subcontinent and Arabian Peninsula has greatly contributed to achieving a better knowledge of the Middle Palaeolithic in the study region, and answering a few questions as to the origin and suggested provenance of the Middle Palaeolithic assemblages,[15] their chronology,[16] variable structural composition and cultural affiliation.[17]

Following a traditional view, in the Indian Subcontinent "*the Acheulian slowly evolved into the Middle Palaeolithic by shedding some of the tool types and by incorporating new forms and new techniques*".[18] Given its characteristics, some authors do not include it in the Mousterian complexes,[19] while others attribute the Middle Palaeolithic assemblages of peninsular India to the Nevasian.[20] Nevertheless, where long sequences are known, the Middle Palaeolithic layers are stratified between Early Palaeolithic (Acheulian) and Late (Upper) Palaeolithic (so-called microlithic) complexes,[21] following a sequential terminology proposed more than 50 years ago.[22] They have been recently subdivided into three main developmental phases,[23] from most of which the typical Levallois reduction technique is almost absent.

According to the few absolute dates so far available, Middle Palaeolithic complexes are represented in the region since roughly 150 ky, while the Late (Upper) Palaeolithic ones make their appearance at least just after 40 ky from the present,[24] although the dispersal of modern individuals, following a coastal route, is suggested to have taken place some 10 ky before[25] or even earlier[26] despite scarce archaeological evidence.[27] The problem related to the makers of the Middle Palaeolithic tools is still debated,[28] mainly because of the absence of fossil human remains of this period in the entire Subcontinent.[29]

One of the most important issues consists of the south-easternmost spread of the Neanderthals and their associated Mousterian assemblages that is so far badly defined. Although typical Levallois Mousterian industries are known from south-eastern Arabia,[30] Iran,[31] Afghanistan,[32] and former Soviet Central Asia,[33] they are almost unknown in the Indian Subcontinent, except for a few surface sites in Lower Sindh and the Indus Valley,

15 PETRAGLIA–ALSHAREKH 2003; ROSE 2010.
16 PETRAGLIA et al. 2007.
17 PANT–JAYASWAL 2013.
18 MISRA 2001, 495.
19 ALLCHIN et al. 1978, 314.
20 KHATRI 1962; ALLCHIN–ALLCHIN 1997, 55–60.
21 HANNAH–PETRAGLIA 2005; PETRAGLIA et al. 2009.
22 SUBBARAO 1956; ALLCHIN 1959.
23 PAL 2002, 79.
24 MISHRA 1995.
25 FIELD et al. 2007.
26 BULBECK 2007.
27 BEYIN 2011.
28 HASLAM et al. 2010.
29 STOCK et al. 2007.
30 CREMASCHI–NEGRINO 2002.
31 PIPERNO 1972.
32 DUPREE et al. 1970; DAVIS 1978.
33 RANOV–GUPTA 1979.

which have been discussed in a recent paper.[34] Furthermore the more recent studies seem to support the impression that "*the early Middle Palaeolithic (or Middle Stone Age) of India and Nepal probably developed indigenously*",[35] which suggests the existence of a distinctive boundary between the west and the east marked by the axis of Indus river valley, that according the evidence discussed in the next paragraph might represent the south-easternmost limit of Neanderthals expansion.

The Levallois Mousterian finds from Lower Sindh

Levallois assemblages are known from a few localities of Lower Sindh (***Fig. 1.***),[36] the most important of which is Ongar (otherwise known in the literature as Milestone 101[37]), discovered byW.A. Fairservis Jr.,[38] and later published by B. Allchin. On its limestone terraces she discovered Palaeolithic assemblages and workshops of different periods, among which are Middle Palaeolithic ones.[39] The area was revisited by A.R. Khan in the early 1970s, when the sites were being destroyed due to the opening of limestone quarries for industrial exploitation. During his rescue visits Professor A.R. Khan collected an impressive quantity of Palaeolithic tools, among which are Levallois cores, (retouched) Levallois points, one typical Mousterian point (***Fig. 3.***), wide blades, flakes and different types of side and transversal scrapers (***Figs. 2. and 3.***). The above author was the first to signal "*the presence of the Levalloisian industry in the area beyond any doubt*"[40] in Sindh.

After studying some of the finds collected by A.R. Khan in the Museum of Prehistory and Palaeogeography, Karachi University, one of the authors (PB) systematically surveyed the Ongar region between 2005 and 2008.[41] Although it was impossible to define the precise locations of the spots from which A.R. Khan collected Levallois Mousterian implements, identical chipped stone assemblages, characterised by a thick, white patina, were recovered from the upper profile of the terraces of a seasonal stream that flows eastwards, from the limestone mesas down to the village and the national road (***Fig. 4.***).

These latter finds, which are represented exclusively by Levallois flakes and blades, are also covered with a thick white patina, although they show a few *concassage* detachments due to a certain shifting from their original deposition (***Fig. 5***.).

Other typical, small Levallois assemblages, or isolated finds, come from the region immediately to the east of Karachi: among them are the Mulri Hills, Landhi, Deh Konkar[42] and the Laki Range.[43] One more characteristic Levallois flake was found on the surface of a limestone terrace, close to the Baloch village of Arzi along the national road, north of Hyderabad.[44]

All the Levallois assemblages so far recovered from Lower Sindh come from the region west of the course of the Indus. Although other Palaeolithic sites are known from this province, the richest of which are the Rohri Hills,[45] it is important to point out that none of the Palaeolithic industries from these latter sites, all located along the eastern bank of the Indus, ever yield any typical Levallois tool.

Discussion

Recent research carried out on the skeletal fossil remains of Europe strongly supports the designation of Neanderthals as a separate species, i.e. *Homo neanderthalensis*, which gave no contribution to the evolution of modern Europeans.[46] Also from the point of view of the lithic techno-typology and the use of raw materials, an abrupt change can be noticed in Eurasia at the onset of the Aurignacian, which has no connections with the Levallois Mousterian techno-typology, supporting the idea of the systematic replacement of Neanderthals with anatomically modern humans. Although we have to consider that the pattern at present available from the best investigated areas, i.e. central-western Europe and the Levant, cannot be necessarily applied to other territories,[47] the general situation is still far from being clear and is rather controversial.[48] If we move from the Levant farther to the east, toward the Indian Subcontinent, the picture is even more complicated, due to the absence of human fossil remains[49] and limited fieldwork.[50]

The Middle Palaeolithic assemblages of India are often attributed to the Nevasian.[51] Recently they have been subdivided into two main groups whose appearance has been radiometrically dated to some 150 ky from the present.[52]

The archaeological evidence gathered in the last years by the Italian expedition in Sindh has contributed

[34] BIAGI 2006.
[35] DENNELL 2009, 144.
[36] BIAGI–STARNINI 2014.
[37] ALLCHIN 1976, 486.
[38] FAIRSERVIS 1975,77.
[39] ALLCHIN 1976.
[40] KHAN 1979b, 80.
[41] BIAGI 2005; BIAGI–FRANCO 2008.
[42] KHAN 1979a, 13.
[43] BIAGI 2008.
[44] BIAGI 2010.
[45] ALLCHIN 1976; NEGRINO–KAZI 1996.
[46] HARVATI et al. 2006.
[47] KUHN–HOVERS 2006.
[48] ZILHÃO 2010b.
[49] STOCK et al. 2007.
[50] PANT–JAYASWAL 2013.
[51] SANKALIA 1956.
[52] MISRA 1989.

to fill the gap, and shed some light on the south-easternmost distribution of the Levallois Mousterian complexes.

The Levallois assemblages discovered in Sindh, which display very characteristic features, among which are facetted and "*chapeau de gendarme*" butts, can be attributed to Middle Palaeolithic human activity in the area, most probably related with the south-easternmost spread of *Homo neanderthalensis*. This species might have reached the Indian Subcontinent either from the Anatolia-Caucasus-Mesopotamia corridor, or across the southern regions of the Arabia Peninsula, where Levallois Middle Palaeolithic sites are known to date.[53] The reason why their spread most probably did not go beyond the Indus delta might be caused by a geographic barrier, as it has already been suggested for the dispersal of modern humans along the western coastline of the Indian Subcontinent.[54]

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Many thanks are also due to the former Vice-chancellor of Sindh University, Prof. Mazharul Haq Siddiqui, and the former Director of the Institute of Sindhology, Mr. Shoukat Shoro, who provided accommodation and every sort of facilities at Sindh University Campus, Jamshoro. Thanks are also due to Dr. C. Franco (Ca' Foscari University, Venice - I), who took part in the 2007 fieldwork season, and Prof. A.R. Khan and B. Talat (Department of Geography, Karachi University - PK), who allowed the study of the Palaeolithic assemblages stored in the collections of the Museum of Prehistory and Palaeogeography of the same University, and provided accommodation at Karachi University Campus in 2000-2002. Special thanks to the Prehistoric Society (London - UK), Prof. G. Traversari and the CeVeSCO (Venice - I), and the Ligabue Foundation (Venice - I) that sponsored and financed the archaeological fieldwork seasons at Ongar.

Last but not least we are grateful to the reviewer for his useful criticism and to our friend B.A. Voytek (Berkeley University – USA) who kindly improved the English version of the text.

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[53] PETRAGLIA–ALSHAREKH 2003.
[54] STOCK et al. 2007, figure 1.

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MIDDLE PALAEOLITHIC SIDE-SCRAPER FROM THE AVAS HILL, MISKOLC (4 GÖRGEY ARTÚR ST.)

PÉTER SZOLYÁK–ZSOLT MESTER

Keywords: *Miskolc-Avas, Middle Palaeolithic, Mousterian, Szeletian felsitic quartz-porphyry (metarhyolite)*

Research history of the Avas Hill and its environment[1]

There are some regions in certain countries, which have great significance because of their abounding in archaeological sites and finds or their role in research history. These are e.g. the Vézère valley in France, the Wachau in Austria, the Pavlov Hill in the Czech Republic, the Krakow region in Poland, the Crimea in Ukraine or the Don River basin in Russia. In Hungary, there are two similar regions: the Danube Bend, in the research of which, scholarship of Viola T. Dobosi was primordial,[2] and the Bükk region, where the numerous caves were the main targets of the Hungarian Palaeolithic Research for many decades.[3] The Avas Hill, towering above Miskolc City, also belongs to the latter. It became the symbol of the town.[4] In 1891, the memorable three hand-axes of the Bársony House were found at the foothill of the Avas. The discussion brought about these finds actuated the methodical and scholarly research of the Prehistoric Man in the territory of Hungary.[5] Although this task was 120 years-old in 2011, the heritage of our ancestors are still countless quantity on the hilltop and around the hill.

The archaeological finds approve that the Prehistoric Man knew the Avas as a raw material source since the Middle Palaeolithic at least.[6] The hydro- and limnoquartzite, and the silicified Miocene tuff, which are apt for knapping, are found *in situ* and in great quantity on the higher relieves of the hill. The colours of these materials vary from white to dark brown. The qualities of them are also multifarious. In Prehistoric time, the raw material was an inviting factor. Furthermore, the Avas Hill is situated in a very good geographic position. The Bükk Mountains are westward. The Great Hungarian Plain extends southward and south-eastward. The Tokaj Mountains is easily accessible eastward and north-eastward, as well the Cserehát Hills northward. The Sajó and the Hernád rivers flow almost in front of the piedmont. On the north side of the Avas, there is the valley of the Szinva Stream, which was probably a very important pathway of the games between the Bükk Mountains and the Great Hungarian Plain.

In Miskolc, the intentness always turned to the Avas Hill increased because of the public interest in the age of the prehistoric man opening in 1891. Knapped stones were regularly found in the orchards and vineyards planted on its slopes and in the course of expanding constructions. The research started to become systematic with the planned excavations and collecting finds by amateurs. The most part of the evidences mainly enriched the Archaeological Collection of the Herman Ottó Museum in Miskolc. The main data of the research of Avas' Palaeolithic were summarized in 1979 by Katalin Simán based on documentations of the repertory and inventory of the

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[1] The first version of this study was published in 2011 (SZOLYÁK–MESTER 2011). As the data processing is in progress, here we can give results just partly in respect of the total assemblage.

[2] T. DOBOSI 1981; 2005, 64–65; 2005–2006; T. DOBOSI–KÖVECSES-VARGA 1991; T. DOBOSI et al. 1983.

[3] KADIĆ 1915; 1934; 1940; 1944; KADIĆ–MOTTL 1938.

[4] DOBROSSY ed. 1993.

[5] HERMAN 1893; KADIĆ 1934, 15–19; VÉRTES 1965, 101–103, 147; RINGER 1999.

[6] RINGER 2003; MESTER 2005.

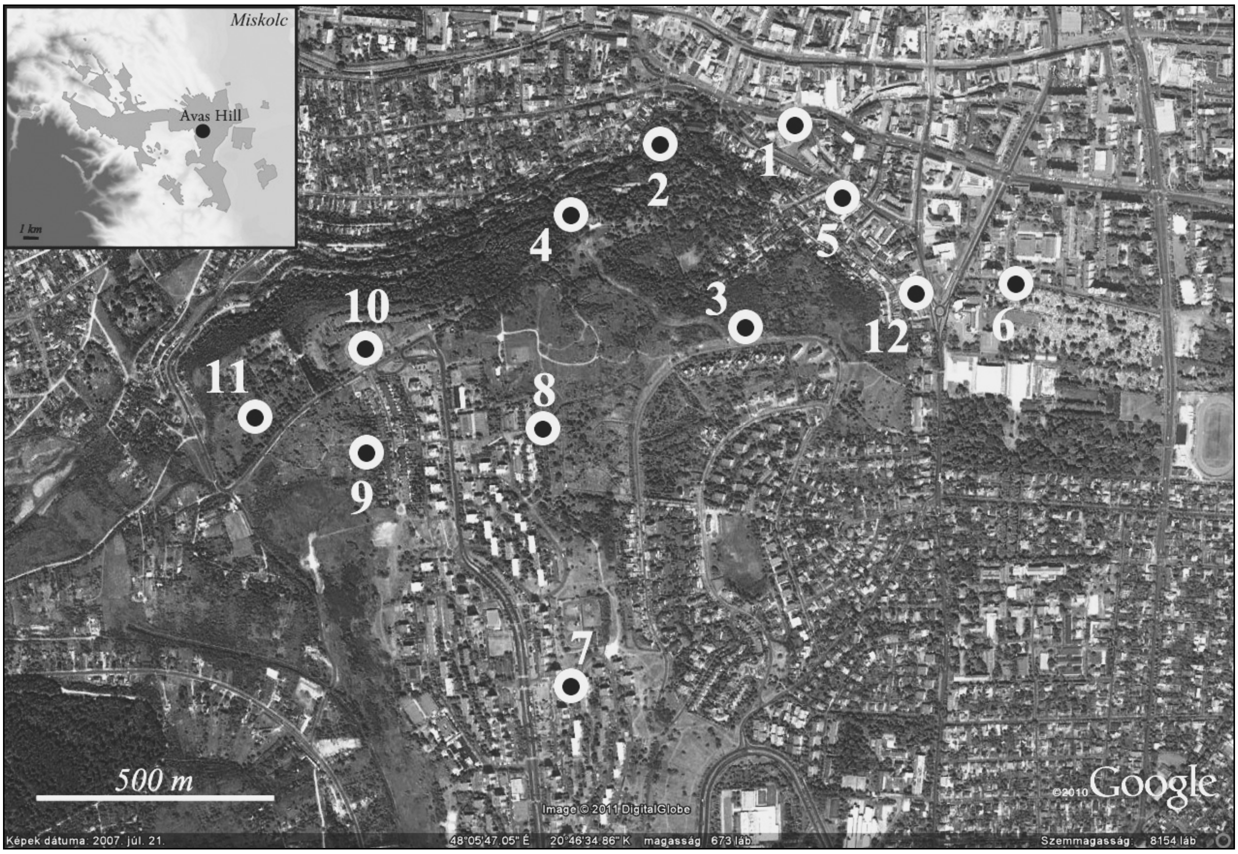

Fig. 1. *Northern part of the Avas Hill with the most known Palaeolithic sites in the satellite photo of the Google Earth (1st of July 2007).The 3rd and the 6–11th points in the photo sign the centres of the areas and not the places of excavations or finds.*
1. House of János Bársony city counsel (today: 2–4 Kálvin János St.), 2. Calvinistic cemetery, 3. Tűzköves, 4. Pergola (Tower), 5. 12–14 Molotov St. (former: 4–6 Mindszent St.; today: 32–34 Papszer), 6. Petőfi St. (today: Dankó Pista St.), 7. Alsó-Szentgyörgy, 8. Felső-Szentgyörgy, 9. Mendikás, 10. Avas-tető (Top of the Avas), 11. Israelite cemetery, 12. 4 Görgey Artúr St.

Herman Ottó Museum.[7] Unfortunately, she did not scholars give references to the data, so we tried to identify independently the most important occasions, and sites of the research history *(**Table 1.**)*. We also used the Archaeological Repertory and Inventory of the Herman Ottó Museum and the basic publications of researches as sources. In this study, we deal with just one interesting find of the last excavation in detail.

Excavation at 4 Görgey Artúr St., Miskolc (Preliminary report No. 2)

Between July and October in 2009, the Herman Ottó Museum made a preventive archaeological excavation before a block of flats was built in the ground of 4 Görgey Artúr Street, Miskolc *(Point 11 on the **Fig. 1.**)*.

More than 65.000 pieces of finds[8] were excavated from the 1227 m² ground, which was disturbed by urban buildings from the second part of the 18th century at least.[9] 97% of the assemblage consists of prehistoric knapped stone tools, blanks and waste of the knapping and mining activities. Some finds of medieval and early modern periods were also excavated, such as broken pieces of ceramics, metals, animal bones, a coin and a ring from the 14–17th century. Generally, these ones did not connect with contemporaneous objects. A well backfilled with wastes – probably from the 19th century – was also discovered.

[7] SIMÁN 1978–79b.

[8] The taking stock and studying of total assemblage took at 65.214 pieces of finds in September of 2014.

[9] 1st Military Land-Surveying in the reign of Joseph II. (1782–85) Maps: XX–13, XXI–13.

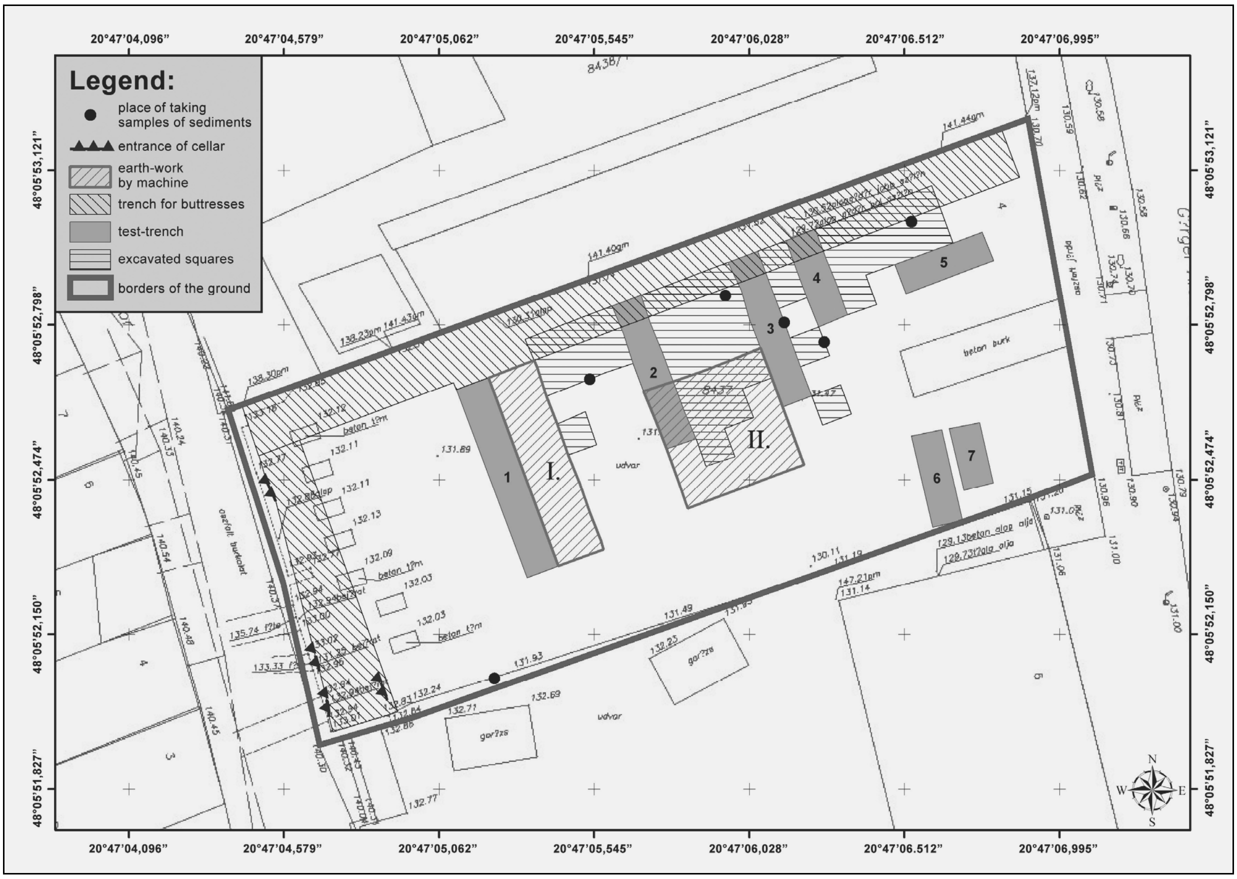

Fig. 2. *The area of the excavation with the trenches at 4 Görgey A. Street, Miskolc. The Middle Palaeolithic convergent side scraper was found in the trench I, which was excavated by hydraulic excavator.*

The ground was covered by a raster with 2 × 2 m squares. These ones were the basic excavating units. We quartered them if required. The finds were usually collected after 20 cm levels, but where the stratigraphic phenomenon justified it, we measured their 3D positions with cm accuracy. The area, which was researched by test trenches, probes and large surface exploration, was 520 m^2 overall *(**Fig. 2.**)*. Nine strata to 5 m absolute deep have been separated. The layers sloped down in 5–25º north-eastward. A 52 m long cross-section has been drawn perpendicularly to the longitudinal axis of the hill. We collected 30 sediment samples from the characteristic places. The sedimentological analyses was made by István Marsi in 2012 (in press). Their results confirm that all Palaeolithic finds were located in piedmonts.

The layers, numbered from bottom to top, are the following:

1. layer sequence from the Tertiary period (Badenian-Sarmatian age);[10] >3 m thick[11],

2. slump scraps evolved on surface of layer sequence from the Tertiary period; approx. 1 m thick,

3. greyish brown layer with clay and some fine debris of hydroquartzite (not archaeological evidences?!); approx. 1 m thick,

4. light brown layer with clay and some fine debris of hydroquartzite (not archaeological evidences?!); >3 m thick,

5. abraded and mixed dark brown layer with tuff debris and archaeological evidences in great quantity (flints, ochre, pebbles in 200 pcs/m^3), which were evenly divided horizontally and vertically; approx. 2.5 m thick,

6. transitional mixed zone with pieces of clay and archaeological (flint) finds in various density; pieces of the Layer 7 were mixed into the Layer 5; there were rifts perpendicular to the angle of slope and at least three laminae with fine gravels in 35º to the level; approx. 2.3 m thick,

[10] HAJDÚNÉ MOLNÁR 1993; HARTAI–SZAKÁLL 2005, 16–18.

[11] Thickness was measured perpendicularly to the surface of slope.

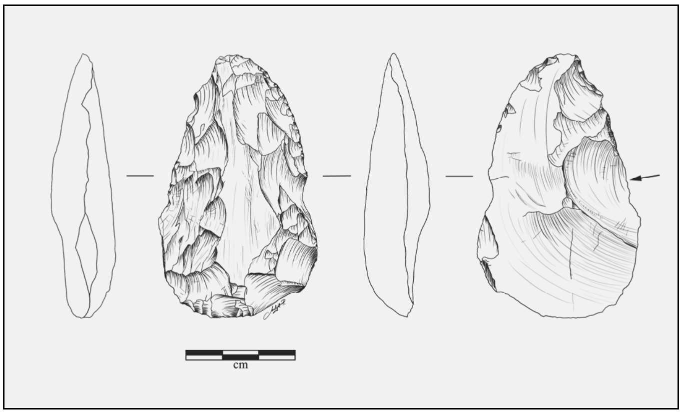

Fig. 3. *The Middle Palaeolithic convergent scraper. Accession number: 2010.4.1. Archaeological Collection, Herman Ottó Museum. (Drawn by Péter Szolyák, 2010)*

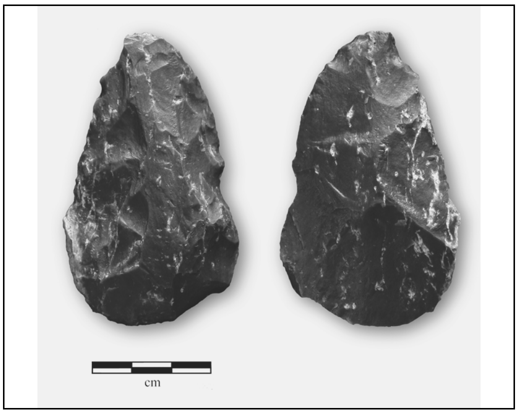

Fig. 4. *The Middle Palaeolithic convergent scraper. (Photo by Péter Szolyák, 2010)*

7. yellow clayey layer (loess?); it included archaeological finds (Palaeolithic flints) in various density; approx. 2.3 m thick,

8. black humus evolved *in situ* with numerous archaeological finds (prehistoric flints, pieces of ceramics, bones and metals from the 14–17th century); max. 0.4 m thick,

9. recent rubbish (derived from 19–20th century buildings and caving cellars); 0.5–2 m thick.

The total interpretation of the whole assemblage, which includes several myriad finds, is not possible yet. The elementary analyzing work was about 80% readiness in 2014. We can summarize the following facts based on it. Almost the whole assemblage consists of the local hydro- and limnoquartzite. They present in ten forms of colours at least. The other raw materials are represented just with some pieces. These are the grey coloured felsitic quartz-porphyry (metarhyolite) of the Eastern Bükk Mountains[12], the obsidian and the radiolarite. Long-distance raw materials (from more than 50 km distance) are not in the studied assemblage. More than 5% of flints can be connected to human activities directly. The other ones are products of the natural fragmentation or secondary products of the flint mining from the higher relieves.[13] Damages caused by freeze are on 12% of stone finds. Although 1.5% of them was burnt, we have not found evidences of the heat treatment yet.

The proportion of tools among the knapped stones is less than 10%. Most of them are retouched flakes, but we identified some end-scrapers and burins. They are not characteristic enough to closer determination. The most typical tool by chronology and culturally is a Middle Palaeolithic side-scraper. We will interpret it hereafter in details. There are 8 pieces of flake cores, 1 blade core and 1 bladelet core in the studied assemblage. The proportion of the technological chippings is high (53%). In the group of blanks, the flake and blades are in 5:1 ratio.

The Middle Palaeolithic side-scraper

The side-scraper ***(Fig. 3 & 4.)*** lay in the Layer 5, but its exact location is unknown. As we could research the ground of the building by only preventive excavation, we were not able to study the whole layer with detailed archaeological methods. The Layer 5 was abraded and mixed and did not include archaeological structures or phenomena, just the finds in great quantity. We trenched it in 13 m length, 2 m width and 3 m depth *(Trench 1. on the **Fig. 2.**)* by an excavator machine. The rest of layer, approx. 94 m^3 *(Area I on the **Fig. 2.**)* was transported to the depot of the builder company. We checked it extensively during and after the excavation. The side-scraper came to light then.

The raw material of the item is a relatively seldom, dark form of the felsitic quartz-porphyry, which can be collected on the bed of Stream of Bükkszentlászló village (synonyms: Tatár-árok or Stream of Tatár-árok; "árok" means "valley") and at the spring-head named Kaán Károly. On its surface, inclusions with 1–3 mm measures can be seen in 1 cm. The scraper made on a large flake, which was detached almost perpendicular to the morphological left edge. Originally, the butt was about 30 mm wide with cortex, but it reduced to an 18x6 mm surface

[12] To nomination and history of the research of the raw material: VÉRTES–TÓTH 1963; T. DOBOSI 1978; SIMÁN 1986; T. BIRÓ 1984, 44, 46; MARKÓ *et al.* 2003; TÓTH 2011; SZOLYÁK 2011 as respects the archaeology; SZENTPÉTERY 1932; VENDL 1930; 1933; T. BIRÓ–T. DOBOSI 1991; T. BIRÓ et al. 2000; PELIKÁN 2002a-b & 2005 as respects the geology and mineralogy.

[13] HILLEBRAND 1929; SIMÁN 1978-79a; RINGER 2003.

during tool shaping. The large scars on the ventral surface probably served the removing of the butt and reduction of the extensive bulb. Therefore, the basis of the flake became a working edge. Because of this feature, we took direction of the tool by the morphological and not the debitage axis.

The retouch go around on the dorsal surface, but it break off a little at the tip. In the middle of the dorsal face, an older abraded natural surface can be seen, which go along the longitudinal axis to the tip. The left and right edges were shaped with stepped retouch, while the bended proximal part was formed with steep negatives. This is why the latter one is similar to the end-scraper edges. The scars of dorsal surface are usually deep, and they go out many times like as the hinged knapping accidents *(réflechi)*. The left edge is lineal from the rest of the butt to the tip, but the right one is slightly convex. On the lower third part of the right edge, the fine retouch breaks off because of two larger scars. The edges in profile align with the line.

This flake is a blank in the *chaîne opératoire.* Nothing denotes to the Levallois debitage. We can not conclude on the knapping technique because of the reduction of the butt and bulb. The originally great bulb and the wide and short flake rather argue for direct percussion and hard hammer. The shaping of the side-scraper is point-like and it was formed along the convergent edges in similar degree and way. It had already happened by soft hammer.

Possibilities of the cultural determination

Based on its technological and morphological features, the side-scraper from 4 Görgey Artúr Street, Miskolc can be classified to the Middle Palaeolithic. According to the typology, it is a convergent scraper with lineal and bended edges *(racloir convergent droit-convexe)*.[14] Such types are general in the Mousterian, but they are most frequent in the Typical Mousterian and Ferrassie-type Mousterian facies.[15] This tool-type is represented in similar ratio in two different industries of the Layer 3 and Layer 11 of Subalyuk Cave, but a clear distinctness shows up in the more abundant tool-kit of Combe-Grenal.[16] Note must be made that the blanks of mentioned types are usually triangular flakes, on which the debitage axes coincide with the morphological axes.

The top-view and side-view silhouettes of the side-scraper are comparable with the heart-shaped hand-axes of the Lower and Middle Palaeolithic.[17] We urge that the find from Miskolc did not make by bifacial shaping. This morphological feature suggests that the side-scraper can be connected to such industry, in which there are bifacial tools and hand-axes. The phenomenon was already observed in the northern part of continental Europe. There are finds in the assemblage of Saint-Brice-sous-Rânes, Normandy, which are shaped bifacial in part. The original forms of blanks were utilized to get the heart-like form.[18] This silhouette occurs relatively often at the flakes come from the edge of the flat block of grey quartz-porphyry. We know two such flakes from the assemblage of Eger-Kőporos collected from the field by Sándor Béres. The prehistoric knapper started bifacial shaping on one of their tips.[19] In 2009, a unifacial side-scraper made by brown limnoquartzite came to light during the excavation. The morphology of the flake was the same as in cases of the former ones. Such tools of Eger-Kőporos can be connected to a Micoquian-like industry.[20]

The edges shaping by stepped retouch may relate to the Quina-type Mousterian phase, which is also named Charentian. In the assemblages of Subalyuk Cave and Érd, which are two significant Hungarian sites of the Charentian, there are not same type as in Miskolc[21], but the grey quartz-porphyry is a preferred raw material in the Layer 11 of Subalyuk.[22]

Although there are not Hungarian sites, where similar tool-type was found, the convergent scraper of 4 Görgey Artúr Street, Miskolc can be referred to the Middle Palaeolithic in the Bükk region. The closer cultural determination is not possible yet, but the study of total assemblage may modify the recent image.

Acknowledgement

Péter Szolyák, as leader of the excavation, owes a debt of gratitude to Péter Turbucz and Gergely Bartha students, who not only found the Middle Palaeolithic side-scraper during the research depot of the Layer 5, but they were readily aware the scientific importance of it. The excavator is indebted to advice and observations during the excavation for Árpád Ringer and György Lengyel. Many thanks to Endre Dobos for help to the sedimentary analysis on field-day.

[14] BORDES 1961, 27; DEBÉNATH–DIBBLE 1994, 80-81.
[15] BORDES 1961, Pl. 19–21.
[16] MESTER 2008, Table 1.
[17] BORDES 1961, Pl. 55: 2, 61: 6-7, 62: 4, 66: 3.
[18] CLIQUET et al. 2001, Fig. 4–5.
[19] Inventory no.: Eg1/349 and Eg1/378.
[20] KOZŁOWSKI et al. 2012.
[21] BARTUCZ et al. 1938; GÁBORI-CSÁNK 1968.
[22] MESTER 2004; 2008, 92.

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Date	Location	Method of research	Excavator/Finder	Reference
1891	House of János Bársony lawyer (today: 2–4 Kálvin János St.)	field-survey	the builders	Herman 1893.
1901	Calvinistic cemetery	field-survey	Dobos, Ferenc	Herman 1906.
1905**	Calvinistic cemetery	field-survey	?	Simán 1979b. 12.
1907**	?	excavation and field-survey	?	Simán 1979b. 12.
1909**	Calvinistic cemetery	excavation	?	Simán 1979b. 12.
1912*	?; Sashegy; above Gyöngy St.; above Koch's cellar	field-survey	Butkay, J.; Szendrey, J.; Máhr, Pál; Molnár, J.	HOMAInv(-1953) I., Simán 1979b. 12.
1913	Calvinistic cemetery, Kőporos-dűlő, Petőfi St.	excavation and field-survey	Gálffy, Ignác	HOMAInv I. , Simán 1979b. 12.
1920*	Israelite cemetary	field-survey	Vilá ghi, Kálmán	HOMAInv(-1953) I., Simán 1979b. 12.
1922*	Tűzköves	field-survey	Szabó, B.	HOMAInv(-1953) I., Simán 1979b. 12.
1926–1927	?	field-survey	Budai, József	HOMAInv III.
1928–1935	Pergola (there is the environment of the Observation Tower), Plateau in front of the Pligler's villa	excavation	Hillebrand, Jenő; Leszih, Andor; Megay, Géza	HOMAInv I. and VI., Hillebrand 1929, Simán 1979a.
1931–32	Calvinistic cemetery; Tűzköves	field-survey	Dobos, Ferenc and Szabó, I.; Gálffy, Ignác	HOMAInv I., Simán 1979b. 12.
1935*	Top of the Avas Hill, Máhr's vineyard	field-survey	Meskó, M.	HOMAInv(-1953) II., Simán 1979b. 12.
1937*	Máhr's vineyard; Mendikás	field-survey	Máhr, K.; Czupon, E.	HOMAInv(-1953) II., Simán 1979b. 12.
1946	Tréki-Török's vineyard (Felső-Szentgyörgy); Világhi's vineyard (Alsó-Szentgyörgy)	field-survey	Gáspár, Mihály; Világhi, Kálmán	HOMAInv I.
1949	Világhi's vineyard (Alsó-Szentgyörgy)	field-survey	Világhi, Kálmán	HOMAInv I.
1959	12–14 Molotov St. (previously: 4–6 Mindszent St., today: 32–34 Papszer)	excavation	Megay, Géza	HOMRep 759–1969 and 1110–1974.
1961	Top of the Avas Hill, Alsó- and Felső-Szentgyörgy	excavation	Vértes, László; Korek, József	Vértes 1965, Simán 1979b. 12.
1972	Felső-Szentgyörgy, Tűzköves	field-survey	Saád, Andor	HOMAInv IX.
1973	Alsó- and Felső-Szentgyörgy, Top of the Avas Hill, Bányagödör, Mendikás, Tréki-	field-survey	Tóth, Lajos	HOMAInv X., Tóth 1975.

Date	Location	Method of research	Excavator/Finder	Reference
	Török's vineyard, Tűzköves			
1975	Top of the Avas Hill and Zsidóbánat; Felső-Szentgyörgy	excavation; field-survey	Hellebrandt, Magdolna and Korek, József; Hellebrandt, Magdolna and Tóth, Lajos	Simán 1979b. 13.; HOMAInv XI/2., Tóth 1975.,
1976	Alsó-Szentgyörgy	excavation	Hellebrandt, Magdolna and Simán, Katalin	HOMRep 1269–1976, HOMAInv XII., Simán 1979b. 13.
1977	Tűzköves II., Alsó-Szentgyörgy	excavation	Hellebrandt, Magdolna and Simán, Katalin	HOMRep 1349–1978, Simán 1979b. 13.
1978	Top of the Avas Hill	excavation	Simán, Katalin	HOMAInv XIII., Simán 1979b. 13.
1988-1989	Tűzköves	excavation	Ringer, Árpád	HOMRep 2126–1990, Ringer 1989–90, Ringer 1991.
2001–2002	Tűzköves	excavation	Ringer, Árpád	HOMRep 3465–2003, Ringer 2003.
2004–2005	Percel Mór St. (building Southern Byroad between Perczel Mór St. and the Observation Tower)	excavation	Ringer, Árpád	HOMRep 3994–2006.
2009	Top of the Avas Hill, Tűzköves, Percel Mór St.	field-survey	Bedécs, László	Under registering (HOM, Acc. No. 2010.5.1.–…)
2009	4 Görgey Artúr St.	excavation	Szolyák, Péter	Under registering (HOM, Acc. No. 2010.4.1.–…)
?	Tűzköves	field-survey	Máhr, Pál	HOMAInv I.

* data were just found in the inventory books used before 1953.

** data were not found neither the inventory books nor the Archaeological Database of the Herman Ottó Museum in 2010.

Table 1. *Memorable events (date, site, method, excavator and reference) in the history of the Palaeolithic research in the Avas Hill.*
HOM – Herman Ottó Museum
HOM Rep – Repertory of the Herman Ottó Museum
HOMA Inv – Inventory Books of the Archeological Collection, Herman Ottó Museum
HOMA Inv(-1953) – Inventory Books of the Archaeological Collection, Herman Ottó Museum before 1953

LES ORIGINES DU TERME SZÉLÉTIEN ET SES DIFFÉRENTES APPROCHES AU COURS DE LA RECHERCHES DU PALÉOLITHIQUE

ÁRPAD RINGER

Mots clefs: *Solutréen, Předmostien, Szélétien, Gravettien*

Le but de l'article

Si nous voulons donner une nouvelle interprétation assez large et profonde du Szélétien de la grotte Szeleta, nous devons – tout d'abord – éclaircir les origines de ce terme et prendre en compte trois approches différentes. Dans cette contribution nous nous occuperons de l'utilisation de ces approches de 1906 à nos jours.

Les origins du terme Szélétien

Nous présentons ci-dessous les trois approches du Szélétien de la grotte éponyme.

Approche I.

Ce terme fut proposé pour la première fois par le chercheur Tchèque, J. Skutil qui l'a utilisé dans sa thèse de 1926 sur les découvertes de la célèbre station de Předmostí, attribuée au Gravettien aujourd'hui[1].Un an après, cette dénomination fut adaptée par I. L. Červinka dans son travail 'Pravěk zemí českých'[2] ; nous citons sa conception d'après M. Oliva:

„…would be better described by the term Szeletien industry (Szeletaien) according to the finds in Hungary, since the station at Předmostí lack a uniform character and has absolutely nothing in common with the French Solutrean"[3]. Červinka remplaçait le terme 'Předmostien' par Szélétien.

„…le terme de 'Předmostien' proposé par F. Wiegers en 1920, pour des industries à pointes foliacées en Europe centrale, afin de les differencier du Solutréen français. J. Andrée en 1930 empoyait le terme de Szélétien dans le même sens…"[4].

Comme nous le savons, le fouilleur hongrois O. Kadić a publié une monographie des résultats de la première campagne de fouilles de Szeleta, effectuée entre 1906 et 1913[5]. Il nous semble que Skutil et Červinka se sont tout d'abord focalisés sur la collection lithique des couches 6/a-6, c'est-à-dire sur ce que l'on appelle Szélétien supérieur de nos jours, qui fut mieux représentée par Kadić dans sa monographie de 1916[6] que celle de la couche 3, autrement dit le matérial lithique du Szélétien inférieur.

Puisque la collection archéologique du Paléolithique supérieur de Předmostí se rattache maintenant au Gravettien[7], d'après cette première approche, le Szélétien peut être un Gravettien à pièces foliacées. Ce terme fut proposé par K. Simán au colloque de Miskolc en 1991[8].

Approche II.

C'est le deuxième fouilleur de la grotte, J. Hillebrand qui aurait voulu introduire la dénomination Szélétien sur les découvertes de la couche 3 de Kadić, correspondant au Szélétien inférieur d'aujourd'hui. Selon sa conception ce Szélétien a donné naissance à l'industrie des couches 6a-6 de la grotte Szeleta qui fut déterminé par lui comme un vrai Solutréen similaire au Solutréen de l'Europe occidentale[9].

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[1] SKUTIL 1926 (cité par OLIVA 2005, 30.)
[2] ČERVINKA 1927, 66.
[3] OLIVA 2005, 30.
[4] GÁBORI-CSÁNK 1988, 1014.
[5] KADIĆ 1916.
[6] KADIĆ 1916.
[7] SVOBODA et al. 2002.
[8] SIMÁN 1995.
[9] HILLEBRAND 1935.

Le préhistorien allemand, O. Menghin partage l'opinion de Hillebrand, en utilisant déjà la dénomination Szélétien en 1930[10].

Approche III.

C'est F. Prošek qui dans sa contribution 'Szeletien na Slovensku' a renouvellé l'utilisation du terme Szélétien, perdu pendant longtemps[11]. Par la suite, L. Vértes a introduit cette dénomination dans ses travaux sur le Paléolithique de Hongrie[12]. Mais selon cette approche le terme Szélétien se rapporte aux industries à pièces foliacées de l'ensemble des couches 3-4-5-6-6a[13], en le subdivisant en trois parties: inférieure (couche 3), transitoire (couches 4-5) et supérieure (couches 6-6a selon O. Kadić).

Nouvelles interprétations les plus importantes pour les trois approches du terme Szélétien

Dans cette deuxième partie nous présentons les trois approches en détail.

Approche I.

L'optique de cette version est orientée du haute vers bas, dans la séquence du remplissage 'szélétienne' de la grotte Szeleta. Selon cette approche, le Szélétien se trouve en haut, dans les couches 6a-6, et va, en comptant sur une homogénité culturelle[14], jusqu'à la couche 3 de Kadić.

Nous pouvons revoir en substance la vue de Skutil - Červinka dans la conception plus récente de K. Simán. Elle a proposé le terme Gravettien à pièces foliacées au lieu de 'Szélétien supérieur' de la grotte éponyme par exemple au colloque de Miskolc en 1991. D'après elle, il y aurait un niveau aurignacien interstratifié entre le Szélétien 'inférieur' et 'supérieur'. Ainsi les deux industries à pièces foliacées sont différentes, sans liaison culturelle[15].

D'après K. Simán, quand les gravettiens se sont installés dans les grottes de Bükk, les chasseurs ont taillé et utilisé les lances à pointe foliacée pour tuer les ours des cavernes. Cependant, ce type d'outil est absent des sites de plein air[16].

Cette idée de K. Simán que le 'Szélétien supérieur' serait un Gravettien fut renouvellée depuis peu par et Gy. Lengyel et Zs. Mester[17].

Approche II.

Cette version du Szélétien compte sur une évolution directe depuis la couche 3 aux couches 6-6a et sur une homogénité culturelle dans toute la séquence des couches 3-4-5-6-6a. Hillebrand, par rapport de l'opinion de Wiegers, Skutil et Červinka, entretenait la dénomination Solutréen que nous allons expliquer ci-dessous. Cette dénomination culturelle a d'ailleur existé officiellement jusqu'en 1954, l'année durant laquelle M. Gábori a fait publié son ouvrage 'Le Solutréen en Hongrie'[18].

Selon J. Hillebrand (et les autres préhistoriens de cette époque), les vestiges paléolithiques des couches 6a-6 de la grotte Széléta représentent un 'Hochsolutréen' qui a pris naissance dans son Szélétien, c'est-à-dire dans l'industrie à pièces foliacées de la couche 3 de Kadić. Comme nous l'avons déjà présenté, Hillebrand a élaboré une théorie sur l'origine du Solutréen français de Hongrie dont les trous il a cherché à la même culture dit Szélétien[19].

Il est très important de noter que les préhistoriens pionniers de Hongrie, dans leur échelle chronologique du Solutréen hongrois après le Hochsolutréen de Szeleta, ont identifié encore une phase finale : le 'Spätsolutréen'. Ils ont décrit cette phase récente des abris de Puskaporos et celle de Herman et du remplissage de la Grotte Büdös-pest, qui se trouvent à 3 km de Szeleta[20].

En ce qui concerne ce point de l'histoire de notre recherche sur le Szélétien, on peut trouver une explication possible sur la très longue durée de notre Solutréen, qui fut entretenu pendant presque 50 ans, entre 1906 et 1954.

En effet, au cours de son voyage en Europe centrale en 1922, H. Breuil a déterminé les découvertes paléolithiques des sites précédents comme étant des analogies de celles du Solutréen inférieur de France[21]. Ces remarques de l'ancient Doyen français de la Préhistoire, concernant en premier lieu les outils de l'Abri Puskaporos, ont malheureusement perdu leur importance pendant la deuxième guerre mondiale…

Notons que l'âge du Szélétien solutroïde[22] de l'Abri Puskaporos est contemporaine de celle du

[10] GÁBORI-CSÁNK 1988, 1014.
[11] PROŠEK 1953.
[12] VÉRTES 1955; 1956.
[13] VÉRTES 1965.
[14] ČERVINKA 1927, 66 (cité par OLIVA 2005, 30).
[15] SIMÁN 1995.
[16] SIMÁN 1995.
[17] LENGYEL–MESTER 2008.
[18] GÁBORI 1953.
[19] HILLEBRAND 1935.
[20] KADIĆ 1934; HILLEBRAND 1935.
[21] BREUIL 1923.
[22] RINGER 1990.

Protosolutréen français, daté de 21000-22000 BP[23]. Puisque son âge C-14 dans cet abri: 21730±110 BP[24].

L'idée de Breuil, sans doute, a exercéune influence fondamentale sur les premiers préhistoriens hongrois. Ceci peut en partie expliquer la longue survivance du terme Solutréen dans la recherche paléolithique de Hongrie.

Approche III.

Cette approche de la séquence szélétienne de la grotte éponyme montrent une grande variabilité depuis 1966. Au cours des dernières décennies, la plupart des chercheurs hongrois considéraient que cette séquence était composée de deux couches principales du Szélétien – 3 et 6-6/a – en liaison directe l'une avec l'autre[25].

Parmi les chercheurs étrangers P. Allstworth-Jones, dans son immense oeuvre consacrée à la question du Szélétien, considère lui aussi que le Szélétien inférieur et supérieur de la grotte éponyme réprésente une industrie transitoire entre le Paléolithique moyen et supérieur[26].

Par rapport aux chercheurs précédents une autre opinion fut proposée par V. Gábori-Csánk et K. Simán. Selon la première paléolithicienne il y avait dans la Grotte de Szeleta une immense couche mixte entre le Szélétien 'ancien' et 'évolué'[27]. Pourtant, d'après K. Simán, nous devons compter sur un niveau aurignacien - interstratifié entre les couches du Szélétien 'inférieur' et 'supérieur'- avec un vaste foyer et sans pièce foliacée.'Ce niveau était couvert par 1m ou 1.5m de sol épais…Le Szélétien supérieur…a été découvert au-dessus de ce niveau'[28].

Dans la documentation détaillée des anciens fouilleurs de la Szeleta, O. Kadić et M. Mottl, il est impossible de vérifier les deux constatations précédentes. Dans le remlissage de la grotte éponyme il n'y avait ni une 'couche mixte'ni un 'foyer aurignacien'.

En 1989-1990 l'auteur de cet article a élaboré une échelle chronologique des industries à pièces foliacées du Nord-est de la Hongrie. Cette hypothèse suppose un développement direct à partir du Bábonyien - une industrie à pièces foliacée du Paléolithique moyen, proche des Keilmesserguppens et hypothétiquement antérieur au Szélétien de Bükk[29] – via le Szélétien inférieur et supérieur jusqu'au Szélétien solutroïde[30].

Après avoir effectué la première partie de notre révision de la grotte Szeleta entre 1999 et 2002, nous avons publié l'histoire de la recherche de cette grotte et les conclusions de la réinterprétation de son Szélétien dans une contribution consacrée au 80ème anniversaire de Karel Valoch. Nous y avons déterminé 3 unités culturelles dans la couche 2, 7 dans la troisième et 2 dans celle de 6 et 6/a de Szeleta[31].

Depuis les années 2000 Zs. Mester a fait des analyses métriques sur les pièces foliacées du Szélétien 'inférieur' et 'supérieur' par la méthode de F. Bordes, élaborée pour les analyses métriques des bifaces[32]. A la suite des conclusions de cette recherche comparative, il était d'avis que les pièces foliacées de deux couches culturelles diffèrent significativement. Zs. Mester a aussi montré qu'il y a une liaison entre les pièces foliacées szélétiens de la grotte Szeleta et celles du Jankovichien[33].

Il y a un an, cet auteur a modifié un peu son opinion. Selon cette nouvelle interprétation, nous ne connaissons pas précisément les positions stratigraphiques de quelques pièces foliacées analysées. –Les pièces concernées, et donc leurs données métriques et techno-typologiques, pourraient appartenir soit à la couche 'inférieure' soit à la couche 'supérieure'[34].

Lesanalyses métriques des pièces foliacées sont sans doute très importantes aujourd'hui mais on ne peut oublier:

– que ces 'fossils directeurs' ne sont pas identiques au Szélétien,

– que même ces outils ont été soumis à l'évolution techno-typologique du Szélétien de Bükk qui peut expliquer les differences entre les pièces foliacées du 'Szélétien inférieur' et celles du 'Szélétien supérieur'.

Finalement, après avoir réalisé la révision complexe de la Szeleta entre 1999 et 2007, on a publié les résultats les plus importants de la réinterprétation archéologique en 2011[35]. L'idée principale de cette ouvrage est que dans la grotte éponyme il n'y a qu'un Szélétien, le Szélétien de Bükk, depuis la couche 3 au 6/a ou du niveau VII au niveau II de Kadić dans la séquence de l'Entrée - sans phases 'inférieure' - 'supérieure' - 'transitoire' -, à coté des découvertes de plusieurs autres industries. Le remplissage de Szeleta

[23] DJINDJIAN et al. 1999, 217.
[24] RINGER 2011, 21.
[25] VÉRTES 1965; GÁBORI 1984; RINGER 1990; RINGER et al. 1995.
[26] ALLSTWORTH-JONES 1986.
[27] GÁBORI-CSÁNK 1988, 1013-1014.
[28] SIMÁN 1995.
[29] RINGER 1983.
[30] RINGER 1990; RINGER et. al. 1995
[31] MESTER–RINGER 2000.
[32] BORDES 1961.
[33] MESTER 2011.
[34] MESTER et al. 2013.
[35] RINGER 2011.

fut distribué par O. Kadić en six couches paléolithiques, 2-3-4-5-6-6/a de bas en haut, et en XXIV niveaux de 0.5 m d'épaisseur de haut en bas. Il a effectué les fouilles de cette grotte avec un carroyage de 2x2 m, de niveau en niveau et de couche en couche[36].

Notre réinterprétation de la collection archéologique est la combinaison des Approches I-II présentées ci-dessus.

D'après moi, le Szélétien de Bükk se caractérise, en premier lieu, par des pièces foliacées esthétiquement taillées et régulièrement symétriques, par des lames et lamelles toujours très régulières et par des types généralement attribués au Paléolithique supérieur dominants. Cette industrie est datée d'entre 37260±760 et 22107±130 ans BP[37].

[36] KADIĆ 1916.

[37] RINGER 2011, 24.

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TECHNOLOGIE DES PIÈCES FOLIACÉES BIFACES DU PALÉOLITHIQUE MOYEN ET SUPÉRIEUR DE LA HONGRIE

ZSOLT MESTER

Mots-clés: *pièce foliacée, Paléolithique moyen et supérieur, technologie, Szélétien, Jankovichien*

Remerciement

Je me permets de commencer cet article, dédié à l'oeuvre scientifique de Viola T. Dobosi, par ce qui devrait normalement être à la fin. Outre que je remercie les éditeurs de m'avoir invité à écrire dans ce volume, ma gratitude ira, en premier lieu, à Viola pour son travail infatigable par lequel elle a fait avancer la recherche du Paléolithique en Hongrie pendant plus de quatre décennies. Cela concerne non seulement son travail de préhistorien et de conservatrice consciencieuse, mais aussi ses démarches faites pour faciliter la recherche des collègues dans les collections du Musée National de Hongrie. Personnellement, j'en ai profité maintes fois, de même que de ses remarques et conseils formulés à propos de ma thèse de doctorat sur la révision du Moustérien de la montagne de Bükk dont elle était l'un des rapporteurs.

Révision et reconsidération

Dans son rapport mentionné, elle a mis en relief combien la révision des matériels des anciennes fouilles relevait de problèmes sans donner l'espoir de les résoudre. Elle le connaissait bien par sa propre expérience après avoir effectué les révisions de plusieurs sites.[1] En entendant le mot « révision », on a tendance à penser qu'il s'agit là de la correction d'une erreur précédente. Cependant, ce qui est considéré ajourd'hui comme une erreur pouvait bien sembler raisonnable à un niveau précédent de nos connaissances. Cela provient de la nature de la science où les nouvelles données non seulement s'ajoutent aux connaissances déjà acquises, mais s'y intègrent et nous poussent à les reconsidérer. L'évolution des méthodes de recherches, des approches et des problématiques scientifiques a la même conséquence. Bien que j'accepte la position de Viola T. Dobosi que nombreux de nos problèmes archéologiques ne peuvent pas être résolus sans les fouilles modernes de nouveaux sites, je persévère à dire que nous devons, de temps en temps, réanalyser les matériels provenant des anciennes fouilles en appliquant les nouvelles méthodes de recherche d'une manière très prudente.[2]

Problématique

Les outils foliacés jouent un rôle particulier dans la Préhistoire de la Hongrie, et dans celle de l'Europe centrale aussi. La première raison en est d'ordre historique et elle se relie au problème du Protosolutréen d'antan[3], ainsi qu'à la naissance du terme du Szélétien[4]. La seconde raison est d'ordre « esthétique » puisque ces pièces attirent l'attention par leur caractéristiques morphologiques et techniques, surtout celles qui ont été élaborées avec un soin particulier. Étant donné que leur confection exige une technologie spécifique, elles sont généralement considérées par les préhistoriens comme types d'outil primordiaux des assemblages dans lesquels elles se rencontrent.[5] Enfin, la troisième raison est d'ordre

[1] T. DOBOSI 1995; T. DOBOSI–VÖRÖS 1986; 1987; 1994.

[2] MESTER 2001.

[3] FREUND 1952.

[4] PROŠEK 1953.

[5] Par exemple, les outillages du Strélétskien d'Europe orientale sont dominés par les grattoirs qui font environ 30%. Une proportion identique y représente le total des types à façonnage bifacial dont les pointes de Streletskaya considérées comme fossiles directeurs – CHABAI 2003, 75–77. Dans les outillages du Szélétien de la Moravie, la proportion des pointes foliacées est de 5 à 15%, y compris les pointes de Jerzmanowice à façonnage unifacial – OLIVA 1991, 319.

archéologique, tenant compte du fait que ces outils étaient présents dans les industries du Paléolithique moyen et supérieur pendant plusieurs dizaines de millénaires de l'Atlantique jusqu'à l'Altaï. [6] C'est à ce phénomène que se base l'hypothèse qu'ils témoignent une tradition technique qui faisait transition du Paléolithique moyen au Paléolithique supérieur.[7]

En Europe centrale, le Szélétien permet de formuler cette interprétation depuis la découverte des industries à outils bifaciaux du Paléolithique moyen de la région dans les années 1970 et 1980.[8] Les collègues moraves s'accordent sur l'origine micoquienne du Szélétien de leur pays,[9] mais ce n'est pas le cas en Hongrie. En décrivant le Bábonyien pour la première fois, Árpád Ringer a déclaré l'existence d'une relation génétique entre celui-ci et le Szélétien ancien de la montagne de Bükk.[10] Puisqu'il a considéré cette entité comme la première phase de développement du Szélétien, suivie par deux autres – le Szélétien évolué et le Szélétien solutroïde –,[11] il supposait l'existence de développement continu du Bábonyien jusqu'au Szélétien récent, enfin il a même regroupé ces industries en un complexe techno-typologique.[12] Miklós Gábori a accepté l'origine bábonyienne (donc micoquienne) pour le Szélétien ancien mais il en a séparé le Szélétien évolué.[13] Contrairement à cela, Katalin Simán a contesté même l'existence du Bábonyien, tout en considérant les sites en question comme des ateliers du Szélétien ancien.[14] Elle a catégoriquement réfuté l'hypothèse d'une relation génétique entre Szélétien ancien et évolué, tout en interprétant ce dernier comme une tendance à produire des outils foliacés à l'intérieur du Gravettien.[15]

À l'appui d'une évolution continue, Árpád Ringer a invoqué trois arguments :[16]

1) l'utilisation permanente du quartz-porphyre comme matière première en relation stricte avec le façonnage bifacial ;
2) le façonnage par *wechselseitig-gleichgerichtete Kantenbearbeitung* et par la méthode du Bábonyien ;
3) la prédominance permanente des types de couteaux foliacés, de pointes foliacées et de racloirs foliacés dans l'outillage principal.

Katalin Simán a énuméré cinq facteurs qui contestaient le développement continu entre les deux Szélétiens :[17]

1) il y a des sites fournissant des industries analogues au Szélétien ancien, mais le Szélétien évolué n'est connu que dans la grotte Szeleta ;
2) si les dates au ^{14}C sont fiables, plusieurs millénaires séparent les deux Szélétiens ;
3) les caractéristiques des deux industries font penser à des types d'occupation différents (atelier et camp de chasse) ;
4) le nombre des foyers et des outils est trop faible par rapport à l'intervalle de dix mille ans (ce qui fait 1 éclat par 10 ans et 1 foyer par 200 ans) ;
5) les deux industries sont nettement séparées stratigraphiquement dans la grotte.

Depuis les recherches de László Vértes, c'est Viola T. Dobosi qui était la première à s'occuper de la relation de ces industries du Paléolithique moyen et supérieur, en analysant les paramètres techniques des outils foliacés, considérés comme les types d'outil les plus importants.[18] Elle a comparé les dimensions (longueur, largeur, épaisseur) et la forme (angles mesurés à l'extrémité distale et au deux côtés de la base) de 27 pièces pour le Jankovichien, 27 pour le Szélétien évolué et 23 pour le Bábonyien.[19] Sur la base des données présentées, Viola T. Dobosi a constaté que les outils des deux industries du Paléolithique moyen (Jankovichien et Bábonyien) montraient bien d'avoir des racines communes, tandis que ceux du Szélétien évolué étaient de vraies pointes foliacées ayant de dimensions plus grandes et de formes plus allongées. Par conséquent, elle a conclué que les outils foliacés ne prouvaient pas le développement supposé du Bábonyien au Szélétien.

L'hypothèse raisonnée que les caractéristiques morphométriques de ces outils reflètent les traditions technologiques suivies par les tailleurs qui les ont produits constitue la base méthodologique de ces études comparatives. C'est avec la même base que j'ai commencé l'étude de la technologie des outils foliacés en 2004. Cependant, mon objectif n'était pas de chercher les relations génétiques. Il remontait aux résultats de la révision du gisement de Szeleta, programme de recherches effectué entre 1999 et 2002 au Département de Préhistoire et d'Histoire ancienne de l'Université de Miskolc. Dans le cadre de cela, Árpád Ringer a élaboré une nouvelle conception pour

[6] KOZŁOWSKI éd. 1990; KOZŁOWSKI 1995.
[7] La bibliographie de la « transition » est très-très riche même pour les industries à outils foliacés, par ex. ALLSWORTH-JONES 1986; KOZŁOWSKI 1988; FARIZY (dir.) 1990.
[8] VALOCH 2000; GÁBORI-CSÁNK 1983; RINGER 1983
[9] VALOCH 2000; SVOBODA 2001; NERUDA 2000; NERUDA–NERUDOVÁ 2009.
[10] RINGER 1983, 125–126.
[11] RINGER 1990.
[12] RINGER 2001a; RINGER–MESTER 2000, 266–267.
[13] GÁBORI 1982, 5; 1989, 137–138.
[14] SVOBODA–SIMÁN 1989, 306-307; SIMÁN 1990, 193.
[15] SIMÁN 1990; 1995, 42.
[16] RINGER 2001a, 215.
[17] SIMÁN 1995, 41.
[18] T. DOBOSI 1989.
[19] T. DOBOSI 1989, Table 1, 2 et 3.

l'interprétation du matériel archéologique du site, notamment que les hommes de plusieurs entités culturelles (dont les industries mentionnées ci-dessus) avaient occupé la grotte d'une manière parallèle durant les cent millénaires entre le dernier Interglaciaire et le dernier Pléniglaciaire, ce qui veut dire leur contemporanéité dans la région de la montagne de Bükk.[20] Je me suis posé donc la question : si l'on accepte cette idée, peut-on trouver des paramètres technologiques par lesquels les outils foliacés du Jankovichien et du Szélétien pourraint être séparés les uns des autres à l'intérieur d'un assemblage lithique ? J'ai effectué les analyses sur les pièces mises au jour dans les sites éponymes. Les résultats en ont été présentés pour la première fois en 2007 à la table-ronde de Miskolc sur Szeleta (outils de la grotte Jankovich)[21] et au colloque de technologie lithique de Florence (outils de la grotte Szeleta)[22].

Matériel étudié et méthodologie appliquée

Bases théoriques

L'étude technologique à approche paléoethnologique envisage de reconstituer le processus de la production des outils lithiques dans sa complexité. Cela veut dire qu'elle s'intéresse non seulement à la série d'opérations enchaînées qui a donné naissance à la pièce en question, mais également aux facteurs qui ont dirigé ou ont influencé la réalisation. La première partie de ces facteurs est liée aux capacités personnelles du tailleur, la seconde partie en est déterminée par les conditions existant pendant la réalisation, la troisième partie en tire son origine des traditions techniques du groupe humain.[23] Grâce aux recherches expérimentales, on a réussi à comprendre le processus de la production du point de vue du tailleur et d'en établir des modèles.[24] La réalisation d'un outil lithique déterminé n'est possible que si le tailleur en dispose, dès le début du processus, d'une image mentale – plus ou moins idéalisée –, nommée *schéma conceptuel*, qui donne les paramètres primordiaux : quel est l'aspect d'un outil comme ça.[25] Dans chaque culture humaine, il y a un consentement général concernant les caractéristiques principales de chaque type d'outil. Les membres du groupe humain apprennent ces principes pendant leur socialisation et les suivent au cours de leurs activités.[26] De même au début du processus, le tailleur doit disposer d'un plan de réalisation : comment faire un outil comme ça. Dans la plupart des cas, cela signifie une gamme de solutions possibles, nommé *schéma opératoire*. Bien entendu, la composition de ce schéma est largement déterminée par les savoirs-faires du tailleur (sa formation, son habileté, ses connaissances, ses expériences), de même que par les règles, les exigences et les coutumes du groupe auquel il appartient. Ainsi, les schémas conceptuel et opératoire mettent conjointement en oeuvre ce que les préhistoriens considèrent comme le reflet d'une tradition technique et culturelle. Le tailleur choisit donc du schéma opératoire une série d'opérations par laquelle il envisage de produire l'outil qui ressemble le plus possible au schéma conceptuel, en tenant compte des conditions données et des contraintes éventuelles (matière première et outils de tailleur étant à sa disposition, temps à dépenser pour la réalisation, exigences provenant de l'utilisation envisagée, etc.). Au cours de la réalisation peuvent cependant se produire des choses imprévisibles qui obligent le tailleur de modifier le plan original (un accident de taille par exemple). Dans ces cas, il choisit également de la gamme des solutions du schéma opératoire ou bien il en invente des nouvelles. La réalisation effectuée est nommée *chaîne opératoire*.

Ce modèle de structuralisation de « schéma conceptuel–schéma opératoire–chaîne opératoire » nous permet d'esquisser le processus complexe de la production, à proprement parler en sens inverse, en partant du produit final. La lecture technologique[27] des outils finis et des pièces non-finies ou ratées, présents dans l'assemblage étudié, nous permet de reconnaître les éléments (procédés techniques[28], paramètres morphométriques) appliqués dans les chaînes opératoires effectuées par les tailleurs préhistoriques. Si nous en éliminons les éléments qui sont strictement liés aux situations uniques ou particulières, le reste nous rapproche du schéma opératoire. Après cela, si nous estimons quels sont les paramètres auxquels les tailleurs ont eu l'intention d'aboutir, nous arriverons à nous faire une idée du contenu probable du schéma conceptuel. Plus une tradition technique et culturelle est strictement déterminée ou rigoureuse, moins leur produits et leur processus de production sont variés.

Les outils foliacés se prêtent particulièrement à être analysés avec une telle approche puisque, dans leur cas, la forme finale doit faire partie du schéma

[20] RINGER–MESTER 2000, 266–268.
[21] MESTER 2008-2009.
[22] MESTER 2010.
[23] TIXIER 1980, 1199; 2012, 41.
[24] PELEGRIN 1985; 1991; INIZAN et al. 1995, 15, 102.
[25] En quelque-sorte analogues à ce schéma conceptuel sont les termes « ideal type » (CZIESLA 1990 – cité par KOT 2014, 383), « mental template » (URBANOWSKI 2003, 7, 38–39; MIGAL–URBANOWSKI 2006, 2), « general tool concept » (KOT 2014, 383.)

[26] Ce phénomène donne raison à la typologie archéologique.
[27] INIZAN et al. 1995, 91–96.
[28] INIZAN et al. 1995, 30.

conceptuel, ainsi que l'application du façonnage bifacial résulte également certains limites technologiques. Dans le schéma conceptuel, les paramètres de caractère métrique, morphologique ou technique se combinent d'une fréquence différentielle. Les combinaisons qui se répètent dans l'outillage correspondent à des conceptions réelles de variété d'outil. Une étude de Krzysztof Sobczyk sur les prondniks par l'analyse multicritères l'illustre bien : 100 outils mis au jour à trois sites polonais ont pu être regroupés d'après l'analyse des correspondances basée sur la corrélation des attributs.[29] Ces groupes correspondent à ce que la typologie archéologique nomme sous-type. Il est évident que les paramètres étant co-présents dans une combinaison n'ont pas eu la même importance pour les tailleurs préhistoriques.[30] Mais il nous est pratiquement impossible de les pondérer. Quand même, nous pouvons reconnaître les conceptions mentionnées de *variété d'outil*, si nous prenons en considération la fréquence des combinaisons de paramètres avec un certain degré de tolérance. Pour les outils foliacés, nous les appelons « *modules* ».

Récemment, Małgorzata Kot s'est occupée des outils foliacées de la grotte Jankovich et de Sajóbábony-Méhész-tető, dans le cadre d'une recherche sur les pointes foliacées les plus anciennes d'Europe centrale et méridionale.[31] Pour comparaison, elle a analysé ceux de la grotte Szeleta aussi.[32] Son approche est inspirée par la méthode d'analyse des étapes opératoires, élaborée par les chercheurs allemands[33] et appliquée par les chercheurs polonais[34], ainsi que par le concept des unités techno-fonctionnelles, mis au point par les chercheurs français[35]. Son étude a consisté à analyser la chronologie des enlèvements et à reconstituer les séquences opérationnelles, puis à reconnaître les étapes de production de chaque pièces. En généralisant ces résultats au niveau des sites, elle a recherché les idées technologiques appliquées par les tailleurs préhistoriques. Son objectif principal a été de chercher des critères pour mieux définir les pointes foliacées bifaces et les distinguer d'autres types d'outils comme les couteaux bifaciaux.[36]

[29] SOBCZYK 1994.
[30] Les 100 prondniks mentionnés ont formé 8, 12 et 5 groupes relativement au choix de caractères à tenir compte – SOBCZYK 1994, fig. 1–4.
[31] KOT 2013, 246–259; 2014.
[32] KOT 2013, 292-301.
[33] RICHTER 1997,192–194; 2001; 2004; PASTOORS–SCHÄFER 1999; JÖRIS 2001; UTHMEIER 2004.
[34] URBANOWSKI 2003; MIGAL–URBANOWSKI 2006.
[35] BOËDA 2001; SORIANO 2001.
[36] KOT–RICHTER 2012; KOT 2014.

Matériel archéologique étudié

Dans son article mentionné plus haut, Viola T. Dobosi a étudié les outils foliacés du Jankovichien, du Szélétien évolué et du Bábonyien. En ce qui concerne celui-ci, les sites qui figurent sur le ***tableau 3*** de l'article de V. T. Dobosi, à l'exception de Sajóbábony et Mályi, ne sont plus attribués à cette entité culturelle. Le problème de l'appartenance culturelle de « la pointe de la rue Petőfi » et du « biface de la maison de Bársony », tous les deux trouvés à Miskolc sans contexte archéologique, n'est pas résolu faute d'analogies dans les assemblages du Paléolithique de la Hongrie. Les sites d'Eger-Kőporos, d'Ostoros et de Nekézseny, attribués auparavant à la culture d'Eger, ont été classés au Bábonyien par Árpád Ringer en 1983.[37] Dans une nouvelle synthèse sur le Paléolithique de la région d'Eger, Krisztián Zandler a cependant lié au Szélétien tous les sites qui ont fourni d'outils foliacés.[38] Les opinions sont partagées même sur l'interprétation de l'industrie du site d'Eger-Kőporos : à cause des incertitudes stratigraphiques, il n'est pas évident si elle constitue un ensemble culturel[39] ou bien elle est le résultat du mélange de plusieurs ensembles[40]. Nous n'avons pas intégré dans notre analyse les outils foliacés attribués actuellement au Bábonyien parce que nous en savons trop peu : Á. Ringer en a publié seulement 13 pièces provenant de ramassages de six sites,[41] V. T. Dobosi en a décrit quatre mis au jour pendant les fouilles du site éponyme en 1974,[42] les matériels archéologiques fournis par les fouilles récentes des sites de Sajóbábony-Méhész-tető et de Mályi ne sont pas encore publiés en détails[43].

Quant aux pièces foliacées de la grotte Jankovich, László Vértes en a publié 35 pointes et 5 racloirs de type Szeleta.[44] Dans sa monographie sur le Jankovichien, Vera Gábori-Csánk en a décrit 35.[45] Par contre, une de ces pièces fut trouvée dans la grotte Dzeravá skala (grotte Pálffy)[46], trois autres ne sont pas bifaciales et trois ne sont pas foliacées, mais en revanche un outil classé comme racloir simple est en

[37] RINGER 1983, 131–134.
[38] ZANDLER 2006; 2012.
[39] T. DOBOSI 1995; SIMÁN 2003, 84.
[40] MESTER 2000, 89; KOZŁOWSKI et al. 2012.
[41] RINGER 1983, 15–38.
[42] T. DOBOSI 1987-1988.
[43] RINGER–ADAMS 2000; ADAMS 2000. La même constatation est valable aux gisements concernés de la montagne de Bükk, cf. RINGER 2001b, 76–79; DOBOSI 2005, 53–54.
[44] VÉRTES 1965, 307.
[45] GÁBORI-CSÁNK 1993, 131–134.
[46] GÁBORI-CSÁNK 1993, pl. I 3 – A. MARKÓ (2013, 17.) a le mérite de l'avoir reconnue.

réalité un outil foliacé biface.[47] De cette manière, l'ensemble que nous avons étudié a compris 29 outils.

En ce qui concerne les pièces foliacées de la grotte Szeleta, Ottokár Kadić a classé 57 artefacts dans les différentes catégories typologiques des feuilles de laurier dont 33 ont été attribués au Protosolutréen et 24 au Solutréen moyen (*Hochsolutréen*).[48] Dans sa monographie sur le Paléolithique et le Mésolithique de la Hongrie, László Vértes a publié les données statistiques du matériel de la grotte Szeleta où il a compté 116 différentes pointes foliacées et 40 racloirs foliacés dans l'outillage du Szélétien ancien, ainsi que 56 feuilles de laurier dans celui du Szélétien évolué.[49] Contrairement au matériel archéologique de la grotte Jankovich dont la totalité est conservée au Musée National de Hongrie, celui de la grotte Szeleta se trouve aujourd'hui dans les collections de différents musées grâce au fait que les fouilles ont été financées par différents institutions[50] et grâce à l'habitude conforme à l'époque d'échanger des objets archéologiques entre musées. Des collections considérables provenant des fouilles de la grotte Szeleta qui contiennent de pièces foliacées aussi, se trouvent au Musée Herman Ottó à Miskolc (Hongrie), au Musée archéologique à Cambridge (Royaume Uni) et au Musée national historique de Transylvanie à Cluj (Roumanie).[51] Mes analyses ont pu concerner les pièces conservées à Budapest et à Miskolc. Plusieurs chercheurs ont mis en relief que nombreux outils foliacés mis au jour dans les couches inférieures de la grotte Szeleta avaient été défigurés par la cryoturbation.[52] Ces pièces ne convenaient pas à l'analyse technologique en question, de même que celles dont le façonnage bifacial fut abandonné avant d'arriver à une forme foliacée reconnaissable. L'analyse a compris ainsi 73 pièces foliacées bifaces provenant de la grotte Szeleta.

Méthodes de l'analyse

Si l'on cherche le schéma conceptuel appliqué à la production des outils foliacés, on doit étudier leur caractéristiques métriques et morphologiques. À côté des dimensions maximales (longueur, largeur, épaisseur), on doit également prendre d'autres mesures qui peuvent caractériser la morphologie (***Fig. 1.***). Telles sont la position de la plus grande largeur par

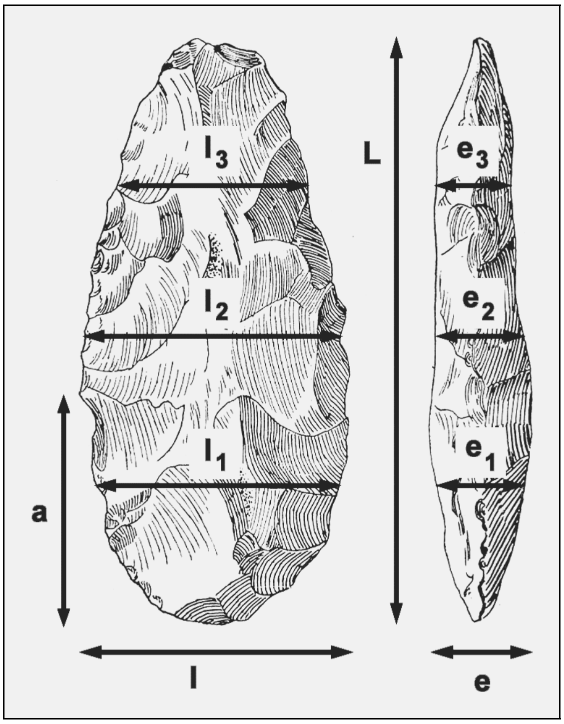

Fig. 1. *Mesures appliquées dans les études morphométriques (KADIC 1916, Abb. 24 modifiée). L: longueur maximale; l: largeur maximale; e: épaisseur maximale; a: distance de la largeur maximale par rapport à la base; l_1: largeur au quart proximal de la longueur; l_2: largeur à la moitié de la longueur; l_3: largeur au quart distal de la longueur*

rapport à la base, ainsi que la largeur prise à la moitié de la longueur. À l'aide de ces paramètres, François Bordes a réussi à séparer les différents types de bifaces.[53] Pour approcher les formes foliacées, il a paru utile de mesurer encore les largeurs aux quarts proximal et distal de la longueur. Avec toutes ces mesures, on peut calculer des rapports dont le rapport longueur-largeur (L / l), le rapport entre la distance de la plus grande largeur et la longueur (a / L), ainsi que le rapport entre les largeurs distale et proximale (l_3 / l_1) semblent les plus caractéristiques concernant la forme de la pièce.

Si l'on cherche le schéma opératoire, l'analyse doit être portée à l'étude des types de support, des procédés techniques appliquées et de l'économie des matières premières. Dans le cas des outils à façonnage bifacial, le support n'est pas toujours reconnaissable avec certitude. On peut conclure à un éclat ou une lame comme support au cas où une partie de la face d'éclatement est encore visible sur l'une des faces de l'outil bifacial, ou bien celui-ci montre la morphologie

[47] MESTER 2008-2009.
[48] KADIĆ 1916, 232–242, 252–260.
[49] VÉRTES 1965, 339, 341.
[50] MESTER 2002.
[51] ALLSWORTH-JONES 1978; RINGER–SZOLYÁK 2004, 16.
[52] GÁBORI-CSÁNK 1970; ALLSWORTH-JONES 1978; 1986; T. DOBOSI 1989; RINGER 1989; GÁBORI 1989; 1990; SIMÁN 1990.
[53] BORDES 1961, 49–55; 1981, 71–76.

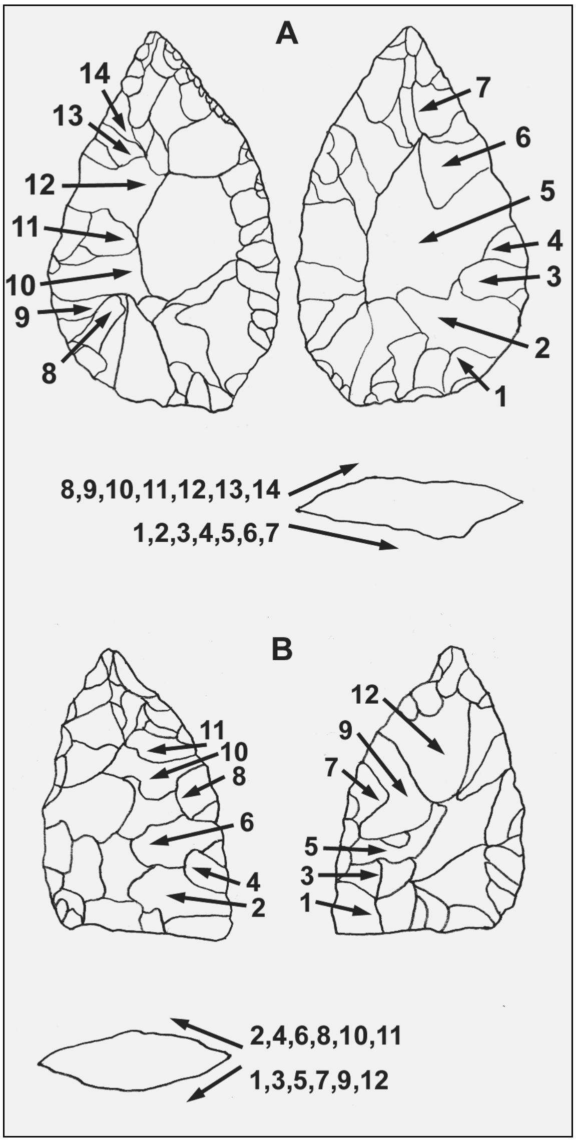

Fig. 2. *Illustration du façonnage alterne (A) et du façonnage alternant (B) (d'après* M*ESTER 2008-2009, fig. 5)*

caractéristique d'un éclat ou d'une lame dans sa section longitudinale. On peut se baser de la connaissance des caractéristiques des matières premières. Grâce aux expérimentations de taille,[54] nous savons que les blocs du quartz-porphyre gris, d'origine de la partie orientale de la montagne de Bükk, ont tendance à se fragmenter en morceaux plus ou moins plats à cause de leur structure interne. Ce sont ces fragments qui sont nommés « plaquettes » dans les publications. Cependant, les fragments d'aspect de vraie plaquette – délimités par des faces parallèles – se produisent seulement de la variété à structure feuilletée du quartz-porphyre. Mais, dans ces cas, la structure feuilletée dérange la propagation de l'onde de choc et elle cause fréquemment d'accidents de taille, surtout des enlèvements réfléchis. Par conséquent, les supports les plus aptes au façonnage bifacial ont une morphologie plutôt asymétrique ce qui peut expliquer la fréquence de la section asymétrique ou en forme de parallélogramme.

La section de l'outil foliacé témoigne également du mode de son façonnage. J'en ai distingué deux variétés principales : plan-convexe et biconvexe.[55] J'ai considéré la section comme biconvexe, si les convexités dorsale et ventrale par rapport au plan d'intersection des deux faces étaient à peu près égales. Au cas inverse, si l'une de ces convexités était moins accentuée, la section a été considérée comme plan-convexe. Il paraîtrait évident de conclure à l'existence d'une corrélation entre supports d'éclat ou de lame et sections plan-convexes, d'une part, ainsi que entre supports « en plaquette » et sections biconvexes, d'autre part, mais les résultats des analyses ne l'ont pas confirmée. La morphologie originale des supports offrait cette possibilité pour le façonnage dont les tailleurs préhistoriques ont profité ou non. La section de la pièce façonnée dépend des angles des enlèvements qui modifient la surface et l'épaisseur. Elle témoigne donc la stratégie de façonnage appliquée par le tailleur. Il y a eu des pièces parmi les outils foliacés de toutes les deux gisements (grottes Szeleta et Jankovich) pour lesquelles la section n'était pas facile à classer. Dans ces cas, je l'ai attribuée à celle dont elle était plus proche. Deux outils de la grotte Szeleta[56] a eu la particularité que les moitiés proximale et distale ont été façonnées de manière différente, produisant une section biconvexe pour l'une des deux parties et une section plan-convexe pour l'autre. L'explication de ce phénomène peut être trouvée dans la situation où l'épaisseur de la partie proximale du support a été nettement plus (ou moins) grande que celle de la partie distale. De ce fait, leur épaisseurs n'auraient pu être équilibrées qu'au prix de modifier largement soit la silhouette, soit les dimensions de l'outil, mais le tailleur ne le voulait pas apparemment faire. J'ai figuré toutes les deux pièces dans les statistiques selon la partie proximale.

[54] Outre mes expériences personnelles, je peut me référer aux informations reçues de mes collègues, Katalin Simán, György Lengyel et Péter Szolyák qui trouvent ici l'expression de ma gratitude.

[55] Dans l'industrie micoquienne de la grotte Kůlna en Moravie, Éric Boëda en a distingué cinq variétés suivant la combinaison des enlèvements plats et convexes sur les deux faces de la pièce. – BOËDA 1995, 58 et fig. 2.

[56] Tous les deux outils sont conservés dans la collection du Musée Herman Ottó à Miskolc (n[os] d'inventaire : 53.4.20 et 53.38.7).

Le façonnage des arrêts latéraux constitue également un élément important de la production. En étudiant les outils foliacés de la grotte Jankovich, j'en ai reconnu deux modes principaux que j'ai nommés *façonnage alterne* et *façonnage alternant*.[57] Les deux modes représentent de stratégies différentes. Dans le cas du façonnage alterne, les enlèvements régularisant la délinéation de l'arrêt sont produits en deux séries dont la première concerne uniquement la face dorsale (ou ventrale) et la deuxième concerne l'autre face (***Fig. 2, A***). Ce mode de façonnage correspond à celui qui a été décrit dans les industries micoquiennes de l'Allemagne sous la dénomination de *wechselseitig-gleichgerichtete Kantenbearbeitung*.[58] Dans le cas du façonnage alternant, les enlèvements régularisant la délinéation de l'arrêt sont produits en une série concernant les faces dorsale et ventrale d'une manière alternante (***Fig. 2, B***). Il n'est pas nécessaire que cette alternance soit rigoureux, c'est-à-dire que le tailleur change de face à chaque enlèvement. Les outils étudiés démontrent que l'alternance s'est produite parfois en courtes séries de deux à trois enlèvements.

J'ai étudié l'économie de la matière première pour chercher des préférences éventuelles dans la production des outils foliacés.

Résultats

Les outils foliacés de la grotte Jankovich ont un aspect assez homogène. Ils sont de forme variée à silhouette asymétrique (***Fig. 3.***). Leur dimensions se caractérisent par 30 à 77 mm de longueur, 24 à 41 mm de largeur et 7 à 12 mm d'épaisseur (***Tableau 1, Fig. 7.***). Deux pièces sont seulement plus grandes, avec une longueur dépassant 90 mm. Il n'y a que deux fragments d'outils dont la morphologie diffèrent de l'aspect général, paraissant plus allongés que les autres, mais leur formes originales sont impossibles à reconstituer.[59]

Les outils foliacés de la grotte Szeleta sont loins d'être si homogènes. Ils peuvent être classés en trois groupes principaux (***Tableau 1; Fig. 7.***) :[60]

– Le groupe 1 est composé de 32 pièces – dont 6 sont des fragments – qui sont larges et symétriques (***Fig. 4.***). Leur dimensions caractéristiques sont de 87,5 à 109,5 mm de longueur, de 37 à 46 mm de largeur et de 9 à 14 mm d'épaisseur. Sur le diagramme ne se trouvent que trois pièces qui sont beaucoup plus grandes.
– Le groupe 2 compte 21 outils dont deux sont des fragments (***Fig. 5.***). Ils sont étroits et symétriques, de dimensions plus variées que les pièces du groupe précédent : longueur de 65 à 128 mm, largeur de 26 à 38 mm et épaisseur de 7 à 14 mm.
– Le groupe 3 embrasse 20 outils – dont 3 sont des fragments – de formes très variées mais toujours asymétriques (***Fig. 6.***). Ils sont 34 à 72 mm de long, 24 à 42 mm de large et 8 à 12 mm d'épais.

Les valeurs moyennes des paramètres métriques des outils de la grotte Jankovich sont identiques à celles du groupe 3 de la grotte Szeleta, tandis qu'elles diffèrent nettement à celles des groupes 1 et 2 de la grotte Szeleta (***Tableau 1; Fig. 8.***). Les tailleurs des outils symétriques de la grotte Szeleta ont eu l'intention nette de produire des formes allongées dont le rapport longueur-largeur dépassait toujours 2,0. Par contre, ce rapport n'a atteint qu'exceptionnellement 2,0 dans le cas des outils asymétriques des grottes Szeleta et Jankovich. (***Fig. 9.***)

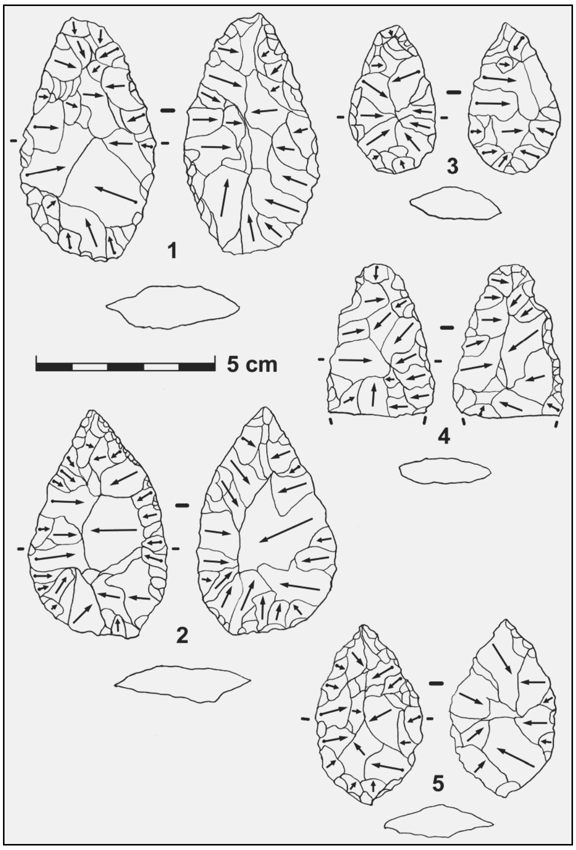

Fig. 3. *Pièces foliacées bifaces de la grotte Jankovich (d'après* MESTER *2008-2009, fig. 6)*

[57] MESTER 2008-2009, 86; 2010, 110.
[58] BOSINSKI 1967, 43. Il est souvent nommé retouche WGK dans les publications des chercheurs hongrois.
[59] N^os d'inventaire: 94/915.36 et 38/916.12 – voir GÁBORI-CSÁNK 1993, pl. III: 3 et 4.
[60] MESTER 2010, 110.

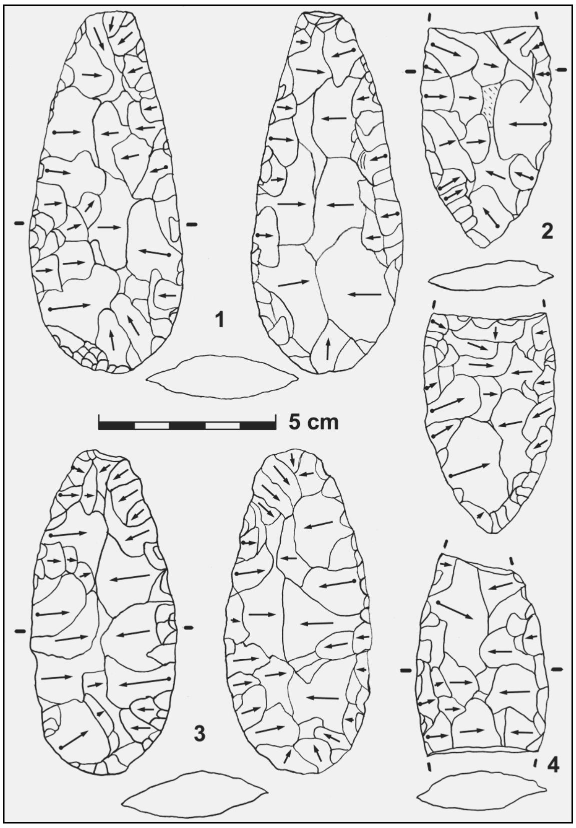

Fig. 4. *Pièces foliacées bifaces de la grotte Szeleta : groupe des pièces larges et symétriques (d'après* MESTER *2010, fig. 3)*

Si nous envisageons de reconnaître les formes idéales cherchées par les producteurs des outils foliacés étudiés, nous pouvons constater également l'existence de différences fondamentales (***Tableau 1; Fig. 10 et 11.***).

Le schéma conceptuel des outils foliacés larges et symétriques (Szeleta 1) devait être le plus strictement déterminé. La longueur devait faire environ 100 mm parce qu'elle varie très peu entre 90 et 110 mm. Elle devait mesurer approximativement deux fois et demi plus que la largeur (le rapport L / l se concentre entre 2,19 et 2,55). La plus grande largeur devait située entre le tiers proximal et la moitié de la longueur (le rapport a / L se concentre entre 0,36 et 0,46, avec un minimum de 0,28 et un maximum de 0,54). La forme est plus ou moins pointue à son extrémité distale mais elle se rétrécie également vers la base, la largeur distale (l_3) fait 69–89% de la largeur proximale (l_1). Deux modules principales se distinguent : l'une à base arrondie, l'autre à base pointue (***Fig. 12, 1A et 1B***).

Le schéma conceptuel des outils foliacés étroits et symétriques (Szeleta 2) a permis une plus grande variabilité concernant les dimensions et les proportions de l'outil. Dans leur cas, le rapport L / l pouvait atteindre même 3,5 et la plus grande pièce est deux fois plus longue que la plus petite. Par contre, la forme devait être déterminée d'une manière assez rigide. La largeur maximale se trouve toujours près du milieu de la longueur (le rapport a / L varie majoritairement entre 0,39 et 0,47). Les largeurs proximale (l_1) et distale (l_3) sont équilibrées : cette dernière fait 80–90% de la première. Malgré la variabilité restreinte, deux modules peuvent être reconnues suivant la position de la largeur maximale (***Fig. 12, 2A et 2B***).

Les schémas conceptuels des outils foliacés asymétrique (Szeleta 3 et Jankovich) ont donné beaucoup plus de libertés aux producteurs que les schémas précédents. Les dimensions sont très variées mais la longueur ne dépasse qu'exceptionnellement 80 mm. La pièce est rarement allongée, parfois même trapue (le rapport L / l se situe majoritairement entre 1,5 et 2,0). La forme est également variée, la largeur maximale se trouve entre le tiers proximal et la moitié de la longueur (le rapport a / L varie pratiquement entre 0,32 et 0,53). En même temps, les outils ont l'aspect plutôt pointu : la largeur distale fait – pour la plupart – moins que 80% de la largeur proximale. Conformément à la variabilité des paramètres, plusieurs modules existent (***Fig. 12, 3A à 3E***).

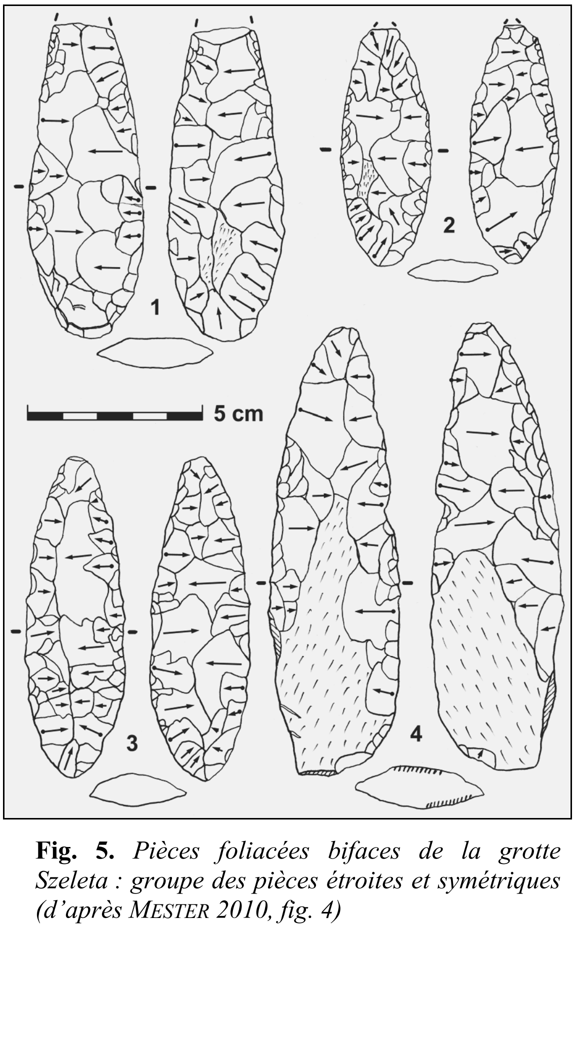

Fig. 5. *Pièces foliacées bifaces de la grotte Szeleta : groupe des pièces étroites et symétriques (d'après* MESTER *2010, fig. 4)*

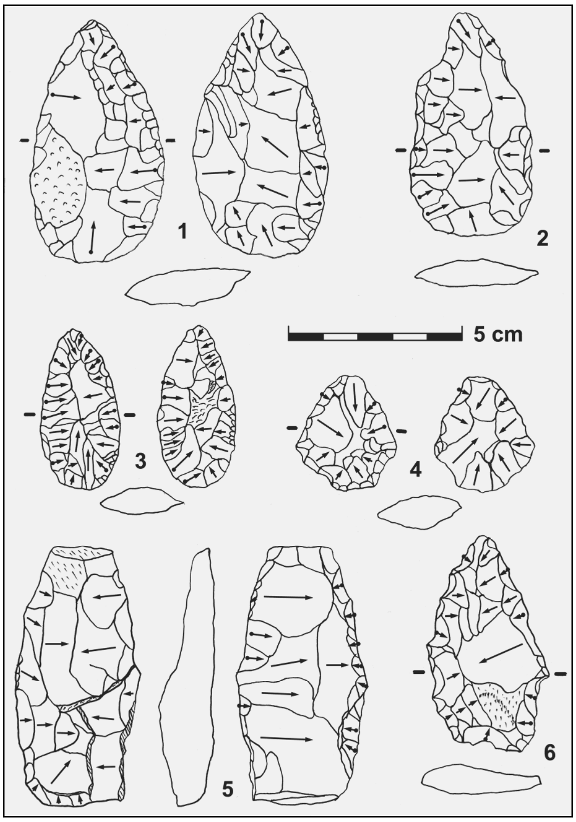

Fig. 6. *Pièces foliacées bifaces de la grotte Szeleta : groupe des pièces asymétriques (d'après* MESTER *2010, fig. 5)*

L'analyse morphométrique a confirmé donc que les producteurs des outils foliacés symétriques ont suivi des schémas nettement différents que ceux des outils foliacés asymétriques. Sur les diagrammes, les valeurs de Szeleta 1 et de Szeleta 2 se situent les unes près des autres, tandis que les valeurs de Szeleta 3 et de Jankovich forment pratiquement un ensemble. Nous pouvons relever l'hypothèse que les pièces symétriques et asymétriques représentent des traditions techniques et culturelles différentes.

D'autres différences s'observent au niveau des schémas opératoires (***Tableau 2.***). Durant l'élaboration des outils foliacés symétriques, les tailleurs ont appliqué majoritairement la combinaison du façonnage alternant et l'obtention d'une section biconvexe : 65,63% et 47,62% pour Szeleta 1 et Szeleta 2 respectivement. Le façonnage alternant prédomine pour ces deux groupes avec une proportion supérieure à 70%. À propos des sections, on constate le même phénomène que dans le cas des paramètres métriques : les outils de Szeleta 1 sont assez strictement liés à la section biconvexe (78,13%), tandis que ceux de Szeleta 2 ne décident pas entre section biconvexe (52,38%) et section plan-convexe (47,62%). Les producteurs des outils foliacés asymétriques ont préféré la combinaison du façonnage alterne et l'obtention d'une section plan-convexe dans toutes les deux grottes (78,95% pour Szeleta 3 et 40,74% pour Jankovich). Le façonnage alterne prédomine nettement dans les deux ensembles (89,48% pour Szeleta 3 et 66,67% pour Jankovich), de même que la section plan-convexe (respectivement 84,21% et 59,26%).

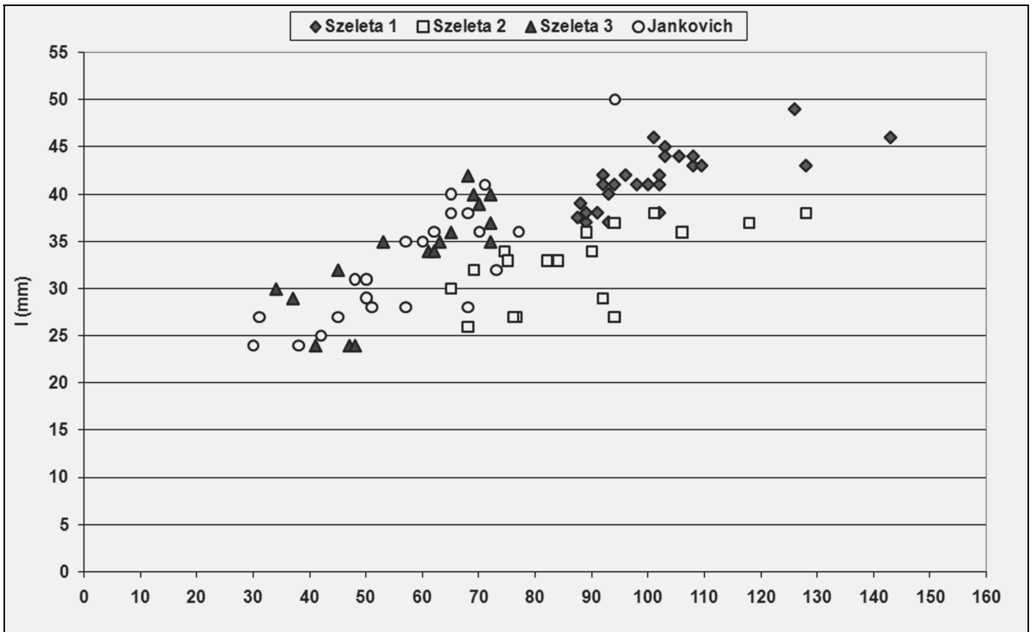

Fig. 7. *La longueur (L) et la largeur (l) des pièces foliacées étudiées, sans les pièces cassées*

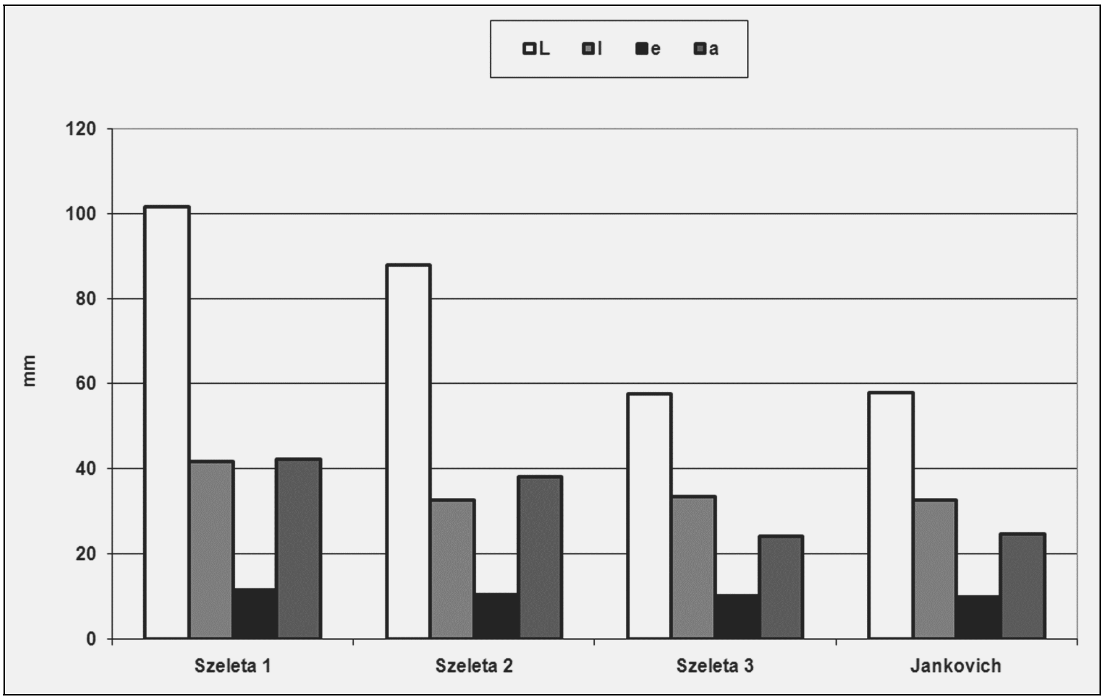

Fig. 8. *Longueur moyenne (L), largeur moyenne (l), épaisseur moyenne (e), distance moyenne de la largeur maximale par rapport à la base (a) pour les ensembles de pièces foliacées étudiées*

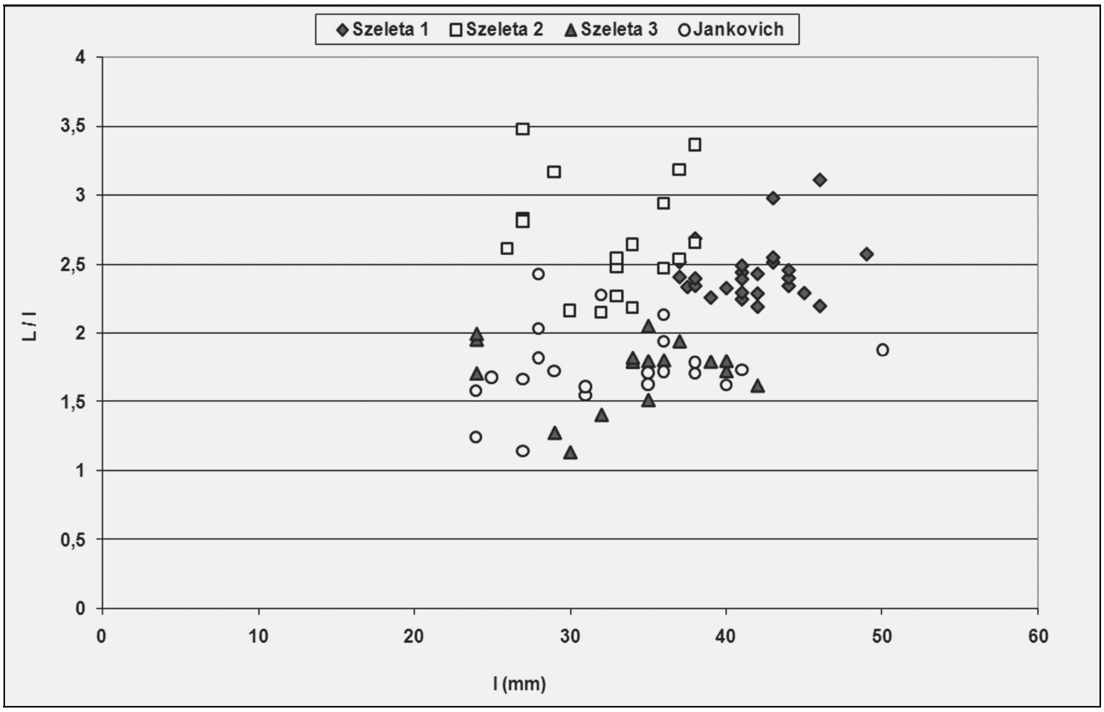

Fig. 9. *La largeur maximale (l) et le rapport longueur/largeur (L / l) des pièces foliacées étudiées*

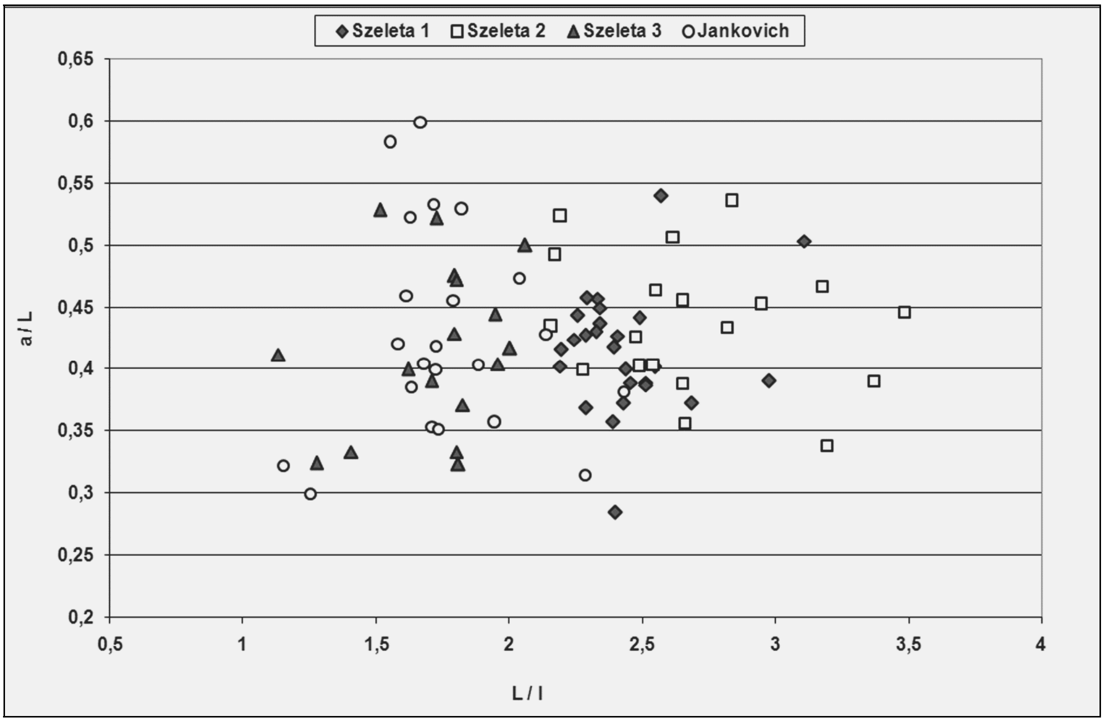

Fig. 10. *Caractéristiques morphologiques des pièces foliacées étudiées d'après le rapport longueur/largeur (L / l) et la position de la largeur maximale (a / L)*

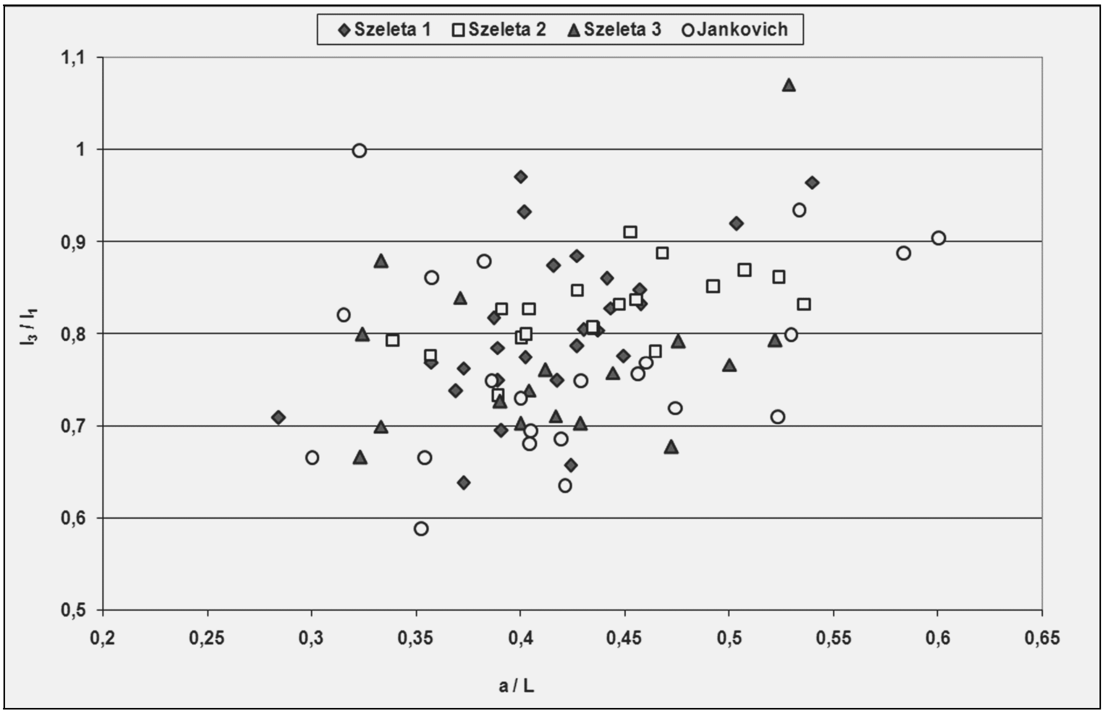

Fig. 11. *Caractéristiques morphologiques des pièces foliacées étudiées d'après la position de la largeur maximale (a / L) et le rapport des largeurs aux quarts distal et proximal de la longueur (l_3 / l_1)*

Quant à l'économie de la matière première, les outils foliacés symétriques et asymétriques ne semblent pas montrer de telles différences que dans les domaines mentionnés (***Tableau 3.***). Les producteurs des outils foliacés symétriques ont utilisé le quartz-porphyre comme si c'était obligatoire : il est presque exclusif pour Szeleta 1 (93,75%) et largement prédominant pour Szeleta 2 (81,82%). Par contre, les tailleurs des outils foliacés de Szeleta 3 ont utilisé une gamme assez large de matières premières accessibles, dont le quartz-porphyre, les limnoquartzites et la radiolarite. Les hommes préhistoriques de la grotte Jankovich paraissent avoir choisi presque toujours la radiolarite comme matière première des outils foliacés (92,59%). Il est à noter cependant que, dans la montagne de Gerecse, la radiolarite constitue pratiquement la seule matière apte à faire ces types d'outils. Dans ce gisement, une variabilité comparable à celle des matières premières des outils de Szeleta 3 est représentée par les variétés de radiolarite.

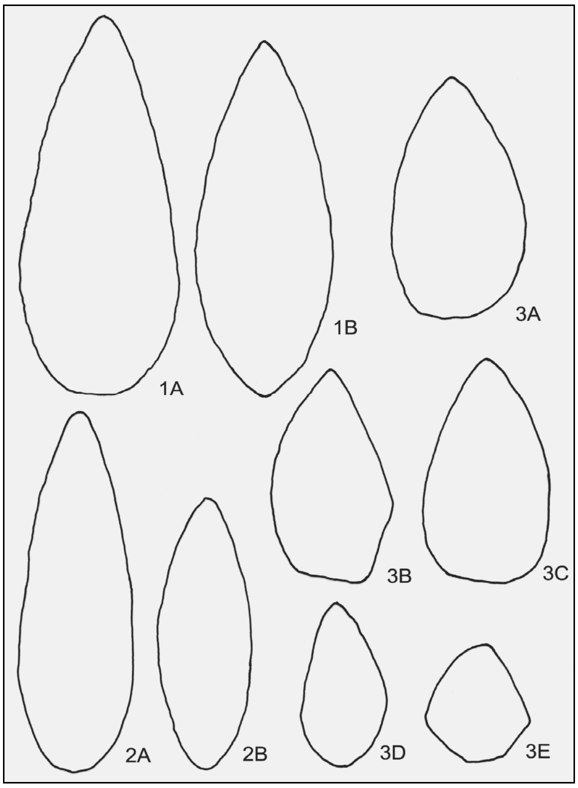

Fig. 12. *Modules reconnues des outils foliacés bifaces de la grotte Szeleta. 1: outils foliacés symétriques et larges, à base arrondie (A) ou à base pointue (B); 2: outils foliacés symétriques et étroits, avec largeur maximale dans la partie proximale (A) ou au milieu (B) de la pièce; 3: outils foliacés asymétriques, en forme de feuille de laurier (A, B, C), en forme de petite feuille de laurier (D), subtriangulaire (E) (d'après* MESTER *2010, fig. 1)*

Conclusions

Les analyses présentées ci-dessus ont démontré que les quatre ensembles d'outils foliacés des grottes Szeleta et Jankovich forment deux unités du point de vue technologique. Les ensembles constituant chacune des unités se rapprochent beaucoup, tandis que les unités elles-même se diffèrent nettement. Les diagrammes des analyses morphométriques (***Fig. 7 à 11***) argumentent d'une manière assez persuasive pour la distinction des deux unités – les outils foliacés symétriques (Szeleta 1 et Szeleta 2) d'un côté et les outils foliacés asymétriques (Szeleta 3 et Jankovich) de l'autre – qui suivent des schémas conceptuels différents. Les données des tableaux présentant les résultats des analyses technologiques (***tableaux 2 et 3.***) confirment l'existence des deux unités au niveau des schémas opératoires. Si l'on tient compte des positions stratigraphiques connues des outils foliacés mis au jour dans la grotte Szeleta (***Tableau 4.***), notamment que la majorité des pièces symétriques (73,91% de Szeleta 1 et 68,75% de Szeleta 2) est provenue des couches 5 (brun rougeâtre), 6 (gris clair) et 6a (jaune clair), tandis que la moitié des pièces asymétriques (50,0% de Szeleta 3) fut trouvée dans les couches 2 (brun foncé), 3 (brun clair) et 4 (gris foncé), on peut associer les outils foliacés symétriques au Szélétien évolué et les outils foliacés asymétriques au Szélétien ancien.[61] Cependant, ceux-ci pourraient également être associés au Jankovichien d'après l'interprétation chronologique et stratigraphique des industries de la grotte Szeleta, élaborée récemment par Árpád Ringer.[62] Dans ce cas, on devrait séparer les matériels lithiques des deux unités taxonomiques l'un de l'autre. Or les analyses morphométriques et technologiques présentées n'ont pu démontrer aucune différence technologique. Bien au contraire, il est à reconsidérer la relation entre le Jankovichien et le Szélétien ancien.[63]

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[61] Dans le Tableau 4, les provenances correspondent aux notes enregistrés pour chaque pièce dans l'inventaire de fouilles (Archives du Musée National de Hongrie, n° d'inv.: 3.Sz.I.) (MESTER 2002, 59–60). Ces notes marque la provenance pour la plupart par la couleur de la couche en question. Les couches sont identifiables comme ça, sauf dans le cas de notes « gris » puisqu'il peut s'agir soit de la couche 4 (gris foncé), soit la couche 6 (gris claire). Dans le Tableau 4, la provenance inconnue ou secondaire veut dire que la pièce fut retrouvée sur le déblais ou dans la fosse préhistorique plus récente.

[62] RINGER–MESTER 2000, 266–268.

[63] MESTER 2008-2009. J'ai présenté même des similitudes typologiques dans ma conférence intitulée „Jankovichien és Korai Szeletien a

À l'état actuel de la recherche, on ne peut pas trancher la question de savoir si le Jankovichien et le Szélétien ancien sont des unités taxonomiques séparées ou bien ils constituent un complexe ou même une seule entité archéologique. De même, il n'est actuellement plus évident que le Szélétien évolué est à considérer comme une phase récente du Szélétien ou bien comme un Gravettien disposant des types d'outils foliacés bifaces, comme l'a déjà supposé Katalin Simán. À mon avis, on ne peut pas aborder ces problèmes uniquement à travers l'étude des outils foliacés. Il n'est même pas nécessaire de les résoudre pour qu'on puisse tirer ici d'autres conclusions des résultats de mes analyses. Il en suffit de constater que les unités des outils foliacés symétriques et asymétriques dessinées ci-avant représentent deux traditions techniques différentes et que l'existence d'une liason génétique entre elles n'est pas probable à cause de leur différences démontrées ici.

Les supports des outils foliacés asymétriques ont été des éclats dont la majorité provenait probablement du débitage Levallois (73,1% pour Jankovich, 50,0% pour Szeleta 3 par rapport des supports reconnaissables). Dans le matériel lithique de la grotte Jankovich, il y a trois pièces qui portent des enlèvements plats et envahissants sur la partie distale de la face ventrale.[64] Ils ne sont pas des enlèvements de retouche mais plutôt les traces d'un façonnage bifacial non achevé. Cela convient bien à la dominance observée du façonnage alterne. Dans la Préhistoire de Hongrie, le rôle du débitage Levallois dans la production des supports des outils foliacés a été reconnu pour le Jankovichien mais non pour le Szeletien ancien. Mon analyse a dévoilé que l'ensemble étudié de Szeleta 3 contenait des supports Levallois et que ceux-ci n'étaient pas liés à la radiolarite mais ils se rencontraient également en limnoquartzite et en quartz-porphyre.

Ce fait donne nettement un aspect de Paléolithique moyen à l'unité des outils foliacés asymétriques.[65] Depuis la parution de la monographie du Jankovichien, de nouvelles études ont ébranlé la datation de l'industrie par la révision de la détermination des vestiges qui en avaient constitué les deux arguments principaux pour la placer avant le maximum du Würm I, c'est-à-dire avant le premier Pléniglaciaire.[66] Les nouvelles déterminations[67] ont reculé l'âge du Jankovichien au début du Würm moyen, c'est-à-dire à la première moité de l'Interpléniglaciaire (stade isotopique 3), qui correspondrait à la fin du Paléolithique moyen. Cette position chronologique ne peut pas être exclue pour la couche 3 de la grotte Szeleta, ce que les dates radiométriques publiées semblent confirmer.[68] Il faut souligner cependant qu'il y a des doutes considérables concernant la validité de ces dates.[69]

Dans la plupart des cas, il est impossible de reconnaître le support des outils foliacés symétriques étudiés. Mais leur caractère allongé, en quelque sorte « laminaire », donne nettement un aspect de Paléolithique supérieur à cette unité. D'après les contexes stratigraphiques des pièces dans la séquence de la grotte Szeleta, celle-ci paraît être contemporaine du Gravettien.[70] Dans ce cas, il faut également relever le problème de la validité des dates au ^{14}C publiées.[71] Pour le moment, il reste une question intéressante de savoir d'où venait la tradition technique produisant ces outils, faits parfois d'une sorte d'élégance, et quelle « fonction » pouvait la faire émerger. Il y aura donc encore des problèmes à reconsidérer pour la génération suivante de préhistoriens hongrois.

levéleszközök fényében" (Le Jankovichien et le Szélétien ancien à la lumière des outils foliacés) à l'occasion de la table-ronde sur la recherche des industries lithiques organisée à l'Université de Miskolc le 3 décembre 2010

[64] GÁBORI-CSÁNK 1993, pl. IV: 4, 8 et 9; MESTER 2008-2009, fig. 4.

[65] Miklós Gábori a considéré le Szélétien ancien comme une industrie du Paléolithique moyen – GÁBORI 1989, 137; 1990, 104. Dans une synthèse récente, Árpád Ringer a fait également connaître le Szélétien ancien dans le chapitre du Paléolithique moyen – RINGER 2001b, 81–82.

[66] Il s'agit de l'ossement d'*Ovibos pallantis* et les dents de l'homme de Nenderthal, mis au jour dans la grotte Remete-Felső – GÁBORI-CSÁNK 1993, 63.

[67] L'*Ovibos* s'est avéré d'être un petit *Bison* – Vörös 2000, 190, tandis que les paramètres métriques et morphologiques des dents humaines peuvent les attribuer alternativement à l'homme moderne aussi – TILLIER et al. 2006, 102.

[68] RINGER 2002.

[69] LENGYEL–MESTER 2008.

[70] SIMÁN 1990.

[71] LENGYEL–MESTER 2008.

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No. inv.	mat. prem.	section	façonnage	L (mm)	l (mm)	e (mm)	a (mm)	l_1 (mm)	l_3 (mm)
Szeleta 1				**101,7***	**41,6***	**11,6***	**42,3***	**37,7***	**30,3***
167/914.1	qp	bk	vk	103	45	13	38	42	31
167/914.2	qp	pk	vk	126	49	14	68	43	41,5
33/951	qp	bk	vk	101	46	10	42	40	35
47/1928.1	qp	pk	vk	105,5	44	11	30	43	30,5
53.4.15	qp	pk	ov	91	38	13	38	36	27
53.4.17	qp	bk	ov	(89)	(41)	(10)	(50)		
53.4.21	qp	pk	ov	93	37	10	36	33	27
53.4.22	qp	bk	ov	92	41	11	39	38	25
53.4.23	qp	pk	ov	98	41	10	35	39	30
53.4.24	op	bk	vk	(54)	(33)	(10)	(23)		
53.8.1	qp	bk	vk	88	39	9	39	35	29
53.38.5	qp	bk	vk	128	43	13	50	41	28,5
53.38.6	qp	bk	vk	94	41	12	43	36	30
53.38.7	qp	bk	vk	93	40	10	40	36	29
53.38.7	qp	bk	vk	102	42	14	38	38	29
53.38.8	qp	bk	vk	102	38	11	38	36	23
53.38.9	qp	bk	ov	108	44	11	42	42	33
57/912.1	qp	pk	ov	103	44	13	45	41	33
57/912.2	qp	bk	vk	100	41	13	40	35	34
57/912.5	qp	bk	vk	89	37	10	38	33	26
57/912.6	qp	bk	vk	87,5	37,5	11,5	40	33	28
57/912.10	qp	bk	vk	(71)	(40)	(15)	(62)		
57/912.11	qp	bk	vk	(62)	(37)	(10)	(43)		
57/912.12	qp	bk	vk	(57)	(37,5)	(12,5)	(16)		
Pb/80	qp	bk	vk	89	38	9,5	40	33,5	26
Pb/81	qp	bk	ov	96	42	11	41	35	31
Pb/82	qp	pk	ov	108	43	11	42	40	30
Pb/86	qp	bk	vk	92	42	14	37	40	31
Pb/88	qp	bk	vk	109,5	43	11	44	37,5	35
Pb/93	lq	bk	vk	143	46	12	72	37,5	34,5
Pb/96	qp	bk	vk	102	41	12,5	45	36	31
Pb 62/151	qp	bk	vk	(71)	(38)	(8)	(2)		
Szeleta 2				**88,0***	**32,7***	**10,3***	**38,0***	**29,9***	**24,7***
167/914.4	qp	bk	vk	65	30	10	32	27	23
53.4.1	qp	pk	ov	118	37	14	40	34	27
53.4.13	qp	pk	ov	101	38	10	36	36	28
53.4.16	qp	bk	vk	106	36	11	48	34	31
53.4.19	qp	pk	ov	84	33	9	39	32	25
53.4.20	qp	pk	vk	69	32	10	30	31	25
53.8.2	sl	bk	vk	76	27	9	33	26	21
57/912.3	qp	bk	vk	89	36	11,5	38	33	28
57/912.4	qp	pk	vk	(90)	(33,5)	(11)	(37)		
57/912.7	qp	pk	vk	82	33	11	33	30	24
57/912.9	qp	bk	vk	(69)	(29)	(9)	(30)		
9/915.4	qp	bk	vk	90	34	10,5	41	31	26
9/915.5	qp	bk	vk	90	34	12,5	35	30	22
Pb/70	qu	pk	vk	92	29	10	43	27	24
Pb/71	qp	bk	ov	94	27	8	42	24	20
Pb/72	qp	bk	vk	76,5	27	9	41	24	20
Pb/73	qp	pk	vk	68	26	7	34,5	23	20
Pb/76	qp	pk	vk	74,5	34	10	39	29	25
Pb/79	lq	pk	vk	75	33	12,5	30	27	21,5
Pb/91	km	bk	vk	94	37	9	38	35	29
Pb/92	qp	bk	vk	128	38	12,5	50	35	29
Szeleta 3				**57,59***	**33,5***	**10,2***	**24,2***	**28,7***	**22,0***
30/913.12	lq	pk	ov	(31)	(28)	(11)			
47/1928.2	qp	pk	ov	72	40	12	34	31	21
47/1928.3	sl	pk	ov	53	35	10	28	28	30
53.4.25	ob	bk	vk	(58)	(33)	(10)	(24)		
53.5.4	rd	pk	vk	68	42	10	25	37	26
57/912.8	qp	pk	ov	72	37	10	32	31	23,5
Pb/14	sl	pk	ov	37	29	10	12	25	20
Pb/15	rd	bk	ov	34	30	10	14	23	17,5
Pb/16	lq	bk	ov	45	32	12	15	25	22

No. inv.	mat. prem.	section	façonnage	L (mm)	l (mm)	e (mm)	a (mm)	l_1 (mm)	l_3 (mm)
Pb/22	lq	pk	ov	61	34	10	29	29	23
Pb/23	rd	pk	ov	63	35	10	21	30	21
Pb/24	lq	pk	ov	62	34	10	23	25	21
Pb/30	rd	pk	ov	69	40	12	36	34	27
Pb/45	qp	pk	ov	41	24	9	16	22	16
Pb/75	qp	pk	ov	65	36	10	21	36	24
Pb/78	qp	pk	ov	(65)	(35)	(10)	(21)		
Pb/83	qp	pk	ov	70	39	12	30	37	26
Pb/84	lq	pk	ov	47	24	8,5	19	23	17
Pb/85	lq	pk	ov	48	24	8	20	22,5	16
Pb/97	qp	pk	ov	72	35	10	36	30	23
Jankovich				**57,82***	**32,7***	**9,98***	**24,6***	**28,9***	**22,0***
13/917.1	rd	pk	ov	68	38	12	31	33	25
13/917.2	rd	pk	ov	42	25	8	17	23	16
13/917.3	rd	pk	ov	45	27	9	27	21	19
34/918.3	rd	pk	vk	65	38	11,5	23	36	24
34/918.5	rd	bk	vk	48	31	12	28	27	24
34/918.6	rd	bk	ov	60	35	8	32	31	29
34/918.11	rd	bk	ov	57	28	11	27	25	18
38/916.11	rd	bk	ov	(44)	(31)	(9)	(9)		
38/916.12	rd	pk		(42)	(34)	(10)			
61/925.1	rd	bk	ov	(68)	(38)	(10)	(23)		
61/925.2	rd	pk	ov	65	40	11	34	38	27
61/925.2	rd	bk	ov	77	36	10	33	32	24
94/915.4	rd	bk	vk	50	29	9	20	26	19
94/915.6	rd	pk	vk	71	41	11	25	39	23
94/915.8	rd	pk	vk	62	36	10	26	33,5	23
94/915.9	rd	pk	vk	57	35	10	22	32	24
94/915.13	rd	pk	ov	50	31	10	23	26	20
94/915.14	rd	pk	vk	51	28	10	27	25	20
94/915.15	rd	bk	vk	(40)	(27)	(9)	(11)		
94/915.16	rd	pk	ov	30	24	8	9	21	14
94/915.17	rd	pk	ov	31	27	7	10	20	20
94/915.36	qp	bk		(38)	(33)	(10)			
94/915.40	op	pk	ov	38	24	9	16	22	14
„Gábori"	rd	pk	ov	70	36	10	25	29	25
Pb/555	rd	bk	vk	(92)	(44)	(13,5)	(35)		
Pb/556	rd	pk	ov	94	50	14	38	44	30
Pb/557	qp	bk	ov	(47)	(30)	(8)	(14)		
Pb/559	rd	pk	ov	73	32	9	23	28	23
Pb/560	rd	bk	ov	68	28	10	26	25	22

Tableau 1. *Données des pièces foliacées étudiées. Légende: bk – biconvexe; lq – limnoquartzite; km – marne silicifiée; ob – obsidienne; op – opalite; ov – alterne; pk – plan-convexe; qp – quartz-porphyre; qu – quartzite; rd – radiolarite; sl – silex; vk – alternant; * – valeur moyenne; ( ) – valeur d'une pièce cassée*

	Szeleta 1		Szeleta 2		Szeleta 3		Jankovich	
	ov	vk	ov	vk	ov	vk	ov	vk
bk	4 12,50%	21 65,63%	1 4,76%	10 47,62%	2 10,53%	1 5,26%	7 25,93%	4 14,81%
pk	5 15,63%	2 6,25%	3 14,29%	7 33,33%	15 78,95%	1 5,26%	11 40,74%	5 18,52%

Tableau 2. *Corrélations entre la section transversale et le mode de façonnage selon les ensembles étudiés. Légende : bk – biconvexe; ov – alterne; pk – plan-convexe; vk – alternant*

mat. prem.	Szeleta 1	Szeleta 2	Szeleta 3	Jankovich
qp	30 93,75%	18 81,82%	10 43,48%	1 3,70%
lq	1 3,13%	1 4,55%	6 26,09%	
rd			4 17,39%	25 92,59%
sl		1 4,55%	2 8,70%	
qu		1 4,55%		
km		1 4,55%		
ob			1 4,35%	
op	1 3,13%			1 3,70%

Tableau 3. *Utilisation des matières premières selon les ensembles étudiés. Légende : lq – limnoquartzite; km – marne silicifiée; ob – obsidienne; op – opalite; qp – quartz-porphyre; qu – quartzite; rd – radiolarite; sl – silex*

provenance	Szeleta 1	Szeleta 2	Szeleta 3
couche 6 et 6a	8	6	3
foyer entre les couches 5 et 6	7	2	1
couche 6 ou 4	2	3	2
couche 5	2	3	3
couche 4	3	1	1
couche 3	1	1	7
couche 2			1
inconnue ou secondaire	9	6	5

Tableau 4. *Position stratigraphique des pièces foliacées étudiées de Szeleta selon les ensembles : les larges et symétriques (Szeleta 1), les étroites et symétriques (Szeleta 2) et les asymétriques (Szeleta 3)*

REVISION OF THREE OPEN-AIR PALAEOLITHIC SITES IN THE BÜKK MOUNTAINS, NE-HUNGARY

KRISZTIÁN ZANDLER – SÁNDOR BÉRES

Keywords: *Middle and Upper Palaeolithic tools, leaf shaped points, Micoquian, Szeletian, Aurignacian, Mesolithic*

Introduction

In the first half of the 1950's Márton Rozsnyói, director of the Gábor Áron Museum at Ózd identified several open-air sites in the north-east region of the Bükk Mountains, described as Mesolithic settlements in that time. After the closing down the Ózd museum, a small collection of finds got into the Herman Ottó Museum at Miskolc.[1] The assemblages have been described as belonging to the Mesolithic Eger culture just like the ones in the environs of Eger, Korlát and Avas.[2]

Later Miklós Gábori re-evaluated the materials of the Mesolithic sites in eastern Hungary, placing them into the Middle Palaeolithic period.[3]

In present days the general aspect is significantly differentiated. It is clear now that on these sites, belonging to the so called „grobgerätige Mesolithikum'', several different stone industries are represented. In many cases the artefacts of these industries are mixed on the surface (for example Korlát-Ravaszlyuk-tető).[4] The definition of the Bábonyian culture,[5] the survey of the leaf shaped point industries,[6] most recently in the Cserhát Mountains: Galgagyörk-Csonkás-hegy,[7] Legénd-Káldy-tanya,[8] Vanyarc-Szlovácka-dolina[9] and the revision of the open-air sites in the vicinity of Eger[10] including the publication of the excavation at Egerszalók-Kővágó-dűlő[11] yielded numerous new pieces of information. That is why we feel it necessary to shortly review the open-air sites of Bükkmogyorósd, Csokvaomány, Nekézseny discovered by Rozsnyói. Unfortunately, the available artefacts are only part of the total surface collected assemblages, however, the typical chipped stone tools and more interesting raw materials offer some interesting points.[12]

Bükkmogyorósd-Hosszú-bérc

Geographical situation

The village lies at the northwestern part of the Bükk Mountains between Szilvásvárad and Ózd (***Fig. 1.***). The Hosszú-bérc is a hilltop from south-west from the village, 337 m a.s.l, surrounded by stream valleys from East and North-West.[13] The area was used for agricultural production during the 1950s, but the identification of the site is not possible because it is currently uncultivated.

Research history

M. Rozsnyói found the site during one of his field surveys in 1954.[14] In the next year László Vértes and László Papp investigated the locality. On the highest spot of the hill[15] they gathered a few unretouched opal and chalcedony flakes. Vértes assigned these finds into the Mesolithic period. In 1974 Viola T. Dobosi

[1] KOREK 1961.
[2] VÉRTES 1965, 212–221.
[3] GÁBORI 1982, 1–7.
[4] SIMÁN 1999, 29, 35–36.
[5] RINGER 1983.
[6] T. DOBOSI 1990, 175–188.
[7] MARKÓ et al. 2002, 245–257; MARKÓ 2004, 10–12.
[8] MARKÓ–PÉNTEK 2004, 165–177.
[9] MARKÓ 2007, 5–18.
[10] ZANDLER 2006; ZANDLER 2012, 3–54.
[11] KOZŁOWSKI et al. 2009, 399–453.
[12] ZANDLER–BÉRES 2011, 55–76.
[13] ROZSNYÓI 1963, 73–74; T. DOBOSI 1990, 177–178.
[14] ROZSNYÓI 1963, 73.
[15] VÉRTES 1955.

visited the site and gathered a few radiolarian schist fragments from the surface.

Description of the artefacts

Rozsnyói found 455 pieces of chipped stone implements during his field survey in 1954. Among them he mentioned leaf shaped points, end-scrapers, borers, flakes and blades. The most frequently used raw material was felsitic porphyry and a flint type which came from Bánhorváti-Köbölice-tető.[16] Hereinafter we describe the pieces which can be found in the collection of the Hungarian National Museum.

The small assemblage is dominated by Middle Palaeolithic tool types. The most significant piece is a Mousterian point (***Fig. 3:4***) made of felsitic porphyry with an obliquely truncated base and ventral thinning along one of its edges.

The side-scrapers are very diversified. We found only one convex side-scraper which is made of hydroquartzite (***Fig. 3:3***). This tool type is frequent in the Middle Palaeolithic industries. The edge of the single transversal scraper (***Fig. 3:2***) is convex and made on a felsitic porphyry flake. The collection contains a hydroquartzite double scraper and a convergent side-scraper made of felsitic porphyry (***Fig. 3:1***) too.

The single limace of the assemblage, made of felsitic porphyry, has partially retouched edges.

Four of the five bifacially worked tools are asymmetrically shaped and worked by WGK („*wechselseitig gleichgerichtete Kantenbearbeitung*") method. The tool's cross-section is varied: plan-convex (***Fig. 3:5***), biconvex (***Fig. 3:6***) and parallelogram. The base of two leaf shaped points are rounded (***Fig. 3:5***) and of one is obliquely truncated. All leaf shaped tool are made of felsitic porphyry which is the most favoured raw material of the Szeletian culture.

All of the three retouched flakes, interpreted as *ad hoc* tools were made of felsitic porphyry as well.

The Upper Palaeolithic tool types are represented by ten end-scrapers. Two of them are nosed forms made of limnic quartzite. A massive tool of felsitic porphyry was thinned on its ventral face. Four end-scrapers were made on flakes, made of locally available hydroquartzite (2 pieces, ***Fig. 4:2***) and felsitic porphyry (2 pieces, ***Fig. 3:7***). Only one of them was retouched along its edge. The blanks have plain and prepared bases.

There are two circular end-scrapers in the collection, one of them is made of felsitic porphyry, with plain base, the other one is of limnic quartzite (***Fig. 4:3***), with winged base. Finally the lateral edges of the double end-scraper are retouched, one of them on the ventral face (***Fig. 4:1***).

It is worth to mention a single flake core made of felsitic porphyry.

Csokvaomány-Határ-tető

Geographical situation, research history

The site is separated from the north-western part of the Bükk Mountains by the valleys of the Bán and Szilvás streams (***Fig. 1.***). The artefacts were found on the hilltop at 250-260 m a.s.l. and on the lower terrace levels.[17] Later when the hilltop was driven by ploughing before forestry works only a few finds came to light.[18] As the Határ-tető is situated between Csokvaomány and Nekézseny the site could be identical with the latter described below.[19]

Description of the artefacts

Vértes, who described the assemblage as a Mesolithic industry[20] mentioned a Solutrean-type leaf shaped point, blades and other tools (convex Mousterian side-scraper and a „rostrocarinate" tool) made of quartzite and hornstone from the collection of Rozsnyói. According to him the tools made of quartzite are finely elaborated[21]. Unfortunately, in the collection of the Hungarian National Museum only the artefacts from the field survey by Vértes are available.

In the collection from the lowermost terrace Nr. 1. we found only an end-scraper and a retouched flake made of limnic quartzite. Furthermore five flakes and two unretouched blades are known from this location. Beside the local limnic quartzite, silex and quartzite were also used in the settlement, but the felsitic porphyry and the extralocal raw materials are absent from the assemblage.

From the collection found on terrace Nr. 2. beside the artefacts with Palaeolithic character made of silex, we know three black burned prehistoric ceramic fragments without any characteristic feature. This fact suggests that the material belonging to Palaeolithic and younger prehistoric cultures could have mixed on the surface. Only a truncated flake, made of hydroquartzite and a finger-nail end-scraper made of flint (***Fig. 4:7***) are formal lithic tools. However, a core of Jurassic Cracow flint with Palaeolithic character is worth to mention. The raw material of the unretouched flakes is local hydroquartzite (12 pieces), silex (1) and quartzite (1). The unretouched blades comprise a piece

16 ROZSNYÓI 1963, 74.

17 VÉRTES 1952.

18 KOREK 1961.

19 T. DOBOSI 1990, 177.

20 VÉRTES 1952.

21 VÉRTES 1952.

made of local hydroquartzite and another one made of the extralocal Carpathian radiolarite. The raw material of two chips and another bladelets is hydroquartzite.

Among the 36 pieces of the collection of the Nr. 3. terrace there are 7 well made tools, mostly belonging to the Upper Palaeolithic period and 2 cores. First of all, however, an asymmetrical, bifacially worked point made of felsitic porphyry (***Fig. 4:4***) is worth to mention.

There are two end-scrapers made of limnic quartzite in the collection, one of them is a typical Aurignacian nosed end-scraper (***Fig. 4:8***) with prepared base and notched lateral edge. The other piece is a tool with retouched edges (***Fig. 4:10***).

The four retouched blades belong to different types. An Aurignacian-type blade and a bilaterally retouched piece was made of Silesian flint (***Fig. 4:5***), a unilaterally retouched blade is of hydroquartzite, and finally a notched blade was made of Carpathian 2T obsidian (***Fig. 4:9***).

Among the cores there is a single platform blade core made of local limnic quartzite and a flake core made of opal.

In the debitage material, beside the local limnic quartzite we can find northern flint (3 pieces). Generally, the high number of northern flint would indicate that only the selected part of the assemblage and the unique artefacts were inventoried.

Nekézseny-Határ-tető

Geographical situation

The site can be found on the same hill at the fringes of three valleys, as the former site (***Fig. 1.***) and the two sites could have belong originally to a single unit. Rozsnyói, who discovered the site in 1951 mentioned 5 settlement places between the top of the hill and the railway line[22].

In the autumn of 1952 because of deforestation the area had been ploughed. Rozsnyói and Vértes visited the site together during these works[23]. In his report Rozsnyói mentioned a 40 cm thick culture bearing layer containing chipped stone tools and ceramic fragments in a 1,5 m thick profile[24].

It could be seen that the five settlement areas are culturally different from each other. The collections from settlement 3, 4 and 5 contain ceramics, polished and knapped stone tools also, while bifacially worked tools were found only in the 1st and 3rd areas.

After the dissolution of the Ózd museum, a small collection of finds got into the István Dobó Vármúzeum (Eger)[25], from where only 12 tools got into the Hungarian National Museum (Budapest) and were inventoried there.

Description of the artefacts

We can tell that all the pieces of the collection available today, namely one side-scraper and bifacially worked tools, end-scrapers and retouched blades are well worked tools.

Importantly, the single convergent side-scraper is made of Carpathian 2T obsidian which raw material was used in the Csokvaomány site too (***Fig. 5:9***).

The common characteristics of the leaf shaped tools are the zigzag edge and the asymmetrical contour of the pieces, while the deltoid shaped point is the only exception (***Fig. 5:3***). Three of the leaf shaped tools have plan-convex cross-section: two of them are made of felsitic porphyry (***Fig. 5:2***) and one is of hydroquartzite (***Fig. 5:3***). Three leaf shaped tools made of felsitic porphyry, limnic quartzite (***Fig. 5:4***) and Silesian flint (***Fig. 5:1***) respectively have biconvex cross-section. The base of two leaf shaped points are truncated (***Fig. 5:4***). Among the two end-scrapers there is one nosed piece (***Fig. 5:8***), the other one is made on a flake (***Fig. 5:7***). Both pieces are made of Carpathian radiolarite, similar to one of the Aurignacian type blade (***Fig. 5:5***). Another blade was made of opal (***Fig. 5:6***). On the third blade made of Northern flint traces of use can be observed along the edges.

Typological comparisons

In the 1990s the assemblages from Bükkmogyorósd and Csokvaomány had been connected to the Mesolithic sites around Eger, to the artefacts of the Korlát-Ravaszlyuk-tető site and to the biface and leaf-shaped point industries of the Thráki-Török, Világhy-vineyards, Hernádnémeti and Kehnec[26]. Besides, at the review of the material of the Csokvaomány site, J. Korek mentioned a similar industry from the top of a hill near Ózd[27], but regrettably, there are no any further information about this site.

According to our present analysis the described sites do not show any homogenous picture.

The collection from Bükkmogyorósd-Hosszú-bérc contains asymmetrical bifacially worked leaf shaped tools with truncated bases, similar to the tools of the Eger-Kőporos-tető in the southern part of the Bükk Mountains[28].

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22 ROZSNYÓI 1963, 69–70.
23 ROZSNYÓI 1963, 72.
24 ROZSNYÓI 1963, 70–71.
25 KOREK 1961.
26 VÉRTES 1957.
27 KOREK 1961.
28 ZANDLER 2006; ZANDLER 2012.

The asymmetrical bifacially worked tool, in fact belonging to the class of the Volgograd-type bifacial knives (***Fig. 3:5***) is similar to the pieces known from the Bábonyian site of Miskolc-Kánás-tető[29] and Galgagyörk-Csonkás-hegy[30], from the Szeletian industry of Eger-Kőporos-tető[31] and Hont-Csitár[32], from the upper cultural layer of the Szeleta cave[33] and from the Miskolc-Kánás-tető sites[34]. Finally, numerous similarly bifacially worked tools were collected by one of us from the open-air sites lying between Korlát[35] and Boldogkőváralja together with artefacts of Middle Palaeolithic-type industries[36].

Another important piece is a leaf-shaped point made of felsitic porphyry (***Fig. 3:6***), identical with the piece known from Nekézseny (***Fig. 5:2***) and Rörshain[37]. The radiocarbon-dated Moravian Szeletian industries of Vedrovice V. and Moravsky Krumlov IV.[38] contain side-scrapers, bifacially worked pieces, end-scrapers made on flakes, but the burins and retouched blades are present only sporadically. On the other hand, the truncated asymmetrical bifacial points are the most common elements of the Central-European Late Micoquian. This culture was spread from South-Germany[39] across the Czech Republic – Kůlna layers 6a and 7a[40] – to the Crimean peninsula, where it disappeared about 30,000 kyears ago as we can see at the sites Prolom I upper layer and Buran Kaya III. B. 1. layers[41]. The above described tool type appears in the Bábonyian and Szeletian cultures too, both having an affiliation with the Micoquian circle.

Keeping these considerations in our minds we connect the Bükkmogyorósd site to the Central-European Micoquian (Bábonyian) or to the Moravian Szeletian. Beyond the typological traits the raw material procurement, namely the lack of extralocal flints rather strengthen its connections with the Szeletian culture. On the ventral face of the Mousterian point we can see thinning (***Fig. 3:4***) which is a characteristic element in the Vanyarc-type Industry of Vanyarc-Szlovácka-dolina site[42]. This industry with many Late Middle Palaeolithic components too, resembles the archaic Moravian Szeletian sites as e.g. Jezeřany. The analogy to the end-scraper on flake (***Fig. 3:7***) known from the Bábonyian site at Miskolc-Kánás-tető[43] and the Szeletian site at Egerszalók-Kővágó-dűlő[44]. On the dorsal face of some end-scrapers we can find negatives of previous detachments just like on the ones in Demjén-Hegyeskő-tető I[45], Eger-Kőporos-tető[46], Egerszalók-Kővágó-dűlő I[47], Galgagyörk-Csonkás-hegy[48] and Legénd-Káldy-tanya[49]. Generally, Upper Palaeolithic tool types, especially end-scrapers and retouched blades can be found in the materials of the Szeletian sites at Hont-Csitár and around Eger, but they are absent from the Bábonyian sites in the Bükk and Cserhát Mountains[50] and in the recently published material of Szécsénke-Kis-Ferenc-hegy[51].

In the selected collection only local raw materials – hydroquartzite and felsitic porphyry – can be found.

Turning to the Csokvaomány site, the analogy of the leaf shaped point which was made on felsitic porphyry (***Fig. 4:4***) is known from the Szeletian site at Miskolc-Avas-Alsószentgyörgy[52]. To sum up the finds of the Csokvaomány site, this set shows a different picture from the former assemblage. Although the Csokvaomány artefacts were found in different locations, terraces, the analysed tools are characteristically Upper Palaeolithic types with many Aurignacian components (***Fig. 4:5–6, 8***) and similar elements can be found in the collections of Nekézseny (***Fig. 5:5–6, 8***) too. It is noteworthy that one of the Aurignacian-type blade (***Fig. 5:5***) has an analogy in Hont-Bánat-street. This piece has been linked to the upper cultural layer of the Istállós-kő cave[53].

There is no information about the exact finding place of the fine worked Mousterian side-scrapers, Vértes and Rozsnyói probably also identified the traces of a Middle Palaeolithic or Szeletian settlement on the hill, but the lithic implements were lost during the past years.

As we mentioned earlier, the Nekézseny and Csokvaomány sites might have belonged to the same unit, however, the evaluation of the collection from the Nekézseny site are rather problematic, as only twelve tools are known, but without any information

29 RINGER 1983, Abb. 35.
30 MARKÓ 2004, 11-12; 1. tábla 2. kép.
31 ZANDLER 2006, I. képtábla 5; ZANDLER 2012.
32 ZANDLER 2010, 9. ábra 4.
33 KADIĆ 1915, XIX. t. 3.
34 RINGER 1983.
35 SIMÁN 1999, 29–44.
36 SIMÁN 1983, 37–49. We can mention here the unpublished collections of Sándor Béres, too.
37 BOSINSKI 2001, 125, Fig. 33. 1.
38 NERUDA–NERUDOVÁ 2009.
39 BOSINSKI 2001.
40 VALOCH 1988.
41 CHABAI 2003, 133.
42 MARKÓ 2007, 12. Fig.4.1; MARKÓ 2013.
43 RINGER 1983, Abb. 65.
44 ZANDLER 2006, V. képtábla 7; KOZŁOWSKI et al. 2009, 45; PLANCHE 18.3; ZANDLER 2012.
45 ZANDLER 2006, 76, I. képtábla 3; ZANDLER 2012.
46 ZANDLER 2006, II. képtábla 7-8; ZANDLER 2012.
47 ZANDLER 2006, V. képtábla 1-2, 7; ZANDLER 2012.
48 MARKÓ et al 2002, 249, Fig 2:1,4.
49 MARKÓ–PÉNTEK 2004, 169, Fig. 4:4, 170, Fig. 5:5.
50 ZANDLER 2010, 36–39.
51 PÉNTEK–ZANDLER 2013.
52 SVOBODA–SIMÁN 1989, 305. Fig.15.1.
53 SIMÁN 1993, 249, 252, 2. ábra 5.

about their original finding place of the five different locations on the hilltop. Moreover, the Palaeolithic material mixed up with later Prehistoric artefacts too. We can only laconically mention that a convergent side-scraper (***Fig. 5:9***) and the asymmetrical truncated leaf shaped tools (***Fig. 5:4***) show Middle Palaeolithic characteristics and probably have Micoquian or Szeletian connections, as similar convergent tool is known e.g. from Hont-Csitár[54] and has got an analogy from the collection of Mohelno[55] site, which contains Szeletian elements too.[56] According to our present knowledge on the Bábonyian and Szeletian industries in Hungary there are no traces of use of the Silesian flint, but the Nekézseny collection contains a leaf shaped tool of this flint type. Importantly, only bifacial tools are made of extralocal raw materials. The same tendency can be observed at the Szeletian sites Eger-Kőporos-tető and Egerszalók-Kővágó-dűlő[57] (Bükk Mountains). On the contrary, in the collections of the Vanyarc-type industry[58] and practically at most sites with leaf shaped implements in the Cserhát Mountains, the intensive use of the felsitic porphyry is noteworthy. To the deltoid shaped point (***Fig. 5:3***) an analogy could be found in the G1 layer of the Vindija cave.[59] There are many analogies in the Cserhát Mountains, at the Szécsénke-Kis-Ferenc-hegy[60], in the stone assemblages of the newly discovered site-complexes at Szécsénke-Berecz-oldal and Kétbodony-Halyagos-hegy, and in the direct vicinity of the latter sites at Legénd-Rovnya.[61] During the last years many Aurignacian site had been found in North-Hungary: Acsa-Rovnya[62], Andornaktálya-Zúgó-dűlő[63], Nagyréde I-II.[64], Szendrő-Temető-domb[65] and Demjén-Szőlő-hegy[66]. The sites which we presented in our paper located in the neighbourhood of the classical Aurignacian territory (Istállós-kő and Peskő caves). The Csokvaomány/Nekézseny settlements had got connection with the above mentioned cave sites. Unfortunately the sorted small surface assemblages are unfitted for further conclusions.

[54] ZANDLER 2010, 30. 6. ábra 5.
[55] ŠKRDLA 1997-1998, 40. Obr. 4:6.
[56] ŠKRDLA 1997-1998, 50.
[57] ZANDLER 2006; ZANDLER 2012.
[58] MARKÓ 2009, 108; MARKÓ 2013.
[59] KARAVANIĆ 1994, 136. Tabla 1.4; ZILHÃO 2009, 412. Fig. 3. H.
[60] PÉNTEK–ZANDLER 2013.
[61] The manuscript on this assemblage is in preparation.
[62] T. DOBOSI 2008, 151–159.
[63] KOZŁOWSKI–MESTER 2004, 109–140.
[64] LENGYEL et al. 2006, 79–85.
[65] BÉRES 2009, 9–13.
[66] The manuscript on this assemblage is in preparation by the authors.

Summary

To sum up the described materials of the three localities, it can be stated that all of them contain both Middle Palaeolithic and Upper Palaeolithic components. We placed the classical Moustérian tool-types (side-scrapers and Moustérian point) and Micoquian elements (symmetrical and asymmetrical bifacially worked leaf shaped tools and bifacial knives with truncated basis) into the Middle Palaeolithic group. These forms appear in the Bábonyian industry both in the Bükk and the Cserhát Mountains and they occur in the collections published from the environs of Eger and from Hont, identified as belonging to the Szeletian and transitional assemblages.

The carinated and nosed end-scrapers, burins, Aurignacian and other retouched/unretouched blades are interpreted conventionally as Upper Palaeolithic components. This way, the main problem of all three sites is the connection or disconnection of the Middle and Upper Palaeolithic elements.

If we examine the used raw materials the collection from Bükkmogyorósd is very homogenous and it could be connected to the Szeletian culture. On the sites of this industry, either around Eger or in other regions, beside the Middle Palaeolithic tool-types, end-scrapers and nosed end-scrapers made on flakes can be found regularly too. The fact that the local rocks dominate in the raw material spectrum speaks for the Szeletian affiliation too.

On the natural terraces near Csokvaomány most probably the presence of one or more Aurignacian settlements can be proved. Both the characteristic tool types and the presence of extralocal raw materials are signs of this industry. Only a single unusual tool, a leaf shaped point, which is the only one tool made off felsitic porphyry, was found on the terrace Nr. 3.

In the case of five collecting points in Nekézseny, identified by Márton Rozsnyói, we do not have any information about the provenance of the 12 tools, which can be found today in the collections. That is why we can only state that the hill was occupied during both the Middle and the Upper Palaeolithic period by the Szeletian and Aurignacian cultures.

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	hydroquartzite	felsitic porphyry	total
Mousterian point		1	1
convex side scraper	1		1
transversal scraper		1	1
double scraper	1		1
convergent scraper		1	1
limace		1	1
leaf shaped tool		5	5
retouched flake		3	3
nosed end-scraper	2		2
massive end-scraper		1	1
end-scraper on flake	2	2	4
circular end-scraper	1	1	2
double end-scraper		1	1
core		1	1
total	7	18	25

Table 1. *Tool types of the Bükkmogyorósd site*

	hydroquartzite	quartzite	silex	total
end-scraper on flake	1			1
retouched flake	1			1
flake	2	2	1	5
blade	1	1		2
total	5	3	1	9

Table 2. *Tools types of the 1st terrace of the Csokvaomány site*

	hydroquartzite	quartzite	Bükk-type radiolarite	silex	Carpathian radiolarite	Jurassic Cracow flint	total
truncated flake	1						1
finger-nail end-scraper				1			1
core						1	1
flake	12	1		1			14
blade	1				1		2
chip	2						2
bladelet	2						2
waste		1	1				2
total	18	2	1	2	1	1	25

Table 3. *Tool types of the 2nd terrace of the Csokvaomány site*

	hydro-quartzite	felsitic porphyry	quartzite	silex	opal	obsidian	Silesian flint	Northern flint	total
bifacial point		1							1
nosed end-scraper	1								1
end-scraper on flake	1								1
Aurignacian blade							1		1
unilaterally retouched blade	1								1
bilaterally retouched blade							1		1
notched blade						1			1
core	1				1				2
flake	8		2					1	11
blade	8			1	1			1	11
chip	1							1	2
waste	1								1
raw material piece	1		1						2
total	23	1	3	1	2	1	2	3	36

Table 4. *Tool types of the 3rd terrace of the Csokvaomány site*

	hydro-quartzite	felsitic porphyry	radiolarian schist	opal	Carpathian radiolarite	Silesian flint	Northern flint	total
convergent scraper			1					1
leaf shaped tool	2	3				1		6
nosed end-scraper					1			1
end-scraper on flake					1			1
Aurignacian blade				1	1			2
bilaterally retouched blade							1	1
total	2	3	1	1	3	1	1	12

Table 5. *Tool types of the Nekézseny site*

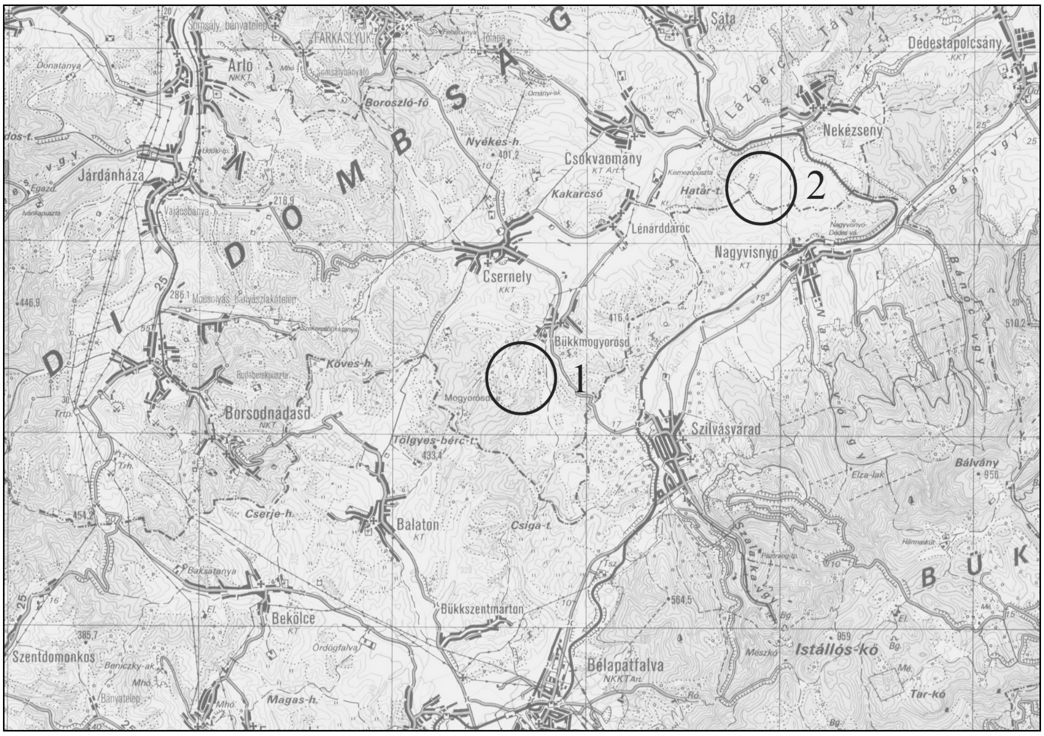

Fig. 1. *The location of the sites. 1: Bükkmogyorósd-Hosszú-bérc, 2: Csokvaomány and Nekézseny-Határ-tető*

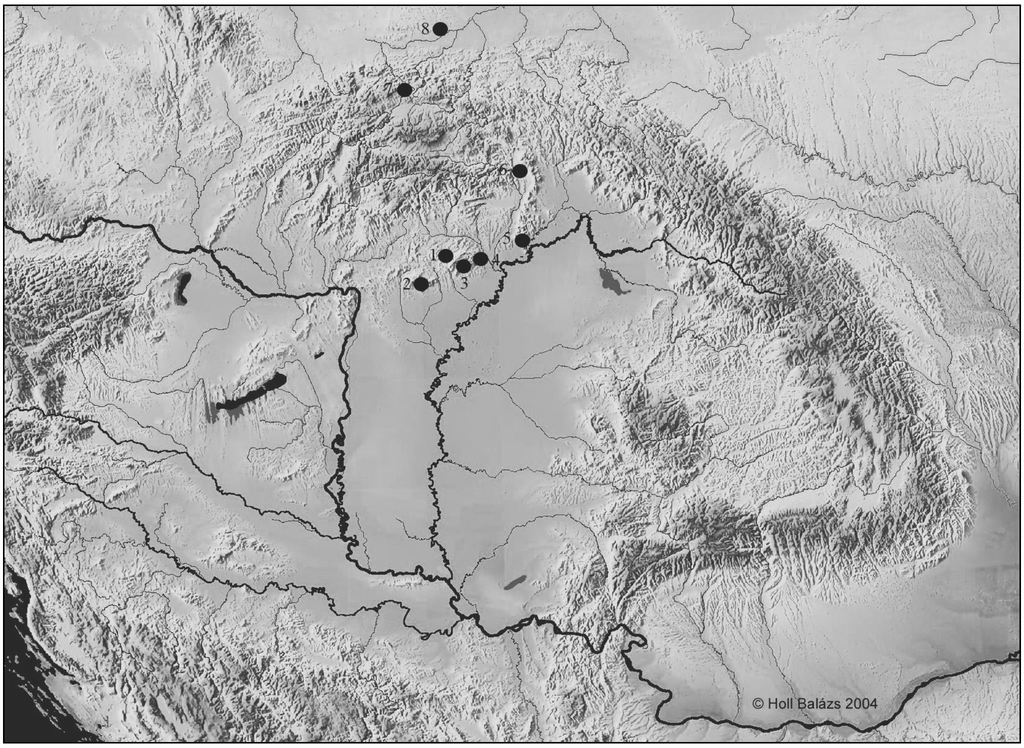

Fig. 2. *Sources of the raw material types used on the sites. 1: Location of the Bükkmogyorósd, Csokvaomány and Nekézseny sites, 2: opal, 3: hydroquartzite, radiolarian schist, Bükk-type radiolarite, 4: felsitic porphyry, 5: Carpathian 2 obsidian, 6: Carpathian radiolarite, 7: Northern flint, 8: Jurassic Cracow flint.*

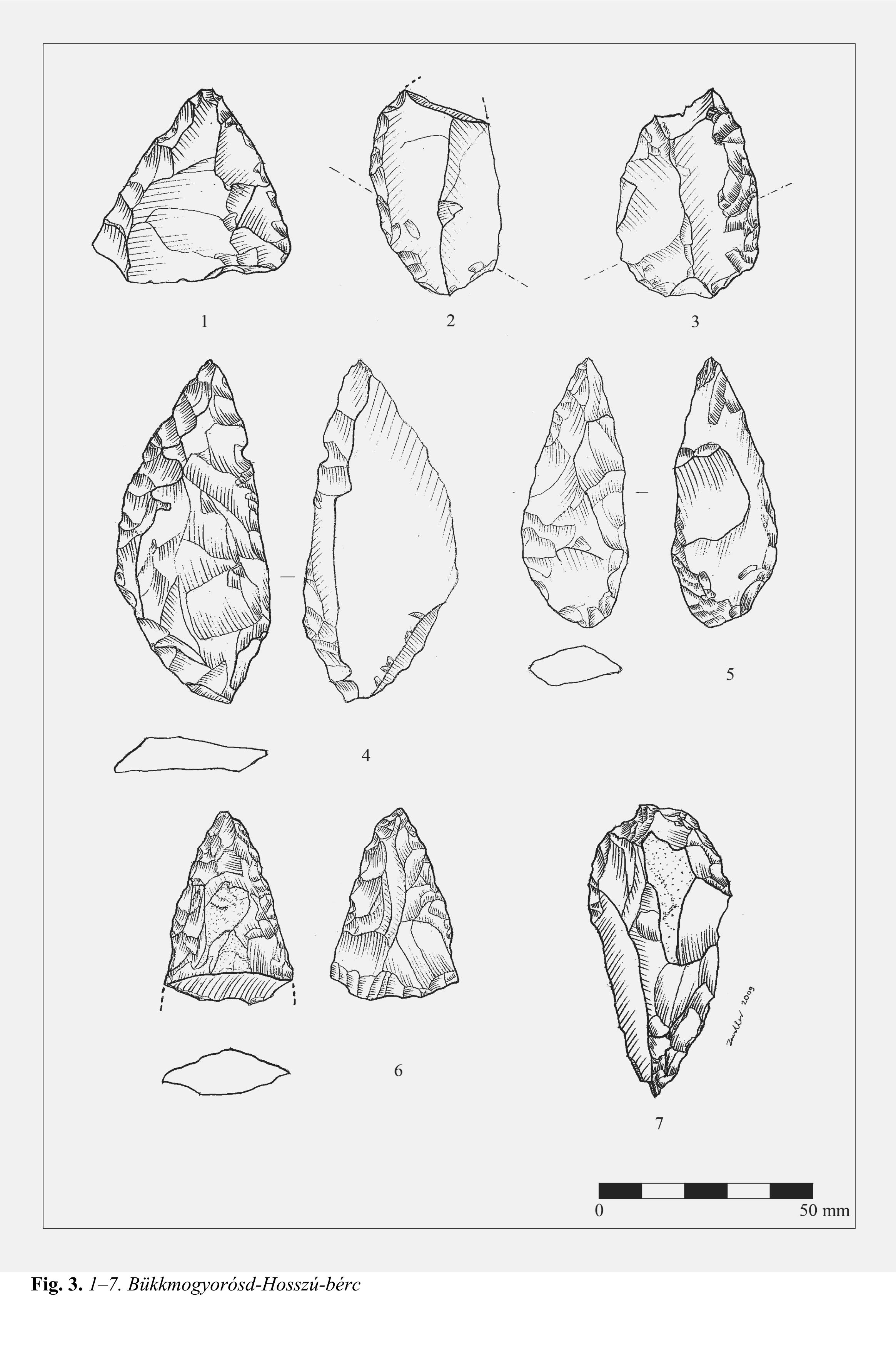

Fig. 3. *1–7. Bükkmogyorósd-Hosszú-bérc*

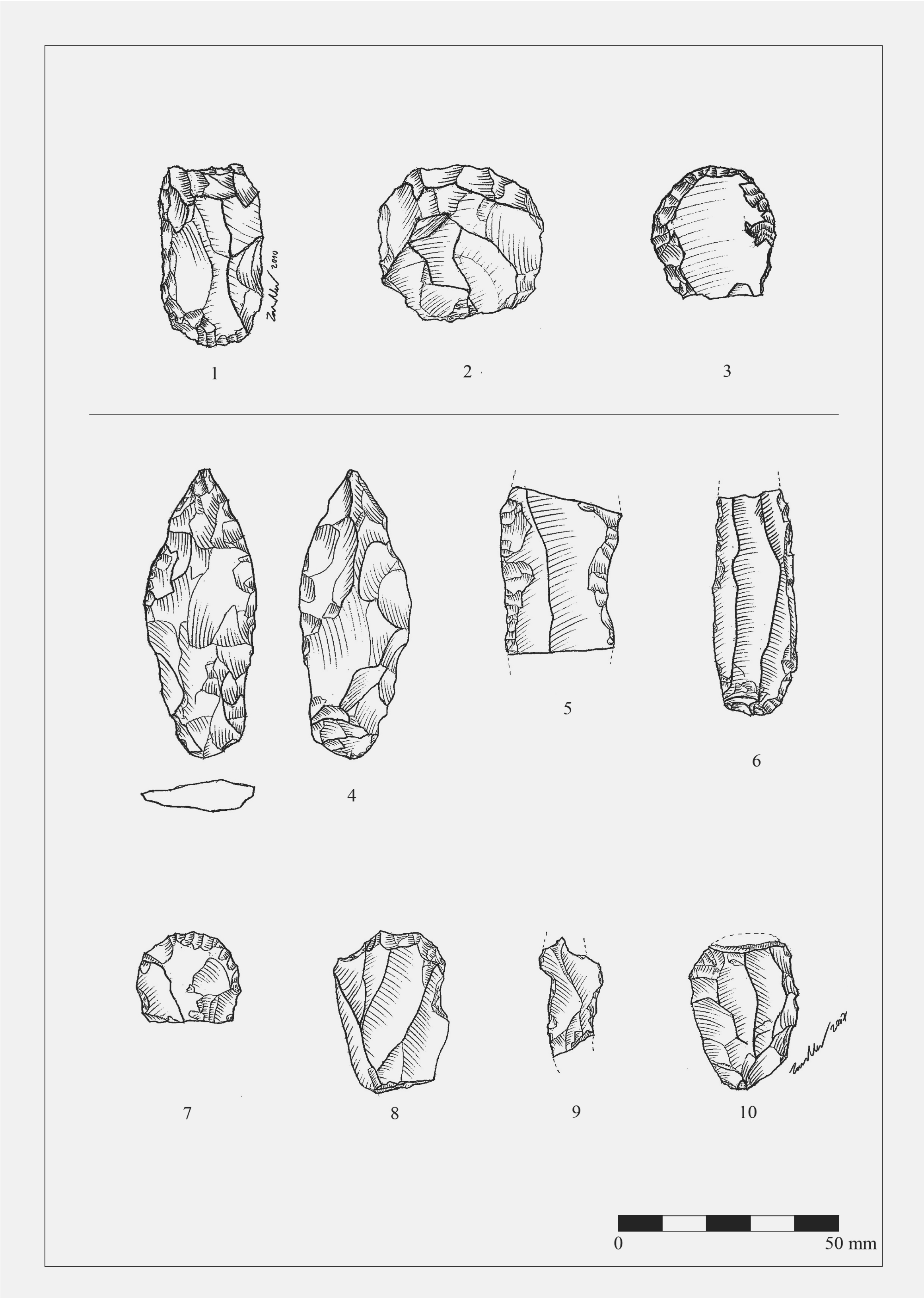

Fig. 4. *1–3. Bükkmogyorósd-Hosszúbérc, 4–10. Csokvaomány-Határ-tető*

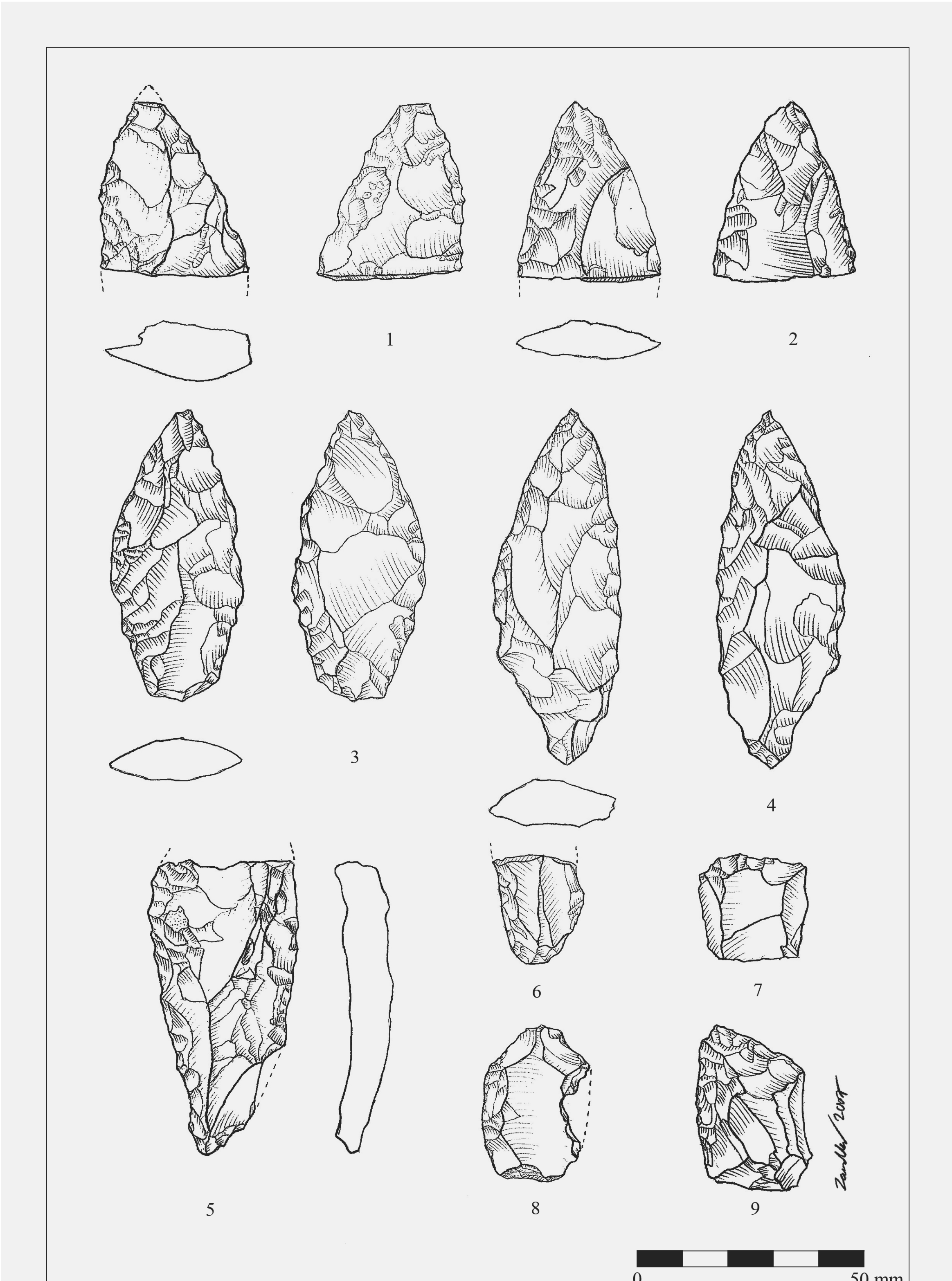

Fig. 5. *1–9. Nekézseny-Határ-tető*

DID THE JAPANESE OBSIDIAN REACH THE CONTINENTAL RUSSIAN FAR EAST IN THE UPPER PALAEOLITHIC?

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Keywords: *obsidian exploitation, Russian Far East, Palaeolithic, Neolithic, long-distance transportation, Hokkaido, Paektusan*

Introduction

Obsidian, a kind of volcanic glass, is usually produced by some volcanic activity around the orogenic belt, related to the active plate tectonics movement. In the Northern hemisphere, obsidian has been widely exploited since prehistoric times in the coastal and archipelagic areas on the Pacific Rim and the plateau and mountain areas from Southeast Asia, Oceania to the Aegean Sea, including the Himalayas, Caucasia and Anatolia. In East and Northeast Asia, obsidian was mainly produced in Primorye (Russian Far East), the North Korean, and the archipelagic area from the Kamchatka Peninsula to the Japanese archipelago.

Obsidian was extremely high quality for production and utilization of stone tools in prehistory, so in circum Japan Sea area, including Japanese Archipelago, Sakhalin Island, Continental Russian Far East and Korean Peninsula, obsidian was much used. Although, sources of obsidian are so limited in this area, that obsidian was transported in long distance, more than 1,000 km. This paper addresses the prehistoric obsidian exploitation in the Russian Far East, and which did the Japanese obsidian exploited the Continental Russian Far East or not.

It has been well known that obsidian was used in the prehistoric Russian Far East; it is only recently, however, that archaeometric source analysis has not been conducted. Organized research carried out by many researchers, including the author of this paper, has done much to clarify the actual condition of obsidian exploitation.[1] It has also been said that obsidian from the Kamchatka Peninsula was widely used: however, since results of the archaeometric source analysis do not yet clarify the relationship with archaeological material in the Palaeolithic and Neolithic, it will not be discussed in this paper.

Obsidian exploitation in the Russian Maritime Province, or Primorye, and Sakhalin Island is discussed in these articles that contain the results of source analysis of obsidian stone implements from prehistoric sites in Primorye and Sakhalin Island. The source analysis is based on the Instrumental Neutron Activation Analysis on obsidian raw material from local obsidian sources in Primorye, Paektusan on the Korean Peninsula, and obsidian sources in Hokkaido (Oketo, Shirataki, Tokachi-mitsumata and Akaigawa).[2]

Obsidian exploitation in Primorye

Obsidian sources

Four main obsidian sources are known in Primorye: three local sources and one exotic source. Most of the plenteous obsidian products, found in sites from Palaeolithic to Early Iron Age and Middle Age in this area, are brought from three of these four sources.[3]

Three local obsidian sources (including perlites) are (A) poor quality rhyolitic perlites in the eastern Sikhote-Alin Mountains, (B) several outcrops on the Shkotovo basaltic plateau and Shufan basaltic plateau in the north of Vladivostok,[4] and (C) the Gladkaya River basin near the border with North Korea. Rhyolitic perlites from (A) the eastern Sikhote-Alin Mountains have not been found from archaeological

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[1] КУЗМИН–ПОПОВ 2000; KUZMIN et al. 2002a; 2002b; SATO et al. 2002; SATO 2004b; КУЗМИН et al. 2005; KUZMIN 2006; KUZMIN–GLASCOCK 2007; DOELMAN et al. 2008; DOELMAN et al. 2009; PHILLIPS–SPEAKMAN 2009; KLUEV–SLEPTSOV 2007; 2010.

[2] KUZMIN et al. 2002a; 2002b; SATO et al. 2002; SATO 2004b.

[3] КУЗМИН–ПОПОВ 2000; KUZMIN et al. 2002a; 2002b; SATO et al. 2002; КУЗМИН et al. 2005; KUZMIN–GLASCOCK 2007; DOELMAN et al. 2008.

[4] KLUEV–SLEPTSOV 2007; 2010.

sites; it seems that they were not used to make stone implements, probably because of its poor quality. As exotic lithic raw material, (D) obsidian from Paektusan on the border between North Korea and China is utilized (***Fig. 1.***). In addition, since obsidian from an unknown source was used at the sites in the Samarga River basin on northern Primorye, an unknown obsidian source may exist in this region.

Obsidian exploitation in Upper Palaeolithic period

In Primorye, obsidian seems not to have been utilized in the sites dating back to Upper Palaeolithic period, such as the Ustinovka sites and sites neighbouring Usrrisk. The beginning of obsidian exploitation in this area is estimated to be at the end of Upper Palaeolithic period (***Table 1.***). At the end of Upper Palaeolithic period, obsidian exploitation started at the Ustinovka sites and Suvorovo sites in the Zerkalnaya River basin, the Ilistaya sites in the Ilistaya River basin, and sites in the Razdolnaya River basin. In the Ustinovka sites and Suvorovo sites in the Zerkalnaya River basin, they used the obsidian from (B) the Shkotovo basaltic plateau and Shufan basaltic plateau, which is more than 200km away, instead of the obsidian from a nearby source, (A) eastern Sikhote-Alin Mountains. In the sites in the Ilistaya River basin and the Razdolnaya River basin, obsidian from a local source, (B) the Shkotovo basaltic plateau and Shufan basaltic plateau is mainly used.[5] At the Razdolnoye site, however, obsidian from (C) the Gladkaya River basin 150km away was used. It is noteworthy that, at the sites in the Ilistaya River basin, the utilization of obsidian from (D) Paektusan started at this time period.

While obsidian exploitation, which started at the end of Upper Palaeolithic period, was based on obsidian from local sources in principle, it is to be noted that obsidian from Paektusan at a distance of 400 to 500km has been used from the beginning. In addition, we must pay attention to the fact that the so-called local obsidian often contains obsidian from sources at a distance of 150 to 200km. According to the author's observation of the microblade industries from the Ilistaya River basin including the Ilistaya sites and the Gorbatka sites, while they produce microblade cores by a technique adapted to the raw material condition of the local obsidian, which consists mainly of small rounded pebbles with a diameter of approximately no more than 5cm, they are likely to have used obsidian from Paektusan to produce the stone tools made from blanks of large blades, because the necessary size and quality of obsidian were not available locally.[6] It may be assumed that the lithic reduction strategy adapted to the manner of obsidian production resulted as the two phases of obsidian exploitation in Primorye, exploiting local and distant sources. This feature is also observed in the obsidian exploitation on the Korean Peninsula.[7]

Obsidian exploitation in the Neolithic period, Early Iron Age, and Middle Age

In the Neolithic period, obsidian is homogeneously used throughout Primorye. While obsidian from (B) the Shkotovo basaltic plateau and Shufan basaltic plateau is widely used, the utilization of obsidian from (C) the Gladkaya River basin is also widely observed, though small in quantity. We must pay attention to the heavy use of (D) obsidian from Paektusan, which developed in the Zaisanovka culture period (***Table 1.***). The heavy use of obsidian in the Zaisanovka culture has already been recognized. Because this obsidian is different from the obsidian used for the microblade industry, Onuki[8] concluded this was a result of the establishment of a trading network including obsidian from Paektusan.[9] The result of the source analysis supports this view.

Data on the obsidian exploitation in the Early Iron age and Middle Age are insufficient to draw any conclusions. It may be assumed that the utilization of (B) obsidian from the Shkotovo basaltic plateau and Shufan basaltic plateau and (D) obsidian from Paektusan continued from the previous time period, while (C) obsidian from the Gladkaya River basin is not observed.

Exploitation of obsidian from Paektusan

As mentioned above, obsidian from Paektusan was used in Primorye since the beginning of the obsidian exploitation. Therefore, expansion of its exploiting range through the ages cannot be observed in Primorye as obviously as on Sakhalin Island. The distance of the obsidian yielding sites in Primorye from the farthest obsidian source, Paektusan, was 400 to 500km in the Palaeolithic period, a little over 600km in the Neolithic period, and 700km in the Early Iron age and Middle Age. This seems to show that obsidian exploiting range was expanding albeit slightly (***Fig. 2.***).

In Korean Peninsula Paektusan obsidian distributed till the border area between South and North Korea, and much used in prehistory, Upper Palaeolithic and Neolithic.[10]

A small quantity of obsidian was used at the Xhumi site near across the river from Komsomolisk-

[5] DOELMAN et al. 2009; KLUEV–SLEPTSOV 2007; 2010.

[6] SATO 2002; 2004.

[7] OBATA 2003.

[8] ONUKI 1998.

[9] OBATA 2003.

[10] OBATA 2003; KIM 2006.

na-Amur City on the lower Amur, which belongs to the Osipovka culture period (Incipient Neolithic, 13-10 ka). The result of the X-ray fluorescence analysis on the obsidian from Xhumi site, conducted by a group including the author, indicates that it is very likely to be from Paektusan.[11] This result is not quite certain because we used the archaeological materials collected from a site outside *Kainei-jo* near Paektusan for correlation,[12] instead of obsidian directly from Paektusan. If the assumption that the material from outside *Kainei-jo* is from the Paektusan source is correct, there existed obsidian movement (exchange) over a distance of 1,500km in a straight line (***Fig. 3.***). This distance of 1,500km is not entirely fantastic, because if obsidian from Shirataki was really exploited in Primorye, which will be mentioned later, more than 2,000km-long distance distribution area would have existed in this time period.

Obsidian exploitation on Sakhalin Island

Obsidian sources

It has been widely known that many stone tools made of obsidian are excavated from prehistoric sites in Sakhalin Island, though there exist no obsidian source on the island. To identify the source and study the distribution of obsidian on prehistoric Sakhalin Island, we collected 79 samples of obsidian products from 35 sites of the Upper Palaeolithic period (20-13ka), Neolithic period (13-2ka), and Early Iron age (2-0.8ka), and conducted the source identification by the Instrumental Neutron Activation Analysis in 1999, using the obsidian raw material from four major obsidian sources in Hokkaido, which are archaeologically most likely.[13] Among the four analyzed sources of Hokkaido, Akaigawa, Tokachi-Mitsumata, Shirataki, and Oketo, obsidian from the former two sources were not identified on Sakhalin Island. It became clear that obsidian on Sakhalin Island is dominated by obsidian from Shirataki (A) (B) and obsidian from Oketo (C) (***Fig. 4.***). Since no obsidian sources are known in the lower Amur River basin, which faces Sakhalin Island across the Mamiya strait, the nearest obsidian sources, except for the Hokkaido ones, are those in Primorye. Obsidian samples from Sakhalin, however, do not correspond with the chemical composition of the obsidian from sources in Primorye.

In addition, the result we obtained showed that the chemical composition of the obsidian from Shirataki source is largely divided into two groups, which was already reported by another research group.[14] It may be assumed that while the outcrops of (A) Shirataki 1 group are located on the mountain top of Mt. Akaishi in Shirataki, the outcrops of (B) Shirataki 2 group are distributed around the mountain top just below and in the mountain mass to the south (***Table 2.***, ***Fig. 5.***). Obsidian samples from Shirataki were collected from the top of Mt. Akaishi, Horoka-zawa, Hachigo-zawa, and Ajisai-no-taki. At Horoka-zawa, as both obsidian (A) Shirataki 1 group from the mountain top and obsidian (B) Shirataki 2 group from directly below the mountain top were collected, both groups were identified by analysis.[15]

Obsidian from Shirataki has been classified into several kinds according to their appearance: reddish *Hanatokachi*, rough *Nashihada*, etc. Such classification by outward appearance, however, does not correspond to the classification by chemical analysis, (A) Shirataki 1 group and (B) Shirataki 2 group.

Obsidian exploitation in Upper Palaeolithic period

The source of obsidian from Hokkaido in Upper Palaeolithic was limited to Shirataki. Both (A) Shirataki 1 group and (B) Shirataki 2 group are exploited; while the former (A) reaches the middle Sakhalin, the latter (B) is limited to south Sakhalin. This distributional feature is not certain because it is based on data from a small number of sites. In the cases of the Neolithic period and after, however, the distribution of (B) Shirataki 2 group is rather small compared to (A) Shirataki 1 group and (C) Oketo group. In Upper Palaeolithic, the maximum distance reaches 600km for (A) the Shirataki 1 group and 340km for (B) the Shirataki 2 group. In both groups utilization dates back to Layer 2 of the Ogonki 5 site (19ka), and both groups have been exploited throughout Upper Palaeolithic period.

Obsidian exploitation in the Neolithic period and Early Iron Age

The exploitation of obsidian from (C) Oketo source started in the Neolithic period. This phenomenon matches the analysis of Koshimizu and Nomura.[16] Obsidian from (A) (B) Shirataki is heavily exploited as in the previous time period. In the Neolithic period, the exploiting range of obsidian from Hokkaido covered all Sakhalin Island: Obsidian from (C) Oketo and (A) Shirataki 1 group reached the northern end of Sakhalin Island. The maximum distance from the source reaches 1,000 km. This situation basically continued in the Early Iron age.

[11] WARASHINA et al. 1998.
[12] MATSUSHITA 1998.
[13] KUZMIN et al. 2002b; SATO et al. 2002; КУЗМИН et al. 2005.
[14] INOUE 2003.
[15] SATO et al. 2002; SATO 2004b.
[16] KOSHIMIZU–NOMURA 1990.

These phenomena support the possibility that obsidian from Hokkaido was transported mainly by a land route until the early Neolithic period, through the Mamiya strait, between the Cintinent and Sakhalin, and Soya strait, between Sakhalin and Hokkaido, which formed land bridges in Pleistocene or shallow and narrow straits in Holocene, since there are reports on the possible use of obsidian from Shirataki at the Malaya Gavani site in the lower Amur River basin[17] and the Osinovka site in the suburbs of Usrrisk in Primorye.[18] This means that an obsidian procurement network over 2,000km may have existed.

Obsidian distribution route on Sakhalin Island

While Sakhalin is now an island, from the Pleistocene to early Holocene, it formed the northern half of the Palaeo-Sakhalin/Hokkaido/Southern Kuril peninsula connected to the Continent and Hokkaido. But, the formation process of the Soya strait is not fixed clearly. When a view is considered, however, the formation is thought to have started at approximately 12ka, and at 8-7ka, the topographic landscape became what we know today.[19] On the other hand, the Mamiya strait is known to be so shallow that it was almost impossible to find any route large sail boats could cruise, though many expedition teams were send by the Imperial Russia to find out whether Sakhalin is an island or not. In the Pleistocene, the Amur River flew south to the Japan Sea between Sakhalin and the Continent. Large-size ships could sail along this river valley after it sank under the sea. At the north end of the south-flowing Amur River, however, it is assumed that a narrow land bridge existed between Sakhalin and the Continent, and the strait became established at approximately the same time as or later than the Soya strait.

As seen above, from the Pleistocene to the beginning of Holocene, Hokkaido with southern Kuril Islands was the end of a peninsula projecting south from the Continent. Therefore, it may naturally be assumed that obsidian from Hokkaido was transported by land route[20] (***Fig. 6.***). After this time period, they would have had to cross the newly formed strait. However, probably because the obsidian procurement route was firmly established, no particular change is observed on the obsidian procurement network.

[17] KIMURA 1992; 1998; 1999; KANAYAMA 1992.
[18] MORI 1989; KASHIHARA KOUKOGAKU KENKYUJO (ed.) 1994.
[19] OHSHIMA 1990.
[20] SATO 2000.

The question of the "obsidian that crossed the sea"

Background

Many introductory and technical books or articles in Japanese archaeology state that obsidian was transported from Japan to the Continental Russian Far East in prehistoric times.[21] Most of the books, however, do not cite official results of analysis; some of them even seem to depend on second-hand quotations. Here I will examine this issue, following the recent study by Onuki.[22]

According to Onuki, the statement that obsidian from Oki (small island in the Sea of Japan near the seashore of Shimane Prefecture, southwest Japan), Akaigawa, Shirataki, Oga (small peninsula from the seaside of Sea of Japan in Akita Prefecture, northeast Honshu), etc. crossed the Sea of Japan to Primorye, which is now widely found in archaeological books, can be traced to the words of Prof. S. Kato at two symposiums.[23] While the details are unclear because the author did not attend either of the meetings, the book[24] seems to give a more or less accurate overview.

In this book, Prof. Kato makes the following announcement based on information from Prof. M. Suzuki, who was in charge of the analysis; in Primorye, they identified obsidian from Oki in the Ustinovka site and Ilystaya site, obsidian from Oki and Akaigawa in the Neolithic sites of Troitsa and Karebara, obsidian from Akaigawa in the Neolithic sites of Ryba 2 and Rybak ; in the middle and lower Amur River basin, they identified obsidian from Shirataki in the Neolithic sites of Gromatykha (Middle Amur) and Malaya Gavani (Lower Amur). Citing the resume of this lecture distributed at the time, Prof. M. Yamada states that obsidian from Oga is also identified in the Neolithic Primorye.[25]

Did the Japanese obsidian cross the sea?

The recent obsidian source research in the Continental Russian Far East by Kuzmin et al. analyzed material from most of the sites listed above. However, they could not identify any obsidian from the Japanese archipelago, except for one example from Osinovka.[26] In the research by another group including the author, no obsidian from the Japanese archipelago was found either.[27] On November 2 and 3, 2003, the Meiji University Academic Frontier Promoting

[21] OKAMURA 2000a; b; 2002; YAMADA 1990, etc.
[22] ONUKI 2003.
[23] MORI 1989.
[24] KASHIHARA KOUKOGAKU KENKYUJO (ed.) 1994.
[25] YAMADA 1990.
[26] KUZMIN et al. 2002a.
[27] WARASHINA et al. 1998.

Project, "Research of obsidian mine in the stone age," was held at the Meiji University Obsidian Research Center in Nagano Prefecture. In response to the author's paper given there at a general discussion meeting for the year 2003 titled "Human history and obsidian exploitation in East Asia," Prof. M. Suzuki commented that he had not made an official announcement of the analysis results, except for the Malaya Gavani example, because there were some problems about the reliability of the analysis.

Recent data shown above indicate that, except for the example in Osinovka, suggested by Kuzmin et al., and obsidian from Shirataki in Malaya Gavani, analyzed by Prof. M. Suzuki, obsidian from the Japanese archipelago was not distributed in the Continental Russian Far East.[28] As mentioned above, the examples from Osinovka and Malaya Gavani may be probably transported by a land route from Hokkaido, where had barely become a peninsula at the time. It is natural to assume that obsidian from Shirataki was brought into the Continent through Sakhalin, because an obsidian procurement network had already existed between Sakhalin and Shirataki since the Pleistocene. Therefore, "obsidian that crossed the sea" in the strict sense did not exist in the Russian Far East. The Japanese obsidian did not exploited in the Continental Russian Far East in Upper Palaeolithic except for a only few uncertain reports.

Obsidian exploitation on the Continent

As we have seen, heavy exploitation of obsidian started by the end of the Upper Palaeolithic period, especially around the obsidian sources. The exploitation range of obsidian expanded in the Neolithic period. Obsidian exploitation range on the Continent is characterized by its relatively wide, compared to that on the Japanese archipelago. A long-distance transportation extending more than 1,000 km is not an exception on the Continent. This difference was probably caused by the difference in geographic and geological landscape and lithic environment; while on the Japanese archipelago many obsidian sources are scattered within a small and complex landform, on the Continent good obsidian sources are limited and far apart in a huge and simple landform.

It may be assumed from this status of obsidian distribution that cultural formation and change took place on a more dynamic scale on the Continent than on the Japanese archipelago.

[28] ONUKI 2003.

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Number	*Site name*	*Basaltic plateau*	*Gladkaya River*	*Paektusan*
Upper Palaeolithic				
1	Ustinovka 1	+		
2	Ustinovka 4	+		
3	Suvorovo 3	+		
4	Kentsukhe	+		
5	Ivanovka	+		
6	Gorelaya Sopka	+		+
7	Firsanova Sopka	+		+
8	Ilistaya 1	+		
9	Lesozavodsk	+		
10	Osinovka	+		
11	Gadychya Sopka	+		
12	Borisovka	+		
13	Razdolnoye		+	
14	Timofeevka 1	+		+
Neolithic				
15	Ustinovka 3	+		
16	Sinie Skaly†	+	+	
17	Eustaphy†			+
18	Phusun†	+		+
19	Valentin-peresheek†	+		
20	Kievka†	+		
21	Pereval			+
22	Senkina Shapka	+		
23	Maikhe†			+
24	Chernaya Sopka†		+	+
25	Boisman 2			+
26	Troitsa†	+		+
27	Gladkaya†			+
28	Khansi			+
Early Iron Age and Middle Ages				
29	Monastyrka 3			+
30	Lebyazhye	+		
31	Bulochka	+		
32	Anuchino 1	+		
33	Rybak			+

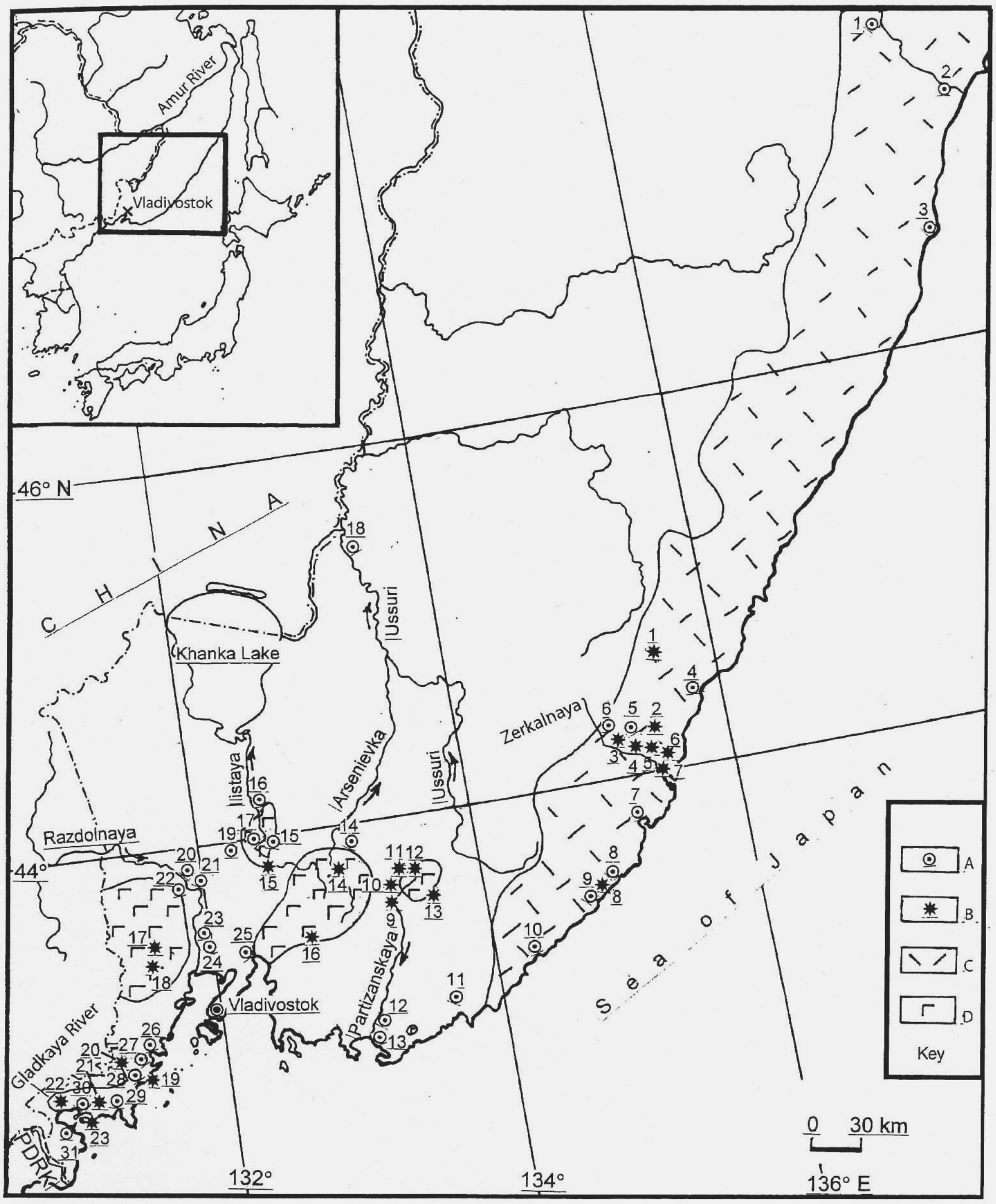
* The sites of Ust-Svetlaya, Samarga 2A and Samarga 5 (all of Early Iron Age), correspond to an unknown source and are not included.

† Zaisanovka culture site.

Table 1. *Archaeological sites found obsidian in Primorye (after KUZMIN et al. 2002a)*

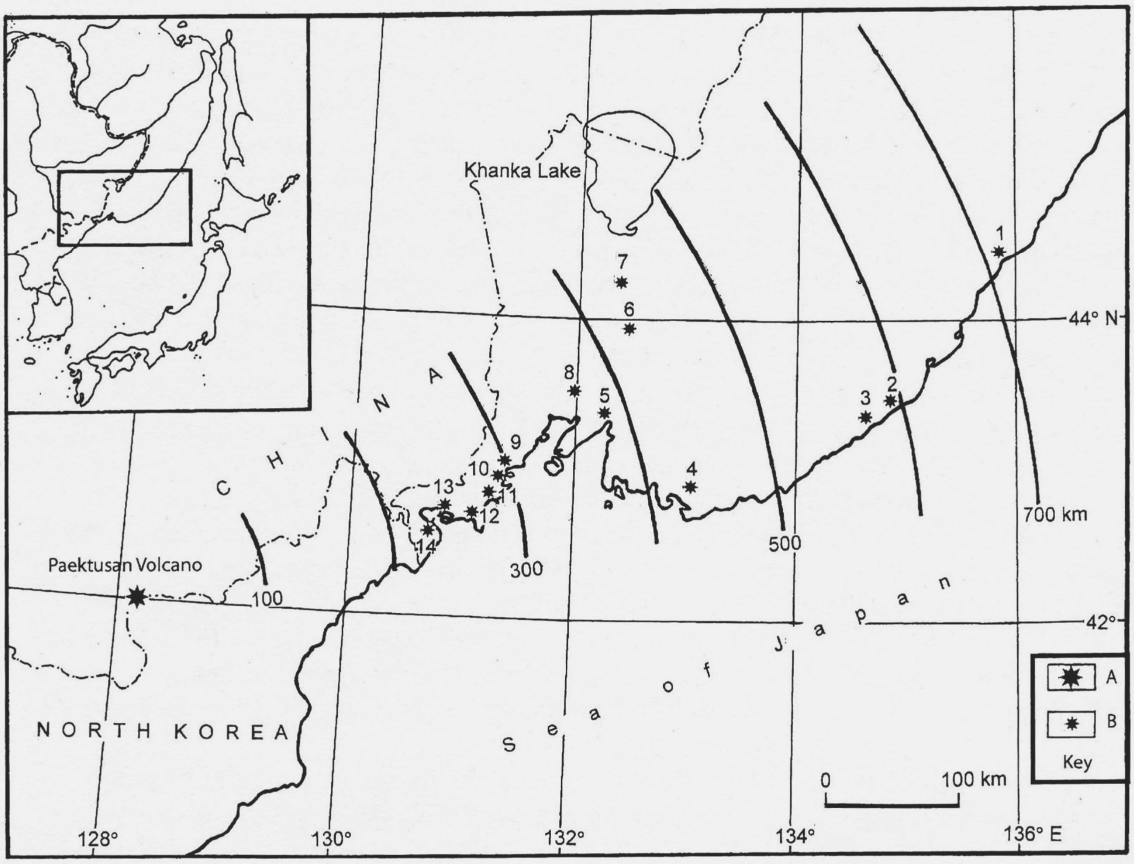
No.	Sites	Oketo	Shirataki A	Shirataki B
Paleolithic				
1	Ogonki 5, 6, and 7		+	+
2	Sennaya 2			
3	Olimpiya 1		+	+
4	Ostantsevaya Cave		+	
5	Sokol		+	+
Neolithic				
6	Odoptu	+	+	
7	Slavnaya 2		+	
8	Novoalesandrovsk 2, 3, and 6		+	+
9	Pugachevo 4 and 5		+	
10	Dolinsk 1		+	+
11	Starodubskoye		+	
12	Porechye 4		+	
13	Lugovka			+
14	Yuzhnaya 2	+		+
15	Sedykh 1			+
16	Bogataya 1	+	+	
17	Moneron 5	+		+
18	Vostochny 2		+	+
19	Yasnoye 3			+
20	Shebunino 1			+
21	Kirpichny 9	+		
22	Naiba 6		+	
23	Ado-Tymovo 4			+
24	Puzi 4			+
25	Blagodatny 3		+	
Early Iron Age				
26	Beregovoye	+		
27	Zarechye 2	+		
28	Vostochny 1	+		
29	Lovetskoye 5	+		
30	Razmolovka	+		
31	Sadovniki 1	+	+	+
32	Yasnomoskoye 3			+
33	Stary Nabil 5	+		
34	Bakhura			

Table 2. *Archaeological sites found obsidian in Sakhalin (after SATO et al. 2002)*



A, archaeological sites; B, geological outcrops; C, eastern Sikhote–Alin volcanic belt; D, Basalt Plateau sources. Archaeological sites: (1) Samarga 5; (2) Samarga 2A; (3) Ust-Svetlaya; (4) Monastyrka 3; (5) Ustinovka 1, 3 and 4, Suvorovo 3; (6) Kentsukhe; (7) Sinie Skaly; (8) Eustaphy; (9) Phusun; (10) Valentin-peresheek; (11) Kievka; (12) Pereval; (13) Lebyazhya, Bulochka; (14) Anuchino 1; (15) Ivanovka, Gorelaya Sopka; (16) Firsanova Sopka; (17) Ilistaya 1; (18) Lesozavodsk; (19) Osinovka; (20) Gadychya Sopka; (21) Senkina Shapka; (22) Borisovka; (23) Razdolnoye; (24) Timofeevka 1; (25) Maikhe; (26) Chernaya Sopka; (27) Rybak; (28) Boisman 2; (29) Troitsa; (30) Gladkaya; (31) Khansi. Geological outcrops: (1) Nezhdanka, Yakut-Gora; (2) Bogopol; (3) Sadovaya River; (4–6) Brusilovka River basin—(4) Pad' Pryamaya, (5) Pad' Bogopolskaya Tropa and (6) Pad' Schmeidegir; (7) Sea of Japan coastal outcrops south of the Brusilovka River mouth; (8) Pad' Arsamasovskaya; (9–13) Partizanskaya River basin—(9) Sadovy Stream, (10) Kazenny Stream, (11) Chernaya Rechka, (12) Partizanskaya River headwaters and (13) Sergeevka River; (14) Arsenievka River basin; (15) Ilistaya River basin; (16) Steklyanukha River basin; (17) Nezhinka River basin; (18) Analievka River basin; (19) Klerk Peninsula (Ryazanovskoye Lake); (20) Ryazanovka River basin; (21) Vinogradnaya River basin; (22) Kraskino; (23) Krabbe Peninsula.

Fig. 1. *Obsidian sources and their archaeological sites in Russian Far East (after* KUZMIN *et al. 2002a)*



Key: A, Paektusan Volcano; B, Paektusan Volcano-related sites—(1) Monastyrka 3, (2) Eustaphy, (3) Phusun, (4) Pereval, (5) Maikhe, (6) Gorelaya Sopka, (7) Firsanova Sopka, (8) Timofeevka, (9) Chernaya Sopka, (10) Rybak, (11) Boisman 2, (12) Troitsa, (13) Gladkaya and (14) Khansi.

Fig. 2. *The Paektusan Volcano source and remote archaeological sites with made from Paektusan obsidian (after* KUZMIN *et al. 2002a)*

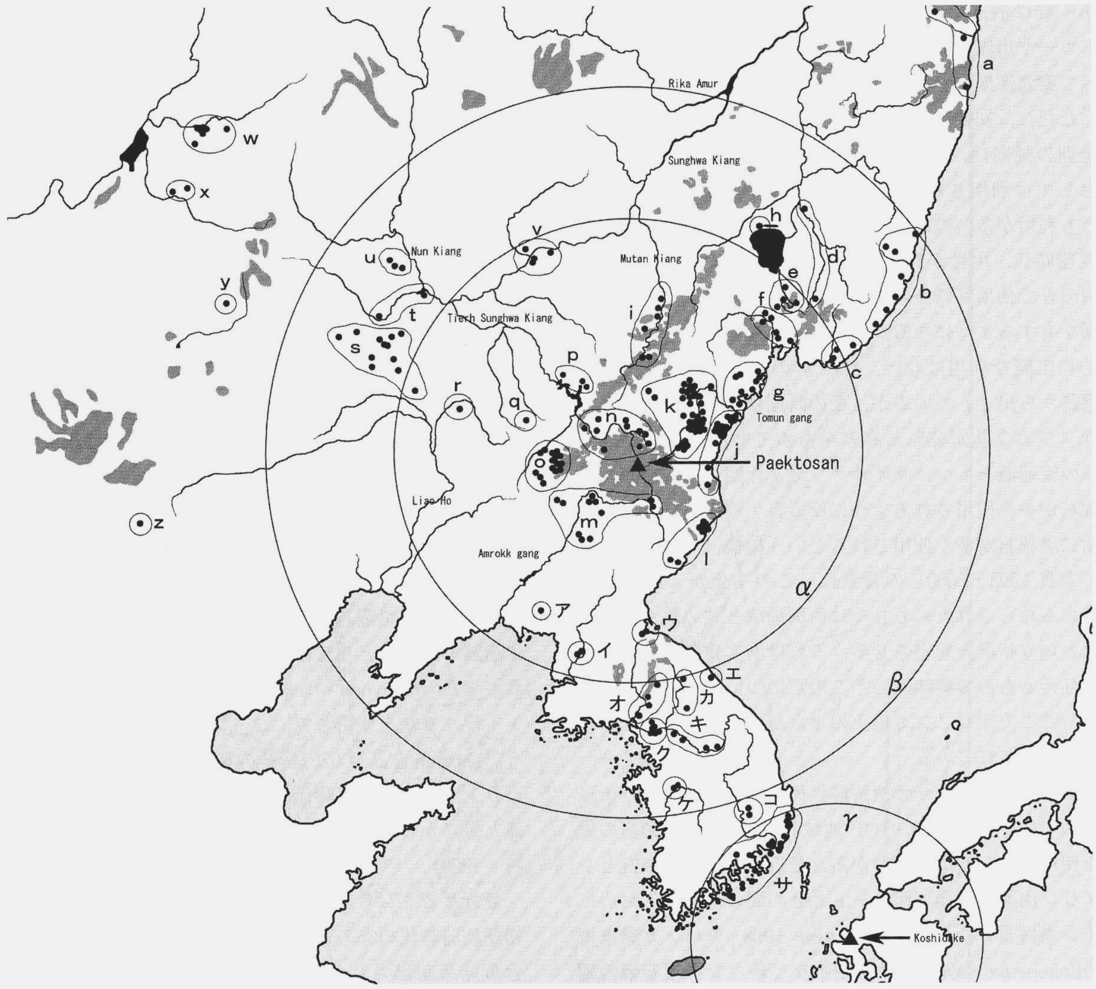


Fig. 3. *Distribution of sites with obsidian in Far East and Korea (after OBATA 2003)*

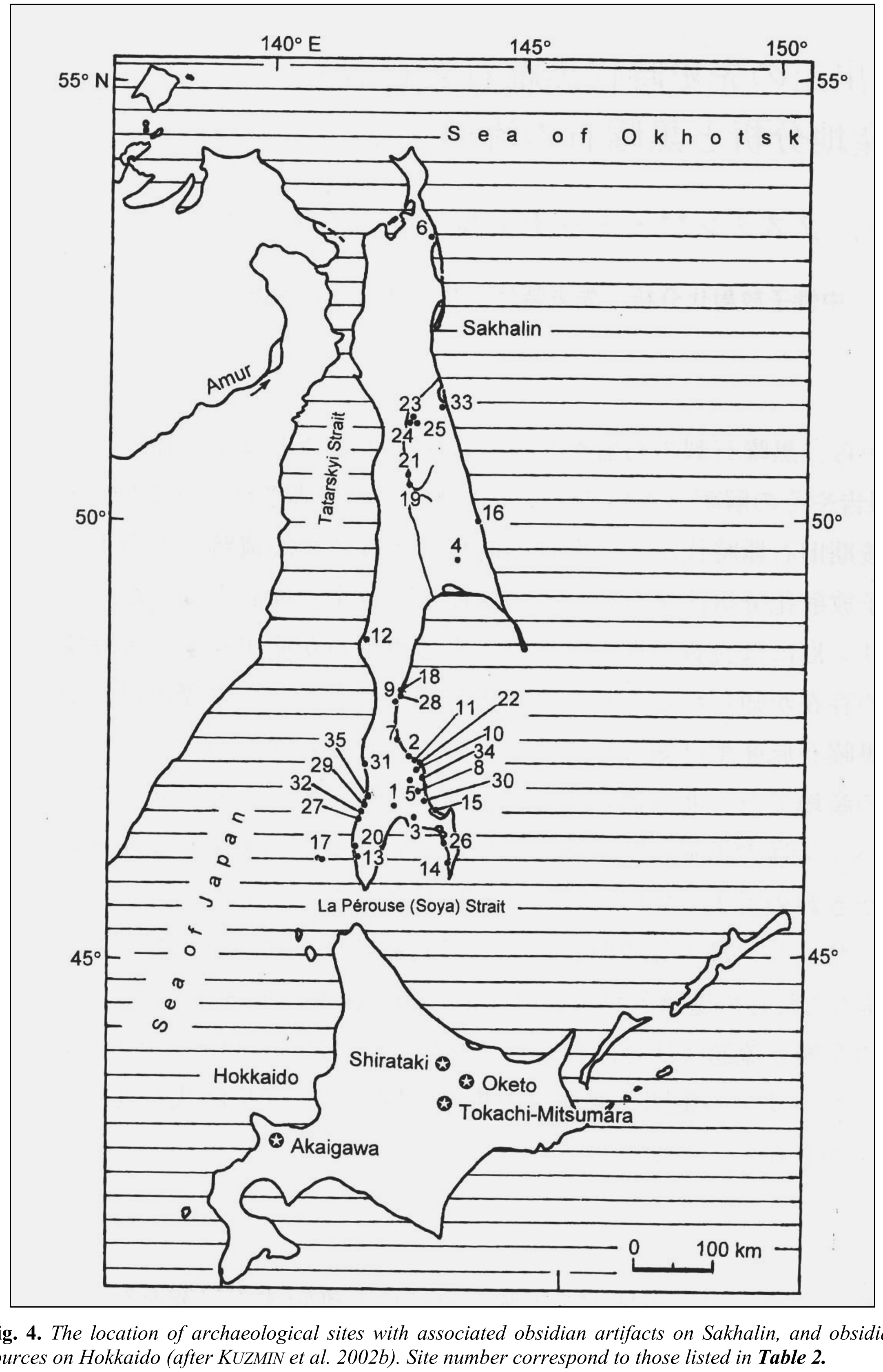


Fig. 4. *The location of archaeological sites with associated obsidian artifacts on Sakhalin, and obsidian sources on Hokkaido (after* KUZMIN *et al. 2002b). Site number correspond to those listed in* ***Table 2.***

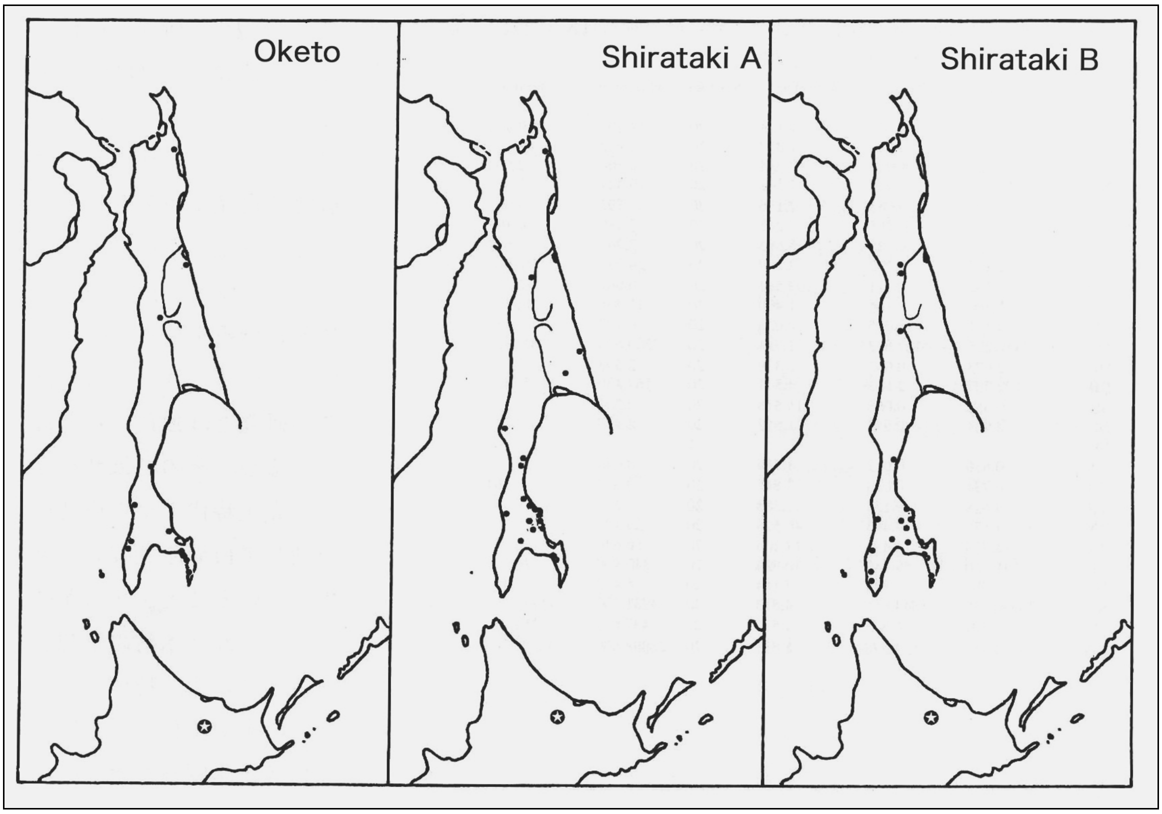


Fig. 5. *Geographic distribution of the obsidian sources from Hokkaido (after* KUZMIN *et al. 2002b)*

THE EPIGRAVETTIAN CHIPPED STONE INDUSTRY FROM THE NITRA III SITE (SLOVAKIA)

ĽUBOMÍRA KAMINSKÁ – ADRIÁN NEMERGUT

Keywords: *Slovakia, Epigravettian, Nitra, chipped stone industry*

Introduction

In the town Nitra there are several sites known with Palaeolithic finds, almost all of them resulting from J. Bárta´s explorations and excavations. The majority of them, including the Epigravettian site of Nitra III, were published only partially.[1]

The site topography

This locality is situated on the south-eastern border of the town (in the city district of Horné Krškany), between the Novozámocká road and the railway track, in J. Ballanga´s garden (***Fig. 1.***). It is situated on a low right-bank terrace of the Nitra river 140 m a.s.l., at the distance of 700 m from the present riverbed. Approximately 500 m to the west of it an extensive Upper Gravettian site, i.e., Nitra I-Čermáň was situated in a former brickfield area.[2] Another Upper Gravettian site, Nitra VI (Tobola, also Katruša, 212 m a.s.l.) is situated to the south-west, on a quarry area border.

The site excavation

A random find of stone artefacts was found during earthworks in J. Ballanga´s garden. J. Bárta led the investigation there in September and October 1964. The documentation and the finds are deposited in the Archaeological Institute of the Slovak Academy of Sciences in Nitra. We succeeded in finding almost all of the stone artefacts, but some documentation has been missing or proved to be insufficient, especially drawing documentation from the field, accurate description of finding situations, the detailed stratigraphy, and finally, description of the photo documentation (***Fig. 2.***). Technical diaries exist containing information about working methods, depth of finds and their schematic picture.

The general plan of the excavated surface was not found, only spatial recording of finds in particular trenches and sections (***Fig. 3; 4.***). The area under study was divided into 2x2 m sections. The trench A was 16 m long and 2 m wide with 8 sections (A/I-A/VIII). The excavation area was then extended by the sections B/VIII and C/VI-V/VIII, as a total to an area of 48 m^2. The sections A/VI and A/VII included the finding spot where J. Ballanga had found the artefacts.

The sections A/I and A/II did not yield any finds. In the sections A/III-A/V artefacts occurred 110-210 cm deep; in the A/VI they reached 275 cm of depth. In the deep test pit – a half of the section A/VII – artefacts occurred up to 340 cm. In the section A/VIII chipped stone artefacts were found also 256 cm deep; in B/VIII -205 cm; in C/VI - 210 cm; C/VIII - 240 cm. Apart from chipped stone artefacts, some sections included ash (A/V, A/VI, A/VIII, B/VIII, C/VIII), pieces of mineral pigments (A/VI, A/VII, A/VIII, C/VIII), malacofauna remains (A/V) or fragments of animal bones (A/VII).

Fragments of prehistoric pottery proving also younger settlement of the site were found sporadically in the sections A/VII and A/VIII at the depth of 55-70 cm.

Stratigraphy

It is known from the published articles that the lithics were situated on the surface of last loess.[3] On photographs from the excavations, particular layers of the profile are marked with capital letters A-J (***Fig. 2.***). One snap of the profile in the section A/VII

[1] BÁRTA 1980; 1993.
[2] KAMINSKÁ–KOZŁOWSKI 2011.
[3] BÁRTA 1980; 1993, 11.

Technological groups	Raw material									
	Radiolarite	Limnosilicite	Obsidian	Volhynian flint	Patinated flint	Quartzite	Quartz	Sandstone	N	%
cores	6								6	1,6
blades and fragments	54	7	1	2	6				**70**	18,1
flakes, fragments and chips	209	20	4	2		1	1		**237**	61,2
tools	57	7	1		2				**67**	17,3
burin spalls	4				1				**5**	1,3
hammerstone								1	**1**	0,3
Total	**330**	**34**	**6**	**4**	**9**	**1**	**1**	**1**	**386**	100

Table 1. *Nitra III. Technological groups of finds*

provides more distinguishable differentiation of upper layers A to C (***Fig. 2: 2.***). The layer including finds was not damaged by ploughing as the stone artefacts occurred in the layer C (***Fig. 2: 2–5.***). According to the excavation diary in which depths of all finds are given, in the section A/VII the first finds occurred 125 cm deep. The layer C is situated under the layers B and A, each of them 60 cm thick. This later unit was divided into two parts – arable soil and B horizon probably. The layer B is darker in colour than the loess layer C, but more accurate characterization is missing. Vertical scattering of the finds is relatively wide, in the deep test pit it ranged from 125 to 340 cm. However, the finds belonged to one settlement horizon.

The biggest concentration of finds occurred in the section A/VIII; the settlement centre is assumed to be situated within the sections A-C/VI-VIII. The sections A/III-V formed the border of the settlement and culture layer could not be observed in the sections A/I and A/II (***Fig. 3; 4.***).

Technological analysis of the chipped stone industry

According to the reports in the excavation diary and the drawing documentations, positions of 332 artefacts are drawn in the sections and further 54 lithics and a hammerstone were collected by surface survey, i.e. the number of analysed artefacts is 386 (***Table 1.***). As regards raw materials, radiolarite is totally prevailing (85.53%), followed by limnosilicite (8.79%), patinated silicite (2.32%), obsidian (1.55%), Volhynian flint (1.03%) and quartzite, quartz and sandstone each in one artefact (0.26% each). The limnosilicites and flints are slightly patinated that can be indicating a relatively younger age of the artefacts.

The chipped stone industry includes cores, flakes, burin spalls, blades, tools and the hammerstone.

Cores

The six cores are the only group of artefacts that was not found in the depository. Their photo documentation has been preserved, however, so we are able to present their basic characterization. All of them are radiolarite blade cores in different phase of core reduction (***Fig. 5.***). The cores no. 1 and 3 are probably residual pieces. Apart from the core no. 4, which is double-platform prismatic form, all the cores are possibly single-platform ones, core no. 5 with a pyramidal shape. The pieces are 5-6 cm long and 3-4 cm wide.

Flakes

Flakes are the most numerous group (***Table 2.***). Small flakes (35.3%) and flake fragments (32.8%) are predominant, chips (16.4%) and complete flakes (15.1%) are less frequent. Almost all flakes (***Fig. 8: 2–18.***) are without cortex (***Table 3.***), but on some artefacts cortex remains were present (***Fig. 8: 17.***). Traces of scars on dorsal side of the artefacts indicate chipping from cores mainly in parallel (44.4%) and transversal (36.1%) directions. Three flakes from core edges (***Fig. 7: 9; 8: 5, 6.***), three other ones from striking platform renovation (tablet) and part of a radiolarite pebble with cortex (***Fig. 8: 20.***) were preserved as well. Flake butts were the most frequently unprepared (47.2%) and linear or punctiform ones (27.8%).

Average length of the flakes is 28.55 mm, width 25.44 mm and thickness 6.26 mm.

Flakes	Raw material							
	Radiolarite	Limnosilicite	Obsidian	Patinated flint	Quartzite	Quartz	N	%
Flakes	34	2					**36**	15,1
Small flakes	71	9	4				**84**	35,3
Fragments	71	5			1	1	**78**	32,8
Chips	33	4		2			**39**	16,4
Total	**209**	**20**	**4**	**2**	**1**	**1**	**237**	100

Table 2. *Nitra III. Structure of flakes*

Blades and bladelets

Seventy blades, bladelets and their fragments were preserved (***Table 4.***). Complete blades (***Fig. 7: 13, 16, 17, 20, 22; 8: 10, 15.***) are 40% of this group, the other blades are distal (***Fig. 7: 8.***), mesial (***Fig. 7: 2, 10, 11, 14.***) or proximal (***Fig. 7: 1, 7, 15; 8: 11, 14.***) parts. Majority of the blades are without cortex, only 8 of them had preserved original surface on their lateral part (***Table 5.***). Prevailing part of the blades were chipped from single-platform cores (84.3%), very little of them were from double-platform cores (4.3%). Six were crested blades (***Fig. 6: 13; 8: 12.***) and two blades had preserved distal and proximal part of core (*outrepassé*). Butt types are presented by prevailing linear (50%) butts over unprepared (38%) ones; marginal butts are complemented with faceted (10%) and one dihedral butt. Narrow platform, traces of obliquely oriented *esquillements* on weakly marked bulb are indicating direct use of soft stone in chipping of artefacts.[4] Butt edges were prepared in 94%. Blades with parallel edges (45.7%) were predominant, followed by a rather equipollent group of blades with convergent, divergent and irregular edges. The blade cross-section was mostly triangular (55.7%), less trapezoidal (35.7%) and complemented with irregular cross-section (8.6%). Their longitudinal profile was prevailingly straight (68.6%), less twisted (22.9%) and convex in some blades (8.6%). Average blade length was 40.4 mm, width 16.4 mm and thickness 4.25 mm.

Nine bladelet fragments were decorticated, six of them with broken bases and three with broken distal parts (***Fig. 9: 8.***).

Shapes of flakes	N	%
Cortical flakes		
wholly cortical	1	2,8
50%	1	2,8
25%	4	11,1
decorticated flakes	30	83,3
Total	**36**	**100**
Dorsal pattern of flakes		
parallel scars	16	44,4
perpendicular scars	13	36,1
opposed direction scars	1	2,8
crested flakes	3	8,3
tablets	3	8,3
Total	**36**	**100**
Butt types		
cortical	1	2,8
unprepader	17	47,2
single-blow	1	2,8
faceted	6	16,7
dihedral	1	2,8
punctiform-linear	10	27,8
Total	**36**	**100**

Table 3. *Nitra III. Shapes of flakes*

Blades	Raw material						
	Radiolarite	Limnosilicite	Obsidian	Volhynian flint	Patinated flint	N	%
blades	17	6	1	1	3	28	40
distal part		5		1		6	8,6
mesial and distal part	6				1	7	10
mesial part	**3**	4				7	10
mesial et proximal part	5	5			2	12	17,1
proximal part	3	7				10	14,3
Total	**34**	**27**	**1**	**2**	**6**	**70**	100

Table 4. *Nitra III. Structure of blades*

[4] PELEGRIN 2000, 80.

Shapes of blades	N	%
Cortical blades		
lateral part	8	11,4
decorticated blades	62	88,6
Total	**70**	**100**
Dorsal pattern		
uni-directional scars	59	84,3
opposed direction scars	3	4,3
crested blades	6	8,6
outrepassé	2	2,9
Total	**70**	**100**
Butt types		
unprepared	19	38,0
faceted	5	10,0
dihedral	1	2,0
punctiform-linear	25	50,0
Total	**50**	**100**
Butt edge		
unprepared	3	6,0
prepared	47	94,0
Total	**50**	**100**
Shape		
parallel	32	45,7
convergent	14	20,0
divergent	11	15,7
irregular	13	18,6
Total	**70**	**100**
Cross-section		
triangular	39	55,7
trapezoidal	25	35,7
irregular	6	8,6
Total	**70**	**100**
Profile		
streight	48	68,6
convex	6	8,6
twisted	16	22,9
Total	**70**	**100**

Table 5. *Nitra III. Shapes of blades*

Tools

Retouched tools are representing 17.3% of the acquired artefacts. Ten end-scrapers are represented by five types made mostly on short or broken radiolarite blades. The blade end-scrapers are on shorter blades of various widths, five of them are made of radiolarite (***Fig. 6: 3, 4, 7; 9: 17, 18.***) one of slightly patinated limnosilicite (***Fig. 6: 1.***). An atypical piece is made on a wider radiolarite blade, with a slightly asymmetric working front and the retouch is partially extended to the right edge (***Fig. 7: 23.***). Another piece made on irregularly retouched blade is made of radiolarite (***Fig. 6: 2.***). The *éventail* end-scraper made of patinated silicite (***Fig. 6: 8.***) and a radiolarite flake end-scraper (***Fig. 6: 5.***) occurs in the collection as well. Another two end-scrapers were parts of combined tools, one is made on a radiolarite blade with dihedral burin (Fig. 6: 11), the other one on truncation (***Fig. 6: 6.***).

The group of tools includes also five burins. The asymmetrical dihedral burin was on radiolarite flake (***Fig. 8: 19.***) and another obsidian burin was on a snap (***Fig. 8: 8.***). Two radiolarite truncation burins were on concave truncation (***Fig. 6: 9, 14.***). The multiple burin on radiolarite blade (***Fig. 8: 16.***) occurs in the group as well.

Steeply retouched blades are not numerous here. Only two backed blades occur in fragments (***Fig. 8: 3, 7.***). Blades with straight truncation are represented by three radiolarite artefacts. One of them has straight truncation on the blade proximal part (***Fig. 7: 18.***), the other two on the blade distal part (***Fig. 7: 25, 26.***). Two blades, one made of limnosilicite (***Fig. 8: 9.***) and the other of radiolarite (***Fig. 9: 14.***), have oblique truncation on distal part, the both have broken bases.

Five radiolarite blades have retouch on one edge, which was discontinuous (***Fig. 6: 12; 7: 19; 9: 23.***).

Notched tools occur in 11 artefacts on blades and flakes (***Fig. 6: 10; 8: 13; 9: 15, 21, 22.***).

This group includes also microliths, e.g. the pointed retouched part of limnosilicite bladelet with oblique truncation on the triangular base (***Fig. 9: 12.***). Among the microlithic tools, backed or truncated bladelets are the most frequent. Two bladelets have edges with transversal truncation that form rectangle, one of them of radiolarite has alternate retouch on right and left edges (***Fig. 9: 13.***). The other rectangle of patinated silicite has backed left edge (***Fig. 9: 19.***). Two radiolarite bladelets (***Fig. 9: 1, 9.***) and one made of limnosilicite (***Fig. 9: 2.***) have truncated ends. Three other radiolarite bladelets were backed (***Fig. 9: 6, 20.***). One of them has both edges backed – the left edge totally and the right in pointed basal part, on its distal end changed for inverse retouch (***Fig. 9: 16.***). One radiolarite bladelet has backed edge and truncated end (***Fig. 9: 4.***). Three pieces of radiolarite have been retouched on their ventral face. Ventral retouch is

Tools	Raw material						
	Radiolarite	Limnosilicite	Obsidian	Volhynian flint	Patinated flint	N	%
blade end-scraper	5	1				**6**	9,0
atypical blade end-scraper	1					**1**	1,5
End-scraper on retouched blade	1					**1**	1,5
éventail end-scraper					1	**1**	1,5
flake end-scraper	1					**1**	1,5
End-scraper / burin	1					**1**	1,5
End-scraper / truncation	1					**1**	1,5
burin dihedral asymetrical	1					**1**	1,5
burin on a snap			1			**1**	1,5
burin on concave truncation	2					**2**	3,0
multiple burin	1					**1**	1,5
backed blade	2					**2**	3,0
blade with straight truncation	3					**3**	4,5
blade with oblique truncation	1	1				**2**	3,0
retouched blade unilateral	5					**5**	7,5
notch	11					**1**	16,4
triangle		1				**1**	1,5
rectangle	1				1	**2**	3,0
truncated bladelet	2	1				**3**	4,5
backed bladelet	3					**3**	4,5
backed bladelet truncated	1					**1**	1,5
bladelet with inverse retouch	3					**3**	4,5
retouched bladelet	2	1				**3**	4,5
retouched flake	9	2				**1**	16,4
Total	**57**	**7**	**1**	**0**	**2**	**67**	100

Table 6. *Nitra III. Composition of tools*

found on the left edge of the distal part of irregular bladelet (***Fig. 9: 10.***) and the proximal part of parallel bladelet (***Fig. 9: 7.***). The last bladelet is a pointed one with ventral retouch on the distal end (***Fig. 9: 11.***), very similar to the pointed bladelet with backed edges and partial inverse retouch on the ***Fig. 9: 16.*** Three bladelets have micro-retouch, on the left edge of a broken bladelet of slightly patinated limnosilicite (***Fig. 9: 3.***), on the right edge of broken radiolarite bladelet (***Fig. 9: 6.***) and on the left edge of parallel bladelet with broken proximal part.

The last group of the tools are the retouched flakes (11 pieces), including nine radiolarite artefacts (***Fig. 7: 3–6, 12, 22, 24; 8: 1.***) and two flakes of limnosilicite.

Evaluation

The chipped stone artefacts from the Nitra III site can be characterized as a blade industry made out of radiolarite single-platform cores predominantly. In the case of Nitra III we consider radiolarite as a local raw material, because of its occurrence in the riverbed of

Váh that flows 25 km in the south-western direction. Raw materials of medium-local (limnosilicite from central Slovakia) and large distances (obsidian from eastern Slovakia or north-eastern Hungary, erratic flint from northern Moravia, Volhynian flint from the Dniester river basin) occur in small amounts.

As regards the typology, short end-scrapers (IG=14.92) are prevailing over burins (IB=7.46); truncated blades and backed tools (both blades and bladelets) are presenting 12% of the artefacts (index 11.94). The assortment is complemented with notched pieces and truncated flakes. Considering their technology and typology, the chipped stone artefacts from Nitra III are mostly corresponding to Epigravettian industries. Concentration of the finds, together with technology and typology of the finds suggest that the settlement in Nitra III was a short-term camp with domestic activities.

In the closest vicinity of the Nitra III site (***Fig. 1.***) the Upper Palaeolithic sites Nitra I-Čermáň and Nitra VI (Tobola)[5] are situated. Finds from Nitra VI have not been published yet. The Nitra III site is situated lower than the Nitra I-Čermáň position, in a protected valley closer to the Nitra River. Stratigraphy of the finds at the Nitra III position shows that they were situated in the upper part of a relatively thick layer of the last loess that is common also at other sites dated to this period. The Nitra I-Čermáň position is an extensive site with multiplied settlement within the shouldered point horizon,[6] existence of which is limited by two radiocarbon dates: 24 220±640 BP (GRN-2456) a 22 860±400 BP (GRN-2449). The oldest settlement is connected with the humus horizon named as "Čermáň oscillation",[7] the next settlement came at the turn of the humic horizon and the last loess base and the following one was situated in the youngest loess. As regards the typology, shouldered point is the leading artefacts of the upper Gravettian industry at the Nitra I-Čermáň site.

The use of radiolarite and several types of artefacts are common on both sites. At the Nitra I-Čermáň position, however, erratic flint was used apart from radiolarite and limnosilicite and in the Nitra III site Volhynian flint occurs together with patinated silicite, provenience of which cannot be pinpointed, but most probably it is erratic flint from northern Moravia.

Considering technology at the assemblages, artefacts were chipped from single- and double-platform cores. In the typological structure of the artefacts from Nitra III end-scrapers are twofold prevailing over burins while at Nitra I-Čermáň the situation is the opposite: index of end-scrapers in particular concentrations of artefacts ranges from 6.6 to 12.5 and index of burin from 18.6 to 37.8. The end-scrapers from Nitra I-Čermáň in contrast to Nitra III were made on long blades[8] and generally, of ten blades that were found at Nitra III only four were above the average length of 40 mm, while the blade average length at Nitra I-Čermáň was 46 mm. At the later site an end-scraper-burin combined tool was also recorded.[9] All the burin types from the Nitra III site – dihedral, on broken blade, truncated, multiplied burins – were found at the Nitra I-Čermáň position as well. The index of backed tools – blades, bladelets, points, microliths – at Nitra I-Čermáň ranges from 20 (in the concentration I) to 25.5 (concentration II[10]), including a triangular micro-point[11] also; in Nitra III this value is 11,94.. Backed bladelets with truncated end and rectangles occurred in Nitra I-Čermáň[12] and rectangles are also recorded in the Upper Gravettian assemblage from Trenčianske Bohuslavice, working place A[13] with radiocarbon dating (GrA-16 161): 23 280±140 BP[14] as well as at Moravany-Noviny[15] and Banka-Kňazovice[16] in the Váh valley and finally in Ostrava-Petřkovice[17] in Moravia.

Nitra III site and the Epigravettian Sites in Slovakia and Neighbouring Regions

Western Slovakia

In contrast to the Upper Gravettian, the Epigravettian in western Slovakia was present in a remarkably less extent, the sites have not been excavated adequately and indexes of their artefact inventories are opposing. Similar situation has been learned in neighbouring regions, mainly in Hungary, Moravia and the Lower Austria as well. We consider relevant that in all regions with strong Upper Gravettian settlements Epigravettian sites occur, too. This is the case of the positions at Moravany-Banka, Trenčín, Cejkov, Kašov and finally also in Nitra.

Genesis of the Epigravettian has not been clarified sufficiently yet. It is connected with the Gravettian via backed tools. The opinion is preferred that the Epigravettian implies only chronological

5 Bárta 1960; 1966.
6 Kaminská–Kozłowski 2011.
7 Haesaerts et al. 2004, Fig. 7.

8 Kaminská–Kozłowski 2011, obr. 30: 1; 33: 8; 36: 1; 47: 10; 49: 10; 50: 6; 52: 14.
9 Kaminská–Kozłowski 2011, obr. 52: 20.
10 Kaminská–Kozłowski 2011, obr. 38: 1, 2, 6, 7; 39: 4, 5; 43: 10; 49: 1, 4; 53: 3.
11 Kaminská–Kozłowski 2011, obr. 52: 1.
12 Kaminská–Kozłowski 2011, obr. 40: 5; 43: 1–3.
13 Bárta 1988, Fig. 2.
14 Verpoorte 2002, Tab. 2.
15 Bárta–Kazior 2000, Pl. 6: 9.
16 Sobczyk 2000, Pl. 37: 2.
17 Novák 2008, Fig. 24: 38.

succession of industries following the Gravettian with possible contribution of other cultures, and not their genetic connection.[18] Within the space of central Danubian region the assemblages of industries dated to the 20-17 kyr BP used to be classified Epigravettian, in some of them Epiaurignacian elements occur. Some surviving Gravettian traditions, namely, backed bladelets are evident in the production technology and typology of artefacts.

The discussion considering the settlement of Central Europe in the Last Glacial Maximum period and after it has been still topical. After 25 kyr BP the western part of central Europe was depopulated, except for a short occupational episode at 19-18 kyr BP.[19] In the Middle Danube region the Upper Gravettian settlement of the shouldered point horizon has been proved in the rivers Váh and Nitra basins by numerous short-term camps within the period of 24-21 kyr BP.

Considerable deterioration of climate during the LGM and after it at 20-17 kyr BP had to be reflected in adaptation to new ecological conditions and ways of gaining food also by changes in hunting techniques and way of life. Smaller groups of hunters-gatherers were migrating at longer distances and staying at short-term camps, with horse and reindeer their main preys. Not global climate changes but regional conditions that offered enough food were circumscribing factors for building camps.[20] Both surface finds and dated sites prove the settlement moved more southward, in the direction inward the Carpathian Basin. Common feature of Epigravettian assemblages in western Slovakia is predominant use of locally available radiolarite.

The site at Moravany-Žakovská position has been the most discussed site in the Váh river basin because of its Epigravettian classification.[21]

Alike at Nitra III (85.53%), radiolarite (94.6%) is predominant among the raw materials. As far as typology of tools is concerned, end-scrapers (10.2%) are much more frequent than burins (1.1%). Backed tools were represented by 23.5% at Moravany-Žakovská, and only 12% in Nitra III.

The research in 1991 and 1992[22] brought dating of charcoal[23] to 18 100±350 (Gd-4915). New dating of the charcoal in 2000 (GrA-16159) 24 230±150 BP[24] classified the site at Moravany-Žakovská to the incipient shouldered point horizon. The occurrence of backed microblades brings about the contemplations of changing its dating to the Upper Gravettian.[25]

Banka-Horné farské role is another Epigravettian site at the area of Moravany – Banka. During the excavation in 1997 finds dated to the Upper Gravettian and Epigravettian were discovered. Artefacts made of erratic flint are dominating, shouldered points and animal bones mainly of reindeer among them were found in the trench IV, in the loess layer 5 and at the interface of the layers 4 and 5. Based also on their dating to 22 010±210 (GrA-19909) and 22 320±220 (GrA-19910),[26] the finds are placed to the shouldered point horizon. Moreover, in the upper layer of the last loess at the trench III, 329 artefacts were revealed at the area of 13 m^2; 55.3% of them were made of radiolarite, 28.3% of erratic flint, 5.1% of limnosilicite, other raw materials were less frequent. As opposite to the Nitra III site, among the tools (29 pieces) burins (12) prevailed end-scrapers (2) and share of radiolarite is slightly exceeding 50%. These classes were complemented with 6 retouched blades, 3 borers, 3 denticulated-notched tools, a Kostenki knife, a splittered piece, a combined tool and a retouched flake.[27]

The excavation in Trenčianska Turná-Hámre (Váh valley) at the Za dvorom position was run in 2007. The majority of the artefacts, however, come from surface collections preceding the excavation.[28] The site is situated on a gentle slope with inclination to the east. The eroded loess layer under the arable soil, included artefacts that we classified, considering their typology, to the transition period between the Middle and Upper Palaeolithic and to the Gravettian/Epigravettian. However, cultural layer was not found. Among raw materials of the Gravettian/Epigravettian artefacts radiolarite exceeds over limnosilicite, other materials with erratic flint among them are present in small numbers only.[29] Single-platform cores were in balanced rate to double-platform ones, complemented with a core with changed orientation and two pre-cores. Tools form 5.72% of the assemblage (25 pieces), including 5 end-scrapers, a combined end-scraper-burin, 7 burins (a burin with straight truncation, a burin on broken blade, 2 dihedral burins and 3 multiple burins), a backed bladelet, 7 truncated blades and 3 truncated flakes. Eight tools were made of limnosilicite, 8 of erratic flint, 7 of radiolarite and 2 of opalite/chalcedony. The group of blade end-scrapers comprises also one piece with irregular oblique head and a tool on short blade.

[18] KOZŁOWSKI 1996, 20; SVOBODA 2006, 27.
[19] STREET–TERBERGER 2000, 290; TERBERGER–STREET 2002.
[20] VERPOORTE 2004, 263.
[21] HROMADA 1998; HROMADA–KOZŁOWSKI 1995.
[22] HROMADA–KOZŁOWSKI 1995.
[23] PAZDUR 1995, 74.
[24] VERPOORTE 2002, 313, Tab. 4.
[25] SVOBODA–NOVÁK 2004, 473; VERPOORTE 2004, 260.
[26] VERPOORTE 2002, 315, Tab. 7.
[27] ALEXANDROWICZ et al. 2000.
[28] KAMINSKÁ et al. 2008.
[29] KAMINSKÁ et al. 2008, tabela 21.

At the site burins are also predominating (IB=28) over end-scrapers (IG=20), at the difference to Nitra III, but backed implements are less frequent.[30]

Central Ipeľ river basin

During the LGM and in the following period Palaeolithic hunters lived in southern Slovakia also. During the explorations in the central Ipeľ river basin in 1955-1960 tens of sites with chipped stone artefacts dated to the Middle and Late Palaeolithic were found, but on none of them have been realized any excavations.[31]

The Ipeľ River flows through mountainous land; on its right bank the sites are situated on southern promontories of the Krupinská planina plain that run out to the river. On the left bank of the river on Hungarian side are northern promontories of the Börzsöny and Cserhát mountain ranges. The southern projections of the Krupina plain with their height over 200 m a.s.l. are separated by brook valleys. The Palaeolithic sites were situated mostly on the top of the southernmost promontories overlooking the river. The Ipeľ valley is connecting the region of Danube and the Tisa valley across the crossings at Cérová vrchovina hills and the valleys of the Rimava, Slaná and Hornád, as a possible migration way in the east – west direction. Palaeolithic artefacts were found on arable soil surface, on gravel terraces and sand dunes as well, indicating heterogeneous geological subsoil.

In this territory the available raw material was classified as silicified palaeogenous limestone,[32] lately as nummulitic silicite[33] and recently as nummulitic chert.[34] Apart from this, artefacts made of patinated flint, obsidian, chalcedony and radiolarite were found at the sites in the Ipeľ basin. The artefacts from the majority of sites are atypical pieces and classified only generally to the Upper Palaeolithic (e.g. Veľká Čalomija I-III; Vrbovka I-IV), a part maybe to the Aurignacian. The majority of the sites with blade tools were classified to the Gravettian (Bušince II, Kiarov II, Šahy). In the following we discuss some assemblages from Veľká Ves nad Ipľom-Kurja, Kováčovce I-Hradište and Záhorce-Selešťany, classified as Gravettian as well.[35]

An assemblage of more numerous and typical blade artefacts mostly made of nummulitic chert and complemented with patinated flint, obsidian and radiolarite come from the site of Veľká Ves nad Ipľom - Kurja. The workshop character is indicated by numerous flakes and unprocessed blades and a pyramidal core. Tools are represented by short blade end-scrapers, burins (dihedral, on truncation, multiple on truncation), a combined end-scraper-burin, a backed microbladelet and retouched flakes. Small blade end-scrapers and *éventail* end-scrapers are made of obsidian mostly[36]. Similar end-scrapers, including a fan-shaped one are known from the Nitra III site too.

The authors of explorations[37] ranked the artefacts among the Gravettian, but the mentioned types of tools make their classification to the Epigravettian possible.

Within the village cadastre of Veľká Čalomija artefacts were found at four places but only at the site IV (Nad vinicami, 237 m a.s.l.) were found a considerable number of artefacts made of nummulitic chert, suggesting their local production. Among them flakes and unprocessed blades made from pyramidal cores are predominating. The tools are represented by dihedral burin, a retouched blade on both sides, a blade with steep retouch and a notched tool. Artefacts of Aurignacian type did not occur, so the assemblage was classified as Upper Palaeolithic,[38] here we consider it, with a certain reserve, as Gravettian/Epigravettian.

Another site with finds including a flake core, blade flakes, bladelets, microbladelet and bladelet on oblique truncation is situated at Záhorce-Selešťany, on a Krupina plain promontory, closely over the Ipeľ valley. Small dimensions of the artefacts are proving most likely their Epigravettian rather than Gravettian affiliation.[39]

A concentration of more numerous typical Gravettian blade artefacts from Kováčovce I,[40] made mostly of nummulitic chert, patinated flint, rarely of obsidian and radiolarite was found on the top of Hradište hill 265 m a.s.l. The cores were prismatic and pyramidal ones, both with scars of narrow blades. As regarding typology the proximal part of a backed bladelet artefact, together with short blade end-scraper, flat nosed end-scraper, burin, and pointed blade with retouch on left edge classified as small Gravettian point[41] are the typical pieces, which would not reject their possible classification as Epigravettian either.

J. Bárta declared Svodín, situated in the Hron river basin also a Gravettian site.[42] The blade artefacts

[30] KAMINSKÁ et al. 2008, 198–208, Fig. 22: 4; 23: 7.
[31] BÁRTA 1961; BÁRTA–PETROVSKÝ-ŠICHMAN 1962; PETROVSKÝ-ŠICHMAN 1961.
[32] BÁRTA 1961, 168.
[33] BÁRTA 1979, 9; MIŠÍK 1975, 101.
[34] MARKÓ–KÁZMÉR 2004.
[35] BÁRTA–PETROVSKÝ-ŠICHMAN 1962, 308.
[36] BÁRTA 1965, 129.
[37] BÁRTA–PETROVSKÝ-ŠICHMAN 1962, 300, obr. 78.
[38] BÁRTA–PETROVSKÝ-ŠICHMAN 1962, 302, obr. 79: 9–11.
[39] BÁRTA–PETROVSKÝ-ŠICHMAN 1962, 302.
[40] BÁRTA–PETROVSKÝ-ŠICHMAN 1962, 306, obr. 79: 1–7.
[41] BÁRTA–PETROVSKÝ-ŠICHMAN 1962, obr. 79: 3.
[42] BÁRTA 1961, 169.

found here[43] are made of radiolarite and nummulitic chert.

All the above mentioned sites of southern Slovakia are closely connected with the main water flows. They have the typical Epigravettian characteristic – the use of local raw materials, represented by nummulitic chert in the region. Both the mesolocal raw materials (radiolarite) and those of more distant proveniences (patinated flint and obsidian) are less frequent. The patinated flint use to be considered the Volhynian flint from the Dniester basin.[44] The tool typology includes short end-scrapers, combined end-scraper-burin tools, various types of burins, bladelets, backed bladelets and bladelets with oblique truncation.

Eastern Slovakia

In Eastern Slovakia the largest concentration of Gravettian and Epigravettian localities is recently known from the Východoslovenská nížina lowland. Natural sources of obsidian, the main raw material of the Epigravettian exist in southern part of the Zemplínske vrchy hills. The most plentiful settlement was on northern and eastern slopes of the hills in 120-200 m a.s.l.[45]

The most significant site of the Upper Gravettian is situated at the Cejkov I locality with several settlement phases[46] and further sites were identified at Cejkov II-V, all comparable with Cejkov I.[47]

The oldest horizon of this period, dated between 24.5-22.5 kyr BP is characterized by more intensive southward contacts with the presence of patinated obsidians and limnosilicites of most probably Hungarian origin[48]. A surface find of a small obsidian shouldered point at Cejkov I[49] shows a connection line to the regions of Kraków, through north-eastern Slovakia (Marhaň in the Topl'a valley, also with patinated limnosilicites of southern origin[50]) and Hungary (Hidasnémeti in the Hernád valley[51]).

The younger phase of the settlement at Cejkov I is contemporary with the older settlement layer at Kašov and probably also at Hrčeľ-Nad baňou. The layer at Cejkov I is situated in loess[52] and is dated to 19 600±340 BC (KN 14) and 19 755±240 (Berlin 1414)[53]; the lower layer at Kašov is dated to 20 700±350 BP[54]. As regards the raw materials used, erratic flint prevails the local obsidian in these assemblages as well as in Cejkov II.[55] Presumably this group of sites is connected with the movement of the last groups of Gravettian hunters during the LGM from the Krakow region[56] through Carpathian passes to the south into the Carpathian Basin and the Východoslovenská nížina lowland.

The youngest settlement at Cejkov I is situated in the upper part of the last loess. The artefacts made of obsidian almost entirely come from the surface and their dating is missing, but general character of the artefacts allows their ranking to the Epigravettian.

The upper layer at Kašov, with 43 540 artefacts, is dated to 18 600±390 BP (Gd-6569) and linked to the same industry.[57] In addition to stone artefacts, also grinding stones, lumps of mineral pigment, charcoal and few ceramic pieces were preserved here.[58] According to the recent knowledge the settlement was concentrated in several clusters, the size of which ranged from 1 to 6 m. Assortment of the artefacts documented their being divided into workshops (including numerous flakes and fragments) and living areas (smaller concentrations with more retouched artefacts). Spreading of the tools indicates short succeeding occupations, which were connected with high mobility of the groups in the vicinity. A single hearth at the same time could be used by groups of hunters who left 2-3 concentrations of finds.[59]

In the analysed 30 concentrations of artefacts obsidian (81.73%) prevails limnosilicite (9.92%), radiolarite from north-eastern Slovakia (3.11 %), erratic flint from Silesia (2.45%), Volhynian flint from the Dniester basin (0.40%), felsitic porphyry from Hungary (0.04%) and other raw materials.[60]

Considering the technological analysis, cores with the single platform were most numerous. The core shapes were flat, ovoid and globular. Only 21.2% of blades were complete artefacts, others were preserved in fragments, indicating their intentional damage.

In typological composition of 234 retouched artefacts end-scrapers (43.9%) were predominating over burins (23.1%). The end-scrapers were made on whole as well as broken blades, on short blades and flakes. Unguiform end-scrapers and thick

[43] BÁRTA 1965, tab. L: 20–23.
[44] BÁRTA 1965, 129.
[45] KAMINSKÁ–KOZŁOWSKI 2002.
[46] BÁNESZ 1961; 1969; 1996.
[47] BÁNESZ 1959.
[48] KAMINSKÁ–TOMÁŠKOVÁ 2004, 210.
[49] BÁNESZ 1961, 771, obr. 268: 1.
[50] VALDE-NOWAK 2008.
[51] SIMÁN 1989.
[52] BÁNESZ–PIETA 1961.
[53] BÁRTA–BÁNESZ 1981, 24.
[54] BÁNESZ 1993.
[55] BÁNESZ–KAMINSKÁ 1984; NOVÁK 2002; 2004.
[56] BÁNESZ et al. 1992, 19; KOZŁOWSKI–SOBCZYK 1987, 67.
[57] BÁNESZ et al. 1992.
[58] BÁNESZ 1996.
[59] BÁNESZ et al. 1992, 20.
[60] BÁNESZ et al. 1992, Tab. III.

"Aurignacoid" types occurred as well. Among burins, dihedral pieces and ones made on broken blades were the most frequent, but multiple burin types, polyhedral, on truncation, transverse, flat and the Noilles-type tools occurred, too. Combined tools were represented in 3.8%. Retouched blades were more frequent (9.6%), but backed implements were rare (0.12%). Microblades consisted of a small number of backed, truncated, denticulated and inversely retouched artefacts. Other types of tools are borers, side-scrapers, raclettes, notched and denticulated pieces.

Analogies in the Epigravettian assemblages of both the upper layer at Kašov and Nitra III are found in the use of local raw materials and the end-scrapers prevail burins; backed tools differ in their numbers. Plenty of artefacts found in the Kašov upper layer led L. Bánesz (1990, 16) to think about the possibility to name the local Epigravettian with the term "Kašovian"; in present, from the point of view of chronological setting and typological content the term "Kašovian" is more often proposed to be used for the whole circle of Epigravettian industries for eastern central Europe after the LGM.[61]

The site of Hrčeľ-Pivničky is situated to the west of Kašov is compared to the Epigravettian industry from the Kašov upper layer. Here the majority of artefacts come from surface collection and only a small part originated from the excavations. Among the raw materials obsidian (69.95%) prevails limnosilicite (15.66%) and radiolarite (6.79%) and there are small quantities of flint from the Dniester basin (1.86%) and felsitic porphyry from the Bükk Mountains (0.02%).

As regards the typological structure, end-scrapers (21.21%) are predominating over burins (15.18%). The implements include also combined tools (3.70%), rather frequent retouched blades (15.56%) as well as truncations (10.31%). Backed bladelets comprised 6.03%. The tendency towards microlithization of tools can be seen, as well as the occurrence of Aurignacoid forms.[62]

Further Epigravettian finds from the northern slope of Zemplínske vrchy hills are known from Veľaty, where two surface artifact-concentrations were discovered. The site I is similar to the Hrčeľ-Pivničky site with obsidian dominance (66.45%) and the end-scrapers are more frequent than burins (12.5%) and some Aurignacoid elements appeared at this site also.[63] Finally further Epigravettian sites are known from the area of Zemplínske hills, e.g. from Kysta, Zemplínske Jastrabie and Zemplín.

Another assemblage of Gravettian to Epigravettian artefacts was found at the Nižný Hrabovec I and II in central part of the Ondava valley[64] and some Epigravettian artefacts (a single-platform core for blades and a microlithic end-scraper of local opal complemented with Aurignacoid end-scraper) were found at Červenica in the Torysa valley.[65]

The Gravettian and Epigravettian in eastern Slovakia shows different tendencies of spatial contacts than the Gravettian in western Slovakia, reflected in the presence of limnosilicites and the felsitic porphyry from north-eastern Hungary. Typology of the artefacts differs from those found in the Váh valley as well, e.g. shouldered points are rare in eastern Slovakia and north-eastern Hungary and represented by atypical pieces

After the LGM the chipped stone industry was made mostly from local raw materials, like the obsidian which was complemented with mesolocal rocks (radiolarite, opal) and those imported from longer distances (typically Volhynian flint from the Dniester Basin). Among the tools end-scrapers are prevailing; burins and Aurignacoid elements also occurred sporadically.

Hungary

The Gravettian entity in Hungary can be divided into three phases. The Older Gravettian, contemporary with the Pavlovian is dated to 28-26 kyr BP and the site at Hidasnémeti is the only Hungarian site of the shouldered point horizon.[66]

The Epigravettian follows after a longer time span that is divided into two independent groups with different settlement strategies,[67] each of them includes two time phases.[68] The first Epigravettian group is the Ságvárian, characterized by its preference to pebble raw materials is concentrated in the region of the Danube bend and named after the eponym site at Ságvár with two cultural layers,[69] dated around 19-18 kyears B.P. The sites Mogyorósbánya, Madaras, Szob are classified sites as belonging to the Ságvárian.[70] The typology includes short end-scrapers predominating over burins, most of them are atypical ones.[71]

The other Epigravettian group is partially contemporary with the Ságvárian culture. The lithic

[61] SVOBODA 2006, 28; SVOBODA–NOVÁK 2004, 475.
[62] KAMINSKÁ 1995.
[63] KAMINSKÁ 1986.
[64] KAMINSKÁ et al. 2000, 76.
[65] HARČÁR et al. 1995–1996.
[66] T. DOBOSI 2000, 82; SIMÁN 1989.
[67] T. DOBOSI 1996, 30, 31; 2009[a].
[68] T. DOBOSI 2005.
[69] GÁBORI-CSÁNK 1978.
[70] T. DOBOSI 1998-1999; 2000; T. DOBOSI–SZÁNTÓ 2003; MARKÓ 2007.
[71] T. DOBOSI 2003, 149; 2009b, 127; TOLNAI-DOBOSI 2001.

assemblages are poorer in typology and much different,[72] excavated on short-term camps of small groups of hunters-gatherers, specialized for reindeer and horse hunting.

This older Epigravettian phase is dated to the period after the LGM and can be connected to the upper embryonal soil horizons of the Ságvár-Lascaux interstadial around 16 kyr BP.[73] Beside the Pilismarót settlements, the site at Esztergom-Gyurgyalag in the Danube bend belongs to this group. This habitation site of general function has special position among Hungarian sites because of its use of flint of the Prut River (more than 93.6% of the artefacts were made of this rock, imported from over 600 km distance) and typological traits (blades with worked edge is represented by 79% of all the artefacts.[74] Prut flint in Hungary occurs also at these Epigravettian sites: Jászfelsőszentgyörgy,[75] Pilismarót,[76] Szeged-Öthalom[77] showing that the sites are found on the Hungarian Plain and in the Tokaj mountains (the lower cultural layer at Arka[78]) too.

In the Ipeľ river basin the site at Hont-Várhegy[79] was classified to Epigravettian. The assemblages of the Jászság area[80] and the lower cultural layer at Arka[81] are typical of the Epigravettian older phase in the Hungarian Plain.

The younger Epigravettian phase is dated to the end of the Pleistocene around 13-11 kyr BP.[82] The sites are situated in the Hungarian Plain mainly; in the Hernád valley, the upper cultural layer at Arka is the most significant. The raw materials used and the artefact structure indicate two settlement functions. The first is habitation where various local and mesolocal raw materials were used, and the second is workshop near hydroquartzite deposits with a ratio of 65.2%. Other raw materials were less frequent: radiolarite, jasper, chert, obsidian (8%), various flints with 2 artefacts made of Volhynian/Prut flint among them.

As regards the tool typology, end-scrapers (IG=22.44%) were predominating over burins (IB=20.39%). The end-scrapers were on blades, flakes, often short ones, globular and unguiform. The burins were mostly dihedral or polyhedral form. Both groups contain "Aurignacoid" elements. The ratio of blades was 7.8% and among the tools backed microblades, laterally retouched and truncated blades were also present.[83]

Small lithic assemblages left by small groups of hunters with short-term camps were found at Hungarian Epigravettian sites. In comparison with the Older Gravettian and the Ságvárian cultures that mostly used local deposits of raw materials, the Epigravettian groups made their tools of long-distance raw materials.[84]

Moravia

In Moravia the Epigravettian settlement was scarce, the most typical, stratified and dated site is known from Brno-Stránská skála IV locality, considered a specialized hunting site for horses.[85] Here the cultural layer was situated in the uppermost part of the last loess. Dated horse bones proved the age around 18 kyr BP.

The stone artefacts were concentrated into two clusters. In the assortment of used raw materials local chert is prevalent (55.9%), complemented with other cherts, erratic flint, radiolarite, porcelanite, rock crystal, obsidian, a. o. Single-platform prismatic cores are predominant, complemented with double-platform prismatic core and rare other types. Blades create 51.9% of the assemblage. Regarding the typology, the artefacts seem to be atypical forms as only a single short end-scraper, a polyhedral end-scraper or burin, some retouched and denticulated blades and flakes, borers and more numerous notches were found. A truncated blade,[86] however, is worth to mention.

Both the artefact typology and the technology are similar in some ways to the Epigravettian from Nitra III: the occurrence of a short end-scraper, numerous notches and retouched flakes and a truncated blade are the common elements first of all.[87] The frequent use of local raw materials and less long-distance ones are characteristic as well. At Stránská skála IV the occurrence of obsidian proves eastward contacts to Slovak territory.

In Brno two other closely situated sites that are dated to the Gravettian to Epigravettian are known. New evaluation of older finds from the Brno-Kamenná ulica to the Epigravettian classified the position of the site situated lower in the vicinity of the river. The artefacts are typically made on fragmentary blades, almost entirely of erratic flints. The assemblage of 18 tools includes 10 burins, among them dihedral, on

[72] T. DOBOSI 2009b, 127.
[73] T. DOBOSI 1998-1999, 59.
[74] T. DOBOSI 2010.
[75] T. DOBOSI–HERTELENDI 1993, 138; T. DOBOSI 2001.
[76] T. DOBOSI 2005-2006.
[77] BANNER 1936.
[78] VÉRTES 1964/65.
[79] SIMÁN 1996, 45.
[80] T. DOBOSI 1999, 313.
[81] VÉRTES 1964/65.
[82] T. DOBOSI 2005, 64.
[83] T. DOBOSI 1986, 253, 254; VÉRTES 1964/65.
[84] T. DOBOSI 2010, 125.
[85] SVOBODA 1991, 44.
[86] SVOBODA 1991, 32–39.
[87] SVOBODA 1991, obr. 22: 16.

truncation and multiple ones. Only one end-scraper was found as a combined tool with burin. More numerous are fragments of retouched blades, one of them with ventral retouch on its terminal part, but no backed bladelets were found. The site, at which also mammoth and reindeer bones were found, is considered a short-term hunting or processing camp.[88]

The other site in Brno is situated at the Vídeňská (former Koněvova) ulica. The excavations in 1972 provided finds from two positions,[89] mostly made of erratic flint (85.71%). The cores were prismatic single-platform ones. One end-scraper and another one combined with burin were found. The burins were numerous, including dihedral, on truncation, multiple and flat ones. Microlithic tools are represented by a point with ventral retouch, two retouched bladelets and a fragment of backed bladelet. Retouched blades, notches and denticulated implements occur as well.

The finds were classified to the Gravettoid industries,[90] their dating set the age of 14 450±90 (GrN-9350)[91] and 14 820±120 (GrA-20002). At present, their reassessment to the Magdalenian is also possible.[92]

The sites at Pístovice II and Opava are considered more typical Epigravettian sites in Moravia[93]. The surface collected artefacts were mostly made of erratic flint (47%). Other raw materials used are quartzite, spongiolite, Moravian chert, quartz and 1% was radiolarite. Three wedge-shaped microblade cores are worth to mention. Among the formal tools burins are predominating over end-scrapers, among which short and unguiform pieces occurred as well. The burins were also small and short ones, some of them polyhedral. The assemblage includes also a laterally retouched blade and a part of backed blade.[94]

At Opava the Kylešovice Hill site the artefacts were found together with animal bones on the surface and also stratified in loess. The stone artefacts were made mostly of local erratic flint. The cores were prismatic or pyramidal pieces but a wedge-shaped microblade core was found as well. Typology of the artefacts includes end-scrapers and burins of almost identical numbers. The end-scrapers were short pieces and burins were mostly on broken blades, truncations and polyhedral. Partially retouched blades and microblades were discovered, too.[95]

Here we point out that J. Svoboda considered the presence of the wedge-shaped microblade cores in the finds from Stránská skála IV,[96] Pístovíce II[97] and Opava[98] the most significant element in technology of Epigravettian industries around 20 kyr BP. However, no such cores are known from Slovakia up to the present.

Lower Austria

The site at Grubgraben is the most significant Epigravettian assemblage from here. The excavations that have run since 1985 revealed five cultural layers excavated partly in direct superposition, with a series of hearths and dwellings. Occupation of the site is connected with a series of data to 20-16 kyr BP.[99]

Apart from coarser pieces made of local quartz, quartzite, granulite and rock crystal occasionally, the chipped stone artefacts were mostly made of erratic flint and radiolarite (more than 80%). According to A. Montet-White,[100] the presence of extralocal raw material types prove migration and contacts with the contemporary groups in northward direction, across Moravia to deposits of erratic flint in Silesia and eastwards to radiolarite deposits in Hungary or Slovakia.

Tools created 25%, flakes 55% and blades 20% of the assemblage. End-scrapers, with the exception of the youngest AL 1 layer, were predominating over burins. Their types varied: made on short blades, on flakes, sub-circular, unguiform, but carinated pieces were also found.[101] The burins were dihedral forms, made on snap or on truncation, but polyhedral as well.[102] Other types in the assemblage include blades, truncated blades, splintered pieces and scrapers. Some differences among the layers are in microlithic implements, e.g. flechettes, retouched microlithic blades, backed bladelets, truncated backed bladelets and several geometric shapes.[103] Concerning the common points with the Nitra III assemblage, the dominance of end-scrapers over burins, the presence of basic types of implements, e.g. short end-scrapers, burins, but mainly backed bladelets and geometric microliths should be stressed. We have to mention, however, that F. Brandtner (1996, 144) does not agree with the classification of the Grubgraben site and

[88] NERUDOVÁ 2010.
[89] VALOCH 1975.
[90] VALOCH 1975, 14.
[91] VALOCH 1996, 166.
[92] SVOBODA 2006, 27; VERPOORTE 2004, 262, Table 1.
[93] SVOBODA 2006, 467.
[94] SVOBODA 1994, 28, Fig. 7: 1–3.
[95] SVOBODA 1995, 653.
[96] SVOBODA 1991, obr. 23: 3.
[97] SVOBODA 1995, Fig. 2: 1, 3.
[98] SVOBODA 1995, Fig. 2: 4.
[99] HAESAERTS 1990, 3; HAESAERTS et al. 2004, 48; MONTET-WHITE 1991, 67.
[100] MONTET-WHITE 1991, 65.
[101] MONTET-WHITE 1990, 144, Fig. IX-9: A-Q.
[102] MONTET-WHITE 1990, 149, Fig. IX-12.
[103] MONTET-WHITE 1990, 149, Fig. IX-13: A-L; 1991, 66, Fig. 4: 1–5.

different opinions have arisen in connection with the bone industry too.[104]

Discussion

The period of 20-17 kyr BP, to which the Epigravettian sites are dated, is characterised by frequent alternation of short interstadial and colder stadial oscillations.[105] The climate changes were reflected in modification of settlement strategies of hunter groups (short-term camps), in the use of local raw material deposits and those of more distant places as well in adaptation of hunting techniques for hunting of reindeer and horse. In the artefact typology short end-scrapers and burins are predominating; backed bladelets and microlithic shapes are surviving in smaller amounts. The Epigravettian site at Nitra III meets these conditions by its location, the raw materials used and the artefacts typology as well. In Slovakia there is a lack of dated sites with well represented artefact assemblages. The upper Kašov layer is the only exception. Only a part of the finds has been analysed until now,[106] in spite of this the possibility of introducing the term "Kašovian" for sites after the LGM in eastern part of the Carpathian Basin is feasible.[107]

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[104] NEUGEBAUER-MARESCH et al. 2008, 116; SVOBODA–NOVÁK 2004, 463.
[105] HAESAERTS et al. 2004, 48.
[106] BÁNESZ et al. 1992.
[107] SVOBODA–NOVÁK 2004, 475.

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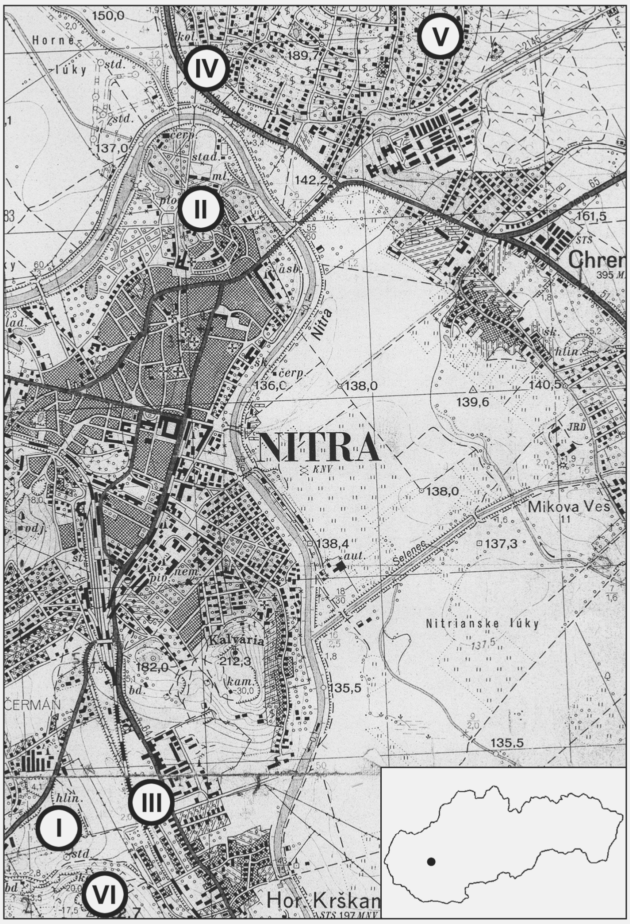

Fig. 1. *Nitra. Map of the town with Palaeolithic sites. I – Nitra I-Čermáň; II – Jaskyňa pod Nitrianskym hradom (Cave under the Nitra castle); III – Ballangova záhrada (Garden of Ballang); IV – Terasa rieky Nitry (Terrace of the Nitra river); V – Martinská dolina pod Zoborom (Martinská valley under the Zobor hill); VI – Tobola I-III/Horné Krškany I-III. According to J. Bárta 1993*

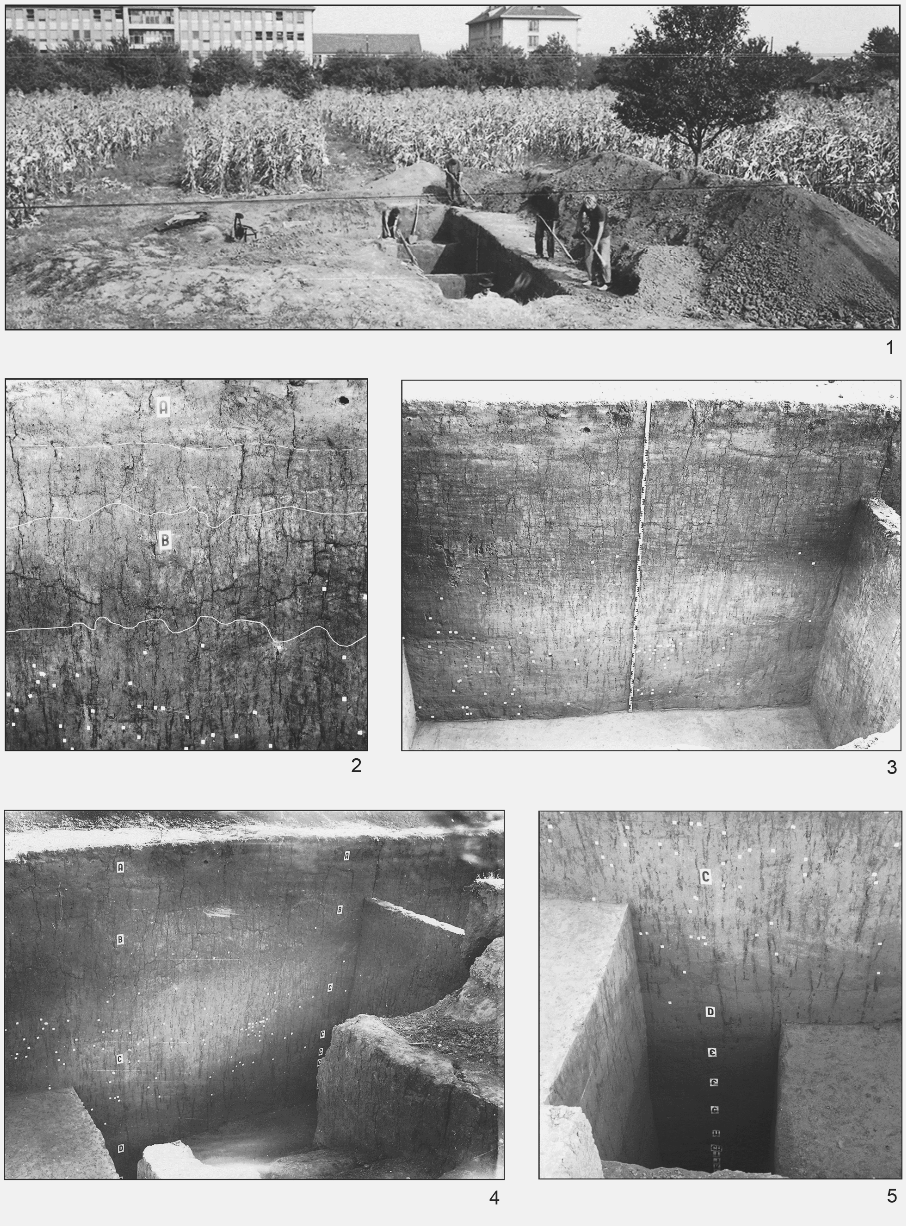

Fig. 2. *Nitra III. Excavation in 1964. 1 – view at excavated area from the west; 2 – succession of layers; 3 – spread of artefacts in the trench profile (white squares); 4, 5 – stratigraphic trench A/VII*

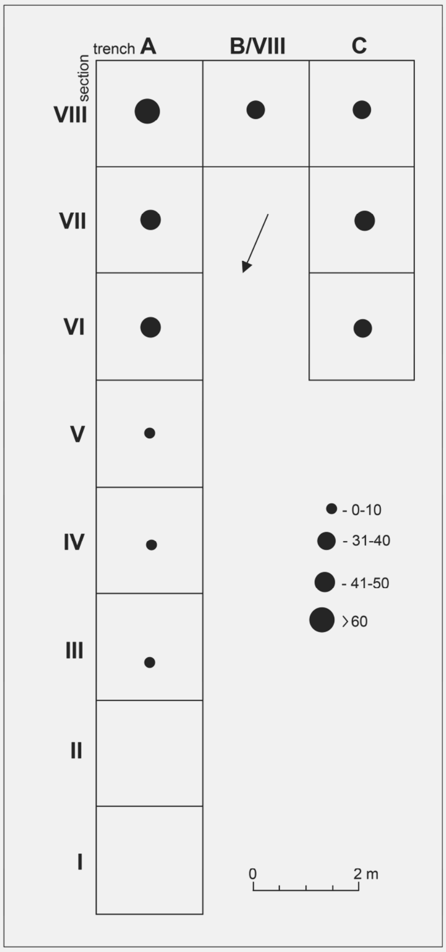

Fig. 3. *Nitra III. Frequency of stone artefacts*

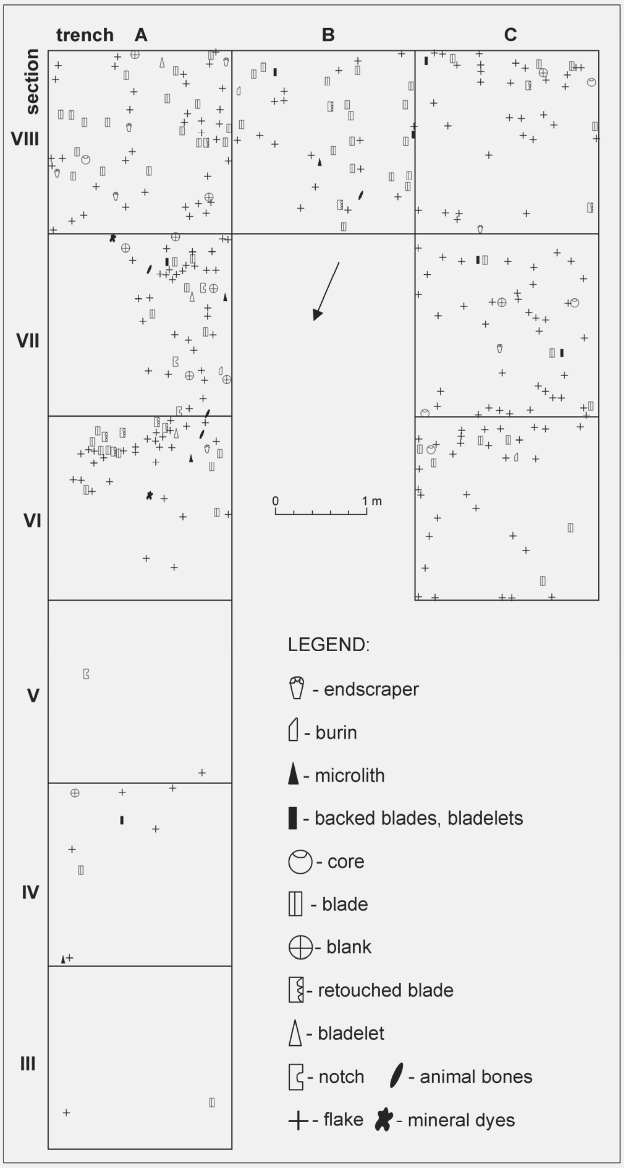

Fig. 4. *Nitra III. Distribution of artefacts in trenches and sections*

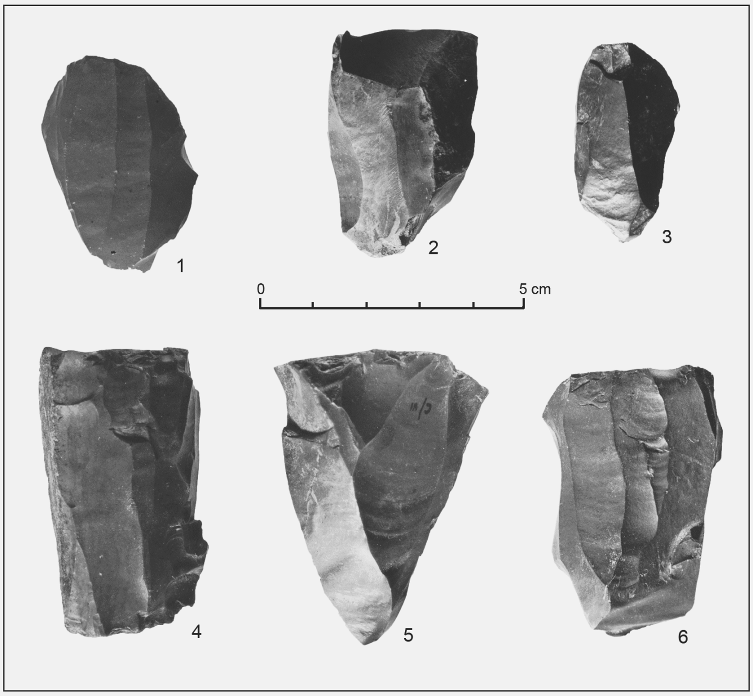

Fig. 5. *Nitra III. Cores*

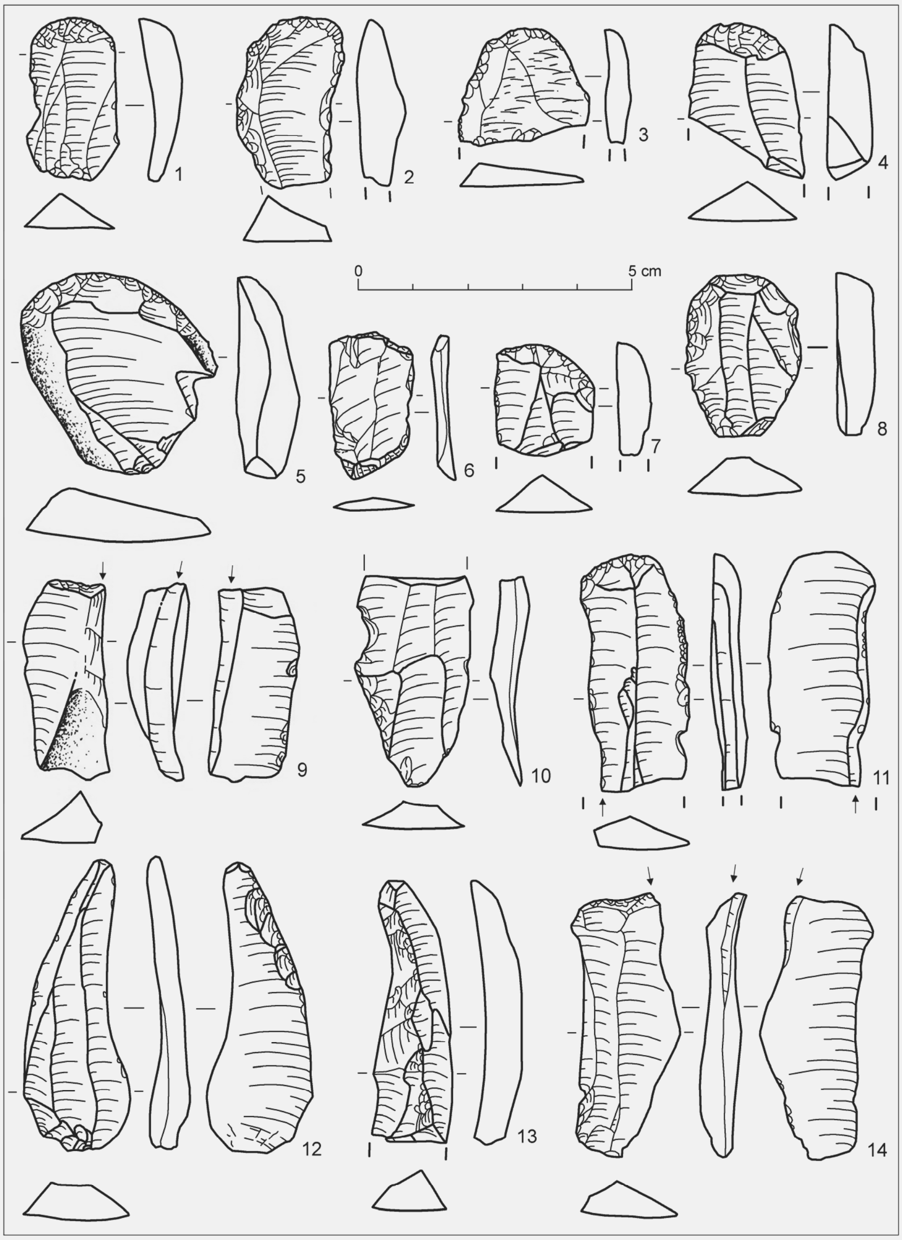

Fig. 6. *Nitra III. Stone industry: 1–5, 7, 8 – end-scrapers; 6 – end-scraper / trucation; 9, 14 – burins on concave truncation; 10 – notch; 11 – end-scraper / burin; 12 – retouched blade unilateral; 13 – crested blade. Raw material: 1 – limnosilicite; 2–7, 9–14 – radiolarite; 8 – patinated flint*

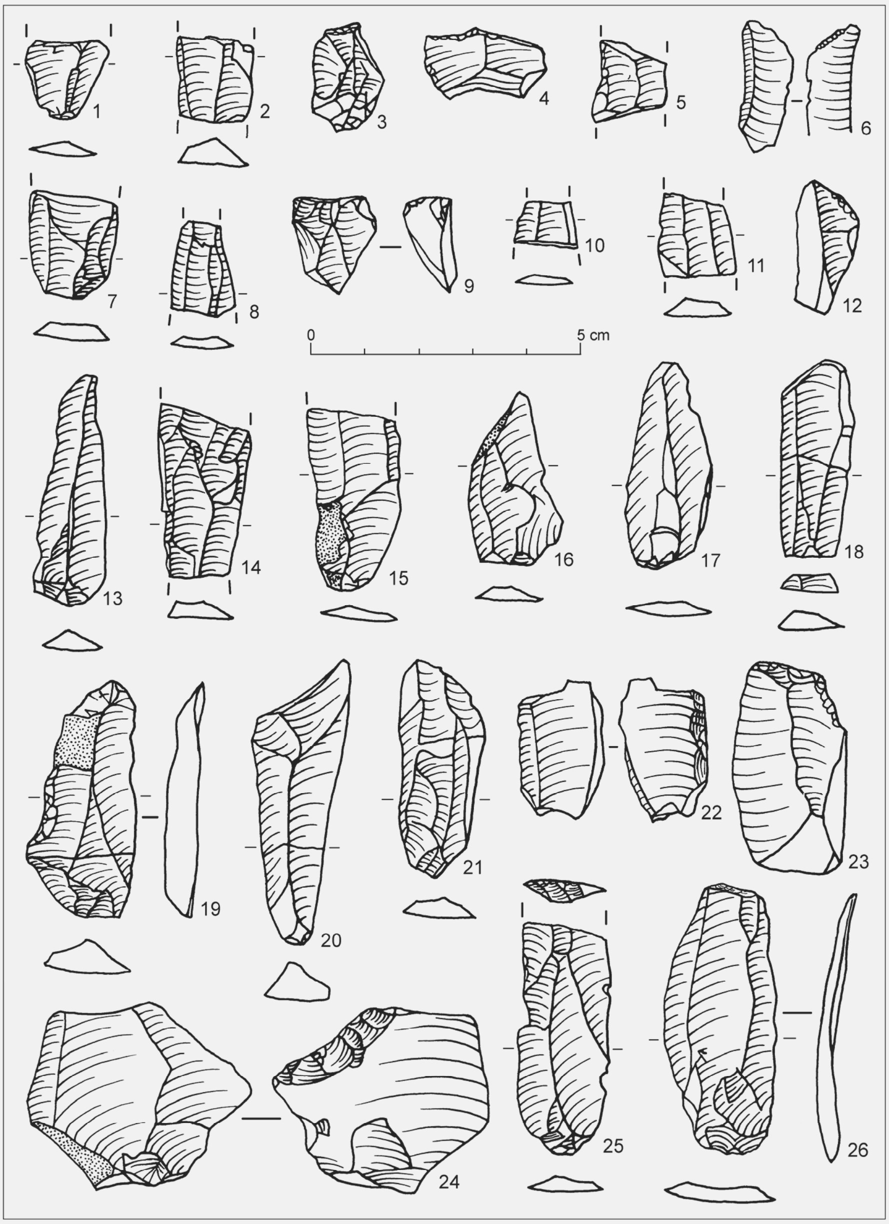

Fig. 7. *Nitra III. Stone industry: 1, 2, 7, 8, 10, 11, 14, 17, 20, 21 – blades; 3–6, 12, 22, 24 – retouched flakes; 9 – crested flake; 18, 25, 26 – blade with straight truncation, 19 – retouched blade; 23 – end-scraper. Raw material: 1, 3–7, 9–14, 16–26 – radiolarite; 2, 15 – limnosilicite; 8 – Volhynian flint*

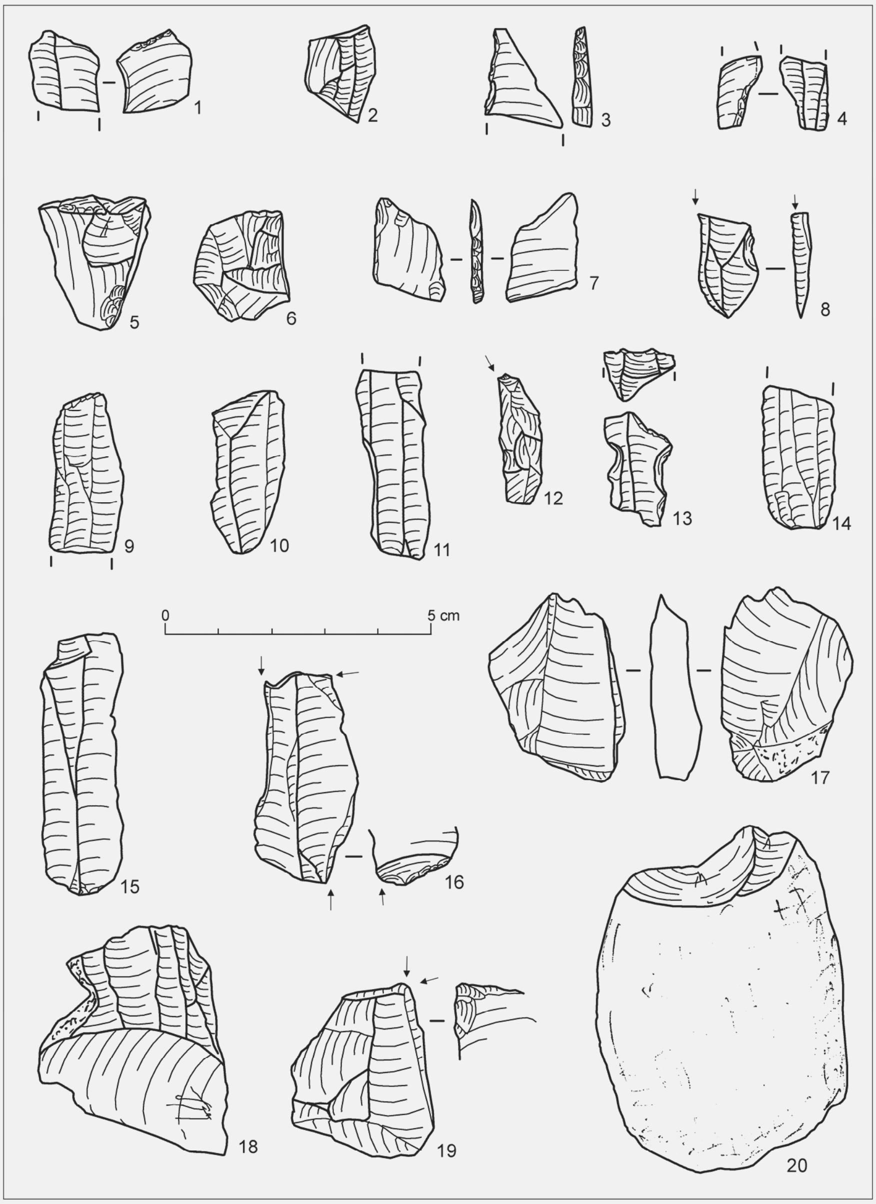

Fig. 8. *Nitra III. Stone industry: 1, 9 – retouched flakes; 2, 5, 6, 18 – flakes; 3, 7 – backed blades; 4, 13 – notches; 8 – burin on a snap; 10–12, 14, 15 – blades; 16 – multiple burin; 17, 20 – blanks; 19 – dihedral burin asymetrical. Raw material: 1, 9, 14, 15, 17 – limnosilicite; 2–7, 11–13, 16, 18–20 – radiolarite; 8 – obsidian; 10 – Volhynian flint*

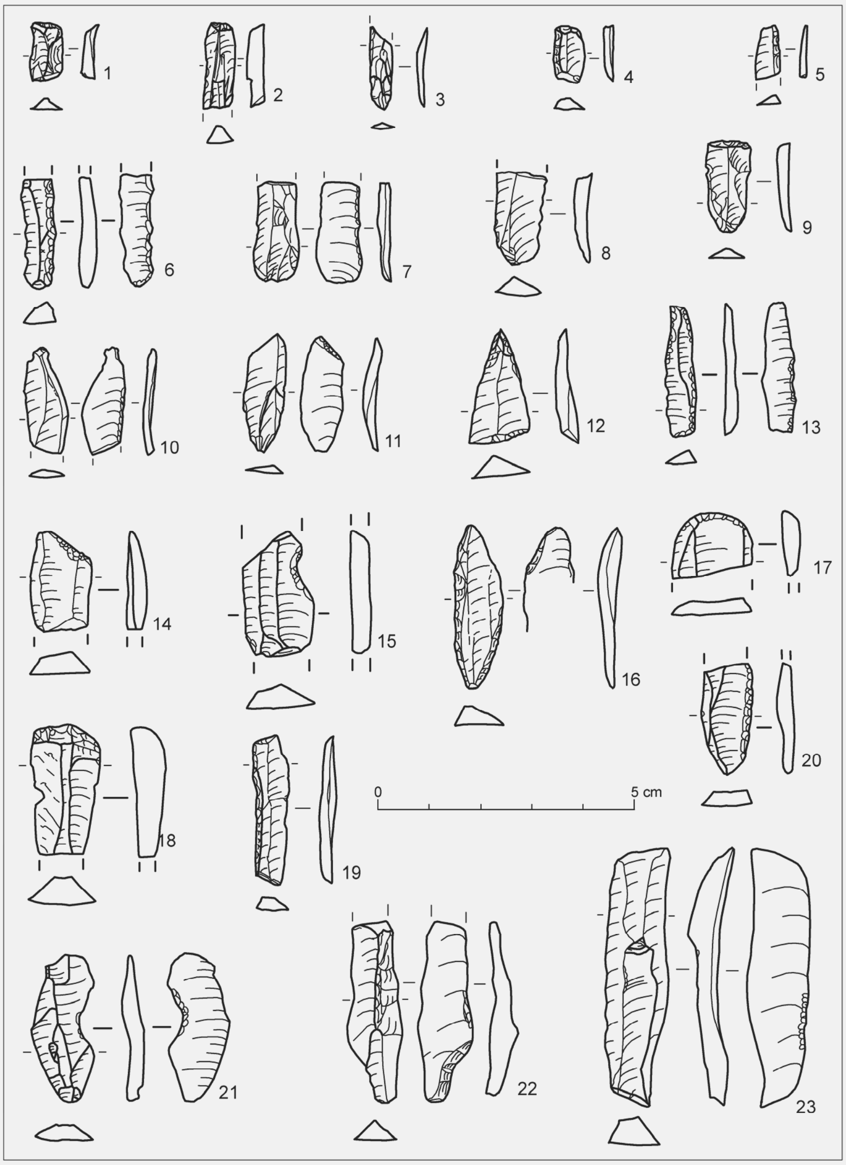

Fig. 9. *Nitra III. Stone industry: 1, 2, 9 – truncated bladelets; 3, 5 – retouched bladelets; 4 – backed bladelet truncated; 6, 16, 20 – backed bladelets; 7, 10, 11 – bladelets with inverse retouche; 8 – bladelet; 12 – triangel; 13, 19 – rectangles; 14 – blades with oblique truncation; 15, 21, 22 – notches; 17, 18 – blade end-scrapers; 23 – retouched blade. Raw material: 1, 4–18, 20–23 – radiolarite; 2, 3 – limnosilicite; 19 – patinated flint*

BACKED TOOL TECHNOLOGY AT ESZTERGOM–GYURGYALAG EPIGRAVETTIAN SITE IN HUNGARY

GYÖRGY LENGYEL

Keywords: *Epigravettian, lithic technology, backed tools*

Introduction

Esztergom–Gyurgyalag is located in North Hungary, the western edge of Visegrád Mountains, on the right bank of Danube.[1] An excavation in 1984 uncovered an area ~145 square meters, which yielded ~1200 archaeological finds. The find assemblage consisted of lithic artifacts, ochre lumps, shell ornaments, and animal bones. Hearths were also preserved. Charcoals from one of the hearths were dated to 16,160 ± 200 BP (Deb–1160).[2] All the archaeological features corresponded with the Epigravettian.[3]

A remarkable feature of the lithic assemblage of Gyurgyalag is the frequency of exotic raw material originating from the southwestern fringe of the Podolian upland in samples of Prut river valley flints.[4] It counts over a thousand pieces[5] which is 93.6% of the total lithic assemblage. The other remarkable feature is that the flint assemblage contains a high frequency of tools, especially backed artifacts. Compared with other Upper Palaeolithic sites in Hungary, this proportion of backed tools in the toolkit, ~ 60%, is unusual.[6] The only comparable site is Nadap with similar frequency of backed tools[7]. Due to the small number of technologically informative elements,[8] the backed flint tool production and the lithic technology of Gyurgyalag have never been uncovered. The aim of this paper is to discuss the relation between the lithic technology and the preponderance of backed tools of Gyurgyalag Epigravettian site.

Methods and material

The method applied in this study is the technological reading of the knapped stone artifacts.[9]

I have analyzed a total of 1006 “Prut flint” artifacts.[10] This number of artifacts slightly differs from that published earlier.[11] The technological analysis excluded quartzite fragments which could have been derived from crushing hammer stones.

Prut flint makes up the greatest proportion of the assemblage, by both count and weight (***Table 1.***). The few “local” raw materials, limnic quartzite and radiolarite, could have been procured from Garam valley and the Transdanubia. The single obsidian item is of Tokaj–Prešov Mountains origin of Carpathian 1 type.[12]

	Count	Percent by count	Gram	Percent by gram
Prut flint	1006	93,8	2344	90,6
Limnic quartzite	43	4,0	209	8,1
Obsidian	1	0,1	2	0,1
Radiolarite	22	2,1	1	1,2
Total	1072	100,0	586	100,0

Table 1. *Raw materials of knapped artifacts in Esztergom–Gyurgyalag assemblage*

[1] T. DOBOSI–KÖVECSES-VARGA 1991.
[2] T. DOBOSI–HERTELENDI 1993; HERTELENDI 1991.
[3] T. DOBOSI 2000.
[4] T. DOBOSI 2011; VARGA 1991.
[5] T. DOBOSI–KÖVECSES-VARGA 1991.
[6] T. DOBOSI–KÖVECSES-VARGA 1991.
[7] T. DOBOSI et al. 1988.
[8] T. DOBOSI 2011.
[9] INIZAN et al. 1999; PELEGRIN et al. 1988.
[10] T. BIRÓ–T. DOBOSI 1991; T. BIRÓ et al. 2000; VARGA 1991.
[11] T. DOBOSI–KÖVECSES-VARGA 1991.
[12] T. DOBOSI–KÖVECSES-VARGA 1991.

The flint assemblage was divided into several technological categories following Inizan et al (1999) (***Table 2.***). These categories represent operational phases of the flintknapping process. Blades and bladelets are not distinguished, they are studied together as blades. In the technological categories broken artifacts and retouched tools are included. Technological features recorded are the dorsal scar direction, platform type, treatment of overhang, presence of impact point, length, maximum width and thickness, and the formal tool types. Formal tool types are presented in broad categories (***Table 5.***). Subtypes remained undifferentiated. Within formal tools, type "retouched tool" compiles tools with retouched longitudinal edge. Denticulate and notched artifacts are included in this category. Tool types with blunt back, truncation, and pointed tips are also called armature based on their supposed function as inserts in composite hunting weaponry.[13] Another broad category mentioned in this paper is the "domestic tool" which include all other types supposedly used with non–hunting purpose (endscraper, burin, retouched tool, and borer). Comparing metric attributes of the artifacts t-test was used.[14]

Technological reading of the flint assemblage

Most abundant technological categories are related with blade production (***Table 2.***). No debitage of flake can be observed and all flakes are by–products of the blade debitage. By count, blades, neo-crest blades, and the sub-crest blade make up ~52% of the flint assemblage. By weight (gram), blade products are far the most abundant, making up 71.5% of the total weight of the flint assemblage.

	Frequency	Percent
Flake	189	18,8
Blade	515	51,2
Debris	212	21,1
Platform rejuvenating flake	9	0,9
Core tablet	1	0,1
Blade core	1	0,1
Burin spall	70	7,0
Neo–crest blade	8	0,8
Sub–crest blade	1	0,1
Total	1006	100,0

Table 2. *Technological categories of the flint assemblage (incomplete items are included)*

Because debris, including chips, and flakes are also numerous, the flint processing and tool retouching all were performed at the site. The few core trimming items infer to a full cycle of blade knapping activity.

		Cortical items	Total
Flake	#	57	189
	in flakes	30,2%	100,0%
	in total	33,7%	18,8%
Blade	#	92	515
	in blades	17,9%	100,0%
	in total	54,4%	51,2%
Debris	#	9	212
	in debris	4,2%	100,0%
	in total	5,3%	21,1%
Rejuvenating flake	#	2	9
	in rejuvenating flake	22,2%	100,0%
	in total	1,2%	0,9%
Core tablet	#	1	1
	in core tablet	100,0%	100,0%
	in total	0,6%	0,1%
Blade core	#	1	1
	in blade core	100,0%	100,0%
	in total	0,6%	0,1%
Burin spall	#	5	70
	in burin spall	7,1%	100,0%
	in total	3,0%	7,0%
Neo–crest blade	#	1	8
	in neo–crest blade	12,5%	100,0%
	in total	0,6%	0,8%
Sub–crest blade	#	1	1
	in sub–crest blade	100,0%	100,0%
	in total	0,6%	0,1%

Table 3. *Frequency of cortical artifacts (incomplete items are included)*

Cortex is present in each technological category (***Table 3.***). Thus flint nodules could have arrived at the site hardly pre-processed. Also, the high percent of cortex on blades shows no core decortication prior to the start of the blade debitage.

The core preparation did not apply cresting. Although the only sub–crest blade may refer to this core preparation modality, this particular item could have been also removed after neo–cresting.

[13] ELSTON–BRANTINGHAM 2002.
[14] MORGAN et al. 2012.

The single unipolar blade core and the preponderance of unidirectional dorsal scars on the blades (85.8%, N = 197) identify single striking platform core exploitation. Direct soft hammer percussion identification was based on the frequent overhang abrasion (82.9% N=35), the thin blade platforms (M = 2.1 mm, N = 35, SD = 1.87), and that only one blade has impact point on its platforms.

Flakes preserved more frequently impact points (29.3%, N = 41), unabraded overhang (41.5%, N=41), and thicker platforms (M = 3.6 mm, N = 42, SD = 2.95). The platform thicknesses are significantly different between blades and flakes, t(70.27) = 2.72, p = 0.008. This support that hard hammer percussion was also used to remove flakes besides soft hammer percussion.

Blades have rarely hinged distal termination (0.6%, N = 35) and no overpassed specimens were observed. Knapping accidents thus are apparently low. Abundance of incomplete blades (93.2%, N = 515), however can be the result of both intentional and knapping accidental breakage. Rejuvenation of core striking platform and the debitage surface was applied. The striking platform was primarily prepared plain according to the plain blade platform frequency (77.1 %, N = 35).

Blades were produced between 100 and 20 mm in length based on complete items (see ***Table 7.*** for statistics). Within this the interquartile range is between 60 and 30 mm. Blades thicknesses are under 10 mm and breadth is narrower than 35 mm. Most blades have rectilinear profile (81.5%, N=324) and parallel edges (49.4%, N=324).

The formal tool kit is composed of mainly blades (***Table 4.***). None of the debris, rejuvenating flakes, core tablets, burin spalls, and sub–crested blade was selected for tool production.

Blades are prime blanks of backed artifacts (***Table 5.***). Flakes are most often edge retouched tools, some of them are also backed, and some are burin. Among the backed artifacts the simple backed bladelet is the most abundant. Backed–truncated specimens are the next, and different pointed backed artifacts are also numerous. Altogether, armature dominates the tool kit, while domestic tool types are fewer.

		Blank	Tool	Total
Flake	**#**	163	26	189
	in flake	86,2%	13,8%	100,0%
	in tool kit	24,3%	7,8%	18,8%
Blade	**#**	207	308	515
	in blade	40,2%	59,8%	100,0%
	in tool kit	30,8%	91,9%	51,2%
Neo crest blade	**#**	7	1	8
	in neo–crest blade	87,5%	12,5%	100,0%
	in tool kit	1,0%	0,3%	0,8%

Table 4. *Distribution of blank types in the tool kit (incomplete items are included)*

Tool type		Blank type			Total
		Flake	**Blade**	**Neo–crest blade**	
Endscraper	**#**	0	4	0	4
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	1,3%	0,0%	1,2%
Burin	**#**	5	24	1	30
	in tool type	16,7%	80,0%	3,3%	100,0%
	in blank type	19,2%	7,8%	100,0%	9,0%
Retouched	**#**	12	49	0	61
	in tool type	19,7%	80,3%	0,0%	100,0%
	in blank type	46,2%	15,9%	0,0%	18,2%
Backed	**#**	7	130	0	137
	in tool type	5,1%	94,9%	0,0%	100,0%
	in blank type	26,9%	42,2%	0,0%	40,9%
Backed–truncated	**#**	0	50	0	50
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	16,2%	0,0%	14,9%

Tool type		Blank type			Total
		Flake	Blade	Neo–crest blade	
Trapeze	**#**	0	3	0	3
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	1,0%	0,0%	0,9%
Rectangle	**#**	1	0	0	1
	in tool type	100,0%	0,0%	0,0%	100,0%
	in blank type	3,8%	0,0%	0,0%	0,3%
Trapeze–rectangle	**#**	0	5	0	5
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	1,6%	0,0%	1,5%
Truncated	**#**	0	9	0	9
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	2,9%	0,0%	2,7%
Pointed backed	**#**	0	8	0	8
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	2,6%	0,0%	2,4%
Arched backed point	**#**	0	15	0	15
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	4,9%	0,0%	4,5%
Gravette point	**#**	0	2	0	2
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	0,6%	0,0%	0,6%
Retouched point	**#**	0	6	0	6
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	1,9%	0,0%	1,8%
Borer	**#**	1	2	0	3
	in tool type	33,3%	66,7%	0,0%	100,0%
	in blank type	3,8%	0,6%	0,0%	0,9%
Endscraper–burin	**#**	0	1	0	1
	in tool type	0,0%	100,0%	0,0%	100,0%
	in blank type	0,0%	0,3%	0,0%	0,3%
Total	**Count**	26	308	1	335
	% within tools	7,8%	91,9%	0,3%	100,0%
	% within type	100,0%	100,0%	100,0%	100,0%

Table 5. *Tool types by blanks*

		Group statistics			T-test		
		N	Mean	Standard deviation	t	df	p
Length	blank	37	30.19	13.80			
	tool	26	34.67	14.91			
	t-test				–1.228	61	0.224
Thickness	blank	37	5.72	2.84			
	tool	26	6.23	3.55			
	t-test				–0.623	61	0.535
Width	blank	37	22.90	9.00			
	tool	26	25.48	12.07			
	t-test				–0.924*	43.735*	0.361*
*Equal variances not assumed by Levene's Test for Equality of Variances							

Table 6. *T–tests of metric attributes of flake blanks (complete items) and flake tools (fragments included)*

		Group statistics			T-test		
		N	Mean	Standard deviation	t	df	p
length	blank	20	46.29	21.57			
	tool	308	34.15	15.05			
	t-test				2.478*	20.219*	0.022*
thickness	blank	20	5.33	2.52			
	tool	308	4.94	1.96			
	t-test				0.826	326	0.409
width	blank	20	16.24	7.23			
	tool	308	15.01	4.26			
	t-test				0.751*	19.864*	0.461*
*Equal variances not assumed by Levene's Test for Equality of Variances							

Table 7. *T–tests of metric attributes of blade blanks (complete items) and blade tools (fragments included)*

Comparing the mean values of metric attributes of blanks and tools by the two main blank types, flakes and blades, there is no difference within flakes as all p values are greater than the 5 % significance level (***Table 6.***). Within blades however there is a significant difference in the length ($p<0.05$) (***Table 7.***).

Discussion and conclusion

The lithic features of Esztergom–Gyurgyalag show an efficient use of raw material that hardly produced byproducts at the site and the proportion of formal tools is high. The main product of the technology, the blades, weighs the majority of the assemblage. The comparison of metric attributes between complete blade blanks and blade tools shows that during retouching the length of the blades were frequently reduced but regarding the width and especially the thickness shows that any of the flint blade blanks had the potential to fit the metric requirements of the formal tools. This blade production represents a standardized technology. Using numerous blades to obtain backed artifacts shows the technology was devoted to hunting weaponry, production, and reparation of armatures for composite hunting tools.[15] Concerning the flakes, there is no difference between blanks and tools, which represents an unbiased selection among the flakes available in the by–product assemblage of the blade production. Also, the flakes were not deliberately reduced in length in the retouching process alike the blades.

[15] ELLIS 1997; ELSTON–BRANTIGHAM 2002; YAROSHEVICH et al. 2010.

Armature types shaped with backing and abrupt truncations are not hand hold tools. They are inserted into shafts made of wood, bone, ivory, or antler. They function is to provide sharp edges for composite hunting weapons.[16] Stone inserts are fragile and generally brake or become easily damaged in action. Because of this reason the inserts are designed for a single use and therefore those are often numerous in the lithic tool kit.[17] If any of the inserted tool brakes or its edge becomes dulled, it must be replaced to keep the efficiency of the hunting weapon.[18] Because making the shafts takes an effort greater than making flint tools,[19] the inserts must be standardized, primarily in thickness. Length and width are easily adjustable by snapping the distal or proximal end and blunting the edge.[20] Backed artifact size must fit their slots that have constant depth and width.[21] Therefore, composite hunting tool production involving stone inserts requires a standardized blade technology that is capable to keep metric attributes of blades constant. Standardization of lithic tool production increases maintainability and reliability of tools, and improves efficiency and ease of hafting.[22] These features explain the technological standardization of the Gyurgyalag assemblage.

Standardization, as integral part of an "abundance strategy" characterized by high productivity and ease in replacement of inset tools, has been understood as a response to increased foraging risks, increased group mobility, and environmental change.[23] Besides Gyurgyalag, other Epigravettian assemblages in Hungary can fit the policy of abundance strategy, likewise Nadap in the centre of the Carpathian Basin in Hungary, dated to ~13 ka BP,[24] and characterized by backed artifact abundance and exotic flint preference.[25] Epigravettian raw material economy thus may refer to frequent movements across the Carpathians,[26] which could have generated a major risk in foraging.[27] The age of Esztergom–Gyurgyalag and Nadap sites, ~16–13 ka BP, corresponds with climatic and vegetation fluctuations after the Last Glacial Maximum in the Carpathian Basin.[28] This period east to the Carpathians, where lithic raw materials of Esztergom–Gyurgyalag were collected, also was related with instable climatic conditions due to frequent occurrence of interstadial events.[29] In this climatic condition, Epigravettian sites in Eastern Europe, especially those dated after the Last Glacial Maximum, also tend to contain more backed artifacts and geometric microliths.[30] Therefore, the general correlations between backed tool technology, standardization, foraging risk, and dynamic climatic conditions can be applied to explain the proliferation of microlithic armature types in the archaeological record of the Epigravettian industries after the Last Glacial Maximum in the Carpathian Basin and beyond eastwards.

According to the number of artifacts, the flint assemblage is far unique in the Hungarian Upper Palaeolithic. But, taking into account the weight of the flint artifacts, the total of 2344 g, the assemblage does not differ much from for instance Bodrogkeresztúr–Henye Gravettian assemblage,[31] where flints of Prut and Southern Poland weigh 1669 g.[32] The difference, 675 g, is not considerable and the proportion of flints at Bodrogkeresztúr is distorted by the frequency of other, mostly local raw material types. From the point of view of exotic raw material mass, Gyurgyalag site is not very unique. But it is regarding why the local raw materials were almost completely omitted by the technology, and how this archaeological record was formed by hunter-gatherers.

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[21] YAROSHEVICH 2006.
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[24] VERPOORTE 2004.
[25] T. DOBOSI et al. 1988; LENGYEL 2014.
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RECENT STUDIES ON THE UPPER PALAEOLITHIC ASSEMBLAGE OF TARCAL (TOKAJ HILL, NORTH-EASTERN HUNGARY)

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Keywords: *refitting, raw material, core, Epigravettian*

Introduction

After the end of the 1960s, the death of L. Vértes and before the rescue excavations in the Danube bend very few excavations were carried out on Palaeolithic open-air sites in Hungary. One of the exceptions was the Citrom quarry in Tarcal, lying on the western flanks of the Tokaj (Kopasz) hill. Here, E. Krolopp malacologist observed pieces of charcoal pieces and fossil bones and collected lithic tools from the last loess layer. After the publication of the results of the verifying excavations by V. Dobosi in 1970, extending to a little surface because of the quarrying activities and the viticulture the site was mentioned only sporadically and in studies of special interests.[1] Since the publication of the short monographic evaluation of the site,[2] written by the excavator V. Dobosi, the finder E. Krolopp, furthermore D. Jánossy palaeontologist and J. Stieber anthracotomist, both the methods used in the Palaeolithic research and the questions raised changed in a considerable way.

In the last years new excavations were carried out and new analysis were performed on the Pavlovian (Gravettian) and Epigravettian sites and assemblages of the southern (Bodrogkeresztúr, Megyaszó)[3] and northern (Hidasnémeti, Kašov, Cejkov and Hrčel)[4] part of the Hernád/Hornád and Bodrog valleys, which may shed new light to the find material known from Tarcal too. Finally there is a special reason of the re-evaluation of this assemblage: the reconstruction of the shaping of the 'gigantolith' excavated in the find concentration III was the first example for the systematic refitting studies in Hungary and the Carpathian basin.

Site description and chronology

The site is lying at the border of the 'obsidian region', on the slopes of the Fekete ('Black') hill. The chronology of the culture bearing layer is quite poorly known after the present day standards. The poorly preserved bones from the excavations were identified as reindeer and horse, however, before the excavation from the loess profile and from the refuse material of the stone quarry mammoth remains were also collected. The analysis of the charcoal samples did not give surprises: beside the spruce or larch remains, not identifiable on anthracological base (*Larix-Picea* group) the dominating *Pinus cembra* suggest for a common cold, glacial climate. Finally the analysis of the malacological material showed for a slightly milder climate in the level of the culture bearing layer (slightly humic loess) – at least compared to the over- and underlying layers.[5] This way, even if the study was carried out by the old methods without the statistical evaluations, the fine stratigraphy and electron microscopic investigations, the rather rough data shows that the culture bearing layer was formed during a relatively mild period of the last Würmian glaciation, most probably in the Ságvár-Lascaux mini interstade.[6] This way the site of Tarcal can be compared in chronological point of view to the Epigravettian localities of the Jászság region and the

[1] T. DOBOSI 1985, 27, 32; BIRÓ 1984, Table 2; SIMÁN 1996, 44; VÖRÖS 2000, 197; T. DOBOSI 2001, 108–109.

[2] T. DOBOSI 1974.

[3] T. DOBOSI (ed.) 2000; T. DOBOSI–SIMÁN 1996.

[4] SIMÁN 1989; BÁNESZ et al. 1992; KAMINSKÁ 1995; NOVÁK 2002; KAMINSKÁ-TOMÁŠKOVÁ 2004.

[5] For the details see: T. DOBOSI 1974, Appendices I-III.

[6] GÁBORI-CSÁNK 1978. The faunal remains of the artefact-bearing level were listed among the sites of the Pilisszántó-Bajót phase, which refers to the same period: VÖRÖS 2000, 197.

Danube bend and to the contemporaneous lower culture layer from Arka or the upper one of Kašov I.

According to the observations before the excavations two slightly sloping charcoal rich layers were found in the loess packet, however, lithic artefacts were collected only in the upper one.[7] During the authenticating excavations carried out a month later two little trenches, lying at a distance of 13 m from each others were investigated, as a total of 22 square meters. The larger trench 'A' two larger and two smaller, more-or-less intensively burnt spots (hearths) were discovered. In the area of the eastern large fireplace several intensively burnt places and a flake-scatter was documented (concentration I). The concentration III was found at the border of the western large hearth, while scatters II and IV were not connected to the features.

Archaeological artefacts

As a total number of 410 tools, blades, flakes, cores and raw material blocks are found in the Palaeolithic Collection of the Hungarian National Museum (***Table 1.***). The raw materials belong mainly to the local rocks, like the volcanic rocks with different degree of silicifications, colourful hydro- and limnic quartzite variants and jasper. As the lithics of this site are not or only slightly patinated, it was possible to distinguish 18 variants by a naked eye. However, many of them, like the 'stone marrow', the characteristic raw material of the Gravettian assemblage of Bodrogkeresztúr – Henye[8] was represented by single pieces. Similarly, a banded brown coloured hydroquartzite variant is present only in the case of an exhausted bipolar core and only the single blunted blade was made a yellowish rock of also banded structure. Finally a characteristic opalic rhyolite tuff variant is known as two fragments.

Among the 'hydro- and limnic quartzite variants' basically two groups could have been distinguished. One of them is known in the form of layers of some cm in thickness with cleavage planes of yellowish or rarely reddish in colour, while the 'fresh' surfaces like the flake or blade scars are of yellowish white or white coloured and more-or-less homogenous structure. On the other hand the poor quality raw material of reddish-brown colour and grainy structure, often filled with inclusions, was found as oval shaped or angular blocks. This grainy variant is less suitable for making chipped stone tools because of the inhomogeneity.

Two groups of raw materials should be cared separately. The exceptionally high quality, homogenous rock raw material of two flakes were originally identified as flint, however, there are serious problems at the separation of the *sensu stricto* 'flint' (shallow marine sedimentary rock with sponge spicules, mainly from the Cretaceous period) and the excellent quality hydroquartzite variants by macroscopic methods, we tend to sort these pieces into the large group of the later rocks. Similarly, it is questionable the identification of the yellowish, dull raw material (4% of the total inventory), which was originally identified as 'porcelanite' during the analysis of the Upper Palaeolithic assemblage of Szob.[9] The occurrence of this rock at Tarcal at least questions the connections with the Mesozoic formations of the Transdanubia and rather the hydrothermal origin seems to be possible.[10]

The different pebble types, most probably collected from Pleistocene river beds belong to the 'sensu lato' local raw materials too. In the assemblage the quartzite and the characteristic 'Carpathian quartzite' with grainy structure were sorted into this group. This later rock, identified for the first sight as silicified sandstone is quite similar to the variant, known from the vicinity of Egerbakta (eastern part of the Mátra mountains).[11] In fact, however, a macroscopically similar variant of the (menilithic) cherts, described from the alluvial deposits of the river valleys in eastern Slovakia[12] could have been also used on the site.

About one fifth of the total assemblage was made of the characteristic volcanic glass of the Hegyalja region, the obsidian and a light grey coloured shiny rock with black inclusions, identified as perlite (89 pieces i.e. 21.65%). The outcrop of this later variant is known from 2-3 km in distance, on the northern slope of the Kopasz-hill, at the Lebuj-bend of the Bodrog river. The best known source of the grey obsidian is lying at a distance of 6-7 km on the Kakas or Nyerges hill south of Mád. However, in the technical literature similar rock was mentioned from several points on the right bank of the Bodrog (Poklos, Meszes-dűlő and Sötétes-hill). The black coloured variant was transported from 16-18 km, from the southern slopes of the Szokolya-hill (west of Tolcsva), the transparent obsidian from the region of Streda nad Bodrogom,

[7] For the traces of the fossil forest-fires in the region see: RUDNER–SÜMEGI 2001; SÜMEGI–RUDNER 2001.

[8] T. DOBOSI 1974, 18.

[9] MARKÓ 2007, 15.

[10] In fact, it can not be determined by macroscopic methods that the pieces found on these sites lying more than 100 km from each other, are identical in petrographic point of view, or, that their source(s) can be linked to which geological formation.

[11] Under the inventory number of L86/24 in the comparative raw material collection of the Hungarian National Museum (Lithotheca), identified as Mátraháza-Felnémet type opal.

[12] KAMINSKÁ 1991, 20–21.

Viničky, Vel'ká and Malá Bara, at a minima from 40 km of distance.

Finally the raw material of two blade fragments is radiolarite of unknown origin, however, certainly collected from non-local sources.

Concerning the typological composition of the assemblage, among the few retouched tool there are an end-scraper on hydroquartzite flake and two pieces made on blades of obsidian. Besides, only two blade like flakes with inverse retouching, one unilaterally and one bilaterally retouched blades and two burins (one of them is atypical and fragmentary one) are present in the assemblage. Finally the affiliation with the Gravettian industries are marked by an abruptly retouched tool (Gravette-point), mentioned earlier because of the raw materials. Moreover, that on one of the intact edges of a burned fragment from refit group 5 traces of regular retouching can be observed, so possibly the number of the former tools could have been higher. Interestingly in trench B several burin-spalls of perlite were found, which could not be refitted to the scars seen on the available tools. According to our opinion the core burins, published earlier from the site, are technical flakes detached before the blank production and similarly, the 'rabots' belong rather to the cores.

Recent studies

As it is obvious the very few formal tools hindered the traditional typological interpretation of the assemblage. In the following we try study the material from two view-points: from the sides of the cores and the refits.

Refit studies

The study of the intentionally produced or naturally fragmented artefacts belongs today to the generally accepted methods of the analysis of Palaeolithic artefact-bearing levels[13]. In the technical literature in Hungary, however, after the publication of the Tarcal assemblage with conjoined artefacts of quartzite, the conjoined pieces were mentioned only as curiosities and as general without discussing the details[14], and only recently, during the analysis of the Ságvárian industry of Szob[15] tried to gain more information by the use of this method. The results of this work raised our attention to the roughly contemporaneous assemblages, which were based on the use of raw material blocks and not pebbles. The actually interesting question is if there are any common points, typical for the Epigravettian period of the either culturally differentiated industries or the use of raw materials. On the other hand, if can be observed any differences in the use of lithic raw materials in the assemblages of different cultures and industries on the technological investigations.

As a result of the studies on the Tarcal material 18 refit groups could have been identified, with 48 artefacts (i.e. 11.7% of the whole inventory: ***Table 2.***).[16] Three of the groups (nr. 1, 6 and 16) are the reconstruction of natural fragmentation. The formation of angular or potlid fractures without bulb of percussion are generally interpreted as consequences of thermic causes, i.e. heat or frost.[17] In three cases (group nr 3, 4 and 5) the small, crater-like depressions on the surface of the artefacts indicate the traces of heat.

Among the fractures, caused by humans during the manufacturing in two cases (refit groups 7. and 12) the vibration inhomogeneity hidden in the raw material led to the transversal fragmentation of the blades.

In the cases of nine refit groups could have been reconstructed parts of the intentional manufacturing of blanks and tools. The most important and most informative of them is the group nr 12 which is linked to the formation of a pre-core and which elements

[13] e.g.: CZIESLA et al. (eds.) 1990; SCHURMANS–DE BIE (ed.) 2007; PIGEOT (ed.) 2004.

[14] e.g. ADAMS 2000, 174; RINGER–MESTER 2001, 13; LENGYEL–SZOLYÁK 2007.

[15] MARKÓ 2011; see also: MARKÓ 2011a – After the publication of the original version of this article, the results of the refitting were published from the site of Ságvár (LENGYEL 2011). However, the main conclusion of these works, i.e. that the assemblages of the two artefact-bearing layers can be linked to a single occupation event is highly problematic, as it is in conflict both with the published and unpublished documentations and with the observations can be made even today on the site. According to our opinion in this case the 'post-excavational' disturbances of the not-inventorised assemblages between 1959 and 1973 is the most parsimonious explanation for the mixing of artefacts.

[16] These numbers figure only the refit groups identified by us, as not results of recent damages. Partly because of the characteristic of the raw material types several flakes and cores were fragmented according to the angular pattern, most probably before the excavations and which were glued in the seventies.
On the other hand, during the review of the assemblage, we counted more pieces than it was mentioned in the report (T. DOBOSI 1974, 11.). We interpret the differences as the result of the natural fragmentation of the raw material, caused by the desiccation.

[17] STAPERT 1976, 20; LUEDTKE 1992, 97, 100.

were excavated in Concentration III as closed assemblage. Because of the grainy raw material with often large crystals, cleavage surfaces and quartz veins it is very problematic and sometimes it is impossible to identify the base or the direction of the flaking on the blanks, so our observations in some cases differ from the reconstruction published by Viola Dobosi.

The original piece was a bread-shaped quartzite cobble oval contours. The macroscopic characters of the rock led us to declare that this raw material was present only in the territory of the Concentration III and it is not known from the other part of the excavations. The available artefacts suggest that from the right side of the proximal part were prepared by at least two flakes when the pieces were introduced to the excavated part of the site. Most probably the flat ('ventral') side of the proximal was thinned also outside the excavated area, as the cortical waste material is absent from the inventory (***Fig. 1.***).

The first cortical flake, reconstructed from seven angular fragments was removed from the edge of the pebble and from the right side (and it is by flake 'b' by V. Dobosi V.[18]: ***Fig. 2.***). Several pieces, flaked also from the edge of the pebble are absent from the excavated material. The next refitted flakes are entirely cortical pieces, preserved as fragments too (flakes 'a' and 'c' on ***Fig. 3.***) from the distal part and from the middle section of the left side, immediately from the edge of the pebble. The most likely goal of the forming was the removal of the convex cortical part of the pebble and the shaping of the edge of the future core. As the next step from the distal part of the left side the flake 'b' were removed with a similar piece with cortical talon but on the dorsal part there are several scars visible (***Fig. 4.***). The forming of the core ended by the removal of two flakes from the distal part of the right side and the proximal third of the left one. Generally the dorsal part of these pieces is covered by scars, even if the base of one of them is cortical. It is worth to note that one of the flake was transversally broken as a consequence of the quartz vein of the raw material (flakes 'd' and 'e': ***Fig. 5.***). Most probably the long flaw seen on the flat cortical side of the piece which hindered the shaping of the striking platform of the core on the distal part was formed during the removing of this last flake.

The other refit groups of blank production are linked to the forming and reshaping of cores of laminar limnic quartzite (refit groups 9-11). Two of them contain pieces with at least weathered dorsal side suggesting for the first steps of the core preparation. Importantly, the elements of all the groups were excavated in Concentration I, which can be identified as partly the place of core shaping.

From the artefacts of the same concentration however, it was possible to conjoin a weathered flake to the fragment of a blade (group 7), showing for the decortication and blade production was also performed in the same place. The pieces in this case were made of blocks of hydroquartzite containing numerous fossils and cleavage planes; that is why the pieces were broken transversally.

During the culture bearing level of trench 'A' two conjoined flakes of andesite and hydroquartzite were found (refit groups 2 and 8), without clear connections to the find clusters. This is rather unusual in the former case, however, at least the implications can be drawn that the (probably initial, after the weathered surface of one of the andesite flake) steps of the raw material manufacturing were carried out on the site. Similarly, the partially cortical flakes of group 15 were removed from an angular block on the site, but the further blank production was hindered by the poor quality of the raw material. Finally, two conjoined distal blade fragments of obsidian, found in trench 'B' (group 14: ***Fig. 6: 2.***) can be interpreted as the only clear evidence of the local blade production on the site, beside the mentioned group 7.

Classification of the cores

The cores from the excavations of Tarcal can be sorted into two morphological categories. Two pieces were formed on large flakes (***Fig. 7.***), where the thick base of the original flake or the distal part, modified by transversal burin spalls was used as a striking platform. The initial core, reconstructed above may have planned a similar form: the refitted flakes controlled the lateral convexity of the core, while the removals on the distal part of the flat ('ventral') surface the longitudinal convexity.

The other basic type of core was used primary for hydrothermal rocks with laminar structure, where both the flaking and striking platform, meet in an acute angle were formed on the narrowest side of the 'edge' of the slab. As the blank production went on, the flaking surface extended to the longer side of the raw material (on a piece of hydroquartzite and another one of obsidian) or it was continued on the narrow part (a piece of 'Carpathian quartzite': ***Fig. 6: 3.***).

Concerning the different stages of core reduction, among the not modified/shaped raw material pieces, present in the assemblage a red coloured nodule of hydroquartzie has to be mentioned, which was not worked because of the angular fragmentation. Another interesting piece is a yellowish coloured, slab (refit group 18), the fragment of which were collected as scattered pieces during the cleaning the surface, however, most probably the not directly refitted pieces

[18] In the following we refer to the designations of the original publication: T. DOBOSI 1974, 19–21, 8–12. ábra.

of the same rock were found in Concentration II and III. Finally, a piece mentioned among the refittings (group 15) may belong to the same category, as the only one flake show for the local testing and abandoning of the poor quality block of grainy structure and with many inclusions.

Because of the flake scars forming the flaking and striking surfaces a piece of red hydroquartzite, collected during the field prospections of September 1970 is identified as a pre-core. In this case the further flaking was impossible because of the fragmentary rock. Taking into consideration the angular fragments of Tolcsva-type obsidian and burned andesite (groups 3 and 16 - this later one collected in trench 'B') we can suggest that during the working of the individual raw material types a large number of waste material was came off on the site.

The start of the sensu stricto blank production is represented by four unipolar cores, two of them formed on raw material piece of laminar structure, one on a pebble of 'Carpathian quartzite' and the last piece on a thick flake. According to the field observations one of the laminar pieces was excavated in concentration IV, the other ones during the cleaning of the culture bearing level.

Five cores from the assemblage were abandoned in the advanced stage of reduction. A piece made on flake, another one of laminar rock and piece of banded hydroquartzite mentioned among the raw materials were organised according to the bipolar technology, while the remainder pieces of obsidian and perlite were flaked according to the unipolar conception.

Finally the last phase of the core reduction is represented by a piece of Mád-type obsidian and a small core of 'Carpathian quartzite'. On this later piece after abandoning the narrower 'edge' of the piece a new flaking surface was initiated on the opposite part of the core, from where, however, only some unsuccessful removals were started.

Finally a conical blade core of obsidian is missing from the collection. Beside the refitted blade fragments a core tablet (***Fig. 6: 1.***) clearly show the presence of this form on the site, from where it was probably exported.

Conclusions

The recent investigations on the Upper Palaeolithic assemblage from Tarcal imply the followings:

On the site the originally nodular block raw material was worked basically as cores on large flakes and blades, removed from them. The working of the hydrothermal rocks of laminar structure on the other hand started immediately by the forming of the striking platform, and by the removing of the original ridges of the block. According to our observations both type of raw materials were first used as a unipolar blade core. The possibility that the bipolar forms were configured only in the advanced stage of core reduction, after abandoning of the original striking surface is suggested, however, in spite of our efforts it was not possible to prove by refittings. Anyway, the bipolar forms are quite obviously little forms and they are close to the abandoning. On the other hand, our idea is supported by the observations on the little core of 'Carpathian quartzite' with temporal differences among the two flaking surfaces. Furthermore, similar observations were taken on the single Epigravettian assemblage, examined systematically in technological point of view. On the Ságvárian site of Szob the cores were exploited according to the unipolar method; after the exhaustion of the flaking surface at the core was abandoned or a new surface was started.[19]

A further common point among these sites is that beside siliceous rocks the coarse grained quartzite and andesite was also used as a chipped stone raw material. However, in the case of the Szob assemblage the method was relatively simple: from the more or less plain surface of the pebble or cobble a series of flakes were removed without any preparations[20], at Tarcal the formation of the pre-core needed more planning. Further differences are seen in the intensity of stone working, as at Szob large series of blades and flakes could have been refitted, in one case from the decortication until the abandonment of the nucleus. On the actually studied site only the forming of the cores and some removals could have been documented by little refit groups. Typically, with the exception of group 7 there is not a blank refitted to a core in the whole assemblage and the bases of the conjoined blades are also missing. This way it is also possible that the removal of the pieces did not happened on the site, but the blades were introduced as fragmented blanks. Finally, taking into consideration that at Tarcal the traces of tool making are absent and the typical retouched forms were made on single pieces of rare raw materials but at Szob at least an end-scraper and a burin was made or rejuvenated on the site. This way, the duration of occupation was considerably shorter at Tarcal than at Szob. Generally the function of the

[19] MARKÓ 2011 – In the recent studies on the last excavated assemblage from Ságvár (LENGYEL 2013) a slightly different picture could be drawn, as here not only pebbles but raw material blocks were also used. On the other hand, flakes are the dominating elements in all the published refit groups including that ones with blade cores. Finally the cores were turned is several times during the reduction.

[20] At Tarcal we can made similar observations on refit group 15, where the flake was removed from an angular raw material block.

former site can be identified as a place specialised for the core preparation, lying in the vicinity of raw material sources.

Finally we can establish that even if the investigations on the technological traits of the Epigravettian period has just recently started in Hungary, the refitting studies, started by Viola Dobosi 40 years ago, offer good possibilities for the further researchers.[21]

[21] The publication of this paper was supported by Hungarian Scientific Research Fund project OTKA K-100385 "Provenance study of lithic raw materials of stone tools found in the Carpathian Basin"

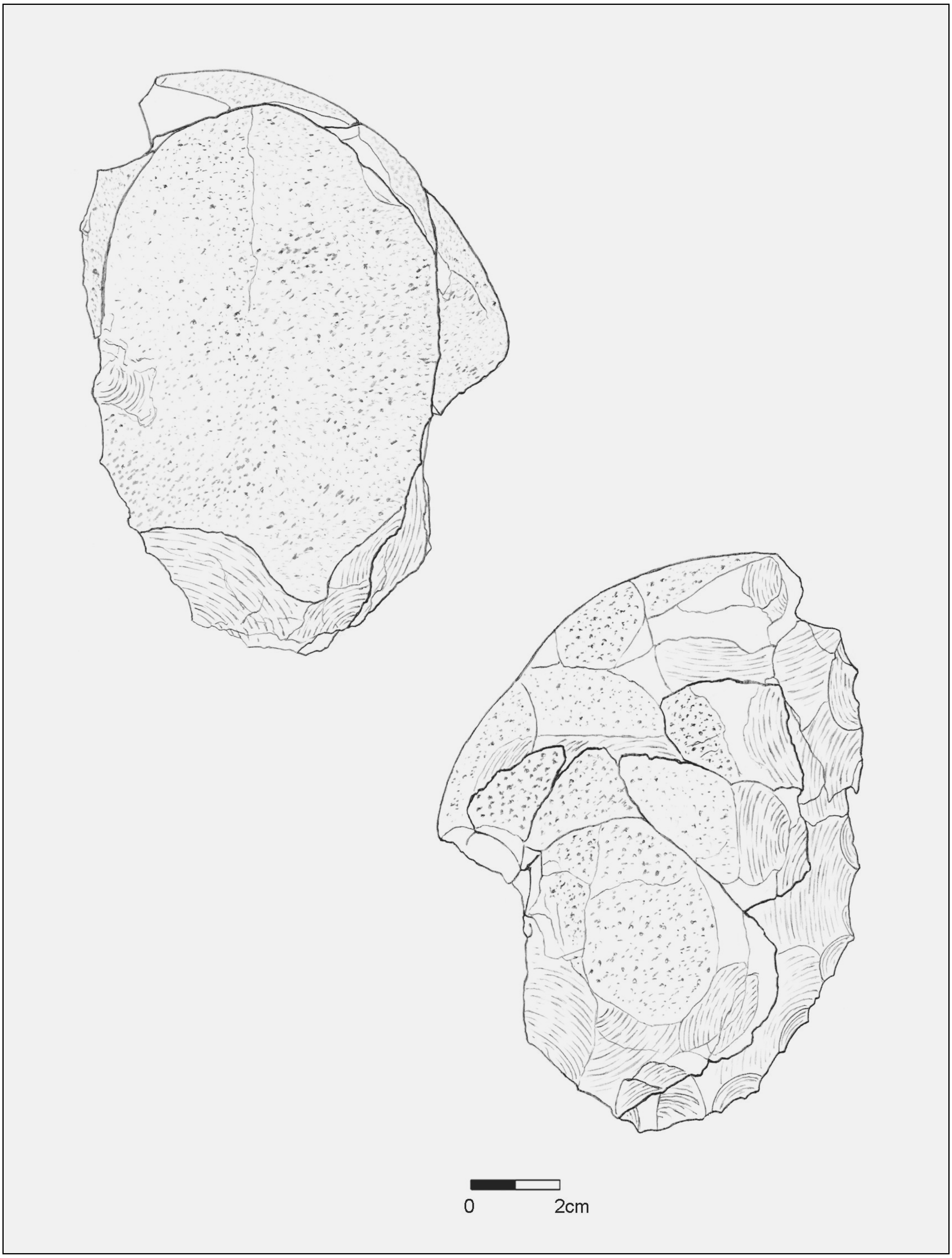

Fig. 1. *Reduction of a cobble: refit group 12 (drawings by B. Andics)*

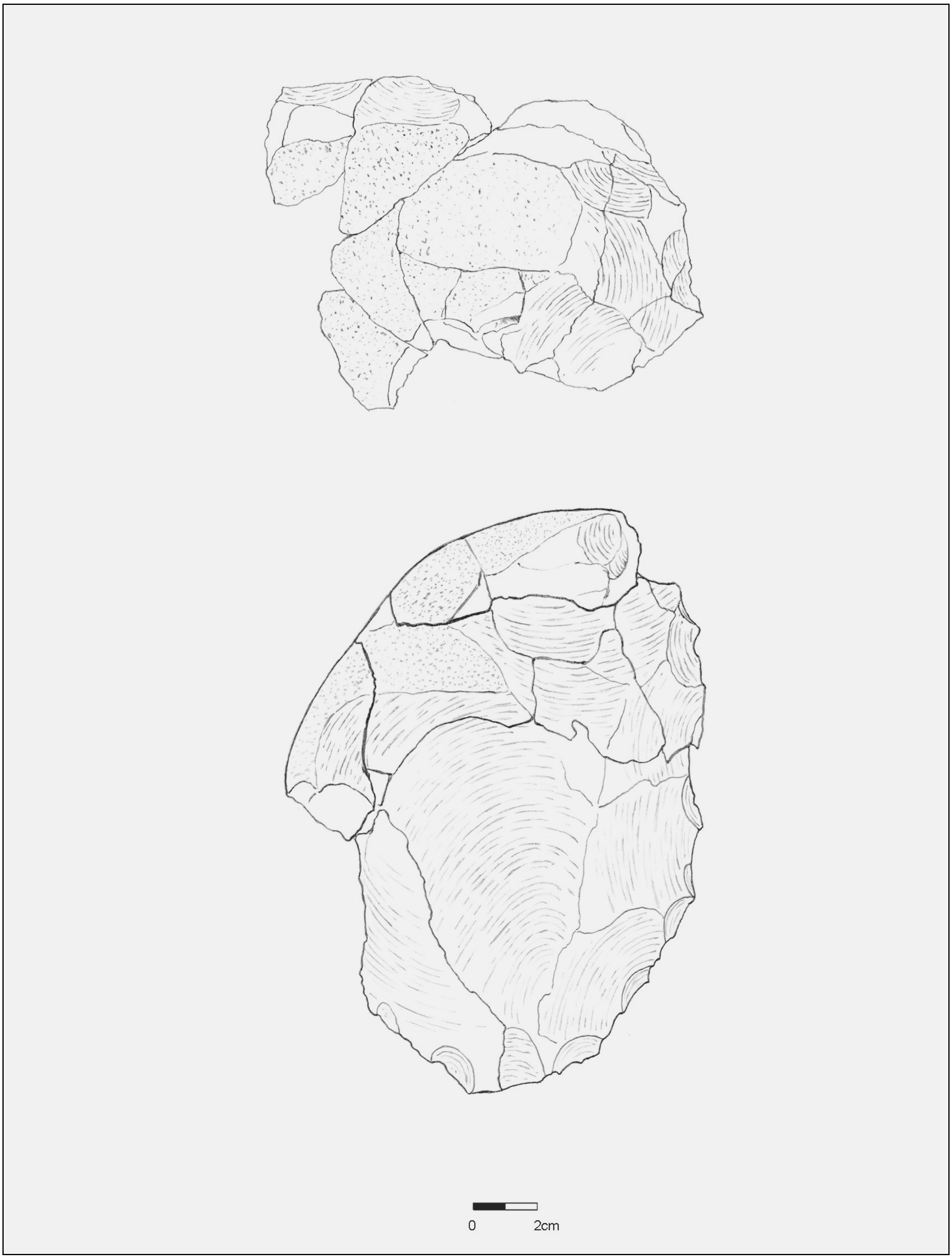

Fig. 2. *Reduction of a cobble: refit group 12 (drawings by B. Andics)*

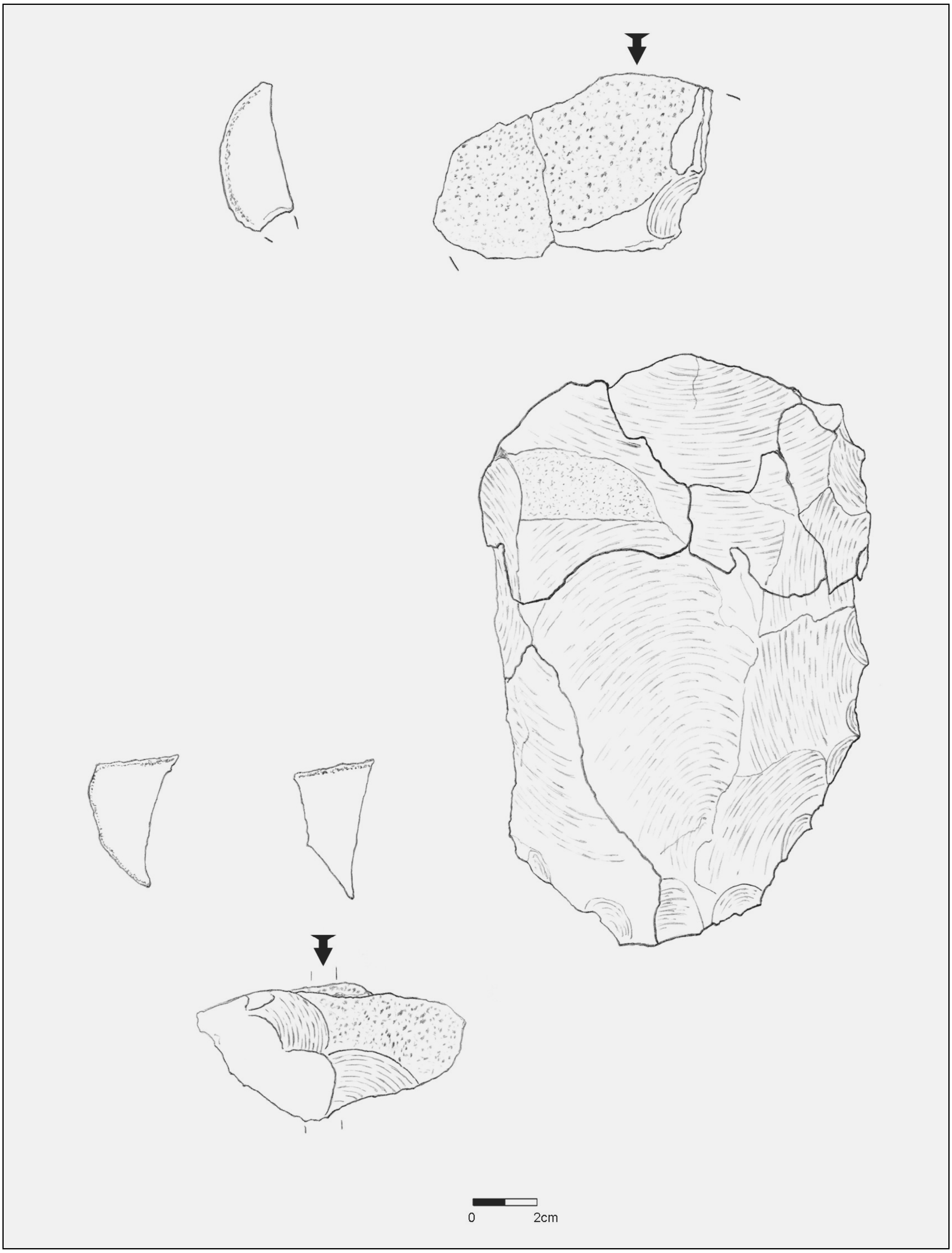

Fig. 3. *Reduction of a cobble: refit group 12 (drawings by B. Andics)*

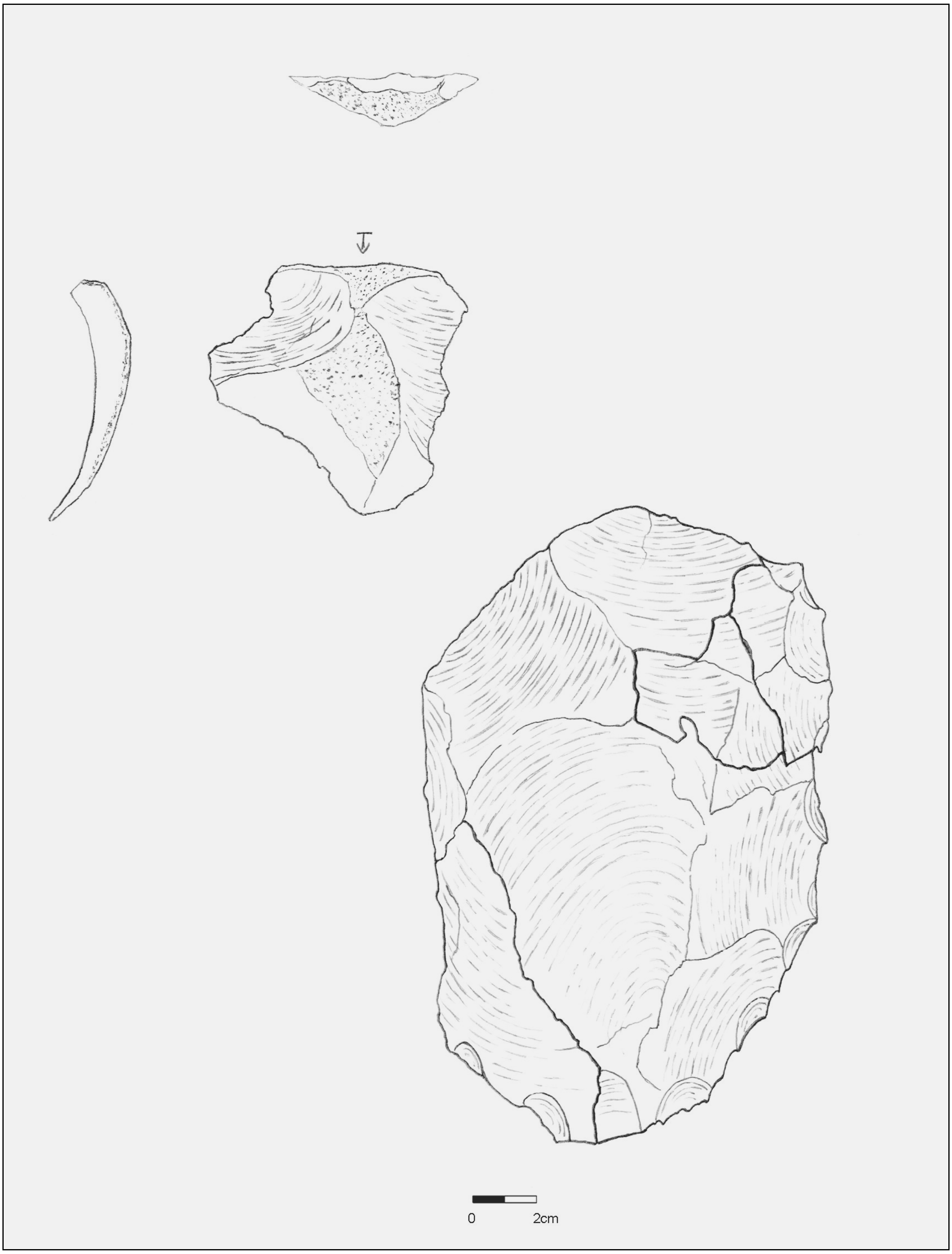

Fig. 4. *Reduction of a cobble: refit group 12 (drawings by B. Andics)*

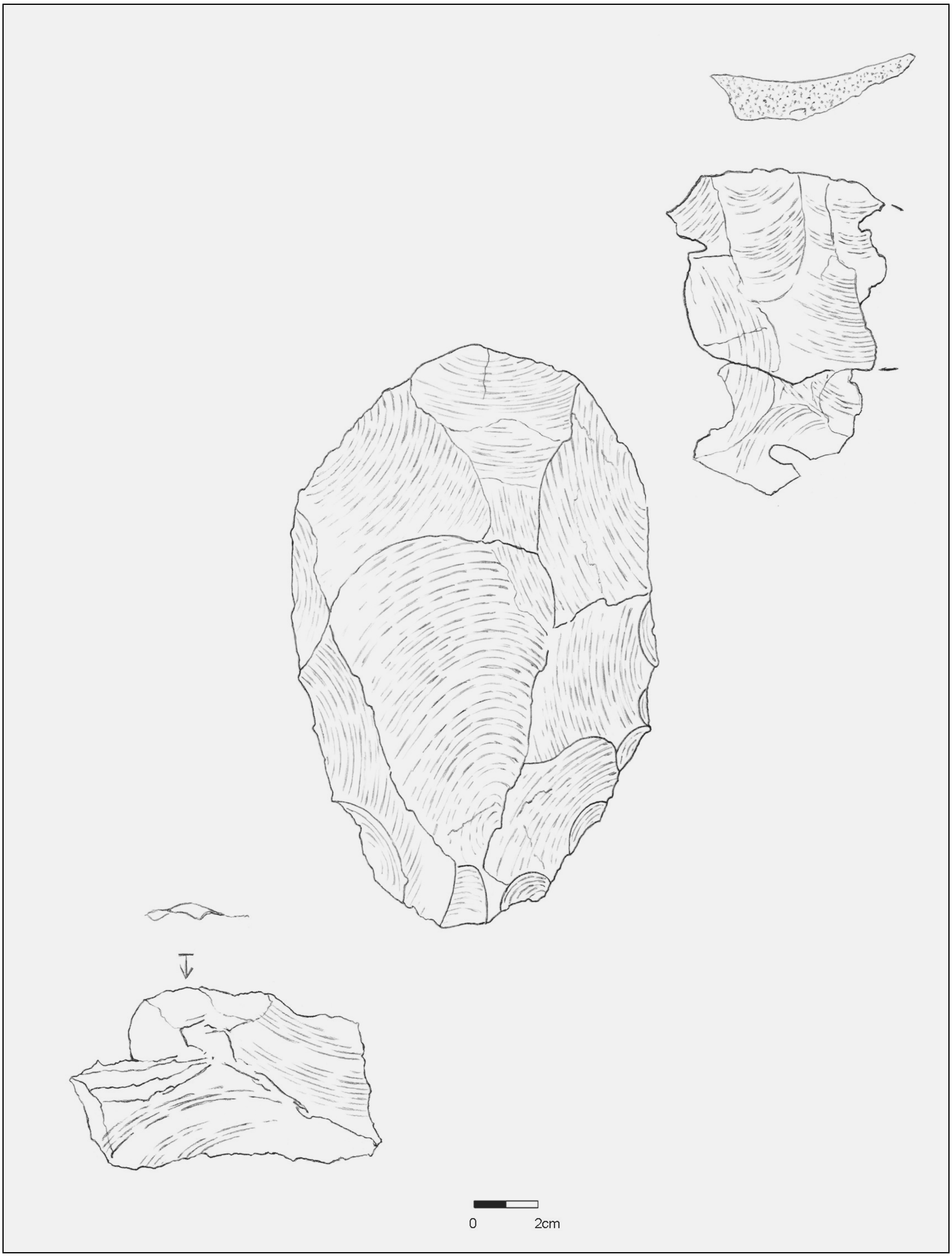

Fig. 5. *Reduction of a cobble: refit group 12 (drawings by B. Andics)*

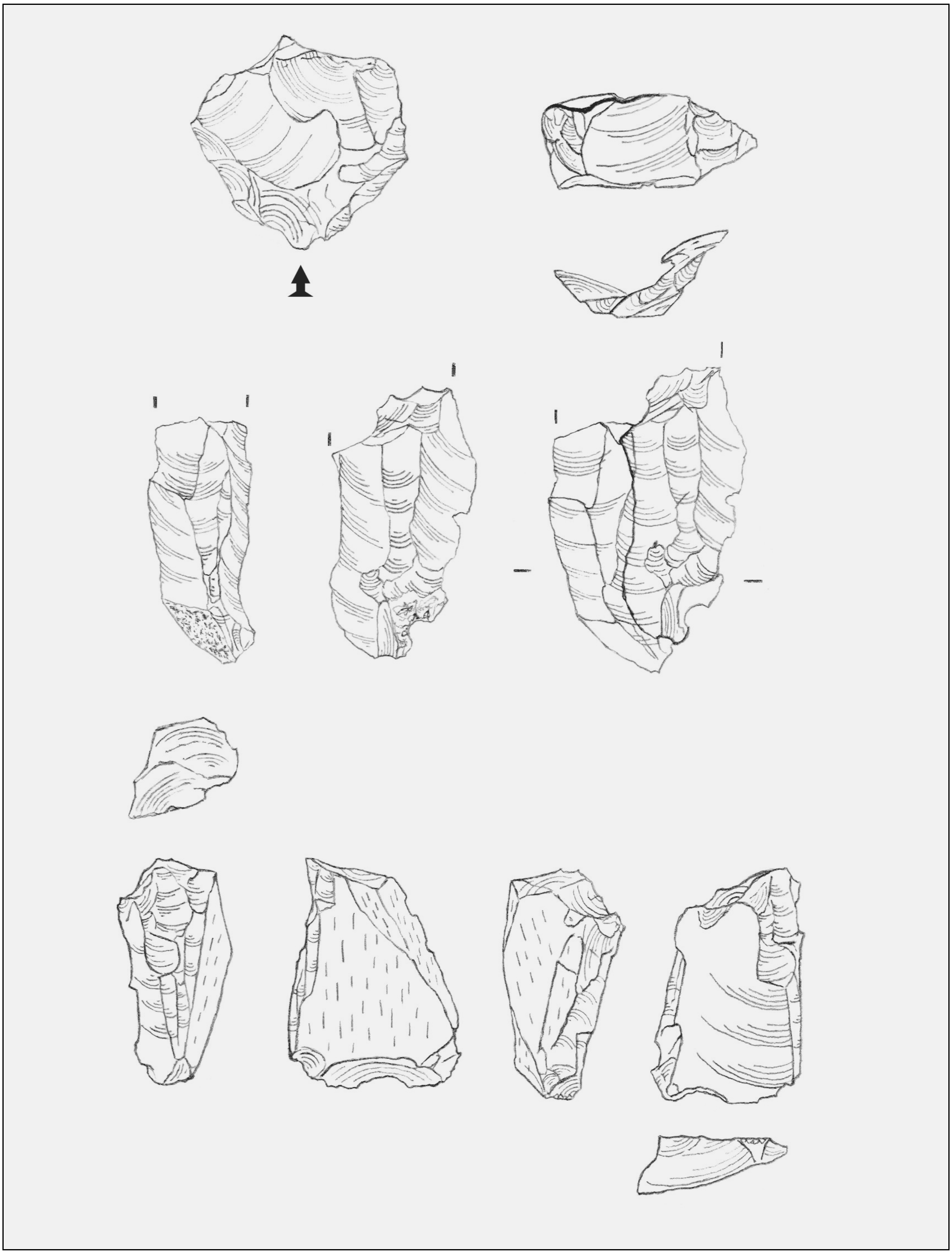

Fig. 6. *Core tablet, refitted blades (refit group 14) and an exhausted core from Tarcal (drawings by B. Andics)*

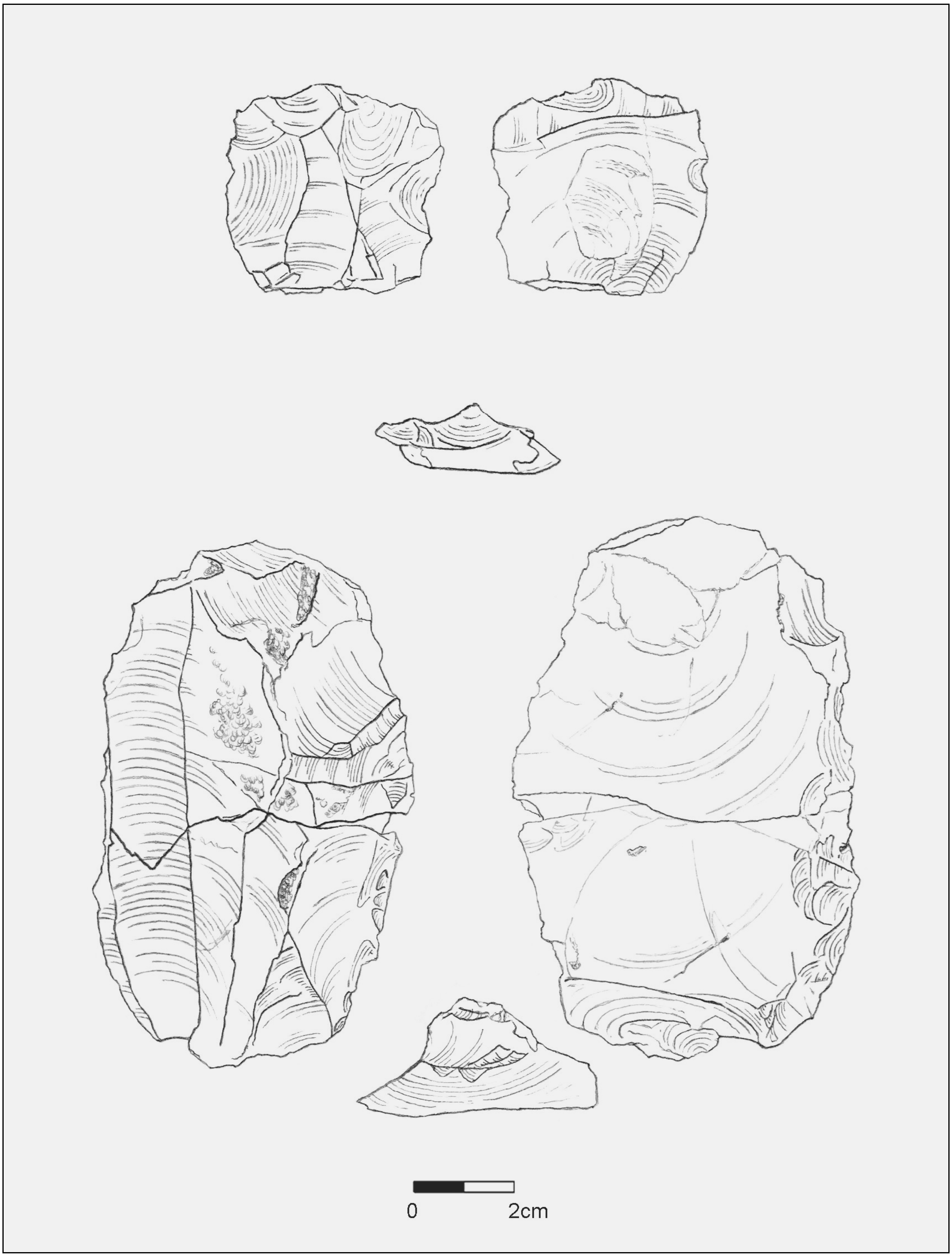

Fig. 7. *Cores on thick flakes (drawings by B. Andics)*

		trench A					B		
	scattered	I	II	III	IV	scattered		total	%
hydroquartzite	34	49	15	7	5	87	3	**200**	**48.78%**
'flint'	2	-	-	-	-	-	-	**2**	**0.49%**
'porcelanite'	1	-	-	-	1	14	-	**16**	**3.90%**
silicified vulcanite	1	-	-	-	-	1	-	**2**	**0.49%**
vulcanite	4	-	-	-	-	16	3	**23**	**5.61%**
radiolarite	1	-	-	-	-	1	-	**2**	**0.49%**
Slovakian obsidian	-	-	-	-	2	7	-	**9**	**2.20%**
Mád-type obsidian	9	1	-	-	1	14	9	**34**	**8.29%**
Tolcsva-type obsidian	1	4	-	-	-	8	11	**24**	**5.85%**
perlite	-	-	2	3	-	8	9	**22**	**5.38%**
'Carpathian quartzite'	-	-	-	-	-	4	7	**11**	**2.68%**
quartzite	-	-	-	11	-	-	-	**11**	**2.68%**
burned	13	-	-	-	1	40	-	**54**	**13.17%**
total	**66**	**54**	**17**	**21**	**10**	**200**	**42**	**410**	**100%**
%	**16.10%**	**13.17%**	**4.15%**	**5.12%**	**2.44%**	**48.47%**	**10.24%**	**100%**	

Table 1. *Raw material types used in Tarcal*

	provenance	pieces	character	raw material	inv. nr
1	from profile cleaning	2	potlid fracture	hydroquartzite	Pb. 71/54, 62
2	trench A, culture layer	2	flaking	andesite	Pb. 71/93
3	trench A, culture layer	3	burned(?) fragments	andesite	Pb. 71/93
4	trench A, culture layer	3	burned(?) fragments	andesite	Pb. 71/93
5	concentration I	2	burned fragments	hydroquartzite	Pb. 71/99
6	concentration I	2	potlid fracture	hydroquartzite	Pb. 71/99
7	concentration I	2 2	flaking, transversal fragmentation	hydroquartzite	Pb. 71/99
8	trench A, culture layer	2	flaking	hydroquartzite	Pb. 71/93
9	concentration I	2	flaking	hydroquartzite	Pb. 71/99
10	concentration I	3	flaking	hydroquartzite	Pb. 71/99
11	concentration I	3	flaking	hydroquartzite	Pb. 71/99
12	concentration III	8	flaking, transversal fracture	quartzite	Pb. 71/103
13	trench B, cultural layer	2	transversal fracture	perlite	Pb. 71/117, 125
14	trench B, cultural layer	2	blade production	Tolcsva-type obsidian	Pb. 71/123, 124
15	trench A, cultural layer	2	flaking	hydroquartzite	Pb. 71/94, 95
16	trench B, cultural layer	3	angular fracture	Tolcsva-type obsidian	Pb. 71/1220, 125
17	trench A, culture layer	2	transversal fracture	Mád-type obsidian	Pb. 71/93
18	trench A, culture layer	2	fracture	hydroquartzite	Pb. 71/85, 111

Table 2. *Refit groups in the Tarcal assemblage*

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DATA TO THE STUDY OF THE CHIPPED STONE IMPLEMENTS OF THE MIDDLE COPPER AGE BODROGKERESZTÚR CULTURE

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Keywords: *Middle Copper Age Bodrogkeresztúr culture, chipped stone implements, nomenclature, regsiter of sites, microwear studies, raw material*

This project started at the beginning of the nineties of the last century, its aim was the typological, statistical and technological investigation of *Copper Age and Bronze Age chipped stone implements*.[1]

Till the beginning of the nineties of the last century the professional study of stone implements, the procurement and trade of their raw material as well as their use and typology remained in the periphery of archeological sciences, nothwithstanding stone implements have a great *information value* – especially as regards their use in households and in hunting – also in those parts of prehistory which are rich in ceramics and metal tools.

The result of the above-mentioned study was the elaboration of the nomenclature of Copper Age and Bronze Age chipped stone tools based on the investigation of the material of sites mentioned below (***Table 1.***). Collections made over several years resulted in the continually increasing number of registered sites with a considerable quantity of archeological data. The publication of these data is continuous even in these days.[2] This paper deals with the chipped stone implements of the Middle Copper Age sites Hajdúszoboszló, Konyár and Polgár-Bacsókert (Hajdú-Bihar county).[3]

After this introduction the first task is to present the material of the different sites succeeded by a survey of general questions, nomenclature as well as by the results of other investigations and conclusions.

Part of the chipped stone implements were suitable to perform a microwear study on them.[4] The results are in this volume in the paper of Erzsébet Bácskay. Besides the primary typological determination of the chipped stone implements it is also very important to determine the later use of the tools which can be made by this method. Unfortunately the character of the raw material of the tools has a great influence on the possibility to make microwear study on them. That is microwear (use-wear) cannot be detected on obsidian, on raw materials which have a reflective or greasy surface and on implements with highly patinated surface. At the same time it is possible that original edges with use-wear were destroyed by later intesive retouch.

This seems to occur in the case of chipped stone tools from Hajdúszoszló (***Fig. 1, 6.***) and in the case of a *Mittelstichel*-type burin (***Fig. 2.***) and of a retouched blade-point (***Fig. 3.***) in the material of Polgár-Bacsókert. There is no use-wear on the burin, except two striations on the middle part of its ventral face suggesting that the tool was not used with a motion parallel to its edges but the edge was used as a scraper. There are no traces of use on the retouched blade point either, though on its ventral face, below the point remnants of some organic material can be oberved.

However, in spite of the negative results of these studies the tools were by all means intensively used as it is suggested by the well observable retouch. As for the point microscopic investigation proved that the sinuous scars of retouch had penetrated into the

[1] The collection, typological and statistical study of Copper Age and Bronze Age chipped stone implements was started by the financial support of the Foundation for Hungarian Science of the Magyar Hitelbank at the beginning of the nineties of the last century and was continued by the financial support of project OTKA (T-22941).

[2] CSONGRÁDINÉ BALOGH 1998-1999; 2000a; 2001; 2004; 2008; 2010.

[3] The material is stored in the Déri Museum in Debrecen.

[4] CSONGRÁDINÉ BALOGH 1998-1999; BÁCSKAY–CSONGRÁDI–BALOGH 2010.

	LIST OF TYPES	CHARACTERISTICS
A	**Retouched blade**	Marginal, stepped, pearl-like, conchoidal, steep, parallel retouches.
B	**Unretouched blade**	Microlithic, small-sized, medium-sized and large-sized blades, mostly with a triangular, rarely a quadrangular cross-section and smooth, prefabricated talon. In Copper Age graves they are present in great number
C	**Retouched flake**	Marginal, stepped, pearl-like, conchoidal, steep, parallel and surface retouches
D	**Unretouched flake**	„Ad hoc" implements with smooth, prefabricated talons, narrowed down bulbs. In Copper Age graves they are present in great number
E	**Scraper**	This characteristic group of tools of the Upper Paleolithic survived during the Copper Age, appearing in various forms: curved flake scraper, circular, beaked, unguiform, double scrapers, scraper on retouched blades, end-scraper, fan-shaped scraper, plane-like and core scrapers are present
F	**Scraper**	Flake scrapers with straight and convex edges. The characteristic group of tools of the Middle Paleolithic appears only in a small number.
G	**Saw**	While the presence of saws is not characteristic of Copper Age find assemblages, they form a typical group of tools in Bronze Age. Most of them are bifacial flakes with saw-edge
H	**Burin**	This tool type can be found both in the Copper Age and in the Bronze Age. Burin edges were shaped by snapping off burin spalls. Mittelstichel-type,. lateral and horizontal burins occur
I	**Point**	The two types used to occur are: the standard retouched blade point and the arrow-head[5]
J	**Borer**	It is a rare tool type in Copper Age and Bronze Age material, lateral and double borers used to appear in Early Copper Age assemblages.
K	**Notched blade**	A single or sometimes more notches appear mostly on blades with marginal retouch.
L	**Truncated tool**	Straight, concave, convex, oblique retouched truncations are present both on blades and flakes
M	**Geometric tool**	They are present already in the Early Copper Age, though they bacame significant during the Late Copper Age. They have several types: trapeze, segment-de-clerc, rectangle, triangle. The form of their truncations is also varied.[6]
N	**Combined tool**	Its types: borer—scraper with lateral point, truncated blade—lateral burin, scraper—Mittelstichel-type burin, double borer—truncated blade, scraper—truncated blade transition. The last one is a characteristic type of the Neolithic, but is appears also in the Copper Age.
O	**Core**	Globoid, prizmatic, cylindrical, conical and amorphous cores used to strike off small-size and medium-sized blades and flakes from them
P	**Divers**	This group includes waste products of manufacture, processed raw material pieces, burin spalls.

Table 1. *Nomenclature of Copper Age and Broze Age chipped stone tools*

surface to such a distance where – even if the edge was used also before the retouch – it cannot be detected already. Practically there are no left parts of the original edge between the retouch scars.

The analysis method of the typological and technological determination of Copper Age and Bronze Age stone tools follows the method used by the researchers of the Paleolithic with those modifications which are necessary in the study of chipped stone tools used in Metal Ages. The determination of Copper Age and Bronze Age chipped stone implements I made according to the typological–statistical method used in the study of Paleolithic chipped stone tools. The reason for this is that the shape of tools, the basic forms of manufacture, methods of manufacture and the function of tools are the basic factors in the determination of these implements as well. The function could be even manifold, both in the case of synchronous use or in the case of a posterior rejuvenation. With the aid of statistical data the overall typological and technological picture can demonstrate the presence of the same characteristic industries from these later ages as in the case of Paleolithic cultures.[9]

The manufacturing process of prehistoric chipped stone tools, the descripion and analysis of the technology of stone tools are a very important source of information for the chronological determination of the material. The study of those finds which are originated from sites with a solid chronological classification can help us to date sporadic finds. Technology and raw material could be telltale signs in the chronological classification of finds. At the same time we have to be cautious about a classification made merely on technological and typological base since the typological distribution within a certain assemblage could be pratcically the same and only percentual tolerance, some culture-specific phenomena may refer to the presence of a material belonging to a different population even within the same cultural unit (as it occurred e.g. in the lower and upper layers of the Upper Paleolithic site Ságvár).[10] Chipped stone tools were made practically according to the same processing methods through several thousand years depending on the role of later products that is – basically – whether blades or flakes were intended to make. Flakes and blades were snapped off from cores. The process and the shape of the tool were determined by the shape of the prepared core.

5 Several groups of arrow-heads can be distinguished regarding their forms and tehchnology are represented in Table 3.

6 CSONGRÁDINÉ BALOGH 2009, 389–391.

9 A good example of this working method is the investigation of the raw material of the large quantity chipped stone tools found in the Late Copper Age cemetery at Budakalász: CSONGRÁDINÉ BALOGH 2009, 388–407.

10 CSONGRÁDINÉ BALOGH 1997; 2000b; 2000c.

During the Paleolithic the raw material of stone tools was procured mostly from local raw material sources by surface collecting, though raw materials were transported or bartered over greater distance as well. The use of raw material as long distance import became widespread in later ages of Prehistory. As for the whole of a certain find assemblage the ratio of imported and local raw materials within it could be of chronological value (e.g. in the case of Tiszapolgár and Bodrogkeresztúr cultures).[11]

The result of microwear studies could be a great help for the chronological classification of stone tools. Namely, it is obvious that the presence of sickle gloss on tools – which can be observed even in the naked eye – excludes the use of the tool before the Neolithic, but the study of microscopic use wear could give more information on the function of the implement. Recently the study of unretouched tools, flakes, production waste became more and more important – it can give information on the quantity and origin of the raw materials used at the settlement in question.

Chipped stone tools found in cemeteries also help chronological classification since within this closed units (graves) the other finds, which came to light together with stone tools, give an exact determination of their chronological position. E.g. in the grave No. 91 of the Budakalász cemetery (Late Copper Age Baden culture), besides the typological analysis of the relatively large quantity of chipped stone tools, during a comparative study we could observe also a shift in the use of local raw material (the different ratio of limnoquartzite and radiolarite).[12]

Hajdúszoboszló

In the October of 1928, during the digging of a canal beside the Hajdúszoboszló railway station, several graves were found. János Sőregi made excavations at the site already in the November of the same year and excavated 12 graves. In his 1961 work entitled *„A bodrogkeresztúri kultúra temetői"* (Cemeteries of the Bodrogkeresztúr culture) Pál Patay published a more detailed description of the Hajdúszoboszló finds, by using the nomenclature which was generally accepted in that time literature. However, due to some insufficiencies of the excavation and to a 1944 bombing, he could not describe all the grave goods because part of them was lost and some of them did not get into the museum at all. Unfortunately several stone tools which are known from the literature, cannot be found in the museum, by now. Their description was made by Patay based on the inventory register.[13]

Pál Patay raised the following question regarding chronology: „...in the territory of the excavation and in its neighbourhood also ceramic finds belonging to the Early Copper Age Tiszapolgár Culture came to light. It is possible that this cemetery was present there already in the Early Copper Age and the latter finds are originated from the destroyed graves of this earlier phase. At the same time it is possible that here there was an Early Copper Age settlement, because Zoltai mentions also a hearth near the cemetery. Though at the same time Bronze Age finds came to light from the same area, maybe the hearths, too, belong to this period. In the material the presence of large-sized vessels, jugs, hollow-pedestalled bowls is conspicuous. The arrow-heads, polished stone tools and copper implements are also very important. Some phenomena, the frequent occurrence of hollow-pedestalled bowls, the larger number of blades in certain graves, the presence of copper pins, and of mace, points to the fact that the graves are originated from the age of the Bodrogkeresztúr culture."[14]

The description of the survived chipped stone tools according to graves[15]

Grave 1.

According to P. Patay in the grave there was a contracted skeleton of most probably a male, lying on his right side. The grave goods are: stone mace, 2 stone knives, animal tooth, „milk jug," copper flate axe, a flat polishing stone, tusk of a wild boar, a flowerpot-shaped vessel, a hollow pedestalled bowl, a hemispherical bowl, a deep bowl with two handles, rib bone of some ananimal and two obsidian arrow-heads[16]

Unretouched blade, *behind the skull, directly at the nape.* (***Fig. 1.***)

Long, narrow blade, talon, bulb are missing, narrowed down at the base. Dimensions: 176×29x10 mm. Raw material: silex, patinated.

Unretouched blade, *behind the vertebral column.* (***Fig. 1. 2***)

Medium-sized narrow blade. There is retouch of use at both margins. Talon is present, the bulb is reduced in size. Dimensions: 133x24x7.5 mm. Raw material: silex, patinated

Arrow-head, *at the left foot* (***Fig. 6. 6***)

Triangular-shaped arrow-head, with bifacial marginal and surface retouch, with a straight base Dimensions: 27x19x4 mm. Raw material: obsidian.

[11] CSONGRÁDINÉ BALOGH 2004, 34, 7. ábra.
[12] CSONGRÁDINÉ BALOGH 2009, 396, Figs. 16–18.
[13] PATAY 1961, 25–30.
[14] PATAY 1961, 30.
[15] CSONGRÁDINÉ BALOGH 1993.
[16] PATAY 1961, 26.

Grave 3.

According to P. Patay: a contracted skeleton, lying on its right side. Grave goods: „milk jug", two stone blades, stone knife, stone end-scraper, copper pin, tusk of a wild boar, 2 or 3 silex arrow-heads, fragments of vessels, shoulder-blade of an animal, and 4 silex and obsidian flakes beside the spine[17]

Unretouched blade *in front of the belly* (***Fig. 6. 1***)

Medium-sized narrow blade, talon and bulb are present. Dimensions: 108x24x4.5 mm. Raw material: greyish brown silex, patinated

End scraper, *in front of the belly* (***Fig. 6. 2***)

There is some marginal retouch along the right margin of the dorsal part of the blade while its basal end is retouched by marginal retouch extending over the surface of the tool. The scraping edge is formed by fan-shaped retouch.. Talon is narrow, medium-sized blade with bulb. Dimensions: 74x23.5x6 mm. Raw material: greyish brown silex, patinated

Retouched blade, *below the elbow* Fragment of the proximal end of a retouched blade. It is a blade with triangular cross-section with an alternating retouch along the left edge of its dorsal side.Talon, bulb are present. Dimensions: 40x15x4 mm. Raw material: patinated limnoquartzite

Unretouched blade, *below the elbow*

Fragment of the proximal end of an unretouched blade. Talon is small, bulb flat Dimensions: 49x11x5 mm. Raw material: patinated limnoquartzite.

Arrow-head, *behind the spine* (***Fig. 6. 5***)

Triasngular-shaped, bifacial arrow-head with a straight base, manufactured with marginal and surface retouch. Its tip had broken off. Dimensions: 31x17x4 mm. Raw material: obsidian.

Arrow-head, *behind the spine* (***Fig.6. 7***)

Triangular-shaped, bifacial arrow-head with a straight base, manufactured with marginal and surface retouch. Dimensions: 23x21x3 mm. Raw material: obsidian.

Arrow-head, *behind the spine* (***Fig. 6. 8***)

Triangular-shaped, bifacial arrow-head with a straight base, maufactured with marginal and surface retouch. At the margin of its ventral side there are steep retouches parallel with each other, extending considerably on the surface. Dimensions: 19.5x19x4 mm. Raw material: obsidian.

Grave 6.

According to the description of P. Patay in the grave there was the contracted skeleton of a male, lying on his right side. Grave goods: „milk jug", stone blade, and end scraper at the jaw and at the elbow, copper pin.[18] The stone tools cannot be found in the museum.

Grave 7.

According to the desciption of P. Patay it was a grave with a contracted skeleton. Grave goods: perforated stone axe, four arrow-heads beside the right upper leg, two ones beside the two shins of both sides (2 of them triangular-shaped obsidian arrow-heads, 2 of them triangular-shaped silex arrowheads and 2 trapeze-shaped ones), vessel, cup.[19] As for the stone tools only a single arrow-head was found in the museum.

Arrow –head (***Fig.6. 4***)

Triangular-shaped bifacial arrow-head with a straight base, manufactured with marginal and surface retouch. Its tip is damaged. Dimensions: 19x18x3 mm. Raw material: patinated blue silex

Grave 8.

According to the description of P. Patay it was a grave with a contracted skeleton lying on its right side. Grave goods: jug, arrow-head[20]

Arrow-head, *beside the right shin.*

Triangular-shaped arrow-head with a straight base. Its whole dorsal side is manufactured with steep, parallel retouch while its ventral side is manufactured with the same retouch only partly. Dimensions: 27x16x4 mm. Raw material: obsidian

Grave 10.

According to the description of P. Patay it is a grave with a contracted skeleton lying on its right side. Grave goods: stone knife on the left temple of the skull, „milk jug", cup.[21] The chipped stone tool cannot be found in the museum.

Sporadic finds

Though Patay does not mention an item with this inventory number, on the basis of this very number it is highly possible that an unretouched blade came to light from the territory of the cemetery. It is an unretouched blade with talon and bulb. Dimensions: 64x14x6 mm Raw material: Silex, patinated (***Fig. 6. 3***)

[17] PATAY 1961, 27.

[18] PATAY 1961, 28.

[19] PATAY 1961, 28.

[20] PATAY 1961, 28.

[21] PATAY 1961, 29.

	TYPES	pieces	CHARACTERISTICS
A	**Retouched blade**	1	Blade with alternating retouch on its both sides.
B	**Unretouched blade**	5	Two of them are long, narrow, characteristic Early and Middle Copper Age type blades, the third one is a wider variant of them. The two other ones are undistinctive pieces without chronological value.
E	**Scraper**	1	Large-sized, intact end scraper with sporadic retouch.
I	**Point**		
	Arrow-head, group 1.	3	Triangular-shaped, bifacial arrow-heads with straight base.
	Arrow-head, group 2.	3	Those arrow-heads belong to this group which have surface and marginal retouch on their dorsal sides, while their ventral sides are manufactured only with marginal retouch. On the ventral sides only the margins of the flakes were manufactured.

Table 2. *Typological composition of the chipped stone tool assemblage of the Middle Copper Age cemetery at Hajdúszoboszló*

As I already mentioned above in connection with nomenclature (***Table 1.***), on the basis of the investigated find assenblages., among the arrow-heads several groups can be distinguished from morphological and technological points of view. At Hajdúszoboszló the types of groups 1. and 2. are present.

In the typological composition of the small group of chipped stone implements studied by me (13 pieces, the other ones are unfortunately missing) unretouched blades and bifacial arrow-heads are predominated. In spite of their small number it is obvious that these and especially the arrow-heads are characteristic tool types of the Bodrogkeresztúr culture. Other tools are represented only by a single piece each, though it is highly possible that the quantity of chipped stone tools in the graves was considerably larger since only part of the cemetery was unearthed and even from this part several finds had not got to the museum. Besides the insufficiencies of the excavation and bombings during World War II caused a great damage to the collection. Among the raw materials of the chipped stone tools the so-called Prut blue silex, greyish brown silex and obsidian are present. As I mentioned above because of the highly patinated surfaces of the tools and of the vitreous character of the obsidian microwear studies did not yield real results.

TYPES OF ARROW-HEADS	MORPHOLOGICAL CHARACTERISTICS
group 1.	Triangular-shaped bifacial arrow-head with straight base. The whole surfaces of both the dorsal and the ventral sides are manufactured with marginal and surface retouch.
group 1/a.	The manufacture is the same as in group 1., only that tools in this group have a retouched concave truncation at the base.
group 2.	Triangular-shaped bifacial arrow-head with straight base. Manufactured with surface and marginal retouch on its dorsal side and only with marginal retouch on its ventral side.
group 2/a.	The manufacture is the same as in group 2 only that in this group there is a retouched concave truncation at the base.
group 3.	Triangular-shaped bifacial arrow-head with straight base. Both the dorsal and ventral sides are manufactured y with marginal retouch. only
group 3/a.	The manufacture is the same as in group 3 only that in this group there is a retouched concave truncation at the base.
group 4.	Triangular-shaped bifacial arrow-head with straight base. On the dorsal side it is manufactured with marginal retouch while on the ventral side only one of the edges is naufactured with marginal retouch..

Table 3. *Types of bifacial arrow-heads and their morphological characteristics*

In the typological composition of the small group of chipped stone implements studied by me (13 pieces, the other ones are unfortunately missing) unretouched blades and bifacial arrow-heads are predominated. In spite of their small number it is obvious that these and especially the arrow-heads are characteristic tool types of the Bodrogkeresztúr culture. Other tools are represented only by a single piece each, though it is highly possible that the quantity of chipped stone tools in the graves was considerably larger since only part of the cemetery was unearthed and even from this part several finds had not got to the museum. Besides the insufficiencies of the excavation and bombings during World War II caused a great damage to the collection. Among the raw materials of the chipped stone tools the so-called Prut blue silex, greyish brown silex and obsidian are present. As I mentioned above because of the highly patinated surfaces of the tools and of the vitreous character of the obsidian microwear studies did not yield real results.

Konyár

The site is situated to the east of the community Konyár, beside the canal of the Kálló brook. In the autumn of 1930, during earthworks, graves were found. In 1931-32 János Sőregi and Vilmos Kiss excavated there several graves which belong to the

Bodrogkereszrtúr culture.[22] Unfortunately great part of the material is missing, therefore only a few pieces could be studied – in spite of the fact that according to the description of Pál Patay, besides the small-sized copper spirals, copper knives, perforated marble axe, marble pearls and vessels characteristic of Bodrogkeresztúr culture also „stone knives" and an obsidian arrow-head (grave No. 12) were found in the graves.

Grave 11

Scraper

Scraper with straight edge on a flake wth steep, parallel retouches, talon, bulb are missing. Dimensions: 33x27.5x12 mm. Raw material: obsidian with cortex

? „questionable" grave: either uncertain or undeterminable or something else, though it is not registered with a question mark

Unretouched blade

Medium-sized, fat blade with a thick talon and flat bulb. Dimensions: 97x20x9.5 mm. Raw material: patinated limnoquartzite

From typological point of view the remained chipped stone implement material consists of an unretouched blade and a scraper with straight working edge. In the excavated 17 graves, however, as it was mentioned above, there were much more chipped stone tools and during the earthworks the majority of the graves of the Konyár cemetery was most probably destroyed. It is worth mentioning that the obsidian scraper was found in grave No. 11, together with the perforated marble axe.

Polgár-Bacsókert

In 1954 Pál Patay made rescue excavation in the Bacsókert sand-pit, at the southern edge of the community Polgár.[23] The graves came to light during sand extraction. Pál Patay excavated 14 Copper Age graves during his rescue excavation, though it is possible that several graves were destroyed even after the finds were reported. The graves belong to the Bodrogkeresztúr culture, they were described in details by the excavator.[24] Among the chipped stone tools I could find only 5 pieces in the museum. Trying to identify the graves which they came to light from I used Patay's desciption of graves.[25]

Grave 2.

According to P. Patay's description it is a grave with a contracted skeleton lying on its right side. Grave goods: stone knife, flat axe, vessels characteritic of the culture.

Mittelstichel-type burin, *Beside the skull* (***Fig. 2.***)

Mittestichel-type burin, at the tip of the blade, with parallel, steep retouch in the right margin of the ventral side. The 6 mm wide burin edge was shaped by using a natural fracture and by striking a burin spall. Talon is manufactured, bulb was narrowed down. Dimensions: 134x24x8 mm. Raw material: Silex, translucent, greyish brown.

Grave 3.

According to P. Patay's desciption it is a grave with a contracted skeleton lying on its left side. Grave goods: flat copper ring with open ends, obsidian core, vessel

Grave 4.

According to P. Patay' s description it is a grave with a contracted skeleton lying on its right side. Grave goods: stone knife, fragment of the foot of a hollow pedestalled bowl with pierced work, copper awl

Unretouched blade, *At the skull.* (***Fig. 4.***)

Large-sized, wide, unretouched blade. The right margin of the dorsal side is ribbed by use. Dimensions: 225x43x13.5 mm. Raw material: Silex, translucent, greyish brown, with cortex

Grave 5.

According to P. Patay's description in the grave there was a broken stone knife.

Grave 6.

According to P. Patay's description it is a grave with a contracted skeleton lying on its right side. Grave goods: stone knife, flower pot-shaped vessel, fragment of „milk jug"(?).

Retouched blade point. *Beside the left elbow* (***Fig. 3.***)

Regarding both its raw material and type it is completely analogous with material from the site

[22] PATAY 1961, 39.
[23] PATAY 1961, 68–69.
[24] PATAY 1958; 1961, 68–69.
[25] PATAY 1958, 142–146.

Tiszakeszi-Fáykert.[26] Both the right and left margins of the dorsal side of the tool is manufactured with steep, parallel retouch. Large-sized faceted talon, intact, prominent bulb. There are sporadic traces of retouch on its ventral side. Dimensions: 115x27.5x10.5 mm. Raw material: Translucent greyish brown silex.

Grave 8.

According to P. Patay' description this grave could be a „pseudo-burial" (cenotaph). Among the grave goods, besides vessels of different types (flower pot shaped vessel, „milk jug") there was also a silex core.

Core remnant, *Near to the lower part of the „milk jug"*

Globoid core remnant with double striking platform. Dimensions: 29x26 mm. Raw material: Hydroquartzite, white, with cortex

Grave 12.

According to P. Patay's description it is a grave with a contracted skeleton lying on its right side. Grave goods: stone knife, „milk pot", bowl, pig bones

Unretouched blade, *At the calvaria* (***Fig. 6. 1***)

Long, narrow, unretouched blade. Ribs caused by use at both margins, talon manufactured, the bulb was narrowed down considerably. Dimensions: 160x27.8x7 mm. Raw material: Silex, translucent, greyish brown

	TYPES	pieces	CHARACTERISTICS
A	Retouched blade	1	Almost completely retouched blade, except its right proximal end. Traces of sporadic retouch are on its ventral side. Parallel, steep, here and there stepped retouches are present.
B	Unretouched blade	2	One of them is a large-sized unretouched blade. The other one is smaller, though it is also a blade-type characteristic of Middle Copper Age.
H	Burin	1	Typlogically it is a Mittelstichel on a narrow unretouched blade.
O	Core	1	Typologically it is a globoid piece with double striking platform

Table 4. *Typological composition of the chipped stonetools found in the Middle Copper Age cemetery Polgár-Bacsókert*

The goup of few chipped stone implements from Polgár-Bacsókert – unfortunately only the above described ones were found in the museum – represents the characteristic tools of Bodrogkeresztúr culture, due first of all to the retouched and unretouched blades (***Table 4.***). Accoding to the description of Pál Patay their number could be considerably larger, since he remarked that „at about a 20-25 m's distance from the grave No. 10 (which in the excavated area was the outside one westwards) was found a stone knife.[27] At the same time he mentioned chipped stone tools found in 5 graves when he analyzed the grave material. He emphasized the large size of the tools found in grave No. 4, and as for the tools in the other graves he calls attention to their position in relation to the skeletons, remarking that the position of tools at the skull was a routine in Bodrogkeresztúr culture.[28]

Though no doubt, in the graves of the Polgár-Bacsókert cemetery chipped stone tools were found at the skull, in the Hajdúszoboszló cemterey, studied above, we find various positions of the chipped stone tools in the graves, that is they were found not only at the skull, but also at the nape (***Fig. 1. 1***), three arrowheads were behind the vertebral column (***Fig. 6. 5, 7–8***), just as an unretouched blade (***Fig. 1. 2***), also in front of the belly (***Fig. 6. 1–2***), at the left foot (***Fig. 6. 6***), at the leg and shin (6 arrow-heads). In two cases the chipped stone tools were put under the elbow. Therefore it seems that the position of chipped stone tools in graves does not depends on some consequent ritual factor. Neverteheless to clear up the exact cause of positioning we need to make comparative investigations also in other cemeteries of the culture.

Because of its dimensions the core remnant in grave No. 8. was suitable for striking off microlithic bladelets from it. Its raw material, too, (patinated hydroquartzite) differs from that of the larger sized implements. It is a general observation that if cores were put into the graves, they were suitable mostly only to produce small-sized implements. Large-sized blades - as in this case the unretouched blade of grave No. 4 had got into graves only as ready-made products. (***Fig. 4.***). At the same time it is important to note the obsidian core found in grave No. 3, because it came to light from a grave in which a contracted skeleton lying on its left side was buried, suggesting that probably it was the grave of a female. At the same time in the Bodrogkeresztúr culture chipped stone tools as grave goods were found in the graves of males.

For lack of settlement material we are tempted to think that these large- and medium-sized unretouched blades were transported into our region already as ready-made or half-made products, that is they can be

[26] According to the oral communication of Jacek Lech it was made of „Saspów" flint, mentioned by CSONGRÁDINÉ BALOGH 1993.

[27] PATAY 1961, 69.

[28] PATAY 1958, 150.

considered as imported barter objects. At the same time the hoard from Kálló-Bikázó dűlő, which came to light as a sporadic find, containig 12 pieces, 9 of which with cortext[29], as well as the original cortex over a large surface of the above-mentioned large-sized blade from Polgár-Bacsókert suggest a local raw material processing. Presumably the raw material was transported into the place of processing in the form of large blocks. The Kálló material is rather homogeneous from typological point of view, it consists mostly of retouched and unretouched blades. Unfortunately because of their large size these tools are unsuitable to make microwear study on them, therefore we do not know whether they were used or not. In the lack of information of this kind it is hard to determine what was the function of these blades hidden as a hoard. Whether they were implements for everyday work or/and they were prestige objects for funeral rites, we do not know. Their dimensions and special character seems to suggest the latter hypothesis. There can be no doubt that originally they were in some sheath, perhaps in a leather sheath, because they were found as lying tightly on each other. It is also obvious that they were not processed on the spot because none of the 12 pieces could be fitted toegther. Therefore we think that these blades were produced previously somewhere else, either at a base settlement or in the close neighbourhood of the raw material provenance.[30] Because it is a sporadic find its ranging into age and culture is questionable, it is doubtful if it belongs to the Middle Copper Age.

During her systematic studies on the workshops processing lithic implements Katalin T. Biró distinguished three different phases of processing. According to her the Kálló hoard belongs to the second phase. In this phase we find near the raw material outcrops those half-made products which were intended for further processing.[31] According to Pál Patay the raw material of the blades is grey chalcedony (silicified andesite), though later he modified his opinion declaring that he reckond it to be identical with the raw material of the large size-blades of the graves of Bodrogkeresztúr culture.[32] According to Katalin T. Biró the raw material of the Kálló blades is of not local origin, rather it is more similar to the Volhynian type flint.[33] At any rate in this respect the Kálló hoard is still problematic, perhaps also raw material barter is involved.

At this moment we are unable to decide whether such large- and medium-sized blades were processed locally or not because for it we need to study a larger quantity of chipped stone tools, cores, production waste, processed and unprocessed pieces of raw material from settlements. For the time being, however, we haven't a knowledge of such large-sized unretouched blades in settlement material.

The importance of the locality is emphasized also by the fact that it came to light near the Polgár-Basatanya cemetery where we know the material of both Tiszapolgár and Bodrogkeresztúr cultures from closed grave units. Microwear studies made on this chipped stone tools, though they could not give an unambigous result, rendered probable that these medium- and large-sized retouched and unretouched blades were put into the graves as „prestige objects".[34]

With the aid of the above analyzed small quantity of chipped stone tool material this short paper lays stress on the importance of those tools which came to light from closed grave units, because both from typological and technological points of view as well as regarding their raw material they can give significant information. At the same time they can draw attention to several possibilities in comparison studies which help us to get a more detailed and complex knowledge of the burial customs of the Middle Copper Age Bodrogkeresztúr culture.

[29] CSONGRÁDINÉ BALOGH 2000, 51.
[30] PATAY 1960, 33.
[31] BIRÓ 1986, 5.
[32] PATAY 1976.
[33] BIRÓ 1984, 392.
[34] CSONGRÁDINÉ BALOGH 2000, 53–54; 2004, 31–33.

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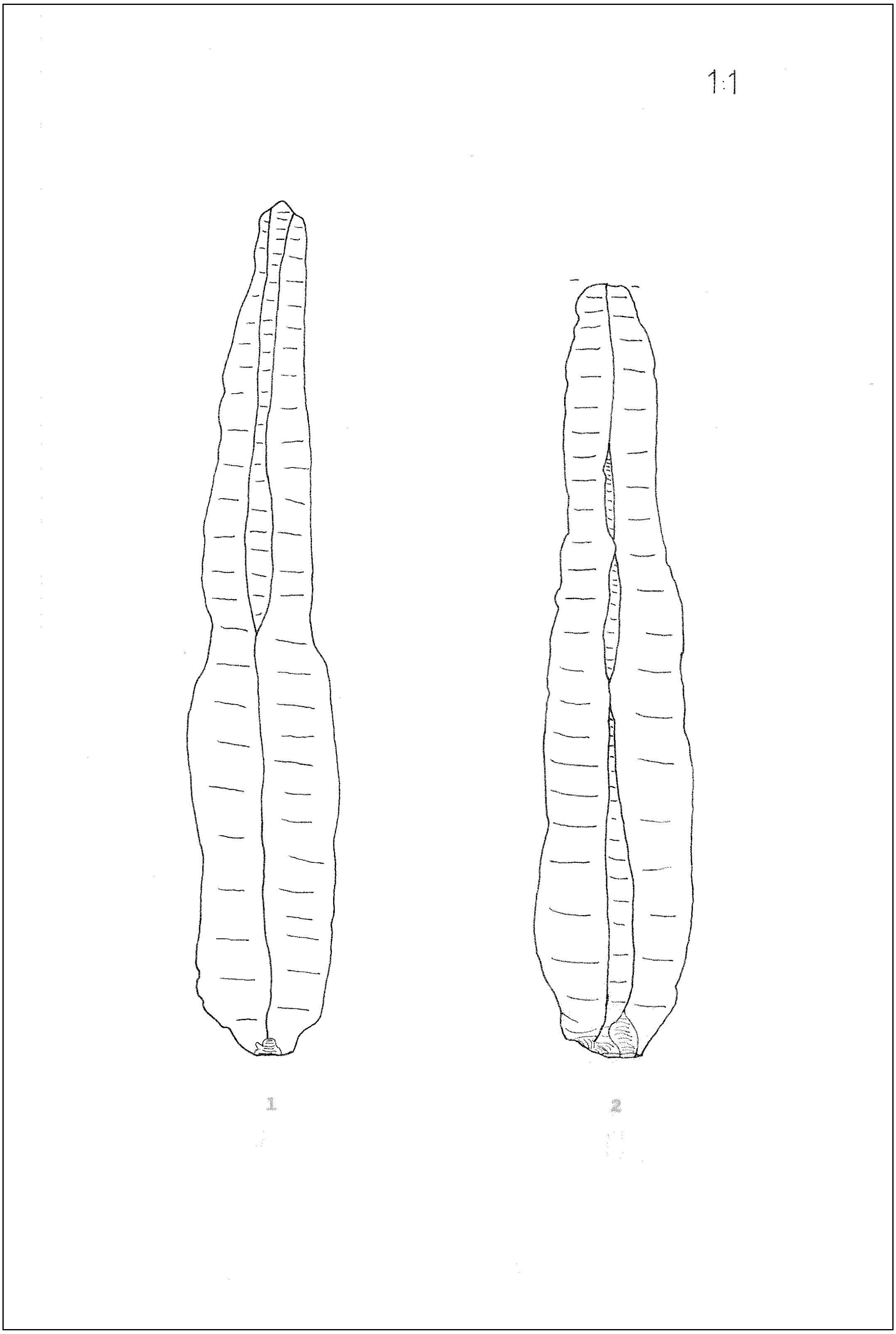

Fig. 1. *Chipped stone tools from Hajdúszoboszló*

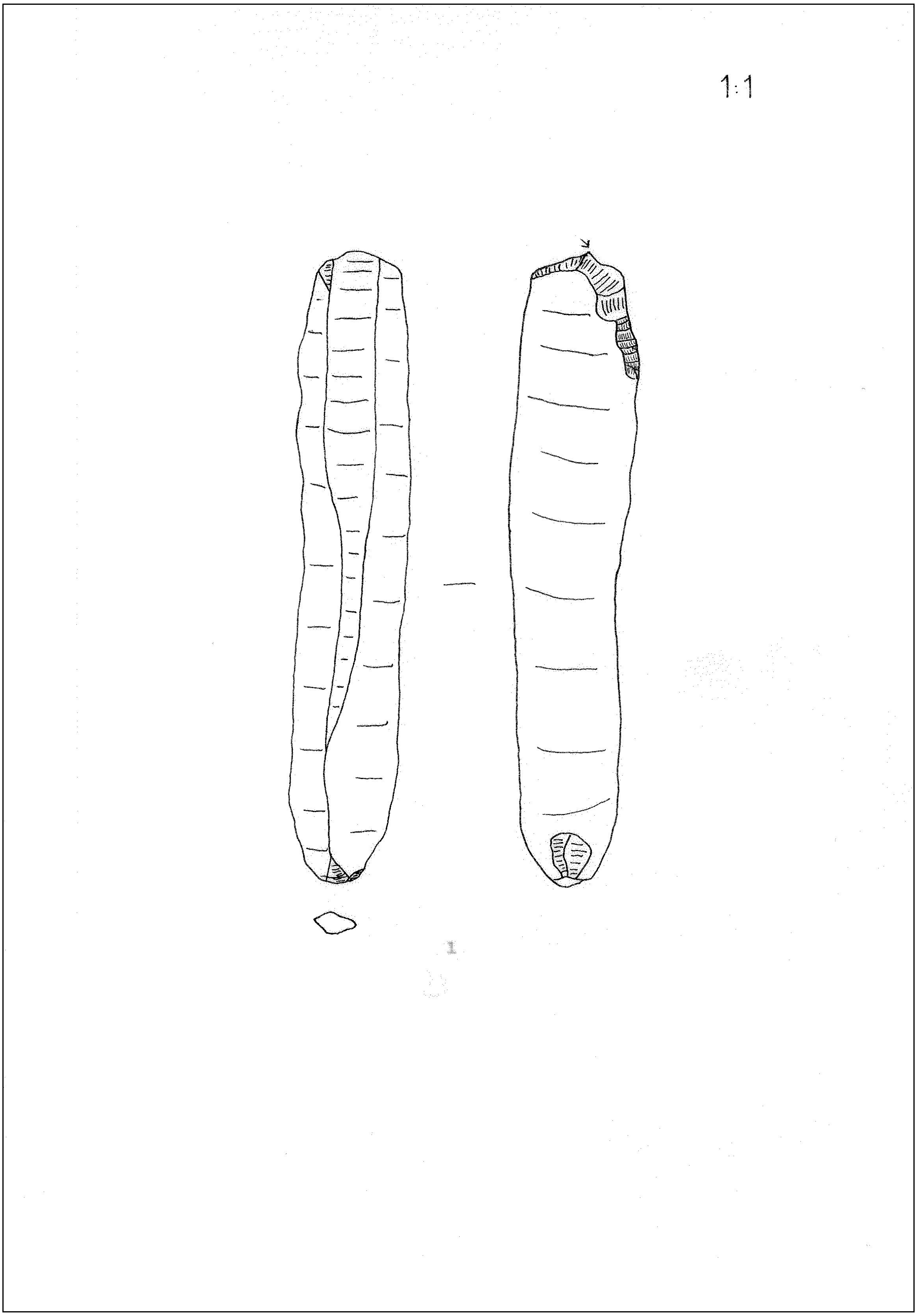

Fig. 2. *Mittelstichel-type burin from Polgár-Bacsókert*

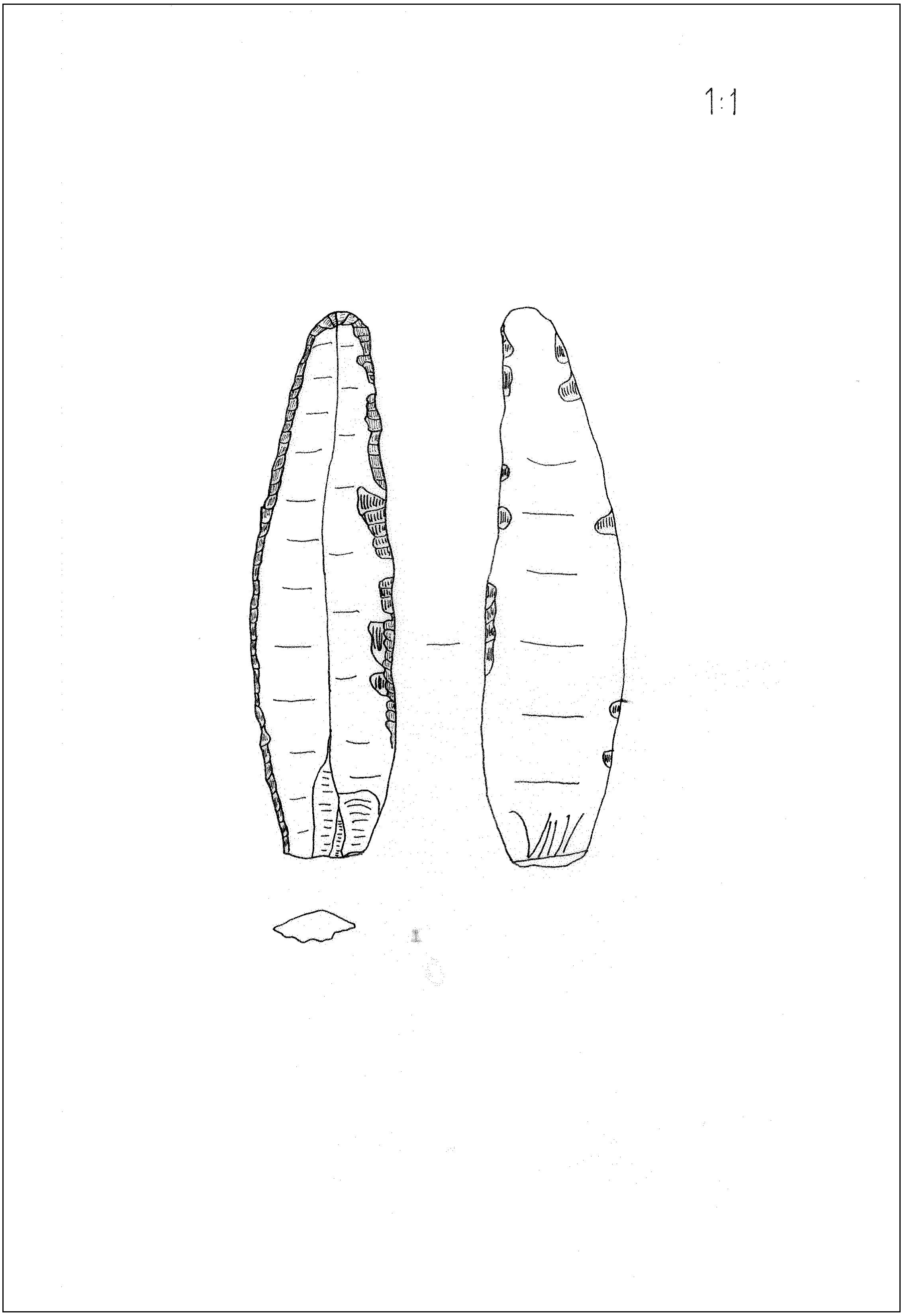

Fig. 3. *Unretouched blade from Polgár-Bacsókert*

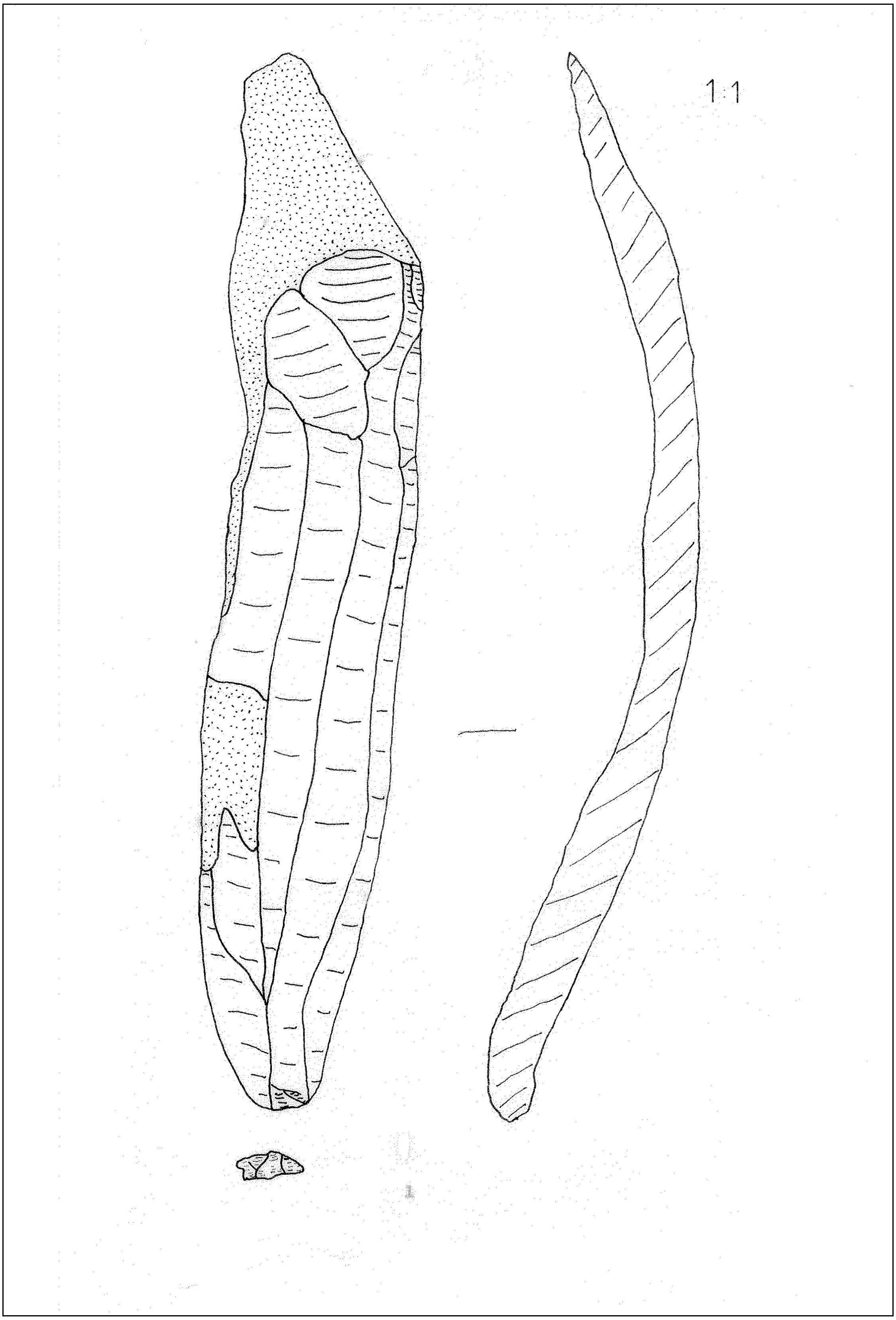

Fig. 4. *Retouched blade point from Polgár Bacsókert*

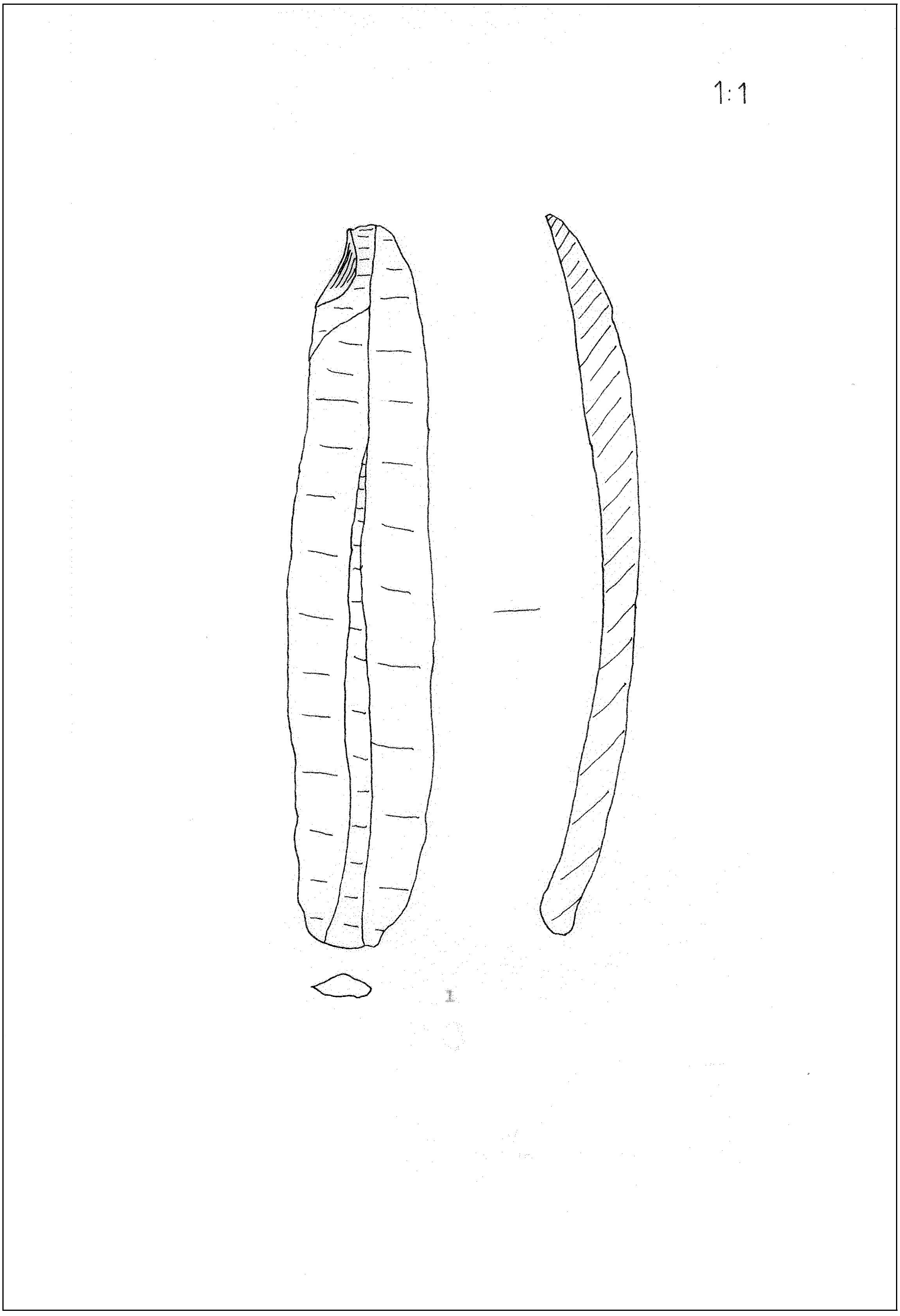

Fig. 5. *Large-sized unretouched blade from Polgár-Bacsókert with cortex*

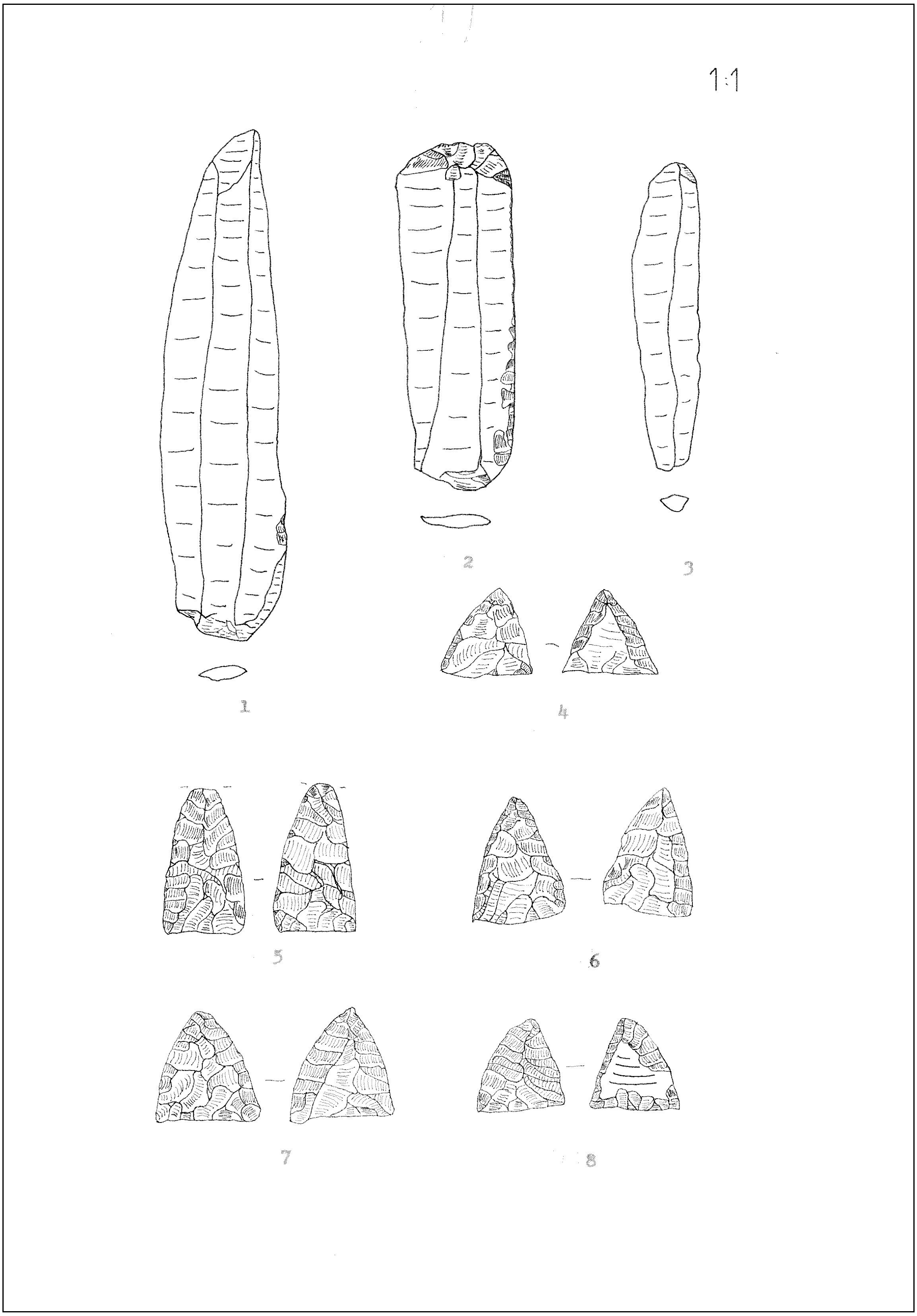

Fig. 6. *Chipped stone tools from Hajdúszoboszló*

ANTHROPOMORPHIC PENDANT FROM VÉRTESSZŐLŐS

JULIANNA KISNÉ CSEH

Keywords: *Vértesszőlős, Middle Bronze Age, bronze jewellery, human figure*

Introduction

Vértesszőlős is a trademark name in Palaeolithic research. The archaeological excavations that started in 1962 and the professional work related to the construction and maintenance of the open-air archaeological site yielded the cognition of several new archaeological sites.

After the death of László Vértes, the curatorial duties of the site and the open-air exhibition were trusted on Viola T. Dobosi, who used to work on the excavations formerly as an assistant of Vértes. Her professional openness and commitment opened the way for several new sites into the 'Vértesszőlős archaeological topography', thus she was personally involved in locating the area of the site yielding the find assemblage presented below.

In the current paper I will present a Middle Bronze Age find assemblage comprising a unique item, found for the first time in Komárom-Esztergom County; altogether, only three analogous specimens have been recovered from the complete territory of the Carpathian Basin (namely, Kölesd-Nagyhangos, Öreglak and Včelínce/Méhi).

The site and the finding circumstances (Fig. 1.)

The site is located immediately to the SW of Vértesszőlős, on the territory lying between the highway Nr. 1. and the Budapest-Győr (Vienna) railroad, on the second terrace of the river Által-ér (**Fig. 1.**). Preventive excavations were conducted here in 2009, under the direction of Gabriella Pál. A preliminary report was published on these works, offering an exact description of the natural endowments and the archaeological research history of the area[1]. In this paper I only want to highlight the archaeological localities in the immediate surroundings of the site; notably, a cemetery attributed to the Transdanubian Incrusted Pottery Culture (in the followings, abbreviated TIPC) lying just to the North of this site, settlements from the Roman period and the Árpád Dynasty period as well as further settlement remains from the Middle Bronze Age, the early phase of the Tumulus Culture and the Árpád Dynasty period, opened on the western side of the main road[2].

The excavations were started by removing the humus layer on the whole project area in the depth of 20-40. The storage area of the humus and the disturbed surface between the excavation units and the humus storage area were constantly monitored by metal detector instruments, resulting in the discovery of numerous metal artefacts, most of them from the Roman period. As a result of the preventive excavations, some 37 Bronze Age features were located, among them, details of the TIPC settlement, mould graves of the Early Tumulus Culture, as well as details of the Roman and the Árpád Dynasty settlement[3].

The bronze pendant presented in the current paper was found as stray find in section IV, within the Early Mould Grave settlement territory, near a Roman building and close to an Árpád Dynasty house.

Description of the pendant (Fig. 2.)

Cast bronze anthropomorphic pendant, with pierced hole for suspension on the 'head' part.
Height: 4.4 cm
Width: 2.5–2.4 – 1.3 cm
Thickness: 0.2 cm
Weight: 6 g

The pendant is worn from use, one of the 'hands', the right side of the rounded bottom and the left margin of the 'head' is slightly injured. The fracture surface is 3 mm. The two sides are not symmetrical, probably due to casting error, same as the different

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[1] PÁL–KISNÉ CSEH 2013.

[2] PÁL–KISNÉ CSEH 2013, 5–9, with further references

[3] PÁL–KISNÉ CSEH 2013, 9–13.

shaping of the 'left hand'. With an eye on the necessary metal analyses, the object was cleaned only with distilled water. On the uneven surface of the object, caused by the casting error, apart from protective natural patina, harmful corrosion products have also appeared. On the high resolution image we can observe both the injuries resulting from finding accidents and the traces of these harmful corrosion products on the uneven surface (***Fig. 2/1–2.***).

The lower part of the cast pendant is formed by an almost regular circle, the breast part is a bit disproportionate, with the arms rising also in an asymmetrical manner: one of them is curved like a hook; the other one is arched and seemingly injured. Suspension was realised by a small circular hole pierced into the oval head-form; its worn status indicates intensive use.

Middle Bronze Age anthropomorphic pendants and representations (Fig. 3–4.)

This object belongs to the class of bronze pendants depicting a stylized human figure. Its variants have been found, as mentioned before, from Öreglak (***Fig. 5/2.***),[4] the Kölesd-Nagyhangos treasure, the inhesion of which is questionable (***Fig. 5/3.***)[5] and the depot of Včelínce/Méhi[6] dated to the Koszider period (***Fig. 5/4.***). István Bóna assigned this type of pendant among the characteristic jewel forms of the TIPC (Tolnanémedi type hoards)[7], and besides the comb-pendants symbolizing male figures, described them as female representations.

The metallurgy of the TIPC was recently summarised by Szilvia Honti and Viktória Kiss.[8] The anthropomorphic pendant motives on the shoulder of an 'urn-shaped vessel' from the Vörs-Papkert site (Grave CXXI, ***Fig. 3/3.***)[9] extended the use of this type from the older phase of the TIPC till the complete existence of this culture. In accordance with Bóna, they consider the use of this pendant by the associated cultic and magical role as an amulet, i.e., a votive object.[10]

The Vértesszőlős specimen is the only piece known from the territory of the North-Transdanubian group of this culture, its best parallel can be found in the Nagyhangos treasure.[11] Anthropomorphic representation, *per se*, is not an alien element in our region among the decorative motifs of the pottery ornaments. We can find them in the early phase of this culture in the decoration elements of the Tokod group, like on the vessel from the Lenhardt-Collection from Dunaalmás coming from a settlement feature[12] (***Fig. 3/1.***), or on two identical cups from Grave 24 in the cemetery Tatabánya-Bánhida, Dinnyeföldek (***Fig. 3/2.***).[13] The Dunaalmás piece is decorated by a human figure constructed from anchor-shape pendant forms running around the waist of the vessel, while on the Tatabánya items we can observe the representation of human hands. Similar decorative ornament can be observed on the small cup of Grave 74 in the Battonya cemetery, imported from TIPC context in its formation phase.[14]

In the classical phase of the TIPC, comb-pendants symbolising male figures appear among the ornamental motifs of funerary pottery, as, for example, on the urns of Tata[15] and Tatabánya (Tatabánya-Bánhida, Dinnyeföldek, Grave 35; ***Fig. 4/1.***). On both of these urns they decorate the shoulder of the vessel in the form of a chain composed of anchor-shaped pendants.

These two kinds of representation appear together by the closing phase of this culture on the Szőny urn dated to the Koszider period (Szőny-Nagymagtár, ***Fig. 4/2 a–b.***).[16] On the basis of the decoration on the shoulder of the vessel, they would be hanging behind the 'hands' on the back side, also on a chain of anchor-pendant.

The collection of anthropomorphic representations, however, is far from complete as yet, even for the comb-shaped pendants,[17] but my purpose here was a summary of stylised human figures. The perfect analogy of the Vértesszőlős pendant was not found among them, only the formation of the upper part resembled that of the Dunaalmás anthropomorphic figure (***Fig. 3/1.***). The representations can take us closer to the style of wearing the pendants: Similar to comb-pendants, the chain composed of anchor-shape pendants was probably decorating the décolletage or the rear-side hanging parts of the coiffure.

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[4] BÓNA 1975, 215, Taf. 172, 8.
[5] BÓNA 1975, Abb. 22/4., Taf. 270, 3–4, 6–7.
[6] FURMÁNEK 1980, 14, Abb. 94/100.
[7] BÓNA 1975, 216, Abb. 22, 3–4.
[8] HONTI–KISS 2000; KISS 2012, 89–150.
[9] HONTI–KISS 1998, XI. tábla 1.
[10] BÓNA 1975, 215; HONTI–KISS 1998, 51.
[11] BÓNA 1975, Abb. 22/4. Taf. 270, 4.
[12] VADÁSZ 1986, 23, VIII. tábla 3.
[13] KISNÉ CSEH 1998, 14.
[14] SZABÓ 19, Abb. 24, Grab 74, 2.
[15] KISNÉ CSEH 2003, 65, IV. tábla 1.
[16] RégFüz 1970, 38; VADÁSZ 1973, 63; KISNÉ CSEH 1999, 45; 2003, XI, tábla, the incrusted ornament of the vessel enhanced by computer graphics.
[17] See e.g. KISNÉ CSEH 2003, X. tábla 3. or KISS 2013, fig. 33.

Summary

The anthropomorphic pendant of Vértesszőlős was unfortunately found as a stray find on a locality that was identified as a settlement of the TIPC and the cemetery of the Early Tumulus Culture starting in the Koszider period, thus its exact assignment is uncertain. Its use was documented from the earliest phase of the TIPC (Vörs vessel)[18] till the classical phase of the culture (find assemblage of the Öreglak cemetery) and, provided that we accept its relation with the comb-pendant (as its female equivalent), on the basis of decorative representations we can suppose that its use extended over the Koszider period as well.

Similar to comb-pendants, the representations are known from funerary pottery,[19] corroborating its votive character. This is not contradicted by the fact that they may have served as parts of the attire,[20] as both the pendant and its representations are very rare, denoting a special or directly cultic role of the bearer and its wear.

As a stray find it will not elucidate for us the questions arising from the Nagyhangos hoard or the Včelínce/Méhi treasure dated to the Koszider period,[21] but it can offer a new example for the distribution of this specific type of jewellery (***Fig. 5.***).[22]

[18] HONTI–KISS 1998, 51, XI. tábla 1.

[19] With the exception of the Dunaalmás cup, found on a settlement, but the vessel could serve similar purpose.

[20] KOVÁCS 1986, discarding the use of the comb-pendant as amulet or votive object on statuettes from the Lower Danube as they do not conform to elements of attire.

[21] MOZSOLICS 1967, 151–152; BÓNA 1975; FURMÁNEK 1980, 15. The author shares the opinion expressed, i.e., that the pendant might have been kept for the sake of its bronze raw material as well: HONTI–KISS 1988, 91. ff.; HONTI–KISS 2000, 87, KISS 2000, 21; KISS 2013, 107.

[22] Photos were made by István Dallos, drawings by Gábor Tokai. The author wants to thank both of them here, too.

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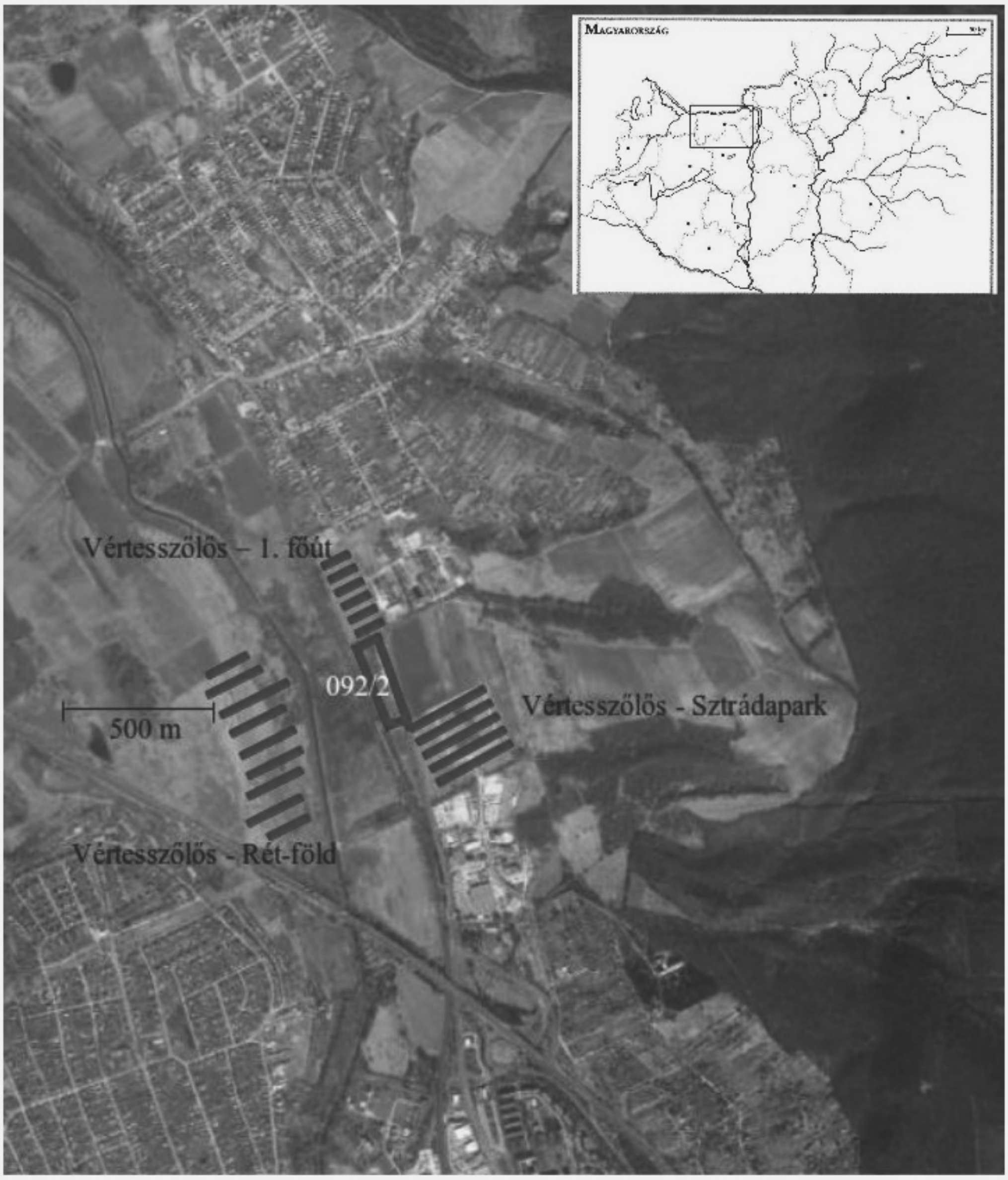

Fig. 1. *Geographical location of the site Vértesszőlős 92/2*

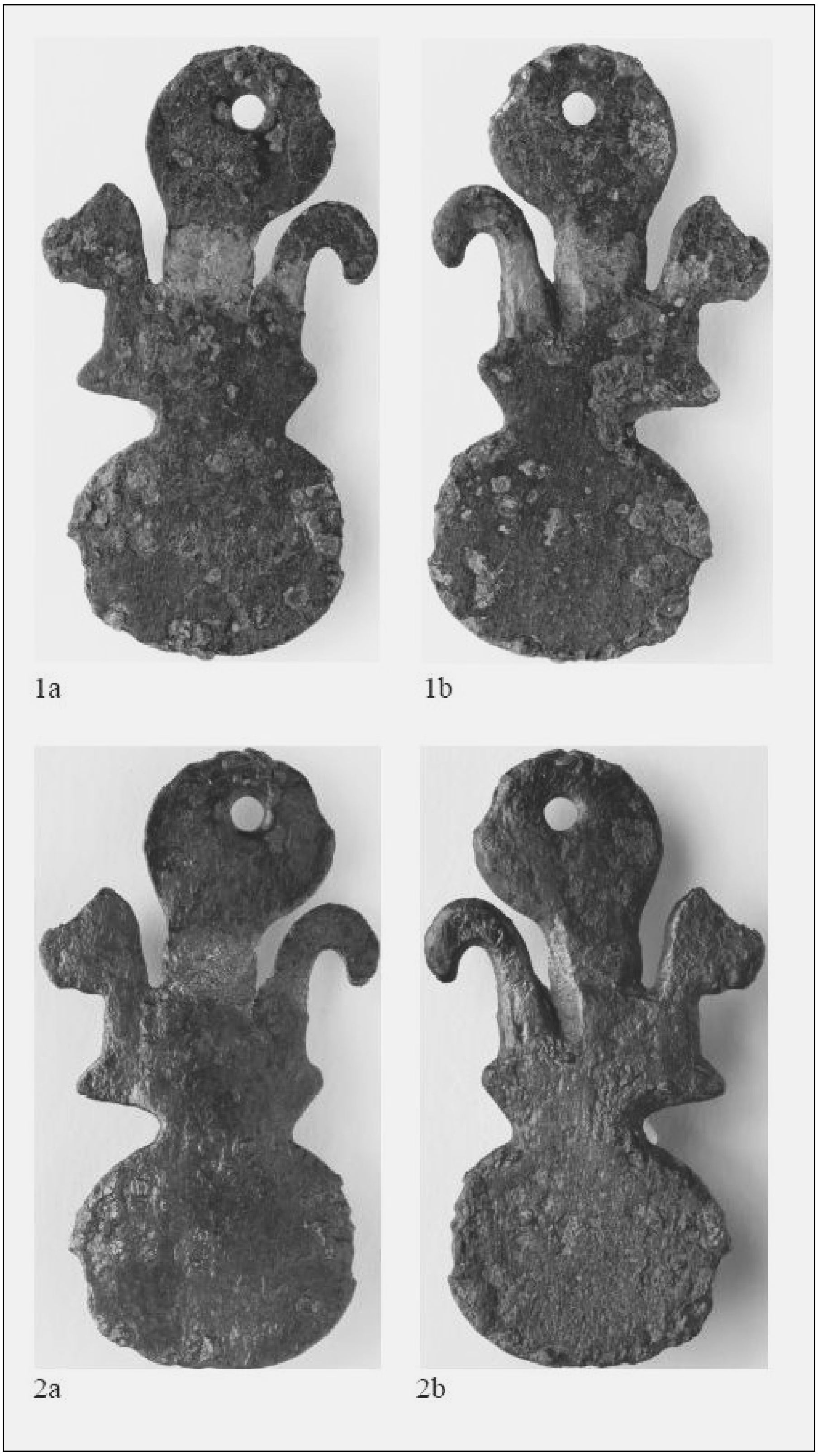

Fig. 2. *Anthropomorphic pendant from Vértesszőlős, before and after cleaning in distilled water*

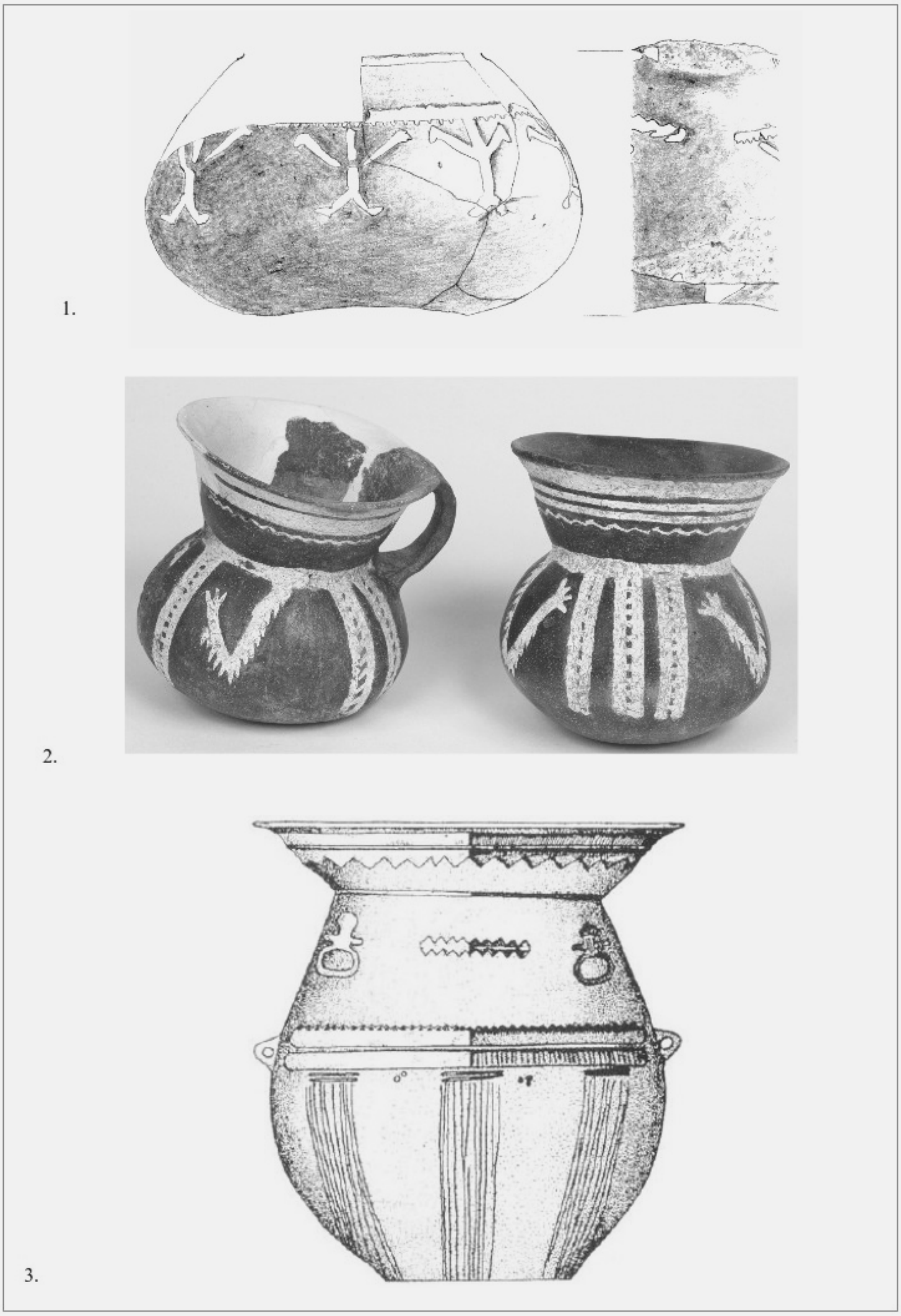

Fig. 3. *1 – Tokod type cup from Dunaalmás (L 68, VADÁSZ 1986, 23.) 2 – Tokod type cups, Tatabánya-Bánhida, Dinnyeföldek site, Grave 24./3. Vörs-Papkert site, urn-form vessel from Grave CXXI. (HONTI–KISS 1998, XI. tábla 1.)*

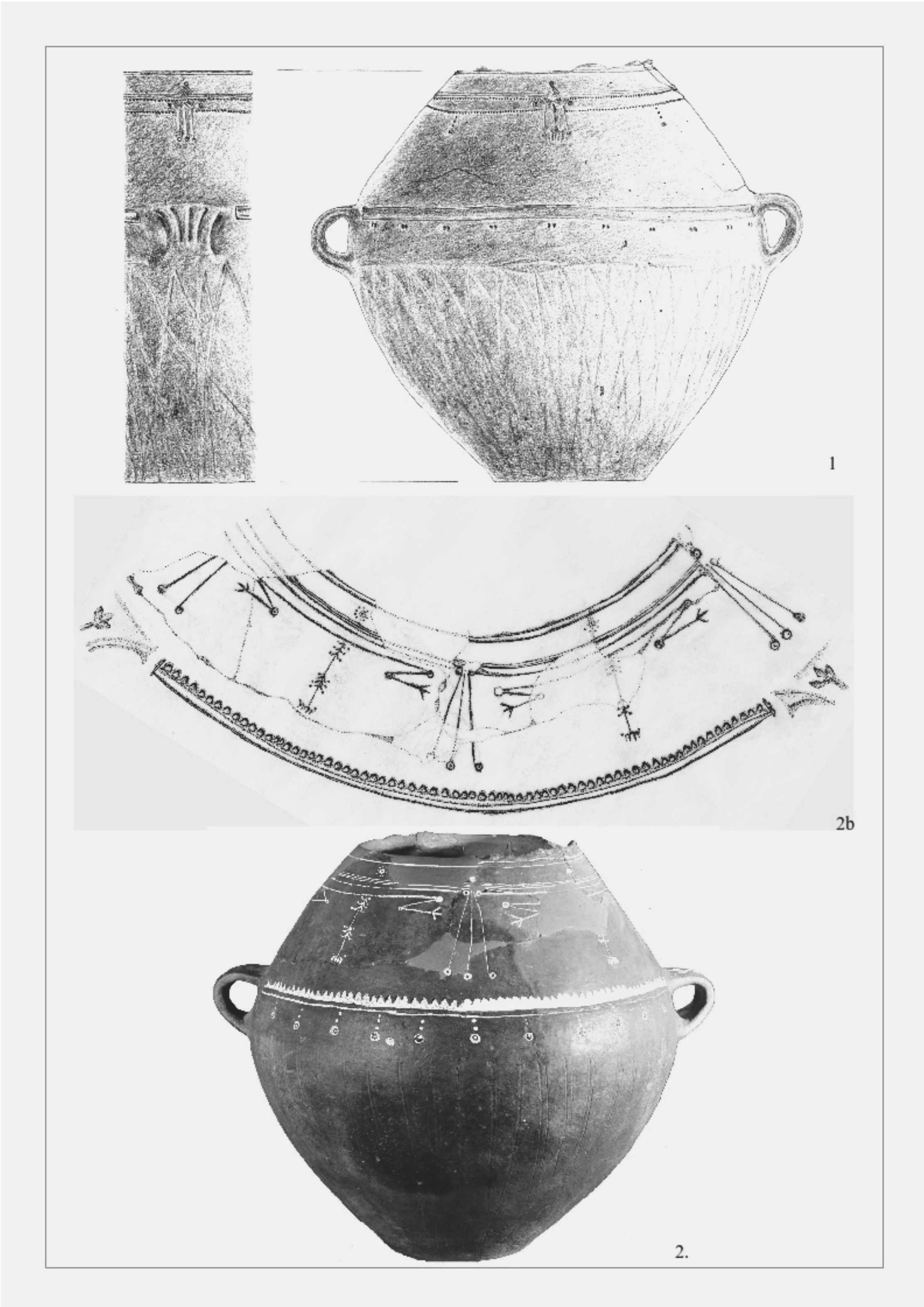

Fig. 4. *1 – Urn from Tatabánya-Bánhida, Dinnyeföldek site, Grave 35. (*CSEH *1999, II. tábla 3.) 2 – Urn from Szőny-Nagymagtár site (*CSEH *2003, XI. tábla 1.)*

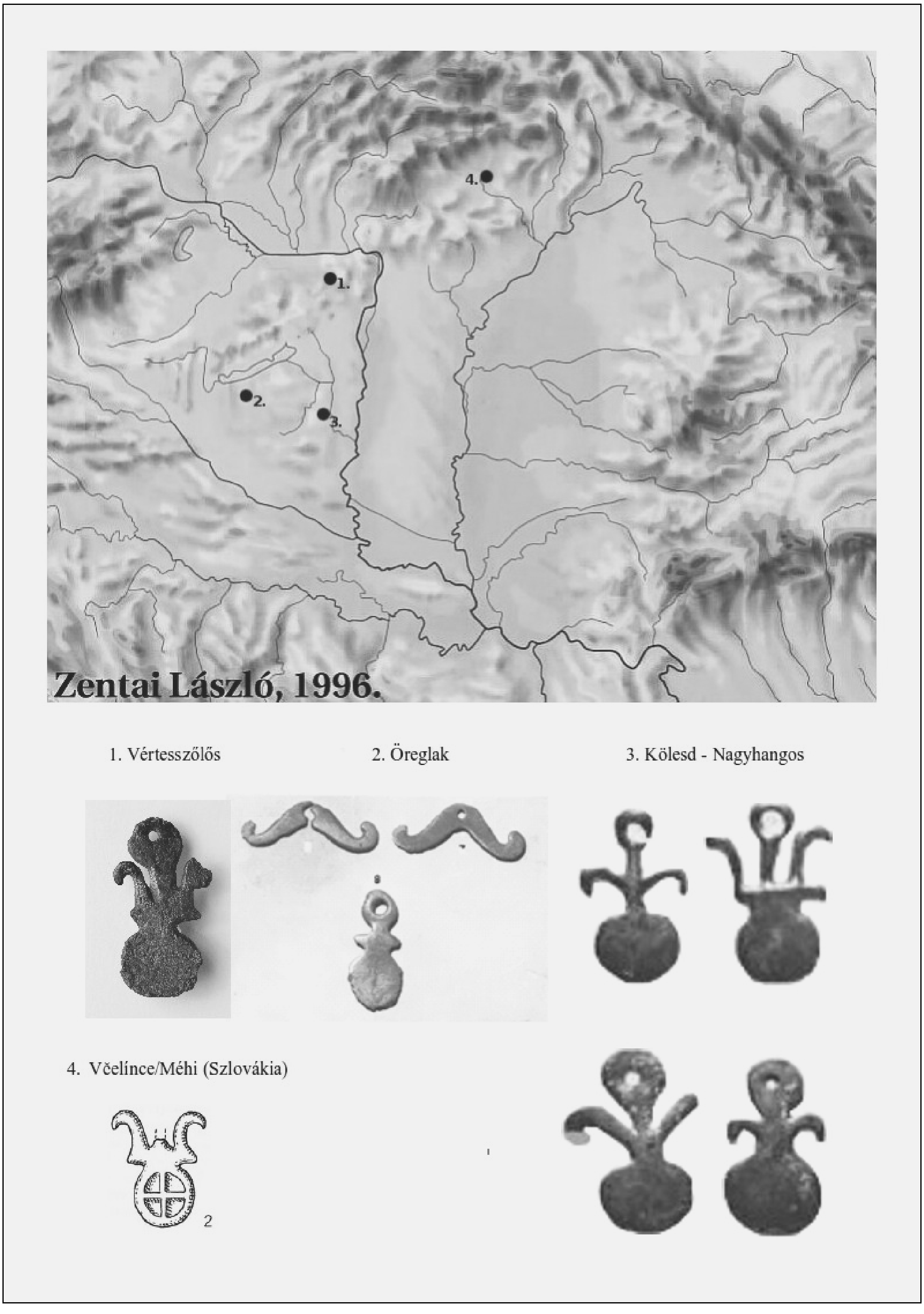

Fig. 5. *Distribution of anthropomorphic pendants (2.* BONA *1975, Taf. 172. 8; 3.*BONA *1975, Abb. 22, 4.)*

The 'Raven Deity' – an interpretation of a Celtic coin from Transdanubia

Melinda Torbágyi

Keywords: *Celtic coinage, religion*

I was deliberating for quite a long time on what I should write as a numismatist to honour my dear prehistorian colleague's soon to be published book. There are stone money – meaning the pieces from the Yap islands – but those cannot be connected either to the Stone Ages or to the scope of numismatics.[1] Coins or other objects made of metals did not exist in those times that Viola researches. Moreover the concept of money was also unknown in the world of prehistoric man, yet certain forms of barter probably had taken place back then. Eventually I came to the idea for this writing below incidentally. Another colleague of mine, András Dabasi, a photographer became very interested in a Celtic coin that depicted – quoting his exact words here – a "fox-headed woman" and just for the sake of it (*l'art pour l'art*) has made a beautiful blow up print of it. (***Fig. 1.***) This has kick-started my fantasy also; after all, this beautiful coin awakened the interest of an outsider too; maybe it could be worth to contemplate on the subject of it.

Fig. 1. *Raven-deity" on the reverse of Mászlonypuszta type*

Fig. 2. *Mászlonypuszta type, Dess. 1179*

This coin (***Fig. 2.***) is known as the *Mászlonypuszta or Nagyhörcsökpuszta*[2] type named after the find spot where a hoard of such coins was found or under a fantasy name, *"Zopfreiter"* – after the particularities of the image on the reverse – which was given to it by Pink, who published the first complete monograph on eastern-Celtic coinage.[3] The type that served as a prototype for the majority of Celtic coins found in Hungary was the silver tetradrachm of the Macedonian king Philipp II (358-336 BC.) with the bearded, laureate head of Zeus on the obverse and an image of a horseman on the reverse. This design sees through the Celtic coinage of the area from the beginnings around the Third Century BC[4] until about the middle-third of First Century BC,

[1] *A pénz története (The history of money)* 1999, 204. These sometimes 4 meters in diameter "stone coins" were used by the Micronesian at the time the first Europeans arrived there in the Nineteenth Century. The stones were mined in the limestone quarries of Palau Island, 400 miles away.

[2] Gohl 1915; Gohl 1907, 60–61 where he mentions the 20-25 coins found in Mászlonypuszta, north from Ó-Dombóvár, and 4 coins from (Sió)agárd.

[3] Pink 1939.

[4] Bíróné Sey 1972; Szabó 1983 – The only Celtic coin hoard which came to light in Egyházasdengeleg where the ceramic vessel was also found. The date of the vessel and the analogies

when the Roman influence prevailed more and more in the coinage of peoples living in the Carpathian Basin until the Eraviscs started to mint their coins after purely Roman design and standard.[5] Between these endpoints there were several different types and versions in circulation, the exact chronology is not thoroughly known yet; their dating is based mostly on typology and metrology, because our area is lacking in well-dated coin finds. The Celtic coins, however, were found either in hoards or as single finds without any other coins or objects much better or exact to date. In the area of Hungary no Celtic coins were unearthed from graves or from any settlements in datable context.

Fig. 3. *Celtic tetradrachm, in west of Danube, Pink 446*

Fig. 4. *Celtic tetradrachm, Northeastern Carpathian basin, Pink 320*

The dating of the *Mászlonypuszta* type without any firm chronological base is tied to the Norico-Taurisc types. The first one to elaborate on the subject of Norican coinage was Karl Pink[6] who dated the entire coinage to the First century BC. In his opinion the Celtic coinage started after the fall of the Macedonian Kingdom in 168 BC to replace the Macedonian coins ceased by then, and by his method he dated the first Norican coinage to the 90's BC. The essence of his method was to establish a line of deterioration, the more a Celtic coin type differs in design and in weight from the prototype or minted far away from the home of the original Greek coins the later it was produced. Pink's chronology was heavily debated right from its beginning, especially by archaeologists and some numismatists, as well. Mostly the Romanians, because on the Balkans were a few Celtic hoards that were dated to be much older by the Greek coins which came to light with them.[7] Preda in 1973 published his great work that dates the entire eastern-Celtic coinage to be about a hundred years older.[8] In 1977, Le Rider's monograph was published about Philipp II's coinage[9] that pulled the rug from under Pink's chronology. It was proven without a doubt that the Philipp's coins were not minted until 168 BC - neither the tetradrachms, nor the gold coins that served as a model for parts of the western-Celtic coinage. Their issue had ceased much earlier: the gold coins around 315 BC, the tetradrachms in the 290's BC, even their circulation did not last beyond the middle of the third century BC.[10] The reconsideration of chronology, which essentially ran its course in the 1980's, was not applied to the Norican's. After Pink Robert Göbl, an erudite scholar who was regarded as an undisputed expert not only in his home country Austria but also in the international numismatics firmly held onto the idea of First century BC dating.[11] He recognized the technique of recutting and repairing in the preparation of the dies, and in the light of these facts he considered some groups of coins contemporaries that Pink regarded as successors, because of the use of common dies. On the base of Göbl's observation Pink's chronology became at least about twenty years shorter. To establish an absolute chronology, there was a very promising source for him, which he used as a fix-point to date the entire Norico-Taurisc coinage. On one of the early Norican-type coins, the *Kugelreiter*, there is a lettering that reads: V.O.K.K. Some researchers identify this name as of *Voccio,* king of Noricum*,* whose sister was married to the German king *Ariovistus.* In 58 BC Voccio was already Caesar's ally who was in turn an enemy of Ariovistus. In 49 BC Voccio sent 300 cavalries to aid Caesar's civil war against Pompeius.[12] Yet another strong point was the connection between the Norican Latin lettered coins and the Boii large silver coins, hexadrachms. (Their occurrence in common hoards.) To determine the date of the Boii large silver coins, the starting point was indicated by the Roman denar of Q. Fufienus Kalenus and Mucius Cordus with a double portrait issued in 70 BC[13] that was the prototype of Biatec type coin. Based on the die-links and the supposition of the continuous and uninterrupted minting of the Boii hexadrachms Göbl ascertained that the entire Norico-Taurisc coinage cannot be dated earlier than the 70's BC. The minting began on the Taurisc territory and the Norican

of the coins date the hoard to the last third of the third century BC.

[5] TORBÁGYI 1984; HAUPT–NICK 1997; PLACHÁ–FIALA 1998; TORBÁGYI 2003.

[6] PINK 1937.

[7] PREDA 1966; HUNTER 1967; PREDA 1970.

[8] PREDA 1973.

[9] LE RIDER 1977.

[10] TORBÁGYI 1991.

[11] GÖBL 1973.

[12] *Iulius Caesar's chronicles of the Gaul campaign, 53, 4*; ALFÖLDY 1974, 40–41.

[13] CRAWFORD 1974, Nr. 403/1.

followed it a few years later.[14] Göbl alluded shortly the related and the neighbouring coinages in Western-Hungary, as well that could not be dated to earlier than the first century BC, not even the earliest, the *Kroisbach* type. As a consequence, there must have been an almost one hundred year gap between the earliest and latest groups of Transdanubian coinages.[15] The majority of researchers felt that there is something amiss here, but all efforts to an earlier dating of the Norico-Taurisc coinage remained unfounded without reliable evidences.[16]

Fig. 5. *Bird-rider type, Pink 340*

Then came a **lucky break**: a new hoard was found in northern Italy in the fall of 1998 in Enemonzo. The find contained 40 pieces of Norican *Kugelreiter* type tetradrachms (*Göbl C2*) and Roman Republican *victoriatii* in a bronze vessel. This hoard can be dated to the Second Century BC based on Roman coins issued between 211-170 BC and the bronze_situla that was not in use in the First Century BC. Gorini, who published the find, dated the tetradrachms between 160-130 BC.[17] Since the tetradrachms of this find do not represented the earliest phase of the type the beginning of minting the *Kugelreiter* type can be dated at least to the first half of the Second Century BC. This northern Italian find and another from the river-bed of Ljubljanica River[18] revolutionized the dating of the Norico-Taurisc and related coinages.[19] In the light of this newly established chronology the *Mászlonypuszta* type coins can be dated much earlier, in the middle of the Second Century.[20]

Fig. 6. *"Boii drachm", reverse, from Tótfalu hoard, Pink 525*

The *Mászlonypuszta* type - let's stick to this name from now on - is a strongly stylized version of the *philippeus* imitations commonly used in the Carpathian Basin. Naturalism is not a trait generally seen in Celtic arts. The designs of the imitated Greek coins were soon modified, disintegrated, broken up into fragments and then the pieces were reintegrated according to their own ideas. Although Celts living in the Carpathian Basin did not create such fantastic masterpieces as their kins in Gallia or the British Isles, yet Celtization of coins was evident here too. The hairstyle of the horseman on the reverse (***Fig. 3.***), the torques ***(Fig. 4.)*** or the bird-sceptre in his hand (***Fig. 5.***), certain motifs such as the triskeles, wheel with spokes (***Fig. 6.***) are inherently Celtic, are appearing early on the coins. Often the figure of the horseman seems insignificant, and e.g. the helmet is much more dominant. (***Fig. 7.***) The rider on the reverse is only a disproportionately large head growing out from a torso. ***(Fig. 8.)*** Instead of horseman there are other motifs: a flower shaped lyra ***(Fig. 9.)*** sun-wheel, S-shape or a bird. Sometimes Zeus head on the obverse was transformed into a wreath. (***Fig. 10.***), or a tiny face appears under a large wreath (***Fig. 11.***). On the *Mászlonypuszta* coins the Zeus head is still recognizable but unlike on Macedonian coins he looks to the left and almost entirely fills out the available space of the flan. The hair-locks, the laurel-wreath and the beard encircle the face that consists of a nose forming a vertical rhomboid with an almond-shape eye in it. Even more interesting is the horseman on the reverse. He also looks to the left unlike the *philippeus* riders. In this case, the model was probably another Greek coin, *Patraos* Paion king's (340-315 BC) tetradrachm (***Fig. 12.***), with a helmeted horseman on the reverse. This figure was transformed to the manner of the Celtic engraver on the *Mászlonypuszta* coin. The design of the horse with strongly formed muscles on its breast indicates the Taurisc influence, and it is a fact that our coins were stamped over on *Varasdin* type. The shape of the horseman is very peculiar, a naked figure with exaggerated breasts – maybe a woman (?) – with a strange, horned helmet, and a braid hanging out from under the helmet (hence the "*Zopfreiter"* name). On the coins that are in good condition – namely not minted with a worn stamp – can be seen well that the figure has a birdlike face or mask. Even from the outlined shapes it is evident that we are not talking about an eagle or waterfowl often

[14] GÖBL 1994.
[15] TORBÁGYI 2000.
[16] ALLEN 1980, 49; KOS 1986, 22; DEMBSKI 1998, 37; TORBÁGYI 1999; DEMBSKI 1998a, 202.
[17] GORINI 2005; 2009.
[18] KOS–ŠEMROV 2003.
[19] There were several studies on the subject of the refinement and revision of chronology. KOS 2004; GORINI 2004; KOS 2007; GORINI 2008; TORBÁGYI 2011.
[20] The theory of this dating is supported the most by the over-strikes. Eight of the coins in the *Nagyhörcsökpuszta* find were definitely minted on *Varasdin* type, which dates back to the first half of the 2nd century BC, according to Gorini's chronology (see: *note 17*).

Fig. 7. *Kapostal-type drachm, reverse, Cf. Dess.243*

Fig. 8. *Kroisbacher type, reverse, Dess. 106*

Fig. 9. *Lyre type, reverse, Pink 396*

Fig. 10. *"Boii drachm", obverse, from Tótfalu hoard, Pink 535*

Fig. 11. *"Boii drachm", obverse, from Tótfalu hoard, Pink 525*

Fig. 12. *Patraos tetradrachm, reverse, Sear 1520*

seen in Celtic depictions. The third possibility is a raven or a crow both regarded as holy birds by Celts.From the first look it reminded me of a bird head- shaped amulet or a buckle from Cserepeskenéz.[21] (***Fig. 13.***) That object was found among the unfortunately scattered remains of a grave belonging to a Celtic warrior.[22] In Celtic mythology the raven often appears. It is one of the animals accompanying Lugus, one of the most respected gods in Gallia. In ancient Roman times he was identified with *Mercurius. "Of the gods, (the Gauls) most worship Mercury. They have many images of him, and regard him as the inventor of all the arts, they consider him the guide of their journeys and marches, and believe him to have a great influence over the acquisition of gain and mercantile transactions." (Caes. b.Gall. 6, 17, 1)* In Caesar's Gallia – at least to an outside observer – these were Lugus's most remarkable_features. The Celts did not have a written history, their customs and myths are only known from Roman and Greek authors who could easily misunderstand or misinterpret things according to their own beliefs. The antique authors obviously simplified the world of Celtic gods to a great extent and tried to fit them in their pantheons (*interpretation romana*) and merge into their own gods. From Roman times approximately 400 Celtic gods are known by name[23] – the majority of those names were featured only once on an inscription - indicating that the Celts did not have a well-constructed mythology like the Greeks or the Romans. They could have worshipped basically the same or similar gods under different names. Those names survived and became epithets for Roman gods in different sites. About a thousand years later Irish sources – now in Christian interpretation – mentioned the ancient Celtic gods and myths. According to those sources, *Lugh* could have been the equivalent of the Gaul *Lugus,* who preserved more of the essence of a Celtic god than the Romanised *Lugus. Lugh* in the Irish legends is the god of all trades, arts (*samildánach*) but at the same time he is the divine warlord as well. Maybe this warlike aspect of a Celtic god – whatever his name is – was more important for the eastern Celts in the third and second centuries BC than his other features. The well- known Celtic coin type, the *"bird rider"* on which the rider is depicted holding a pole with a bird sitting on it, perhaps a military signum,[24] can be also *Lugus/Lugh* or some similar god who leads the warriors into battle. His widespread cult is indicated by the names of cities

[21] Jósa András Museum Nyíregyháza; I thank the Museum, first and foremost dr. Eszter Istvánovits, who provided me with the photographs.

[22] MAKKAY 1958.

[23] NEUE PAULY 12/1.

[24] DEMBSKI 1998, Nos. 1266–1270.

derived from the name Lugus such as: Lugdunum/Lyon, Laon in France, Leiden in the Netherlands and Leignitz in Silesia. Augustus designated Lugdunum to be the capital of Gallia, where on the first day of August every year Lugus's feast was held; the Irish until this day are holding *Lughnasadh* that means *"commemoration of Lugh"* on the same day.[25]

Fig. 13. *"Amulet" from Cserepeskenéz*

The raven or the crow can be associated with other Celtic deities. The rider on the *Mászlonypuszta* coin can be a woman. The Irish-Celtic myths are featuring goddesses of war too, among them *Badhbh* is the Crow/Raven who appears in the company of *Morríghan* (Phantom Queen) and/or *Nemhain* or *Macha.* These goddesses are sometimes identified as being the same; maybe they are the same goddess in three different identities. The occasional references to the three *Morrighans* seem to support this idea. The goddesses are constant shape-changers, often appearing on the battlefield in a form of a grayback crow.[26]

In any case, no matter how the deity on the coins is called, the raven is definitely associated with war and warriors, which explains the presence of the raven-amulet among the funerary goods in the warrior's grave in *Cserepeskenéz*. It is possible that the Celtic silver tetradrachms were issued in connection with some warlike event, thus the depictions may commemorate a successful battle, military campaign or raid. The warlord, king or the leader – it is still unclear who the issuers of particular coins were – of the campaign used parts of the spoils for minting coins; that way it was easier to divide it among the warriors. The large silver coins of the period were mostly occasionally issued, not continuously. Their primary purpose was not to meet demand of trade and regular circulation. The Transdanubian coin types from the end of the third century BC onward – like the *Mászlonypuszta* coins – were unearthed mostly in one or two larger hoards, generally in hardly worn condition. Even if the coins are in worn state of preservation it is not a consequence of their lengthy circulation but the condition of the dies. Among the exemplars of *Nagyhörcsökpuszta* hoard were several overstrike, the foreign coins were simply used as a flan on which they stamped their own motifs. This process indicates that it was important for the issuer to distinguish own coins from the other issuer's one, and the coins did not exclusively represent weighed precious metal. Shaping the patterns and creating the motifs may have depended on the creativity of the engraver, who recreated and interpreted the traditional horseman-figure according to his own idea and belief.

The iconography of Celtic coins certainly remains a field to further explore for religion historians, researchers of myths and legends, even if it seems highly dubious whether the Celtic mythology of the La Tène era can ever be fully reconstructed.

[25] MAC CANA 1993 24–25.
[26] MAC CANA 1993, 87.

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Abbreviation

Dess Gróf Dessewffy Miklós barbár pénzei. Budapest 1910.

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'…DER FEUERSCHLÄGER'

ÉVA GARAM

Segnet so den ersten Mut in Menschen,
Mut des urzeitlichen Feuerschlägers,
Der da sah auf seine erste Flamme
Mit dem Blick des beutesichren Jägers
(Endre Ady, Übersetzung von Heinz Kahlau)

Stichwörter: *Rolle des Feuers, Arten des Feuermachens, Feuerungszubehör, Feuermachen bei den Awaren*

Einleitung

In der Menschheitsgeschichte spielt das Feuer eine grundlegende Rolle. Ohne Feuer müssten wir nicht nur auf die wohltuende Wärme und die geschmackvollen Speisen verzichten, sodern auch auf zahllose Produkte des Handwerks und Gewerbes. Ohne Feuer kein Schmieden, Brennen von Gefäßen, keine Helligkeit, ja nicht einmal Totenverbrennung, aber das Feuer lässt sich auch als Signalgeber und als Waffe verwenden, und mit ihm kann das Erz aus den Gesteinen gewonnen werden. Das für den Menschen so wichtige Feuer hat auch im geistigen Leben einen hervorragenden Platz. Seine Stellung und Wichtigkeit wurden vor allem von Grundlagen bestimmt, die sich aus empirischen Beobachtungen ergaben. Sie beruhten auf den kennengelernten Fähigkeiten des Feuers: es kann die Speise schmackhafter, das Kalte warm, das Dunkle hell, den Ton hart machen, das Erz zum Schmelzen bringen, das Metall schmiedefähig machen und sogar helfen, Abfälle zu vernichten.[1] Die dokumentierte Rolle der Schöpfer und Förderer des Feuers kennen wir seit der griechischen Mythologie, es genügt, an die Taten und Legenden von Hephaistos, Zeus und Prometheus zu denken.[2]

Der heutige Mensch ist so sehr von der vielseitigen Erscheinungsform der Energie abhängig, dass er das langsam aus unserem Leben verdrängte, bis in die nahe Vergangenheit allgemein bekannte und genutzte elementare und gemeinschaftsbildende Erlebnis des offenen Feuers vergisst. Um dieses wiederzubeleben, beschäftigen sich zunehmend mehr Bücher, Lexika, Internetportale und Ausstellungen mit der Rolle des Feuers, indem sie die fast in Vergessenheit geratenden Varianten des Feueranzündens schildern und das seit Jahrhunderten und Jahrtausenden verwendeteWerkzeug des Feuermachens darstellen.[3]

Das Feuer hat der Mensch seit Urzeiten gekannt. Infolge von Blitzschlägen brannten das Schilf und der Wald. Die lange glühenden Baumstämme spendeten Wärme, Licht und hielten wilde Tiere fern, deshalb speiste und bewahrte man das entstandene Feuer. Auf die Bewahrung des Feuers, einen spezifischen Typ dessen, wurde László Vértes aufmerksam, der Ausgräber eines altpaläolithischen Fundortes, der Siedlung von Vértesszőlős in Ungarn. Seine Beobachtungen und Feststellungen mit der zum Thema gehörenden früheren Literatur fasste Viola T. Dobosi in ihrer Studie '*Tűzhelyek Vértesszőlősön*' (Feuerstellen in Vértesszőlős) zusammen. Demnach konnte der Vorzeitmensch das Feuer wahrscheinlich noch nicht anzünden, war aber fähig, es zu bewahren. Auf den oberflächlichen Feuerstellen mit 30−40 cm Durchmesser von Vértesszőlős wurde das vom Himmel 'erhaltene' Feuer zuerst mit Holz angefacht, erhöht und dann mit zerkleinerten Tierknochen

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[1] HANDWÖRTERBUCH 1987, 1390.
[2] PAULY ENZYKLOPÄDIE 1995, 498−502.
[3] Ein bis zwei für das Thema wichtigere mit umfassender Literatur versehene seien erwähnt: BÁTKY et al. 1941−43, 71−77; MNL 5, 1982; REALLEXIKON 8 1991, 402−410; HÁLA 1995, 214−245; HEISS 2004−2005, 5.

strahlenförmig bedeckt. Das Knochenfeuer wird man – dem Experiment von L. Vértes gemäß – mit Erde bedeckt haben, unter der das Holz zu Asche verbrannte, d. h. keine Holzkohle übrigblieb, wogegen die Knochen tagelang noch glühten, also das Feuer wieder entfacht werden konnte. Ein solches Knochenfeuer beanspruchte wenig Zuwendung, war aber ein großer Schritt hin zur 'Domestizierung' des Feuers.[4]

In der Beziehung des Feuers und des Menschen war der nächste entscheidende Schritt die Fähigkeit, selbst Feuer zu machen und zu schüren. Wann genau das geschah, wissen wir nicht, aber es war gewiss das Ergebnis gemeinsamer Erfahrung und Wissensanhäufung von Generationen.

Für das Hervorbringen von Feuer, das Erzeugen des Funkens gibt es unterschiedliche Möglichkeiten: Reiben oder Schlagen mit Verwendung von in der Natur vorgefundenen Materialien bzw. das Zum-Glühen-Bringen und Entflammen leicht brennbarer Stoffe durch Fokussieren oder Sammeln von Sonnenstrahlen.

Eine uralte Art ist das *Reiben*, mit dessen Wärme man Funken erzeugen kann. Allgemein steckt man zwischen zwei zusammengebundene, leicht brennende Holzstücke ein Holzstäbchen, durch dessen schnelle Reibungsbewegung das im Holz vorhandene brennbare Material Funken hervorbringt und dann in oben beschriebener Weise zur Flamme entfacht wird.

Zum *Schlagen* war in der Natur zu findendes hartes Gestein, Pyrit oder Markasit, am besten geeignet. Beim kräftigen Zusammenstoßen zweier Stücke entsteht ein Funken, und wenn dieser in einem leicht entzündlichen organischen Material aufgefangen und schwach angeblasen wird, wobei man schnell aufglühende, trockene flanzliche Fasern oder Blätter daranhält, flammen sie auf, und das Feuer brennt. (Nach Kenntnisnahme des Eisens ersetzte man den einen Stein durch einen geschmiedeten Stahl guter Qualität.)

Das Stärken, Nachlegen und Bewahren des brennenden Feuers war eine schon leichtere, aber Ausdauer, Aufmerksamkeit und Vorsicht erfordernde Aufgabe. Zum Beispiel hatten in der römischen Religion jene, denen man das Feuer anvertraute, herausragende Funktion und ehrenhafte Aufgabe. Die Vestalinnen, die in Kontakt mit den Göttern standen, bewahrten das Feuer, damit es ewig brenne.[5] Das Feuer durfte selbst noch in den neuzeitlichen ungarischen Höfen nicht ausgehen, höchstens vor dem jährlichen feierlichen Feueranzünden zu Ostern. Die Glut wurde nach der Verwendung des Feuers mit Asche bedeckt, damit es später wieder angefacht werden könne.

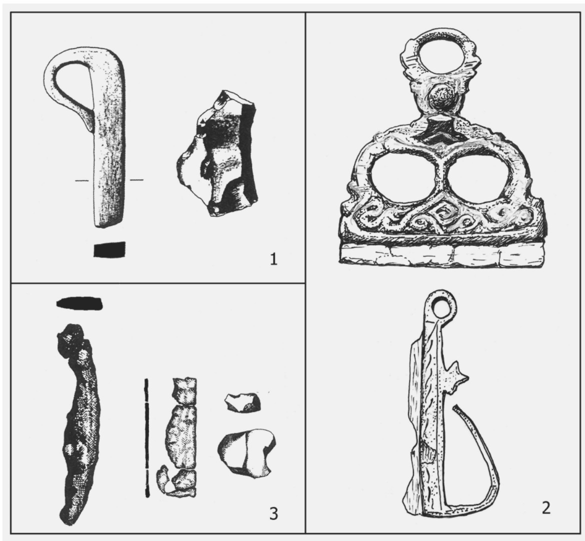

Abb. 1. *La Tène- und römerzeitliches Werkzeug zum Feueranzünden. 1: La Téne: Herze brock-Carlholz Gr. F 26;* 2: Römerzeit: aus dem Bestand ausländischer Privatsammlungen; 3: spätrömische Zeit: Solva/Esztergom 48, Gr. 270 und 221

Kurze Werkzeuggeschichte des Feuermachens

Die urältesten Pyrit- (Eisenkies-, Schwefeleisenerz-) Fundstellen sind aus dem *Jungpaläolithikum* bekannt. Eisenkies war ein Mittel des Feuermachens, sein Vorkommen in dieser Qualität war im Laufe der Urzeit häufiger als später kombiniert mit dem Feuerschlageisen.[6] Pyrit wird im *Neolitikum*ban und auch in der *Bronzezeitkor*ban verwendet, aber auch bearbeitet, z. B. als Lanzenspitze. Auch das zwischen zwei Hirschgeweihsprossen eingeklemmte Schwefeleisenerz kann als Feuerschlageisen interpretiert werden.[7]

Die für das Funkenschlagen geeigneten Steine und zum Reiben gut brauchbaren innen weichen Hölzer kennend, nutzte man die einfacheren Formen des Feuermachens seit dem Paläolithikum und verwendete sie im Laufe der Urzeit verbreitet. Bei den *Skythen*, z. B. in zahlreichen Skythengräbern in der Großen Ungarischen Tiefebene, finden sich die kleineren Feuersteine, die als Mittel zum Feuermachen dienten.[8]

Die Mittel zum Feuerschlagen erweiterten sich, nachdem man das Eisenerz kennengelernt hatte. Das aus Eisen gefertigte Feuerschlageisen, der sog. Stahl, taucht in der *La-Tène-Zeit* auf; die Kelten benutzen

[4] KRETZOI–T. DOBOSI (eds.) 1990, 519–521; T. DOBOSI 2006, 1–7.
[5] PAULY ENZYKLOPÄDIE 1995, 501.
[6] MÜLLER 1994, 192.
[7] STEUER 1991, 402.
[8] KEMENCZEI 2009, 95.

ihn, wenn auch nicht allgemein. Man schmiedete die 10−12 cm langen einsohligen Stähle, an deren oberem Ende durch Ausdünnen eine Schlaufe zum Aufhängen geschaffen wurde ***(Abb. 1.1)***.[9] Unter den *keltischen* Funden in Ungarn ist das Werkzeug zum Feuerschlagen sehr selten, und auch dann allgemein nur Feuerstein.[10]

In der *römischen Kaiserzeit* ist der Werkzeugsatz zum Feuermachen aus Stahl, Feuerstein und Zunder selten.

Bei den Griechen, Römern und sogar auch noch den frühen Germanen war das Feueranzünden mittels Aneinanderreiben zweier Hölzer verbreiteter. Einen Holzstock presste man senkrecht auf eine hölzerne Grundlage, zwischen dem Ende des in beiden Handflächen schnell hin und her gedrehten Stockes und einer Vertiefung in der Holzplatte kam durch die Hitze des Drehens ein Funken zustande, den man mit einem leicht entzündlichen Material auffing und dann zur Flamme entfachte. Das so entstandene Feuer hütete man.[11]

Das Metallwerkzeug zum Feueranzünden wurde – obwohl man die uralten Varianten jahrtausendelang, fast bis heute kannte und verwendete – in spätrömischer Zeit häufiger, findet sich aber auch da nur in 6−8% der Männergräber. Im Gräberfeld des einstigen Solva (Esztergom) beispielsweise lagen Feuerschlageisen und Feuerstein oder nur dieser in 8 Gräbern von 330. Die römerzeitlichen Feuerschlageisen hatten entweder oben eine Aufhängeschlaufe wie bei den Kelten oder waren länglich mit breiter gebogener Sohle,[12] einzelne Stücke waren individuell verziert ***(Abb. 1.2−3)***.

Im römerzeitlichen Barbaricum finden sich auch bei den *Sarmaten* Feuerschlageisen mit oberer Öse germanischen Typs, dies ist die allgemeine Form,[13] doch verwendete man auch kleine rechteckige oder quadratische dicke Eisenplatten oder solche mit gewölbtem Rücken als Feuerschlageisen. Die Feuerschlaggarnitur wurde in einer Tasche getragen, meist zusammen mit Eisenahlen und römischen Münzen.[14]

In den Gräberfeldern des Karpatenbeckens mit größerer Grabzahl im Frühmittelalter bieten sich weitergehende Möglichkeiten der Beobachtungen des Feuermachens und seiner Hilfsmittel. Während man in spätrömischer Zeit – zwar selten − auch bei Frauen und Kindern Geräte zum Feueranzünden findet,[15] zeigt das allgemeine frühmittelalterliche Bild in ganz Europa etwas anderes: Der überwiegende Teil der Feuerschlaggarnitur liegt in Männergräbern, und auch bei diesen bei vielen Bewaffneten. Die Feuerschlaggarnitur der aus Asien stammenden Hunnen, der Germanenstämme im Karpatenbecken, vor allem der Gepiden und Langobarden, dann der aus Mittel- und Innerasien stammenden Awaren und später der von der Westhälfte des Urals fortziehenden Ungarn hat ähnliche Zusammensetzung (Stahl, Feuerstein und vermutlich Zunder), die Art des Feuermachens kann als identisch betrachtet werden, und auch das Aufbewahren des Zubehörs stimmt überein.

Bei den *Hunnen* hing am Gürtel die Ausrüstung mit Ringanhängern, Dolch, Messer und die Leder- oder Leinentasche mit Wetzstein, Kamm und Feuerschlagzubehör.[16] Das Tragen der Tasche bei den Männern durchzieht das gesamte Frühmittelalter, die Völkerwanderungszeit. Im Gebiet der Merowingerkultur, in Mitteleuropa, im Karpatenbecken ganz bis ins Turkengebiet des Altai, später bei den Chasaren und dann auch den Ungarn benutzen die Männer Taschen, zu deren Inhalt auch die Feuerschlaggarnitur gehörte.

In der Großen Ungarischen Tiefebene trugen im 5−6. Jahrhundert auch die *gepidischen* Männer ihre Gebrauchsgegenstände des Alltags und kleineres Werkzeug in einer an der rechten Gürtelseite befestigten Tasche: Scheren, Wetzstein, Ahlen und Feuerschlaggarnitur.[17] Die gepidischen Stähle haben fast ausnahmslos einen leicht gewölbten Rücken, beide Enden sind schmaler und umgebogen, sie sind also im Fachwortgebrauch doppelsohlig ***(Abb. 2.8−11)***. Einzelne Stähle waren auch in der Tasche geschützt, z. B. war der Stahl in Grab 79 von Hódmezővásárhely-Kishomok straff in Leinen gewickelt.[18]

Im 6. Jahrhundert trugen die langobardischen Männer in Transdanubien die Leder- oder Leinentasche hinten links am Gürtel, im Gegensatz zu den Gepiden, bei denen das Tragen auf der rechten Seite allgemeiner war. Die Taschen brauchten auch die Langobarden für Messer, Wetzsteine, Barthaarpinzetten, Scheren, Ahlen und Feuerschlaggarnitur.[19] Die Form der Stähle war variabel, neben dem Typ mit gebogener Sohle, umgebogenen Enden war die schmale, geradsohlige Zimmermannsklammer-Form häufig, aber es kommen auch kahnförmig gebogene Exemplare vor, mit kleinen Aufhängeösen an der Innenseite ***(Abb. 2.1−5)***. Neben den Feuerschlageisen gibt es viele Feuersteine, nicht selten acht Stück, unter ihnen früher auch bearbeitete, z. B. in Tamási Grab 8 eine dreieckige Pfeilspitze aus dem Neolithikum

[9] STEUER 1991, 402, Abb, 62.
[10] HELLEBRANDT 1999, 78: Vác-Gravel, grave 42.
[11] HOMMEL 1972, 408.
[12] H. KELEMEN 2008, 107.
[13] VADAY 1988-89,121.
[14] VADAY−SZŐKE 1983, 117.
[15] STEUER 1991, 404.
[16] TOMKA 1993, 21.
[17] NAGY M. 1993, 64.
[18] BÓNA−NAGY, 2002 11.
[19] BÓNA 1993, 127.

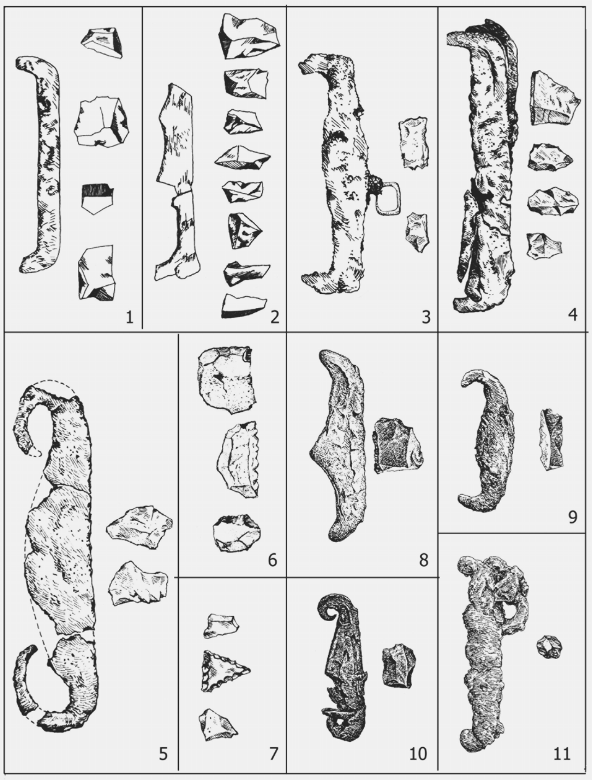

Abb. 2. *Langobardisches Werkzeug zum Feueranzünden. 1: Hegykő Gr. 56; 2: Hegykő Gr. 75; 3: Rácalmás Gr. 4; 4: Tamási Gr. 20; 5: Tamási Gr. 41; 6: Szentendre Gr. 71; Gepidisches Werkzeug zum Feueranzünden. 8: Szolnok-Szanda Gr. 135; 9: Szolnok-Szanda Gr. 4, 10: Kisköre Gr. 43, 11: Hódmezővásárhely Gr. 79*

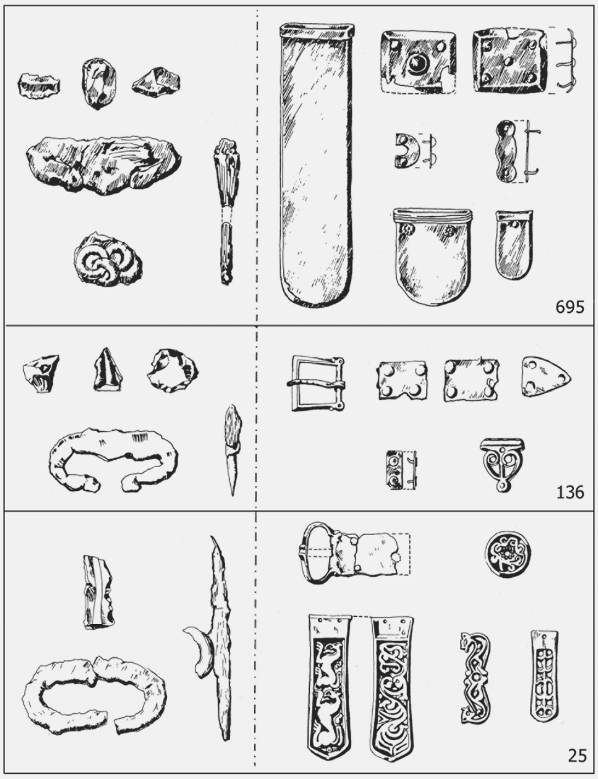

Abb. 3. *Tiszafüred. Männergräber des 7–8. Jh. im awarenzeitlichen Gräberfeld: Gr. 695, 136 und 25 (auf der linken Bildseite die Gegenstände aus der Tasche an der linken Seite des Gürtels des Mannes: Feuersteine, Feuerstahl und Eisenahle mit Holzgriff)*

und in Szentendre Grab 71 ein trapezförmiger Kratzer *(**Abb. 2.6–7**).*

Die am Leibgürtel getragenen Leder- oder Leinentaschen mit den am Ende umgebogenen und innen konkaven Feuerschlageisen und verschiedenfarbigen Feuersteinen waren jahrhundertelang in ganz Europa verbreitete Typen, weshalb sie ohne Kenntnis des Grabkomplexes kaum chronologisch auswertbar sind.[20] Diese Feststellung gilt nicht nur für die germanischen, angelsächsischen und fränkischen, sondern auch die Turkgebiete des Altai-Gebirges und des Tuwa-Berglandes, für das Chasarenreich und auch die südslawischen Gegenden. Die allgemeine Form des Feuerschlageisens war der an beiden Enden umgebogene Stahl[21] oder z. B. wie bei den chasarischen Typen die Form mit zusammengeschweißten verschmälerten Enden.[22] Außer diesen kann man in den Gräbern von West-Tuwa auch die Zeugnisse des Reibens mit dem Holzbohrer entdecken. Letzterer fehlt zwar in den Gräbern, doch finden sich die als Unterlage für den Feuerbohrer benutzten kleinen abgerundeten Holzplättchen mit schmalen Furchen für den Zunder.[23]

Die Mittel der Awaren zum Feueranzünden

Nach obigem kurzen, keineswegs Vollständigkeit anstrebenden Überblick beschäftigen wir uns nun mit dem engeren Thema der Studie, den erhalten gebliebenen Zeugnissen des Feuermachens bei den Awaren durch Bekanntgabe der dazu verwendeten Mittel in der Awarenzeit. Die mehr als 40 000 Gräber von vielen hundert Gräberfeldern können im Rahmen dieser kurzen Arbeit nicht überblickt werden. Deshalb soll nur ein größeres, völlig freigelegtes, in sehr kleinem Prozentsatz gestörtes, typisches awarenzeitliches Gräberfeld im Gebiet jenseits der Theiß untersucht und die dortigen Angaben mit denen

[20] SCHMIDT 1961, 145.

[21] KUBAREV 1984, 42, ris. 9.

[22] PLETNEVA 1989, 92, ris. 45.

[23] KENK 1982, 35, 58, 66.

gleichfalls großer, aber transdanubischer Gräberfelder verglichen werden, solcher Gräberfelder, deren Sachkultur sich von der der Gräberfelder allgemein awarischen Typs der Tiefebene unterscheiden. Die ausgewählten Gräberfelder sind Tiszafüred,[24] Zamárdi[25] und Kölked.[26]

Im Gräberfeld von *Tiszafüred-Majoros* lagen in 91 von 1211 Menschenbestattungen enthaltenden Gräbern Feuerschlageisen und Feuerstein. Der allgemeine Typ der Feuerschlageisen: zweisohliger Stahl mit leicht gebogenem Rücken und schmaler werdenden umgebogen gezwirbelten Enden, der Innenbogen des breiten Rückens allgemein mit Spitze. Tusammen mit den 7−8 cm langen, ca. 3 cm breiten Feuerschlageisen lagen allgemein 1, aber höchstens 3−4 Feuersteine in der Tasche an der linken Seite des Mannes. Das zum Feuerschlagen benötigte organische Material, der Zunder, ein allgemein aus von Baumstämmen abgenommenen Schwämmen durch Auslaugen, Trocknen und Pulverisieren gewonnenes Material, das man in gesondertem kleinen Lederbehälter aufbewahrt haben konnte, war im Boden spurlos vergangen. In Tiszafüred trug man in der an der linken Seite des mit gegossenen Bronzebeschlägen verzierten Gürtels hängenden Tasche mit dem Feuerschlagwerkzeug zusammen auch die eiserne Ahle mit Holzgriff bei sich *(**Abb. 3−4**)*.

In 11 von den überwiegend ungestörten Gräbern mit Feuerstahl von Tiszafüred lag nur ein Feuerstein, in 26 Gräbern fand sich aber neben dem Feuerstahl kein Feuerstein. 2 Feuersteine sind auch alleine zum Funkenschlagen geeignet, der Feuerstahl jedoch nicht. Bei den Gräbern nur mit Stahl ist auf einen Mangel zu schließen oder vielleicht auf eine Aufbewahrung der teureren Feuersteine als der Feuerstahl. Das Feuerschlageisen 'regulärer' Form wurde manchmal durch ein formloses Eisenfragment von zerbrochenen Gegenständen ersetzt. Gut verwendbar war auch eine rechteckige dickere Platte vom Panzer.

In einem frühmittelalterlichen Gräberfeld haben dem allgemeinen Bild gemäß die Männer einen Anteil von 1/3 und ebenso die Frauen und die Kinder. Demnach ist in Tiszafüred mit ca. 400 Männergräbern zu rechnen. Die Gräber mit Feuerstahl machen nicht ganz 1/4 dieser Zahl aus, also enthielten fast 25% der Männergräber Hilfsmittel zum Feueranzünden. Dieser Anteil kann mit dem Bestattungsbrauch (z. B. gab man nur gewissen Männern das Werkzeug zum Feueranzünden mit) oder der Lebensweise bzw. dem Rang (eventuell besaß nicht jeder Mann solches Werkzeug) zusammenhängen, aber es ist auch die Basis eines Vergleichs. Bei den Männern von Tiszafüred war der Anteil des Tragens von beschlagenem Gürtel und Feuerstahl folgender: In 51 Gräbern lagen Feuerschlaggarnitur und auch beschlagener Gürtel. Von den 51 beschlagenen Gürteln hatten 6 gepresste Beschläge, 11 glatte und Flechtbandzierden aus Blech und 34 gegossene Beschläge. Der Gebrauch oder die Grablege des Feuerstahls war also bei den spätawarenzeitlichen Männern mit gegossenen Gürtelbeschlägen in Tiszafüred häufiger als in früheren Zeiten. (Eine Auswahl der Feuerstähle und Feuersteine des Tiszafüreder Gräberfeldes zeigen ***Abb. 5.***)

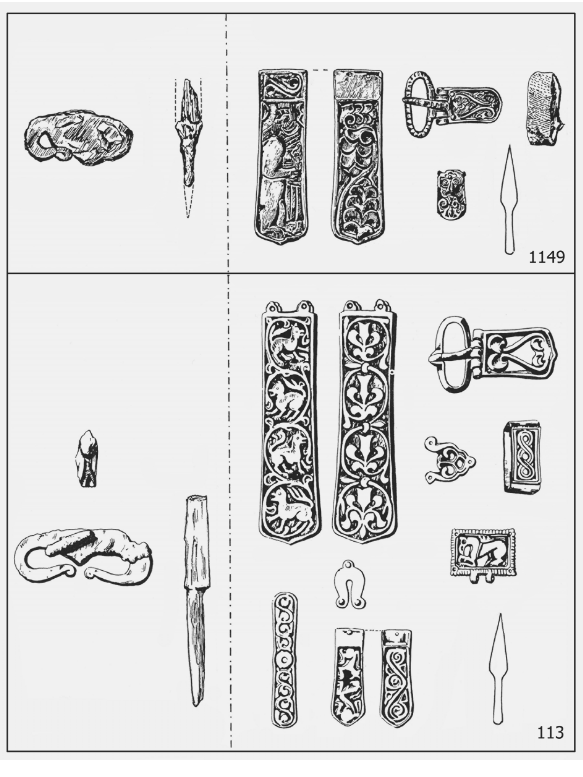

Abb. 4. *Tiszafüred. Männergräber des 8. Jh. im awarenzeitlichen Gräberfeld: Gr. 1149 und 113*

[24] Auf Tiszafüred fiel die Wahl nicht nur, weil es den Kriterien entspricht. Bei der Ausgrabung der Autorin nahm als junge Forscherin auch Viola Dobosi teil, der – außer einigen musterhaft freigelegten Gräbern – auch die mit größter Präzisität freigelegte, gezeichnete und verpackte awarische Perlenkette zu verdanken ist.
In ihrer Monografie über Tiszafüred widmete die Autorin ganze 6 Zeilen den Geräten des Feuermachens, somit ist bei der Analyse keine Wiederholung zu erwarten (GARAM 1995, 336). In den Aufarbeitungen zahlreicher awarischer Gräberfelder ist die Lage ebenso.

[25] Ausgrabung von E. Bárdos. Von der Aufarbeitung ist Band I erschienen, mit dem Katalog der Gräber 1−1500: BÁRDOS−GARAM 2009.

[26] KISS 1996.

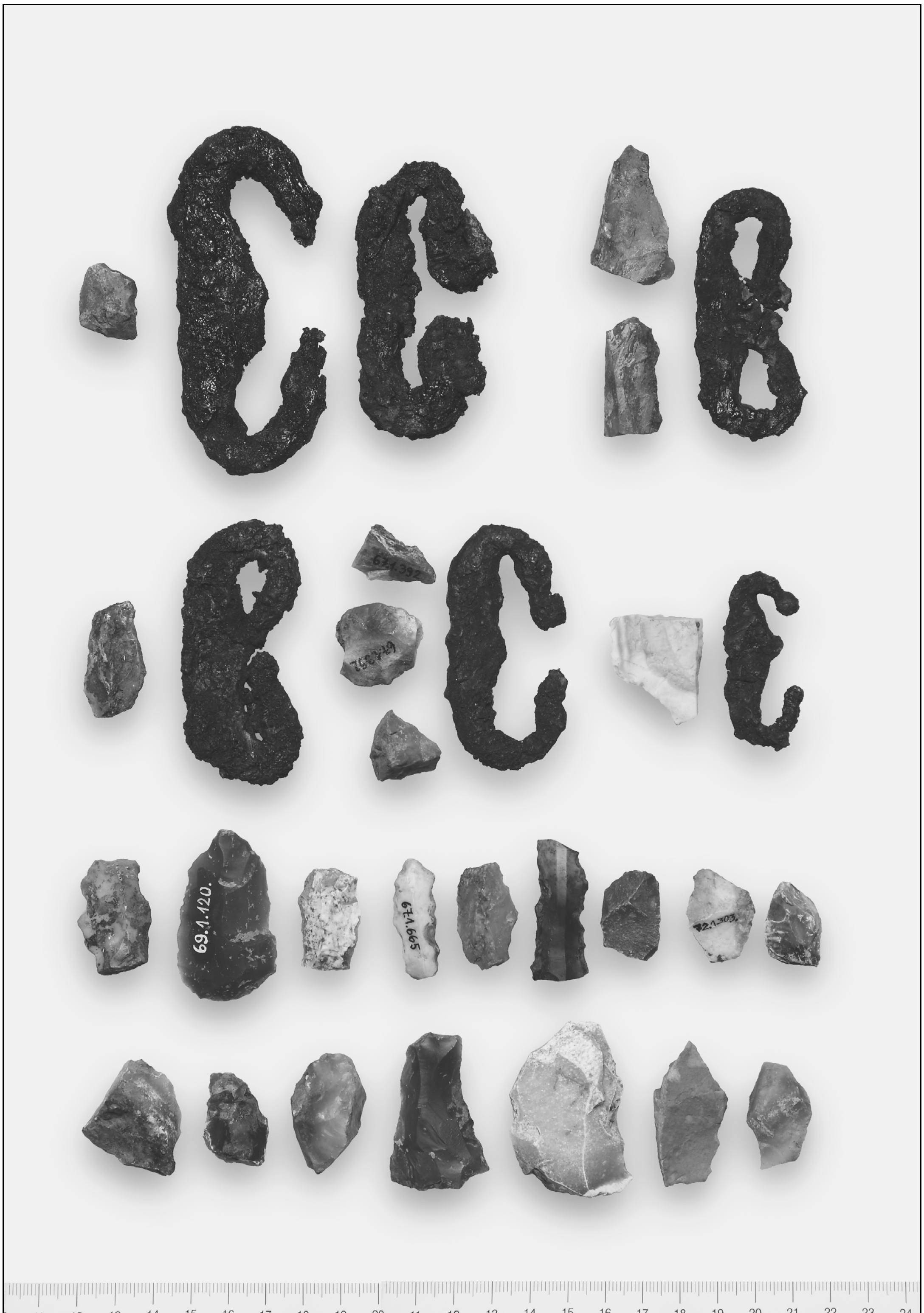

Abb. 5. *Feuerschlageisen und Feuersteine aus dem awarenzeitlichen Gräberfeld von Tiszafüred (Auswahl) (Photo: A. Dabasi)*

Im Gräberfeld von *Zamárdi* mit ca. 2270 Menschenbestattungen machen die 75 Männergräber mit Stahl und Feuerstein ca. 10% aus. Zwar ist das Gräberfeld zu 85–90% gestört, doch ist diese relativ niedrige Zahl nicht mit der Gestörtheit zu erklären. Denn die Beraubung war nicht auf die kleinen Hilfsmittel gerichtet. Das gefundene Werkzeug zum Feuermachen lag in 30 Gräbern bei Männern ohne beschlagenem Gürtel, in den übrigen Gräbern mit Feuerstahl lagen frühawarenzeitliche Bestattete mit gezähnten Flechtbandbeschlägen auf dem Gürtel und nur in 1 oder 2 Gräbern mit Greifengürtelbeschlägen. Die Feuerstahlform von Zamárdi stimmt ungefähr mit der allgemeinen awarischen Form überein, die umgebogenen Enden sind aber kürzer und weniger gezwirbelt.

Gräberfelder zeigen ein unterschiedliches Bild: Szeged-Kundomb: der Feuerstahl ist sehr selten; Szeged-Fehértó: ca. ein Viertel der Männergräber enthielt Feuerschlagwerkzeug. Ähnlich ist sein Anteil auch im mittelawarenzeitlichen Solymár, fast 23% in der unteren, also frühen Schicht, aber von den oberen, spätawarenzeitlichen Männern wurden nicht einmal mehr 10% mit Feuerstahl oder -stein bestattet.[27]

Zusammenfassend: Durchschnittlich bewegt sich der Anteil der mit Feuerschlagwerkzeug versehenen Männergräber in awarenzeitlichen Gräberfeldern zwischen 10 und 30%. Die niedrigen Werte finden sich meistens im frühen Teil der transdanubischen Gräberfelder auch mit spätantiken und merowingischen Wurzeln, dieser Anteil ist auch noch für die frühen Teile der größeren Gräberfelder im Theißgebiet typisch. In ihnen ist auch die Zahl der in den einzelnen Gräbern gefundenen Feuersteine unterschiedlich. In einem 'allgemein' spätawarenzeitlichen Gräberfeld sind 3–4 Feuersteine selten, dagegen sind in den frühen Gräbern von Zamárdi selbst 7–8 Steine nicht unüblich.

Bei den den Awaren im Karpatenbecken voraufgehenden Germanenstämmen war das ins Grab gelegte Werkzeug zum Feuermachen viel häufiger. Etwa bei der Hälfte der langobardischen Männergräber gab es einen Stahl oder Feuerstein: z. B. in Hegykő bei 48, in Kajdacs bei 37, in Rácalmás bei 42, in Szentendre bei 50 und in Tamási bei 52%. Häufiger ist auch das Feuerschlagwerkzeug mit 5–7 Feuersteinen nicht. In den Gräberfeldern gibt es viele Gräber mit Waffen, Männergräber mit Lanze, Schild oder Schwert. Nicht selten legte man bei den Gepiden auch dem Stahl 6–8 Feuersteine bei.

Die awarenzeitlichen Feuerschlageisen und -steine stammen fast ausnahmslos aus Männergräbern. Ein oder zwei Gräber mit Feuerstahl bestimmten die Ausgrabenden zwar als Frauengrab, aber das sind keine anthropologischen Bestimmungen.

Es gibt allerdings einige sichere Frauengräber, in denen sich auf eine Tasche hinweisende Gegenstandsgarnituren an der linken Beckenseite finden. Zwischen den vielen kleinen, großenteils unbrauchbaren Gegenständen taucht manchmal auch je ein Feuersteinsplitter auf, der als grellfarbig glänzender, schön griffiger Gegenstand unter die übrigen, als Talisman aufzubewahrenden Nichtigkeiten geraten sein konnte (z. B. im Gräberfeld von Zamárdi).

Im Gräberfeld *Kölked A* lag ein Feuerstahl nur in 6% der Männergräber, großenteils in Gräbern Bestatteter mit Gürteln germanischen Typs und sehr wenige in solchen mit gegossener Gürtelgarnitur (angemerkt sei aber, dass es in Kölked sehr wenig Greifen-Ranken-Gürtelzierden gab). Die Form der Feuerstähle im Gräberfeld von Kölked weicht von der allgemeinen ab. Ihre Körper sind breiter, ihre Enden sehr ausgedünnt, und häufig im ungarischen ethnografischen Material sind auch nur länglich rechteckige Exemplare mit abgerundeten Enden (z. B. Kölked A Grab 386).

Überblickt man außer den oben untersuchten awarenzeitlichen großen Gräberfeldern flüchtig mehrere solche mittlerer Gräberzahl, erhält man ein gemischtes Bild. Selbst nahe beieinanderliegende

Feueranzünden nach der Awarenzeit

Das Werkzeug der *landnehmenden Ungarn* unterscheidet sich fast in nichts von dem aus der Völkerwanderungszeit bekannt gewordenen. Allgemein ist die zweisohlige Form mit gezwirbelten Enden, aber es gibt auch die eine oder andere individuelle Form, z. B. ein zum Dreieck umgebogenes schmales Eisenblech oder Stangen mit schmalrechteckigem Querschnitt.[28]

Die Form des Feuerschlageisens hat sich in der Arpadenzeit, im Mittelalter, in der Neuzeit und fast bis in unsere Tage wenig verändert. Die bogige einsohlige Form mit umgebogenem gezwirbelten Ende war bis zum Schluss in Gebrauch (z. B. ist der Feuerstahl des 13.–14. Jh. aus dem Graben der kleinen Burg Felsőszolca-Várdomb zu erwähnen),[29] im Material der Volkskundesammlungen aus neuer und neuester Zeit ist dagegen daneben die länglich rechteckige, in der Mitte durchbohrte oder mit Öse versehene Form häufiger.

Mit der Art der Ungarn, Feuer zu entzünden, und dem dazu gehörigen Werkzeug haben sich im 20. Jahrhundert mehrere kleinere oder größere Studien,

[27] TÖRÖK 1998, 84.

[28] ISTVÁNOVITS 2003, 326, Abb. 15.

[29] SIMONYI 2003, 128, Abb. 20.4.

zusammenfassende Arbeiten und Lexikonartikel beschäftigt. Mehrere Studien basieren auf dem Material im Band I der Serie Magyarság néprajza[30] und nutzen die dortige Literatur samt dem Bildmaterial. Unter ihnen ragt die Studie von J. Hála heraus,[31] der über die Typentafeln hinaus auch mit Fotos das wichtigste Werkzeug des Feueranzündens illustriert, wobei er den Feuerstahl während der Verwendung sowie den Gebrauch von Feuerstein und Zunder zeigt. Auch aus der mit reichen Literaturverweisen zum Thema versehenen Studie geht eindeutig hervor, dass es keine an ein Gebiet oder Volk zu knüpfende Werkzeugtypen gibt, somit auch keine *Feuerstahlformen*. Feuerschlageisen/Feuerstahl kann auch leicht selbst aus alten, gebrauchten Eisenstücken hergestellt werden, man konnte es schmieden, es konnte sogar später, auch sekundär in Gebrauch genommen werden.[32]

In seiner Studie befasst sich J. Hála eingehend mit der Herkunft, Qualität und dem Rohmaterial des Feuersteins. Am Flussufer gefundene Quarzkiesel, quarzithaltiger Sandstein, Hornstein, Obsidian oder auch ein abgebrochenes Stück vom Mühlstein waren zur Erzeugung von Feuer geeignet. Im Karpatenbecken war im Kreis der Ungarn in neuer und neuester Zeit das Sammeln von Feuersteinen zum Feuermachen häufig. Die Feuersteinstellen waren bekannt, aber oftmals sammelte man auch die prähistorischen Stücke. Nach dem Pflügen wurde der Brachlandfeuerstein zusammengesucht, auf den Weiden der Natur- oder Sodafeuerstein. Diese waren großenteils prähistorisches, meistens neolithisches Steinwerkzeug. Die größeren Stücke wurden zerkleinert, von den kleineren Stücken trug man zuweilen sogar 10−12 bei sich.[33] (Wie aus dem Obigen zu entnehmen war, traf dies im Laufe des jahrtausendelangen Gebrauchs des Feuersteins am meisten auf die Männer germanischer Völker zu.)

Der dritte Bestandteil beim Feueranzünden ist neben Feuerstahl und Feuerstein allgemein der *Zunder*. Auch bei den Ungarn war dies am häufigsten der von Bäumen gesammelte Zunder, der durch Lockern, Einweichen, Kochen, Trocknen und Verdichten brauchbar gemacht wurde. Zunder stellte man auch aus den Früchten der Rohrkolbenarten her.

Der Gebrauch und die Aufbewahrung des Feuerschlagwerkzeugs stimmen völlig mit dem aus den früheren Jahrhunderten Bekannten und Dargestellten überein. Es wurde im Säckchen oder der Tasche getragen und gehörte zum Bereitschaftszubehör des Hirten. Den Funken zum Feuermachen schlug man am Anfang des 20. Jahrhunderts ebenso wie in der Völkerwanderungszeit oder früher. Auch das Feuerschlagen mit zwei Steinen, Feuersteinen, gibt es fast bis in unsere Tage. Ein alter Hirt in Komádi schlug 2001 einen Funken, indem er einen Feuerstein mit ein wenig angedrücktem Zunder in der linken Hand hielt und mit dem anderen Feuerstein in der rechten Hand diesen vertikal zwei bis dreimal anschlug, der Funken brachte den Zunder zum Glühen, mit dem er dann, ihn auf den Pfeifentabak legend, die Pfeife anzündete, obwohl – wie er sagte − 'ich auch Streichholz und Feuerzeug habe, aber diesen Geruch habe ich lieber'.[34]

Auswertung

Die Feuersteine des Awarengräberfeldes von Tiszafüred wurden aus dem verstreuten Steinwerkzeug der umgebenden urzeitlichen Siedlungen zusammengesammelt. Bis auf zwei Ausnahmen (Grab 113: 67.1.310 und Grab 578: 71.1.87./4) waren alle bearbeitete Stücke, zumeist Abspaltungen und Splitter, fallweise Kernreste. Typisch (urzeitlich) waren 3 St.: in Grab 25: 67.1.64 und in Grab 213: 67.1.665 retuschierte Klingen (eine mit Sichelglanz) und in Grab 295: 69.1.120 ein Klingenkratzer mit Griff. Kiesel- oder Blockfeuerstein- (unmittelbar von der Feuerstein-Rohstoffquelle beschaffte) Stücke waren nicht unter den 'Feuersteinen'. Das Rohmaterial besteht aus typischen Rohstoffen der urzeitlichen (neolithischen und kupferzeitlichen) Siedlungen der Tiefebene: überwiegend Limnoquarzit (ist als lokaler Rohstoff zu betrachten), vereinzelt Rohmaterial aus der Ferne (Feuerstein und Radiolarit). Aufgrund der Typen und der Rohmaterialauswahl wurde es wahrscheinlich in urzeitlichen Siedlungen verschiedenen Alters gesammelt.[35]

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[30] BÁTKY et al 1941−43, 71−77.
[31] HÁLA 1995, 214−245.
[32] HÁLA 1995, 219.
[33] HÁLA 1995, 222−228 .
[34] MAKAI 2001, 98.
[35] Auch auf diesem Wege danke ich all jenen Kollegen, die mir selbstlos dabei halfen, das so 'einfach" scheinende steinige Thema fachmäßiger und vollständiger werden zu lassen, das zu Ehren von Viola T. Dobosi geschrieben wurde, um die Freundschaft zu der Geehrten zu betonen. Die Namensliste der Kollegen: Pál Patay, Katalin T. Biró, András Markó, István Vörös, Endre Tóth, Gergely Szenthe, Tibor Kemenczei, Ádám Szabó, László Révész, Erika Simonyi.

Über das Typ und Rohmaterial der awarenzeitlichen Feuersteine von Tiszafüred (K. T. Biró)[36]

Objekt	*Inv.-Nr.*	*Typ*	*Rohmaterial*	*Größe (mm)*	*Gewicht (g)*
Grab 113 (kein Feuerstahl)	67.1.310.	Fragment	versteinertes Holz?, gelblichbraun	32 x 14 x 9 mm	3.4 g
Grab 391 (3 St. mit 1 Feuerstahl)	67.1.392/1	Splitter, untypischer Kratzer?	bunter Mátra-Limnoquarzit?, pastelle Musterung auf gelbem Grund	25 x 32 x 7 mm	6.5 g
Grab 391 (3 St. mit 1 Feuerstahl)	67.1.392/2	Mikrokernrest	Limnoquarzit -Ércelő Typs?, gelb, undurchsichtig	18 x 22 x 17 mm	4.9 g
Grab 391 (3 St. mit 1 Feuerstahl)	67.1.392/3	Abspaltung, dreieckig, dick	bunter Mátra-Limnoquarzit, pastelle Musterung auf gelbem Grund	23 x 17 x 13 mm	3.2 g
Grab 191 (mit Rost auf dem Feuerstahl zementiert)	67.1.582.	Abspaltung, trapezförmig?	Limnoquarzit?, gelblichweiß	18 x 15 mm	
Grab 25 (kein Feuerstahl)	67.1.64.	retuschierte Klinge	Karpatenradiolarit, marmoriert dunkelrot	40 x 16 x 4 mm	3.4 g
Grab 213 (mit Feuerstahl)	67.1.665.	retuschierte Klinge, auf der Rückseite Sichelglanz	Limnoquarzit, gelblichweiß, undurchsichtig	33 x 12 x 5 mm	2.3 g
Grab 250 (mit Rost auf dem Feuerstahl zementiert)	67.1.769.	Abspaltung, trapezförmig?	sonstig, rostbedeckt	27 x 10 mm	
Grab 295 (kein Feuerstahl)	69.1.120.	Kratzer auf klingenartigem Splitter, mit Griff	Schokoladefeuerstein, hellbraun, im Licht durchscheinend	47 x 27 x 8 mm	10.3 g
Grab 328 (3 St. mit 1 Feuerstahl)	69.1.253/1	klingenartiger Splitter	bunter Mátra-Limnoquarzit, pastelle Musterung auf gelbem Grund	32 x 17 x 7 mm	4.6 g
Grab 328 (3 St. mit 1 Feuerstahl)	69.1.253/2	klingenartiges Splitterfragment	bunter Mátra-Limnoquarzit, pastelle Musterung auf gelbem Grund	33 x 25 x 10 mm	7.6 g
Grab 328 (3 St. mit 1 Feuerstahl)	69.1.253/3	klingenartiger Splitter	bunter Mátra-Limnoquarzit, Lederrest?, pastelle Musterung auf gelbem Grund	30 x 18 x 7 mm	3.9 g
Grab 227 (kein Feuerstahl)	69.1.703.	unretuschiertes Fragment von abgespaltetem Steinwerkzeug	bunter Mátra-Limnoquarzit?	23 x 20 x 9 mm	4.2 g
Grab 413 (mit Feuerstahl)	70.1.12.	Splitter	Feuerstein Typ Mezőzombor (Limnoquarzit), grau, gelb, weiß streifig-fleckig	30 x 27 x 7 mm	5.7 g
Grab 461 (mit Rost auf dem Feuerstahl zementiert)	70.1.184/1	Abspaltung	Limnoquarzit?, gelblichbraun?	27 x 17 mm	
Grab 461 (neben Feuerstahl + Feuerstein)	70.1.185/1	Abspaltung	Limnoquarzit?, gelblichweiß	17 x 15 x 8 mm	1.7 g
Grab 461 (neben Feuerstahl + Feuerstein)	70.1.185/2	unretuschiertes Fragment von abgespaltetem Steinwerkzeug	Limnoquarzit, gelblichbraun	20 x 18 x 11 mm	3.1 g
Grab 429 (mit Feuerstahl)	70.1.65.	Mikrokernrest	Limnoquarzit?, gebrannt, streifig schmutzigweiß	26 x 24 x 14 mm	2.3 g
Grab 476 (mit Feuerstahl)	71.1.243.	Abspaltung	Limnoquarzit, gelblichbraun, im Licht durchscheinend	15 x 17 x 3 mm	1.4 g
Grab 639 (mit Feuerstahl)	71.1.281.	Splitter	Limnoquarzit?, gelblichbraun, undurchsichtig	30 x 18 x 8 mm	2.3 g
Grab 694 (3 St. mit 1 Feuerstahl)	71.1.460/1	Mikrosplitter, Lederspuren?	'Csesztve Silex' (Feuerstein vom Pruth)?, grau, im Licht durchscheinend	23 x 15 x 7 mm	2.2 g

[36] Die Beschreibung, Bestimmung und Auswertung nahm Katalin T. Biró vor. Für ihre Arbeit und Hilfe, mit der sie die Aussagen der awarenzeitlichen Mittel zum Feueranzünden fachgemäßer gestaltete, danke ich ihr auch auf diesem Wege.

Objekt	*Inv.-Nr.*	*Typ*	*Rohmaterial*	*Größe (mm)*	*Gewicht (g)*
Grab 694 (3 St. mit 1 Feuerstahl)	71.1.460/2	Mikrosplitter, Lederspuren?	Limnoquarzit, gelblichweiß	26 x 16 x 10 mm	4.5 g
Grab 694. sír (3 St. mit 1 Feuerstahl)	71.1.460/3	klingenförmige Abspaltung, Lederspuren?	Limnoquarzit, gelblichweiß, durchscheinend weiß	22 x 13 x 3 mm	1 g
Grab 699 (ohne Feuerstahl)	71.1.474.	Klinge, Basisfragment von großer Klinge	'Csesztve Silex' (Feuerstein vom Pruth)	40 x 28 x 8 mm	8.9 g
Grab 578 (kein Feuerstahl)	71.1.87/1	Abspaltung	roter Jaspis	25 x 16 x 7 mm	3.6 g
Grab 578 (kein Feuerstahl)	71.1.87/2	Splitter, Kernsplitter	Limnoquarzit, gelblichweiß, durchscheinend weiß	25 x 25 x 13 mm	8.9 g
Grab 578 (kein Feuerstahl)	71.1.87/3	Mikrokernrest, abgewetzt	Limnoquarzit, schmutzigweiß, bräunlichgrau	24 x 14 x 13 mm	5.7 g
Grab 578 (kein Feuerstahl)	71.1.87/4	Fragment	Limnoquarzit?, matt, rauh, gelblichgrau	41 x 20 x 8 mm	5.7 g
Grab 1089	72.1.1003.	Mikrokernrest	Limnoquarzit, weiß, rot, gelb gestreift	20 x 16 x 9 mm	3.1 g
Grab 845 (ohne Feuerstahl)	72.1.303.	Abspaltung, Kernrand	'Csesztve Silex' (Feuerstein vom Pruth) ?, patiniert	28 x 19 x 9 mm	4.6 g
Grab 845 (ohne Feuerstahl)	72.1.303/1	Abspaltung	Limnoquarzit, gelblichweiß	26 x 20 x 7 mm	3.4 g
Grab 886 (ohne Feuerstahl)	72.1.418/1	klingenartiger Splitter	Limnoquarzit, Lederrest?, gelblichweiß, bläulichgrau	32 x 20 x 6 mm	5.9 g
Grab 886 (ohne Feuerstahl)	72.1.418/2	Messerklinge in Segmentform	Limnoquarzit, Lederrest?, schmutzigweiß, hellgrau	47 x 31 x 11 mm	15.2 g
Grab 913 (2 Feuerstähle)	72.1.93.	unretuschiertes Fragment von abgespaltetem Steinwerkzeug, segmentförmig	Limnoquarzit?, schmutzigweiß, gelblichbraun	15 x 20 x 10 mm	3.1 g
Grab 1026 (ohne Feuerstahl)	72.1.816/1	Mikrokern	Limnoquarzit, weiß, gelblichweiß, am Rand durchscheinend	20 x 21 x 18 mm	12.4 g
Grab 1026 (ohne Feuerstahl)	72.1.816/2	unretuschiertes Fragment von abgespaltetem Steinwerkzeug	Limnoquarzit, gelblichweiß	27 x 15 x 5 mm	2.5 g
Grab 1221 (mit Rost auf dem Feuerstahl zementiert)	75.1.419/1	Abspaltung	Limnoquarzit?	22 x 20 mm	
zu Grab 1221 gehörig	75.1.419/2	Abspaltung	Limnoquarzit, schmutzigweiß, gelblichbraun	25 x 15 mm	
Grab 1246 (mit Rost auf dem Feuerstahl zementiert)	75.1.517/2	retuschierter Splitter, mit Griff	'Csesztve Silex' (Feuerstein vom Pruth)?, gebrannt?	25 x 25 mm	
zu Grab 1246 gehörig	75.1.517/1	kleiner klingenartiger Splitter	Limnoquarzit, gelblichbraun	28 x 18 x 9 mm	4.5 g
Grab 1243	75.1.519.	kleiner klingenartiger Splitter	Limnoquarzit, gelblichbraun, durchscheinend	27 x 16 x 6 mm	3.2 g

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Вулканическое сырье в палеолите Закарпатья: относительная хронология индустрий

Виталий Усик–Адалберт Рац–Ларисса Кулаковская

Ключевое слово: *обсидиан, андезит, Выгорлат-Гутинская вулканическая гряда, Рокосово, Королево*

Вступление

Закарпатье расположено в юго-западной части Украины за главным Карпатским хребтом и занимает два географических региона: северо-восточную часть Среднедунайской (Паннонийской) равнины и часть восточных Карпат (***рис. 1.***). Горы занимают большую часть края (4/5 площади) и состоят из трех хребтов: Горган, Полонинских гор и Вулканических Карпат (Выгорлат-Гутинская вулканическая гряда)[1].

Важность закарпатского региона в изучении палеолита Центральной Европы состоит в том, что именно здесь были обнаружены *in situ* самые ранние находки каменного века (Королево), а также стоянки среднего (Королево, слои V-a,V,III,II-a,II-b, II, Королево – II, слой III, Рубань) и начальной поры верхнего палеолита (Королево, слой I-a, Королево – II, слой II,Сокирница I, Берегово I)[2].

На этой территории известно два крупных месторождения вулканического сырья (андезит и обсидиан), которые использовались первобытными людьми для производства каменных орудий. Месторождение обсидиана находится в районе с.Рокосово Хустского р-на (***рис. 1:1***) на правом берегу Тисы (хребет Великий Шоллес). Материал, получивший в археологической литературе название «андезит», происходит из карьера на горе Саргедь (Выгорлат-Гутинская вулканическая гряда), расположенной на левом берегу Тисы на окраине с.Веряця Виноградовского р-на (***рис. 1:2***).

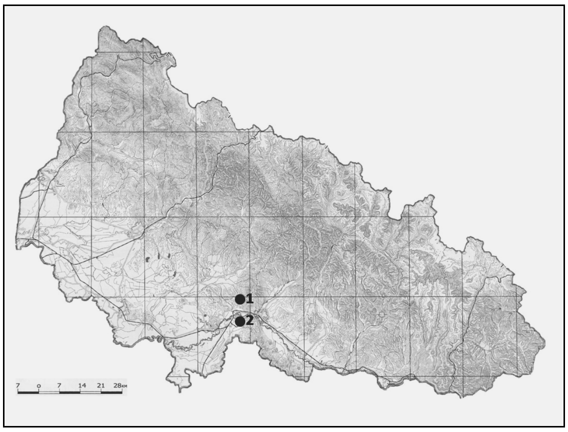

Рис.1. *Карта Закарпатья: 1-Рокосово, 2-Королево*
Fig.1. *Map of Transcarpathia: 1-Rokosovo, 2-Korolevo*

На стоянках в окрестностях Рокосово и Королево наблюдается также использование других видов сырья (до 10%): кварцита, радиолярита, кварцпорфирита, сланцевых (пород). Важно подчеркнуть, что первобытный человек, используя различные виды первичного сырья, использовал традиционные технико-типологические приемы при первичном раскалывании и изготовлении орудий труда. Это есть ярким свидетельством того, что сырье никоим образом не влияло на технологию раскалывания и, соответственно, характер индустрии. Основным моментом в каменном производстве было следование определенным традициям.

Во время изучения археологических материалов было отмечено, что и обсидианы и андезиты имеют определенные свойства изменения поверхности, что проявляется в

[1] ИГС 1982, 9-10.
[2] Гладилин 1985; Кулаковская 1989; Усик 2008; Gladilin–Demidenko 1989; Usik et al. 2003-2004; 2006; Monigal et al. 2006; Kulakovska–Usik 2011.

патинизации и выщелачивании[3]. Другими словами, изделия из этих материалов, которые были изготовлены в более древнее время отличаются по патине и характеру разрушения поверхности от более поздних. На основании изучения внешних характеристик поверхности вулканического сырья, а также в соответствии со стратиграфической позицией находок на стоянке Королево была предпринята попытка построения шкалы относительной хронологии андезитовых артефактов.

В этой статье мы хотели бы обратить внимание на два аспекта:

1. петрографическое исследование андезита;
2. уточнение "хронологических" характеристик сохранности поверхности андезитовых артефактов из стоянки Королево.

Следует отметить, что если для местного обсидиана были проведены петрографические определения[4], то подобные исследования с андезитовым сырьем не проводились.

Итак, на протяжении длительного отрезка времени (900 тыс. лет - 28 тыс. лет тому назад) в Закарпатье функционировали две группы стоянок: Рокосовская и Королевская. Именно здесь отмечено практически абсолютное преобладание вулканического сырья. Этот факт объясняется расположением стоянок вблизи источников сырья. На других стоянках (Рубань, Берегово I, Сокирница I, Шаян) первобытный человек использовал другие виды сырья (кремень, кварцит, радиолярит, халцедон и т.д.), андезит и обсидиан встречается спорадически. Практически не отмечено случаев раскалывания этого сырья непосредственно на стоянках.

Рокосовская группа стоянок

В 1948, 1968 гг. украинский геолог В. Ф. Петрунь открыл в окрестностях с.Рокосово Хустского района два палеолитических пункта Рокосово 1 и 2. Собранные здесь артефакты были изготовлены из обсидиана. "По материалу коллекция неоднородна: часть предметов изготовлена из отчетливо просвечивающегося полосчатого обсидиана (с показателем преломления 1,487+/- 0,002), другая – из темного почти непросвечивающего, полосчатого, не похожего на предыдущее сырье"[5].

Автор сразу же обращает внимание на несколько важных моментов:

– Маломощность, а иногда, и практическое отсутствие четвертичных отложений в районе рокосовских стоянок, переотложенность археологических находок.
– Неоднородность сохранности поверхности обсидиановых поделок: «Поверхность обсидиановых отщепов лишена какого-либо блеска, шероховатая и «дырчатая» (за счет отпрепарированной выветриванием флюидальности и выкрашивания фенокристаллов). В свежих сколах он черный, еле просвечивающий, в тонких сколах с типичным блеском и витрофировой структурой»[6].
– Наличие обсидианов из нескольких месторождений, что "позволяет различать, по крайней мере, 2-е главных группы вулканических стекол в орудиях каменного века Закарпатья. Это местный обсидиан типа Рокосово, и «импортное» сырье северо-венгерского или восточно-словацкого происхождения»[7].
– Технико-типологическая вариабельность обнаруженных находок, присутствие среди них как ашельских, так и мустьерских изделий.

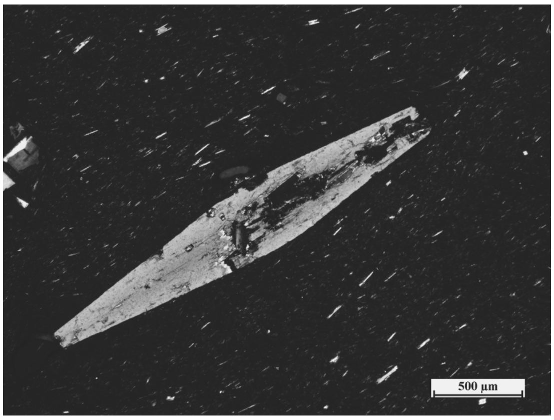

Рис. 2. *Петрографический шлиф гиалодацита: роговая обманка, микролиты плагиоклазов*
Fig. 2. *Thin section of hyalodacite: hornblende, microliths of plagioclase*

[3] ГЛАДИЛИН 1989; КУЛАКОВСКАЯ 1989.
[4] СОБОЛЕВ и др. 1955; ПЕТРУНЬ 1972; ROSANIA et al. 2008; RÁCZ 2013.
[5] ПЕТРУНЬ 1972, 87.
[6] ПЕТРУНЬ 1972, 90.
[7] ПЕТРУНЬ 1972, 91.

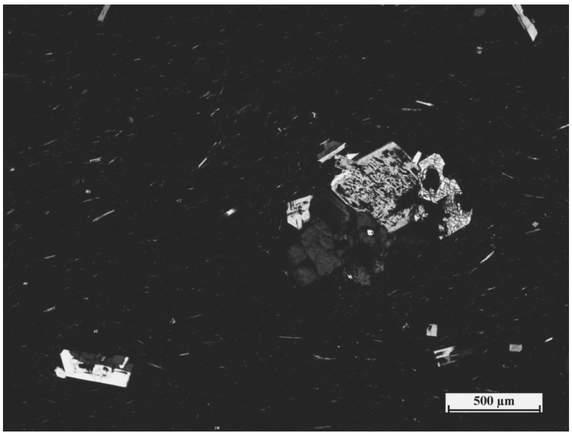

Рис. 3. *Петрографический шлиф гиалодацита: микролиты «охватывают» фенокриссталов, агрегатов*
Fig. 3. *Thin section of hyalodacite: microliths „encompasses" the phenocrystals and aggregates*

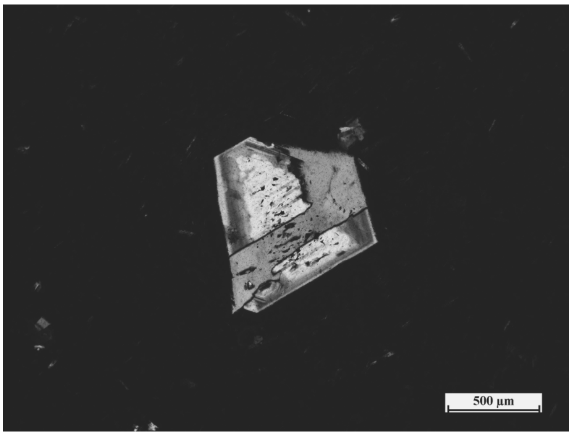

Рис. 4. *Петрографический шлиф гиалодацита: фенокристалл плагиоклазу с зональностью и включениям стекла*
Fig. 4. *Thin section of hyalodacite: plagioclase phenocrystal with zoning and inclusions of glass*

Работы В. Ф. Петруня стали одной из главных причин для начала широкомасштабного планомерного изучения палеолита Закарпатья. В 1969 г. в Институте археологии АН УССР была организована Закарпатская палеолитическая экспедиция под руководством В. Н. Гладилина.

В районе хребта Великий Шоллес, археологические раскопки проводились только на одном из местонахождений – Малый Раковец IV. Плейстоценовая толща здесь, как и в Рокосово маломощна (от 1,80 м до 2,5 м) и разрушена эрозионными процессами[8]. Разновременные обсидиановые артефакты лишены четкого стратиграфического контекста. Только на ограниченных участках сохранились суглинок над палеопочвой последнего межледниковья (MIS 4). Из этого суглинка происходит относительно гомогенная коллекция т.н. культурно-хронологического комплекса II[9].

Таким образом, практически не удалось зафиксировать в непереотложенном состоянии всего спектра хронологически разновременных обсидиановых артефактов.

Вместе с тем, абсолютно очевидно, что обсидиановые артефакты имеют разную степень сохранности поверхности – от сильно разрушенной (патина серого цвета с большим количеством каверн выветренности) до черной, практически непатинированной (***рис. 10.***). На части артефактов отмечается полосчатая структура (***рис. 10: 2***), а также присутствие участков с различной патиной на одном объекте (***рис. 10: 3a, 3b***).

Учитывая тот факт, что в Королево артефакты из обсидиана были найдены *in situ*, была произведена попытка подразделить нестратифицированные ранне- и среднепалеолитические коллекции из рокосовской группы на культурно-хронологические комплексы.[10]

В связи с тем, что произошли некоторые изменения в культурно-хронологической колонке стоянки Королево, было проведено новое исследование «культурно-хронологических комплексов» из рокосовских стоянок. Было выделено шесть уровней разрушения поверхности обсидиановых артефактов. В отдельных случаях определена их культурно-хронологическая принадлежность.[11]

В настоящее время определено, что в карпатском регионе известно три основных группы обсидианового сырья – карпатский 1 (C1) – Пряшовские горы в Словакии, карпатский 2 (C2) – Токайские горы в Венгрии, карпатский 3 (C3) – Рокосовское месторождение в Закарпатье.[12] В этом регионе в палеолите преимущественно использовался местный карпатский обсидиан C3.

Наряду с этим на стоянках также отмечены артефакты, изготовленные из импортного обсидианового сырья, происходящего из месторождений Словакии и Венгрии (C1, C2). Речь идет об изделиях из стратифицированных верхнепалеолитических стоянок Берегово I (прото-ориньяк) и Сокирница I-A (ранний верхний палеолит). Важно отметить, что в Берегово I и

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[8] Ситливый 1989, 150; Sitlivy–Ryzov 1992; Рыжов и др. 2009, 62.
[9] Рыжов и др. 2009, 70.
[10] Гладилин–Ситливый 1990, 65–73.
[11] Вотякова 2012.
[12] Rosania et al. 2008; Рац 2009; Rácz 2013.

Сокирнице I – A эти обсидианы имеют также разные типы патины.

Королевская Группа Стоянок

В 1974 г. на левом берегу Тисы близ пос. Королево была открыта многослойная палеолитическая стоянка. В 12 м толще четвертичных суглинков обнаружено 10 палеолитических слоев (ранний – начало верхнего палеолита). Абсолютное большинство артефактов из всех слоев изготовлено на андезите.

Петрографическое и геохимическое исследование андезитового сырья

Геологические образования территории и каменное сырье.

Территория Закарпатского региона сложена преимущественно вулканогенными образованиями неогена. Среди них выделяются участки, составленные угленосными терригенными отложениями ильницкой свиты (глины, аргиллиты, песчаники, туффиты с линзами бурого угля). Эти образования на разных уровнях переслаиваются с вулканогенными породами, среди которых выделяются кучавский, матекивский, синяцкий и обавский вулканогенные комплексы. Основную часть участка составляют субвулканические массивы дацитов, андезито-дацитов, риодацитов и их порфиров. Выделяется также дайка андезито-базальта. Кроме того, в пределах участка распространены аллювиальные отложения поймы и первой надпойменной террасы р. Тисы, а также реликты нерасчлененных X-IX террас («копаньський уровень»)[13].

Описание вулканогенных комплексов участка

Матекивский комплекс, распространенный, преимущественно, в долине р. Тисы и перекрытый аллювием, составляют андезито-базальты, андезиты и их туфы. Синяцкий комплекс состоит из вулканических пород кислого ряда: туфов и риолитов, риодацитов с потоками андезито-дацитовой лавы. Обавский комплекс составляют мелкопорфировые к афировых андезито-базальты. Западную часть участка составляет большой субвулканический массив дацитов и андезито-дацитов, разработки которого по настоящее время ведутся в карьере у с. Веряца. К востоку от него, на левобережье Тисы, распространен подобный массив более кислого состава (до риодацитов и их порфиров)[14]. Определение абсолютного возраста для пробы UA-7 из карьера у с. Веряця по калий-аргоновому методу составляет 10,75±0470000 лет[15], что соответствует паннонскому ярусу.

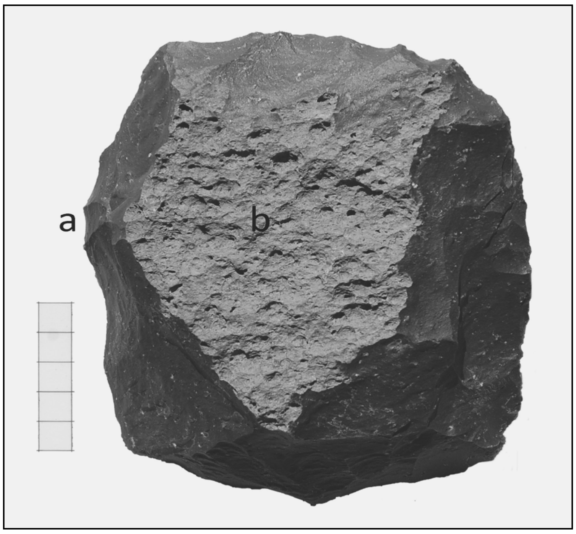

Рис. 5. *Королево, андезит: a-свежая натуральная поверхность; b-естественная корка*
Fig. 5. *Korolevo, andesite: a-fresh natural surface; b-cortex*

Каменные сырьевые ресурсы участка.

В приконтактовой части тела риодацитов встречаются своеобразные, почти черные, стекловидные породы с афировой или мелкопорфировой структурой. Разные по размеру обломки этой породы можно наблюдать в аллювии нерасчлененных X-IX надпойменных террас в окрестностях вершин Бейвар и Саргедь. Данная порода использовалась в качестве основного сырья для изготовления каменных орудий труда в палеолите и, возможно, последующих эпохах. В археологической специальной литературе сырье называют андезит.

Макроскопическое описание.

Королевский «андезит» имеет серую или темно-серую корку с разной степенью разрушения (выветренности) поверхности. Свежая поверхность имеет темный матовый, почти черный цвет. В структуре видно большое количество зерен минералов с белым цветом – полевого шпата (***рис. 2.***). Порода имеет раковистый излом, благодаря большому количеству стекла легко поддается обработке.

[13] МАЦЬКІВ 2009.

[14] МАЦЬКІВ 2009.

[15] PÉCSKAY et al. 2000.

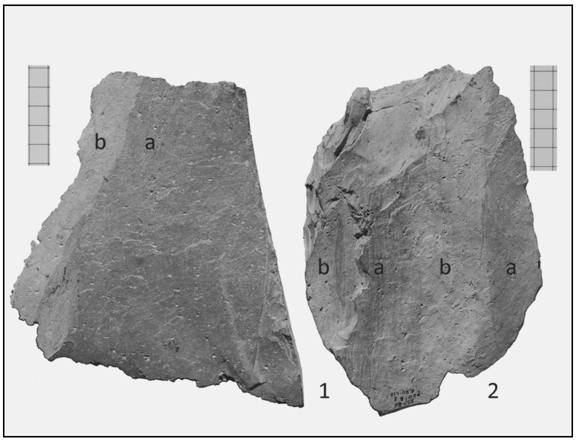

Рис. 6. *Королево, андезит: 1, 2-слой 1а; а-серо-голубая патина, b-белая патина*
Fig. 6. *Korolevo, andesite: 1,2- level 1a; a-grey-blue patina, b-white patina*

Микроскопическое описание.

В шлифах под поляризационным микроскопом порода имеет порфировую структуру. Основная масса сложена изотропным стеклом, в котором бывают разные по размеру вкрапления плагиоклаза, роговой обманки и пироксена, а также скопления (агрегаты) этих минералов (***рис. 4.***). В основной массе присутствует большое количество тонких, ориентированных в определенном направлении микролитов плагиоклаза, которые, чаще всего, соответствует флюидальности. Микролиты очень часто «охватывают» зерна фенокристаллов (***рис. 3–4.***). Среди плагиоклазов случаются полисинтетические двойники, в кристаллах наблюдается зональность, а также включения стекла (***рис. 5.***).

Результаты химического анализа.

С целью точного определения породы сырья, которое использовалась первобытным человеком на стоянке, методом ICP-OES (атомно-эмиссионная спектроскопия с индуктивно-связанной плазмой) и ICP MS (масс-спектрометрия с индуктивно-связанной плазмой) в лаборатории ACME Analytical Laboratories (Vancouver) был проведен химический анализ. Результаты исследований показали, что количество SiO_2 в породе составляет 66,87% (образец KH-1R) и 67,42% (образец KH-1G). Этот химический состав соответствует дацитам. Учитывая факт присутствия в породе большого количество стекла, к названию добавляется термин «гиало» (от гр.

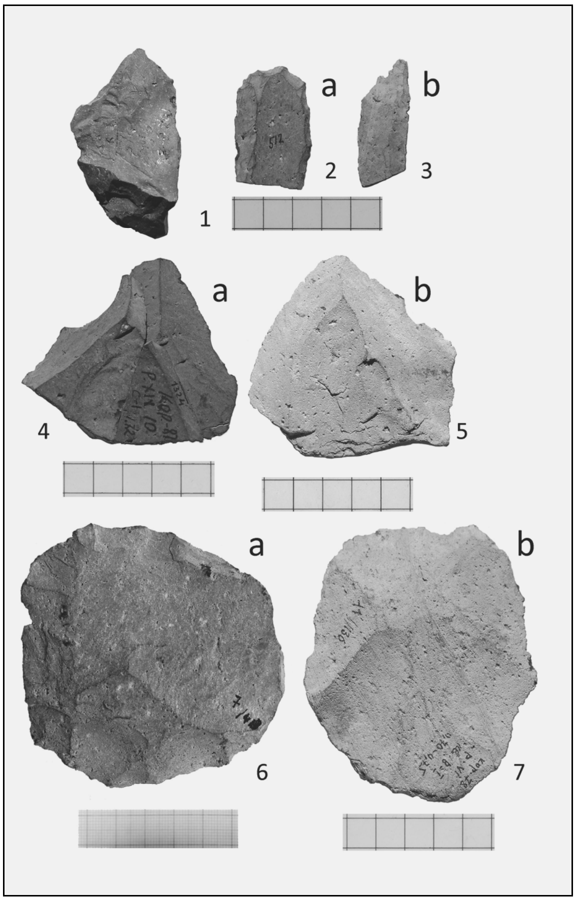

Рис. 7. *Королево, андезит: 1-слой 1; 2,3-слой 1а; 4,5-слой 2b; 6,7-слой III; а-серо-голубая патина, b-белая патина*
Fig. 7. *Korolevo, andesite: 1-level 1; 2,3-level 1a; 4,5-level 2b; 6,7-level III; a-grey-blue patina, b-white patina*

Hyalos – стекло). Итак, каменное сырье, широко распространенное в районе палеолитической стоянки Королево, за петрографическими данными является гиалодацитом[16].

Археологическая периодизация и андезитовое сырье

Как уже неоднократно отмечалось, более 90% изделий во всех слоях стоянки Королево изготовлено из местного андезита (гиалодацита), который имеет определенную градацию химического выщелачивания поверхности (***рис. 7–8.***). Находки нижних археологических слоев явно более разрушены, чем вышележащие[17]**.** Как правило, поверхность изделий в слоях,

[16] RÁCZ 2013.
[17] ГЛАДИЛИН–СИТЛИВЫЙ 1990; Солдатенко 1982.

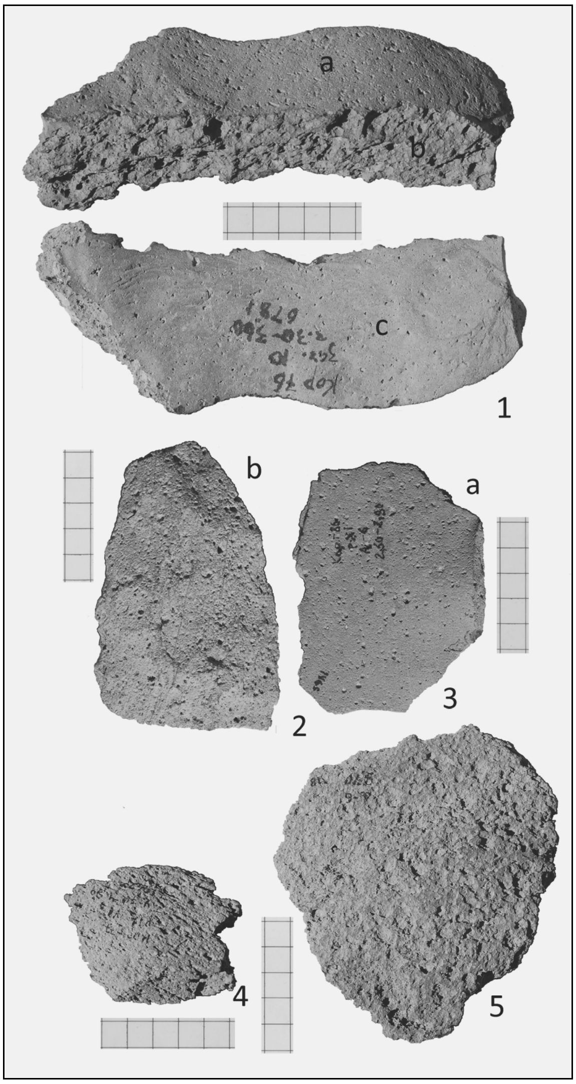

Рис. 8. *Королево, андезит: 1-слой V: a-патина слоя Va, b-корка, c-патина слоя V; 2,3-слой Va; 4-слой VI; 5-слой VII; a-серо-голубая патина, b-белая патина*

Fig. 8. *Korolevo, andesite: 1-level V: a-patina of level Va, b-cortex, c-patina of level V; 2,3-level Va; 4-level VI; 5-level VII; a-grey-blue patina, b-white patina*

приуроченных к почвенным горизонтам, имеет более интенсивное разрушение, чем в суглинках. Находки из аналогичных стратиграфических подразделений имеют сходные параметры разрушения, но всегда отличаются от выше и нижележащих.

В целом ситуация выглядит следующим образом. Свежесколотый андезит имеет темный матовый цвет (***рис. 2: a***). Находки слоя I Королево (MIS 1-2), а также аналогичные нестратифицированные артефакты с разных пунктов Закарпатья имеют легкую серо-голубую патину. На поверхности практически нет ячеек выщелачивания (***рис. 7: 1***). Андезитовые находки культурного слоя I-a (ранний верхний палеолит - MIS 3) имеют серо-голубую патину и редкие ячейки на поверхности (***рис. 7: 2–3***). Среднепалеолитические артефакты Королево , слои: II, II-a, II-b (MIS 4 (***рис. 7: 4–5***)) по цвету патины близки слою I-a, но отличаются несколько более шероховатой поверхностью и частыми ячейками. Андезиты слоя III (MIS 5a) существенно отличаются от всех вышележащих «наждачной» поверхностью и многочисленными ячейками диаметром 1-2 мм (***рис. 7: 6–7***). Андезиты слоя V (MIS 6) имеют меньшее, чем в слое III количество ячеек, но более плотную патину (***рис. 8: 1c***). Поверхность андезитов слоя V-a (MIS 7/8) значительно отличаются от вышележащих из слоя V (***рис. 8: 2–3***). Их поверхность опять имеет «наждачность» и большое количество глубоких ячеек. Поверхность андезитов слоя VI (***рис. 8: 4***) и слоя VII (***рис. 8: 5***) (MIS 14 MIS 23?25? соответственно) практически полностью покрыта глубокими ячейками[18]. Естественная корка андезита имеет практически неизменный вид на всех изделиях Королево от слоя I до слоя VII (***рис. 2: b; 8: 1b***)

При выделении «культурно-хронологического комплекса»[19] руководящим критерием «выступала степень различия в сохранности поверхности (патина, уровень выщелачивания) андезитовых артефактов»[20]. В последние годы было предпринято более детальное технико-типологическое изучения материалов стоянки Королево по объектам (раскопам, шурфам, зачисткам) и археологическим слоям.

Итак, по нашему мнению на состояние поверхности андезитовых изделий могли повлиять два основных фактора:

Неоднородность химического состава самого андезитового сырья[21]. Подтверждением этому есть примеры, когда на поверхности изделий присутствуют различные участки по цвету и

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[18] ГЛАДИЛИН1989; КУЛАКОВСКАЯ 1989.

[19] «Культурно-хронологический комплекс» в Королево во многих случаях представлял коллекцию, которая объединяет артефакты из разных участков стоянки, найденных *in situ*, в переотложенном состоянии, а также подъемных материалов. Одним из весомых признаков при создании «культурно-хронологических комплексов» было, все-таки, состояние внешней поверхности андезитовых поделок (КУЛАКОВСКАЯ–УСИК 2010, 178).

[20] ГЛАДИЛИН–СИТЛИВЫЙ 1990.

[21] КУЛАКОВСКАЯ 1989, 35; ГЛАДИЛИН–СИТЛИВЫЙ 1990, 24.

характеру патины (***рис. 6: 1:a–b; 2: a–b***). Речь не идет о случаях реутилизации (***рис. 8: 1***).

После ознакомления с андезитовым сырьем из стоянки Королево к.г.н Н.Кулик (ИАЭ СО РАН) пришла к таким предварительным выводам: «даже у одного вулкана состав расплава и характер излияний меняются со временем, поэтому в районе памятника просто обязано быть присутствие разных эффузивных пород, включая переходные разности. Многократность излияний непременно должна была приводить к появлению вулканических бомб и туфов за счет обломков лав предыдущих извержений и экструзивного материала, закупоривавшего вулканический канал. Все это потом спекалось и прошпаривалось агрессивными поствулканическими растворами, причем изменение могло быть разным за счет разного состава исходных эффузивов (окремнение, каолинизация, алунитизация, альбитизация) и за счет разной степени изменения. Это также должно сказываться на петрофизических свойствах пород, использовавшихся в качестве сырья каменных индустрий» (устное сообщение).

Изменение степени разрушения андезитовых артефактов, вероятно, определяется древностью захоронения, положением в определенном литологическом слое (ископаемая почва – лессовидный суглинок), а также характером химического воздействия геологических отложений на сырье.

Динамика и конечный результат процесса разрушения, по-видимому, зависит от нескольких факторов: время и продолжительность извержения вулкана, что могло повлиять на химический состав изверженной породы, а также возраст и химический состав палеопочв и суглинков, в которых находились расколотые артефакты в последующем. Не следует также забывать о возможном воздействии окружающей среды на артефакты до их погребения.

Следовательно, степень разрушения поверхности андезитового сырья сама по себе не может быть использована в виде исключительного хронологического и, тем более абсолютного культурного критерия, учитывая тот факт, что речь идет лишь о субъективном визуальном определении.

Другими словами, археологические материалы стоянки Королево демонстрируют тот факт, что общая тенденция изменения поверхности андезитов от более древних к более молодым, которая коррелируется со стратиграфией реально существует. Однако, использование коллекций найденных *in situ* дает возможность внести определенные коррективы в трактовку возраста и культурной принадлежности андезитовых артефактов некоторых «комплексов».

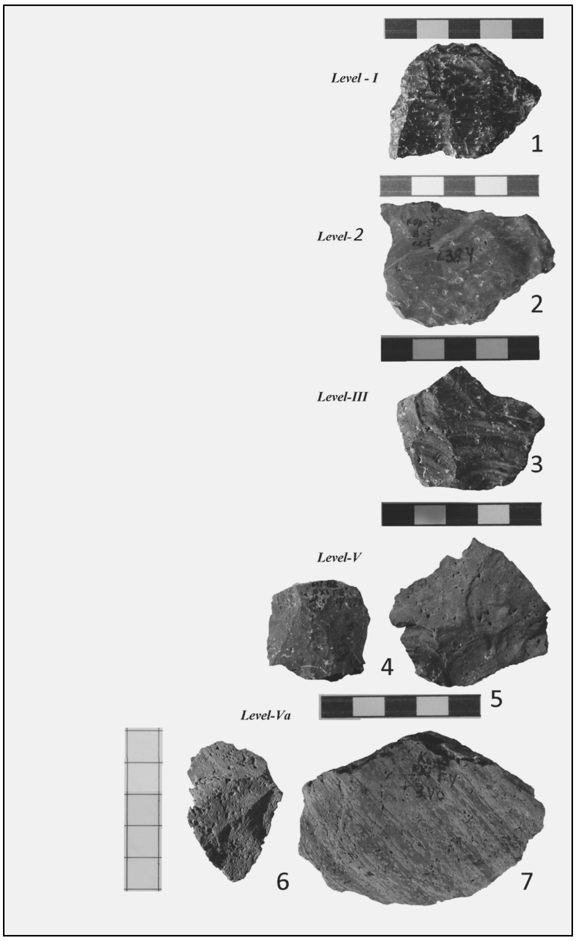

Рис. 9. *Королево, рокосовский тип обсидиана: 1-слой 1; 2-слой 2; 3-слой III; 4,5-слой V; 6,7-слой Va.*
Fig. 9. *Korolevo, rokosovo type obsidian: 1-level 1; 2- level 2; 3-level III; 4,5-level V; 6,7-level Va*

В интерпретации относительной хронологии андезита по степени сохранности поверхности артефактов мы акцентируем внимание на том факторе, что в гомогенных коллекциях разная степень сохранности сырья являлась, в первую очередь, результатом разнообразия химического состава самих пород, а также химического воздействия отложений, в которых они были захоронены. Наиболее четким аргументом для такого заключения выступают предметы с так называемой полосчатой структурой, на которых присутствуют участки с серо-голубой и белой патиной (***рис. 6.***) и, соответственно, с несколько большей и несколько меньшей степенью разрушения[22]. В каждом слое Королево также присутствуют артефакты исключительно с серо-голубой или белой патиной (***рис. 7: 4–5; 7: 6–7; 8:***

[22] Усик 2006, 52.

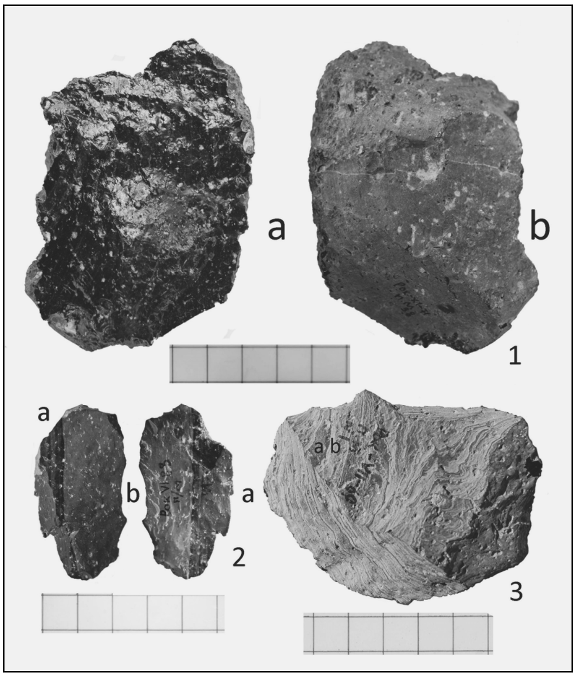

Рис. 10. *Рокосово, обсидиан: 1а-свежая натуральная поверхность, 1b-корка; 2-поздний артефакт с легкой патиной; 3-древний артефакт с плотной патиной; (a,b-различные типы патины на одном предмете)*

Fig. 10. *Rokosovo, obsidian: 1a-fresh natural surface, 1b-cortex; 2-late artifact with light patina; 3-old artifact with deep patina; (a,b-different types of patina on the same sample)*

2–3). Наконец, следует отметить, что для слоев, происходящих из суглинка над ископаемой почвой последнего межледниковья (средний и начало верхнего палеолита) этот метод практически неприменим. В целом, андезитовые изделия этих собраний по степени сохранности поверхности, практически не имеют различий. В данном случае основными критериями выступают технико-типологические характеристики коллекций. (Важно отметить, что исходя из многочисленных примеров ремонтажа отщепов, пластин между собой и с нуклеусами, происходящих из разных культурных слоев Королево, не было отмечено ни одного примера соединения фрагментированных и/или целых изделий с разной патиной или разной выщелоченностью на своих поверхностях (за исключением реутилизированных изделий). Эти примеры косвенно указывают на то, что артефакты, отколотые от каждой отдельности сырья, разрушались (патина, выщелачивание) одинаково.)

Перечисленные замечания также касаются обсидианов из рокосовского месторождения, которые были найдены в культурных слоях Королево (***рис. 9.***) и могут быть использованы для корреляции с аналогичными изделиями с других местонахождений Закарпатья.

Заключение

Петрографический анализ сырья из стоянки Королево позволил предложить более корректное название – гиалодацит.

Итак, андезит (гиалодацит) Королево и обсидиан (обсидиан С3) Рокосово имеют уникальные свойства разрушения поверхности, что связано с возрастом артефактов. Вместе с тем, определенные вариации уровня разрушения поверхности не могут быть безоговорочно использованы для выделения «культурно-хронологического комплекса» в виде уникальной археологической культурной единицы и служить эталоном для хронологического подразделения находок с поверхности. По последним данным, полученным в результате анализа культурных слоев Королево эталоны уровня разрушения поверхности андезита (гиалодацита) соответствуют нескольким длительным хронологическим периодам: MIS 3-4, MIS 5a, MIS 6, MIS 7-8, MIS 14/MIS 23?25?. В каждом конкретном случае один из этих эталонов может коррелироваться с материалами одной или нескольких разновременных и разнокультурных палеолитических индустрий.

В настоящее мы не располагаем достаточным количеством данных для анализа динамики разрушения поверхности андезита (гиалодацита) и обсидиана, происходящих из отложений MIS 2 из-за отсутствия соответствующих стратифицированных стоянок или из-за отсутствия примеров приемлемых для полноценного изучения.

В перспективе более полное и тщательное изучение «андезитовых» и «обсидиановых» индустрий Закарпатья, анализ различий патины и природы ее образования, как в самом регионе, так и на соседних территориях Венгрии и Словакии может дать новый материал для характеристики хронологического контекста использованного вулканического сырья, а также возможных путей и времени транспортировки сырья или перемещений первобытных коллективов.

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COMPARATIVE RAW MATERIAL COLLECTIONS IN SUPPORT OF PETROARCHAEOLOGICAL STUDIES: AN OVERVIEW

KATALIN T. BIRÓ

Keywords: *lithic raw materials, comparative collection, survey*

Introduction

Reference collections, physical and virtual, are of special importance for modern archaeology.[1] They serve access and interoperability, i.e., help us to know our basic conceptual categories better. Reference collections for comparative purposes help to identify and fingerprint the materials used by prehistoric - and historical - population and are imperative to preserve ancient knowledge.

Comparative raw material collections can serve as an important tool for the investigation of archaeological lithic assemblages. One of the oldest and best documented collections of this type is housed at the Hungarian National Museum. It is part of the Archaeological Collection, operating according to normal museum regulations and it is certainly one of the most popular and visited – used – collections of our Museum.

The existence of the Budapest Lithotheca owes much to the systemic mind of Viola Dobosi, her sense and devotion to order which is at the heart of any museum collection. She was instrumental in turning a large heap of stones, collected in course of a survey on archaeological and historical raw materials co-ordinated by József Fülöp, key figure of Hungarian geology in the 1970-ies and 1980-ies[2] into an organised and meaningful museum collection. The base fond of the Lithotheca Collection was obtained during a long series of fieldwork all over Hungary conducted by the Hungarian Geological Institute aiming at discovering the raw material basis of prehistoric communities; an interesting and promising field of research for documenting the movements and economy of prehistoric communities.[3] Viola Dobosi had previously raised the problem in an important article on the raw material basis of prehistoric communities[4] but this is not an issue one can easily solve alone. Realising the potentials of a collection-and-database approach, she offered "home" for the collection in the Hungarian National Museum and helped in the primary elaboration and inventorising of this specific collection.

The first catalogue was published in 1991 by the Museum,[5] theoretical and practical questions of collection management raised and published on several forums of petroarchaeology and flint studies.[6]

The second volume of the catalogue was published ten years later.[7]

The starting fond was published on the internet in a bilingual database illustrated with coloured photos[8] and the Lithotheca collection was one of the first fully digital inventory databases of the Hungarian National Museum.[9]

Regional aspects

The Lithotheca of the Hungarian National Museum is a "world collection" in the sense that it contains hand specimens from all the five continents. We receive gifts, exchange samples and sometimes have the possibility to collect on far-away territories, out of the reach of the prehistoric population. It is evident, though, that the coverage of the comparative raw material collection should focus on "home affairs", i.e., the raw materials potentially used and traded by the peoples inhabiting the territory of

[1] LANGE ed. 2004.
[2] FÜLÖP 1984.
[3] T. BIRÓ 1984; 1986; T. BIRÓ–PÁLOSI 1986.
[4] T. DOBOSI 1978.
[5] T. BIRÓ–DOBOSI 1991.
[6] T. BIRÓ–DOBOSI 1990; T. BIRÓ 1990; T. BIRÓ 1992.
[7] T. BIRÓ et al. 2000.
[8] http://www.ace.hu/litot/indexe.html
[9] T. BIRÓ 2008.

present-day and historical Hungary. We have far better chances to be really representative for the region we actually know - not forgetting that a comparative collection can never be really complete; raw material sources can disappear, get exploited or covered by sediments. The chances to cover an area well naturally decrease by distance from the sources. Another critical point is the diachronical coverage; siliceous raw materials and glassy/homogeneous substances like obsidian will be adequate for chipped stone tools, used in the Palaeolithic and in the younger "lithic" periods but in the latter times, long distance import is realised more by polished stone raw materials. The variety of lithic raw materials to be collected is extended essentially as we proceed towards younger prehistoric periods.

Fortunately, our efforts are not isolated. In recent years, more and more regional collections were founded with similar objectives. The present paper is intended to serve as a germ for collecting such efforts. We should know about the work of other people on this interdisciplinary, interregional and networking field to maximise the benefit of comparative collections supporting petroarchaeological work.

Survey of Lithothecas

Questionnaire

The petroarchaeological information basis, unfortunately, is not easy to collect because these collections, even if they exist and are available, rarely get published. As a method to gather information, I have used two basic techniques: asked colleagues (on e-mail), starting with the Flint mining research group of UISPP and tried to collect information on the internet.

For the personal way of gathering information, I made a simple questionnaire to ask for the basic data ***(Fig. 1.)***. I am most grateful to all colleagues who contributed with information[10] and especially those who completed the questionnaire.[11]

Altogether 13 persons completed the questionnaire till 31.12.2010, about 21 comparative raw material collections in 11 countries.

Internet survey

In course of surveying data for comparative raw material collections I was trying to use various orthographies in search of the subject to give full coverage if available. ***Table 1*** summarises my results that I could "google" (date: 15.01.2011) using different orthographies for comparative collections, including some language variants (and probably omitting others, too).

It is evident, that I could not reach all the existing Lithothecas, but I believe it is a good start and we can always complete the database. Hopefully this survey contains the publicly available electronic data services on comparative lithic raw material collections and we are planning to update the links regularly. Moreover, this summary will be passed to flintsource.net for wider availability.

Orthography for search

Lithotheca is a composite word of partly Greek[12] and partly Greco/Latin[13] origin.

It is used in several orthographic variants for many languages. The standard way of writing in Hungarian is Litotéka and we use the form Lithotheca in publishing in English (mostly...). There are, however, many language variants and inconsequent spelling (not to speak of *Összehasonlító nyersanyaggyűjtemény*[14] on any language). It is also possible that not all the references found are comparative raw material collections for petroarchaeological purposes and though I tried to pop up most, of course I could not see all.

I do not think that I could locate all the Lithothecas all over the World but it is a reasonable start you are most welcome to join, any time!

[10] Information received from Michael Brandl, Cyril Marcigny, Martin Oliva, Naama Goren, Javier Baena, Jacques Pelegrin, Paolo Biagi, Anne Hauzeur, Gillian Varndell, Elisabetta Starnini, Gheorghe Lazarovici, Michael Baales, David Field, Alan Saville.

[11] Questionaire comleted by Gerhard Trnka, Jehanne Affolter, Fabio Negrino, Javier Baena, Magda Mantu, Vin Davis, Debbie Olausson and Anders Högberg, Beatrix Nutz, Jehanne Féblot-Augustins, Cristian Roman, Xavier Mangado Llach, Xavier Terradas, Elena Cristina Nitu.

[12] lithos, http://www.etymonline.com/

[13] theca, Latin expression, from the Greek expression case to put anything in http://www.websters-online-dictionary.org/

[14] Comparative raw material collection in Hungarian.

Lithotheca Questionnaire

Official name of the collection:	
Founded in: (date)	
Scope:	
Regional (please specify):	
Other:	
Organisation	
- is housed at (institution)	
- curated by (contact person, email)	
Collection size?	
- localities	
-items	
Is it open to	
- scholarly research	
- general public	
Exchange stock?	
- yes/no	
Publication:	
- inventory	
- catalogue(s):	
- internet (please give URL address)	
- other relevant publications	
Elaboration	
- analytical data (method, % of material analysed)	

Fig. 1. *Questionnaire on comparative lithic raw material collections*

Form	Google query results (nr)
Lithothèque	121000 (many of them of primarily geological interest)
Litoteca	4400
Lithothek	4370
Lithotheca	473
Litotéka	202
Litotheca	57
Lithotéka	3 (all HNM Lithotheca)

Table 1. *Comparative raw material collections by Google (~Lithotheca)*

Countries with Lithotheca

Let us start with Hungary, as naturally I know the situation here the best.

Lithotheca of the HNM

We have one of the oldest international collections, founded in 1986 in connection with the *International conference on prehistoric flint mining and lithic raw material identification in the Carpathian Basin.*[15] The scope is centred on the Carpathian Basin with essential exchange and collecting activity in Europe and sporadical items from all the five continents. The Lithotheca is part of the Prehistoric Collection of the Hungarian National Museum and up to now, contains 2082 items (5517 pieces) from 998 localities ***(Fig. 2a, 2b, 2c*** – HNM Lithotheca site maps). It is curated by Katalin T. Biró (tbk@ace.hu), with the invaluable help of Viola Dobosi and András Markó, both working in the Palaeolithic Collection of the HNM. The collection is inventorised according to normal museum regulations and is one of the fully computerised collections in the HNM.[16] Two catalogue volumes have already been published for the periods 1986-1989[17] and 1990-1999,[18] respectively; currently we are working on the Catalogue Vol. III. (2000-2010 in preparation) and the electronic version of the previous two catalogues. The base fond of the Lithotheca, the Hungarian type collection is available in two languages (English/Hungarian) with coloured images at www.ace.hu/litot.

The analytical work on the reference collection involves various techniques of petrographical, mineralogical, geochemical and physical analyses like petrographical thin sections (TS), neutron activation analysis (NAA), X-ray powder diffraction analysis (XRD), electron energy dispersive spectroscopy (EDS), X-ray fluorescence spectroscopy (XRF), prompt gamma activation analysis (PGAA), infra-red spectroscopy (IR), proton induced X-ray and gamma ray emission spectroscopy (PIXE-PIGE) and fission track dating (FTD). By 2000, 1790 analyses were reported,[19] currently we estimate that about 20 % of the Lithotheca collection has been subjected to analytical studies.

The collection is open to research according to general museum regulations; the permanent archaeological exhibition of the HNM is also using the Lithotheca material for presenting the most important lithic raw materials to the general public (***Fig. 3.*** Lithotheca material in the permanent archaeological exhibition of the HNM).

There are no more dedicated petroarchaeological collections in Hungary; however, at the ELTE University, Department of Petrography and Geochemistry, a small study collection was made for educational purposes. Moreover, many current studies are documented there.[20] The same University operates one of the extensive general mineralogical and petrographical collections in the framework of the ELTE Natural History Collection.

15 Sümeg conference T. BIRÓ ed. 1986; 1987.
16 T. BIRÓ 2008.
17 T. BIRÓ–T. DOBOSI 1991.
18 T. BIRÓ et al. 2000.
19 T. BIRÓ et al. 2000; on one piece, the combination of several investigation techniques is typically performed because these techniques are complementary in many respect. The principle is to investigate the geological reference material fully and try to pin-point the non-invasive techniques for the analysis of the archaeological items.
20 for the details, see SZAKMÁNY 2009.

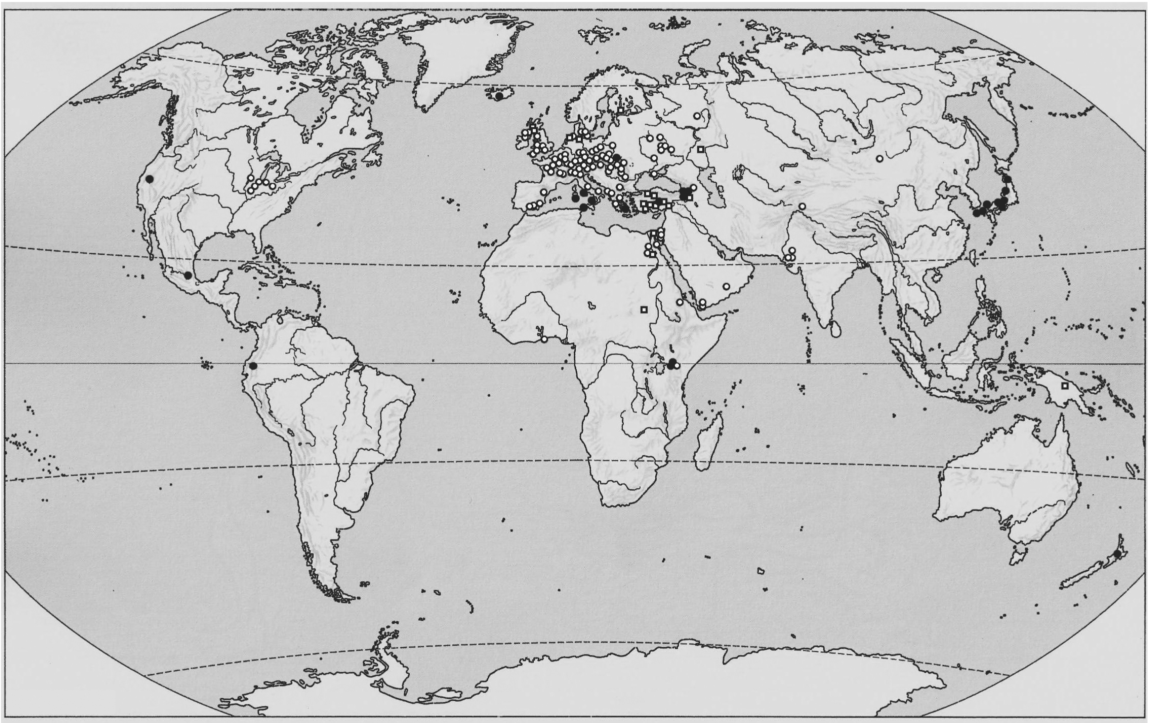

Fig. 2a

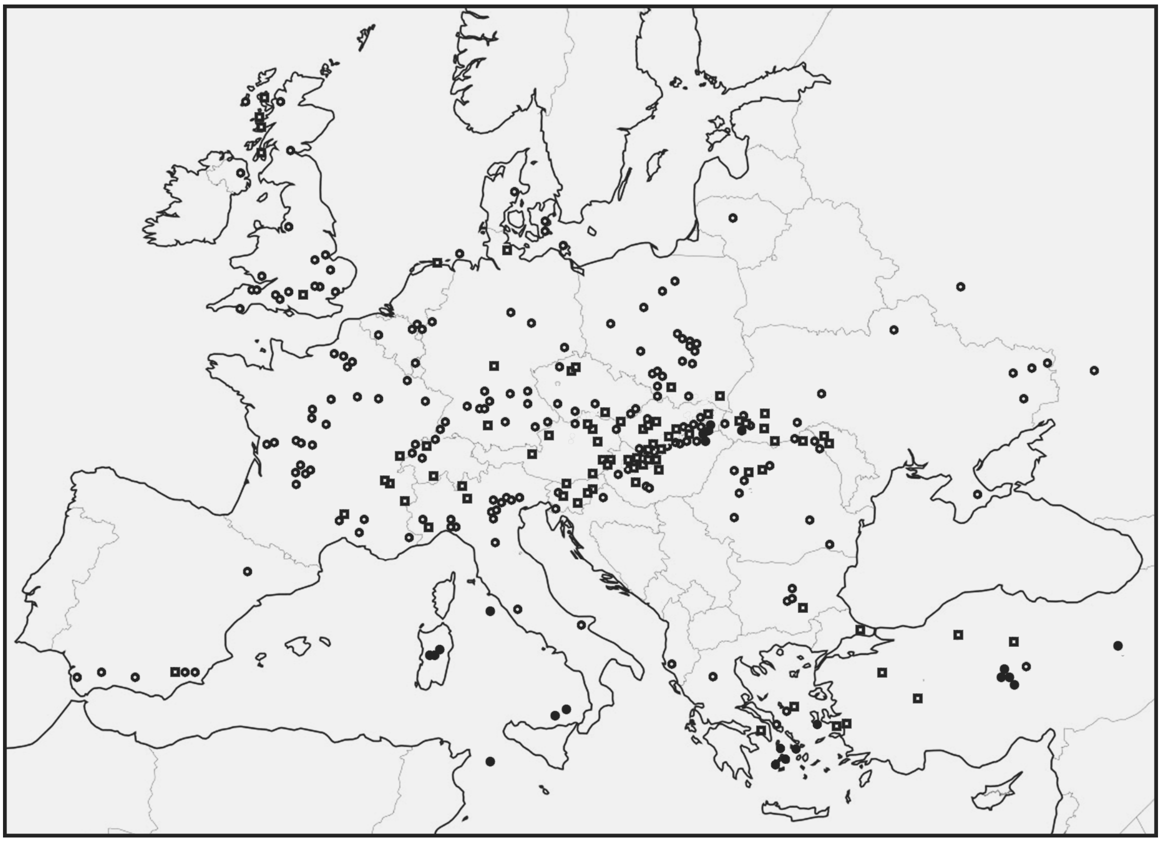

Fig. 2b

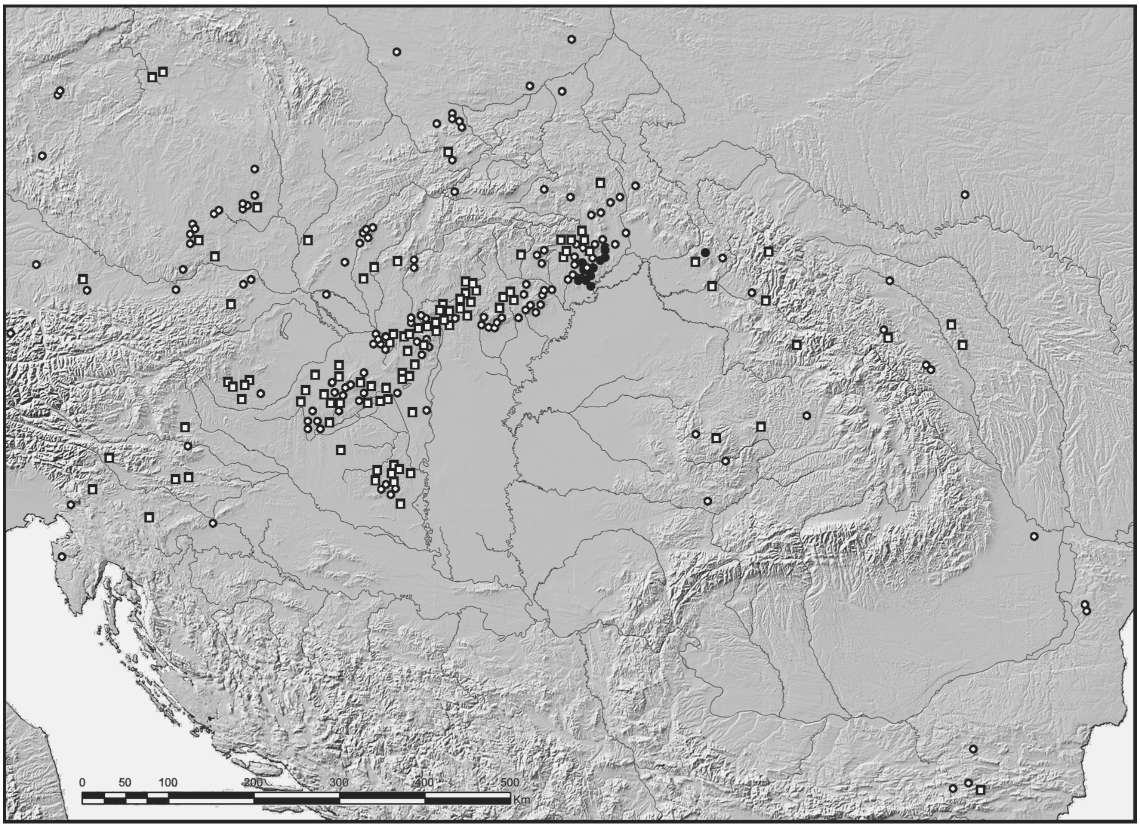

Fig. 2c

Fig. 2. *Raw material samples in the Lithotheca Collection of the Hungarian National Museum.*

Key of symbols: full circles (●): obsidian, open rings (⭘): siliceous rocks; squares (◘): other rocks (for polished stone tools and other stone utensils.
***2a**:* on a World map; ***2b**:* on the map of Europe; ***2c**: i*n the Carpathian Basin

Data: HNM Lithotheca catalogues and inventory database.

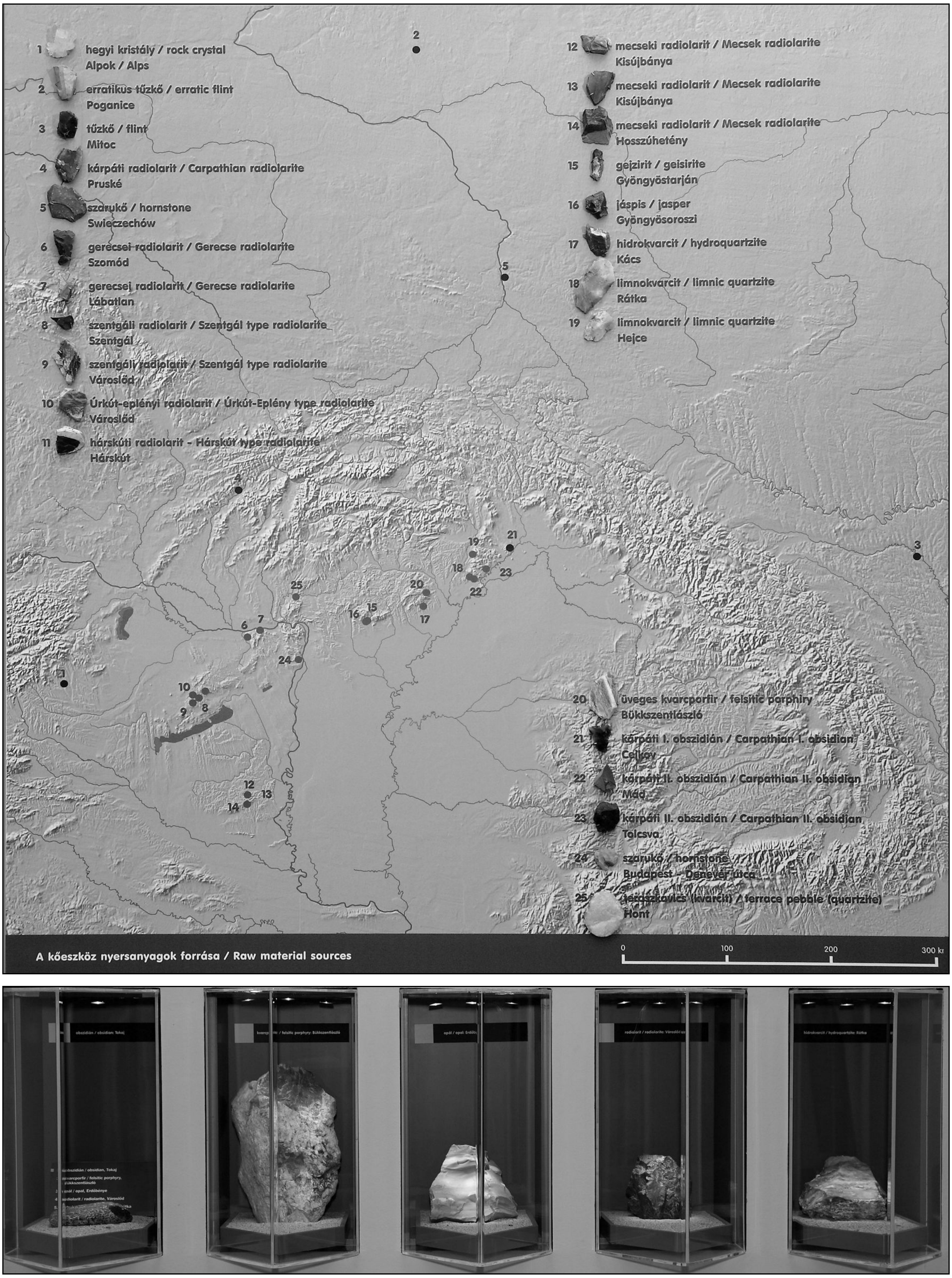

Fig. 3. *Lithic raw materials presented for the public on the permanent archaeological exhibition of the HNM*

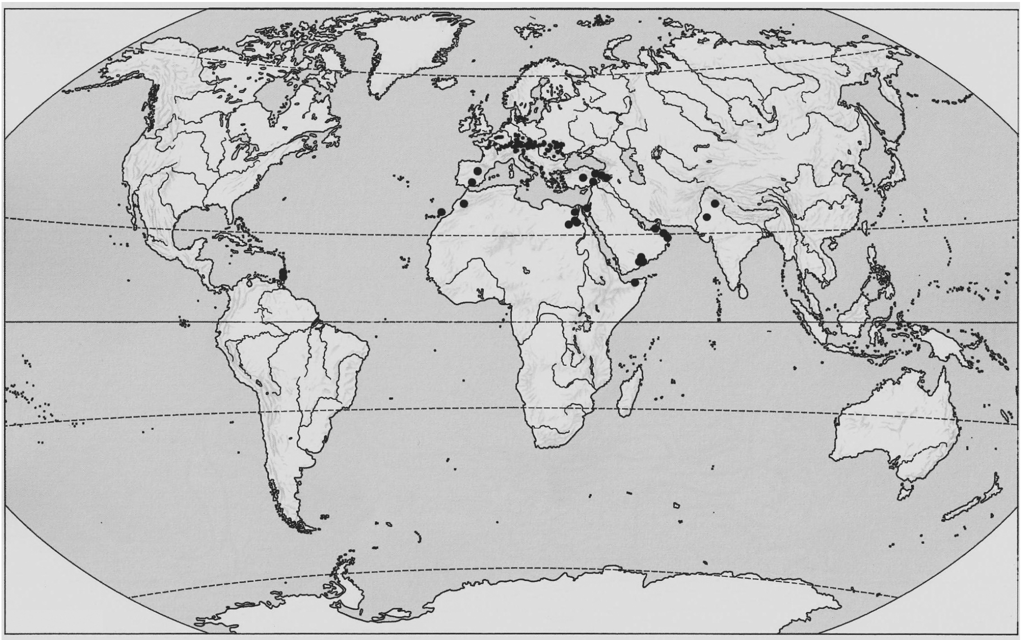

Fig. 4a

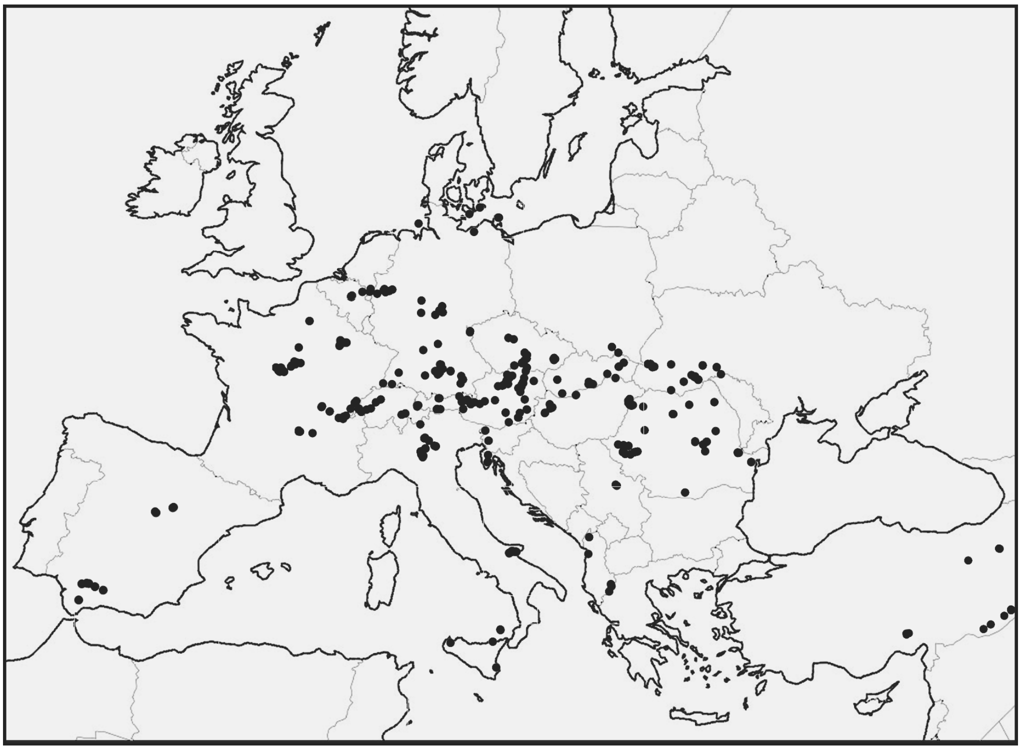

Fig. 4b

Fig. 4. *Lithic raw material samples of the Vienna Lithotheca (VLI).*

Key of symbols: ● localities of the lithic raw material samples.
4a*:* on a World map; ***4b****:* on the map of Europe.
Data: VLI, courtesy of Gerhard Trnka.

Austria

Vienna-Lithothek (VLI)

An important and large comparative raw material collection has been set up in Vienna by Gerhard Trnka. It was founded in 1996. It is extended to multiregional samples from all over the world, mainly European chert samples. It is housed in the Institut für Ur- und Frühgeschichte der Universität Wien, (Franz Klein-Gasse 1, A-1190). The collection is curated by Gerhard Trnka (gerhard.trnka@univie.ac.at) with collaboration of Michael Brandl. The collection comprises, according to the list kindly supplied by G. Trnka, 648 items from approx. 470 sites. There is a GPS-ID list for the samples, on the basis of which we could chart the localities ***(Fig. 4a, 4b)***. The collection is open to scholarly research and exchange with other collections.

Silex Lithotheca of the Institute of Archaeology, University of Innsbruck

Internet search provided another Austrian reference collection *(Lithotheca Transalpina),* curated at the Innsbruck University.[21] Information was provided for this article by Beatriz Nutz. Accordingly, the collection was officially founded in 2007. The focus of the collection is on Northern Alpine chert and radiolarite varieties of North Tyrol and Vorarlberg (Austria), South Alpine varieties of South Tyrol and Northern Italy.

It is housed at the Institute of Archaeology, University of Innsbruck, Langer Weg 11, 6020 Innsbruck, Austria, curated by Dr. Walter Leitner (walter.leitner@uibk.ac.at).

They store currently 197 data sets in the database. The collection is open to scholarly research. They have a moderate exchange stock, on request small amounts of Northern Alpine chert and radiolarite can be provided. There is some internet-based information available on the collection and related project.[22]. Analysis of the collection is in progress.

Czech Republic

In the Czech Republic, important petroarchaeological research is devoted to petroarchaeological problems.[23] However, I received only answer from Martin Oliva from the Anthropos Institute, Brno, stating that they also have a small collection of lithic samples, housed in the Institute (Zelý trh 6, Brno), but with no name and not too systematically collected. They are also interested in exchange of specimens.

France[24]

The *Lithothèque du nord-ouest du Bassin Aquitain* was founded in the 1980-ies. As the name indicates, its primary scope is collecting lithic raw materials from the North-West of the Aquitain Basin as well as the valley of the river Garonne and the Northern part of Dordogne.

It is housed at Musée national de Préhistoire des Eyzies, - curated by Alain Turq (alain.turq@culture.gouv.fr). The collection comprises hundreds of sites of primary and secondary silex deposits. The collection is open to scholarly research. The collection is systematically analysed from micropalaeontological point of view, petrographical analysis is in progress. Publications by A. Turq give further information on this collection.[25]

Information on three French comparative collections (Bugey, Charente, UMR7055) was provided by J. Féblot-Augustins.

Lithothèque du Bugey. Echantillons de référence

Founded in 2004, by J. Féblot-Augustins. Focused on raw material samples for prehistoric raw materials in Bugey region (Ain, France). Housed at (institution): UMR 7055 - Préhistoire et Technologie. Maison de l'Archéologie et de l'Ethnologie - René Ginouvès. 21, allée de l'Université, 92023 Nanterre Cedex, France. Curated by Jacques Pelegrin (jacques.pelegrin@mae.u-paris10.fr). The collection comprises several hundred (3-400) items from 73 localities; 51 petrographic types were distinguished among them. It is open to scholarly research and they have a restricted amount of exchange material. The analytical work on the collection is based on combining macroscopic characterisation and sedimentary microfacies analysis under the stereoscopic binocular microscope; all the collected samples were analysed (100%).

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[21] HOLDERMANN 2004.

[22] http://www.uibk.ac.at/himat/pps/pp05/lithothek.html.en, http://www.uibk.ac.at/himat/pps/pp05/sio2-datenbank.html.en, http://www.uibk.ac.at/himat/pps/pp05/lithothek.html.en, http://www.uibk.ac.at/himat/pps/pp05/sio2-datenbank.html.en.

[23] PŘICHYSTAL 2009.

[24] Several people informed me about a Lithotheque operated by Paul Fernandes, leading a project to collect information on existing reference collections in France.

[25] TURQ et al. 1999; TURQ 2000; 2003.

Information is available in the framework of the Flintsource webpage,[26] Other relevant publications include various papers by J. Féblot-Augustins.[27]

Lithothèque du bassin de la Charente

Founded in 2005, by J. Féblot-Augustins, S.-J. Park & A. Delagnes, focusing on raw material samples from the Charente river basin (France). The collection is housed at the Musée d'Angoulême (Angoulême 16000, France), curated by Jean-François Tournepiche (jftbill@aol.com). It is comprising 183 items from123 localities, open both to professionals and the general public. They have available exchange stock

Analysis of the material is in progress combining macroscopic characterization and sedimentary microfacies analysis under the stereoscopic binocular microscope; all the collected samples were analysed; full descriptions available for 57% (105 samples from 53 localities). Internet information on the collection is available[28] other relevant publication is by J. Féblot-Augustins et al.[29]

Lithothèque de l'UMR 7055

Founded in 2008, by J. Féblot-Augustins. Collecting lithic reference material from various countries, notably 31 countries. Algeria, Germany, England, Brazil, Canada, Denmark, Egypt, Ecuador, Ethiopia, France, Gabon, Greece, Guatemala, Hungary, Israel, Italy, Japan, Kenya, Mexico, Morocco, Niger, Poland, Portugal, Czech Republic Slovakia, Switzerland, Syria, Turkey, USSR, USA.

In France, the following departments: Ain, Aisne, Alpes-de-Haute-Provence, Alpes-Maritimes, Bouches-du-Rhône, Cantal, Charente, Charente-Maritime, Corrèze, Côtes-d'Armor, Dordogne, Drôme, Finistère, Gard, Indre, Indre-et-Loire, Isère, Haute-Loire, Loire-Atlantique, Lot, Lot-et-Garonne, Oise, Rhône –Saône-et-Loire, Savoie, Seine-et-Marne, Somme, Val-d'Oise, Var, Vaucluse, Vienne, Yonne, Yvelines.

The collection is housed at UMR 7055 - Préhistoire et Technologie. Maison de l'Archéologie et de l'Ethnologie - René Ginouvès. 21, allée de l'Université, 92023 Nanterre Cedex, France, curated by Jacques Pelegrin (jacques.pelegrin@mae.u-paris10.fr). It comprises 1137 items from 306 localities. The collection is open to scholarly research. For some samples, they have exchange material as well.

The inventory is currently in the form of Excel files.[30]

Israel

Housed at the Centre de recherche français de Jérusalem, a comparative collection has been set up by Christophe Delage.[31]

Italy

Elisabetta Starnini informed us on a small private raw material collection curated by Fabio Negrino (archeoge@alice.it) at the Soprintendenza Archeologica della Liguria, Genova (Italy). It was founded in 2000 with the aim of supporting research on prehistoric exchange. The regional scope covers Liguria and North Italy mainly, with some coverage on more distant European territories Currently the collection involves about 50 localities. It is open to scholarly research and they have an exchange stock as well.

Romania

Information was provided and organised from Romania by Magda Mantu and Gheorge Lazarovici. My sincere thanks for their help. Accordingly,, there are at least three operating comparative raw material collections in Lithotheca, at Cluj, Targoviste (information by E. Nitu) and the Hunedoara Museum (information by C. Roman).

The *Cluj* comparative raw material collection (the oldest in Romania) is currently not available for research (information by M. Mantu).Related research was also reported by O. Crandell.[32]

Targoviste comparative raw material collection

Founded in 2007; focusing on raw materials used on Romanian Palaeolithic settlements. It is housed at Valahia University, Research Center "Prehistory, interdisciplinary archaeology and conservation of national patrimony", curated by prof. univ. dr. Marin Carciumaru (mcarciumaru@yahoo.com) and drd. Elena-Cristina Nitu (elenacristinanitu@yahoo.com). The collection comprises over 500 items from about 100 localities. Is it open to scholarly research. They can provide samples of raw material for exchange.

The samples are systematically analysed by non destructive analysis with digital microscope VHX 600

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[26] http://www.flintsource.net/flint/ infF_bugey.html
[27] FÉBLOT-AUGUSTINS 2005; 2007; 2009a; 2009b
[28] at: http://www.alienor.org/ARTICLES/lithotheque/index.htm and http://alienor.org/bibliotheque/lithotheque/lithotheque-charente_2010.pdf;
[29] FÉBLOT-AUGUSTINS et al. 2010.
[30] available from J. Pelegrin
[31] DELAGE 1997a; 1997b; 2010.
[32] CRANDELL 2009.

(Keyence) for petrography and paleontological study. About 100 sources of raw materials were analysed.

Relevant publications comprise various papers by M. Carciumaru et alii.[33]

Corvin's Castle Museum Lithotheca (Hunedoara)

The collection was founded in: 2008. They are mainly concerned with collecting archaeological raw materials from Hunedoara county. It is stored at the Corvin's Castle Museum, curated by Sorin Tincu (sorin_tincu@yahoo.com). The following sites are represented: Hunedoara-*Prunilor street*, Silvaşu de Jos-*Dealul Ţapului*, Valea Nandrului-*La Dos*, Nandru-*Petac stream*, Boş-*Grui*, Sântuhalm-*Gheţărie*, Herepeia, Căoi, Cioclovina, Brotuna, Cinciş-Cerna, mainly silex nucleus and flint blade samples, and primary geological source material. It is open to scholarly research and the have an exchange stock as well.

Analytical data are available for Cauce' cave site here, i.e., macroscopic and microscopic analyses, the location of the presumptive zone of origin of the silica rocks (jasper, opals); cca. 40 % of the material is analysed and store cross-section of siliceous rocks nodules used as raw material for flint tools.[34]

Spain

Lithotheca UAM (Madrid)

Founded in 2007. Collecting raw materials from Madrid Region. It is housed at the Dep. Prehistoria y Arqueología, Universidad Autónoma de Madrid 28049 Madrid , Spain, curated by Javier Baena (Javier.baena@uam.es). The collection comprises primary and secondary deposits from more than 200 sites in Madrid environs. It is open to scholarly research; they have an exchange stock. The collection is inventorised.

LITHICUB – Litoteca de matèries primeres prehistòriques de la Universitat de Barcelona

Founded in 2007, focusing on lithic raw materials from Western Europe (Centre Portugal, Centre France, Ebro Valley, Catalan region). The collection is housed at the University of Barcelona. Faculty of Geography and History. Laboratory of Archaeology, curated by Dr. Javier Mangado (mangado@ub.edu). It comprises about 100 items from around 50 localities. It is open for scholarly research. About 50% of the collection is analysed by petrographical thin sections. Internet-based information is available at www.lithicub.net.[35]

LITOCAT[36] – Lithotheca of siliceous rocks from Catalonia

Founded in December 2004. The geographical scope of LITOCAT focuses on the Northeast of the Iberian peninsula which corresponds to the present administrative territory of Catalonia, including as well other neighbour regions (Aragón, Andorra and Languedoc-Roussillon). The reference collection and areas for study and storage of samples and materials of LITOCAT are located in the Institute "Milà and Fontanals" (CSIC - Spanish National Research Council, Barcelona). Curators of the collection are David Ortega (ortega@imf.csic.es) and Xavier Terradas (terradas@imf.csic.es). So far they have documented 258 locations with siliceous rock outcrops in the study area, visited and recorded 59. These 258 locations have allowed to document up to 85 different types of siliceous rocks. Up to now they have approximately 1200 samples from the locations which have been visited and recorded (an average of 20 samples per location). LITOCAT spaces are open to all students and researchers interested in the study of siliceous raw materials from North-Eastern Iberia and neighbouring regions. The curators are working on making available all the information related to the LITOCAT project on the internet as soon as possible.

All locations are systematically recorded and sampled. A selection of samples from every location has been thin-sectioned and analysed through XRD. Occasionally ICP-MS analyses have been done on some samples.

Exchange stock is available from some of the localities. Internet-based information is currently available at:
http://imf.csic.es/web/esp/dptos/sochumanas-laboratorio3.asp?s1=4.

Sweden

Scandinavian flint Collection

Founded in: 2007, focusing on Scandinavian flint in general. Samples are collected from all known flint localities in Sweden, Denmark and Rügen, Germany. There are currently two reference collections in operation, stored at Department of Archaeology and Ancient History, Lund University, Lund, Sweden and at Malmö Museum, Malmö, Sweden. The Lund stock is curated by D. Olausson (Deborah.Olausson@ark.lu.se), at Malmö by A. Hogberg (Anders.Hogberg@sydsvenskarkeologi.se).

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[33] CÂRCIUMARU et al. 2007; 2008; 2009; 2010.

[34] Relevant publications: BARBU 2007; LUCA et al. 2004; ROMAN 2008.

[35] Further relevant literature: MANGADO et al. 2010.

[36] My favourite name – you all know why.

The sampled localities cover all of Denmark. Flint localities in Sweden are mostly located in the southern part; the most northern locality is Kinnekulle. In northern Germany the chalk cliffs at Rügen were sampled. 17 types of flint are separated; samples numbering between 1 and 10 of each type. The collection is open to research as well as the general public. Though they have no formal exchange stock, on request, they are ready to accommodate such needs.[37] Analytical work by non-destructive energy dispersive X-ray fluorescence spectrometry is in progress; pilot study published by Hughes, R.E. et alii.[38]

Switzerland

In Switzerland, two regional comparative raw material collections are in operation. They are basically connected to the research and scientific activity of Jehanne Affolter.[39] The data presented below are supplied from her directly.

The older collection has considerable past is. It is called *Lithothèque de Référence (of AR-GEO-LAB),* founded in 1986. It is collecting samples of flint and chert in European scale. It is housed at AR-GEO-LAB, Dîme 86, CH 2000 Neuchâtel. The collection is curated by Jehanne Affolter (affolterjs@bluewin.ch). The collection comprises items from more than 1200 localities. It is open to scholarly research with previous announcement. For the most raw materials, they also have exchange samples. About 2/3 of the reference collection is analysed by non destructive sedimentary microfacies analysis in relation to the archaeological use.

The *Lithothèque de Référence in the Laténium wa*s founded in 2002. It is collecting flint and chert from the Jura mountains and adjacent regions. The collection is curated by Béat Arnold and Jehanne Affolter (affolterjs@bluewin.ch). It is housed in the above mentioned Laténium at Espace Paul Vouga 2, CH-2068 Hauterive. The collection comprises items from 688 localities. It is open to scholarly research (with previous announcement) and sometimes also to the general public. They have a limited exchange collection from the localities most relevant for the archaeology. The samples are all investigated by non destructive sedimentary microfacies analysis; with special emphasis on their relation to the archaeological lithic artefacts.

United Kingdom

Implement Petrology Group (IPG) National Collection of Thin Sections[40]

The collection originates probably from the 1930s as a formal collection in its present form.

The scope involves basically the region of England and the Isle of Man: it is the national depository of all the thin sections studied by the Implement Petrology Committee (IPC) of the Council for British Archaeology and its successor Implement Petrology Group (IPG).

It comprises also, for information about thin sections of world wide significance, items based on the collections of the British Museum, London and the Natural History Museum, London. But these this sections are owned by the Museums, and do not form part of the IPG National Collection. Some thin sections are known to be in private hands, although the numbers are not thought to be significant.

The collection is held mainly at four sites: Department of Mineralogy, National History Museum, London (remainder of English Counties excluding those listed below). (Dr Dave Smith; D.A.Smith@nhm.ac.uk); Lapworth Museum, University of Birmingham, UK; (English Midland Counties (Jon Clatworthy, j.c.clatworthy@bham.ac.uk); Castle Museum, Taunton, UK (SW English Counties, swimpg@swfed.org.uk); IPG chief petrologist, York, UK (NW England, Dr R.V. Davis, rvindavis@gmail.com). The collection is curated by Allison Fox (Isle of Man, Manx Museum, Douglas, allison.fox@gov.im).

The size of the collection is estimated about altogether 3650 items (London 2000 slides; Birmingham 400 slides; Taunton 1000 slides; York 200 slides; Manx 50 slides). The use of the collection is limited to scholarly research. There is no exchange stock, no opportunity to cut additional material. The collection policy since the 1990s has been to make polished thin sections and retain rock fragments for geochemical analysis. Internet information is under development.

Most of the slides were analysed by optical microscopy and about 1% also by geochemistry.

The catalogue of the collection was published by Cummins and Clough.[41]

Alan Saville informed us on some comparative material collected by Caroline Wickham-Jones available at the *National Museums Scotland*; it is not organised into a formal collection.

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37 HÖGBERG–OLAUSSON 2007.

38 HUGHES et al. 2010.

39 AFFOLTER 2002, 2009.

40 Information supplied by Vin Davis, Chairman, IPG UK

41 CUMMINS–CLOUGH 1988.

Summary

Comparative raw material collections are an essential part of the tools in the service of modern, scientifically supported archaeology imperative for the challenges of 21st century archaeology. It is, however, not enough to carry on regional initiatives, it is important to know about each other's efforts. Internet-based modern technology can help us being in permanent contact, much more than we are now.

Of course I cannot pretend that this list is complete; my means and time for constructing it being equally limited. I am most grateful for the people who helped me to collect information and hope I did not misunderstand their points.

Annex on the **recherche du temps perdu…**

The analysis and query serving as a basis of this study have not been repeated; the author is aware of recent advances in the field. Since the publication of the first version of this paper (2011), at least two important conferences have addressed the topic of Lithotheques directly: the meeting of UISPP Flint Mining Commission in Paris (Paris 10-11 September 2012) and the Fifth Arheoinvest Symposium *'Stories Written in Stone' - International Symposium on Chert and other Knappable Materials* in Iasi, Roumania, 20-24 August 2013).

This means that Lithotheques as such are important tools for research and networking is a necessary step in extending the potentials of comparative raw material collections. Unfortunately, only a small part of these communications were actually published.[42] The thought-evoking communication of J. Affolter (2012) addressed the possible fate of the comparative raw material collections, constructed by immense personal efforts and expertise which are often considered expendable and do not receive the curatorial care necessary to maintain and develop these collections on the necessary standard. Another important communication by A. Burke (2013) was addressed to the problems of how to adequately and representatively collect raw material samples for a petroarchaeological comparative project.[43]

[42] SÁNCHEZ et al. 2014.

[43] The publication of this paper was supported by Hungarian Scientific Research Fund project OTKA K-100385 "Provenance study of lithic raw materials of stone tools found in the Carpathian Basin"

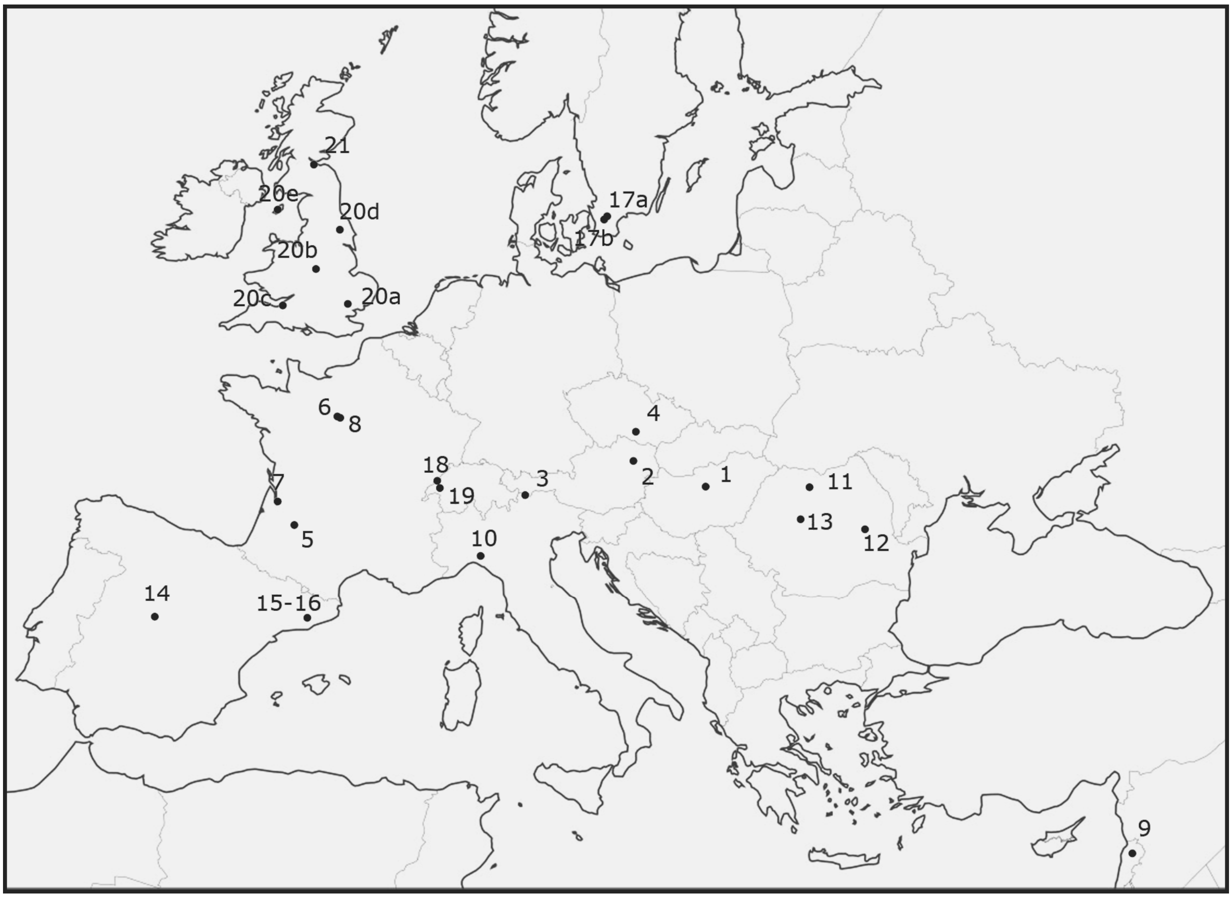

Fig. 5. *Comparative lithic raw material collections according to the present survey*

The list is open for further completion and corrections ***(Fig. 5.***[44]*)*.

[44] The Lithothecas are numbered accordingly
1. Lithotheca of the HNM
2. Vienna-Lithothek (VLI)
3. Silex Lithotheca of the Institute of Archaeologies, University of Innsbruck
4. Anthropos Institute, Brno
5. Lithothèque du nord-ouest du Bassin Aquitain des Eyzies
6. Lithothèque du Bugey. Echantillons de référence
7. Lithothèque du bassin de la Charente Musée d'Angoulême
8. Lithothèque de l'UMR 7055 Nanterre
9. Centre de recherche français de Jérusalem
10. Soprintendenza Archeologica della Liguria, Genova
11. Cluj comparative raw material collection
12. Targoviste comparative raw material collection
13. Corvin's Castle Museum Lithotheca (Hunedoara)
14. Lithoteca UAM (Madrid)
15. LITHICUB. Litoteca de matèries primeres prehistòriques de la Universitat de Barcelona
16. LITOCAT – Lithotheca of siliceous rocks from Catalonia
17a. Scandinavian flint Collection Lund
17b. Scandinavian flint Collection Malmö
18. Lithothèque de Référence (of AR-GEO-LAB), Neuchâtel
19. Lithothèque de Référence in the Laténium Hauterive
20a Implement Petrology Group (IPG) National Collection of Thin Sections London
20b Implement Petrology Group (IPG) National Collection of Thin Sections Birmingham
20c Implement Petrology Group (IPG) National Collection of Thin Sections Taunton
20d Implement Petrology Group (IPG) National Collection of Thin Sections York
20e Implement Petrology Group (IPG) National Collection of Thin Sections Manx
21. National Museums Scotland; Edinburgh

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STUDY OF MICROSCOPIC USE WEAR (MICROWEAR) ON PREHISTORIC CHIPPED STONE TOOLS FROM HUNGARIAN SITES. RESULTS, POSSIBILITIES, PERSPECTIVES

ERZSÉBET BÁCSKAY

Keywords: *microwear studies, prehistoric chipped stone implements*

Study of microscopic use wear traces on chipped stone tools (edge damage, wear, striations, polishing caused by use) with the aid of microscope is already a widely applied and by now a routine investigation method practised in several countries. The aim of these studies is to determine the function of chipped stone tools, the kind and way of the work made by them. Certain use wear traces had been observed on chipped stone tools already in the second half of the 19th century when they were studied by hand magnifying glass. Later, in the first half of the 20th century these traces had been studied under some low-power microscopes as well. During these studies it became clear that contact of different kinds of materials and also the work made by them or on them leave traces on the chipped stone tools. Except some special cases, e.g. sickle gloss, which can be observed even by the naked eye these traces can be studied only under microscope and appear as damages, striations, polishes. Polishes are characteristic of the raw material worked, that is, different raw materials cause polishes of different kinds on tools, naturally on those parts of the tools which were the working parts. Contact/work may cause also scratches on the tools which are linear striations. The place and direction of these striations refer to the moving of the tools during work. The damage of edges may give information on the hardness of the material worked. Usually the joint study of these three use wear types is necessary to the determination of the function of the tool.

After a short cleaning the tools are studied under a binocular microscope with incident light and the observed use wear is compared by the ones appeared on experimental tools after working with them on different materials.

Besides the determination of the function of single tools, the method is suitable to compare the results of microscopic studies with the traditional typological-morphological determinations, also to observe the changes, if any, in the use of certain tool-types, or to determine some places of working within archaeological sites, etc.

Unfortunately in Hungary this method is still not widely used. The first microscopic studies on Hungarian archaeological material were made by Brian Adams (University of Illinois) at the beginning of the nineties of the last century. He studied first of all Copper- and Bronze Age tools[1]. It was he who had taught the basics of this study to the author of this paper and here, too, I should like to express my many thanks for it. I started my three years' studies in 1993 supported by the OTKA project T-13918 and later I continued the work. So far I had studied more than 10,000 prehistoric chipped stone tools (from Upper Palaeolithic, Mesolithic, Neolithic, Copper Age and Bronze Age sites in Hungary (for the list of sites see ***Table 1***) and made 170 experimental tools[2]. Here I should like to express my many thanks for the OTKA support as well as for the kindness of those colleagues who had assigned to me their material for studies or invited me to do these investigations.

Below I should like to give a short summary of the results and most important experiences of my studies made so far as well as to suggest some further tasks.

The study of microscopic use wear traces (further microwear) can be learned relatively easily, yet it demands a prolonged practice and attention. The Australian scholar, Ian Kamminga, one of the initiators of microwear studies, was absolutely right

[1] Mentioned by CSONGRÁDINÉ BALOGH 1998–1999; 2004.

[2] BÁCSKAY 1995 (electronic); 2008.

when he gave the subtitle to his theses „A journey to the *Microscosmos*". That is, those who study the microwear, first of all have to be accustomed to the sight which appears under the microscope. They must have an eye to distinguish „used" and „unused" surfaces on the tool and have to recognize the difference, e.g., between the polish caused by use and post-depositional polish or trashing. While the first one appears only on and near the used edges of the tools, the other ones appear all over the surface of the tool. The correct interpretation of dimensions is also important: scratches of only some microns' length can be used to determine the direction of movement of the tool. E.g. scratches (striations) parallel to the edges are usually regarded as referring to cutting while the ones perpendicular to them are regarded as referring to scraping. Especially beautiful examples of these striations perpendicular to the working edge can be seen on the ventral sides of scrapers near the scraping edges. Scratches (striations) caused by work must be distinguished from other kinds of scratches. Those random scratches which often appear on the tools and in several cases also far from the edges are not the results of use, they are posterior, post-depositional damages. We have to be accustomed also to the sight of the surface of the tool under the microscope which appears as a series of „hills and valleys," which, however, are obviously of only a few microns' dimension. And we have to realize that usewear on tools appears on the higher, protruding parts of these tools only because, though the whole edge itself of the tool meets the worked material, usewear is created at first on the protruding parts.

Naturally, during my studies I had to face several difficulties and problems. E.g., there are some materials – like meat or some other soft materials – which leave only a few and not well-distinguished traces on tools. It is possible that a short-time use even does not leave traces on the implement or, on the contrary, we do not find microwear on a certain tool just because it was so intensively used that the used part had become worn, it had broken off or it was re-sharpened. That is, if we do not find microwear on a certain tool, it does not mean that it was not used at all. Sometimes a more intensive microwear formed later, e.g. sickle gloss, may even cover all the earlier traces on the tool.

In several cases I observed the great role of the character and quality of lithic raw materials of the tools in microwear studies. In cases of tools made of cryptocrystalline rocks with silica content (commonly, though rather incorrectly called as flint, silex) the fundamental condition of a really adequate microwear analysis would be to get those raw material types which the tools of the archaeological site in question had been made of and also to make experimental tools of them for a really correct comparison. In several countries this is an every-day practice. It is an experience that microwear does not appear in the same manner on tools made of different kinds of lithic raw materials. E.g. on some rocks with inhomogeneous structure, with tiny crystals, reflective surfaces or containing inclusions or fossils, microwear can be observed only with much more difficulties than on other rocks. Certain types of hydroquartzites and limnoquartzites of the Northern Hungarian Mid-Mountains have a character like this and these types of rocks were always widely used during prehistoric times. Therefore it would be desirable to establish a collection of experimental tools made of at least those lithic raw materials which can be found most frequently in Hungarian sites as the material of chipped stone tools.

A disadvantage of microwear study is that it cannot be applied on obsidian tools. That is, polishing caused by use does not appear on volcanic glass. Theoretically, striations could be observed on it but practically the hyaline character of the material is extremely disposed to be scratched naturally. In case of obsidian tools with some restrictions the study of edge damage is applied.

When we have to analyse a large quantity of material, when an archaeological site yields several thousands of chipped stone tools, in some cases it is impossible to investigate every single artefact. Therefore a preliminary selection can be applied. Observing the possibly used edges of tools under a hand magnifying glass, we may determine, though only at a very rough guess, whether the given edge had been used or not. During my studies I had investigated the supposedly used edges of several hundred tools by hand magnifying glass and after it under microscope. The result was that about 70-75 % of the edges judged as to be used marcoscopically, proved to be used also under a microscope. At the same time – as it was expectable – under a microscope microwear was observed on much more tools than under a hand magnifying glass. Consequently preliminary selection should be applied only as an expedient method, because the very aim of microscopic analysis is to get a much more reliable result. Besides, the only way to get adequate information on the function of tools used at a given site is to investigate every single artefact found there.

We have to acknowledge that microwear study does not solve every problem regarding the function and use of chipped stone tools. Quite often the only statement we are able to say about a tool is nothing more but whether it was „used" at all or not, or whether there was some „contact" between it and some material or not. Sometimes we are unable to say more about the nature of the material „worked" that it was either hard or soft. Therefore we must not treat the result of microwear analysis in itself; we have to interpret it always within the archaeological context. Strictly speaking, if we find on a tool a polish or edge damage or striation of not natural origin our only honest attitude to this observation could be to declare that this tool had once „met" such-and-such material(s) in some way. And from this statement several different conclusions can be drawn. E.g. the conclusion could be different if the tool was found as a grave good or it came to light from a settlement from a house or from a depot. And the very fact of „contact" makes us to recognize that not all of the microwear traces are the result of working with the tool. E.g. if the tool was in a wooden, bone or antler socket, or in a small pouch, sheath, etc. made of hide, bark, textile, etc. attrition, friction of these materials, too, may create microwear on the tool. (Though usually the microwear resulted by working is much more intensive, well-marked, while the ones resulted by simple curation are faint, diffused.) But the question is not so simple. As an example I should like to quote an analysis made by Brian Adams on a Copper Age implement which can demonstrate well several problems of microwear analysis. The implement in question is a retouched blade which came to light from the grave No. 22. of the Copper Age cemetery Tiszavalk-Kenderföldek. As Adams writes „….the usewear traces on it suggest that the implement had got in connection with at least three different materials:

- dry hide – cutting (left lateral side)
- boring of bone/antler (on the dorsal side both on the right and left lateral parts)
- wood (on the left lateral part at the proximal part)
- finally, on the distal part on the ventral side the hinge-like wear at the tip refers to a damage caused by impact.

One of the possible explanations of these microwear traces is: the implement was used as a weapon, most probably as a spear or a knife which had been thrusted into the body of the person buried in the grave. Because it was found near the abdominal cavity we may think that the „point" had been broken off from its socket and did not come to light from the body. The microwear traces caused by bone and antler refer most probably to contact between the tool and the skeleton of the victim, while the wear caused by wood contact on the proximal part refers most probably to the presence of the wooden socket of the weapon. Microwear resulted by dry hide could be interpreted with more difficulty. It is possible that it refers to the leather sheath of the weapon which used to protect it when it was not used."[3] Éva Csongrádi Balogh, who made the typological analysis of the chipped stone tools of the cemetery, added that it was possible that only in the last phase of its utilization was this implement the „deadly weapon" reconstructed by B. Adams. (Otherwise the grave No. 22, of Tiszavalk-Kenderföldek, that of a man, is remarkable also because of its other grave goods, namely the man was buried also with an obsidian arrowhead and blade, a silex arrowhead, several animal bones and a wild-boar mandible. Only a few graves of this cemetery yielded wild-boar mandibles and silex arrowhead was found only in one of the other graves.

During my studies I found several tools on which more than one microwear could be observed – though they were not as interesting as the grave good described above. First of all I found them on end scrapers. On these tools, on or near the working edges, usually on the ventral side, besides polishes and striations undoubtedly referring to scraping work, we can observe sometimes other microwear, too, along the lateral edge(s) which originated from wood contact. By all means it refers to a haft or a socket. At the same time when there is not too much difference as regards the character and intensity of polishes caused by different materials on the same tool we must not exclude that the implement was either multifunctional or perhaps it had been re-used in a different function.

Below I should like to give a short report of the most important and informative results of my studies made on the microwear of chipped stone tools from prehistoric sites, referring also to the problems of observation and interpretation described above. My studies were made using an Ortholux II. Pol-Bk Leitz Wetzlar microscope with incident light (200x magnification) and with a Stereomicroscope (80x magnification). I studied first of all polishes and striations, edge-damage was investigated only in certain cases. Here, too, I should like to express my many thanks the Hungarian Geological Institute and to the Archaeological Institute of the Eötvös Lorán University, Budapest for allowing me to use the microscopes.

Post-depositional polish used to disturb observation in many cases. E.g. in the material of the Upper Palaeolithic sites Püspökhatvan-Diós and Püspökhatvan-Öregszőlő (excavated by Éva Csongrádi Balogh and Viola T. Dobosi)[4], about two third of the tools bears this polish. In the material of the Upper Palaeolithic site Mogyorósbánya-Ujfalusi dombok (excavation of Viola T. Dobosi)[5] also on a large quantity of tools I found this polish. At the same time, though only very few tools from this last site were suitable for microscopic analysis, some of them proved to be interesting as regards the relation

[3] Quoted by CSONGRÁDINÉ BALOGH 1998–1999.

[4] CSONGRÁDI-BALOGH–T. DOBOSI 1995.

[5] T. DOBOSI 1992.

between the result of microwear study and the traditional morphological-typological determination of tools. Namely, along one of the lateral edges of a blade fragment, there are striations the directions of which suggest that this edge was used not as a cutting one – as it is usual in case of blades – but rather a scraping one. At the same time, on a burin the polish was on the burin edge – thus corroborating the traditional typological determination of the tool. Unfortunately I could not identify the material which resulted the polish on the tool.

In Hungary there was no opportunity to analyze Mesolithic tools until during the last decades Róbert Kertész discovered and excavated several Mesolithic sites. I made microwear study on the tools found in a house in the Late Mesolithic site Jásztelek I. (Róbert Ketész's excavation)[6]. Unfortunately, microwear suitable for analysis was found only on 7 pieces from the whole assemblage containing 47 tools. The marked polish and striations near the working edges on the ventral sides of two end-scrapers refer to work on dry hide and wood. The investigation of three *segments de cercle* proved to be more interesting. The function of geometric microliths is still not clear in every particular. It is possible that they had different functions in different periods and cultures. Undoubtedly they could be used as single tools – at least our data on some types of trapezes used as arrowheads prove this – but it is highly possible that they were used also as inserts both in themselves or together (e.g. in certain cutting tools). As for the Jásztelek segments, on two of them polish was found along their straight edges - one of them was the result of contact some plant parts, on the other one the origin of the polish remained unidentified. Along the straight edge of the third piece polish was absent but such tiny striations, parallel to each other and perpendicular to the extremely thin edge of the tool were found on it which suggest that the tool was used by moving it with small, rhythmic, striking-cutting movements. Obviously such few data do not allow us to draw more comprehensive consequences, yet considering these microwear we may suppose that *segments de cercle* could have been used also to cut some plant parts and break them into small pieces. (Most probably more microliths were mounted together to make such implements).

The majority of tools studied by myself originate from Neolithic sites. The chipped stone material of the Early Neolithic site Méhtelek-Nádas (excavated by Nándor Kalicz and János Makkay) was investigated earlier by Elisabetta Starnini who made also microwear analyses[7]. My own studies amplified her work and since I could use a high-power microscope (with 200x magnification) I had some new results as well[8]. There were relatively few tools suitable for microwear analysis in the assemblage because it contained a large quantity of obsidian pieces and also several ones with post-depositional gloss or covered by patina. On rather many tools can be seen relatively bright, intensive polish, the sheen of which is often comparable to that if sickle gloss. According to the analysis they originate from some plant parts. The exact identification of the origin of these polishes is still uncertain, though on the basis of observations made on experimental tools scholars suppose that at least a part of them is connected to the reaping and processing of reed, sedge or bulrush. Observations on experimental tools made by myself also corroborate this. Tools with such kind(s) of polish can be found in other sites as well. At Méhtelek there are good examples on the connection between the character of the lithic material of the tools and the observation possibilities of microwear on them. E.g., using a high-power microscope, much more polishes can be identified on a certain group of tools than under a low-power equipment. These tools were made of a characteristic dark grey/black microquartzite. This is a remarkable proof of the advantage of using a higher magnification – 200x at least – because at least in cases of some lithic raw materials 80-100x magnification is unsuitable to reveal even the presence of sickle gloss.

At the Late Neolithic site Szentgál-Füzikút (excavated by Katalin T. Biró and Judit Regenye) there were also only a few tools suitable for microwear analysis[9]. One of the lateral edges of a finely manufactured backed blade point I found a polish the origin of which I could not identify. Though it is important because it demonstrates that the tool was used like a needle, with few pricking movements and the manufactured material was most probably some softer one. According to the position of polishes and striations on them the majority of points, borers were used in a different manner, that is microwear appears on them below the tip itself and the striations there refer to a rotatory movement, that is the manufactured material was bored through by piercing and at the same time by rotating the tool. That is why in these cases there is no microwear on the tip itself. Namely this part of the tool – though it was the part which had got into connection with the manufactured material for the very first time – later already usually did not participate in the longer, more intensive process of rotating boring. These cases again draw the attention to the fact that we have to face micro-movements, micro-mechanical phenomena.

[6] ERDÉLYI-BÁCSKAY 2001.

[7] STARNINI 1994.

[8] ERDÉLYI-BÁCSKAY 2001.

[9] T. BIRÓ 1993–1994.

During my studies the largest quantity of chipped stone tools analyzed originated from the Late Neolithic sites Polgár 6 (horizontal site) and Polgár-Csőszhalom tell (Pál Raczky's excavations). From the 11200 tools of the horizontal site 4000 pieces were suitable for microwear analysis while from the 5426 implements of the Csőszhalom tell I could study 3000 pieces[10]. I made only a small-scale preliminary selection because I wanted to study the flakes and atypical pieces as well. The large quantity of tools made possible for me to try to detect the main spheres of activity of the inhabitants of these sites as it could be deducted from the microwear can be found on the tools. The short summary of the results is as follows:

The most widespread microwear on the tools in the tell site is sickle gloss. Among the other tools pieces with wood polish and the ones with polishes from some plant parts appear in more or less the same quantity. In a somewhat smaller quantity tools with dry skin polish appear. Polishes originated from bone/meat also appear, though only in a very few number. Sickle gloss appears first of all on blades, rarely on blade-like flakes or along the lateral edges of end scrapers. Microwear referring to the processing of dry hide can be found almost exclusively on the working edges of end scrapers, just like the microwear referring to wood-working – though the latter can be found in a smaller quantity also along the lateral edges of blades. Polishes caused by plant parts can be seen mostly along the lateral edges of blades, more rarely along the lateral edges of end scrapers and in one case along the lateral edge of a blade point. In several cases it is difficult to decide whether the polish is originated from wood or from plant but these polishes can be found first of all also along the lateral edges of blades and of end scrapers. The few polishes from bone and bone/meat can be found along the lateral edges of blades.

Dry hide was processed obviously by end scrapers, a tool type widely used for this purpose from at least the Upper Palaeolithic. Wood processing was made also first of all by this tool type which means that most probably first of all scraping, planning, splitting, chiselling were made by them. With the lateral edges of blades first of all wood cutting was made. Considering the dimensions and the relative brittleness of the blades this last function most probably did not mean the chopping of larger pieces of wood but rather the cutting of minor pieces of wood, of twigs. „Processing" of some plant parts was also widespread: the pieces with sickle gloss refer unambiguously to the harvesting of cereals, the other tools with polishes originated from plant parts were used most probably to cut minor twigs, leaves, fibres, etc.

In the horizontal site, too, tools with sickle gloss, that is, implements used for harvesting cereals occur in greatest number. On the other tools the following polishes can be observed in decreasing number: microwear originated from wood, dry skin, plant parts and here, too, just like in the tell site, appear those tools on which there are those polishes which could be originated either from wood or from plant parts (the quantity of these last two groups of tools is more or less the same). Polishes originated from fresh hide/meat/bone occur only in a very small quantity.

Therefore, here, in the horizontal site, also the harvesting of cereals was the main activity of the inhabitants as it is proved by the large quantity of tools with sickle gloss. Sickle gloss can be found first of all along the lateral edges of blades and end scrapers. Microwear on the lateral edges of blades and in a much smaller quantity, along the lateral edges of end scrapers refer to wood-working while dry hide polish occurs first of all on end scrapers, among them there are pieces with extremely steep, almost truncated working edges. Lateral edges of blades served to process – most probably to cut – plant parts. Polishes originated from either wood or plant parts appear also on those parts of the tools where plant and wood polishes used to occur.

Comparing to each other the microwear observed on the implements from both sites it seems that at both sites basically the same kinds of tools served for the same tasks.

At both sites, tools with sickle gloss (blades, end scrapers) can be found in greatest number, and the different types of sickles, harvesting tools, too, occur in more or less the same quantity. First of all those sickle types occur which consist of blades inserted obliquely into the haft. The other type, with blades inserted into the haft parallel to it that is the so-called 'reaping knife' occurs in a relatively small number.

As for their quantity in the horizontal site the above tools are followed by wood-working tools and in a somewhat small number tools for dry hide processing. After them, tools used to work on wood/plant parts or plant parts appear in more or less the same quantity. Microwear originated from fresh hide and bone may occur only on a few pieces. In the tell site the majority of tools served to work with them on plant parts. They are followed in decreasing number by wood-working tools and tools used for working on wood/plant parts. It is interesting that tools for processing dry hide appear in less number here, all the more because in the tell site also a large quantity of end scrapers – traditional tools of dry hide processing – were found. It is possible, however, that this difference between the horizontal and tell sites is due to that that I had the opportunity to study many end scrapers of the horizontal site under a high power microscope and naturally higher magnification could

10 BÁCSKAY–T. BIRÓ 2002; ERDÉLYI-BÁCSKAY 2007.

reveal microwear more reliably. Traces of working on bone, or bone and meat occur on tools found in the tell, too, only in a very low number.

There are some, not really essential, differences between the microwear of the tools of the two sites. While in the horizontal site end scrapers were used decisively to process dry hide (about half as many was used for wood-working and only a very low percent of the whole number of end scrapers was used to work on plant parts), in the tell site the number of wood-working end scrapers is hardly less than that of the ones used for dry hide processing. In the horizontal site there are some flake scrapers and scrapers made of nuclei fragments, partly with wood-polishes. Here there are also some truncated blades with dry hide polish or with polish originated from some hard material on their truncated parts.

It is possible that the cause of this difference is simply the larger quantity of tools found in the horizontal site.

There were close connections between the two sites; they belonged to the same cultural tradition. The excavations made it clear that the horizontal site was an ordinary village, living its everyday life, while the tell was the scene of some special social events, cults and rituals. However, in contradiction to other aspects of the archaeological record, in the chipped stone tool material – regarding both the typology and the supposed function – this difference does not appear. That is, apart from some minor changes, in the life of both sites the main activities were the cultivation of cereals, wood-working, dry hide-processing and working on plant parts.

The majority of end-scrapers of the horizontal site were studied under a 200x magnification[11]. In many pieces there are definite striations on the ventral side which are more or less perpendicular to the working edge, though usually there are very small differences in the angles which they reach the scraping edge at. These differences refer to changes in operating the tool during work. Another interesting observation was the – rarely occurring – presence of polish on the dorsal part of the scraping edge which refers to the manner of holding the material processed and the angle which the tool was operated at. From the Upper Palaeolithic it was a widespread practice to use ochre during hide processing. Both in the horizontal and in the tell sites I found some end scrapers with tiny ochre grains on them.

As I mentioned above, at some sites there are tools with rather bright, strong polish, the character and texture of which is so to speak between wood polish and plant polish. The sheen of some of these polishes is often near to that of sickle gloss. Such implements occur at both the horizontal site and the tell site in relatively great number. They are usually cutting tools. As I have mentioned above, it is highly possible that these polishes – or at least the brightest ones – originated from the reaping of reed, sedge, bulrush and probably from their processing as well (e.g. making thatches, rush mat, fences, etc.). This hypothesis is corroborated by the palaeo-ecological investigations which demonstrated that the in the near environment of the sites there was a marshy area where these plants had grown[12].

As I mentioned above, microwear on Copper Age and Bronze Age implements was studied in Hungary first by B. Adams. He studied those tools both from settlements and cemeteries which had been typologically studied by É. Csongrádiné Balogh. He found only a few microwear traces on tools of the Bodrogkeresztur culture. They were traces connected with cutting dry hide, they occurred on several tool types[13]. It is interesting that these microwears refer first of all not to hide-processing (scraping) but to cutting of dry hide. Besides „traditional" tools used in hide-working, also burins were used in this activity. This fact again draws the attention to certain interesting differences between the function of tools determined on the basis of microwear and the one determined by traditional morphological—typological classification.

B. Adams investigated tools from two Bronze Age sites (Bia-Öreghegy, Early Bronze Age and Tószeg, layer IV., Middle Bronze Age). These tools were used almost exclusively for cutting plant parts[14]. In the material from Bia there were several pieces with saw-like edges with sickle gloss on them. At both sites were tools which had been determined earlier as arrowheads. On them he found such damages the character and position of which suggest that they are the result of some impact, that is in these cases the results of microwear analysis corroborates typological determination. It demonstrates that the study of edge damage could give information not only on the hardness of the material worked but also on the way of use of these tools.

As for Copper Age tools I studied first of all those which were found in the Tiszapolgár-Basatanya cemetery[15]. Unfortunately in the Early Copper Age material there were only very few tools with microwear (some polishes from wood, plant parts, meat and bone were found, mostly on blades). In the Middle Copper Age material there were already more tools with microwear: first of all tools with plant polish, wood polish, with sickle gloss. In a smaller

[11] BÁCSKAY 2000; BÁCSKAY–CSONGRÁDINÉ BALOGH 2010.

[12] SÜMEGI et al. 2002.

[13] CSONGRÁDINÉ BALOGH 1998–1999; 2004.

[14] CSONGRÁDINÉ BALOGH 1998–1999; 2001.

[15] CSONGRÁDINÉ BALOGH 2004.

amount tools used to cut dry hide were also present. None of these activities could be connected unambiguously with tool types. From other sites (e.g. Kenderes-Kulis, Tiszaföldvár-Ujtemető, Deszk-Vénó (Early Copper Age settlements) and Konyár, Polgár-Bacsókert (Middle Copper Age cemeteries)) also some insignificant amount of tools with microwear came to light with dry hide and wood polish[16].

In Copper Age cemeteries finely manufactured, long blades are frequently occurring, quite often made of excellent quality, sometimes imported raw material. Unfortunately, usually we do not find microwear on them. We suppose that these tools were most probably not implements for everyday use but they were prestige items. At the same time it is possible that they were used for only a short time or perhaps the character of the lithic material of some of them could be studied only with difficulties.

I studied the material of two Bronze Age sites. One of them, Jászberény-Pusztakerekdomb (Late Bronze Age) yielded only a single tool with microwear: an end scraper with traces of plant/wood-working[17]. From Százhalombatta-Sánchegy I could study a larger amount of implements. They were mostly pieces with saw-like edges with sickle gloss on them. On other, but very few, tools, polishes originated from some plant parts could be observed[18].

In summary I may state that a more intensive study of microwear on chipped stone tools would be desirable in Hungary as well. For the sake of this I suppose we should continue the work already started, amplifying it with some new points. Therefore I think it would be important:

- To study of as many archaeological material as possible.
- To make as many experimental tools as possible. It would be important to work with these tools not only on different kinds of raw materials but also to work with them for different spans of time, because during a long-time use the character, texture, intensity, etc, of microwear may change or by that time certain damages, striations which were still absent during a short time use, may already appear, etc.
- Partly in connection with the above point: the establishment of a reference collection, containing (used) experimental tools made of different lithic raw materials. I suppose the Lithotheca collection, established by Viola T. Dobosi and Katalin T. Biró would be an excellent basis for that[19].
- It would be very important to study the chipped stone tools found as grave goods. While we have some idea on the role of polished stone tools in this respect, we know do not know too much about the role of chipped stone tools in burials. A complex study of their typology, microwear, quantity, position in the grave etc. is necessary and we have to get more information on the so-called prestige tools as well. Moreover, the microwear study of chipped stone tools from depots would be also interesting and study of chipped stone tools from intact find assemblages, especially from some houses, workshops, refuse pits, etc. would be also informative.
- Finally: though it does not belong to microwear studies *sensu stricto*, the observation of some micro-residues can be observed on the surfaces of chipped stone tools is also interesting and instructive. Sometimes ochre grains and some sorts of organic glues (e.g. resin) can be seen even by the naked eye, though under a microscope they can be detected much better. Today already there is the possibility to observe – and study - on tools also some organic micro-residues, like blood, plant fibres, animal or human tissues as well as the phytoliths or other resistant plant particles which had been conserved under the sickle gloss, which is not a shiny abrasion but a coating on the surface of tools.

[16] CSONGRÁDINÉ BALOGH 2001.
[17] CSONGRÁDINÉ BALOGH 2001.
[18] HORVÁTH et al. 2001.
[19] T. BIRÓ–T. DOBOSI 1991; T. BIRÓ et al. 2000.

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Site name	Age	Character of site
Püspökhatvan-Diós	Upper Paleolithic	settlement
Püapökhatvan-Öregszőlő	Upper Paleolithic	settlement
Mogyorósbánya-Újfalusi dombok	Upper Paleolithic	settlement
Jásztelek I.	Late Mesolithic	settlement
Méhtelek-Nádas	Early Neolithic – Körös culture	settlement
Csabdi-Télizöldes	Late Neolithic – Lengyel culture	settlement
Szentgál-Füzikút	Late Neolithic – Lengyel culture	settlement
Polgár-6 ("horizontal settlement")	Late Neolithic – Tisza-Herpály-Csőszhalom complex	settlement
Polgár-Csőszhalom tell	Late Neolithic – Tisza-Herpály-Csőszhalom complex	settlement
Tápé-Lebő	Late Neolithic – Tiszai culture	settlement
Tiszaföldvár-Újtemető	Early Copper Age – Tiszapolgár culture	settlement
Deszk-Vénó	Early Copper Age – Tiszapolgár culture	settlement
Kenderes-Kulis	Early Copper Age – Tiszapolgár culture	settlement
Tiszapolgár-Basatanya	Early and Middle Copper Age – Tiszapolgár and Bodrogkeresztúr cultures	cemetery
Konyár	Middle Copper Age – Bodrogkeresztúr culture	cemetery
Tiszavalk-Kenderföldek	Middle Copper Age – Bodrogkeresztúr culture	cemetery
Polgár-Bacsókert	Middle Copper Age – Bodrogkeresztúr culture	cemetery
Jászberény-Pusztakerekdomb	Late Bronze Age	cemetery
Százhalombatta-Sánchegy	Bronze Age	settlement

Table 1. *The microwear studies were made on the lithic material of the following sites*

THE NEOLITHIC RADIOLARITE MINING SITE OF WIEN – MAUER-ANTONSHÖHE (AUSTRIA)

GERHARD TRNKA

Keywords: *radiolarite mining site, Late Lengyel Culture, graves, lithics*

The northern fringe of the Eastern Alps is formed by the so called '*Flyschzone*' and the '*Klippenzone/Klippenbelt*' (cliffzone) with series of small solid rocks of upper Jurassic age, which is shifted by tectonic processes during the folding of the Alps (lower Tertiary) to their present position (*Fig. 1.*).[1] In the southwest of Vienna the easternmost parts of the *St. Veit Klippenbelt* achieves at the *Antonshöhe* an altitude of 356 m above see level. The core of the *St. Veit Klippenbelt* is made of limestone with mainly grey and red chert types (***Fig. 5 and 6.***), shaly clays and sandstones, which were formed during the Upper Jurassic (Tithonian) and the Lower Cretaceous (Neocomian) period. It was the time of the maximum deepening of the Tethys Sea and therefore it is a primary deepwater-sedimentation. Those sedimentary rocks are surrounded by a cover, built up by marls, clay marls, sandstones and shaly clays out of the Upper Cretaceous (New Red Sandstone series).[2]

Recent geochemical investigations revealed that the reddish-greenish components containing reddish-green radiolarites geochemically display a closer relation to Northern Alpine radiolarites than to *Pieniny Klippenbelt* material.[3] So it seems that an overthrusting by Northern Calcareous Alps components is present within the *St. Veit Klippenbelt*.

At the *Antonshöhe* (23rd district of Vienna) an area of 400 to 120 m these Upper Jurassic, reddish limestone and whitish, Lower Cretaceous limestone are exposed and had been quarried since the 19th century till the mid of the 20th century. As in 1924 human bones were discovered, archaeologists became interest in and Josef Bayer (Director of the Prehistoric Department of the NHM-Wien) controlled 1929-1930 the site, collected finds and registered four shafts of a complex mining system associated with human burials. After his death some observations had been done in 1938 by Lotte Adametz, who was associated with Bayer. In 1949 further investigations by Alfred Neumann from the Historical Museum of Vienna positioned the former shafts and other archaeological evidences in the enlarging quarry. In total six graves with seven individuals (two adult males, three adult females, one child and one infant) had been found. The shafts were refilled after their abandonment with debris of the mining activities and till nowadays it is quite easy to collect raw material and artifacts in the former quarry.

Due to death of both Bayer (1931) and Adamec (1966), merely one preliminary report existed.[4] In 1958 Franz Kirnbauer[5] published the geology of the site and considered about the mining methods without information about the field documentation done by Bayer and Adamec. It was then Elisabeth Ruttkay, with access to the documentation (which is not easy to read and to understand) and the archaeological objects in the NHM-Wien, who wrote in 1970 the basic article about the Neolithic radiolarite mining site at Antonshöhe near Mauer in Vienna.[6]

Summing up the results we can observe, that Mauer-Antonshöhe is still the only known Neolithic chert mine with deep shafts in Austria.[7] As we know, deep-shaft mining starts in early Neolithic (Casa Montero near Madrid, Spain, Arnhofen-Abensberg in Lower Bavaria, Germany, Sąspów in Poland, Krumlov

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[1] OBERHAUSER 1980.
[2] KIRNBAUER 1958, 122–126; THINSCHMIDT 2000.
[3] BRANDL et al. 2013.
[4] BAYER 1930.
[5] KIRNBAUER 1958.
[6] RUTTKAY 1970.
[7] Further reading on Vienna-Mauer, Antonshöche: ANTL-WEISER 2005; BAUER–SPITZENBERGER 1970; GAYCK 2000; KIRNBAUER 1962; RUTTKAY 1981 and 1999; STROUHAL–JUNGWIRTH 1970.

forest in Moravia, Czech Republic) and is common till the Bronze Age or even later.[8]

At Antonshöhe four shafts had been documented with depths of 2-8 meters and width of rather 1-2 meters. Josef Bayer mentioned small gallery-like extensions which cannot be really certified by the present photographs and the fragility of the limestone will not guarantee such a thesis. In total seven individuals (two adult males, three adult females, one child and one infant) had been found in between 1924-1930 in the shafts or wastes. The finds and the burials were reconstructed after they had been found by the workers of the quarry - it means, that no archaeologist has ever seen the authentic evidence.

Graves 1 and 2 were found in shaft IV (1924) at a depth of 3-3,75 m. Unfortunately there is no existing photograph. In Grave 1, a 25-35 years old female was buried at the bottom of the shaft and superimposed by 80 cm by a burial of a male of 25-35 years old (Grave 2) in an upright or sitting position deduced from of one meter the shaft.

Grave 3 (1927), a 25-30 years old female, was found east of shaft IV in the waste.

Shaft I (1929) with some internal parts yielded Grave 4 (*Fig. 3.*) - a double burial with a child (9-10 years) and an infant (0-0,5 years) with a fragmented pot (*Fig. 4.*). In the upper parts of the same shaft, another grave was also found in 1929 (Grave 5), containing a 25-35 years old female with a bowl (***Fig. 4.***).

Some scattered bones of an adult male (1930?) were later labelled as Grave 6.

The shafts with the human bones can be interpreted as underground Neolithic burials, contemporaneous with the mining activities in the area. The deceased were buried with grave goods (ceramics) in the open or partly refilled shafts and must have belonged to the nearby settlers.

Both stylistic and technical analyses of the ceramics indicated a Middle Neolithic Age for the graves, i.e., in the second half of the 5th millennium BC (late phase (IIb) of the western group of the Lengyel Culture.[9]

This chronological attribution has been recently confirmed by three radiocarbon dates on the human skeletal samples. (***Table 1.***, See also ***Fig. 4.***)

Wien – Mauer-Antonshöhe Schacht 4, Grab 2., Individuum 2	VERA-228	5312 ± 31 BP	68.2% probability: 4230 BC (13.2%) 4190 BC – 4180 BC (11.7%) 4150 BC – 4140 BC (43.3%) 4050 BC 95.4% probability: 4240 BC (95.4%) 4040 BC
Wien – Mauer-Antonshöhe, Grab 3.	VERA-229	5650 ± 32 BP	68.2% probability:4525 BC (68.2%) 4450 BC 95.4% probability: 4550 BC (84.5%) 4440 BC – 4430 BC (10.9%) 4370 BC
Wien – Mauer-Antonshöhe Schacht 1, Grab 5.	VERA-230	5662 ± 29 BP	68.2% probability: 4520 BC (68.2%) 4455 BC 95.4% probability: 4560 BC (93.2%) 4440 BC - 4420 BC (2.2%) 4390 BC

Table 1. *Vienna – Mauer-Antonshöhe (Austria). Radiocarbon datations. Calibrated (OxCal 3.10)*[10]

The importance of Mauer-Antonshöhe is the fact, that the Middle Neolithic society disposed their deceased in the shafts or near by in the mining field. Obviously the dead were supplied with goods (ceramics) and the shafts had not been (re)filled with debris before. The pots (***Fig. 4.***) allow an archaeological dating to the later Lengyel culture (western group) and this corresponds to the radiocarbon dates.

It is quite rare, that humans were buried in shafts of flint or chert mines. We have evidence from the mining sites in the Krumlov forest in southern Moravia, Cissbury and Grimes Graves in England, Spiennes in Belgium etc. Some are badly documented or found in the 19th century without accessible proper proofs. The famous “miners” from Obourg and Strépy in Belgium have been identified as a forgery and are dated by radiocarbon of Late Bronze Age and Early Medieval Age.[11]

The *St. Veit Klippenbelt* at Mauer-Antonshöhe marks the easternmost part of the pre-Alps, ending in the west of Vienna and is continuing in the White Carpathians in northwestern Slovakia and adjacent parts of Moravia with mining activities.[12]

[8] TRNKA 2010.
[9] RUTTKAY 1970. 77-78.

[10] STADLER et al. 2006. Tab. 1, STADLER-RUTTKAY 2007. Tab. 1.
[11] DE HEINZELIN et al. 1993. Tab. 1.
[12] CHEBEN–CHEBEN 2010. 21-24., Fig. 6.

We can suppose that also on other hills in the west and southwest of Vienna with outcrops of radiolarite (***Fig. 2.***) some mining activities took place,[13] but no recent field activities were initiated till yet. A first step towards finding the potential sites is the construction of a digital terrain model of the forests at the Antonshöhe (***Fig. 2.***) derived from an airborne laser scanning (ALS, LiDAR).

In the deposit of the Prehistoric Department of the NHM-Wien is a large collection of presumed mining tools (pics and fragments of deer antler, stone axes, hammer stones etc.) and boxes of debitage, flakes and many others (***Fig. 5.***). The determined stone tools for mining were made of different raw materials and are from various provenience (even from the basin of Prague Palaeozoic), but they should be examined more in more detail again.[14]

[13] BRANDL–TRNKA 2014.

[14] NIEDERMAYR–CADAJ 1970; THINSCHMIDT–TRNKA 2000.

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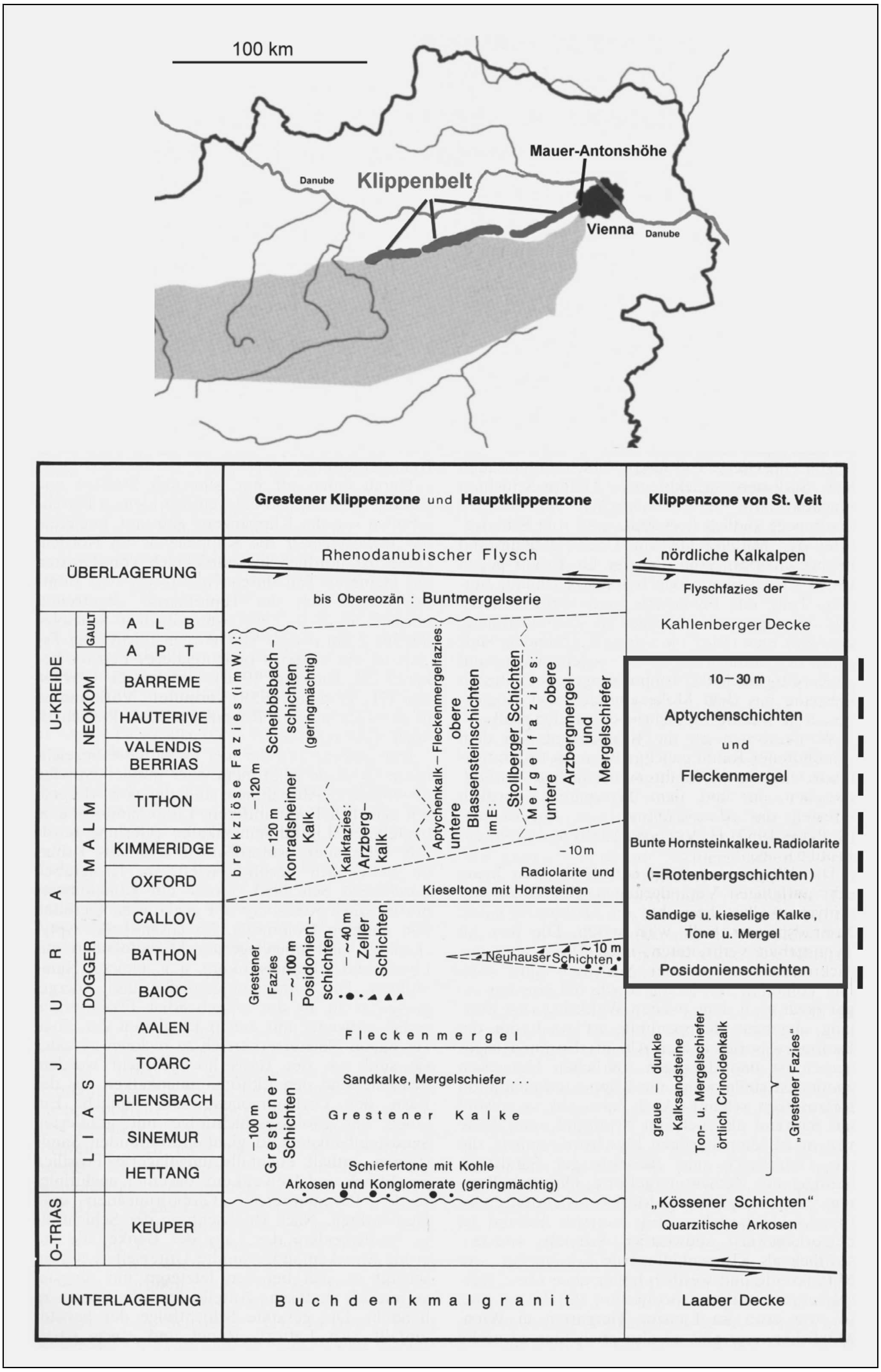

Fig. 1. *Geological table after* OBERHAUSER *1980. Fig. 44.*

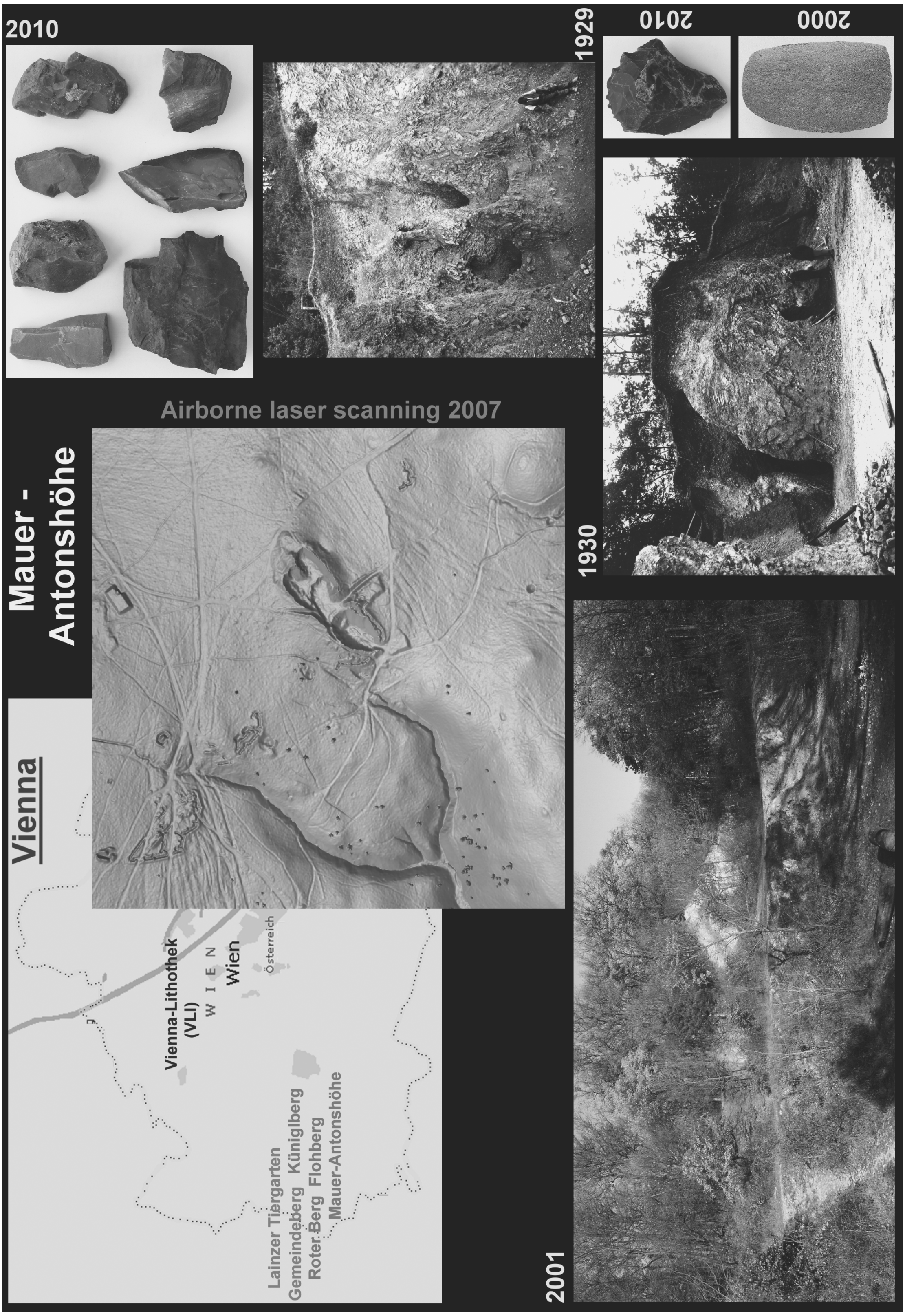

Fig. 2. *Wien - Mauer-Antonshöhe 1929-2010*

Fig. 3. *Wien - Mauer-Antonshöhe 1929. Shaft I and III. Photo: PA - NHM-Wien*

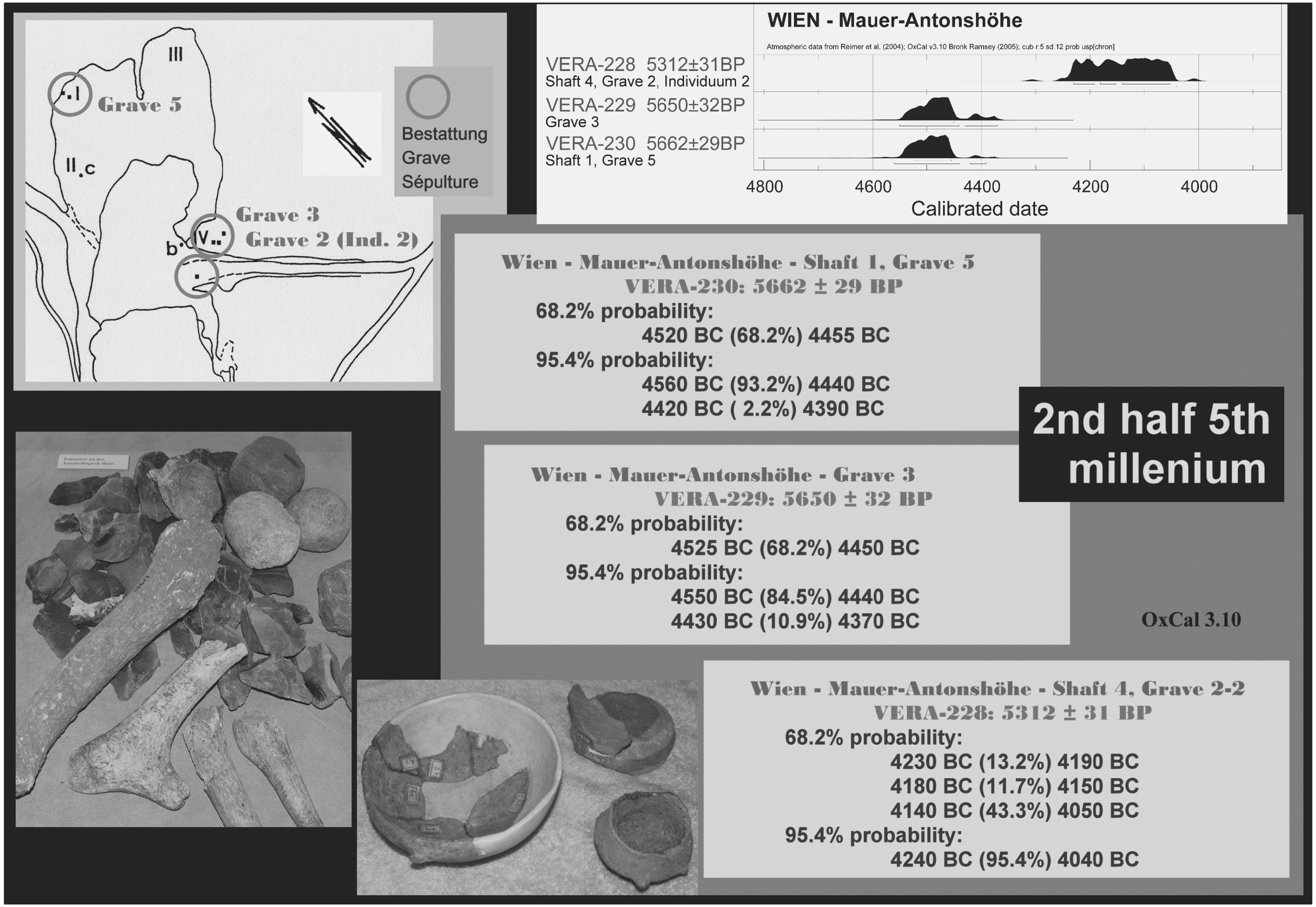

Fig. 4. *Wien - Mauer-Antonshöhe 1929. Sketch of the quarry with position of the graves and shafts. Antler tools, debitage and waste (selection in the exhibition of the PA - NHM-Wien)). Pottery from grave 4 and 5. Table of calibrated* ^{14}*C-dates*

Fig. 5. *Wien - Mauer-Antonshöhe. Radiolarites, stone and antler tools from the site. Depot of the PA – NHM-Wien. Fotos with permission of the PA – NHM-Wien*

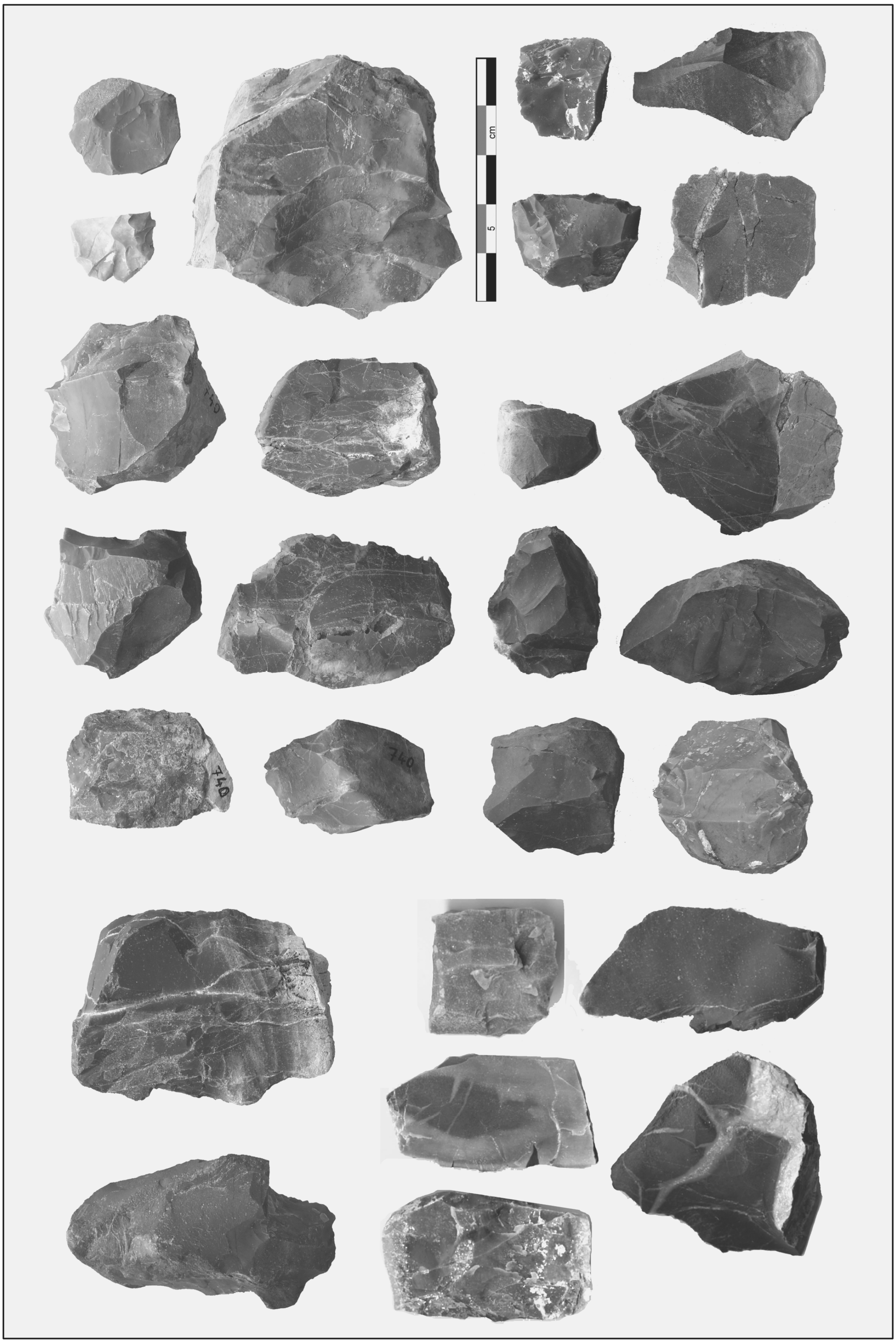

Fig. 6. *Wien - Mauer-Antonshöhe. Varieties of Radiolarites from the site. Scattered pieces and artifacts. Fotos VLI.*

PROVENANCING OF RED FERRUGINOUS ARTEFACTS AND RAW MATERIALS IN PALAEOLITHIC SOCIETIES

JOANNA TRĄBSKA

Keywords: *ferruginous artefact, provenance, ferruginous raw materials, haematite, Palaeolithic*

An interest in provenance of ferruginous raw materials at Palaeolithic sites has been encountered for many years, though only the latest thirty years provided wider research programmes and results. Nature of ferruginous raw materials: their genetic diversity and abundance along with macroscopic similarity of representatives of various geological formations compels to recognise a number of fingerprints – more numerous than for other raw materials – and their sets.

Application of ferruginous raw materials may have been very wide in numerous sacral and everyday contexts, so that not only unprocessed but also processed materials must be considered. The latter would cover powders: intentionally produced or 'side effects' at various processes. They also need to be provenanced, though this procedure may be more difficult to perform due to: a) their processing, b) low amount of material, c) poor representativity of a material accessible only in a low volume. Nevertheless, provenance studies of both large pieces and powders, processed and unprocessed may answer the question on an ability of exploration of variable environments (not only to collect material but also to gather knowledge of other areas that would provide better life conditions[1], on a range of group contacts, on reasons for application of a specific variety of a raw material and reasons for diversity of it[2], also to explain the use of exotic raw materials.

Last but not least, elements of '*châine operatoire*' can be deduced due to the recognition of a raw material and the recognition of it's features after some transformation (e.g. heating; experimental works must be involved here). Moreover, it can be stated for sure that numerous applications of ferruginous materials are unavailable to our interpretation. For example, hard haematite or haematite rocks pieces not producing a streak, found sometimes at various sites: is it an ordinary remnant or intentionally brought material? For what purposes they might serve, then?

Basic principles of raw material provenance studies have been formulated by numerous researchers; the ones by Tycot[3] have been quoted here and they are as follows:

1) all relevant geological sources must be known;

2) these sources must be characterised for the physical properties or parameters (e.g. colour, density, mineralogical, elemental or isotopic composition) which will be measured for the artefacts,

3) one or more properties must be homogeneous within an individual;

4) measurable, statistically valid differences between sources must exist for one or a combination of these parameters; and

5) they must be measurable using analytical methods appropriate for archaeological artefacts'. Not all prerequisites can be met in practise, a question reasonably discussed by Tycot further on[4].

In Central Europe, numerous varieties of red ferruginous raw materials are known. They can be divided into two groups: a) bound to determined lithostratigraphic levels, where palaeoclimatic conditions were a dominant factor of their formation like, for example, sedimentary rocks of Lower Devonian, Lower Permian, Lower and Upper Triassic,

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1 HENSILWOOD 2008, 36.

2 In the South African Middle Stone Age context an increase in raw material diversity and greater colour variation is observed HENSILWOOD 2008, 40. Certain diversity was observed by the author for some Central European Upper Palaeolithic 'red' assemblages, among others, Magdalenian Dzierżysław-35 site Upper Silesia, Poland, TRĄBSKA 2010.

3 TYCOT 2004, 415.

4 TYCOT op.cit.

terra rossa of Devonian, Permian, Triassic, Tertiary and recent age, b) connected to determined geological formations, where mineral and rock origin processes were involved, like haematite bearing scarns, hydrothermal veins, weathering sheets on volcanic rocks, specific sedimentary basins and their sediments (e.g. Carpathian variegated shale), metamorphic rocks (e.g. BIF and others). For all of them, intra-source variability (degree of homogeneity) of a statistically determined level is present.

It can be assumed that all IRRM varieties could have been accessible to Palaeolithic people, cut into valleys or uncovered through landslides, even if their counterparts are not accessible to us now.

In this work the term '*ochre*' will not appear (even if it was introduced by quoted authors) because it defines only a part of ferruginous raw materials. A term *Iron Red Raw Materials* will be used (further in the text as IRRM). When using the term 'red' all 'near red' colour scale is understood (light pink, pink, cherry dark and light, violet, purple, orange, etc).

A review of research made so far, presented in this work, comprises several, to the author opinion, representative articles issued after 1990, organised according to chronological order. The time caesura was accepted because earlier works were based mostly on macroscopic observations. Significant number of fingerprints[5] to discuss and compare appeared in the nineties with wider accessibility of research methods, especially the ones allowing examination of a 'low quantity' material.

In the 90-ies mostly Australians concentrated on IRRM provenance research. In 1997 an article[6] of SMITH and PELL appeared where concentration of oxygen isotopes in quartz grains in IRRM bearing sediments was considered as an indicator. Geological material of various origins was examined and $\delta^{18}O$ relative to V-SMOW standard was calculated. Calculated values were not distant from standard error or fell into it. Very similar isotope ratios were obtained for two outcrops, whereas the other two were distinctively different. Very low amount of samples, however, was investigated; it was admitted by the authors themselves who suggested application of complementary methods. The samples were processed only according to the method procedure. Discrimination between samples representing the same geological context was impossible but differences between samples from various formations gave a satisfactory result.

Jercher et al.[7] published another article on provenancing IRRM; again raw materials from several outcrops of aboriginal interest were screened; samples were collected from museum inventories. To a certain degree, it has limited research possibilities, especially in regard to a problem of raw material variability, but yet, this is a common situation in archaeometrical works. Geological origin was varied, three of the six outcrops represented the same formation but one of the outcrops was quite remote: 600 km from the others. Samples in the field were also collected, representing analogous geological formations. Macroscopic features were described, phase composition and size of elemental haematite cells were examined with X-ray diffraction (XRD), and chemical composition was measured with X-ray fluorescence (XRF). Trace elements in haematite crystal lattice were excluded and chemical composition revealed differences in composition and concentration within the samples, especially for the ones from various geological contexts. In some cases, according to the authors, atypical minerals appeared, like natrojarosite and bassanite. Further statistical analyses might be fruitful, according to the author's suggestion, yet, even at the completed stage it is possible to point at a source (even an outcrop) for a sample. Samples were not intentionally prepared, only following a routine method of procedure.

Magnetic properties were considered as a set of fingerprints for IRRM provenancing also for Australian samples[8], three of them were examined previously by Smith and Pell (1997). One sample came from an archaeological trench; the other two were of unknown origin. Samples were not pre-processed and the methods were non-destructive. Numerous parameters were considered, like magnetic susceptibility, para- (dia)magnetic susceptibility, frequency dependent susceptibility, isothermal remanent magnetisation, saturation isothermal remanent magnetisation, anhysteretic remanent magnetisation, saturation magnetisation, coercive force, S-ratio. They allowed to gain information on variety, concentration and size of ferrimagnetic (e.g. magnetite), anti-ferromagnetic (e.g. haematite), paramagnetic (e.g. iron silicates) and diamagnetic (e.g. quartz) minerals. Differences of the parameters were significant so that ascribing a sample to an ore was possible.

Another research concerned material from Arizona[9]. 110 samples from 22 outcrops were collected and three geological contexts were considered to investigate a variability and homogeneity of the ores. Samples were pre-processed:

[5] A specific property of a mineral or of a rock, observable in all examined rock type but differing significantly in the varieties.

[6] SMITH–PELL 1997.

[7] JERCHER et al. 1998.

[8] MOONEY et al. 2003.

[9] POPELKA-FILCOFF et al. 2008.

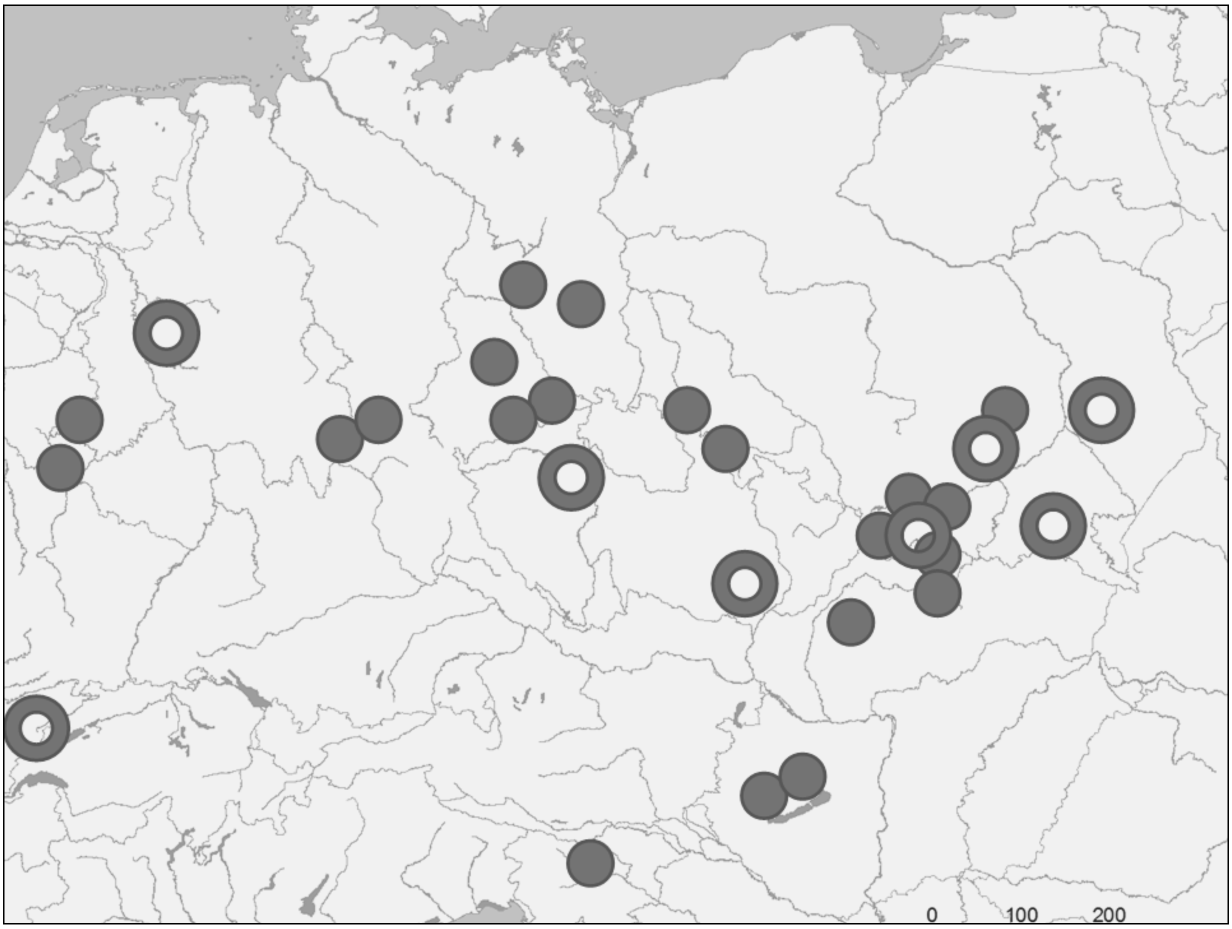

Fig. 1. *Schematic map of Central Europe with IRRM from outcrops (solid circles) and sites (rings). Poland, outcrops: Carpathian Mts., Sudetes, Świętokrzyskie Mts. (Holy Cross Mts.), Tatra Mts., Cracow-Silesian Upland. Poland, sites: Dzierżysław-35, Wierzawice, Klementowice, Rydno-Nowy Młyn. Bohemia, outcrops: NE (Tertiary volcanic formation). Bohemia, sites: Stadice, Hostim. Moravia, outcrops: Moravian karst, Silesian-Moravian metamorphic belt. Moravia, sites: Dolní Vestonice, Brno II, Stranska Skala. Slovakia, outcrops: Tatra, Povařský Inovec. Germany, outcrops: Thuringien, Erzgebirge, Vogtland, Frankonien, Schwarzwald. Germany, sites: Goennersdorf, Andernach. Hungary, outcrops: Permian siltstones, terra rossa. Slovenia, outcrops: Slovenian Alps. Switzerland, sites: Monruz. Outcrops and sites from Croatia and Greece have not been marked on the map.*

the finest fraction was separated and then INAA (Instrumental Neutron Activation Analysis) chemical analysis was performed. Statistical analyses enabled to reveal the elements connected with iron and to explore their mutual dependencies (e.g. As/Fe and Sb/Fe); Pearson's correlation was applied and 90% confidence interval was accepted. PCA (Principal Component Analysis) and CDA (Canonical Discriminant Analysis) analyses allowed to find a „geochemical signature" within the set, even for the samples originating from the same geological context.

Another approach in IRRM provenancing has been applied for red pigments from cave, stone and other paintings as well as red surfaces from other contexts. Several methods of analysis provide information only on a pigment variety, without further works on its origin, due to various reasons. Some proceed further, an example comes from the Obłazowa Cave, Poland, famous for an Early Gravettian mammoth tusk boomerang[10]. Red painted (or covered by a red fluid in another mode) artefact surfaces were examined along with red sediments from the cave of *terra rossa* type and *terra rossa* from the cave vicinity. XRD and SEM/EDS were performed[11] and indicated that actually *terra rossa* was a painting material here.

Aurignacian stone paintings from Grotta di Fumane, Monte Lessini (Italy) were examined by

[10] VALDE-NOWAK 2003.
[11] ŁAPTAŚ–PASZKOWSKI 2003.

Broglio et al.[12]. Samples were collected from loose material, optical microscopy (PLM), scanning electron microscopy (SEM/EDS), X-ray diffraction (XRD) and gas chromatography were applied. Casual, natural pigmentation was excluded. Based on results of chemical analyses the red residual rocks from the vicinity were pointed at as a pigment source. But it was not an exclusive one: the presence of a substance, 'probably haematite' was also confirmed. IRRM was also found in Aurignacian layers: fine crystalline haematite and another IRRM supposedly from Provence, as it was supposed on the basis of macroscopic observations.

The author and colleagues[13] examined a powdery, thin layer on a small pebble from Aurignacian layers from Klissoura, Greece. The origin of the powder: natural or intentional was a problem to solve. *Terra rossa*, ubiquitous in the site and with a wide red shade spectrum, might have colourised a pebble but comparison of haematite crystallite size of the powder and adjacent *terra rossa* allowed to exclude the suspicious rock.

Composition of red pigments in cave and stone paintings used to be ascribed to haematite from a cave outside or *terra rossa*-like rocks from a cave inside or vicinities. This is only a rough estimation: detailed analyses of red cave rocks and neighbourhood reveal far more complex image. A work of Iriarte et al.[14] inspected the problem. Fingerprints of IRRM from two caves and the adjacent areas were searched for to point at potential raw materials for cave paintings from the area of Pyrenees (Northern Spain). Research was conducted with the use of relatively accessible methods (PLM, SEM/EDS, XRD, and ICP-MS). 24 samples from each cave (both from walls and floor) were collected and pre-processed: they were crushed and sieved (sieve diameter 0.15 mm) and the finest fraction was analysed. The red rocks were of various origin, microstructure and chemical patterns, distinction of pigments made of them is, according to the authors, was possible.

From 2006 on, the author with colleagues has been examining samples representing IRRM from various geological context, chronology and locality, mostly from Central Europe. The only selection criterion has been red colour. Field samples have been supplemented by IRRM from archaeological sites and red ferruginous artefacts (***Fig. 1.***). Data are registered in a 'red rocks database', still being completed. An example of the construction of the database is presented in ***Table 1.*** Complementary proposition, based on the Magdalenian Dzierżysław-35 site was issued elsewhere[15].

Outcrop	Basic data	*Loco* (name, coordinates, region, topographic map)
		Description
		Description from reference data, origin
		Geological age
	Supplementary data	Title
		Description
		Photography of an outcrop, sketches, supplementary maps
Sample	Basic data	Name, code
		Additional codes
		Outcrop
		Colour (descriptive and numeric)
		Hardness (in the Mohs' scale)
		Consistency
		Petrographic description
		Remarks
	Specific features of a single sample	Origin (non-weathered, weathered, experimentally processed, other)
		Examination (microstructure SEM, microstructure PLM, phase composition (XRD, Raman, FTIR), crystallite size, chemical composition (XRF, EDS, PIXE)
		Photographs, spectra, diffractograms, calculation sheets
		Remarks

Table 1. *A pattern of IRRM database* [16]

Completed data allow to define some selected fingerprints for each rock (here: microstructure, haematite crystallite size, chemical composition). Samples have been stored and additional measurements for other fingerprints may be introduced, so that the database has an open character. Analogous database has been constructed for IRRM from archaeological sites and 'red' artefacts if they could have been examined.

Selected field material and artefacts were thoroughly examined and the results published[17]. Soft rocks, easily covering surfaces (*e.g.* a palm surface), originating from the Lower and Upper Triassic cherry siltstones from the southern and northern boundary of

[12] BROGLIO et al. 2005, 167.
[13] TRĄBSKA–GAWEŁ 2007.
[14] IRIARTE et al. 2009.
[15] TRĄBSKA 2010.
[16] Construction of the database in Access was performed by D. Bobak.
[17] TRĄBSKA et al. 2008; 2009.

the Świętokrzyskie Mts. were compared, in regard to chemical analysis, with artefacts from the Magdalenian site Dzierżysław-35. Both assemblages are macroscopically very similar to one another. Statistical analysis (PCA, K-means, Kahonen neural net) based on chemical composition (XRF, PIXE) of field samples and artefacts revealed a clear distinction between them. This allowed to eliminate the Świętokrzyskie Mts. cherry siltstones as a potential source for Magdalenian artefacts[18]. The conclusion is important because an immense Final Palaeolithic haematite mine was found there in Rydno[19].

Macroscopically similar rocks from three different geological contexts were examined in another article[20] both in mega- (distinction between geological formation) and in meso-scale (distinction within sub-formation), distinctive fingerprints are presented in the ***Table 2.*** It is likely to discern, on the basis of chemical composition, Lower Triassic siltstones from southern and northern peripheries of the Świętokrzyskie Mts.; recent and 'old' *terra rossa* (from older geological epochs) varies one from the other in haematite crystallite size, Carpathian variegated shale from the sub-units also differ (on the basis of chemical composition and mineral indicators). Works on details are being continued.

	Sedimentary lower Triassic siltstones, Poland (Bundsanstein)	**Carpathian variegated shale, Poland**	**Terra rossa, Croatia, Greece, Poland**
Lithostratigraphic units – rock differences	Chemical composition Size of haematite crystallites Image in thin section	Chemical composition Size of haematite crystallites Image in thin section	*No analyses* Size of haematite crystallites Image in thin section
Sub-lithostratigraphic units – rock differences	Chemical composition	Chemical composition Mineralogical features (illite/smectite ratio; zeolite presence)	*No analyses* Image in thin section Size of haematite crystallites

Table 2. *Fingerprints established for three genetically different haematite bearing rocks[21]*

Provenancing of red ferruginous powders

Provenancing red powders create a separate methodological problem, examples from cave and stone paintings as well as powdery remnants on stone surfaces were quoted above.

Results of research conducted by the author and colleagues from 2006[22] suggest sufficient representativity of powders in regard to a parent rock, both in microstructure and chemical composition as well as haematite crystalline size, so that it seems possible to point at a source of even scarce powders. One can first identify powders composition, then an assemblage homogeneity, next original rocks provenance, finally a manner of processing (e.g. heating). The latter stage seems to be most difficult. All these remarks are going to be explored thoroughly in articles in preparation.

Discussion and Conclusion

All researchers dealing with provenancing of any raw materials are perfectly aware of problems hidden behind straightforward conclusions. For IRRM the obscurities are multiplied, due to reasons mentioned at the beginning but yet, considering their huge significance for sacral and everyday life of Palaeolithic people, the problem should be explored.

One of problems in IRRM provenancing is their variability, even in a one profile; a question formulated long ago[23]. In many occasions the parameter is impossible to estimate (e.g. when an outcrop does not exist or too many analyses should be performed). Some works suggest, however, that successful solutions are available and provenancing on meso-scale was proved[24].

Another problem is the relevance of the raw materials in respect of the processed artefacts. Red ferruginous artefacts may have been heated, ground, mixed with other IRRM or with organic substances. It seems that Popelka-Filcoff et al[25] pointed constructively at the problem, statistically exploring the elements bound to iron. But what about the procedure if two or more iron bearing raw materials had been mixed? A quest and testing of various fingerprints and sets of them (***Table 3.***) has been summarised and their adequacy for sourcing procedures has been presented. Probably at imminent stages of research a unification of fingerprints for all databases at least in Europe will be possible.

18 TRĄBSKA et al. 2008.
19 SCHILD–KRÓLIK 1981.
20 TRĄBSKA et al. 2009.
21 op.cit.

22 TRĄBSKA in press.
23 ADOUIN–PLISSON 1982.
24 JERCHER et al. 1998; POPELKA-FILCOFF et al. 2008; TRĄBSKA et al. 2009.
25 POPELKA-FILCOFF et al. 2008.

Last but not least an important „archaeological" fingerprint: IRRM and other significant raw materials (first of all flint) cropping out close one to the other. The problem was analysed for example in Poland for Final Palaeolithic[26].

Development of research methods in geochemistry introduces continuously new perspectives for new IRRM fingerprints. Even if now their application may be strongly confined, in several years impediments are likely to be defeated. A might be fingerprint can be iron isotopes, ^{56}Fe and ^{54}Fe. For the moment now[27] $\delta^{56}Fe$ for iron bearing magmatic and sedimentary rocks seems not to be distinctive, yet with proceeding growth of data the fingerprint may be worth tracing.

[26] SULGOSTOWSKA 2005, 150–164.

[27] SCHOENBERG–BLACKENBURG 2006, 351.

Publication	Sample outcrop	Proces-sed?	Sample artefact	Proces-sed?	Method	Result
SMITH–PELL 1997	+	+	+	+	Oxygen isotope in quartz associated with iron compounds	Discrimination between samples from the same region is impossible. Significant results for only some outcrops and samples
JERCHER et al. 1998	+	-	+	-	Chemical (XRF) and phase analysis (XRD)	Discrimination between outcrops of various origin is possible.
MOONEY et al. 2003	+	-	+	-	Magnetic properties	Distinctive variations in magnetic parameters.
ŁAPTAŚ–PASZKOWSKI 2003	+	+	+	+	Phase (XRD), microstructral and chemical (SEM/EDS) analyses	Local raw materials of red painted (?) shell was identified.
BROGLIO et al. 2005	+	-	+	-	Chemical (EDS) and phase (XRD) analyses of painted materials, macroscopic evaluation of raw materials	Possible to point at local and remote sources of red pigments.
POPELKA-FILCOFF et al. 2008	+	+	-	-	Chemical composition (INAA), statistical analysis (PCA, correlation, CDA)	Distinctive variations in geochemistry within a one geological formation
TRĄBSKA et al. 2008	+	-	+	-	Chemical analysis (XRF, PIXE), statistical analysis (PCA, k-means, Kahonen neural net)	Distinction between artefacts and outcrop samples from various sources
IRIARTE et al 2009	+	+	-	-	Chemical composition (EDS, ICP-MS), statistical analysis (Al/Si ratio), phase composition (XRD), microstructure analysis (PLM)	Possible to distinguish the examined sources on the basis of textural, mineralogical and geochemical parameters.
TRĄBSKA et al. 2009	+	-	-	-	Chemical composition (XRF), haematite crystallite size (XRD), statistical analysis (cluster analysis)	Distinction between samples from various geological units and possible discrimination within a one unit.

Table 3. *Fingerprints applied at IRRM provenancing, based on quoted references*

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TALKING BONES: SCAPULAE AND EUROPEAN UPPER PALAEOLITHIC RITUALS

BRIAN ADAMS

Keywords: *Scapulae, Gravettian, Magdalenian, Scapulimancy, Plaquettes*

Preface

While much about the subsistence and settlement systems of Upper Palaeolithic hunter-gatherers has been reconstructed on the basis of faunal, lithic and location data, the belief systems of such groups remain elusive. Cave paintings (parietal art), are the most common source of insight into Palaeolithic belief systems.[1] Portable art objects are more commonly used for insights into social interactions during the Palaeolithic,[2] although Marshack[3] has used such objects to hypothesize about calendric systems during the Upper Palaeolithic. In this paper, the occurrence of scapulae in Upper Palaeolithic sites is investigated. Specifically, examples in which scapulae have been recovered in contexts suggestive of ritual behavior are examined. Such cases are interpreted with the aid of historic and ethnographic data.

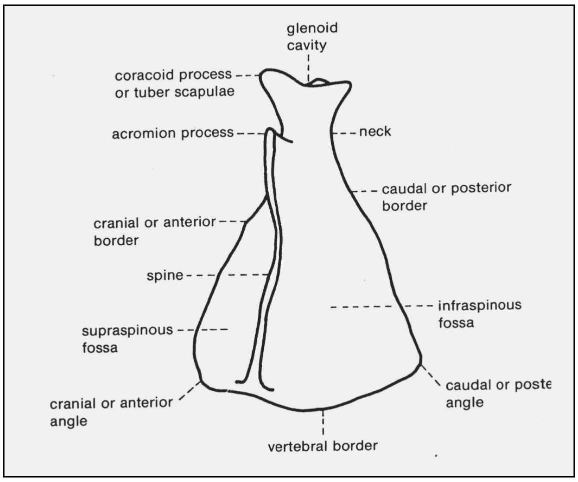

Fig. 1. *Scapula bone from a bovid (KEIGHTLEY 1978, Fig. 1)*

Scapula Bones

The scapula bones from archaeological contexts that are the topic of this paper are chiefly derived from late Pleistocene forms of bovids, cervids, equines, and mammoths. Unfortunately, published accounts generally fail to identify the species from which a decorated scapula was derived, especially from early excavations. The scapula is a flat, roughly triangular bone forming part of the shoulder girdle (***Fig. 1***)[4]. One surface is relatively flat, while the opposite surface is divided by a bony spine called the spina scapulae. The articular surface is termed the coracoid process or tuber scapulae, and is located at the apex of the bone where it articulates with the humerus.

[1] LEROI-GOURHAN 1968; LEWIS-WILLIAMS 2002.
[2] CONKEY 1980; GAMBLE 1982; MITHEN 1996.
[3] MARSCHACK 1972a, b.
[4] GRAY 1977; SCHMID 1972.

Scapula Bones in the Palaeolithic Record

The archaeological record of the European Palaeolithic includes many examples of the use of scapula bones in ritual contexts. These are contexts suggesting these artifacts were not mere food items disposed with other refuse, but appear to have been given special treatment and careful burial. In this paper, it is proposed that during the European Upper Palaeolithic, scapula bones were intimately associated with communications between the living and the world of the dead as a means of retaining contact with the wisdom and advice of the departed ancestors. As will be demonstrated below, the scapula bone itself, and not the particular species of origin, seems to be of primary significance in the hypothesized relationship between the worlds of the living and dead; it is proposed that scapulae of various species (e.g. deer, mammoth) appear to have been associated with similar symbolic meanings. Why this may have been so is

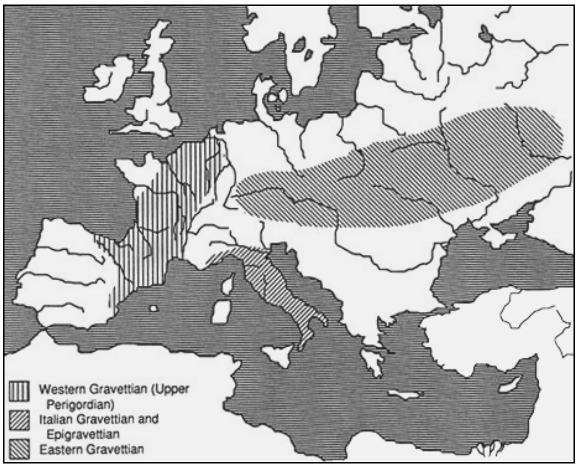

Fig. 2. *Distribution of Gravettian sites (Tattersall et al. 1988)*

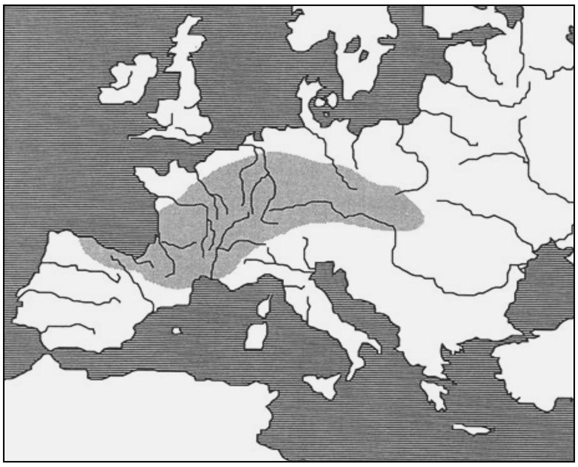

Fig. 3. *Distribution of Magdalenian sites (Tattersall et al. 1988)*

beyond the scope of this paper. It is argued below that scapulae were important in two related ritual contexts: divination and burial of the dead.

The earliest examples of life/death rituals derive from the Gravettian of Central and Eastern Europe, while more recent evidence is associated with Magdalenian occupations in Western Europe (***Fig. 2 and 3***). Scapulae from Gravettian and Magdalenian sites were engraved primarily with naturalistic and sometimes with schematic designs, and were also a source of raw material for some decorated bone discs.[5] Due to their flat surfaces and the nature of the designs engraved, scapulae have been interpreted as “sketchbooks” for prehistoric artists.[6] In this paper an alternative interpretation of these artifacts is presented. Archaeological, ethnographical, and historical evidence provide a rich source of data suggesting that scapulae have long been associated with the interrelated concepts of fertility and the departed ancestors, and were utilized to connect these concepts for the benefit of the world of the living.

The Record from Central and Eastern Europe

The earliest evidence for the ritual utilization of scapulae comes from Central and Eastern European Gravettian sites. In Central Europe these sites are located in Moravia (Czech Republic) and Austria, while in Eastern Europe the evidence derives from sites in the Russian Plain.

Krems-Wachtberg

This is a Gravettian open-air site in eastern Austria dated to 26,580±160 B.P. (Poz-1290).[7] The site consists of a living floor that produced stone artifacts, faunal material, charcoal, ochre, fired clay, and three infant burials. Burial 2 consists of a ca. 3-month-old infant found in a thick layer of red ochre. Burial 1 consists of a double infant burial of two newborns that were buried with over 30 ivory beads and were also covered by a thick layer of red ochre (***Fig. 4***). The double burial was also covered with a mammoth scapula.

Brno II

The Upper Palaeolithic site of Brno II, located in Moravia (Czech Republic), is an isolated burial classified as Gravettian, which in this area dates to between approximately 20,000 and 30,000 years B.P.[8] The site produced a human burial with associated grave goods and was recovered by salvage work during canal construction. Makowsky originally described the find in 1892, and a detailed analysis was presented nearly 60 years later.[9]

The Brno II burial has been identified as a middle-aged, strongly built male.[10] The body was found in a red ochre-stained area accompanied by several grave goods consisting of 600 dentalium shells (likely from a necklace), 2 large perforated stone discs, 14 small discs and disc fragments made from various materials (stone, bone, ivory; some decorated

[5] SIEVEKING 1971; 1983.

[6] LEROI-GOURHAN 1968.

[7] EINWÖGER et al. 2006.

[8] SVOBODA et al. 1996.

[9] MAKOWSKI 1892.

[10] JELINEK et al. 1959.

with incised lines), and fragments of a possible marionette. In addition, several animal remains were found with the burial, including a mammoth tusk, ivory fragments, horse teeth, antler, and a woolly rhinoceros skull and ribs. Like the surrounding loess, the burial and associated artifacts exhibited a red coloration from ochre. A scapula bone from a young mammoth was found near the skull in the burial.

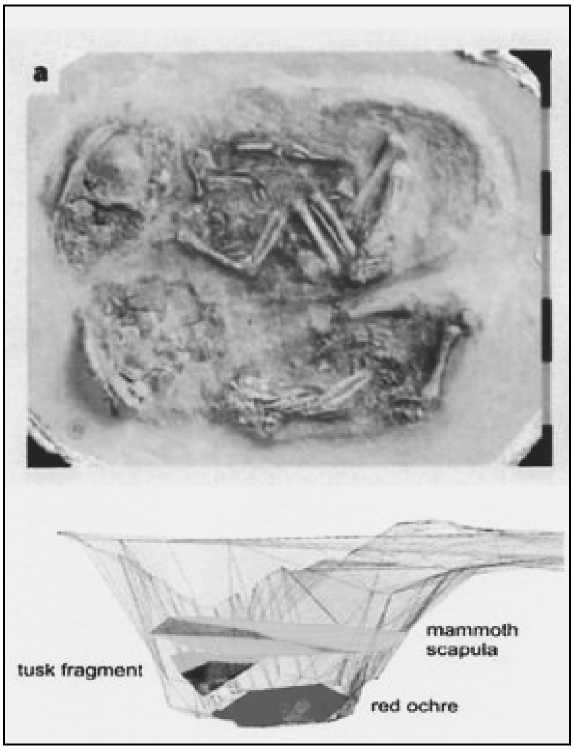

Fig. 4. *Gravettian infant burial from Krems-Wachtberg, Austria: plan view (above); cross-section (below)*
(EINWÖGER et al. 2006, Figure 1a)

Dolní Věstonice II

This is one of three open-air sites located in the Pavlovské Hills of southern Moravia (Czech Republic). The site has produced dates of between approximately 25,500 and 29,000 B.P., and is classified as Gravettian.[11] In 1927 the ochre-covered burial of a child was found at the site.[12] The burial was covered with a large mammoth scapula and was found with a necklace of 42 perforated fox teeth.

[11] SVOBODA et al. 1996, 141, 213.
[12] KLÍMA 1963, 263.

Dolní Věstonice III

This is an Upper Gravettian site dated to 24,560 ±660-610 B.P. (GrN 20392).[13] It is another of the three open-air sites located in the Pavlovské Hills. In 1949, the site produced the tightly flexed burial of a small woman, approximately 40 years old. She had been covered with a mammoth pelvis and two mammoth scapulae, one of which exhibited several cut marks.[14] Also found with the burial were one pointed flint blade, two blade-like pieces of debitage, and one small backed blade.

In addition, tarsal bones and a pelvis from and Arctic fox (*Alopex/Canis lagopus*) were found near the near the deceased's left hand in the burial, and 10 canine teeth from the same species were found in the right hand.

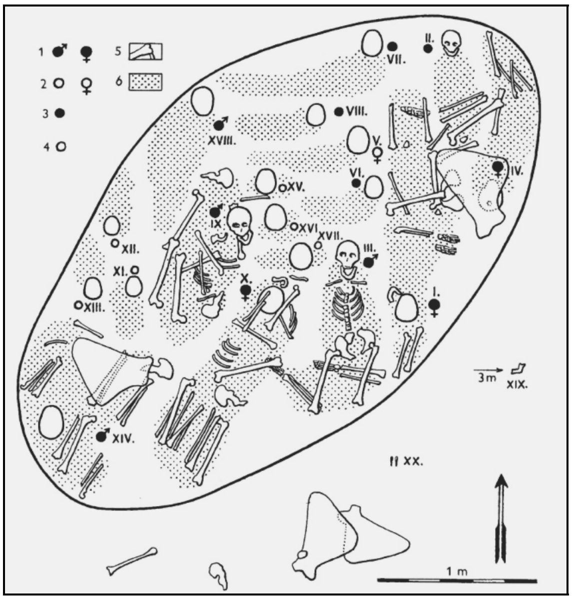

Fig. 5. *Upper Palaeolithic cemetery at Předmosťi, Site I, Moravia (KLÍMA 1991, Figure 2)*

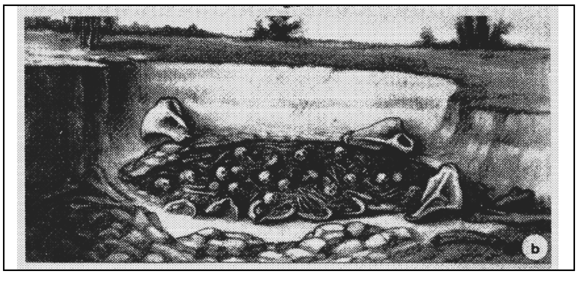

Fig. 6. *Reconstruction of Upper Palaeolithic cemetery at Předmosťi, Site I, Moravia (KLÍMA 1991, Figure 3)*

[13] SVOBODA et al. 1996, 214.
[14] KLÍMA 1963, 150.

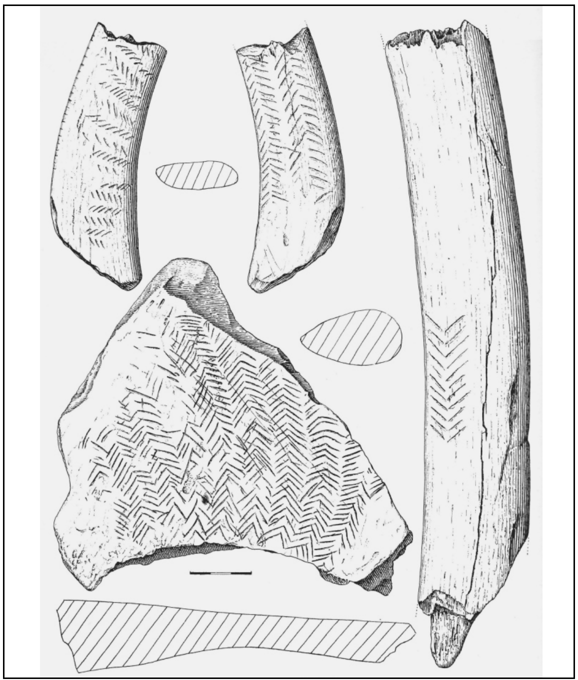

Fig. 7. *Decorated rib and scapula fragments from Předmosťi, Moravia (ABSOLON–KLÍMA 1977, Figure 40)*

Předmostí, Site I (Skalka)

Předmostí is located in Moravia, at the strategic "Moravian Gate", and produced Middle and Upper Paleolithic material.[15] Site I (Skalka) produced an Upper Paleolithic Gravettian cemetery radiocarbon dated to 26,870±250 (GrN 6801) and 26,320±240 (GrN 6852) B.P.[16] The cemetery measured approximately 4.0-x-2.5 meters and was covered with limestone blocks (***Fig. 5 and 6***). Eighteen to twenty burials, mostly contracted, have been identified at the site, including 7 adults (4 male, 3 female), 7 sub-adult, and 4 children. Burial IV (adult female) and Burial XIV (adult male) were associated with mammoth scapulae. Maška[17] identified another cemetery at the site that appeared as a large burnt area surrounded by mammoth bones. Předmostí has also produced mammoth rib and scapula fragments decorated with incised "herringbone" patterns (***Fig.*** *7*).[18]

Additional evidence for the use of scapula bones in rituals comes from the Russian Plain in Eastern Europe. The Kostenki sites are open-air sites located in terraces along the Don River, dating to the "Later" (ca. 20,000 B.P.) and "Terminal" (ca. 15,000-10,000 B.P.) Würm.[19]

A unique pit feature was found at Kostenki I in 1936.[20] This feature, known as "Pit no. 123", produced two ocherous layers. The lower layer, at the base of the pit, was 10-15 cm thick and contained an ivory female figurine. About 20 cm above the lower ocherous layer was a second ocherous layer containing various flint and bone artifacts. This layer was subsequently covered with a mammoth scapula. According to Gvozdover,[21] the function of this and similar pits is unclear.

Kostenki XVIII consists of a grave with a burial covered by "three distinct layers of mammoth bones".[22] The lower layer was composed of scapulae fragments, above with was a layer of long bones followed by another layer of long bones and tusks. As this site has produced only human and animal bones but no artifacts, its precise age is uncertain.

The site of Gorodtsovskaya, dated to the "Later" (ca. 20,000 B.P.) Würm, produced a possible structure below which was found an intentional human burial.[23] The grave contained the remains of a child (5-6 years old) possibly buried in a seated position. Found with the body were a "bone knife" ("paddle-shaped shovel"), 70 flint artifacts (consisting of debitage, 10 end-scrapers, 1 borer), a bone needle, a bone "polisher", and fragments of red and yellow pigments.

In addition, a possible headdress made of several pierced arctic fox teeth was found near the skull. The grave appears to have been covered with a mammoth scapula.

Summary of the Central and Eastern European Evidence

In summary, the Central and Eastern European evidence suggests that mammoth scapulae were sometimes associated with Gravettian burial rituals. The pit feature from Kostenki I also suggests an association with female ("Venus") figurines from this period, although this paper will not investigate this relationship. The question of the relationship between scapula bones and human burial rituals is discussed later in this paper.

The Record from Western Europe: France and Spain

Compared to Central and Eastern Europe, the evidence for the ritual utilization of scapula bones during the Palaeolithic in Western Europe is derived

[15] ABSOLON–KLÍMA 1977; KLÍMA 1991; SVOBODA et al. 1996, 223.
[16] MAŠKA 1894; 1895; SVOBODA et al. 1996, 136, 228.
[17] MAŠKA 1894.
[18] ABSOLON–KLÍMA 1977, 62.
[19] KLEIN 1969; SOFFER 1985.
[20] GVOZDOVER 1989, 75; PRASLOV 1985, 183.
[21] GVOZDOVER 1989, 74.
[22] KLEIN 1969, 164.
[23] KLEIN 1969, 94.

from later contexts, primarily associated with the Magdalenian culture dating to approximately 10,000 to 15,000 years BC.[24] In Central Europe, scapulae are associated with cemeteries, while in Western Europe, where Palaeolithic cemeteries are less common; they are known from non-burial contexts. As much of the evidence regarding scapulae has been summarized in various places,[25] usually in the context of Paleolithic art, an exhaustive review of pertinent sites and literature is unnecessary. Sieveking[26] presents a useful summary of decorated scapulae from Western European contexts, and much of the following information is derived from her work.

As of 1983, decorated scapulae had been recovered from a total of 22 sites in Cantabric Spain, the French Pyrenees, Aquitaine, and Central and Eastern France, and such artifacts are often recovered in large groups, such as those from Laugerie Basse, abri Morin, Rochereil, Castillo, and Mas d'Azil. Scapula bones from these sites are usually decorated by engraving, and naturalistic motifs predominate while geometric patterns are less common.

Species depicted on the bones are the same as those depicted in cave art, with depictions of horse common at some sites and deer at others. Three sites are of particular interest due to the number of scapulae found and the context of the pieces. These sites, Le Mas d'Azil in France and El Castillo and Altamira in Spain are discussed in more detail below.

Le Mas d'Azil (Ariège), Southern France

This is a large cave site in the Pyrenees of southern France described as a "great river tunnel".[27] The site produced Aurignacian, Magdalenian, and Solutrean material, and is best known for the rich Magdalenian assemblage, including portable and parietal art dating to the Middle and Upper Magdalenian.[28] The site, which has been excavated by both professionals and amateurs since the late nineteenth century, also produced cave paintings.[29]

The Arize River passes through a bedrock massif south of the village of Le Mas d'Azil by way of a large cavernous tunnel, measuring a maximum 51 meters high and 48 meters wide.[30] Indeed, the cave is large enough to accommodate National Route 119 as it passes between Le Mas d'Azil and St. Girons. In the 1930's, excavations were conducted in the terrace deposits on the left bank of the Arize at the southern mouth of the cave by Saint-Just Péquart.[31] Here, a five to six meter deep section was exposed with three Magdalenian and one Azilian level.[32] The Magdalenian levels were separated by 1.0 to 2.0 meter thick layers of sterile alluvium. The upper-most Magdalenian level ("Level A") produced an assemblage poor in lithic and bone tools but rich in faunal material. Level B measures approximately 40 to 60 centimeters in thickness and produced a rich Magdalenian assemblage with many engraved osseous artifacts. Among the artifacts found in Level B were 60 scapulae, of which half are decorated and half are not.[33] The presence of so many decorated and undecorated scapula bones in this level is intriguing and suggests the possibility that these bones were cached here and periodically decorated. The decorations consist of simple incisions as well as representations of animals (e.g. horse, reindeer, chamois, etc). Deeper within the cave, approximately midway between the north and south entrances on the right bank of the Arize, the "Galerie" was discovered consisting of a series of interconnected chambers.[34]

The "Galerie" has been divided into two parts: "l'Habitat" in the south and "le Sanctuaire" in the north. The "Galerie" produced an abundance of Magdalenian parietal and mobiliary art, and some of the chambers appear to have been associated with rituals (e.g. the "chimney" in "le Sanctuaire" with its deposit of six large, cut reindeer antlers[35]).

The results of excavations at the Mas d'Azil suggest that this was a site of important ritual activity during the Magdalenian, and it is likely that scapula bones were important components of such rituals.

Other sites in France

At Abri Morin (Perigord, France) 46 decorated scapulae dating to the Magdalenian period were discovered, 17 of which are decorated with naturalistic designs and remainder with more abstract images.[36] Naturalistic designs are dominated by horse (n=9). Interestingly, faunal remains at this site are dominated by reindeer, followed by bison then horse.[37]

Laugerie Basse (Les Eyzies, Dordogne) has produced a large collection of portable art objects, and

[24] BAHN–VERTUT 1988.
[25] ALMAGRO BASCH 1976; DELPORTE–MONS 1975; SIEVEKING 1983.
[26] SIEVEKING 1983.
[27] BAHN–VERTUT 1988, 39; PÉQUART–PÉQUART 1961; 1962; 1963.
[28] PÉQUART–PÉQUART 1961.
[29] LEROI-GOURHAN 1968, 368.
[30] PÉQUART 1937.
[31] PÉQUART–PÉQUART 1939; 1960.
[32] PÉQUART–PÉQUART 1939; 1960, Figure 7.
[33] BAHN–VERTUT 1988; DELPORTE–MONS 1975; PÉQUART–PÉQUART 1939, 451; PALES 1970.
[34] PÉQUART–PÉQUART 1960, 33.
[35] PÉQUART–PÉQUART 1963, 318.
[36] DEFARGE et al. 1975; SONNEVILLE-BORDES 1986, 633.
[37] DEFARGE et al. 1975, 57.

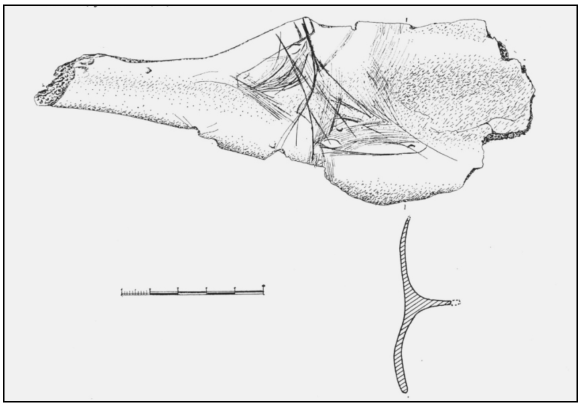

Fig. 8. *Decorated scapula from El Castillo, Spain (ALMARGO BASCH 1976, Fig. 9)*

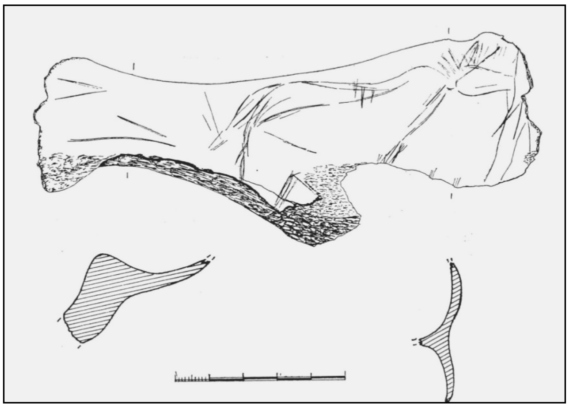

Fig. 9. *Decorated scapula from El Castillo, Spain (ALMARGO BASCH 1976, Fig. 44)*

material from the site has been classified as Magdalenian III, IV, V, VI and Azilien.[38] Unfortunately, provenience information for many of the finds is rather coarse, as excavations commenced in the 1860's, prior to the development of rigorous excavation methods.[39]

Early researchers included Edourad Lartet, Henry Christie, and Marquis Paul de Vibraye in 1863 and Elie Massénat and Léonard Delpeyrat in 1865.[40] Later work was performed by Otto Hauser, Achille Le Bel, and Jean Maury (ibid). A two-meter thick profile is illustrated in Peyrony and Maury[41] consisting of three cultural levels (A, B, and C from bottom to top). Each level produced stone, bone, antler and ivory material classified as Magdalenian. The site has produced one of the largest collections (n=560) of portable art in the Périgord region including several decorated scapulae of unidentified species.[42] This site also produced a flexed male burial dating to the Magdalenian III-IV period (ca 14,500 BP).[43] A scapula fragment of unidentified species with an engraved horse is shown in Cartailhac, and Breuil.[44] Peyrony and Maury[45] illustrate a scapula fragment of unidentified species engraved with a reindeer from level B, and Bourlon[46] describes two scapula fragments of unidentified species depicting a human leg and a trotting *Ruminantia* (deer, bison?).

The cave site Rochereil (Dordogne) also produced a rich assemblage of decorated bone artifacts dating to the Magdalenian period, and many of these consist of engraved scapulae of unidentified species.[47] Indeed, Rochereil is one of the four richest sites of portable art in the Périgord region, with 132 objects.[48] Although several engraved scapulae fragments are illustrated by Jude,[49] a separate detailed discussion of this artifact type is not presented so species identifications are unavailable. The site produced two human burials.[50]

El Castillo (Cantabria), Northern Spain

El Castillo is a large cave located in the Cantabrian Mountains of northern Spain. It is a multi-component site spanning the Acheulean through Bronze Age. Cave art was discovered here in 1906, and excavations were conducted between 1910 and 1914 under the direction of Hugo Obermaier.[51] Obermaier excavated practically all of the 16 to 18 meters of deposits in the cave.

The Magdalenian levels produced a wealth of portable art objects, including engraved scapulae (***Fig. 8 and 9***). According to Straus[52], El Castillo is "…among the half–dozen or so richest, most complex cave art sites in the region…" and "…is one of the richest mobile and rupestral art sites anywhere." Obermaier's investigations at the site resulted in the discovery of 33 engraved scapulae from the Early Magdalenian level ("Magdelenian Beta"), which dates

[38] CARTAILHAC–BREUIL 1907; SAINT-PÉRIER 1965, 146.
[39] HADINGHAM 1979, 236; LEROI-GOURHAN 1968, 25.
[40] www.grandroc.com/laugerie, accessed 6 April 2006
[41] PEYRONY–MAURY 1914, Fig. 1.
[42] BAHN–VERTUT 1988, 34; BREUIL 1936; SAINT-PÉRIER 1965; SIEVEKING 1983.
[43] QUÉCHON 1976.
[44] CARTAILHAC–BREUIL 1907, 28, Fig. 11a.
[45] PEYRONY–MAURY 1914, 145, Fig. 6, No. 5 .
[46] BOURLON 1916, 2.

[47] JUDE 1960.
[48] BAHN–VERTUT 1988, 34; SAINT-PÉRIER 1965,148.
[49] JUDE 1960, Fig. 12 and 13.
[50] JUDE 1960.
[51] STRAUS 1992, 159–160.
[52] STRAUS 1992.

to between 16,750±250 B.P. and 13,000 B.P.[53] Unfortunately, precise provenience data is unavailable for these finds, and it is unknown if they were found in a group or scattered throughout the Early Magdalenian level. A total of 68 animals are depicted on the El Castillo scapulae, with some pieces exhibiting several superimposed animals.[54] Depictions of red deer hinds predominate (38 %), followed by red deer stags (13%). The remainder consists of horses/horse heads (n=8), fish (n=1), one bovine, and four unidentified quadrupeds. Straus[55] notes that the species depicted and engraving techniques utilized at El Castillo are very similar to those found at Altamira Cave, located approximately 17 kilometers away. He further states that the Magdalenian levels at both sites that produced the scapulae were dominated by red deer. Straus[56] also describes an ibex scapula engraved with the figure of a bison from the high-altitude caprid hunting site of Rascaňo.

Altamira Cave (Santander, Spain)

Although this cave had been sporadically investigated beginning in the 1870's, during which time the famous wall paintings were discovered, systematic excavations were initiated in 1902 by Hermilio Alcalde del Río.[57] Work by Alcalde and later by Hugo Obermaier indicated that the cave was occupied by Solutrean and Magdalenian groups. Notable among Alcalde's finds were a group of finely incised red deer (*Cervus elephus L.*) scapulae decorated with does heads. Based on existing accounts, the exact number of decorated scapula bones is uncertain. According to Saura Ramos,[58] Alcalde found four scapulae, while Straus[59] citing Barandiarán[60] mentions six artifacts. Almagro Basch[61] discusses seven engraved scapulae from this site. Straus[62] suggests that since Alcalde worked in a relatively small area in the cave (20 square meters), it is possible that the engraved scapulae are part of a cache left near the entrance to the famous "Polychrome Chamber"/"Hall of Bison" with its "Great Panel". Due to the cave's stratigraphy, which did not indicate a clear break between the Solutrean and Magdalenian horizons, there had been some ambiguity surrounding the precise age of the scapula bones. However, in 1992 a fragment of one of these artifacts was radiocarbon dated, producing a date of 14,480 BP.[63] Another bone fragment clearly associated with the Lower Magdalenian component produced a date of 14,520 BP, while a sample from well within the Solutrean horizon dated to 18,540 BP. These dates demonstrate that the decorated scapula bones from Altamira are associated with the Lower Magdalenian occupation. Further, mass accelerator-spectrometer carbon-14 dating of the Paleolithic drawings in the cave indicate that the scapulae are contemporary with the images in the "Great Panel" of the "Polychrome Chamber"/"Hall of Bison"[64] (average date of 14,450 BP derived from 6 drawings in Great Panel).

Summary of the West European Palaeolithic Evidence

Based on the evidence presented above, it is argued that scapulae bones were accorded differential treatment by Magdalenian groups in parts of Western Europe. Not only were such bones commonly decorated, but the evidence suggests they were incorporated into the archaeological record as caches. It is suggested here that such preferential treatment indicates that scapula bones were involved in rituals.

It has been argued that two of the sites discussed above were the foci of important Magdalenian rituals. Bahn[65] describes the Mas d'Azil as a regional "supersite", or aggregation site where "…normally scattered groups renewed contact and, through rituals and festivities, strengthened the links between them." Such sites may have served as seasonal aggregation sites for dispersed Magdalenian bands.[66] In addition to those proposed by Bahn,[67] Straus[68] considers El Castillo another example of a Magdelenian "supersite" (together with La Paloma, Tito Busillo, Cueto de la Mina, Altamira, El Pendo, El Valle, and Urtiaga).

Historic and Ethnographic Documentation of the Ritual Use of Scapulae

Ethnographic and historic data provide an interpretive framework for the interpretation of the utilization of scapulae during the Palaeolithic. Specifically, the literature records the utilization of scapulae for divination as a means to contact the spirit world for advice, and thus suggests close association with these bones and the afterlife.

The use of scapulae for purposes of divination is termed *scapulimancy,* and its occurrence throughout

53 ALMARGO BASCH 1976; STRAUS 1992, 123.
54 ALMARGO BASCH 1976; STRAUS 1992.
55 STRAUS 1992, 163.
56 STRAUS 1992, 160.
57 SAURA RAMOS 1998; STRAUS 1976/77.
58 SAURA RAMOS 1998.
59 STRAUS 1992, 163.
60 BARANDIARÁN 1972.
61 ALMARGO BASCH 1976.
62 STRAUS 1992, 171.
63 SAURA RAMOS 1998, 44.
64 SAURA RAMOS 1998, 52.
65 BAHN 1982, 265.
66 CONKEY 1980.
67 BAHN 1982.
68 STRAUS 1982, 159.

the world has been well documented.[69] Cooper[70] defines scapulimancy as the

"…divination by the shape, color, or other characteristics of, or by the marks, veins, burns, or cracks in shoulder blades, or other flat or flattish bones, or tortoise shells".

Two types of scapulimancy are recognized: pyro-scapulimancy and apyro-scapulimancy. The former refers to divination based upon fractures, cracks, or burns resulting from intentional heating. Apyro-scapulimancy refers to the practice of divination based on the natural shape, color, veining, and other characteristics of the bone and does not involve burning. Archaeologically, pyro-scapulimancy would be recognizable by evidence of intentional burning, while evidence of apyro-scapulimancy would be more difficult to discern.

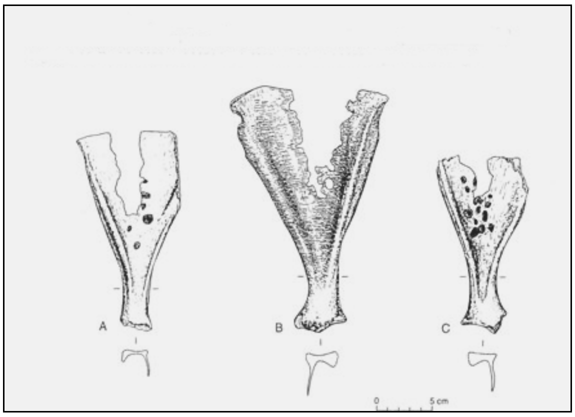

Fig. 10. *Neolithic scapula oracle bones, Kangjia, China (LIU 2004, Fig. 3.17)*

Scapulimancy in China

The earliest recorded evidence for the use of scapula bones in ritual activities comes from the late Neolithic of northern China (***Fig. 10***). The earliest examples are from Fujiamen in Wushan, Gansu, and date to the Shilingxia phase of the Majiaya culture (ca. 3980-3640 BC).[71] At this site a group of sheep/goat, pig, and cattle scapulae were found on a house floor, and thin areas of the bones had been intentionally burned at several locations to produce cracks. The ritual use of scapulae is well documented for the Longshan period in the third millennium b.c.[72]

At the site of Kangjia in Lintong, Shaanxi Province in the lower Wei River valley, a multi-house group was excavated in the late twentieth century.[73] Rectilinear house foundations with frontal courtyards were discovered at the site, and some of the houses were associated with pits containing evidence of ritual behavior. For example, Pit H69 produced two sub-adult female burials, one incomplete adult female burial and an oracle bone made from a water deer scapula. In the bottom of Pit H71, the dismembered skeleton of a 20 to 25 year old woman was found, above which a sika deer scapula oracle bone was discovered. Finally, Pit H79 produced 74 animal bones, of which 72 were from wild species (primarily hare and raccoon dog) and two from domestic animals (pig, sheep/goat). The pit also contained an oracle bone "…indicating that divination was performed perhaps with regard to hunting, butchering, or consumption of animals found in the pit[74]. Other evidence of ritual activity from Pit H79 consists of fragments of a turtle shell painted with pigment[75]. Like scapulae, turtle shells were also used for divination in China, with evidence extending as far back as the Early Neolithic (ca. 7000-5500 BC).[76] Their importance in divination rituals is likely a result of their association with supernatural powers and creation myths in traditional Chinese beliefs.[77] In the myth of the flood, which takes place during the reign of the first human emperor Yao, the high god ("Tiandi") punishes humans for their evil ways by having the god of water flood the world.[78] Ultimately, dry, habitable land is renewed through the spreading of "*Shirang"* or *"Swelling Earth"/"Magic Mould"*, a clay-like substance secured by the hero Yü on the advice of an owl and tortoise and carried on the back of the tortoise.

Scapulimancy became particularly important and sophisticated during the Shang dynasty (1766-1122 B.C.), a period which witnessed the rise of the state in China[79]. Chang[80] notes that while scapulimancy was likely practiced by all segments of Shang society, surviving oracle bones are derived from royal contexts only. He states that "…divination was an important activity that presumably played an important part in decisions pertaining to royal persons and to the state".[81]

During the Shang period scapulae of cattle (*Bos exiqus*) and water buffalo (*Bubalus mephistopheles*) were commonly used for divination, as were the

[69] ANDREE 1906; COOPER 1936.
[70] COOPER 1936, 29.
[71] LIU 2004, 67.
[72] CHANG 1980, 285; CHI 1977, 69; LIU 2004
[73] LIU 2004, 48–71.
[74] LIU 2004, 63.
[75] LIU 2004, 64.
[76] CHANG 1980, 31; CHI 1977, 12; KEIGHTLEY 1978, 8; LIU 2004, 65.
[77] CHANG 1980, 31; LIU 2004, 65.
[78] BIRCH 1961, 21; CHRISTIE 1968, 87; SANDERS 1980, 33.
[79] CHANG 1980.
[80] CHANG 1980, 33.
[81] CHANG 1980, 34.

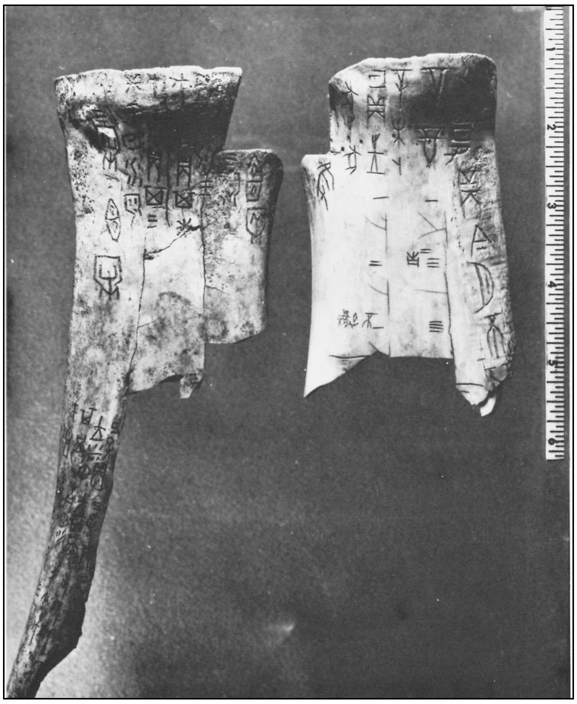

Fig. 11. *Shang Dynasty scapula oracle bones (CHANG 1963)*

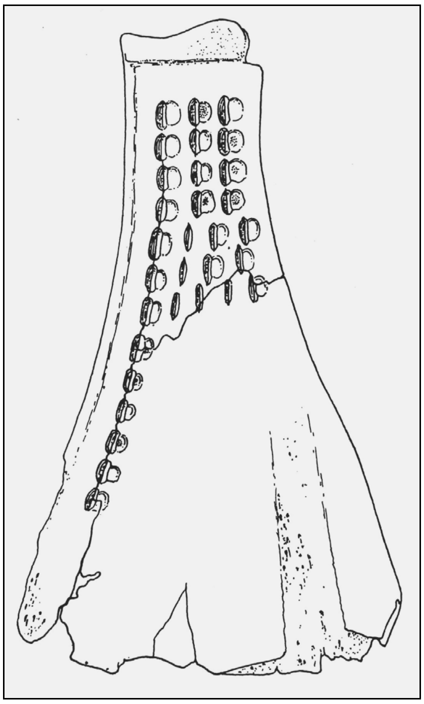

Fig. 12. *Shang Dynasty scapula oracle bone (KEIGHTLEY 1978)*

plastrons and sometimes carapaces of several species of turtle.[82] The basic technique of scapulimancy at this time has been summarized by Chang[83] and Keightley.[84] First, a shoulder blade was polished, after which natural hollows were bored and chiseled to make the bones thinner and more susceptible to cracking. A "diviner" (p'u-jen) would make contact with the ancestral deities and conduct the divining act. Then "…heat was applied…cracks appeared…and were then interpreted for an answer to the question put to the ancestors…"[85]. Interpretation of the cracks was by the "prognosticator" (chan-jen), the individual who actually interpreted the messages from the ancestors. Following this, an "archivist" (shih) would record the results on the bone or shell used either by incision, painting, or incision followed by infilling with red, black, or brown pigments (***Fig. 11 and 12***). One tabulation of deciphered inscriptions on Shang oracle bones indicates that nearly half of inquiries (48 percent) relate to sacrificial offerings, followed by hunting and fishing (16 percent), king's journeys (15 percent), weather and harvesting (12 percent), war expeditions (5 percent), and "miscellaneous" (sickness, life, death, birth, dream, building, etc.: 4 percent).[86]

[82] KEIGHTLEY 1978.
[83] CHANG 1980, 33–35.
[84] KEIGHTLEY 1978.
[85] CHANG 1980, 33.
[86] CHI 1977.

Uses of Scapulae from the Ethnographic Record

The ethnographic record provides a starting point from which to examine the ritual use of scapulae among relatively modern non-industrial groups. While extensive research documents a geographically and temporally widespread use of scapula bones for divination purposes among diverse groups,[87] detailed accounts are rare. The most comprehensive account currently available is Speck's[88] work among the aboriginal Naskapi (Cree) groups in Canada, and the summary below is derived from his work. The Naskapi are an Algonquian-speaking group occupying the Labrador Peninsula of Canada where Speck worked in the early 20th century. Although by this time their traditional way of life based on hunting and fishing had long been supplemented by the fur trade, the Naskapi still relied primarily on hunting/fishing/gathering and still retained their native language and religious beliefs.

According to Speck[89], divination was a core aspect of the religious beliefs of the Naskapi, who were "…continually trying to learn from friendly animal spirits acting as oracles, when and where to go to secure game". Equally important was their desire to know of "…impending fortune in respect to weather,

[87] ANDREE 1906; COOPER 1936.
[88] SPECK 1977.
[89] SPECK 1977, 141.

sickness, and personal concerns”[90]. The scapulae of game and fur-bearing animals were the primary focus of divination among the Naskapi (***Fig. 13***):

In the rite of consultation this tablet-like bone is subjected to heat, and the burnings, in the form of blackened spots, cracks, and breaks, are then interpreted by the cunning and ingeniousness of the practitioner. Imagination suggests the likeness of the marks produced by the heat, to rivers, lakes, mountains, trails, camps and various animals… Abstract ideas may be represented: life, death, success, failure, plenty, famine, sickness, chicanery, time periods, warnings, encouragement; and general good and bad luck are likewise indicated… It would seem… that there is some idea of force by fire in extorting from the animals’ bones the revelations which they are able to give to men whose soul power is sufficiently strong and who are in good standing with the world of animal spirits.[91]

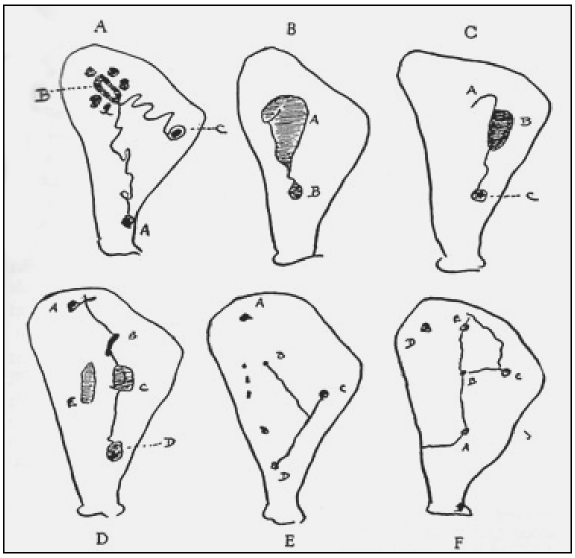

Fig. 13. *Naskapi scapula bones for divination (SPECK 1977, Fig. 17)*

Among the Montagnais, scapulimancy was practiced by both women and men, although some individuals were considered more skillful than others in the interpretation of signs. The practice was prohibited among children, who could attract cannibals (wi’ndigo) by attempting. The scapulae and pelvis bones of small animals (e.g. beaver, hare) were typically used by anyone for general divination, while divination with scapulae from large game animals (e.g. caribou, moose, deer) was restricted to “…the experienced conjuror…” because they are “…‘too strong’ for ordinary men”.[92] Use of bear scapulae for divination was not approved.

Signs were produced by placing a bone directly on embers derived from domestic hearths, and appeared almost immediately (in one case in “about two minutes”[93]). Speck states that general rules of interpretation existed. For example, favorable signs consisted of a clean crack across the middle of a scapula, or the failure of a bone to burn. Bad signs consist of the appearance of small spots or holes upon burning. In addition to cracks and spots, an audible cracking sound was considered a favorable omen: “The heat caused it to give forth a cracking sound. *‘Pak! He cries out strong! He will answer’*”.[94]

Northern Labradorean Bands

In general, scapulimancy among the northern bands (the Naskapi) is similar to that practiced by the southern groups, although certain differences existed. A major difference is the prominent use of caribou scapulae for divination relating to caribou hunting among northern groups.

According to Speck[95]… “[P]ractically all the hunters among these bands practice this form of divination as a religious rite of importance throughout that part of the year when they are living upon the caribou in the interior plateau.” Speck[96] also cites examples suggesting that “professional” diviners existed in this region (i.e. individuals who would divine for hunters prior to an expedition yet not participate in the hunt themselves).

Divination with caribou scapulae among northern groups is highly ritualized, and involves several preparatory steps designed to secure a necessary, preliminary dream regarding the hunt. Dreaming is a religious experience among the Labrador groups: “…the hunting dream is the major object of focus… It is part of the process of revelation by which the individual acquires the knowledge of life. It is the main channel through which he keeps in communication with the unseen world”.[97] Dreaming is induced by a sweat bath, drumming, singing, and rattling. As dreams are vague and unspecific, scapulimancy is used to provide concrete instructions to fulfill a particular vision. Scapulae used in these rituals are removed from a caribou carcass during butchery, carefully cleaned of meat, then boiled briefly to allow removal of any remaining flesh. The cleaned bone is hung up in the house to dry. Divination is practiced at night after children are asleep. The dried

90 SPECK 1977, 141.
91 SPECK 1977, 142.
92 SPECK 1977, 149.
93 SPECK 1977, 149.
94 SPECK 1977, 147.
95 SPECK 1977, 152.
96 SPECK 1977, 163.
97 SPECK 1977, 187.

scapula is sometimes inserted into a slit piece of wood and held over red hot coals "…for a few seconds…", causing the bone to crack and producing burnt spots.[98]

Alternatively, the bone is held with the articular end (coracoid process/tuber scapulae) towards the diviner, the wide part away, over the heat source. The cracks and burnt spots that appear "…indicate the directions and locations to be followed and sought…[T]he shoulder blade is…regarded as a blank chart of the hunting territory".[99] Interestingly, it is believed that dreams resulting in a successful hunt must be paid for by the hunter. "Payment" includes proper respect of the slain animal's remains, post-mortem rites, and "…the execution of symbolic and decorative art designs which serve as memorials to the slain, furnishing them with a kind of satisfaction".[100] Speck[101] presents an example of a caribou sketched on a birch-bark comb case to illustrate this belief.

According to Bawden,[102] scapulimancy was also practiced by the Mongols. Like the Naskapi, the Mongols also interpreted the sound made when a bone was heated/burned, as well as patterns formed by cracks. The Yakuts of Northeast Siberia also practiced scapulimancy in a manner analogous to the Naskapi (***Fig. 14***).[103]

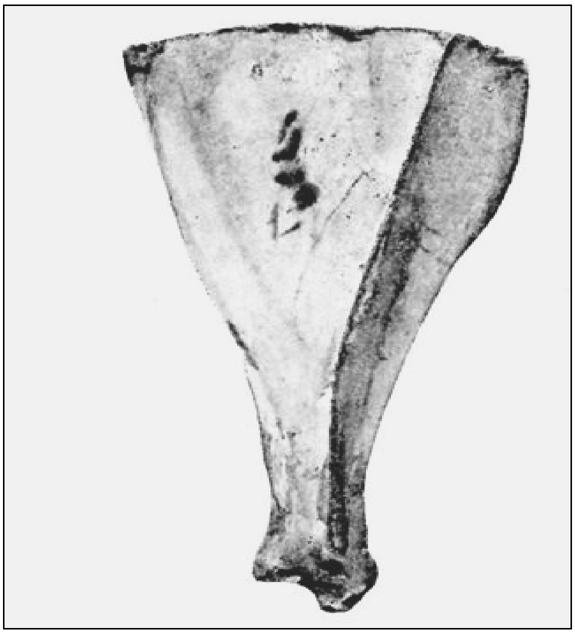

Fig. 14. *Yakut scapula bone for divination (GURVIČ 1978)*

[98] SPECK 1977, 187.
[99] SPECK 1977, 156.
[100] SPECK 1977, 188.
[101] SPECK 1977, 188.
[102] BAWDEN 1958, 11–12.
[103] GURVIČ 1978.

Scapulae, Stone "Plaquettes", and Ceramic Figurines

A discussion of the use of scapula bones during the late Palaeolithic of Western Europe requires a consideration of another class of portable art objects referred to as stone "plaquettes".[104] Plaquettes are small slabs with parallel faces measuring less than 20 centimeters across and 4 centimeters thick. Bahn and Vertut[105] propose that "…shoulder-blades are the bone equivalents of plaquettes". Like scapulae, plaquettes were decorated with naturalistic motifs, but abstract. "…indecipherable scribbles..." are just as common (***Fig. 15 and 16***).[106] Based on the shared attributes of shape and decorations, as well as contexts, to be discussed below, it is proposed here that plaquettes were considered the stone equivalents of scapula bones by Palaeolithic people.

Fragments of plaquettes litter the floors of cave and rock shelter sites, while others have been found in upright positions. Decorated stone plaquettes are found in such abundance at some sites that it has been suggested they represent the remains of Palaeolithic "sanctuaries".[107] A particularly interesting aspect of stone plaquettes is the apparent intentional burning and fragmentation of these artifacts.[108] Intentionally burnt plaquettes were found in abundance in the Galerie at Le Mas d'Azil, and Péquart and Péquart[109] suggest that they were used in a "Rite of Fire" ("Rite du Feu") associated with hunting magic. Such burning is reminiscent of the practice of heating scapulae during divination rituals, and also suggests a relationship with the early utilization of ceramic technology among Gravettian groups in Central Europe. It has been demonstrated that ceramic figurine fragments characteristic of the Moravian Eastern Gravettian (Pavlovian) culture (28,000-24,000 B.P.) exhibit evidence of thermal shock, suggesting that these figurines were intentionally shattered, possibly for ritual reasons.[110] Replication experiments revealed that firing rewetted or undried figurines caused them to loudly explode and shatter.

The connection between heating, fragmentation, and auditory phenomenon is reminiscent of the Naskapi accounts of scapulimancy recorded by Speck discussed above.

[104] BAHN–VERTUT 1988, 76, 81.
[105] BAHN–VERTUT 1988, 79.
[106] HADINGHAM 1979, 242.
[107] HADINGHAM 1979, 240; LEROI-GOURHAN 1968, 180; PÉQUART–PÉQUART 1963, 335; SIEVEKING 1983, 316.
[108] BAHN–VERTUT 1988, 77; HADINGHAM 1979, 240; PÉQUART–PÉQUART 1962, 222
[109] PÉQUART–PÉQUART 1963, 335.
[110] SOFFER et al. 1993; VANDIVER et al. 1989

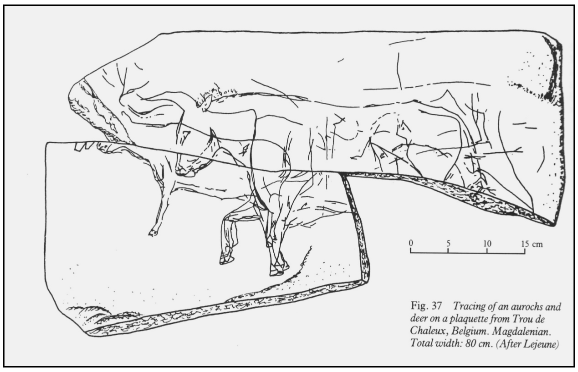

Fig. 15. *Plaquette with aurochs and deer from Trou de Chaleux, Belgium (BAHN–VERTUT 1988, Fig. 37)*

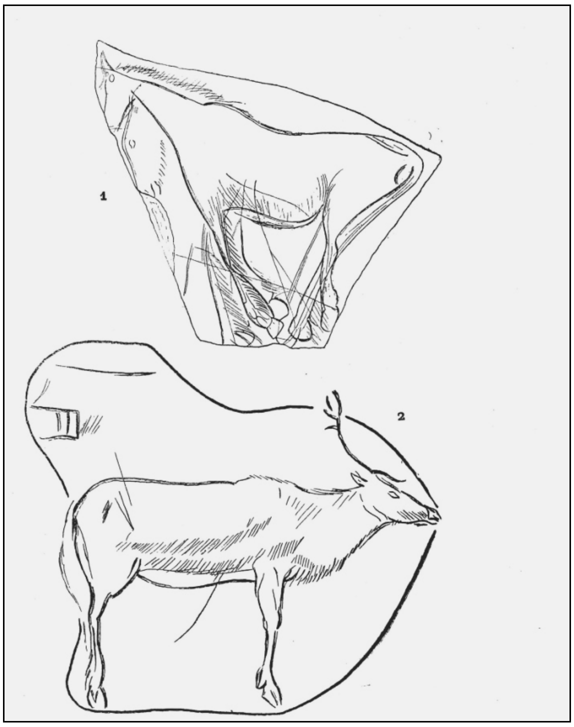

Fig. 16. *Plaquettes with horse and reindeer from Laugerie-Basse (BREUIL 1936, Fig. 6)*

The Proposed Relationship between Scapulae and the Spirit World

Having presented evidence for the ritual use of scapulae during the Late Upper Palaeolithic, followed by a discussion of the archaeological, historic, and ethnographic association of scapulae with divination, the question of the relationship between this particular bone and the practice of divination is addressed. A tantalizing connection between scapulae and the spirit realm is illustrated by practices among ethnographically documented native North American groups. Evidence from this region illustrates how a utilitarian object can be transformed into an artifact of ritual significance.

Due to their unique shape, scapula bones were commonly utilized as digging implements, as demonstrated by native groups from the plains region of North America. Weltfish[111] reports that among the Pawnee, hoes were used as both agricultural and general purpose digging and cutting tools. An example of the latter is the use of buffalo scapula hoes by women to repair the roofs of earth lodges. Women cut new thatch grass with sharpened buffalo scapula hoes, and these same tools were later used to remove the earth covering from existing roofs down to the damaged thatch grass layer. Once the thatch was repaired, men and women working as teams replaced the earth on the roof with pans. In May, women would take their buffalo scapula hoes into the fields to plant crops. Hoes were used to excavate holes approximately 2 inches deep from which any existing roots and sprouts were removed. Next, the loose soil was replaced, and small hills measuring approximately 1 to 1 ½ feet in diameter were created as beds for corn, beans, and other crops.

Similar practices are reported for other groups in the region, and fields were usually hoed on several occasions in order to remove weeds and to keep soil mounded sufficiently to prevent water from running off.[112] Among the Omaha, Mandan, and Cheyenne, agricultural hoes were also fashioned from elk scapulae.[113] Among the Hidatsa, scapulae hoes were used for agricultural activity as well as the excavation of cache pits for the winter storage of corn, beans, sunflower seeds and dried squash.[114]

The important role of scapula hoes in basic agricultural practices resulted in their inclusion in a particular fertility ritual among the Pawnee. The *Awari*, or "Ground-breaking Ceremony" was conducted in the early spring prior to planting, and was the only ceremony in which women had a prominent role.[115]

Part of this ceremony involved a re-enactment of initial hoeing in the spring to break the ground in preparation for planting, and involved the use of "four sacred shoulder-blade hoes that were kept in the four direction bundles". The sacred hoes "…were placed in pairs on the north and south of the (lodge) altar…" together with other sacred objects. The sacred hoes were passed from woman to woman whose dance imitated hoeing in the fields. This dance was combined with a dance by men to insure success in upcoming buffalo hunts. This association of scapula

[111] WELTFISH 1965.
[112] WILL–HYDE 1917.
[113] WILL–HYDE 1917, 82–91.
[114] WILSON 1987, 88.
[115] WELTFISH 1965, 95–105.

hoes with planting and hunting rituals indicates an interconnection between a utilitarian object and concepts of rebirth and fertility. It will be argued later that such concepts are of great antiquity among modern humans. From an archaeological perspective, the historic/ethnographic evidence from the Pawnee demonstrates how context can influence the interpretation of an artifact. As hoes, scapulae can be classified as "technomic" artifacts, while as ritual objects in the four directional bundles used in the *Awari*, they become "ideo-technic" artifacts.[116]

Prehistoric utilization of scapula hoes is well documented at archaeological sites in the Middle Missouri River region of the Northern Plains. Bison, elk, and deer scapula hoes are common in Plains village sites of the Middle Missouri Tradition, dating to approximately A.D. 950 through A.D. 1300[117]. Scapulae were also used to produce knives and sickles of various types at this time. The latter exhibit a high polish, indicating they were likely used to cut plants with high silica content. Scapula hoes are very common at Post-Contact Coalescent (ca. A.D. 1675-1780) sites in this region.[118] These examples indicate a close association between scapula tools and agricultural activities (e.g. planting, harvest).

Archaeological evidence from the American Midwest suggests that the use of scapula hoes as ritual objects extends into prehistoric times in this region, predating their use in the Northern Plains. For example, several buffalo and deer scapula hoes were recovered from a Middle Woodland Hopewell sub-mound fire pit at the Utica site in north-central Illinois, and were possibly associated with burial mound construction rituals.[119]

Henriksen notes that the use of specific soil types for mound construction at Utica (e.g. "black, gummy burial soil"), likely reflect ritual activity relating to "…the life giving river…". As hoes were likely associated with the construction of such mounds, as they were associated with the repair of Pawnee earth lodges, it is suggested that scapulae were symbolically associated with death, burial, and re-birth. Hall[120] suggests that the use of mud and other "aquatic" sediments in northern Midwestern Woodland mound construction ceremonies indicates relationships with World Renewal ritual. It is especially interesting to note that the presence of scapula hoes in association with Middle Woodland mounds at Utica is somewhat perplexing as such tools generally are not common at Hopewell sites.[121]

However, as was discussed above, ethnographic evidence indicates that scapula hoes were not only used for agriculture purposes but also for other activities, such as the repair of earth lodge roofs, and in prehistoric times it is logical to assume that burial mounds were also constructed with hoes. The association of scapula hoes, possibly in a ritual context, with human burial mounds suggests that these tools had ritual as well as practical uses among prehistoric Hopewell groups in this area just as they did among ethnographically documented groups. Other examples of possible ritual use of scapulae from the prehistoric Midwest come from southwest Wisconsin.

An unusually worked elk scapula was found at the Middle Woodland Millville Site,[122] while a "specialized" cache of four minimally utilized bison scapulae is reported from the Oneota Pammel Site.[123] Ritual use of scapulae is suggested by finds at the Mississippian Banks Village site in eastern Arkansas.[124] Here the burial of an adult male was found with "…an unusual assortment of artifacts…", including a group of twenty worked deer scapulae and thirty-two cut and polished mussel shells. The scapulae had been modified by cutting and drilling, and appeared to have been attached to a garment. Also found at the site was another grave containing several objects (an antler point, turtle carapace rattles, mica, galena, red paint-stone, a red-stained sandstone abrader, bone awls, cut and polished mussel shells) including twenty-six cut and drilled deer scapulae. Similarly worked deer scapulae were also recovered at the Mississippian Lilbourn site in southeastern Missouri.[125]

Examples from elsewhere in Asia and Europe demonstrate the protective and spiritual powers of scapula bones. Hungarian folklore describes the placement of scapulae in house rafters as protection from bad weather.[126] In her in-depth discussion of the ritual use of livestock bones among the Mongols, Birtalan[127] indicates throughout Inner Asia and Siberia, the shoulder blade and the skull were believed to be the places of residence of animal spirits and that shoulder blades were placed on altars dedicated to livestock fertility and fortune.

While it is unlikely that scapula bones of adult mammoth were used as digging implements due to their size, it is suggested that due to their size and abundance is certain areas, such elements may have

[116] BINFORD 1962, 219.
[117] LEHMER 1971, 95.
[118] LEHMER 1971, 152.
[119] HENRIKSEN 1965, 27.
[120] HALL 1997, 22.
[121] HENRIKSEN 1965, 63.
[122] PILLAERT 1994.
[123] ARZIGIAN–BOZHARDT 1989
[124] PERINO 1966.
[125] COTTIER 1977, 149, Fig. 63.
[126] CHOYKE 2010.
[127] BIRTALAN 2003.

had "ideo-technic" functions.[128] Scapulae of smaller animals, such as deer, were more likely utilized for digging, and mammoth scapulae may have been equated with the secular function of such "technomic" artifacts, but for use in the spiritual realm.

Discussion

It is suggested here that the prehistoric and historic use of scapula bones for divination is tied to their ancient and widespread use as digging implements. Prehistoric, historic and ethnographic evidence from the New World summarized above suggests a link between scapula bones, the tasks of hoeing, digging, harvesting, and the spirit world. The association of mammoth scapula bones with burials from Gravettian sites in Eastern and Central Europe suggest that this conceptual association is at least 30,000 years old. It is proposed that by Gravettian times, the action of grave excavation was perceived as a means of contacting the interface between the world of the living and world of the ancestors with the intention of facilitating the transition from one realm to the other. Lewis-Williams[129] argues for a similar situation among Upper Palaeolithic "vision questers", who may have perceived decorated cave walls as "…a living membrane…" behind which "…lay a realm inhabited by spirit animals and spirits themselves…". Ethnographic data from North America demonstrate that rituals involving dreaming and scapulimancy facilitated "…communication with the unseen world, and the "unseen world" was consulted to insure the well being of the living.[130]

Scapulae next appear in the Palaeolithic record farther west, approximately 15,000 year ago during the Magdalenian of France and Spain. At this time, scapula bones suggestive of ritual use are known from cave site occupations as opposed to burials. The different depositional contexts of scapulae from the two periods most likely reflects site preservation in the two regions: open-air burials/cemeteries from the Upper Palaeolithic are unknown in western Europe, and burials within caves in this region are uncommon.[131]

The lack of decorated scapulae from late Upper Palaeolithic sites in Central and Eastern Europe is more difficult to explain. Perhaps stone plaquettes were more commonly used in divination rituals instead of scapulae. Sites such as Gönnersdorf and Peterfels Cave have produced quantities of engraved stone plaquettes, which as discussed above, may have been intentionally heated.[132]

The Upper Palaeolithic scapulae discussed above often exhibit both naturalistic and abstract designs. Again turning to ethnographic record, it is possible to interpret these designs as related to attempts to contact the spirit world. As discussed above, Naskapi hunters "paid" for a successful hunt resulting from a dream mapped out by a scapulimancy ritual in part through "…the execution of symbolic and decorative art designs which serve as memorials to the slain, furnishing them with a kind of satisfaction".[133] The decorated scapulae from Magadalenian and Gravettian sites discussed above may represent similar attempts to placate the inhabitants of the spirit world.

While the connection between human burials, scapulae, and the afterlife is relatively straightforward, the reason behind the probable caches of scapulae in French and Spanish cave sites is less obvious. How did scapulae end up in cave caches?

The possible answer rests with the hypothesized function of such locations as "supersites" or aggregation sites, where "…normally scattered groups renewed contact and, through rituals and festivities, strengthened the links between them." Such sites may have served as seasonal aggregation sites for dispersed Magdalenian bands.[134] Scapulae used in such rituals were undoubtedly considered sacred objections and may have been sequestered for future utilization or consultation during seasonal aggregation events during which information derived from divination was shared between individual groups. Use of a common method of divination would enable periodically dispersed groups to share important information regarding the location of critical resources over a large area.[135] As discussed above, some individuals were considered especially skilled at scapulimancy divination among the Naskapi, and were often sought out by hunters prior to a hunt. It is suggested here that during the Upper Palaeolithic, similar individuals existed, and that cooperative divination sessions involving scapulimancy by such individuals from seasonally dispersed groups were conducted at aggregations sites.

With the advent of agriculture, the association of scapula hoes with the underworld, fertility, and rebirth assumed additional importance. Evidence from prehistoric and historic China indicate a direct connection between scapulimancy and the world of the departed ancestors, while historic evidence from the plains regions of North America demonstrates that scapula bones were incorporated into fertility/rebirth rituals.

[128] BINFORD 1962, 219.
[129] LEWIS-WILLIAMS 2002, 214.
[130] SPECK 1977,187.
[131] QUÉCHON 1976.
[132] ALBRECHT 1979; BOSINSKI 1982.
[133] SPECK 1977,188.
[134] BAHN 1982, 265; CONKEY 1980; DICKSON 1990.
[135] DICKSON 1990, 203.

As this paper indicates, the argument presented above requires a "patchwork" of evidence from temporally and geographically diverse contexts. This in part reflects the uneven nature of the archaeological record. The flat surface of the bone, which is generally the locus of "decoration" in prehistoric, historic, and ethnographic examples, is also thin and fragile, and often does not preserve well. It is thus possible that examples utilized in scapulimancy rituals fail to survive or are inadvertently destroyed during excavation. Based on the brief period of burning (from a "few seconds" to "two minutes" among the Montagnais/Naskapi), scapulae used for divination might not appear obviously burned, while scapulae consulted through apyro-scapulimancy would exhibit no evidence of burning. In many cases, it is contextual evidence (caches, burials) that provides the strongest evidence for the ritual use of scapulae during the Upper Palaeolithic. The use of scapulae for divination by heating may have been part of a wider use of heat-induced processes to facilitate communication with the spirit world. As discussed above, decorated stone plaquettes from western European sites also appear to have been heated, and evidence from Central Europe indicates that clay figurines were intentionally heated to make them explode. Perhaps significantly, stone plaquettes have a wider distribution, having been found throughout Europe.[136] This may represent the greater durability of stone as opposed to scapula bones.

In this paper, it has been proposed that scapulae were more than aesthetic art objects during the Upper Palaeolithic. The presence of mammoth scapulae with human burials and cemeteries in central Europe suggests and association between this bone and the afterlife among Gravettian groups. It is hypothesized that, as documented in the ethnographic record, scapula bones were utilized as general purpose excavating tools during the Upper Palaeolithic. It is suggested that the excavation of graves imparted a unique status to these artifacts as tool that enabled the deceased to enter the spirit world. As demonstrated above, ethnographic and historic evidence demonstrates a connection between scapula bones, hoeing, digging, harvesting, and the spirit world. It is proposed here that this is a very ancient concept extending back to at least the Gravettian period. Again, while mammoth shoulder blades at this time were unlikely to have functioned as digging implements due to their size the symbolic connection between scapulae in general and the spirit world potentially imbued them with sacred characteristics incorporated into burial rites. As discussed above, mammoth scapulae at this time can be viewed as "ideo-technic" artifacts as opposed to "technomic" artifacts, such as scapulae of smaller animals, such as deer, that were more likely utilized for digging. It is argued here that mammoth scapulae were equated with the secular function of such "technomic" artifacts, but for use in the spiritual realm.

The proposed association between scapulae and the afterlife is again suggested among later Magdalenian groups, who left caches of scapulae suggesting ritual associations. While such caches may also represent offerings by hunters to ensure a supply of game, an alternative argument is presented here suggesting that scapulae were used in scapulimancy rituals performed to obtain advice from the spirit world, including advice regarding successful hunting strategies.

[136] GAMBLE 1986, 248.

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Prehistoric bone tools from Vörs, Máriaasszony-sziget

Annamária Bárány

Keywords: *prehistory, bone tool, bone spoon, antler hoe, jewel*

Vörs, Máriaasszony-sziget is situated in the SW part of Hungary, on the border of Somogy and Zala counties. The North-South orientated, sandy peninsula is situated on the territory of the Kisbalaton ('Small Balaton') region rising only some meters from its bay.

The excavations were led by Csilla M. Aradi, (Somogy County Museum Directorate (SMMI)) in 1990 and by Zsuzsanna M. Virág (Budapest Historical Museum) and Katalin T. Biró (Hungarian National Museum) in 1999 and 2000.[1]

According to the find-material the settlement was in use from the Neolithic to the Early Middle Ages.

Eight periods can be distinguished on the basis of the available finds: Starčevo Culture (Early Neolithic), Lengyel III Culture (Early Copper Age), Balaton-Lasinja Culture (Middle Copper Age), Furchenstich Culture (Middle Copper Age), Kostolac Culture (Late Copper Age) Kisapostag Culture (Early Bronze Age), La Tène Culture (Late Iron Age), early Árpád Period (Early Mediaeval Age (11^{th}–12^{th} century A.D.)). There are animal bone finds from every period except from the Balaton-Lasinja Culture and the early Árpád Period.

The results presented here are part of an interdisciplinary research supported by National Scientific Research Fund (OTKA). [2]

928 pieces of identifiable bone-fragments were found in 63 features opened up on the territory. There were 44 dated and 6 mixed dated features, 13 features contained stray finds. The mixed dated features were identified to Starčevo-Kisapostag age and Starčevo-Late Iron Age. The greatest part of the excavated features was of Starčevo and Kisapostag age.

7 bone tools and 2 jewels were yielded from the site. 3 pieces of the worked bones came from Starčevo Culture, 1 piece from Furchenstich Culture and 5 pieces from Kisapostag Culture.

The features identified as belonging to the Starčevo, Furchenstich, Kostolac and Kisapostag Cultures, respectively, proved to be richest in animal bone material.

The animal bones found belong to 5 domestic species (82 pieces, 81.8 % of the total bone material) and 8 hunted species (50 pieces, 17.7 % of the total bone material). Domestic species were cattle (*Bos taurus L.*), sheep (*Ovis aries L.*), pig (*Sus scrofa dom. E.*), horse (*Equus caballus L.*) and dog (*Canis familiaris L.*), hunted animals were wild horse (*Equus ferus gmelini A.*), aurochs (*Bos primigenus B.*), red deer (*Cervus elaphus L.*), roe deer (*Capreolus capreolus L.*), wild boar (*Sus scrofa L.*), hare (*Lepus europeus Pall.*) and stone or pine marten (*Martes sp.*). Among the domestic animals cattle and sheep, among the wild animals red deer and wild boar were the most frequent (***Table 1.***).

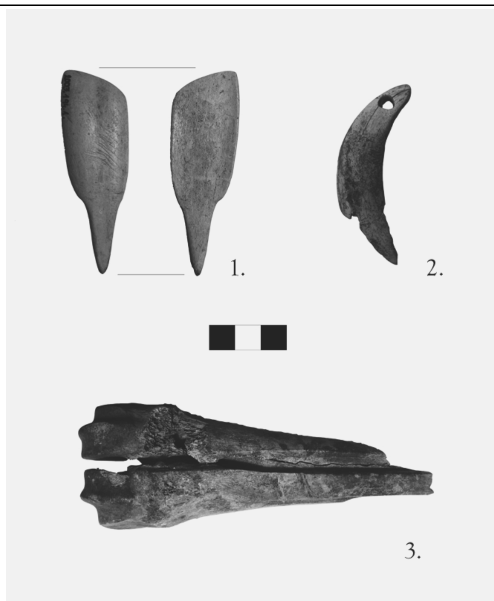

Fig. 1. *Vörs, Máriaasszony-sziget. Bone tools from Starčevo Culture 1. short handled bone spoon 2. Jewel (amulet) 3. Bone tool material*

[1] Kalicz–T. Biró–M. Virág 2002.

[2] OTKA T-046297, Vörs-Máriaasszonysziget – an interdisciplinary study of the prehistoric site. http://www.ace.hu/vors/

Bone tools from Starčevo age (Neolithic)

*Short handled bone spoon from cattle metatarsus (Feature No. 2, catalogue number: 2003.194.1, **Fig. 1/1.**)*

The bone tool is made of the diaphysis of a cattle metatarsus. Every side of the tool is burnished. It has a wide, flat spoon-head part and an elongated, triangle-shape handle part. The "head" is asymmetric trapeze-shaped, its opposite side to the handle is cut slantwise, so the head of the spoon became sharp. The upper, concave side of the head has a rim. The upper side of the head is rough, the lower side is smooth, shiny. Parallel, diagonal scratches are observable on its surface. The greatest length of the tool is 80.5 mm. The shorter side of the head is 43 mm, the longer side is 51 mm, the greatest width of the head is 25 mm, its thickness is 4 mm

*Jewel (amulet) from pig canine (Feature No. 9, catalogue number: 2003.199.1, **Fig. 1/2.**)*

The amulet is made of a lower canine (caninus inferior) of a female individual. Its greatest length is 59.5 mm, the greatest width is 15 mm, the thickness is 10 mm. The surface of the tooth is burnished, the crown is ragged. On the root of the tooth there is a lateromedial orientated perforation, the diameter of the hole is 4 mm.

*Bone tool material from red deer metatarsus (Feature No. 19/a, catalogue number: 2003.198.1, **Fig. 1/3.**)*

The bone tool material is made of the distal part of a right side red deer metatarsus. The length of the fragment is 114 mm, the width of the distal part is 44.5 mm, the depth is 30.5 mm. On the medial side of the bone a deep, longitudinal carving and therefrom shallower, perpendicular cutmarks are visible. These carvings were made during the fabrication of the tool. In the dorsal sulcus of the metatarsus there is thin longitudinal scratch. The bone has a brown tint and matte surface.

Bone tool from Furchenstich Culture (Middle Copper Age)

*Antler hoe from red deer antler (Feature No. 62, catalogue number: 2003.211.1, **Fig. 2.**)*

The hoe is made of a right side red deer antler, the greatest length is 146 mm. The pedicle and the coronet are cropped and burnished. The brow-tine, the bez-tine and the beam are truncated and burnished. The length of the beam form the coronet is 121.5 mm. The beam is longitudinally split caused by the use of the tool. A diagonal carving is visible on the lateral side of it. Between the brow-, and the bez-tine the beam is perforated in cranio-caudal direction. The diameter of the hole is 17 mm. The diameter of the beam is 47×38.5 mm and 23×18 mm of the brow-tine's. The tool is light colored, matte. At the truncation of the beam and tines polish, caused by the usage is visible.

Bone tools from Kisapostag Culture (Early Bronze Age)

*Bone burnisher from cattle rib (Segment II, Feature No. 16, catalogue number: 2003.207.1, **Fig. 3/1.**)*

Distal part of a cattle rib, polished to rounded. The length of the fragment is 60.5 mm, the width is 22 mm, the thickness is 5.5 mm. The bone is brownish, with matte surface. Usage caused polish is visible on its rounded end.

*Bone material from sheep tibia (Between the Features No. 16 and No. 26, catalogue number: 2003.197.1, **Fig. 3/2.**)*

The bone material is made of the diaphysis of a left side sheep tibia. The greatest length of the fragment is 132 mm, the width is 16.5 mm, the depth is 12 mm. The bone, below of the proximal end is polished and cut transversely. The distal end is broken, blackish tint is visible on it. There is not any other working mark on the bone.

*Blade from wild boar canine enamel (Ditch No. 2001/1, catalogue number: 2003.208.1, **Fig. 3/3.**)*

The blade is made of a lower canine (caninus inferior) of a wild boar. The greatest length of the tool is 66.5 mm, the width is 15.5 mm, the thickness is 2.5 mm. The inner surface of the canine-enamel is polished, thin, long, parallel scratches are visible on it. The edge of the blade is blunt from the usage.

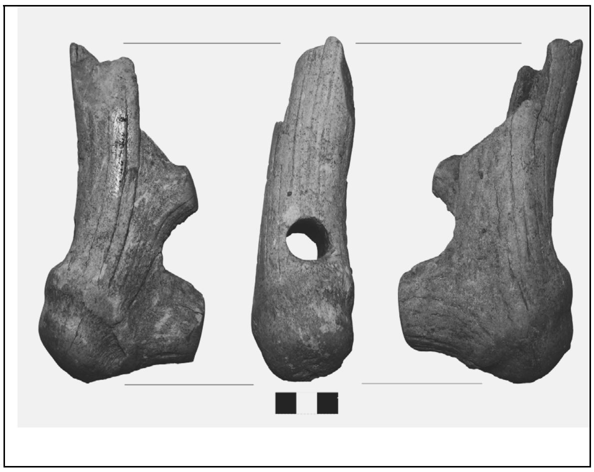

Fig. 2. *Vörs, Máriaasszony-sziget. Antler hoe from Furchenstich Culture*

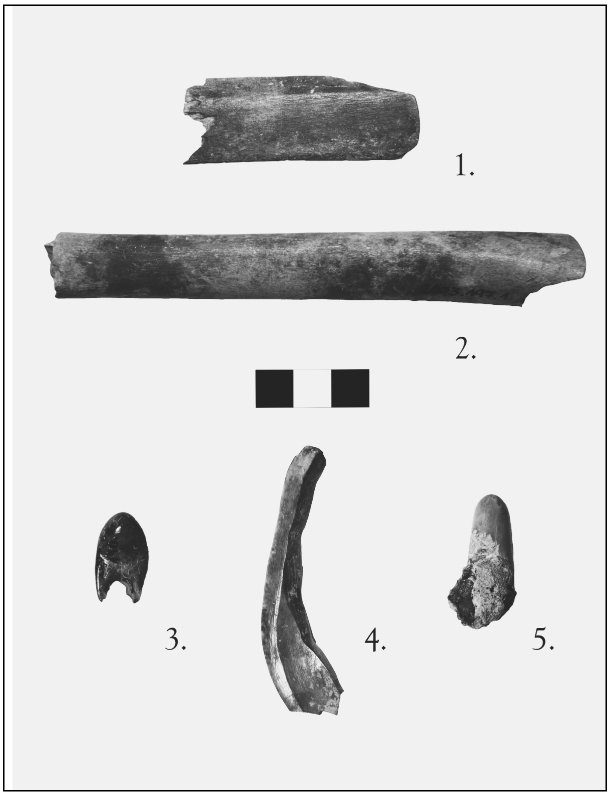

Fig. 3. *Vörs, Máriaasszony-sziget Bone tools from Kisapostag Culture 1. Bone burnisher 2. Bone tool material 3. Jewel (amulet), 4. Blade, 5. Bone awl fragment*

Jewel (amulet) from red deer canine (Segment II, Feature no. 26, catalogue number: 2003.196.1, ***Fig. 3/4.****)*

The amulet is made of an upper canine (caninus superior) of a red deer. The greatest length of the tooth is 20 mm, the width is 12 mm. The crown of the tooth is ragged, the root is pierced. The diameter of the hole is 3.5 mm. The tooth is dark brown and shiny on its surface.

Bone awl fragment from metapodial bone (Feature No. 80, catalogue number: 2003.195.1, ***Fig. 3/5.****)*

Bone-tool fragment, polished in all sides, made of a metapodial bone. The greatest length of the fragment is 24 mm, the width is 11 mm. The fragment is light brown and shiny on its surface.

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Ages / Species	Starčevo (Neolithic)		Furchenstich (Mid. Copper Age)		Kostolac (Late Copper Age)		Kisapostag (Bronze Age)		Other		With-out date	Total	
	pc	%	pc	%	pc	%	pc	%	pc	%	pc	pc	%
Cattle (*Bos taurus L.*)	82	34.2	4	5.7	33	24.4	150	44.4	28	25.0	20	317	34.2
Sheep (*Ovis aries L.*)	76	31.7	9	12.9	81	60.0	51	15.1	18	16.1	11	246	26.5
Pig (*Sus scrofa dom. E.*)	30	12.5			19	14.1	105	31.1	22	19.6	2	178	19.2
Horse (*Equus caballus L.*)					2	1.5	8	2.4	1	0.9		11	1.2
Dog (*Canis familiaris L.*)	1	0.4					6	1.8				7	0.8
Domestic Animals	**189**	**78.8**	**13**	**18.6**	**135**	**100.0**	**320**	**94.7**	**69**	**61.6**	**33**	**759**	**81.8**
Wild horse (*Equus ferus gmelini A.*)	2	0.8										2	0.2
Aurochs (*Bos primigenus B.*)	1	0.4					1	0.3				2	0.2
Red deer (*Cervus elaphus L.*)	7	2.9	50	71.4			7	2.1	4	3.6		68	7.3
Roe deer (*Capreolus capreolus L.*)	7	2.9					1	0.3				8	0.9
Wild boar (*Sus scrofa L.*)	2	0.8	2	2.9			2	0.6	35	31.3		41	4.4
Hare (*Lepus europeus Pall.*)									1	0.9		1	0.1
Martes species	1	0.4										1	0.1
Fish (*Pisces*)	30	12.5	5	7.1			5	1.5	1	0.9		41	4.4
Hunted Animals	**50**	**20.8**	**57**	**81.4**	**0**		**16**	**4.7**	**41**	**36.6**	**0**	**164**	**17.7**
Bird (*Aves*)	1	0.4					2	0.6				3	0.3
Amphibian (*Amphibia*)									2	1.8		2	0.2
Total	**240**	**100.0**	**70**	**100.0**	**135**	**100.0**	**338**	**100.0**	**112**	**100.0**	**33**	**928**	**100.0**

Table 1. *Vörs, Máriaasszony-sziget, distribution of the animal-bone material in pieces and percentage*

"LET ME PLAY THE LION TOO"...

PRELIMINARY REPORT ON THE PLEISTOCENE LION SKULL FROM IKRÉNY–SZILÁGYI TANYA (GYŐR-MOSON-SOPRON COUNTY, HUNGARY)

LÁSZLÓ BARTOSIEWICZ

Keywords: *Pleistocene, cave lion, extant African lion, craniometry, sexual dimorphism*

Introduction

Archaeologists spending a lot of time trying to sort out uncertain bone splinters from Holocene sheep or goat rarely come across lion finds in Hungary.[1] It is particularly lucky therefore that the "royal" find discussed in this paper is chronologically linked to the time period that is close to the work of the célèbre, Viola T. Dobosi as it probably falls within the time bracket of the Upper Pleistocene in Hungary.

This preliminary report presents an unusually well preserved, probably Middle/Upper Pleistocene lion skull from Ikrény–Szilágyi tanya from the Small Hungarian Plain (Győr-Sopron-Moson County, NW Hungary; ***Fig. 1.***). The complete *calvarium* of a small individual was found in June 1994 by an amateur collector, Miklós Boros, at a depth of ca. 4m in an alluvial deposit during gravel quarrying near the ancient bed of the Rába river, a right bank tributary to the Danube. The skull was handed over to me by the late András Figler who at the time directed rescue excavations in the area along the M1 Motorway.

The fact that this skull was not recovered from an archaeological site and the amateur observation of its stratigraphic position at a relatively great depth seem to suggest that this find is unrelated to Holocene lions (*Panthera leo persica* Meyer, 1826)[2] occasionally identified in the Copper and Bronze Ages of the Carpathian Basin and the Balkans. In the absence of absolute dating this preliminary analysis focuses on the description and craniometric analysis of the rarely well-preserved specimen.

Material and Method

Find description

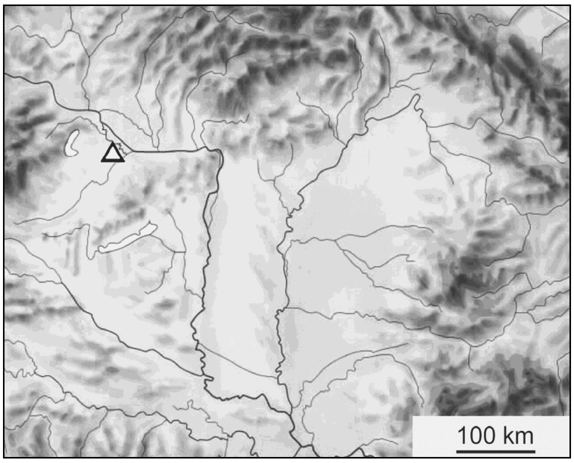

Fig. 1. *The approximate geographical location of the find spot within the Carpathian Basin in relation to the alluvial plain of the Danube (north) and hilly areas in the broader surroundings. Base map: László ZENTAI, 1996*

The approximate coordinates of the find location are as follows: 47°39′11″ northern latitude, 17°31′39″ eastern longitude. This area is to be found in the outskirts of Ikrény village, not far from the Moson branch of the Danube river where the current beds of its tributaries, the Rába, Rábca and Marcal rivers meet (***Fig. 1.***). For millennia, this has been an area of intensive alluvial activity. The lion skull was probably extracted from a Middle or Upper Pleistocene layer at a depth of approximately 4 m from the modern surface.

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[1] VÖRÖS 1982-1983; 1983; 1987.
[2] BARTOSIEWICZ 2009, 764, Fig. 4.

Fig. 2. *Top (norma frontalis), right side (norma lateralis) and bottom (norma basilaris) views of the Pleistocene lion skull from Ikrény–Szilágyi tanya, Hungary. Photos: Erika Gál*

The neurocranium part of the skull separated from the facial part due to warping as the bone dried. The left nasal bone and the upper 2nd premolars were lost *post mortem*. Aside from these minor defects, the state of the find is excellent. The surface preservation is especially good, its dark brown coloration is indicative of an organic deposit rich in humic acid which probably helped saving the osseous material (***Fig. 2.***). In terms of taphonomic interpretation it is important to mention that the skull shows no sign of water transport; following death, the animal's carcass suffered relatively little disturbance and the bone material was hardly damaged in spite of the millennia spent in the alluvial deposit.

It could be established for the first sight that the approximately 300 mm long skull originated from an adult carnivore in the feliform suborder (Feliformia Kretzoi, 1945). The genus was recognized as Panthera (Oken, 1816). The sutures of the skull are not fully closed yet, however all teeth belong already to the permanent dentition. In summary, the find origins from a young adult individual.[3] On the basis of its relatively small size it was hypothesized that the skull belonged to a female. In order to test this possibility a series of reference skulls were included in this study.

Extant comparative materials

This study is concerned with the analysis of morphometric traits. As for its phenotypic position in relation to the *Panthera leo* (Linnaeus, 1758) species, the Ikrény find was compared against a series of 37 modern lion skulls from Africa kept in the Koninklijk Museum voor Midden-Afrika in Tervuren, Belgium. Of the eight extant subspecies of lion most of these represent two subspecies from the former colonial area, the Katanga Lion a. k. a. Southwest African Lion (*P. l. bleyenberghi*) and with a lesser probability North East Congo Lion (*P. l. azandica*). Two of the modern specimens originated from zoos while in one case the geographical origin of the skull was unknown. With the exception of these three specimens it is suggested that the extant specimens were not altered by "breeding" in captivity.

Meanwhile, it must be mentioned that Pleistocene cave lions were rather distant relatives of extant African lions.[4] Therefore comparisons made in this preliminary record are basically functional rather than directly taxonomic in nature.

Methods

The first challenge was the gross taxonomic identification of the skull on the basis of its cranial characteristics. Generations of researchers have reached a consensus that Pleistocene large felid finds from Europe do not represent tigers but can be classified as lions.[5] Morphological criteria published by Helmut HEMMER[6] were used in reconfirming these diagnostic features on the lion find recovered near Ikrény.

In order to obtain a more fine-grained picture of the morphometric status of the Pleistocene find, 15 measurements (***Table 1.***) taken on all skulls following

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3 SMUTS et al. 1978, 121.
4 BURGER et al. 2004.
5 KURTÉN 1968, 85.
6 HEMMER 1966.

the protocol by Angela von den DRIESCH[7] with an attempted accuracy of 0.1 mm.

Since in large felids one must reckon with a considerable degree of sexual dimorphism preliminary calculations (regression analysis) had to be carried out. Following the analysis of frequency distribution in various measurements percentual values (expressed in relation to basal length) were grouped using a principal components analysis. This multivariate method is aimed at defining synthetic variables that can be defined on the basis of the original variables included. The position of individuals – based on their respective cranial typology – may thus be studied in the planes defined by the pairs of principal components obtained during the course of calculations.[8]

Results

Taxonomic identification

On the basis of its basic morphological traits this large felid skull belongs to a lion. Given its good preservation (***Fig. 2.***), the find was easily distinguishable from tiger on the basis of its small size. In addition five distinctive morphological criteria have been established on the neurocranium and palate:

1. The profile line of the frontal bone is flat at the point of ectorbital width, as opposed to the tiger whose skull would be jutting forward at this point,
2. The skull is shallow at the cross-section at the aforementioned greatest width of the frontal bone, it is not depressed between the edges of the *orbitae* as in tigers,
3. The *sutura coronaria* is perpendicular to the saggital plane, it is not expanding in an aboral direction as in tigers,
4. The aboral end of nasal bones does not extend beyond the suture between the frontal bone and the maxilla (*sutura maxillofrontalis*) as in tigers.
5. The preserved aboral edge of the palatal bones has a dull “shoulder” rather than being pointed.

Sexual dimorphism in size and cranial proportions

The next task was testing the research hypothesis whether the find indeed originated from a lioness? While only eight of the reference skulls were explicitly documented as females and 18 as males, when the greatest breadth of skull (Zyg–Zyg) is plotted against the greatest length (A–P; ***Fig. 3.***) a clear bimodality becomes apparent, especially in terms of greatest length. The Pleistocene find, unambiguously representing a young adult, fell into the centre of the group identifiable as females. The good fit to the same linear regression line fitting the measurements of both sexes, however, reveals that the sheer size of individuals is important in differentiating between sexes.

The curve that can be fitted on these dots and the pertinent exponential equation direct attention to two phenomena that will be of interest in further discussions:

- Skull proportions of large male lions are essentially similar to those observed in females: that is the growth of the two main dimensions is isometric, regardless of actual size and sex. Proportions do not change with size (the exponent is approximately 1).
- The data point representing the Ikrény find falls right on the regression line characterized by a high coefficient of correlation. This means that the proportions of this Pleistocene specimen fit perfectly within the main trend outlined on the basis of extant lion skulls from Central Africa.

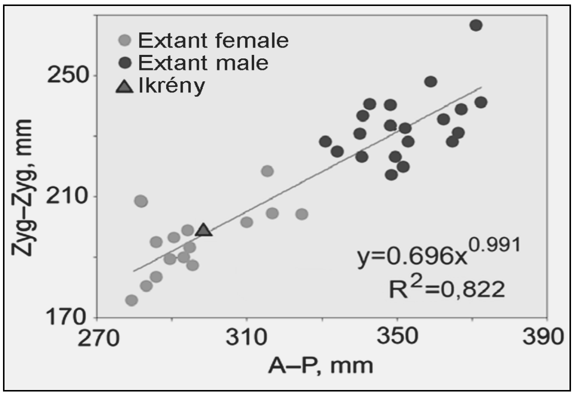

Fig. 3. *Sexual dimorphism in lion skulls as shown by the greatest breadth (Zyg–Zyg) plotted against their greatest skull length (A–P). Both sexes are characterized by the same linear regression equation*

The comparison between total length and the greatest cranial width measured between the zygomatic arches shows a great degree of sexual dimorphism that may divert attention from subtle differences between the two sexes expressed in cranial proportions. This possibility is clearly illustrated by the univariate statistics calculated for the rest of the measurements. ***Table 2.*** shows such parameters calculated for the groups of African lion skulls of documented sex in comparison with the Ikrény find. Due to the high degree of sexual dimorphism between the absolute measurements of females and males all differences are significant in formal statistical terms (P>0.050).

[7] von den DRIESCH 1976, 47.
[8] SVÁB 1979, 51.

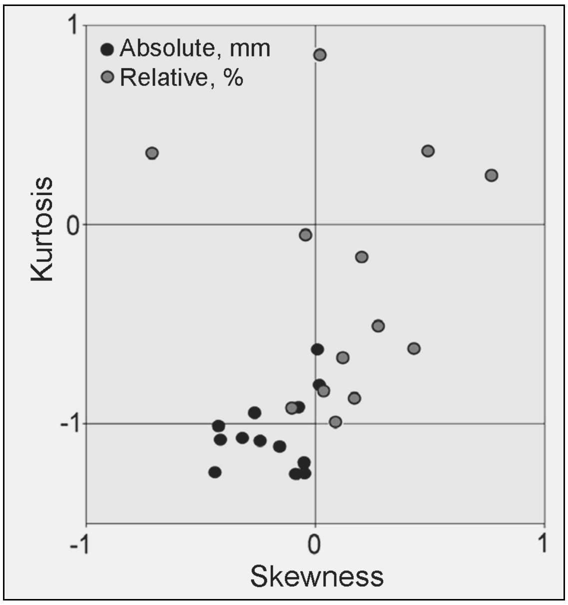

Fig. 4. *Relationship between the Gaussian normal distribution and the distributions of absolute cranial measurements (mm, full dots) and measurements relative to basal length (B–P%; empty circles) used in this study. Note the marked "upward" shift toward the centre of the graph (0) as a result of percentual transformation*

A precondition for subsequent calculations was to identify the ways the effect of size can be reduced in the detailed comparison of cranial proportions between sexes. The use of relative measurement has a long history in osteometric studies. They are sometimes called indices and such ratio values are often expressed in percentages. The use of such indirect dimensions in parametric calculations, however, is risky. Should the distributions of the nominator and enumerator strongly differ from one another, this difference can introduce uncontrollable bias into the end result. [9] The next step thus was a comparison between the frequency distributions of absolute and relative measurements. Since bone measurements are natural biological dimensions, their distributions in principle are close to normal. This means that those approaching average size occur most commonly and the probability of encountering very small or extremely large specimens far less likely. The shape of observed distributions, however, does not necessarily follow the Gausian curve. Its skewness and curtosis are important statistical parameters as well.

The thus checked cranial proportions were subjected to a Principal Component Analysis (PCA). This multivariate method was chosen as an exploratory tool for investigating the major patterns of variation within the sample of modern Central African lions to which the Pleistocene find could be reliably compared. Correlation-based principal components reduced the number of cranial measurements to smaller sets of synthetic variables. Three of these, representing the greatest proportion of total variance (encompassed in the PCs) have been studied in detail.

In order to remove the evidently strong, sexually dimorphic effect of size from these calculations, all measurements were standardized as percentages of basal length (B–P). Although ratio values are not always fit for parametric calculations such as linear correlations upon which the PCA in this paper was based, the percentual transformation reduced the strong bimodality in absolute measurements, yielding a better fit to normal distribution as shown by values of kurtosis plotted against skewness in ***Fig. 4.*** In this graph, skewness characterizes the symmetry, kurtosis the flatness of distribution. The two parameters were studied both using absolute (mm) and relative measurements (% of B–P). Raw absolute measurements show an asymmetric (skewness ≈ -1) and rather flat distribution (kurtosis ≈ -1). These patterns may be explained as follows:

- in comparison with the skulls of more frequently hunted males the smaller number of female cranial measurements do not form a separate group but rather a „tail" extending in the negative direction in accordance with their smaller absolute sizes.
- due to the small sample sizes, absolute measurements within this range do not concentrate, the resulting curve is flatter than that of the Gaussian normal distribution.

Conversion into B–P percentages guarantees that patterns resulting from the calculations will not be directly influenced by absolute size, allowing for more manifestation of other, functionally important craniomorphological traits during subsequent analysis. Using percentages a more concentrated distribution can be observed. In ***Fig. 4.*** relative measurements (% of B–P) are shifted toward the origin of the graph. The skew becomes slightly positive, three general measurements (B–N, Zyg–Zyg, A–N) are clustered in the upper, positive section in terms of curtosis.

This slight detour served to elucidate an important problem. One of the criteria in using PCA successfully is that the variation of the variables used should be as close to the Gaussian normal distribution as possible. Measurements expressed as the percentage of basal length (B–P) seems like a reasonable option in this case and will probably show relatively independent cranial proportions regardless of the great sexual dimorphism in size. This information will be of use in understanding the morphology of the find from Ikrény.

[9] ATCHLEY et al. 1978, 137.

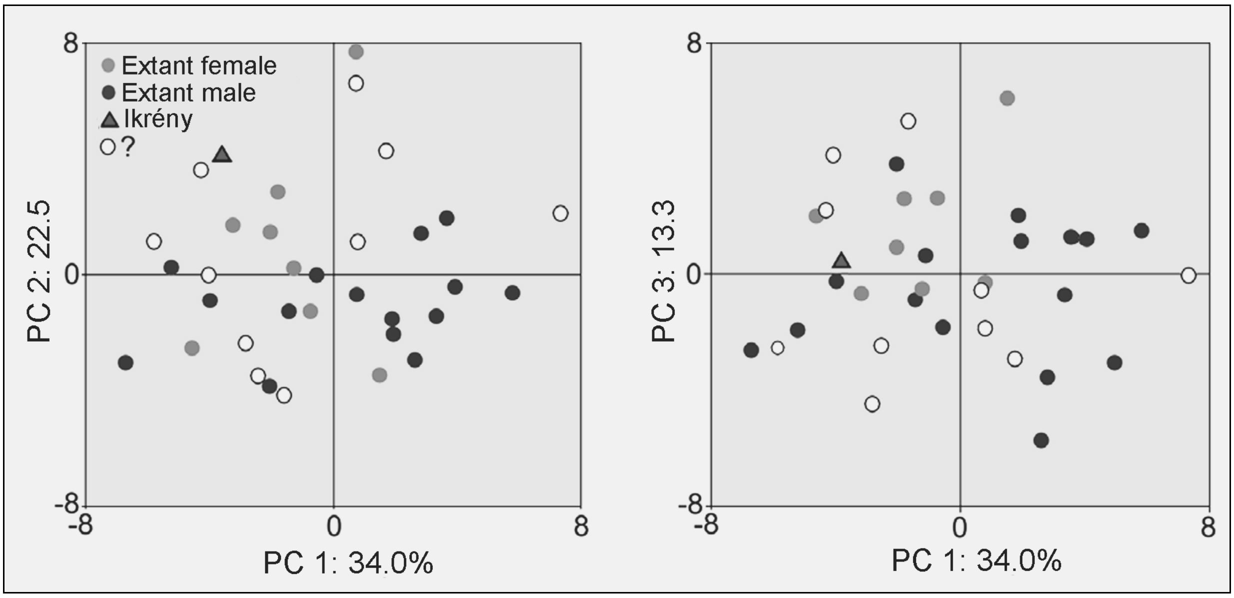

Fig. 5. *Considering the small general size of the Ikrény find (indicated on PC1), her neurocranium (PC2) is disproportionately well developed (left side graph), while her dentition is in proportion with the small general size of the skull (right side graph)*

Four principal components (PC) with eigenvalues over 1, encompassed over 80% of the total variance represented by the selected measurements (***Table 3.***). Of these, the first two possess the greatest explanatory value (34.0% and 22.5%, respectively). A summary of the most characteristic PCs (characterized by eigenvalues greater than 1) is shown in terms of the cranial measurements grouped around them. The associations ranging between -1 and +1 are ranked by the strength of the relationship. The four PCs represent 80% of total variance:

- PC 1 is dominated by positive correlations between greatest breadth across the zygomatic arches (Zyg–Zyg), median palatal length (St–P) and the breadth between the auditory meatuses (Ot–Ot), in contrast with some measurements of the neurocranium. This principal component may thus be regarded as characterizing general size not followed closely by dimensions of the brain case. Male skulls are characterized by a larger frame but relatively smaller brain case.
- PC 2, on the other hand is in a strong positive connection with two longitudinal neurocranium measurements, neurocranium length (B–N) and median frontal length (A–N). These are indicative of the relatively developed state of the brain case.
- PC 3 represents a range of dental measurements, especially dimensions of the upper carnassial (P^4) tooth, in positive relation to palatal breadth (Mol–Mol) and the postorbital constriction of the neurocranium pertinent to the suspension of the masticatory apparatus. These are in principle form a group which is independent of the rest of the cranial measurements.
- Finally, PC 4 was dominated only by the relatively non-characteristic breadth of the frontal bone (Ect–Ect), the entire PC barely contributing 11% of total variance to the overall picture. This principal component is therefore of little explanatory value.

Principal components can be best interpreted when their relations can be studied. When PC scores of individual skulls are plotted against PC 1, the Pleistocene find from Ikrény–Szilágyi tanya has a relatively large neurocranium (PC 2 score around +4) in spite of its small overall size within the group (***Fig. 5***, left). This Pleistocene find also classes with numerous females of the skulls of documented sex. In terms of its relative dental dimensions, however, the small female lion skull from Hungary fits the average of extant Central African lions included in the study (***Fig. 5***, right). It is important to remember that although these features are not independent from size, they are fundamentally based on cranial proportions.

The observations made on the basis of these calculations can also be interpreted from a biological point of view. Brain function is independent of brain size. Therefore a relatively small brain is sufficient for “operating” the body of a large male lion. Smaller females, however, need similar brain size and complexity which makes their neurocranium look more developed relative to basic measurements characterizing skull size (PC 1). The same trend is even more evident in interspecific comparisons. Within the family of Felidae the brain weight of the largest species, tiger, is barely 0.5% of live weight. In the case of lions this value averages 0.6%, while the smallest "large cat", lynx, is characterized by a relative brain weight of 0.43%.[10] This relationship can be mathematically described by the degressive curve shown in ***Fig. 6.*** The exponent of this function (in contrast with that shown in ***Fig. 1.***) is well below 1, illustrating how brain size "lags behind" the increase of live weight. The same trend holds true when growth trends in the two sexes are compared to one another.

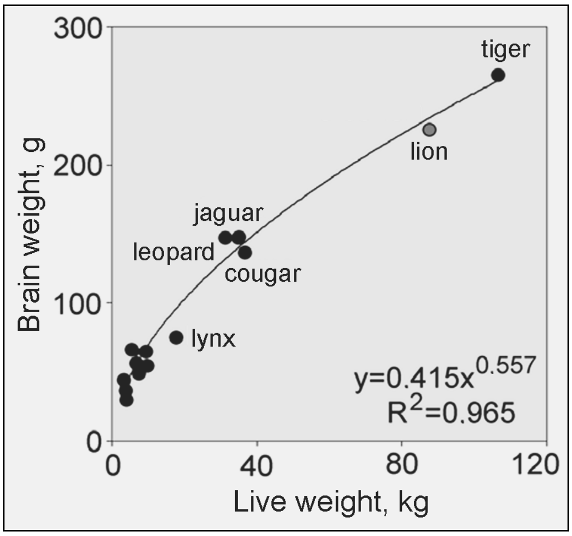

Fig. 6. *Relationship between the live weight and brain weight of various species in the Felidae family. Large cats have relatively smaller brains as is also indicated by the strongly degressive trend line.*

Taxonomic assessment

It is difficult to classify the lioness from Ikrény based only on its phenotypic cranial measurements. Although on the basis of its stratigraphic position the skull may be attributed to the middle or upper Pleistocene, this hypothetical dating needs to be reconfirmed using ^{14}C measurements. Only relative few lion remains are known from Hungary representing this time period. On the basis of its stratigraphic position (and thus hypothesized age) the Ikrény find represents cave lions (*P. l. spelaeus* Goldfuss, 1810). On the basis of the synthetic work prepared by Dénes Jánossy the remains of this species occur most commonly at cave sites in Hungary. Such locations include the Lambrecht Kálmán cave (Layer V),[11] the Tarkő rock shelter,[12] Subalyuk,[13] Lengyel cave,[14] Dorog,[15] Tokod–Nagyberek,[16] Istállóskő,[17] Bodrogkeresztúr–Henye-hegy[18] and Pilisszántó (Rock shelter I).[19] Although lion finds found at the site of Érd[20] were not recovered from caves, in contrast to the Ikrény specimen they do not originate from an explicitly alluvial plain environment.

Cave lions, however, could be found in a great variety of habitats, including coniferous forests and grassland where sufficient numbers of prey animals could be caught.[21] It is at this point where the relatively small size of the Ikrény lioness attains particular interest. The phenotypic size of individuals is influenced by numerous factors. In addition to the animal's biological age, inherited size and its interaction with the environment determine the actual size of the individual. In open landscapes covered only by sparse vegetation, carnivores of smaller body size are at an advantage as they can more easily hide and hunt in the open landscape than their large counterparts.

Meanwhile the small size of the Ikrény lioness may also be explained by genetic reasons. It is possible that if the lion population was small, it was threatened by a degree of inbreeding due to a genetic bottleneck at the time. This possibility will be particularly interesting if the Ikrény find will turn out to be younger than 45,000 years old. Ross BARNETT and his team[22] discovered a strong decline in the genetic diversity of cave lions across Eurasia around 48,000–46,000 bp. Before that time the 12 samples they studied represented nine mitochondrial haplotypes. Samples taken from 18 cave lions dated to approximately 46,000 bp showed a restricted gene pool of only four haplotypes. Although even the authors admit that these results may be prone to sampling bias,[23] if diversity indeed decreased a decline in size may also be explained by genetic drift.

[10] raw data: RÖHRS 1985.
[11] JÁNOSSY 1986, 128.
[12] ibid 130.
[13] ibid. 134.
[14] ibid. 137.
[15] ibid. 140.
[16] ibid. 142.
[17] ibid. 145.
[18] ibid. 148.
[19] ibid. 152.
[20] ibid. 137.
[21] HUBLIN 1984, 318.
[22] BARNETT et al. 2009, 1674, figs 2–3.
[23] ibid. 1676.

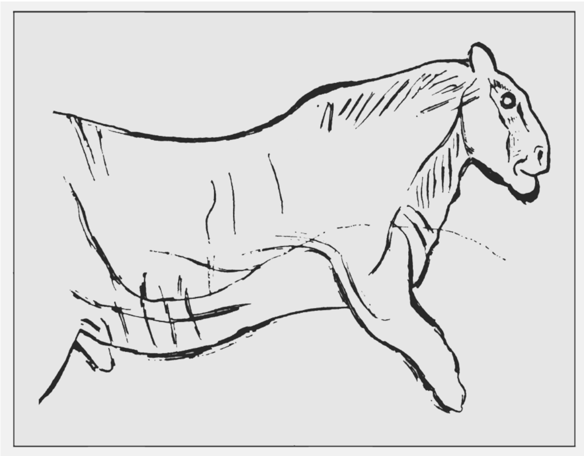

Fig. 7. *Drawing of a cave lion. Les Combarelles, Dordogne (KURTÉN 1964, 55)*

Conclusions

In conclusion, the newly discovered Pleistocene skull found near Ikrény–Szilágyi tanya in NW Hungary originates from a lioness, which in spite of its adult age is rather small in comparison with extant lions from Central Africa. On the basis of its absolute measurements it is most similar to medium size females in that group. In terms of skull proportions it may be considered „feminine” as its neurocranium seems largish relative to overall skull size. Brain weight in large Felids does not follow the increase in body weight in a linear fashion and this seems to be reflected in the size difference resulting from secondary sexual dimorphism of lions. The same difference is far less pronounced in dental dimensions, probably because dentition in carnivores is shaped by function and thus must be in closer correlation with the actual size of the predator. Its dentition is therefore proportional with the skull's overall size.

On the basis of this preliminary craniometric study it would be difficult to identify the exact taxonomic affiliation of this animal. Precise dating and possibly DNA studies would be required to answer the question in which period and under what circumstances did such lions appear in the Pleistocene environment of the Small Hungarian Plain.

Acknowledgements

This study could not have been carried out without the kind help of the late András Figler and my former student, Károly Takács working in the Hanság Museum in Mosonmagyaróvár. Materials in the Museum of Central Africa in Tervuren (Belgium) were provided by Wim Van Neer, curator of the vertebrate collections in 1992. That research was carried out within the framework of the project titled „*Interuniversity Poles of Attraction*”, financed by the government of the Belgian Kingdom. Photographs in ***Fig. 2.*** were taken by Erika Gál.

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Basal length	B–P
Total length	A–P
Neurocranium length	B–N
Viscerocranium length	N–P
Median frontal length	A–N
Neurocranium basis length	B–St*
Median palatal length	St–P
Upper carnassial tooth (P^4) length	P4L
Upper carnassial tooth (P^4) breadth	P4W
Greates mastoid breadth	Ot–Ot
Greatest (zygomatic) skull breadth	Zyg–Zyg
Greatest frontal breadth	Ect–Ect
Greatest palatal breadth	Mol–Mol
Breadth at the canine alveoli	C–C
Breadth of the postorbital constriction	POB*

* Abbreviation not listed by von den Driesch

Table 1. *Cranial measurements used in the study as defined by von den Driesch (1976)*

	A-P	B-P	St-P	B-St	B-N	Ot-Ot	Zyg-Zyg	Ect-Ect	C-C	Mol-Mol	P4L	P4W	A-N	N-P	POB
Female, n=8															
Minimum	282.0	237.4	136.7	98.2	151.4	104.2	187.9	81.4	74.8	111.9	31.9	15.2	162.2	127.8	52.7
Maxi-mum	316.9	270.0	151.7	125.5	178.1	118.5	208.4	101.8	83.7	119.5	36.2	18.2	192.9	148.2	66.1
Mean	294.9	250.9	140.5	111.5	168.1	113.5	196.0	91.4	78.1	115.4	34.2	16.2	180.5	137.4	58.7
Sd	9.9	9.2	4.9	7.4	8.4	5.2	7.4	7.9	2.9	2.7	1.6	0.9	9.9	8.1	4.8
Median	293.8	251.2	139.5	111.3	169.9	115.5	194.9	89.8	77.4	114.9	34.0	16.1	182.9	135.9	59.9
Skewness	1.091	0.707	1.374	0.138	-0.743	-0.577	0.423	0.132	0.582	0.178	0.001	0.999	-0.569	0.185	0.016
Kurtosis	0.438	-0.058	0.573	-0.147	-0.715	-1.393	-1.503	-1.846	-0.999	-1.572	-1.733	0.004	-1.086	-1.844	-1.652
Male, n=18															
Minimum	285.5	256.1	145.5	107.1	162.1	122.2	138.3	80.5	80.3	122.6	33.2	16.5	169.0	129.2	56.8
Maxi-mum	372.5	323.9	189.6	144.9	209.1	143.8	266.1	115.8	100.0	135.8	39.2	20.0	227.9	177.0	73.4
Mean	344.3	293.0	164.7	129.2	191.8	132.7	223.3	105.5	91.1	128.5	37.4	18.5	208.4	158.7	64.3
Sd	22.4	17.3	10.3	10.6	13.2	6.3	26.3	9.3	4.4	4.1	1.8	1.0	15.1	12.4	4.3
Median	346.2	295.6	163.8	131.5	194.8	131.9	227.9	108.4	91.2	128.6	38.2	18.6	207.5	159.7	64.3
Skewness	-0.815	-0.257	0.622	-0.271	-0.473	0.194	-1.644	-1.096	-0.283	0.146	-1.054	-0.477	-0.789	-0.548	0.335
Kurtosis	0.250	-0.670	0.225	-0.822	-0.723	-0.928	3.613	0.497	0.374	-1.221	-0.148	-0.579	0.189	-0.384	-0.817
Ikrény															
Female	302.2	262.2	135.7	127.2	179.9	126.8	200.3	92.0	67.7	120.3	37.9	18.9	194.8	139.2	63.1

Table 2. *Univariate statistics of cranial measurements for African lions of documented sexes and measurements of the Ikrény specimen (mm). Abbreviations as in Table 1*

	PC			
	1	2	3	4
Zyg–Zyg	**0.914**	0.166	–0.241	0.201
St–P	**0.736**	–0.246	0.243	-0.229
Ot–Ot	**0.524**	0.483	0.139	0.289
C–C	0.494	0.178	0.525	-0.014
Ect–Ect	0.465	0.445	-0.241	**-0.691**
Mol–Mol	0.409	0.343	**0.684**	0.362
P^4W	0.222	0.236	**0.610**	0.475
POB	0.036	0.472	**0.570**	-0.391
P^4L	-0.009	0.285	**0.726**	0.108
N–P	-0.035	-0.145	**0.591**	-0.361
B–N	**-0.405**	**0.843**	0.075	-0.017
A–N	**-0.459**	**0.805**	-0.182	0.161
B–St	**-0.541**	0.069	-0.319	0.151
Eigenvalue	18.095	11.959	7.050	5.907
Eigenvalue %	*34.0*	*22.5*	*13.3*	*11.1*

Table 3. *Principal component loadings showing the relationships between PCs and individual cranial measurements (values to be interpreted within the -1 to +1 range). Abbreviations as in Table 1*

The revision of the Upper Pleistocene faunal, floral and Homo remains from the Subalyuk cave (Bükk Mts., NE-Hungary)

Vörös István

Keywords: *Subalyuk cave, vertebrate fauna, chronology, rejecting Neanderthal burial*

The monographic processing, published in 1938 about the first Neanderthal human remains from Hungary, the type-site of the Bükk Mousterian, and the find-material of the Subalyuk cave,[1] is exemplary. The team of the 10 authors did an excellent work; 30th of December, 1935 was the submission deadline of the manuscripts. More and more fair questions arose about the cave find-materials over the years from the different disciplines, which could not be answered in each case by the (at that time the most modern) excavation technology of 1932 and the data recorded in the monograph. New results could be produced in fortunate cases by the finds and the analyses of the written text. It is surprising that the published data are used undiscriminating by some authors and how liberally they handle the writs. The literature of the Subalyuk cave and its finds seems reputable; the last relevant paper was published in 2008. It was a conference proceedings of a convention (2007), jointly organized by the Directorate of Bükk National Park and the self-government of Cserépfalu for the 75th anniversary of the excavation of Subalyuk cave. Beside the publication of the presentations and new documents, this volume contributes to unfold the circumstances of the conflict formed between János Dancza and Ottokár Kadić and how this conflict was exploited by the contemporary Hungarian press. I would like to pay my old debt with to review and when it is necessary to revise the vertebrate fauna, the plant remains and the human finds from the cave, which were recently published in parts in different times and places. The big mammal fauna will be overviewed from archaeozoological aspect. I would like to clearly confute the latest theory of the burial inside of the cave, with the application of contemporary data.

The site is located in the southern edge of the Bükk Mountains, at the entrance of Hór valley opening north from Cserépfalu. The cave-mouth opens 44 meters above the valley-bottom, on the Eastern side of the Kút Mt. (380 m high). The excavations began on 8th of February, 1932 by speleologists formed by craftsmen from Eger with the leadership of János Dancza, with the credential of the Society of the Hungarian Speleology and with the permission of the Forestry Agency of Cserépvár (Cserépfalu, Borsod County) of His Majesty Józsiás Fülöp Saxon Coburg and Duke of Gotha. After the turn-up of the caveman finds the excavation was led by Ottokár Kadić (MKFI[2]) from 9th of May - due to other occupation - in name, from 27th of September personally.

The cave is 26 meters long, its East-West orientated huge cavity consists of 5 major parts, starting with the Foreground ('*Előtér*') from the 2nd to the 8th m is 6 meters long eastwards.

The '*Bejárat*' (Entrance) is the connecting lane between the 13th and the 14th quadrates. The '*Csarnok*' (Hall) is ca. 24 meters long from the 2nd m to point O to -22 meters [the name of the first 10 meters long section of this (from 2nd m to 8 m) is '*Előcsarnok*' (Vestibule) at Dancza]. The '*Zsomboly*' (Shaft) is at the end of the cave, 22 meters high and 4 meters wide (the upper part of it is also known as *Kürtő*[3] or *Töbör*[4]). The '*Folyosó*' (Corridor) is South-Western

[1] As this is a study of History of Science, I should not garble the name of the cave retroactively. The recent – otherwise inconsequent – writing of the name of the cave is concerned to present times.

[2] MKFI: Magyar Királyi Földtani Intézet (Hungarian Royal Geological Institute).

[3] Kadić 1933a, 12; Kadić 1938b, Fig. 4.

[4] Kadić 1938b, 30; Kadić 1940, 154.8.

orientated, located from 22nd m to 36th m, 14 meters long (from 27th m it separated to two, an upper and a lower corridor-section). The narrow, higher located, south-eastern exit of the *Folyosó*, the '*ablak*'[5] (Window) was not considered as the 'main part' unit of the cave. Mester, Zs.[6] has an opposite view. Kadić did not use Dancza's '*Előcsarnok*' name, although in his paper from 1940, in the caption of the Figure 7 'View from the *Előcsarnok*' appears. The determination of the border of the *Előtér* and *Csarno*k (*Előcsarnok*) is variable even at Kadić, who rated the quadrates Nr. 13–16 to the *Előtér*.[7]

18 layers are distinguished in the infilling of the vertically 25 meters high cave (***Fig. 1, Table 1.***). Till 16 meters the plastic clay-layers Nr. 1-6 with few bones are settled horizontally in the *Előtér* and the *Csarnok*. Layers 7–8–9 and 10 appear in the full length of the cave with an inclination angle of ca. 60 degrees in the *Zsomboly* and ca. 30 degrees in the *Csarnok* and the *Előtér*. Layers 11–12–13 and 14 in the *Előcsarnok* and the *Előtér* are petered out both in eastern and western directions. According to the characteristics and the colours of the sediment layer 7, 10 and 11 and layers 13, 12, 14 are considered identical in the Upper group of layers. From these layers 10 and 12, and layers 11 and 14 were united, where the layers 10 and 11 were called the Lower Succession and layers 12 and 14 were called the Upper Succession (***Table 1.***). The sediment sequence was partitioned at the first time to IV and then III layer groups by Kadić. The number of the units of the Lower and Upper layer groups, are different at Kadić and Mottl, who identified and processed the fauna of both layer groups [Lower (layers 1–3) – Upper (layers 5, 7-14)][8] At the listing of find material of each layers, the ordinal numbers of the layers were settled neither by KADIĆ, O. and nor by MOTTL, M. So were not, for example, the layers Nr. 11 and 14 from the same coloured ones.

Mammal fauna (Table 2)

In 1932 as a total 2387 animals bones were collected, which belonged to 41 mammal species. Probably due to a later data processing, neither of the cave bear nor of the ibex bone-remains were published. This is rather regrettable, because altogether 1719 pieces of bones derived from the two species! 668 pieces belong to the other 39 species, 644 of them were found in the *Előtér-Csarnok-Zsomboly* and 24 pieces in the *Folyosó*. 131 identified pieces were collected from the Lower layer-group and 537 pieces from the Upper one. In ***Table 2.***, which contains the species-distribution of layers, the name-list of the species was made partly according to the nomenclatural description of Miklós Kretzoi. [9] If the 239 'bone tools' from the cave would be added to the animal finds, the total number of the animal bones would be 2626 pieces. Nowadays these 'broken up, smoothed and worked' bones would be simply sorted to the unidentified bone fragments. There were 49 pieces of bone tools in the Lower (1–6) Layer-group and 190 pieces in the Upper (7–14) Layer-group. There were 6 pieces of so-called Kiskevély tooth-blade, 3 pieces of pathologically worn teeth and a fragment of mammoth tusk among the 'bone tools'.[10]

The identification of the initial layer of the finds was encumbered by the inclined settlement of the cave infilling, which was cleaned, slumped horizontally. On the other hand the otherwise seemingly practical field practice, applied for the preparation of the frozen, intact sediment of the *Előtér-Előcsarnok* in February [11]i.e. the thick cover of the splay cut section with the earlier extracted 'waste' material could cause sediment mixing. Mottl in 1938 in the list set down separately the find-material of the cave layers, excluding the merged light-brown layers 11 and 14 (***Table 1, 2.***), however, during the palaeontological evaluation of the species she combined the find-material of the two layer-groups and discussed them uniformly.

Generally it is known that the ibex is 'dominant' in the Lower Layer-group (1–3) and the concomitant fauna is rather poor, with a few bear-remains. Cave bear is the 'dominant species' of the Upper Layer-group (7–14, or the layers settling up to the humus). The layers 4, 6, 15 and 16 were sterile in a palaeontological point of view and layer 13 contained only cave bear remains. The upper light brown layer (14) 'contained interesting micro-fauna'[12] (***Table 2.***). The wolverine is listed among the remains of layer 17[13], at the characterization of species is listed into layer 16.[14] At the same time the red fox with the wolverine in layer 17 are mentioned only by Kadić[15], while Mottl did not write about them.[16], even if red fox is mentioned from the 'loess, calcareous layer settled above the wolverine-layer' (layer 17).[17] The example of the chamois, determined as one of the most frequent species of the cave (whilst the cave bear had 'hundreds of teeth-remains') with its 54 pieces of occurrence

[5] KADIĆ 1940, Fig. 8.
[6] MESTER 2008a, 85.
[7] KADIĆ 1938a, 22.
[8] MOTTL 1938c, 205–308.
[9] KRETZOI 1965, in VÉRTES 1965, 276–279.
[10] KADIĆ 1938c, 144–149.
[11] DANCZA 1938a, 15.
[12] MOTTL 1938c, 207–208.
[13] MOTTL 1938c, 211.
[14] MOTTL 1938c, 255.
[15] KADIĆ 1938c, 34.
[16] MOTTL 1938c, 210–211.
[17] MOTTL 1938c, 247.

demonstrates how subjective could be the ‘dominant’, ‘frequent’ characterization of each species.

During the 1932 excavations 62 remains of 9 small-mammal species were collected from the layer 14. Greater mouse-eared bat was identified by Jánossy[18] from the layer 11 from the excavation of year 1932. Remains of hare occurred in the layer 3 (3 pieces) and layer 14 (9 pieces).

Besides the two bear species (layer 1, 3 and 11 contained single finds of the small size brown bear), 251 remains of 14 carnivore mammal species are known from the cave, . Apart from lynx and the Alpine wild dog four carnivore species of the Lower Layer-group (wolf, red fox, cave lion and cave hyena) were also present in the Upper Layer-group. At the same time the seven carnivore species occurring in the Upper Layer-group (jackal, badger, pine marten, ermine, stoat, polecat and cave leopard) are missing from the Lower Layer-group. The ermine is absent from the layer 11 as well. The otter was only found in the *Folyosó*. The largest amount of the carnivore remains was wolf (98 pc), cave hyena (73 pc), ca. the half of hyena’s was red fox (38 pc) and the half of the fox’s was cave lion (19 pc). The amounts of the other species are less than 10 pieces.

14 species of herbivore mammals were identified from the cave. 6 of them derived from the Lower Layer-group (horse, woolly rhinoceros, red deer, chamois, ibex and aurochs) while in the Upper Layer-group all of the 14 herbivore species occurred. Wild boar came from layer 5, wild ass, giant deer, wild sheep and steppe bison from layer 11. This latter unit did not contain woolly rhinoceros remains. The largest amount of the herbivore remains was horse (87 pc), ibex (78 pieces from only the Upper Layer-group), chamois (54 pc), half of the chamois’ was woolly rhinoceros (27 pc), 18-18 pieces of mammoth and red deer, 17-17 pieces of Caspian red deer and aurochs remains. The amounts of the other species were below 10 pieces. The faunal assemblage of the *Folyosó* can be identified as of the Upper Layer-group of the cave (***Table 1, 2.***).

Vertebrate remains are still found in both the remained layer-shreds on the cave-wall, and from the reinvested cave-sediment and from the dump in front of the cave, which characterizes the ‘rate’ of the excavation of the cave.

Small mammal find-material of later collections (Table 3)

Sediments of Hungarian caves were collected by L. Vértes for the purpose of sedimentological analyses in 1956. From the Subalyuk cave Vértes gave 2-3 handful of small mammal containing sediment-material to D. Jánossy for micro-palaeontological identification. According to Vértes the submitted samples derived from the layers 11, 12, i.e. from the Upper Layer-group of the cave. ’Sample A (layer 11)’ was collected near the entrance of the cave, at the northern wall, ca. 180 cm above the present-day ground level and contained five species (northern birch mouse, forest dormouse, bank vole, steppe lemming and common vole) previously not published from the site. ’Sample B (layer 12)’ was collected at the mouth of the southern side-corridor, ca. 220 cm above the present bottom and contained seven new species (common shrew, common pipistrelle, Natterer’s bat, Daubenton’s bat, northern bat, northern birch mouse and wood mouse). Both samples contained fish-, frog- and snake- remains, sample ‘B’ contained lizard- and bird-remains also.[19]

In 1964 Jánossy and Topál were collecting from the then ‘ground level’, identified earlier approximately with layer 3, then after revision with the ‘Upper Layer-group’. In the sample four bird species, remains of six small-mammal species were found. The absolute dominant steppe lemming (80 pc), the significant common vole (44 pc), jumping mouse, wood mouse and steppe pika are present in the other samples as well, but narrow-headed vole was found first in this collecting. The small mammal fauna of year 1932 was completed with 14 new species in the cave and 7 new species in the *Folyosó*[20] by Jánossy (***Table 3.***).

In the second half of the 1990s Árpád Ringer and Péter Solt collected samples from the wall-rifts of the *Előtér*, the *Csarnok* and the *Zsomboly*, following the instructions of Jánossy. The small-mammals were identified by László Kordos. The forest dwelling edible dormouse in ‘layer 11’ = 11? + Upper Layer-group and the Eurasian pygmy shrew, living in lush, dense thickets, from ‘layer 12’ = 12 + Upper Layer-group, are new species from the cave, while the samples collected from layers 15/17 of the *Zsomboly* did not contained new species (***Table 3.***). [21]

What do the large mammal bone-finds show?

The sediment sequence of the Subalyuk cave can be divided into 3 layer groups: Lower (layers 1–3), Middle (layers 5, 7–9) and Upper (layers 10-14) groups with a total of 2387 collected pieces (***Table 2.***). The lowermost dark grey (lower) clay layer 10 of the limestone-detrital Upper Layer-group, is present in the entire length of the cave. It increases slightly in ca. 15 metres in the *Csarnok*, then steeply in the shaft. In the overlying the (lower) light brown loam layer 11 is situated from the 8th meter of the *Előtér* to the ca. 11th

[18] JÁNOSSY 1960, 72.

[19] JÁNOSSY 1960, 71–72.

[20] JÁNOSSY 1979, 131.

[21] RINGER 1993, 85–86.

meter of the *Csarnok*. The overlying three units are shorter, wedged out layer-patches:

- the (upper) dark grey loam layer 12 between the 2nd and 9th meters of the *Csarnok*,
- the greenish grey waste loam layer 13 from the 4th meter of the cave *Előtér* to the 11th meter of the *Csarnok*
- the (upper) light brown layer 14 the 8th meter of the cave *Előtér* to the 4th meter of the *Csarnok*.

Beside the unknown number of cave bear remains in layer 10, 78 pieces, in layer 12, 33 pieces and in the combined layers 11/14 as a total 234 pieces of animal remains were found!

Accepting the pit-wet colours of the layers, the merging of the find-materials of layers 10 and 12, or the layers 11 and 14 is not interpretable. According to the longitudinal section-map of the cave the intense sediment erosion indicator layers 12 and 13 are wedged between the layers 11 (with Neanderthal remains) and 14. After the excavations the layers 11+12+14 were considered as the 'I. Upper culture layer'.

The fauna of the Upper layer-group (layers 10–14) contains 35 species: 11 micro-mammals and 24 macro-mammals. Among the macro-mammals 5 small carnivores (2 types of *Mustela* and *Martes, Putiorius, Meles*), 3 carnivores (*Canis, Vulpes,Thos*), 4 large carnivores (*Ursus arctos, Leo, Panthera, Crocotta*), the herbivorous cave bear (*U. spelaeus*) and 11 herbivorous ungulates *Cervus elaphus, C. maral, Megaloceros, Rangifer, Capra, Ovis* sp., *Bison, Bos, Equus* (large form), *Asinus* and *Mammuthus*.[22] The species-dominancy of the Upper layer-group (based on 274 + x pieces): *Equus* (large) 24.1%, *Capra* 14.2%, *Rupicapra* 12.0%, *Canis* 10.6%, *Vulpes* 7.3%, *Crocotta* 5.8%; *Ursus spelaeus* is 'dominant'.

The fauna of the Lower layer-group (layers 1–3) contains 15 species. Beside a single small mammal (*Lepus*), 14 macro-mammals (131 + x pc) are present, including 4 carnivores (*Cuon, Canis* 47 pc, *Vulpes* 8 pc, *Lynx*), 3 large carnivores (*U. arctos*, *Leo* 9 pc, *Crocotta* 7 pc), the herbivorous cave bear (*U. spelaeus*, 'concomitant species') and 6 herbivorous ungulates (*Capra* 'dominant species', *Cervus* 8 pieces *Rupicapra* 7 pc, *Bos, Equus* 11 pc, *Coelodonta* 19 pc).

One of the measures of the occupation and everyday life of the prehistoric humans are the remains of the preys killed during the hunt. The animal-remains found in Subalyuk cave were preys; the question is whether they were killed by carnivores or the prehistoric humans?

[22] MOTTL 1938, 209-221.

Lower Layer-group (layers 1–3): 12 species, 131 pieces of bones.

The body-region distribution of the remains after Kretzoi[23] shows well that the number of the 'meaty limb' bones is 21 (16.0%). The four pieces of 'meaty limbs' suitable for human consumption are of wild horse (1 scapula fragment) and rhinoceros (3 radius/ulna fragment and patella)! In the case of the latter species the 2 ribs from the 'trunk' region could be taken account. The other 17 pieces of 'meaty limb' bones belong to hare, wolf and red fox. Where are the other 'meaty' body parts? The itemized remains of the ibex are not known, however, it can be indicative that the ibex skeleton mounted in the MKFI by Mottl was assembled from separate goat-bones.[24]

Upper Layer-group (layers 10–14): 20 species, 435 pieces of bones.

The number of the 'meaty limb' bones is 31 (7.2%). The 12 pieces suitable for consumption of the prehistoric humans belong to wild horse (4 pieces: radius fragment sin-dext., 2 tibia), rhinoceros (1 radius fragment), chamois (1 radius fragment), ibex (5 pieces: scapula fragment sin-dext., patella!, 2 tibia sin.) and steppe bison (1 humerus). The other 19 pieces of 'meaty limb' bones belong to hare, wolf, red fox and cave hyena (+ 3 patellae!). 2 epistropheus and a rib belong to the 'trunk' body region. Where are the other 'meaty' body parts?

Compared the Upper Layer-group to the Lower Layer-group the 'head' region increased to 1,5 times and the phalangi increased slightly; the 'trunk' region decreased 2,5 times, the 'meaty limb' 0,5 times, the 'dry limb' 1/3 times (***Table 6.***).

Investigating the animal remains from the Hungarian Palaeolithic campsites, we can find a large number of 'meaty limb' remains everywhere. The number of these bones is high in Érd[25], 230 pieces of cave bear and 28 pieces of chamois bones were in the Istállóskő cave[26], 396 pieces of reindeer and 15 pieces of chamois bones were in the Pilisszántó shelter cave I.[27], 56 pieces of reindeer bones were in Ságvár[28], 116 pieces of the same taxon in Pilismarót-Pálrét[29] and 194 pieces of reindeer, 17 pieces of horse bones were in Pilismarót-Bitóc.[30] The distribution of the natural animal remains found in rock shelters, stone quarries and clefts is more homogeneous and the number of the

[23] KRETZOI 1968b, 230.
[24] MOTTL 1938a, Fig. 6.
[25] KRETZOI 1968b, 233.
[26] VÖRÖS 1984, Tabl. 3.
[27] VÖRÖS 1987, Tabl. 4.
[28] VÖRÖS 1982, Tabl. 6.
[29] VÖRÖS 1985, 302–303.
[30] BILLER 2009, Tabl.4–5.

intact long bones (metapodials for example) is much higher, than on the Palaeolithic settlements.

Taking into consideration the *thanatocoenosis* of the faunal assemblages[31], a mix of a fauna of bear and large carnivores (lion, hyena, wolf), and a highly fragmented bone material of prehistoric humans' occupation can be found in the Subalyuk cave. The qualitative composition of animal bones is most similar to the animal bones of the open-air settlement of Tata. At the junction of the mountains and the plains, distinctive species of both habitats were the preys of the carnivores of the cave.

Avifauna

The bone-material of 24 bird species from the Lower (1–4) and Upper (10–16) layer-groups from the excavation of year 1932 was identified by Jánossy[32]. Among the bird species there are diurnal and nocturnal carnivores, scavengers, species with alpine, mountainous, plain-hilly loessland, plain-hilly forest, water, marsh, open grassland, wooded steppe and forest habitats. There were 8 species in the Lower layer-group and a total of 20 species (18 from the 1932 excavations and 2 from 1964) in the Upper Layer-group (***Table 4.***). by The carnivorous birds of the Subalyuk cave used to feed on small mammals, small carnivores, birds, fishes, frogs, lizards and snakes. The number of the alpine, within this, the scavenger vulture species is remarkable and the remains of the black grouse were found in relatively large number, too. The hunting grounds of the carnivorous birds were the forested Lower Bükk and the plain forest-grass steppe rim of the Northern Alföld. The two northern winter visitor birds were the chough and the snow bunting.

Plant remains of the Subalyuk cave

The charcoal remains of the fireplaces were identified by Ferenc Hollendonner; after his death the results of his observations were published by Sándor Sárkány.[33] The remains of the fireplaces and charcoals were divided into 5 layers, 4 deciduous and 3 coniferous species were identified:[34]

Fireplace-layer I, yellowish-red loam layer 3, (lower cultural layer, fireplace): larch (*Larix*), Scots pine (*Pinus silvestris* L.), hornbeam (*Carpinus*), smoke tree (*Cotinus coggygira* Scop.), dogwood (*Cornus*).

Fireplace-layer II, dark-brown loam layer 5, fireplace?: larch (*Larix*), Scots pine (*Pinus silvestris* L.).

Fireplace-layer III, greenish-gray loam layer with limestone debris 7: larch (*Larix*).

Fireplace-layer IV, greenish-yellow and dark-gray loam layer with limestone debris (9 and 10): larch (*Larix*), linden (*Tilia*). In the later study of Kadić the dark-gray loam layer 10 is absent in the description.[35]

Fireplace-layer V, light-brown loam layer with limestone debris 11, (upper cultural layer, fireplace, Neanderthal remains): larch (*Larix*), Swiss pine (*Pinus cembra* L.).

More recently, József Stieber identified the charcoal remains of Subalyuk cave. During his revision the earlier smoke tree (*Cotinus*) proved to be buckthorn (*Rhamnus*).[36] Of the 855 samples, mentioned from the 16 layers of the cave by Vértes[37], 769 pieces from the mentioned 5 'vegetation layers', presumably correspond with the layers of fireplaces were published by Stieber.

The ratio of the deciduous trees and shrubs in the Lower Layer-group is 69.8%, in the Middle group is 21.6% and 8.6% in the Upper one. The frequency of the pines is 22.4% - 69.6% - 8.0%. All the members of the shrub-level (*Corylus, Prunus, Cornus, Crataegus, Sorbus, Rhamnus*) uniformly belong to dry gallery forest, calcareous forest, forest-glades, shrubby habitats. The deciduous trees are the components of the upper (*Carpinus, Fraxinus, Quercus, Populus*) and the lower (*Acer, Tilia*) canopies. Beech (*Fagus*) is absent. Beside the woodland element species of Scots pine (*Pinus*) members of the alpine zone vegetations as fir (*Abies*), spruce (*Picea*), larch (*Larix*) and Swiss pine (*P. cembra*) also appear. On the lower highlands and hills of the Carpathian Basin (200-500 m high) the coniferous species of the alpine zone vegetation (*Picea-Larix-P. cembra*) are found together as the co-occurrence of larch (*Larix*) – Swiss pine (*P. cembra*) – mountain pine (*P. montana*) – elm (*Ulmus*) – juniper (*Juniperus*) – rowan (*Sorbus*) and northern moss in the so-called blue-clay (from 2.5-14 m depth) in the Alföld clearly shows.[38]

In other words the alpine tree line was lying 2000–1800 meters below the present one. The larch-Swiss pine vegetation zone, generally characteristic to the Alps is absent in the Carpathians.[39] Among the remains from the fireplaces the Scots pine, the hornbeam and the linden burn exceedingly.

The character of the Subalyuk cave

The Palaeolithic lithic industry in the Subalyuk cave is concentrated in two 'main layers', in the *yellowish-red layer 3* and in the *light brown layer 11*,

[31] KRETZOI 1941, 254.
[32] JÁNOSSY 1962, 175–188.
[33] HOLLENDONNER 1938, 309–315.
[34] HOLLENDONNER 1938, 311, 315.
[35] KADIĆ 1940, 174.
[36] STIEBER 1968, 45. Table I.
[37] VÉRTES 1965, 333.
[38] BENDA 1929, 268–271.
[39] BORHIDI 1968, 187.

however, various numbers were published about the stone tools from the site.

During the formation of layer 3 the cave was used for a temporary settlement by prehistoric men. 718 stone tools were published by KADIĆ, O., 251 (35.0%) from these are worked tools.[40] The number of the animal bones – excluding the ibex and the cave bear – is 76 pc, 39 pieces of them are identified for the species and 37 pieces are so called 'bone tools'. In this term the – present – high-mountainous, alpine fauna elements can be found in the lower ground levels. The whole territory of the cave was in use.

In the times of layer 11 the cave was so called home basis site. The number of the stone tools was 4439, of these, 631 pieces (12.2%) were worked tools.[41] The number of the animal bones – excluding the cave bear – is 223 pc, 163 pieces of them are identified for the species and 60 pieces are so called 'bone tools'. Only the *Előtér* and the *Előcsarnok* of the cave were in use.

The amount of the animal remains – I can only repeat – is fairly low, even together with the unidentified 'bone tools', it is only 2626 pieces. The total number of the cave bear remains form the whole cave and the ibex remains from the Lower Layer group comprise 1719 pieces, 65.4% of the total animal bones. We can compare it to the number of cave bear remains from the open-air settlement of Érd, (13245 pieces)[42], and the Istállóskő cave from the Bükk-Mountains, (18601 pieces).[43] The number of the cave finds from Subalyuk cave is only ca. 9-12% of the mentioned sites.

The fauna of the Subalyuk cave was divided into two parts by MOTTL, M., the Lower Layer-group – according to the practice of those days– was classified into the *java* (= Classical), the Upper Layer-group was classified into the *late Mousterian culture*.[44] The Lower Layer-group (layers 1–3) can be dated, according to the Penck-Brückner's calibration, to the R-W interglacial warm, wet, deciduous-forest vegetative period. The Upper Layer-group (layers 9–14), with the decline of the warm-temperate faunal elements, was a colder period, although it contained forest and steppe-semi-desert, continental mixed fauna. The so called cold Würm faunal elements are absent from the layers 10–16 of the cave. According to Mottl, M. it can be dated to end of the R-W.[45]

The chronological classification of the Mousterian culture formed instructively during the past nearly 80 years. Earlier the 'long chronology', based on astronomical calculation, was applied. The classic '*java- (hoch-) Mousterian*' culture was dated ca. 100 000 years. Then came the time of the 'short chronology', where the cultures were crammed into 30-50 000 years periods. Nowadays the 'long chronology' prevails again, the earlier theoretical calculations seem to be proved by the newest scientific methods.

The fauna of Subalyuk cave was re-evaluated first by Vértes[46] and then by Jánossy[47]

One of the upper Pleistocene Würm faunal-ages of the Hungarian vertebral palaeontology is named after Subalyuk. The stratotype of the Subalyuk fauna-age was at first the fauna of the Lower Layer-group (layers 1–3)[48], then of the Upper Layer-group (layers 10–14).[49] Later the two were continuously mixed.

The age of the Lower Layer-group: The end of the R-W[50] R-W/praeW[51]

On stratigraphic basis it could be dated in the early section of the long period R-W or to the end of the Riss (?).

Culture: typical Mousterian.

The age of the Upper Layer-group: Near to the WI maximum[52], late WI[53]

The chronological classification of the Subalyuk Upper Layer-group seems to be the easier task. The occurrence of the frogs, lizards, snakes, the large amount of forest species, a part of the birds and vegetation are clearly mean warm, wet period, temperate climate. There are a few large mammals and in high number of individuals a few small mammal species from the grassland faunal elements. The vertical zonality of the vegetation is incomplete, the associations are mixed in the lower ground surfaces. It could be dated to the second half of the R-W (between Süttő and Varbó, or after Varbó, cannot be determined yet). The birch mice (*Sicista*) – according to the actual knowledge – indicate the classification to the Süttő

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40 KADIĆ 1938c, 137.
41 KADIĆ 1938c, 138.
42 KRETZOI 1968, 62.
43 VÖRÖS 1984, 22. - 8543 pieces are inventoried to the Department of Palaeontology of the Hungarian Natural History Museum. According to the excavation diary of Jánossy, D. 10 058 pieces were reckoned up and rejected at the site.
44 MOTTL 1938c, 207.
45 MOTTL 1938b, 202. large table.
46 VÉRTES 1965, 331–334.
47 JÁNOSSY 1979, 129–132.
48 KRETZOI–VÉRTES 1965, 137.
49 JÁNOSSY 1979, 130. In the Fig. 45, Lower Subalyuk is classified to the Subalyuk faunal stage, and Upper Subalyuk to the Tokodi faunal stage.
50 VÉRTES 1965, 119.
51 KRETZOI 1968, 101. Fig. 17.
52 VÉRTES 1965, 119.
53 KRETZOI 1968, 101. Fig. 17.

and the Varbó periods. Culture: Mousterian type Quina.

The wolverine find of the layer 17 indicates, after a long hiatus, the appearance of the Pilisszántó faunal-age in the cave.

The Neanderthal remains of Subalyuk cave

The story of the first Hungarian Neanderthal finds does not lack any edification. Roughly it can be said, the first scientific processing was published in the 'wrong time', 1938, two years before the outbreak of World War II; in the 'wrong place', in the Mussolini cave[54]; and they got into the hands of an expert, who was less experienced with the Palaeolithic caveman-finds and find-circumstances. Lajos Bartucz himself wrote, that '[...] the *moral*, that need to understand and to evaluate these finds, was absent.' Furthermore the lack of experience and the systematic research, and the critics of the not-understanding made the research of the prehistoric man difficult in Hungary. [55] The 'problem' was not with the moral, but with the experts. The Neanderthal finds from Subalyuk could not have been taken their rightful professional-scientific place yet.

In the end of 1932, Lajos Lóczy Jr., the director of the MKFI delegated a team, formed by 8 experts, to process the – internationally also notable – Subalyuk find-material that got into the MKFI. The prehistoric man-finds were given to Bartucz to elaborate. In the beginning of 1933 Bartucz asked a detailed list from Dancza about the precise finding location and time of the caveman finds, and had 2 site drawings made about the occurrence of the human-bones in the *Előcsarnok*.[56] In 1932 Dancza mentioned 9 pieces of 'identified' human-bones form the site[57], in his 'list' from 1933, there are 11 pieces of human remains[58] (***Table 7.***).

About the remains of the prehistoric human finds of Subalyuk (*Homo primigenius*) Kadić reported at first in professional circles, in the general meeting of the Society of the Hungarian Speleology held in 21st of February, 1933. During the cave excavation bones of an adult and an infant were found in the upper cultural layer. The bones of the infant: *fragment of skull, a few vertebrae, several rib-fragments and phalangi.*[59]

A presentation was held about the results of the excavation of the Mussolini cave by Bartucz and Kadić in the 41st Roving Conference of the Hungarian Doctors and Nature-explorers in Budapest, 1933. Bartucz held a presentation with the title of '*The first skeleton of the Neanderthal in Hungary*' on 5th of June. The title is deceptive itself, it tells more than the reality, than he reported about in his presentation. He wrote incorrectly that the excavation in Subalyuk was led by V. Pataki and E. Pálos. His own identification of the caveman-bones received for scientific observation was as follows:

'A. adult individual': mandible, manubrium of the sternum, first cervical vertebra (2 pc), three thoracic vertebrae, sacrum, index-finger metacarpal bone of the left hand prox. piece, left patella, metapodial bone of the 4th radius of the left leg, metapodial bone of the 2nd radius of the right leg, metapodial bone of the 3rd radius of the right leg (dist. is missing), phalanx prox. fragment. Later he also found in the received bone-debris, a piece of a totally intact nasal bone of an 'adult'.

'B. bones of an infant': neurocranium (broken to more than 80 pieces), left half of a maxilla with 5 teeth, frontal projection of a right side maxilla and several viscerocranial fragments with 7 separate teeth; *several vertebrae, ribs, long bones, phalangi of the hand and leg* from the skeleton are in such a hurt, broken condition, that neither can be fit together, *most of them nor can be identified precisely.* The remains of the child enumerated by Kadić were completed with the 'long bone' (=limb-bone) by Bartucz.[60]

He noticed with the right eye, that on the 'considerable' amount of the bones, recent damages, defects can be found. He claimed categorically that a part of the caveman-remains had been ruined (sic![61]) during the excavation.

Kadić presented a lecture with title of 'The Mussolini cave of Cserépfalu' on 8th of June. He reviewed *inter alia* the bone remains of the prehistoric man. Skeletal elements of the adult: mandible, sacrum, first member of the sternum, a patella and a few metatarsal and metacarpal bones. He repeated the list of the infant-bones: *fragments of the skull, a few vertebrae, several rib-fragments and phalangi.*[62]

In 1933, the 16th International Geological Congress was held in Washington. Hungary was represented by L. Lóczy Jr., director of MKFI, who presented and reviewed the caveman finds of Subalyuk. In the congress publication, which came out three years later (in 1936), the name of 'foreman' Dancza is missed to Danko. The list of the remains of

[54] The name of the Subalyuk cave was changed to the name of the Italian prime minister for the initiation of Hillebrand, J. in the committee meeting of the Society of the Hungarian Speleology held on 12th of December, 1932. The Subalyuk name was always beside the "official" name too.

[55] BARTUCZ 1938, 53.

[56] BARTUCZ 1938, Fig. 1–2.

[57] DANCZA 1938a, 14–20.

[58] DANCZA 1938b, 61–63.

[59] KADIĆ 1933a, 19.

[60] BARTUCZ 1934, 141–143.

[61] BARTUCZ 1934, 140–156.

[62] KADIĆ 1933b, 15–16; 1934, 208–211.

the adult and infant cavemen is identical with the previous list of Bartucz.[63]

The manuscript of Bartucz made for the monograph was finished in June 1935.[64] He identified and described[65] among the caveman-finds of Subalyuk cave, the fragments of 17 pieces of bones of a 40-45 years old woman[66] and fragments of a skull (ca. 50-60 pieces of neuro- and ca. 20 pieces of viscero-cranium fragments) from *a skeleton* of a 6-7 years old *child* (***Table 7.***). The mandible is bonded from several fragments (P_1 sin. and P_2 dext. is missing). The right side mt II is broken to two pieces, the left side mt IV is broken to several pieces, both of them are bonded. The proximal piece of the damaged right side mt IV was found among *animal-suspected* bones.

Bartucz mentions '*skeleton*' consistently in the case of the infant. In spite of that, as the multiple repeated entries show in his study, written in different times and in several parts, he noted precisely that from the infant skeleton *several vertebrae, ribs long bones, phalangi of the hand and leg are in such a hurt, broken condition, that neither can be fit together*, *most of them nor can be identified precisely.*[67] Then he repeated again 'unfortunately *the other parts of the skeleton* (sic!) are such damaged, that most of them cannot be identified precisely, *totally inappropriate for scientific observation,* therefore I do not deal with them here.'[68]

In 1940 Kadić summarized the results of the researches conducted in the 'caves of Cserépfalu region' in the 16th issue of *Barlangkutatás* (Speleology). At the review of the caveman finds of Subalyuk cave – applying the work of Bartucz – he set out 15 pieces of the adult individual at first[69], later he mentioned 2 more pieces. The adult individual is a woman, 40-45 years old.[70] At the remains of the infant he applied 'dual description'. At first 'the desired, not found' remains are also listed, interestingly the skeleton is not mentioned here. The *bones of the infant*: 1. small fragments of the skull (left half of a maxilla with 5 teeth, several viscerocranial fragments, 7 separate teeth), 2. *several vertebrae*, 3. *rib*, 4. *limb-bone*, *phalanx* of 5. *hand* and 6. *leg* in fragmented condition.[71]

Secondly, the actually found skull-find was described as the *part of the skeleton of the 6-7 years old child*: *neurocranium, bonded from ca. 55 pieces, viscerocranium, teeth*. 'On the assembled skull, especially on the temporal region, sharp lines can be observed, which gives the impression that they originate from a kind of sharp tool, or weapon.'…'These signs point to the fact that the child was murdered anno.'[72]

The question of the burial of the Subalyuk caveman

Dancza, the 'foreman' of the Subalyuk excavation, as a craftsman, perceived with excellent sense and with the help of his colleagues, scrupulously documented the system of the sedimentation-row of the cave and the finds. The possibility, that the cavemen were buried inside the cave, had been arisen during the excavation. He reported about this: 'after many have suggested, that the human remains might take their present place through a partial burial, I feel the need the review some tangible evidence against this. The most notable evidence against the burial, is the thick fireplace-layer, which did not occur in patches, but as a unified layer, in 8 meters length in the whole width of the cave, also above the quadrates, which contained the human remains. The fact, that only a few and not tightly connected parts from both of the skeletons of the adult and the juvenile individuals were found in such a dispersion indicates, that opposed to a partial burial, the bodies of the two were hauled apart by predators, and the human remains in the cave are only signs of the feasting of the predators. This theory seems to be proven with the only human *metatarsus*, which was found in the filling of *Gubalyuk*, which is 30 minutes walk from Subalyuk and has the same banding as the Upper level of Subalyuk and contains the similar fauna as well.'[73] The mentioned Gubalyuk, later Kecskésgalya cave is open to the side of the Kecskésgalya and its sedimentation is totally identical with the 'uppermost light brown and dark grey layers of Subalyuk' and contained a '*Homo primigenius* metatarsus' (mt), found in 1932.[74]

Dancza wrote two times abut the remains of the child from Subalyuk: 'after the beat of an about a 0.4 m diameter, fairly solid block, a shattered skull and *other remains* of a child yielded.'[75] On the 3rd level of the 15th quadrate 'all of the bone-pieces belonging to the child were in one, 30-40 cm diameter block. The block was pulled off with a pickax and smashed onto the mass of soil, cut before the profile. The skull at the smash of the block [...] was lying with face turning to the ground. The surfaces of the fractures showed, that

[63] Kadić et al. 1936; 783; 786.
[64] Bartucz 1938, 49. footnote 1.
[65] Bartucz 1938, 97, 92–99.
[66] Bartucz 1938, 77, 63–92.
[67] Bartucz 1938, 56.
[68] Bartucz 1938, 92.
[69] Kadić 1940, 194.
[70] Kadić 1940, 199; 201.
[71] Kadić 1940, 194.
[72] Kadić 1940, 202–203.
[73] Dancza 1938a, 20.
[74] Dancza 1938a, 20; Kadić 1940, 215.
[75] Dancza 1938a. 19.

the skull had been cracked already, but the fitting pieces could become separate only after the falling apart of the block. The block, containing the infant skull and *other skeletal elements*, was fairly dry and loose, and so to speak fell off spontaneously from the bones at the smashing, so the bones could also fall apart.'[76]

As convincingly and professionally Bartucz argued for that there was no human burial inside the cave, as unquestionably and with determination he claimed, that the skeleton of the child was lying in situ in the cave. 'Whether lying, in situ, whole skeletons the adult woman and the child had got, which have been ruined [...], or [...], the bones got into the ground dispersed, [...], even animals mauled them apart [...] – because of the bonded bones, and the lack of local observations – cannot be decided. [...] Some of the bones had been already damaged by the time they got to the place where they were found, [...] they were lying in their secondary, tertiary location. [...] While *there were remains of almost every part of the fragile infant skeleton* – even in lower numbers – until there was no sign of the larger, longer, limb-bones and the skull of the more stronger adult skeleton, [...] if animals would brought the bones into the cave, it is really amazing, that so many parts of the skeleton lay in such a small area.' [77]

'In the right half of the *Előcsarnok* [...] none of the bones lay in such a position that indicates they were buried, [...] the adult was mauled apart in the area of quadrates 11-12…the location of the *infant skeleton* in the adjacent quadrate 15, indicates the same.'

'The biggest part of the *infant skeleton* was lying in a relatively small, only a half square metre area.' [78] He diagnosed, that the deepest discontinuities on the back surface of the manubrium of the sternum 'can be originated' from animal tooth.[79]

The 3rd volume of the *Palaeopathologia* was published in the year of the death of Bartucz, in 1966. The Subalyuk caveman finds were discussed in the issue of the Introduction, entitled 'The anthropological, palaeopathological and medical historical evaluation of the skeleton-material found in the ground'. 'From the only Hungarian *Homo primigenius* find, from the female skeleton from Subalyuk for example, only the damaged mandible, teeth, sacrum, the handle of the sternum (manubrium sterni), metapodial bones of the hand and leg, phalangi, patella and some vertebrae fragments remained, probably as the remains of the feast of the large carnivores (cave bear, etc.). The others were hauled away by the animals, or whirled by the water of the cave. More surprising, that *an infant skeleton remained in situ* and, for example one of its nasal bones was found in totally intact condition. However the skeleton was undermined and taken out from the cave debris with caving, broken into many parts. The damages of the sternum (manubrium streni),[80] the vertebrae (corpus vert.),[81] the metacarpal bones and the phalangi, indicate chewing of the carnivores (***Fig 1.***).'[82]

On 4th of October, 1979, J. Dancza visited the department of Anthropology of the Hungarian Natural History Museum on the invitation of Tibor Tóth to inspect the caveman finds of Subalyuk. He saw with dismay the 'conditions and lacks' of the caveman finds. More surprising, that he itemized in his 'reminiscence' the 'missing' bones of the child: '*intact vertebrae, ribs, clavicles, scapulas, long limb-bones, metapodials of the hand and leg, phalangi*', which probably do not exist, certainly cannot be found in the Collection of Department.[83]

In 1996 an international research team led by Ildikó Pap (Department of Anthropology, HNHM) observed again and revised the remains of the caveman of Subalyuk cave. They identified and studied 10 pieces of skeletal finds of the adult female. They corrected the age of the woman to 25-35 years old. The previous 5 vertebra fragments and the phalanx I of hand (ph. I) were absent, according to the new identification from the mt IV dext. became mt III dext, from the 2nd dig. ph. I prox. became 3rd ph. I. prox. Beside the infant skull (fragment of neuro- and viscerocranium), 4 vertebrae were mentioned, 2 of them were cervical vertebrae, 2 – probably – fragment of thoracic vertebrae (***Table 7.***). The age of the infant, according to the identification of Thoma (1963)[84], was determined to 3-4 years old.[85] They mentioned from the list of the caveman finds from 1938: *the two phalangi* (one phalanx of a hand 7/b and of the leg 9/d, ***Table 6.***) are not human, but animal bones. [86] The di^{1-2} of the infant maxilla is not left side[87], but right side.[88] It is unknown that the 4 vertebrae of the child are from the previous 'latent bone finds' from 1932 or perhaps new find?

76 DANCZA 1938b, 62.
77 BARTUCZ 1938, 56; 58; 60.
78 BARTUCZ 1938, 63.
79 BARTUCZ 1938, 86., Table III. 7.

80 BARTUCZ 1966, Fig. 1a; 1938 Table III. 7.
81 BARTUCZ 1966, Fig. 1b; 1938 Table III. 4.
82 BARTUCZ 1966, 18–19.
83 DANCZA 1984, 131. - He wrote his "reminiscense" in despair. The author was drifted into the world of irreality by his defamations, formulated after 1979.
84 THOMA 1963.
85 PAP et al. 1996, 233–270.
86 PAP et al. 1966, 234.
87 BARTUCZ 1938, Table VII 3.
88 PAP et al. 1996, Fig.11.

Last, in 2008 Mester argued markedly for the burial of the caveman of Subalyuk. He quoted the studies of eight previous authors, where opinions, pros and cons, can be found about the burial. It is not surprising, that everyone writes down about an event, which did not take place, whatever crosses one's mind, only the infinite fantasy could set a limit.

His most important claim, that 'the bodies could not be dragged into the cave by the predators, because there are not any damages, marks of bite or chewing of hyena-teeth on the human bones, [...] assuredly they could be seen.' How 'complete' was the skeleton of the Homo, he asks the question? Then he gave the answer, Dancza and Bartucz also suggest, that 'the infant skeleton was fairly complete.' What does the 'fairly complete' mean, 10, 50, 100 or 150 pieces of bones? 'This circumstance itself is in favour of, that the body *could be* buried.' The fact, that Dancza and his colleagues did not observe a pit 'does not exclude the possibility of a regular burial'. On the base of the stratigraphic position of the remains, closured into the formed block, 'we can state, that the child form Subalyuk '*most likely was buried* into the cave, and because of the size of the *grave* (sic! V.I.) *assuredly in crouched position.'*[89] He establishes, that the adult was not buried, even if she had a funeral, her bones 'could move away' on the sloping surface of the cave.[90]

What did the circumstances of the homo-find indicate?

During the excavation of the Subalyuk cave the finds were transported first to the Oszla-hunting lodge. They were not separated, the possibly human and the animal bones remained together. Later on the yielded 'human suspicious metatarsus' was already handled separately. On 27th of April, during the partial excavation of the level 11/III, József Horváth and József Kovács found a fragment of a disintegrated mandible. The unidentifiable bone-debris was sorted to the 'animal-suspicious' finds. They did not recognize the human sacrum. Dancza personally did not find any of the caveman finds in the Subalyuk cave. Only the description in the publication witnessed about the 'authentic' state of the caveman find-material. We have not got any authentic data (photo, find-description) about the state of the caveman-finds 'before their dilapidation'. Only Dancza had information on the uninjured finds and others were informed also by him (1932; 1933). The Collecting-inventory, introduced by Kadić, was started by Mottl only from the end of May.

Dancza did not name the bones of the child, 'other remains' [91], and other skeletal elements' [92] can be found in his descriptions, what is not surprising, because the skull of the child fall into more than 90 pieces! Dancza and Kadić were not anatomists, but Bartucz was!

Kadić's list about the infant-bones[93] - as mentioned earlier - was completed by BARTUCZ, L. with the *limb-bones*. [94] The only surprising thing in this list, that these bones were never seen by anyone, taken into anybody's hand! Otherwise still one of the most difficult bone-identification exercise is the distinction of the bones of a child and a bear cub. It could mean something, that neither of the two experts of great experiences, Mottl and Bartucz could identify the 'infant bone-finds'![95] Bartucz never corrected his earlier (1933) mistake. As the years past his conviction in the fact, that an 'in-situ infant-skeleton' was ruined during the excavation, has become more proved. Therefore he condemned the excavators, that they did not nominate a *committee* to the aim of certifying the disturbance and the inhesion of the find.[96] However the infant-bones, which '*cannot be identified*, [...] *totally inappropriate for scientific observation'*[97]did not call out for a committee! However, the professional integrity of Bartucz included, that the postcranial skeletal elements of the child were never described 'scientifically' in his anthropological studies.

It is thought-provoking: were these Homo-remains indeed? Certainly were not. This basic misunderstanding need to be clarified: neither the skeleton of an adult, nor of an infant was found in Subalyuk! A human has 206 pieces of discrete bones. Only 17 or 10 pieces of bone remains of the adult female and 1 or 5 (?!) pieces of the child were found in the Subalyuk cave (***Table 7.***).

Whether the child was '[…] intentionally buried under the fireplace?' asks Mester[98] Since the caveman-bones had been there earlier, than the layer 11 was formed, deposited over the bone-layers and the fireplace in it was in use, the question is a little bit striking. It is like to ask, whether the fire was intentionally set above the Homo remains, lying the just beneath the hearth. Since there was no pit, grave, the establishment of the fireplace is an event of a later period.

[89] MESTER 2008b, 102.
[90] MESTER 2008b, 103, 105. - Unfounded opinion may deriving from the lack of anatomical knowledges or from the ignorance of the finds.

[91] DANCZA 1938,19.
[92] DANCZA 1938, 62.
[93] KADIĆ 1933a, 19.
[94] BARTUCZ 1934, 142.
[95] BARTUCZ 1938, 56; 92.
[96] BARTUCZ 1934, 145.
[97] BARTUCZ 1938, 56; 92.
[98] MESTER 2008b, 103.

When? 100, 1000, or 10000 years later, it is unknown. According to the subsequently made 'site drawing'[99] all of the caveman-bones from the cave were found along the northern wall, in the middle of the quadrate 16/15 (1 m west from the O point of the cave), inside the set ca. 3 m radius circle. Compared to the 'central positioned' infant skull, the 5 pieces of bone-remains of the quadrate 12 (finds 6-10) and the 3 pieces of bone-remains of the quadrate 11 (finds 3-5) were found in clusters, 2 meters eastwards. The sacrum was lying in quadrate 18, 3 meters west, the metatarsus in the quadrate 14, 3 meters south. On two of the bones of the adult female there are marks of carnivore bites on their surfaces (sternum, corpus vertebrae).[100] The damages on other vertebrae, metacarpal bones and phalangi –similar to the animals – had natural origin. The presence of the human patella is not a unique phenomenon, 5 pieces of patellae of three mammals were also found in the Subalyuk cave. In the Pilisszántó rock-shelter 157 pieces of patellae of reindeer were found.[101]

In the second half of the 1990-ies Ringer and Solt collected soil samples from the right wall-rift near the 'Entrance' of the *Csarnok* (could be equivalent of the layer 11? +Upper Layer-group). From the submitted vertebrate find-material, a tooth-fragment of a Neanderthal was identified by Kordos[102], which is an entoconid-hypoconulid enamel-fragment of the crown of a left side inferior M_2.[103] The tooth-find shows well, that the homo-finds were spread in a bigger area. In the other hand the left side M_2 fragment means, that there were the remains of not 2, but 3 Neanderthals in the Subalyuk cave. The bones of the caveman of Subalyuk [*Homo primigenius* Wilser = *Homo sapiens neanderthalensis* (King 1864.)] – with most of the animals remains – got into the cave as the preys of the large carnivores. There are not chew-marks on the generality of the animal bones. It is simple to explain: what the large carnivores did not chew, there is not chew-marks on it! From the 'chewed' bones the meat was gnawed off.

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[99] BARTUCZ 1938, Fig. 1–2.
[100] BARTUCZ 1938, 86; Table III 3, 7; 1966. Fig. 1a–b.
[101] VÖRÖS 1987, Table 3; Fig. 2.
[102] RINGER 1993, 85.
[103] KORDOS 1993, 116, Fig. 1; 1995, 28.

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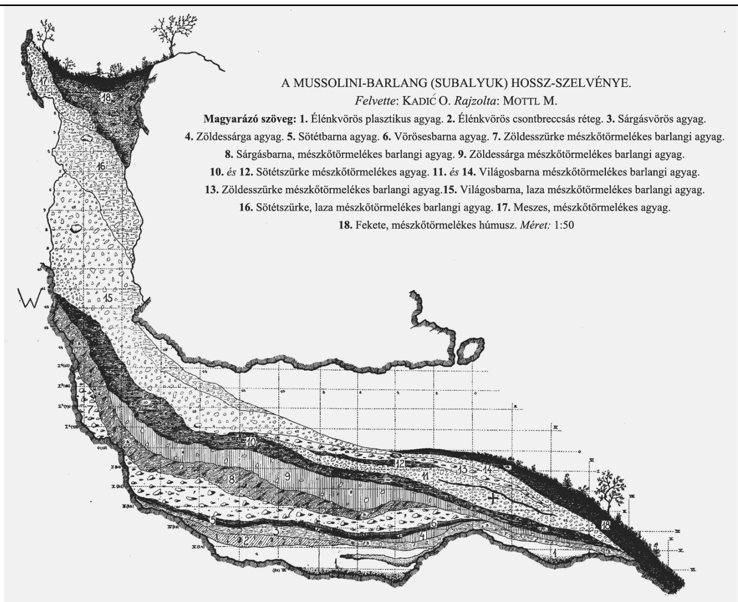

Fig. 1. *Longitudinal section of the layer sequence of the Subalyuk cave (Recorded by, on the basis of sketches of J. Dancza, by O. Kadić. Drawing finalised by M. Mottl in* KADIĆ *1940, 159.)*

Succession of *Előtér* (Foreground), *Csarnok* (Hall) and *Zsomboly* (Shaft) 1932.		
Lower layer group	**Thickness**	**Note**
1. Bright red plastic clay	1 m	only a few bones
2. Bright red clay with bone breccia	0.5 m	lack of Palaeolithic finds
3. Yellowish red clay with Palaeolithic finds	0.3 m	2nd lower cave cultural-layer bones: rarely
Upper layer group		
4. Greenish yellow clay	0.35 m	lack of bones, a few stone-tools
5. Dark brown clay	0.20 m	stripe of the fireplace running along, few cave bear remains
6. Reddish brown clay	0.10 m	lack of bones
7. Greenish gray cave loam with limestone debris	1–1.5 m	quite a lot of bones
8. Yellowish brown cave loam with limestone debris	0.5–1.5 m	a fair number of bones
9. Greenish yellow cave loam with limestone debris	0.15–1.5 m	many bones
10. Dark gray cave loam with limestone debris Lower layer	0.5 m	rather barren
11. Light brown cave loam with limestone debris Lower layer	1.5 m	1st upper cave cultural-layer, Homo, inclined" fireplace-layer
12. Dark gray cave loam with limestone debris Upper layer	0.25 m	1st upper cave cultural-layer, a few bones
13. Greenish gray cave loam with limestone debris		
14. Light brown cave loam with limestone debris Upper layer		1st upper cave cultural-layer, microfauna, varied faunal remains
15. Light brown loose cave loam with limestone debris	max. 2.5 m	barren
16. Dark gray loose cave loam with limestone debris	3.5 m	barren
17. Calcareous, loessy cave loam with limestone debris	1 m	fox and wolverine
18. Black, gray humus with limestone debris		Holocene fauna

Succession of *Folyosó*, Subalyuk cave (KADIĆ 1938b 35, 1940 163)				
1932 Layers of *Folyosó* (Corridor)		Thickness	Correlation with the layers of the Csarnok (Hall)	
Levels	**bottom-up**	**max.**	**same***	**suggested layer**
F1.	Greenish gray cave loam with limestone debris	1 m	Cs. 7.	Cs.7 F1.**
F2.	Reddish brown cave loam with limestone debris	0,5 m	Cs. 6.	F2.
F3.	Greenish gray cave loam with limestone debris	1,5 m	Cs. 13.	F3.
F4.	Dark gray cave loam with limestone debris	0,5 m	Cs. 12.	F4.
F5.	Light brown loose cave loam with limestone debris	0,5-2 m	Cs. 11.	F5.
F6.	Yellowish brown cave loam with limestone debris	1 m	Cs. 8.	Cs.8. F6.

*Kadic 1938b 44. *Folyosó* Segment No. 22, ** Mester, Zs. 1989, Figure 5.

Table 1. *Layers of the Subalyuk cave (KADIĆ 1938b, 31–35, drawings: 37–38; 1940, 158–64, Map Annex II – Figure 1.: KADIĆ 1940, 159–164.)*

Species / Layer	**1.**	**2.**	**3.**	**5.**	**7.**	**8.**	**9.**	**10.**	**12.**	**11./14.**	**17.**	**Corridor**	**Total**
Layer Group	**Lower**			**Middle**				**Upper**				**Folyosó**	
Lepus sp. (europaeus Pallas 1778) hare			3							9			12
Ochotona pusillus (Pallas 1778) steppe pika										12			12
Sciurus vulgaris L. 1758 red squirrel										1			1
Citellus citellus L.1766 ground squirrel										3			3
Cricetus cricetus (L. 1758) hamster										24			24
Mus sp. (sylvaticus L. 1758) forest mouse										1			1
Microtus arvalis-agrestis group										3			3
Arvicola sp. [terrestris (L. 1758)] water vole										11			11
Spalax sp. (leucodon Nordmann 1840) mole rat										6			6
Allactaga jaculus (Pallas 1779) jumping mouse										1			1
			3							71			74
Ursus spelaeus Rosenmüller-Heinroth 1794 cave bear	+	+	+		+	+	+	+	+	+			
Ursus arctos L. 1758 brown bear	1		1							1			3
Canis lupus L. 1758 wolf	15	21	11	1		1	18	14	3	12		2	98
Thos sp. indet jackal										1			1
Vulpes vulpes (L. 1758) red fox	1	1	6	1			9	5	1	14			38
Cuon alpinus Pallas 1811. wild dog			2										2
Meles meles L.1758 badger										1			1
Lutra sp. indet. otter												1	1
Martes martes (L. 1758) pine marten										4		2	6
Mustela erminae L. 1758 ermine								3					3
Mustela nivalis L. 1758 stoat										1			1
Putorius eversmanni (Lesson 1827) polecat							1			2			3
Gulo gulo L. 1758 wolverine											2		2
Panthera (Leo) spelaea (Goldfuss 1810) cave lion	4	5					1	7		1		1	19
Panthera (Felis) pardus (L. 1758) cave leopard										1			1

Species / Layer	1.	2.	3.	5.	7.	8.	9.	10.	12.	11./14.	17.	Corridor	Total
Layer Group	**Lower**			**Middle**				**Upper**				**Folyosó**	
Crocuta (Hyaena) spelaea (Goldfuss 1823) cave hyena	5		2	1	24	3	18	9		7		4	73
Lynx lynx L. 1758 lynx	2	1	1										4
Carnivore	28	28	23	3	24	4	47	38	4	45	2	10	256
Sus scrofa L. 1758. wild boar				1									1
Mammuthus primigenius (Blumenbach 1799) mammoth						3	3	3		9			18
Asinus hydruntinus (Regalia 1907) european wild ass										1		3	4
Equus abeli-mosbachensis group	4	2	5	3			6	5	19	42		1	87
Coelodonta antiquitatis (Blumenbach 1807) woolly rhinoceros	5	9	5			2	4	1				1	27
Rangifer tarandus (L. 1758) reindeer							3			1			4
Megaloceros giganteus (Blumenbach 1803) Irish elk										1			1
Cervus sp. [maral (Gray 1850)] Maral red deer						1	7		1	7		1	17
Cervus elaphus L.1758 red deer	3	3	2	1			1		4	4			18
Rupicapra rupicapra (L. 1758) chamois	6		1	2			9	4	3	26		3	54
Capra sewertzowi-ibex. csop. alpine ibex	+	+	+	8		7	23	26		13		1	78
Ovis sp. indet. wild sheep										3			3
Bison priscus ssp. steppe bison										6		3	9
Bos primigenius Bojanus 1827 aurochs	1		3	1		2	1	1	2	5		1	17
Herbivore	19	14	16	16		15	57	40	29	118		14	338
Total	**47**	**42**	**42**	**19**	**24**	**19**	**104**	**78**	**33**	**234**	**2**	**24**	**668**

Table 2. *The mammalian fauna of Subalyuk cave by the layers (MOTTL 1938, 209-225, pieces)*

Layer 11 1932 (idenfied by Jánossy, D. 1960 72)	pieces
Myotis myotis (Brokhausen 1797) greater mouse-eared bat *	1

1956 collected by Vértes, L. (JÁNOSSY 1960, 71–72.)

Fundstelle A. about layer 11 (1956), Revid. Upper layer group	pieces
Pisces sp. indet fish	1
Ranida sp. indet frog	1
Ophidia sp. indet. snake	1
Sicista cf. subtilis (Pallas 1773) southern birch mouse *	1
Citellus cf. citellus L.1758 ground squirrel	1
Dryomys nitedula (Pallas 1778) forest dormouse *	1
Myodes (Clethrionomys) glareolus (Schreber 1780) bank vole *	1
Lagurus aff. lagurus (Pallas 1773) steppe lemming *	12
Microtus arvalis (Pallas 1779) common vole *	9
Microtinae indet. (kis alak) vole	3
Arvicola cf. terrestris L 1758 water vole	1

1956 collected by Vértes, L. (JÁNOSSY 1960, 72.)

Fundstelle B. about layer 12 (1956), Revid. Estuary of the Folyosó Upper layer group	pieces
Bufo sp. toad	1
Lacerta sp. indet. lizard	1
Ophidia sp. indet. snake	1
Aves sp. indet bird	4
Sorex araneus L. 1758 common shrew *	1
Pipistrellus pipistrellus (Schreber 1774) common pipistrelle *	1
Myotis nattereri (Kuhl 1817) Natterer's bat *	2
Myotis daubentoni (Kuhl 1817) Daubenton's bat *	2
Eptesicus nilssonii (Keyserling et Blasius 1839) northern bat *	3
Sicista cf. betulina (Pallas 1773) northern birch mouse *	1
Spalax cf. leucodon Nordmann 1840 mloe rat	1
Apodemus cf. sylvaticus (L. 1758) wood mouse *	1
Cricetus cricetus (L. 1758) hamster	1
? Myodes (Clethrionomys) glareolus (Schreber 1780) bank vole	1
Lagurus aff. lagurus (Pallas 1778) steppe lemming	1
Microtus arvalis (Pallas 1779) common vole	24
Microtinae indet. (kis alak) vole	11
Arvicola cf. terrestris L. 1758 water vole	1
Ochotona pusilus (Pallas 1778) steppe pika	1

1964 collected by Jánossy, D. – Topál, Gy. (JÁNOSSY 1979, 131.)

abut layer 3 (1964), Revid. Upper layer group	pieces
Allactaga major (Pallas 1779) jumping mouse	2
Apodemus sylvaticus (L.1758) wood mouse	2
Lagurus lagurus (Pallas 1773) steppe lemming	80
Microtus arvalis (Pallas 1779) common vole	44
Microtus gregalis (Pallas 1776) narrow-headed vole *	3
Ochtonona pusilus (Pallas 1778) steppe pika	1

1990s collected by Ringer, Á. and Solt, P., identified by Kordos, L. (Ringer 1993, 85.)

1990 about layer 11, loessal layer, Revid. 11? + Upper layer group	
Salientia indet. Anura frog	1
Chiroptera indet. bat	2
Glis glis (?) (L. 1758) edible dormouse *	1
Microtus gregalis (Pallas 1776) narrow-headed vole	2
Lagurus lagurus (Pallas 1773) steppe lemming	2
Homo sapiens neanderthalensis Neandrethal	1
1990 about layer 12 Revid. cave 12 + Upper layer group	
Pisces indet. fish	2
Salientia indet Anura. frog	4
Lacerta indet. lizard	1
Aves indet. bird	4
Ophidia indet. snake	4
Sorex minutus L. 1758. Eurasian pygmy shrew *	1
Sorex araneus L. 1758. common shrew	1
Ochotona sp. steppe pika	5
Sicista sp. mouse	1
Apodemus sylvaticus-tauricus csop. mouse	2
Arvicola sp. water vole	1
Lagurus sp. steppe lemming	1
Microtus gregalis (Pallas 1776) narrow-headed vole	4
Microtus arvalis (Pallas 1779) common vole	3
Myodes glareolus (Schreber 1780) bank vole	1
1990 Zsomboly, layer16 Revid. layer 15/16	
Salientia indet. Anura frog	2
Ophidia indet. snake	1
Lacerta indet. lizard	2
Aves indet. bird	3
Sorex minutus L. 1758. Eurasian pygmy shrew	1
Sorex araneus L. 1758. common shrew	1
Sicista sp. mouse	3
Microtus gregalis (Pallas 1776) narrow-headed vole	1
Arvicola sp. water vole	3

Ringer 1993, 86; identified by Kordos, L.

1990 Kadić layer 17? Revid. layer 16/17	
Lepus sp. hare	1
Microtus gregalis (Pallas 1776) narrow-headed vole	1

1990 Zsomboly, layer 20?	
Ophidia indet. snake	1
Arvicolidae indet. vole	2
1990 Zsomboly, layer 22?	
Microtus arvalis (Pallas 1779) common vole	1

* New species added to the small mammal fauna from 1932

Table 3. *Small vertebrate finds of Subalyuk cave collected in 1932, 1956, 1964 and in the 1990s (pieces)*

	1932 Collected by Kadić-Mottl (JÁNOSSY 1962 175-188, 1979 131-132)	**Layers**	
	Bird species	1–4.	10–16.
		pc	pc
1.	Anas platyrhynchos L mallard – water	1	
2.	Anas querquedula (L.) garganey – reedy lakes, rivers		1
3.	Gypaëtus barbatus (L.) bearded vulture – high mountains, scavenger	1	1
4.	Aegypiida indet.		
	Aegypius monachus L.* cinereous vulture - high mountains, scavenger	1	
5.	Falco peregrinus Tunst.		
	Falco cf. peregrinus Tunstall 1771.* peregrine falcon - mountains		1
6.	Falco cf. vespertinus L. red footed falcon – lowland forests		1
7.	Buteo buteo L. common buzzard – wooded areas	1	
8.	Lyrurus tetrix (L.) black grouse - mountains; swampy areas surrounded with forest, turf bog with groves	2	9
9.	Tetrastes bonasia (L.) hazel grouse - mountainous, hummocky forest		1
10.	Perdix perdix (L.) grey partridge – steppe environment, glades of groves, meadows	2	3
11.	Coturnix coturnix (L.) common quail – dry grasslands		3
12.	Rallus aquaticus L. water rail – watery habitat, thick aquatic vegetation		1
13.	Otis tetrax L. little bustard – broad grassy plains		1
14.	Numenius arquatus (L.) eurasian curlew - boggy, grasslands with willow-bushes, peat lands, migratory		1
15.	Columba palumbus L. wood pigeon – forest edges		1
16.	Asio otus (L.) long-eared owl – plains-hills, forest species		4
17.	Bubo bubo (L.) eurasian eagle owl – protuberant cliffs of forests		1
18.	Apus melba (L.) alpine swift – rocky mountains	1	
19.	Riparia cf. rupestris Scopoli sand martin – plains-hills, high loess-, sand-, or clay-walls, migratory		1
20.	Pica pica (L.) magpie – sparse woody, bushy groves, pastures		1
21.	Pyrrhocorax graculus (L.) chough – high mountains, visitor	2	4
22.	Plectrophenax nivalis (L.) snow bunting – winter visitor, northern coast		3

* completed data in 1979 (1979, 131-132)

1956 collected by Vértes, L.

	about layer 12 (Jánossy 1979 131), Revid. Folyosó layer 7	
	Aves sp. indet bird	4

1964 collected by Jánossy, D. - Topál, Gy.

	about layer 3 (Jánossy 1979, 131), Revid. Upper layer group	
23.	Falco tinnunculus Tunstall common kestrel, open grasslands, hills	1
8.	Lyrurus tetrix (L.) black grouse	1
10.	Perdix perdix (L.) grey partridge	2
18.	Apus melba (L.) alpine swift	1

	about layer 11 (Jánossy 1979, 131)	
24.	Aegolius funereus (L.) boreal owl, high mountains, coniferous forests	1

Table 4. *Avifauna of the Subalyuk cave (pieces of bones)*

Levels of vegetation		**I.**	**II.**	**III.**	**IV.**	**V.**	**Total**
Cave layers		**3.**	**5.**	**7.**	**9.**	**11.**	
		Lower	**Middle**			**Upper**	
Corylus	hazel	2		1?			3
Prunus spinosa	blackthorn+	3				2	5
Cornus	dogwood	4 *				1	5
Cornus-Betula-Corylus	dogwood-birch-hazel	1					1
Crataegus	hawthorn	1					1
Sorbus	rowan	1					1
Rhamnus cf. cathartica	buckthorn	24 *	16			6	46
Carpinus	hornbeam	16 *				1	17
Acer	maple	11	6				17
Fraxinus	ash	2					2
Quercus	oak	1					1
Populus	aspen	4					4
Tilia	linden		2		*		2
	deciduous trees	11					11
	coniferous trees	7	14	10	5	6	42
Abies	fir	2				3	5
Pinus	pine	69	19	81		17	186
Pinus silvestris	Scots pine	* 1	* 1	7			9
Pinus cembra?	Swiss pine	7	6	9		2	24
Pinus cembra	Swiss pine	2		16		* 3	21
Larix	larch	*	*	*	*	*	
Larix-Picea	larch-spruce	58	268	2	17	21	366
							653

* identified by HOLLENDONNER 1938, 311, 315

Table 5. *Charcoal remains of the Subalyuk cave (STIEBER 1968)*

Species	**pc**	**Head**	**Trunk**	**Meaty limb**	**Dry-limb**	**Phalangi**
Lower layer group						
hare	3			2	1	
brown bear	2	1			1	
wolf	47	12	5	12	11	7
red fox	8	4		3	1	
alpine wild dog	2	2				
cave lion	9	2			2	5
lynx	4				2	2
cave hyena	7	5			1	1
wild horse	11	3		1	3	4
rhinoceros	19	1	2	3 (1 path.)	11	2
red deer	8	3			2	3
chamois	7	2			2	3
aurochs	4	1			3	
Total	131	36	7	21	40	27
%		27,5	5,4	16,0	30,5	20,6

Upper layer group	**pc**	**Head**	**Trunk**	**Meaty limb**	**Dry-limb**	**Phalangi**
hare	9			7		
brown bear	1					1
wolf	49	12	12	2	15	18
jackal	1				1	
red fox	30	9	9	4	10	6
cave lion	9	2	2		3	3
cave leopard	1				1	
cave hyena	62	37	37	6 (3 path.)	9	10
wild boar	1				1	
mammoth	18	15	15		3	
wild ass	1	1	1			
wild horse	73	54	54	4	8	7
rhinoceros	7	1	1	1	4	1
reindeer	4	1	1			3
Irish elk	1	1	1			
Maral red deer	16				3	13
red deer	10	9	9			1
chamois	44	1	1	1	14	28
alpine ibex	80	54	54	5 (1 path.)	7	12
aurochs	12	1	1	1	7	3
steppe bison	6				4	1
Total	435	198	9	31	90	107
%		45,6	2,0	7,2	20,6	24,6

Table 6. *Distribution of the animal remains from Subalyuk cave by the body regions (pc)*

DANCZA 1932; PATAKI–PÁLOSI–DANCZA 1938, 9–20.	Catalogue of Dancza made in 1933, published by BARTUCZ 1938, 61–63.	BARTUCZ 1938, 47–99.	PAP et al 1996, 233–270.
Subalyuk I.			**Subalyuk 1.**
p. 14–20.	p. 61–62, Figure 1–2	p. 55–56, 63–92.	p. 236–252.
adult	adult	female, age 40-45.	female, age 25–35.
8 pieces	11 pieces	17 pieces	10 pieces
20th of February 14/II. "human likely metatarsus"	1. metatarsus	1. mandible 1/a. pars mentalis sin.C, I_{1-2}, dext. I_{1-2} ,C, P_1, 1/b. corpus mandb. sin. P_2+M_{1-2-3}, separated dext. M_{1-2-3}	1. mandible
	12th of April 18/II. 2. sacrum (hurt)	2. atlas fr. (2 lateral side)	3. atlas (3 pieces)
27th of April 11/III. mandible	3. mandible (hurt)	3/a. corpus+ sin. arcus vert. (? v. thorac.I.)	
28th of April 11/III. sternum	4. sternum	3/b. corpus+ sin. arcus vert. (? v.thorac.II/III.)	
28th of April 11/III. metacarpus	5. metacarpus	3/c. corpus+ sin. arcus vert. (? v.thorac.XI/XII.)	
2nd of May 12/III. infant vertebra	6. infant vertebra	3/d. proc. spinosus fr. (? vert.thorac.)	
	2nd of May 12/III. 7. metatarsus	4. arcus fr., + proc. spinosus (? v. lumb.)	
2nd of May 12/III. incisive	8. incisive	5. sacrum I-II.-III.fr.	4. sacrum
	2nd of May 12/III. 9. patella	6. manubrium sterni	2. manubrium sterni
2nd of May 12/III. vertebra	10. vertebra	7/a. metacarpus II. prox. sin.	6./1. metacarpus II. sin.
		7/b. 1. dig. phalanx I.	
		8. patella sin.	5. patella sin.
		9/a. metatarsus II. dext..	6/3. metatarsus II. dext.
		9/b. metatarsus IV. prox. dext.	6/4. metatarsus III. fr. dext.
		9/c. metatarsus IV. sin.	6/5. metatarsus IV. sin.
		9/d. phalanx I.prox.	
		9/e. 2. dig. phalanx I. fr.	6/2.3. dig. I. prox. sin.
Subalyuk II.			Subalyuk 2.
p. 19.	p. 62–63.	p. 56, 92–99.	p. 252–267.
infant	infant	age 6-7 (p. 97-98.)	age 3-4 (p. 253.)
3rd of May 15/III. collapsed skull and „other fragments'	11. skull, and „other skeletal parts'	neurocranium	neurocranium
		maxillae, max. sin.+ 5 teeth	maxillae + 10 teeth
		7 separated teeth	
		os nasale sin.	os nasale sin,
			2 vert. cervicale
			2 vert. thoracale

Table 7. *Human remains from the Subalyuk cave*

MODELLING THE RELATIONSHIP OF THE UPPER PALAEOLITHIC COMMUNITIES AND THE ENVIRONMENT OF THE CARPATHIAN BASIN DURING THE UPPER WÜRMIAN

PÁL SÜMEGI

Keywords: *Palaeolithic, radiocarbon dating, sedimentology, Quaternary malacology, palaeoenvironment*

Introduction

According to malacological data from 36 radiocarbon dated Upper Würmian loess profiles the first chronological unit determined from the inferred palaeoclimatic changes embeds a period between 32,000–25,000 BP years. This unit was correlated by the Denekamp interstadial[1] located at the boundary of the Middle and Upper Pleniglacial in Western Europe[2], and between the SPECMAP 2 and 3 isotopic stages[3]. The palaeosol horizons dated into this period can be correlated with the Stillfried B palaeosol. According to the available malacological data, this period can be divided into two parts. The older phase between 32,000–27,000 uncal. BP years was characterized by milder and more humid conditions. While the younger phase representing the period between 27,000–25,000 uncal BP years was characterized by lower temperatures and drier conditions.

For this time period we could infer mean July palaeotemperatures ranging around 19-20 °C in the southern parts of the Carpathian Basin, 18 °C in the central parts of the Great Hungarian Plains, and 17 °C in the Northern Mid-mountains and the southern foothills of the Northern Carpathians, respectively. This N-S trend observable in the distribution of the temperature values is congruent with the differences observable between the individual parts of the country even today; i.e. a 2-3 °C difference between the northern and southern parts. Furthermore, we had only minimal deviations from the modern temperature values here being in the range of 2-3 °C implying the presence of very mild conditions between 32,000–27,000 uncal BP years.

There were large-scale differences in the climatic conditions observable at the micro-scale, in accordance with the topography, as it could have been clearly justified by the analysis of the mollusc fauna of the palaeosol horizon of the Nagy Hill profile at Tokaj, corresponding to this period[4] as well as the embedded charcoal remains[5]. Thanks to the versatile topographic conditions mean July palaeotemperatures ranging between 14-17 °C could have been reconstructed for the different slopes characterized by different exposition. It's worth mentioning that from the bedrock of the Nagy Mohos peat-bog of Kelemér[6] managed to infer a similar strong warming in the climate via the advent of thermomesophilous deciduous arboreal elements during this time as well. From the palynological results[7] we could have inferred mean July palaeotemperatures of 16-17 °C in the Kelemér valley[8] during this time, which is congruent with the values of the mid-mountains reconstructed via the application of the malaco-thermometer method.

According to our palaeobotanical data, a mixed taiga dominated by spruce must have emerged in the area of the Northern Mid-mountains and its foothills during this time (***Fig. 1.***). It might be important to know in reconstruction of the surrounding environment of the Palaeolithic hunters, that several

[1] WEST 1988.
[2] ZAGWIJN 1961; 1974.
[3] SHAKLETON 1977; SHAKLETON–OPDYKE 1973; SHAKLETON et al. 1983; 1984; IMBRIE et al. 1984; RUDIMANN et al. 1989.
[4] SÜMEGI–HERTELENDI 1998.
[5] RUDNER–SÜMEGI 2001.
[6] JUHÁSZ 2002, 46.
[7] JUHÁSZ 2002; MAGYARI 2001.
[8] JUHÁSZ 2002, 46; SÜMEGI et al. 2008.

Picea charcoal remains studied by Edina Rudner[9] have been recovered from the Palaeolithic sites themselves (Bodrogkeresztúr-Henye-tető: 26,318 ± 365 uncal BP; Megyaszó, Szeles-tető: 27,070 ± 680 uncal BP; Püspökhatvan-Diós, Öregszőlő: 27,700 ± 300 uncal BP; Hont-Parassa III/Orgonás: 27,350 ± 610 uncal BP years).

Results

All these data seem to underlie that the earliest Gravettian hunting groups appearing during an interstadial at the end of the Middle Würmian in the Carpathian Basin[10] must have populated spruce woodlands containing thermomesophilous arboreal elements (*Carpinus* – hornbeam, *Salix* – willow, *Alnus* – alder, *Betula* – birch, *Pinus sylvestris* – Scotch pine and possibly *Corylus* – hazelnut, *Tilia* – linden, *Quercus* – oak) as well. Sporadic changes in the dominance of shade-loving mollusc species, as well as the scattered distribution of the charcoal remains forming major spots refer to the presence of variegated mixed taiga woodland containing steppe elements (forest steppe). The differences in exposure between the slopes might have contributed to the emergence of minor spots, characterized by warmer conditions harbouring thermomesophilous arboreal elements within the spruce woodland. A modern analogy of this spruce woodland can be found in the Altai Mts. where a mixed spruce woodland of loose stands can be found at lower elevations containing such elements as Norway pine, alder, willow and oak (*Quercus mongoliensis*)[11]. According to the data of STIEBER and RUDNER–SÜMEGI[12] this spruce woodland can be traced within the Carpathian Basin as far as the Transdanubian Mid-mountains, turning gradually into forest steppes dominated by Norway pine and birch in the southern parts of Transdanubia and the Danube-Tisza Interfluve. While the area of the Hajdúság in the Tiszántúl harboured thermo-mesophilous steppes at the same time. Finally the areas of the Hortobágy, Nagykunság, and Körös-Maros Interfluve were characterized by floodplain areas studded by alkaline steppes. These open vegetation areas were studded by gallery forests running along the watercourses, and were characterized by hydromorphic, black earth and alkaline soils (***Fig. 2.***), parallel with the podzolic soils of the Northern Mid-mountains. The area of the Danube-Tisza Interfluve was characterized by wind-blown sand deposition and movement as well as the development of soils under a highly special forest steppe vegetation composed of dominantly Norway pines and birches. The southern parts of Transdanubia were covered by evenly distributed woodlands, and clear signs referring for the closure of the arboreal vegetation could have been found in the former fauna and flora there. To my mind[13], a major environmental boundary must have emerged in the centre of the Carpathian Basin (***Fig. 2.***) dividing it into two parts characterized by different evolutionary histories of the vegetation. These regional differences follow the same trends as observable today, only the composition of the vegetation was different from the modern one. These differences between this former vegetation characterized by a dominance of pines at 32,000–27,000 uncal BP years, and the modern vegetation characterized by a dominance of deciduous trees must be attributed to the shorter growth periods and the cooler winter temperatures during the interstadial. Nevertheless, it's rather surprising that the Gravettian sites of this period are restricted to the spruce woodlands of the Northern Mid-mountains.

Several researchers, primarily geographers[14] have questioned the reliability of our temperature reconstructions considering them too high. They have also debated our data referring to the presence of thermo-mesophilous arboreal elements in the vegetation, especially that of Carpinus (hornbeam) along with the presence of two biogeographic units, despite the fact that several archaeologists have noted the presence of two climatic-economic units within this relatively closed system of the Carpathian Basin during the Upper Palaeolithic, based on archaeological results[15].

In order to put an end on these debates, we have attempted to compare our vegetation and palaeoenvironmental data with those of the neighbouring areas to disprove the hypothesis according to which the Carpathian Basin was nothing else but an alternation of cold and warm desert conditions during the stadials and interstadials of the Würmian. We have tried to gather all the available information from coeval archaeological (Willendorf, Dolní Věstonice, Pavlov[16]) as well as environmental historical (pollen and macrocharcoal) sites: Lago Grande di Monticchio[17], Les Echets[18], Lac du Bouchet[19], Grands Pile[20], Monte Cavallo[21],

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[9] WILLIS et al. 2000; RUDNER–SÜMEGI 2001.
[10] GÁBORINÉ CSÁNK 1980; T. DOBOSI 2000.
[11] SÜMEGI 1996; SÜMEGI et al. 1999.
[12] STIEBER 1967; RUDNER–SÜMEGI 2001.
[13] SÜMEGI 1995; 1996.
[14] FÁBIÁN et al. 2004; KOVÁCS et al. 2007.
[15] GÁBORINE CSÁNK 1980, 217.
[16] DAMBLON 1997.
[17] WATTS et al. 1996.
[18] DE BEAULIEU–REILLE 1984.
[19] LALLIER-VERGÈS et al. 1991.
[20] GUIOT et al. 1989.
[21] FUCS 1969.

Korrestobel[22], Bärenhöhle[23], Baumkirchen[24], and Tischofer-Höhle[25].

According to the gained information from the literature, our findings can not be treated as unique to the Carpathian Basin by any means. Since numerous charcoal remains of *Picea* and those of *Pinus cembra*, *Larix-Picea*, *Pinus sylvestris*, *Juniperus*, *Abie*s, *Taxus baccata* have been recovered from various sites in the layers dated between 32,000–25,000 uncal BP years in Moravia, the Alps and the Vienna Basin (***Fig. 1.***). Besides the coniferous elements, remains of several deciduous elements have also been retrieved (*Betula*, *Salix*, *Tilia cordata*, *Ulmus betulus*, *Populus*, *Fagus silvaticus*, *Quercus robur*, *Corylus avellana*) implying the development of favourable microclimatic conditions and a warming of the climate. The pollen charts containing information from this studied interstadial interval all indicated the appearance and expansion of thermomesophilous elements along with a strong advent of the coniferous forms during this period. The complex, systematic comparative archaeological and environmental historical investigations implemented at the sites of Pavlov and Dolní Věstonice[26] have univocally justified the development of gallery forests dominated by pines but containing several thermomesophilous elements as well at the end of Denekamp interstadial, beginning of the Upper Pleniglacial in the valley of the Dyje creek. While the loessy hills elevated over the creek's alluvium and giving the settlement site of the Gravettian hunters was harbouring forest steppes with loose stands of dominantly *Picea* pines. Several thermo-mesophilous arboreal elements also populated these pine woodlands. The higher areas were covered by steppes containing stands of spruce and alpine pine (*Pinus cembra*).

This picture is clearly congruent with the one reconstructed for the southern foothills of the Northern Carpathians and the Northern Mid-Mountains in the Carpathian Basin via the investigation of charcoal, pollen, and mollusc remains, marking the presence of mixed spruce woodlands composed of loose stands of pines and various thermo-mesophilous deciduous arboreal elements in the mid-mountain zone of the Northern Carpathians and probably the northern parts of the Alps as well. The soils of the spruce woodlands must have been affected by intensive podzolization during this climatic stage[27]. Consequently, the distribution of the oldest Gravettian sites seems to be closely linked to that of the spruce woodlands (***Fig. 2.***).

This may refer to the development of a close-knit relationship between the fauna and ecological conditions of these pine woodlands and the life strategies of the oldest Gravettian hunting groups. In order to elucidate something about this special relationship, we were trying to find connections between the prey animals and the former vegetation using information from the literature. The oldest Hungarian Gravettian site is that of Bodrogkeresztúr, Henye-tető[28]. This site yielded numerous vertebrate bones assigned into the Istállóskő fauna phase[29], studied by Miklós KERTZOI and István VÖRÖS[30]. The bones recovered from a surface of 258 m^2 by Viola T. DOBOSI and that of 165 m^2 sampled by László VÉRTES were dominantly those of wild horses, moose, mammoths and buffalos, both in terms of specimen numbers and the amounts of meat yields[31].

When we have a look at the habitat preference of the individual vertebrate species, we can clearly see that the highly complex, mosaic-like patterning in the environment inferred from the results of malacological studies[32] and macrocharcoal analysis[33] is also corroborated by the findings on the vertebrate fauna. However, the extraordinary proportions of steppe elements, especially those of the wild horses calls for further explanation. The camp site of the Gravettian hunters at Henye tető was located in a spruce woodland on the hill. Several drinking sites must have been present on the underlying floodplain along a river, which must have occupied the site of the present-day Bodrog River, at a distance of only 1.0-1.5 km, where the herds of animals dwelling in different habitats must have gathered increasing the chance of a successful hunt for the humans. It is rather interesting that the local environment of the oldest Gravettian sites was characterized by similar natural endowments at each and every Hungarian site (Püspökhatvan-Diós, Püspökhatvan-Öregszőlő, Verseg, Hont-Parassa I.-II.-III.[34]) with a creek valley harbouring mixed taiga woodlands surrounded by loess-covered hills of steppes and spruce forests, the latter giving the camp sites of the hunters, similarly to the coeval sites along the Morava at Dolní Věstonice and Pavlov. It's also worth noting that not a single artifact belonging to the Gravettian culture has come to light from the areas located south of the mid-mountains and the belt of spruce woodlands within this chronological period.

[22] GROSS 1958; 1959.
[23] KNEUSSL 1972.
[24] BORTENSCHLAGER–BORTENSCHLAGER 1978.
[25] KNEUSSL 1973.
[26] MASON et al. 1994; RYBNIČKOVÁ–RYBNÍČEK 1994.
[27] NIKOLOV–HELMISAARI 1991.
[28] VÉRTES 1966; T. DOBOSI 2000.
[29] KRETZOI 1953; JÁNOSSY 1979.
[30] VÖRÖS 2000.
[31] VÖRÖS 2000.
[32] SÜMEGI 1996; SÜMEGI–HERTELENDI 1998.
[33] RUDNER–SÜMEGI 2001.
[34] T. DOBOSI 1994.

This may be attributed to the low number of excavated areas in those regions at the first sight. Nevertheless, it is also quite interesting that no Palaeolithic artifacts have been recovered from the thoroughly investigated palaeosol horizons of the numerous artificial outcrops in Southern Transdanubia or the area of the Alföld, dated into the Denekamp interstadial. On the other hand, as the environmental historical data available for the area imply, a different ecological unit characterized by the dominance of Norway pine and birch forest steppes must have evolved in these latter areas[35]. According to the former anthracological studies[36] there was a gradual increase in the arboreal vegetation cover towards the southern parts of Transdanubia characterized by the presence of such arboreal elements as *Corylus*, *Fagus*, *Quercus*, *Ulmus*, *Fraxinus* besides *Pinus sylvestris* and *Betula*. A very similar pattern is observable in the distribution of the individual mollusc species with the presence of xerothermophilous elements like *Pupilla triplicata*, *Chondrula tridens* along the foothills of the Northern Mid-mountains, complemented by such thermophilous forms as *Granaria frumentum*, *Vallonia enniensis*, and *Helicopsis striata* in the southern parts of the Great Hungarian Plains. While in the southern parts of Transdanubia the deciduous woodland and forest steppe dweller *Cepaea vindobonensis* and the woodland dweller *Aegopinella ressmanni* also turn up in this chronological horizon.

There was a complete turnover in the mollusc fauna at the end of the Denekamp interstadial, and the beginning of the Upper Pleniglacial, characterized by a retreat but by no means complete disappearance of the thermophilous and woodland elements. These must have survived in the protected refugia of the region[37]. This transformation in the mollusc fauna may refer to a global cooling of the climate as the cold-loving elements gave a significant part of the mollusc faunas of the Carpathian Basin during this time with the presence of such forms as the Boreo-Alpine *Columella columella*, *Vertigo modesta*, *V. parcedentata* and the Northern Asian, xeromontane *Vallonia tenuilabris*. Representatives of the newly identified *Pupilla* cf. *loessica*[38] in Hungary have also come to light from this horizon[39].

Even though these cold-loving, open area dwellers composed the major part of the mollusc fauna, significant differences can be observed in their dominance values moving from the north to the south in the basin (NE: >80%, centre 40-50%, S: < 20%). Parallel with this spatial decrease in the proportions of the cold-loving elements, a concomitant increase in the ratio of the mesophilous and cold-resistant forms is observable in the fauna.

We have managed to come across specimens of *Pupilla* cf. *loessica* everywhere in the northern sites, while this taxon was substituted by *Pupilla sterri* in the southern parts of the basin during this period. Thus a mean July palaeotemperature of 14 °C could have been inferred for the southern, southwestern parts of the basin (***Fig. 3.***), while this value could have gone up as high as 15-16 °C in the southern slopes of the hills, sand dunes and the more protected microhabitats[40]. Conversely, the reconstructed mean July palaeotemperature values for the NE parts were much lower around 12 °C. Moreover, even colder temperatures could have developed in the colder, less protected valleys and crests with a tundra-like vegetation during the referred period[41]. However, the southern slopes, thanks to the favourable morphological conditions must have been characterized by mean July palaeotemperatures around 14 °C. Thanks to the special location of the Carpathian Basin[42] at the interface of several climatic influences, several minor protected warm spots and habitats could have survived even during this strongest global cooling between 25,000–22,000 uncal BP, offering a safe haven to the cold-resistant and mesophilous elements. This referred cold stage could have been correlated with the Heinrich 3 event[43].

This assumption is corroborated by the findings of STIEBER [44] who managed to identify charcoal remains of *Pinus sylvestris*, *Picea*, *Pinus cembra*, *Larix*, *Salix* and *Betula* within this chronological horizon. There is only a single radiocarbon-dated profile known to intersect this period in Hungary located in the areas of the Hortobágy, as the ages of the other profiles formerly classified into the Upper Pleniglacial was highly questioned by the newly gained radiocarbon results. According to the observable characteristics in the radiocarbon-dated Hortobágy profile, the cold continental steppes of the period must have been characterized by an advent of such elements as *Poaceae*, *Artemeisia*, *Chenopodiaceae*, with a coeval survival of the alkaline species as well. However, among the APs the presences of *Pinus*, *Picea*, *Juniperus*, *Betula*, *Salix* and *Larix* could have been justified, indicating the presence of a steppe-dominated forest steppe vegetation in the Carpathian Basin under colder climatic conditions. However, the deciduous elements

[35] SÜMEGI 1996.
[36] STIEBER 1967.
[37] SÜMEGI–HERTELENDI 1998; SÜMEGI–KROLOPP 2002.
[38] LOŽEK 1954.
[39] SÜMEGI 1996.
[40] KROLOPP et al. 1995.
[41] SÜMEGI 1996.
[42] SÜMEGI 1995; 1996.
[43] BOND et al. 1992; 1993.
[44] STIEBER 1968.

could have survived despite the a strong global warming in the areas where the milder microclimatic conditions, attributable to the favourable orography were combined by higher humidity values thanks to a higher ground water table (sand dunes, the interface of the natural levees and alluvial plains)[45]. Unfortunately not a single Palaeolithic site have been identified from this period hampering the elucidation of the interrelations between the Upper Palaeolithic hunters and their surrounding environment during the first stage of loess formation in the Upper Würmian (25,000–22,000 uncal BP years).

Conversely, the characteristic advent of the Arctic elements in the vertebrate fauna marks the development of a newer environmental historical phase, the so-called Pilisszántó fauna stage[46]. The macrovertebrate fauna was dominated by reindeer (*Rangifer tarandus*), snow grouse (*Lagopus mutus*) and ptarmigan (*Lagopus lagopus*). The microvertebrates were dominated by *Dicrostonyx*, *Ochonata* along with such sporadic elements as arctic fox (*Vulpes lagopus*), wolverine (*Gulo*), and arctic vole (*Microtus nivalis*). Despite the efforts of PAZONYI[47], this fauna zone could not have been divided into further subzones due to the lack of sufficient radiocarbon dates.

On the other hand, as the example of the Tokaj-Csorgókút profile have clearly demonstrated, there is a good chance for preparing such subdivisions in the zonation of the Upper Würmian vertebrate fauna, by the introduction of new finer sampling methods, the screen washing of more deposits and the implementation of several radiocarbon analysis on the samples, finally leading to a complete re-evaluation of the former results. According to the findings of investigations implemented in this former profile of the Tokaj area, parallel with the dominance of the Northern Asian, xeromontane[48] *Vallonia tenuilabris* in the mollusc fauna, several microvertebrates characteristic of the Northern Asian and Southern Siberian cold continental steppes could have been recorded in this horizon (*Micortus gregalis* as the dominant form, plus *Lagurus*, *Citellus citelloides*, *Allactaga*, *Sicista*[49]). These data, being completely congruent with each other, clearly indicate the appearance of the characteristic forms of the Eastern European and Central Asian loess plateaus in the NE parts of the Carpathian Basin during the times of the strongest coolings, in proportions of no match in other parts of the basin. This picture brings up the possibility of the evolution of an ecological corridor between the two areas during the strongest stadials, microinterstadials, when the Carpathian Basin must have formed the western margin of the Central Eurasian- Eastern European Pleniglacial loess belt, with a fauna poor in species but characterized by high specimen numbers.

On the other hand, according to the findings of the sedimentological[50], malacological[51], anthracological[52], and palynological investigations of the Upper Würmian loess profiles in the Carpathian Basin[53] the loess formation was not continuous in this area during the Upper Würmian or the Upper Pleniglacial as in Western Europe[54]. But this strong cooling phase was interrupted by several alternating short warmings and coolings, lasting for some hundred or some thousand years (microinterstadial) which slowed down loess accumulation in the area. The first microinterstadial was recorded at 21,000 BP years, and was characterized by an increase in different APs (*Sambucus*, *Pinus*, *Larix*, *Picea*, *Betula*, *Alnus*), but the preservation of the original duality of the palaeoenvironmental conditions in the basin. The northern parts were inhabited by mixed taiga woodlands harbouring such elements as *Picea*, *Pinus cembra*, *Pinus mugo*, *Salix*, *Larix*. While the southern mixed taiga woodlands were dominated by such taxa as *Pinus sylvestris*, *Salix*, *Betula*. These latter elements were also present on the floodplains in the company of some thermophilous arboreal taxa (*Quercus*, *Acer*, *Corylus*). The proportions of APs exceeded 70-80 % in the river valleys of the Great Hungarian Plains, and the lower-lying valleys of the mid-mountains. Conversely, alkaline meadows must also have emerged due to edaphic reasons in the extensive floodplain areas located behind the gallery forest-covered river banks (Hortobágy). The southern areas witnessed an expansion of the thermophilous elements of the mollusc fauna during this time (*Granaria frumentum*), while the waterbank areas were populated by eurytpic, hygrophilous forms requiring larger vegetation cover and inhabiting the modern boreal woodlands as well (*Clausilia dubia*, *Perofratella bidentata*, *Arianta arbustorum*, *Discus ruderatus*). Conversely, the closed woodland elements have undergone an increase in the southwestern parts of the basin (*Orcula dolium*, *Vitrea crystallina*). These palaeoenvironmental data imply the survival of the formerly existing mosaic-patterning in the environment and the flora during this time, leading to

[45] WILLIS et al. 2000; DELI–SÜMEGI 1999.
[46] KRETZOI 1969; JÁNOSSY 1979.
[47] PAZONYI 2004.
[48] MENG 1995.
[49] KORDOS–RINGER 1991.

[50] PÉCSI 1975; 1977; 1993.
[51] SÜMEGI 1989; 1995; 1996; SÜMEGI–KROLOPP 1995; 2002.
[52] RUDNER–SÜMEGI 2001; 2002.
[53] SÜMEGI et al. 1999; MAGYARI 2002; MAGYARI et al. 1999.
[54] WEST 1988.

the emergence of mixed, extinct floral and faunal associations. However, a characteristic increase in the dominance of the mesophilous, forest steppe dweller *Vallonia costata* is clearly observable in the majority of the profiles for this time (*Vallonia costata* zonula[55]).

After this microinterstadial, another strong transformation is observable in the flora and the fauna of the Carpathian Basin characterized by the advent of the cold, continental steppe-tundra vegetation in the area of the Northern Mid-mountains, dominated by *Chenopodiaceae*, *Artemisia*, *Poaceae* and such Arcto-Alpine vegetation elements as *Sanguisorba officinalis*, *Thalictrum*, *Epilobium*, *Polygonum bistorta*, *Pleurospermum austriacum*, *Saxifraga oppositifolia*, *S. granulata* type, *Ephedra fragilis* for example[56]. Conversely, APs of trees and bushes like *Betula pubescens*, *Larix*, *Pinus*, *Juniperus* have also been recovered during this stage of the Upper Pleniglacial from the zone of the mid-mountains. The disappearance of the thermophilous molluscs, concomitant with the transformations in the vegetation as well as a retreat of the mesophilous mollusc elements, plus the recurrent advent of the cold-loving, cold-resistant, Boreo-Alpine, Northern Asian steppe and tundra-like habitat preferring molluscs (*Columella columella*, *Vertigo geyeri*, *V. genesii*, *V. parcedentata*, *V. substriata*, *P. sterri*, *P.* cf. *loessica*, *C. nitens* , *Vallonia tenuilabris*) as well as their peak dominance implies the development of a strong cooling in the climate, corresponding to the so-called Heinrich 2 event[57], the Last Glacial Maximum during this time in the Carpathian Basin.

Conversely, according to the findings of the palynological[58] and malacological analyses of radiocarbon-dated profiles from the northern and southern areas of the basin[59], there were significant differences in the palaeotemperatures of the individual regions not only at a regional but a local scale as well. The reconstructed mean July palaeotemperatures in the southern areas of the basin were around 14 °C, while those of the northern parts ranged around 12 °C, as it could have been inferred from palynological[60], and malacological results[61]. On the other hand, there were several micro-areas which were either cold spots with palaeotemperatures below 10 °C and a tundra vegetation or acted as warm spots with highly deviating temperatures of 16 °C at a local scale in the northern parts of the basin. These data further corroborates the presence of a mosaic-like patterning in the environment both at the regional and at a local scale as well. Accordingly the northern parts of the basin and the areas of the mid-mountains must have harboured a mosaic vegetation characteristic of the tundra/taiga boundary today. While the southern parts must have hosted a mix of boreal forest steppes and continental cold steppes with such scattered arboreal elements as *Pinus cembra*, *Larix*, *Pinus sylvestris*, *Betula pubescens*, *Salix*. The local cold-spots must have harboured Arcto-Alpine vegetation elements, while the local warm spots or oasis[62] must have hosted thermomesophilous trees and bushes.

This picture reconstructed by us for the Upper Würmian might be surprising for those who previously assumed a relatively homogenous environment for the area of the Carpathian Basin forming a part of the Eurasian loess belt. However, as our findings clearly demonstrated the source and erosion, transportation and accumulation areas of the material required for loess formation should be by all means separated from one another[63]. In the light of our results, we must account for not only NS but EW trends in the palaeoenvironmental conditions of this belt as well. In our opinion, the observed differences in the vegetation of the Carpathian Basin must be attributed to the fact, that the central parts of the basin must have formed the interface of the sporadic and discontinuous permafrost belts during the Upper Würmian interstadials. And this must be attributed to a similar overlap of several climatic zones or influences during this period to the one observable in the basin today.

Discussion

Nevertheless, one of the fundamental goals of our work was to clarify how these environmental mosaics might have affected the hunting Upper Palaeolithic Gravettian cultures in the basin. Even though we could not gain radiocarbon dates for each and every one of the numerous excavated Upper Palaeolithic sites dating to the Upper Würmian (***Fig. 2.***)[64], the presently available information points to the recurring appearance of these cultural groups in the basin during both the interstadials and stadials of the mentioned period. Conversely, the majority of the radiocarbon-dated Upper Palaeolithic sites seems to be restricted either to the transitional periods between the cold and

55 SÜMEGI 1989.
56 MAGYARI 2002; MAGYARI et al. 2000; 2002.
57 BOND et al. 1992; 1993.
58 SÜMEGI et al. 1999; MAGYARI et al. 2000.
59 SÜMEGI 1989; 1995; 1996; SÜMEGI–KROLOPP 2002.
60 MAGYARI et al. 2001.
61 SÜMEGI 1989; 1995; 1996; SÜMEGI–KROLOPP 2002.
62 WILLIS et al. 2000.
63 SÜMEGI 2001.
64 LACZKÓ 1929; BANNER 1936; GÁBORI 1954; 1969; GÁBORI M.–GÁBORI V. 1957; GÁBORINÉ CSÁNK 1970; 1978; 1984; T. DOBOSI 1967; 1975; 1989; 1993; 1994; T. DOBOSI–KÖVECSES-VARGA 1991; CSONGRÁDI-BALOGH–T. DOBOSI 1995; DOBOSI et al. 1983; 1988; SIMÁN 1989; VÉRTES 1964-1965.

warm waves[65], or to the period dated between 18,000–16,000 uncal BP years at the end of the Upper Würmian.

According to our findings, the species requiring larger vegetation cover underwent an expansion between 18,000–16,000 uncal BP in the areas of the Danube bend, the foothills of the Northern Mid-mountains, as well as the southern parts of Transdanubia, the Tiszántúl and the Danube-Tisza Interfluve (*Mastus venerabilis*, *Discus ruderatus*, *Punctum pygmaeum*, *Clausilia dubia*, *Vestia turgida*, *Macrogastra ventricosa*, *Aegopinella ressmanni*, *Semilimax semilimax*, *S. kotulai*, *Vitrea crystallina*, *Vitrina pellucida*, *Bradybaena fruticum*, *Arianta arbustorum*) becoming dominant elements of the fauna in the studied profiles[66]. Parallel with the expansion of the woodlands elements, and those dwelling at the border zone of the open and closed vegetation areas, the cold-loving and open area dwellers (*Columella columella*, *Pupilla sterri*, *Vallonia tenuilabris*) experienced either a steady decrease, or completely disappeared from the studied faunas[67].

The inferred mean July palaeotemperatures also rose to the values ranging between 14-16 °C, compared to the 12-14 °C values of the Last Glacial Maximum, with an average value of 15.6 °C. It's worth noting that the average mean July temperature values inferred for the NE parts of Hungary were around 15.2 °C, while those of the sites of southern Transdanubia and Great Hungarian Plains were 15.8 °C and 16.2 °C, respectively. These differences and trends in the regional temperature values are congruent with the ones observable today[68].

On the basis of an observable increase in the dominance of the woodland dweller, hygrophilous mollusc species, a relative warming of the climate could have been inferred, embedding about 2000 years and characterized by a 2-3 °C rise in the mean July palaeotemperatures, as well as a considerable rise in the amount of the precipitation. This was congruent with an expansion of the arboreal elements inhabiting the woodland refugia located in the transition zones of the Carpathian Basin (Pannonicum) and the surrounding mountain belts (Carpathicum, Illyricum, Noricum[69])[70]. These marginal woodland refugia belonging to the areas of the Precarpathicum[71], Preillyricum[72], and Prenoricum, experienced fluctuations in space and time in accordance with the global and regional climatic changes, characterized by iterative expansions and retractions (e.g. the woodland refugium of the Kereszt Hill site[73]). These peripheric fluctuating areas[74] extended into the margins of the Pannonicum between 18,000–16,000 BP years. However, they also could have infiltrated into the central parts of the Pannonicum via the ecological corridors of the river valleys (e.g. Tiszaalpár profile[75]).

The vegetation cover inferred from the analysis of malacological data indicating the spreading of woodlands has been justified by the findings of STIEBER (1967), who could infer the presence of taiga vegetation in the Carpathian Basin between 18,000–16,000 uncal BP years via the analysis of charcoal from deposits of the same age. Burnt charcoal zones observed by STIEBER (1967), PÉCSI (1975, 1993), HAHN (1977) also indicate the presence of an extensive taiga, as the development of forest fires tends to follow a cyclic pattern as well in the present-day taiga vegetation zone especially in its southern margin characterized by mixed forests[76]. As a result of the increasing forest cover due to a milder and wetter climate intensive humidification initiated in the area leading to the formation of a less- developed top soil of the Dunaújváros-Tápiósüly Loess Complex (h1)[77]. According to the detailed investigations on the Tápiósüly profile, this soil horizon can be dated between 17,000–16,000 uncal BP, corresponding to the development of the *Punctum pygmaeum* - *Vestia turgida* zonula[78].

Only scant information is available for the vertebrate fauna of the Ságvár-Lascaux interstadial, representing the Bajóthian fauna stage[79] with a few exceptions known from the archaeological layers and archaeology of the Upper Palaeolithic Gravettian sites[80]. However, the large quantities of reindeer bones retrieved from several sites are quite remarkable[81]. The presence of these reindeer bones, serving as potential prey animals at the sites further underlie the palaeoecological picture reconstructed for the Carpathian Basin on the basis of the Mollusc fauna for the period between 18,000–16,000 uncal BP (19,500–17,100 CAL BC), as hunting must have taken place at the time of herd formation and migration of the

[65] KROLOPP–SÜMEGI 2002.
[66] SÜMEGI 1996; KROLOPP et al. 1995; HUM 1998; 1999; FARKAS 2000.
[67] SÜMEGI–KROLOPP 2000; 2001.
[68] SÜMEGI–KROLOPP 2000.
[69] SOÓS 1943.
[70] WILLIS et al. 1995; 1997; 2000; SÜMEGI 1996.
[71] SÜMEGI 1996; DELI–SÜMEGI 1999.
[72] SÜMEGI et al. 1998.
[73] SÜMEGI 1996.
[74] VARGA 1981.
[75] SÜMEGI et al. 1992.
[76] PAYETTE 1991.
[77] HAHN 1977; PÉCSI 1975; 1993.
[78] HAHN 1977; PÉCSI 1975; 1993.
[79] VÖRÖS 1987; 2000.
[80] VÖRÖS 1982.
[81] VÖRÖS 1982.

reindeer[82]. The migration of the reindeer is related to the alternation of the seasons as they tend to dwell in the tundra during the summertime and retract into the taiga belt during the winter[83]. Their migration between the two belts or zones appears during the spring and fall. Palaeolithic hunters specialized for the hunting of these animals, which served as a basis of their subsistence tended and tend to pursue the herds throughout their migration[84]. Reindeer must have migrated between the taiga areas of the Carpathian Basin and the tundra regions surrounding the basin from the north and the west between 18,000–16,000 uncal BP years as well[85], because according to the latest findings of the analysis of vertebrate remains[86] the reindeers were hunted down during the winter in the Carpathian Basin; in other words, during the period when the reindeers were dwelling in the taiga zone. The migration of the reindeers to the winter taiga zone is an annual process triggered by the lack of food resources and unfavourable conditions of the tundra in wintertime and the presence of lichens as food source in relation to the coniferous vegetation in the taiga. Thus it is not surprising that the southern margin of the taiga zone coincides with the southern limit of migration of the reindeers. Consequently, during the Late Würmian it was the area of Transdanubia, or at a broader scale the southern margins of the Carpathian Basin that formed a southern boundary of the distribution of reindeers[87].

The emergence of this interstadial also witnessed the expansion of floral and faunal elements characteristic of the taiga and mixed taiga zones from the forest refugia and relict spots surviving in the marginal areas of the embracing mountains and the area of the Pannonicum. As a result of this process, the marginal areas of Pannonicum became covered with woodlands with the emergence of a vegetation zone observable in the southern margins of the present-day taiga. Nevertheless, the floral and faunal assemblages surviving among different environmental conditions (Carpathicum, Illyricum) expanded differentially at the northern and southern margins of the Carpathian basin. For example it was the forest dweller Carpathian spindle snail (*Vestia turgida*) that populated the northern and eastern parts of the basin, while the smooth spindle snail (*Cochlodina laminata*) was restricted to the southern areas. The distributions of the Carpathian-Alpian *Semilimax kotulai* and the Western-Central European[88], also Atlanto-Mediterranean[89], *Semilimax semilimax* were influenced by the actual positions of the colder but wetter Carpathian montane climate centre and the milder, more temperate and also wetter oceanic climatic centre. These differences tend to indicate the emergence of an environmental barrier zone in the central parts of the Carpathian basin during the closure of the Pleistocene[90].

Most likely taiga forests with a dominance of *Picea* (spruce) must have emerged in the north while similar type of woodlands with a dominance of *Pinus sylvestris* (forest pine) must have developed in the southern areas[91]. Nevertheless, on the basis of the malacological findings the intermittence of open, steppe-like regions must have broken down the uniform taiga forests into mosaic-like smaller patches. Present-day analogies of this Late Würmian taiga, mixed taiga vegetation with intermittent patches of steppe areas can be found today in the northern rim of the Altai mountains, at the Kulunda-, Baraba-steppes, The Upper-Ob floodplains and the Vasjugan mountains, as well as the opening of the Surgut Plains[92]. Here, at the interface of the taiga and the tundra the classical "Dokuchaevan" Eurasian floral and pedological zones form environmental mosaics corresponding to the local topography and hydrography.

Conclusion

This former landscape of the Carpathian Basin characterized by dominantly taiga forests, yet displaying a mosaic-like patterning regarding vegetation cover and soils, was one of the major destinations of the migration of Upper Würmian reindeer herds and the Upper Palaeolithic hunters pursuing them. According to our findings, the hunting communities of the Gravettian culture were practicing a hunting following the seasonal migration of reindeer herds between the taiga, steppe-taiga or taiga steppe areas of the inner margins of the Carpathian basin and the tundra developed in the northern and western outer margins of the Carpathians around 18,000–16,000 uncal BP years during the Ságvár-Lascaux interstadial[93].

According to the palynological findings for the Bátorliget, Kelemér, Hortobágy, Balatonederics and Baláta profiles, the rate of arboraceous pollens displayed a significant drop following the Ságvár-Lascaux interstadial (between 18,000–16,000 uncal

[82] STURDY 1975.
[83] JARMAN et al. 1982.
[84] STURDY 1975; JARMAN et al. 1982.
[85] STURDY 1975.
[86] VÖRÖS 1982.
[87] VÖRÖS 1982.
[88] KERNEY et al. 1983.
[89] BÁBA 1982; 1983a; 1983b; 1986.
[90] SÜMEGI 1996.
[91] SÜMEGI 1996.
[92] SÜMEGI 1996; SÜMEGI et al. 1999; SÜMEGI–KROLOPP 2000, 2001.
[93] SÜMEGI–KROLOPP 1995; 2000; 2001.

BP, i.e., 19,500–17,100 CAL BC years), accompanied by an increase and dominance of plant pollens characteristic of the steppes and open vegetation areas (*Gramineae*, *Cyperaceae*) as well as a rise in the ash concentrations recording cyclic forest burnings.

Moreover, several character forms of the tundra vegetation was recovered from the section of the Balatonederics profile dated to 14,240 uncal BP, such as *Dryas octopetala*, *Betula nana*[94]. According to the pollen composition, a colder and drier climatic cycle emerged during this phase. This can be placed between 16,000–13,500 uncal BP (17,100–14,200CAL BC) years on the basis of radiocarbon dated pollen analytical and Quaternary malacological results[95]. This climatic period seems to be well correlated with the emergence of the so-called Heinrich event (H1 level) of the North Atlantic regions[96] and the oldest Dryas horizon established on the basis of palynological results[97]. According to the results of the malaco-thermometric method, the prevailing mean July temperatures were around 12–14 °C in the northern and eastern parts of the Carpathian Basin[98], with a predicted value of 16 °C in the southern areas[99].

It was this horizon referred to as the *Pupilla sterri* zonula[100] that marked the last large-scale appearances of cold-resistant, xerophilous, presently xeromontane mollusc species in the central parts of the Carpathian Basin[101]. The Upper Würmian wind-blown sands of the Nyírség and the Danube-Tisza Interfluve, as well as the closing member of the Hungarian loess series, the so-called "top loess layers" emerged parallel with the development of this colder and drier climatic period[102].This period also corresponds to the last significant appearance of cold-loving elements in the mollusc fauna; i.e. the typical loess steppe dweller elements in the Carpathian Basin. The major part of the basin was covered by cold continental steppes studded by tundra vegetation during this time. Besides some areas characterized by favourable edaphic microclimatic conditions must have harboured spots of mixed taiga woodlands, hosting thermomesophilous arboreal elements as well.

Surprisingly several forest dweller species have come to light from the loessy layers of Southern Transdanubia and the Southern Great Hungarian Plains from the same period (e.g.: *Mastus venerabilis*, *Discus perspectivus*, *Aegopinella ressmanni*), indicating that the development of the flora, fauna as well as the climatic conditions must have taken a different path in the southern parts of the Carpathian basin from that of the northern and eastern areas, similarly to the times of preceding coolings and warmings as well[103]. According to the available Hungarian palynological data[104], a mean July palaeotemperature of 13.4–14.2 °C could have been inferred for this period. These data are in good correlation with the ones gained for the mean July palaeotemperatures of the northern areas of the Carpathian Basin via the application of the malaco-thermometer method.

As it can be seen from the available radiocarbon data, this period marks the last appearance of Upper Palaeolithic hunters related to the Gravettian culture in the Carpathian Basin[105]. However, in contrast to the earlier assumptions[106], this was the time of last occurrence of mammoth in the basin as well[107]. Most likely the steppe vegetation favourable for the mammoth populations was still present in a part of the basin during this period for the last time, and was totally expelled from the basin after 13,500 uncal BP years with its accompanying faunal associations as a result of initiating environmental changes connected to a global warming. The number of Northern Asian and Central Asian vertebrate and Mollusc elements is surprisingly high in the loess areas of the NE Great Hungarian Plains (Hajdúság) and the northern foothills for this period. The malacofauna, poor in species, seems to be in close affinity with those of the Russian and Ukrainian loess areas[108]. This period also corresponds to the last appearance of the Arcto-Alpine and Northern Eurasian elements of the vertebrate fauna in the Carpathian Basin (*Elephas primigenius*, *Rangifer tarandus*, *Ovibos*); i.e. the closing phase of the Bajóthian fauna.

All these findings along with the palaeoenvironmental results from Bátorliget, Balatonederics, Kelemér, Baláta and Kardoskút seem to indicate the possible presence of a floral and faunal migration pathway or green corridor for the continental elements between the Eastern European Lowland and the Great Hungarian Plains during this

[94] SÜMEGI et al. 2008a.
[95] SÜMEGI 1989; 1996; 2003a,b; 2007; SÜMEGI et al. 1992; 1999; KROLOPP–SÜMEGI 1992; KROLOPP et al. 1995.
[96] BOND et al. 1992; 1993.
[97] JÁRAINÉ KOMLÓDI 1969; MANGERUD et al. 1974.
[98] SÜMEGI 1995.
[99] HUM 2000.
[100] SÜMEGI 1989; SÜMEGI et al. 1992.
[101] SÜMEGI–KROLOPP 1995; SÜMEGI et al. 1998.
[102] BORSY et al. 1982; 1985; SÜMEGI et al. 1998; PÉCSI 1975, 1993.
[103] SÜMEGI 1996; SÜMEGI et al. 1998; SÜMEGI–KROLOPP 2002.
[104] MAGYARI 2002; SÜMEGI 2004.
[105] KROLOPP et al. 1995.
[106] VÖRÖS 1987.
[107] KROLOPP et al. 1995.
[108] KORDOS–RINGER 1991; SÜMEGI 1989; 1996.

time in the northern parts. Most likely it was this corridor that offered a path for a NE retreat of the seasonally migrating big games and the pursuing Palaeolithic hunters following the initiation of a Late Glacial warming[109]. Meanwhile, the southern and southwestern parts of the basin were characterized by an expansion of woodlands.

According to the results of the detailed malacological and palynological analysis of the Bátorliget, Kelemér, Baláta and Balatonederics profiles, an expansion of the taiga woodlands must have occurred at 13,000 uncal BP years thanks to a warming during the Late Glacial, which must have resulted in the closure of the above mentioned continental corridor. Nevertheless, as it was inferred from the profiles of the Hajdúság and the Hortobágy such as a continuous "ecological island" of extensive continental steppes, floodplain meadows and alkaline steppes have managed to survive in the central parts of the Great Hungarian Plains (Hajdúság, Hortobágy)[110]. Furthermore, the elevated loess plateaus (Mezőföld, Bácska) were characterized by the presence of local extensive forest steppes containing open arboreal spots of Norway pine and birch, thanks to the favourable hydrologic and orographic conditions[111] while the foothill areas were covered by closed mixed woodlands with elements deriving from the Illyric, Carpathian and Transsylvanian woodland refugia[112]. By this time elements characteristic of closed mixed taiga woodlands dominated the flora and the fauna everywhere in the basin, as it was shown by the results of malacological[113], palynological[114], vertebrate[115] and anthracological analyses[116]. Several faunal (*Cepaea vindobonensis*[117]) and floral elements (*Corylus avellana*[118]), which underwent an expansion during the beginning of the Holocene appear here, marking the complete disappearance of the background environmental conditions required for the life of the Upper Palaeolithic hunting groups in the basin. The presently available archaeological data also indicates the appearance of Epipalaeolithic, Mesolithic groups in the basin during this time, taking over the place of the Upper Palaeolithic hunters[119].

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109 BELL–WALKER 1992; JARMAN et al. 1982.
110 SÜMEGI et al. 2005; 2006; SÜMEGI–SZILÁGYI 2010.
111 SÜMEGI 2003a, b; JAKAB et al. 2004.
112 SÜMEGI 2004.
113 SÜMEGI 1989.
114 WILLIS et al. 1995; 1997.
115 VÖRÖS 2000; JÁNOSSY–KORDOS 1976.
116 BORSY et al. 1982; STIEBER 1968.
117 SÜMEGI 1989; 1996
118 SÁRKÁNY in BORSY et al. 1982; WILLIS et al. 1995; JUHÁSZ 2002.
119 GÁBORI 1956; 1968; KERTÉSZ et al. 1997.

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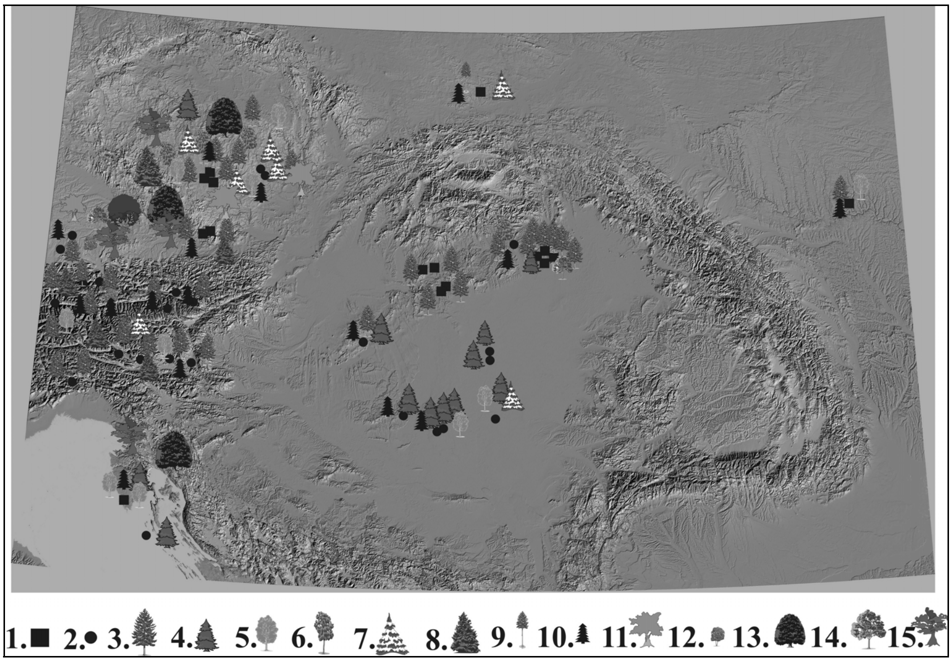


Fig. 1. *Upper Palaeolithic sites and palaeovegetation of the interstadial phase between 32,000–25,000 BP years*

1. Upper Palaeolithic sites, 2. Paleoecological sites, 3. Picea (spruce) remains, 4. Pinus sylvestris (Scotch pine) remains, 5. Betula, Salix, Alnus (birch, willow, alder) remains, 6. Pinus cembra (cembra fir) remains, 7. Abies (fir) remains, 8. Juniperus (juniper tree) remains, 9. Larix (larch tree) remains, 10. Pinus (needle leaved tree) remains, 11. Quercus (oak) remains, 12. Corylus (hazel) remains, 13. Ulmus (elm) remains, 14. Carpinus (hornbeam) remains, 15. Fagus (beech) remains

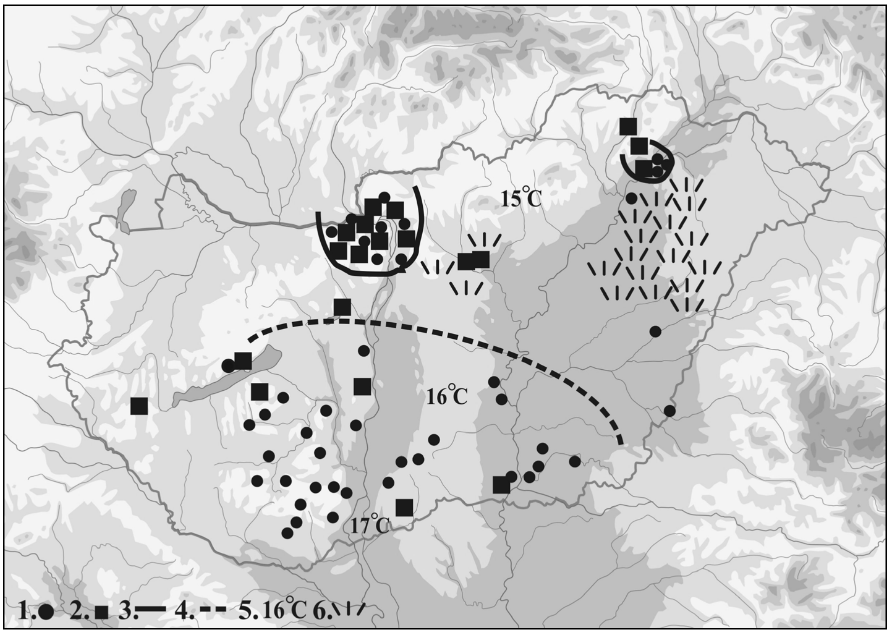


Fig. 2. *The Upper Palaeolithic sites, vegetation, July palaeoclimate, shade-loving Mollusc sites and environmental transition line position in the Carpathian Basin between 18,000–16,000 BP years*

1. Ecotone and shade-loving Mollusc site, 2. Upper Palaeolithic site, 3. Closed taiga forest, 4. Northern borderline of Palaeoillyrian type mixed taiga forest, 5. July palaeotemperature, 6. Grassland

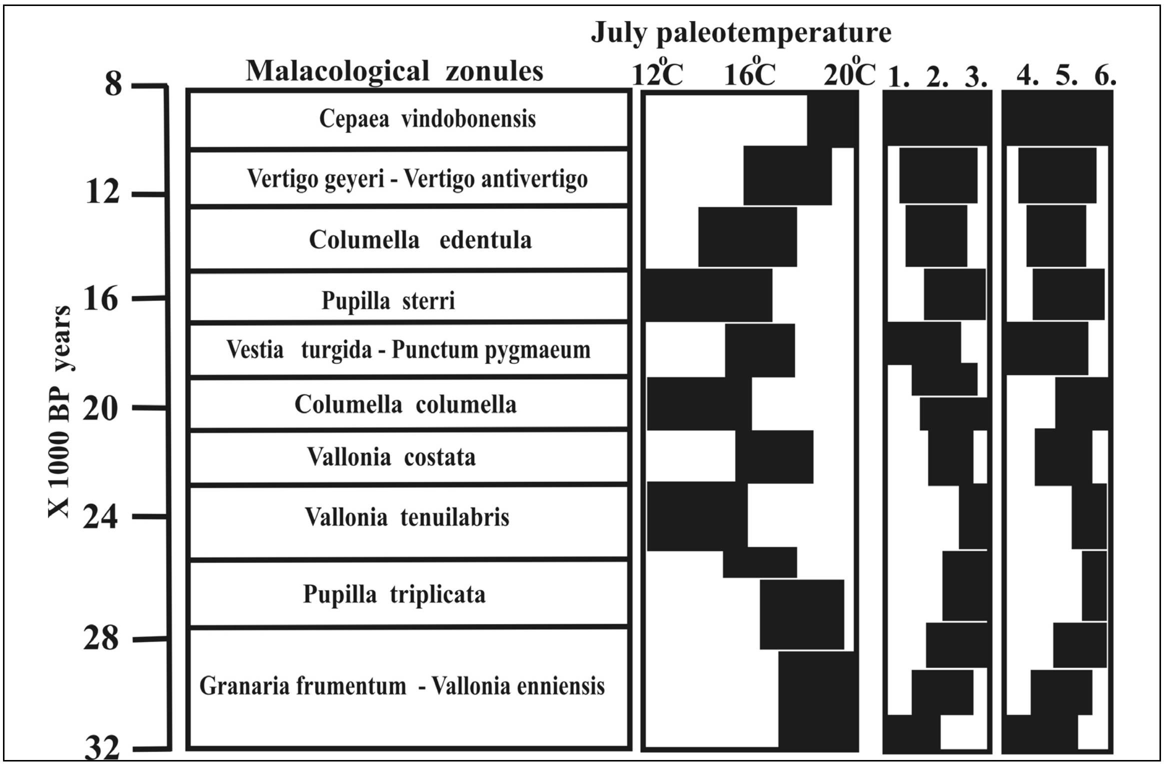
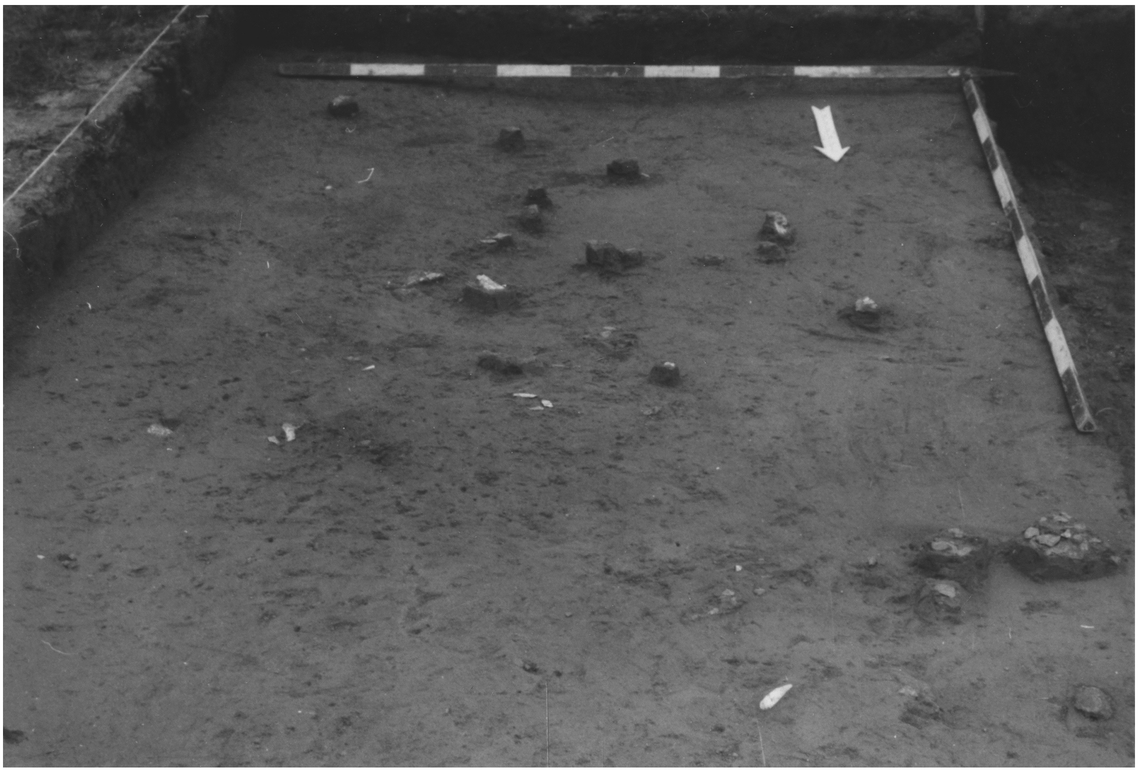


Fig. 3. *Malacostratigraphic units and palaeoenvrionmental factors between 30,000 and 8,000 BP years in Hungary*
1. Wet climate, 2. Transition climate, 3. Dry climate, 4. Woodland, 5. Forest steppe 6. Open vegetation (steppe or/and tundra like vegetation)

PICTURES OF THE EXCAVATIONS

Mogyorósbánya, 1982 (photo by István Homola)



Excavations in the sandpit near Nadap

Pilismarót – Diós (photo by István Homola)

The Danube Bend, Esztergom and the site of Mogyorósbánya from the Jankovich cave

Mogyorósbánya: after the flood

Mogyorósbánya: culture bearing layer