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To the memory of Avraham Ronen (1935–2018)

LITHIC ANALYSIS OF THE MIDDLE AND LATE UPPER PALAEOLITHIC IN HUNGARY

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Abstract. This paper presents lithic technology studies on the Middle and Late period of the Upper Palaeolithic in Hungary between 26 and 13 ka BP. The studies aimed at describing and then comparing the technological processes from lithic raw material procurement to the formal tool making. An attempt was made to find correlations between technological features and chronological positions of the assemblages to see if lithic technology operated traditionally or opportunistically. The study found that technology was rather shaped toward efficiency with an adaptive behavior. Therefore, in most cases, the way how tools were made is useless to differentiate archaeological cultures, while the tools themselves, especially the armatures, can be markers of cultures as was shown earlier. This study found that the formation of the archaeological record and its variability most likely depended upon the dynamism of human ecology.

Keywords: Lithic technology, technical behavior, raw material procurement, hunter-gatherers, subsistence strategy

INTRODUCTION

The archaeological record of Late Pleistocene modern humans in Hungary is chiefly represented from the Middle and Late Upper Palaeolithic (MUP and LUP) periods 28–12 ka BP. MUP and LUP lithic assemblages had long been classified with the Gravettian Entity model (GEM) into four discrete units of the Gravettian family: Pavlovian 28–26 ka BP, Ságvárian 20–17 ka BP, Epigravettian (the "expedient") 18–16 ka BP and Epigravettian ("rich in blunted blades") 16–12 ka BP (Dobosi 2000a, 2004, 2009a, b). GEM claimed that Pavlovian tools were always made with higher quality, but originated the Epigravettian in the Pavlovian, and meanwhile isolated the Ságvárian being different on the basis of technological characters (Dobosi 2004, 2009b). GEM's chronology thus was based upon lithic tool typology, radiocarbon dates and lithic technology.

A test on the typological considerations of GEM found that: 1) the units are typologically different, 2) the Pavlovian term cannot be applied for the Hungarian assemblages because Pavlovian tools are missing and the finds of this unit possess Late Gravettian characters dated to 25–21 ka BP elsewhere, 3) in fact, there is no convincing data on Gravettian occupation before 26 ka BP, and 4) the Ságvárian typologically is not different from the "expedient" Epigravettian (Lengyel 2016). The revised typology thus suggested an alternative chronology for the MUP and LUP in the Carpathian basin, which consisted of Late Gravettian (LG) 26–21 ka BP, Early Epigravettian (EE) 21–17 ka BP and Late Epigravettian (LE) 17–13 ka BP human occupations (Lengyel 2016). This alternative classification was largely supported by the revised radiocarbon database of GEM (Lengyel 2008–2009).

GEM's taxonomy also was laid on lithic technological observations and assumed that lithic assemblages produced by the same brand of technology likely had a common cultural origin. This was emphasized with an alternative vocabulary in GEM, which termed Older Blade Gravettian, Pebble Gravettian and Younger Blade Gravettian the Pavlovian, Ságvárian and the Epigravettian, respectively (Dobosi 2004). The supporting technological information emerged from the distinction between blade and flake production on pebble or not pebble raw material. As a result, the presence of a classic slender blade technology supported to originate the Epigravettian in the Pavlovian along the Blade Gravettian lineage. The Ságvárian that produced mainly flakes and short blades was an outlier of the blade technology heritage, and its pebble economy gave it an atypical character rooted probably in the pebble user Middle Palaeolithic (Tolnai-Dobosi 2001; Dobosi 2004, 2009b, 2016).

To confront basic lithic technology data, as GEM has done that, to define cultural entities, must be handled with care because the flintknapping process and the subsequent archaeological record often could have been affected by the availability, quality and shape of the raw materials (Andrefsky 1994a, b; Lengyel 2013; Tixier 2012). On the other hand, there are more modalities even within the domain of blade technology which can make lithic assemblages different (Pelegrin 2011), and undeniably there is a relation between human subsistence strategy and lithic assemblage formation (Binford 1979, 1982; Kelly 1983, 2013; Andrefsky 2009).

Therefore, involving the lithic technological component among the principles of GEM brings up several aspects of the formation of the MUP and LUP lithic archaeological record in Hungary which are yet unclear. If indeed there was a technological lineage from the Gravettian to the Epigravettian, there must be clear traces of it, inferring to similar ecology, subsistence strategy and technological knowledge, which could be detected with an analysis digging deeper into the domain of lithic technology.

THE MUP AND LUP IN EASTERN CENTRAL EUROPE

During the hundreds of millennia of the Pleistocene, the fluctuation of the terrestrial ice sheets in the northern hemisphere profoundly affected the settlements of humans (Tallavaara et al. 2015). Well-known cold period in European prehistory is the Upper Pleniglacial, in which the continental ice sheet restarted southward advancing after a mild period of the Weichselian Interpleniglacial (Boulton et al. 2004). This cooling peaked in the Last Glacial Maximum (LGM), which according to global data earliest started at ~24 ka BP and lasted until 17 ka BP (Clark et al. 2009; Hughes et al. 2013). The LGM in Eurasia united the British-Irish, Fennoscandian and Barents-Kara ice sheets into a Eurasian Ice Sheet (EIS) (Grosswald 1980). EIS reached its maximum extent by 21 ka BP with covering seven million square kilometers from the British Isles to the Taymyr Peninsula between the 52°N and 77°N latitude (Hughes et al. 2016). The EIS lasted in this position until 18 ka BP and began retreating during 17 ka BP. By 12 ka BP, the line of the current Baltic sea shore line was once again unglaciated (Marks 2012; Stroeven et al. 2015).

The MUP and LUP human record in eastern Central Europe (ECE) consists of three archaeological cultures that represent three hunter-gatherer populations: Gravettian 30–28 ka BP, Epigravettian 20–13 kya BP and Magdalénian 15–12 kyr BP (Svoboda 2007; Maier 2015; Lengyel, Wilczyński 2018). The Gravettian archaeological record further can be classified into three clusters. The earliest is the Early Gravettian, dated to ~30–28 ka BP (Moreau 2009). The next is the Pavlovian, dated to ~27–26 ka BP (Svoboda 2016). The last member of the Gravettian culture is the Late Gravettian, also called Willendorf-Kostenkian (Svoboda 2007), which occupied ECE between ~26–20 ka BP (Wilczyński 2016).

Gravettian lithic tools are distinct from the subsequent periods. One key to classify ECE lithic assemblages is the armature component of the retouched tool kit (Lengyel 2016). Early Gravettian armatures are the microgravette, backed bladelet, retouched blade point and fléchette (Moreau 2009). The Pavlovian contains the Early Gravettian armatures, and additional tools are the backed denticulated bladelets, crescents, triangles and basally inverse thinned blade points (Kozłowski 1996, 2015; Svoboda 1996, 2007). The Late Gravettian lacks these additional Pavlovian types, but besides the Early Gravettian armatures, it further has shouldered point, backed truncated bladelet, rectangle, including backed ventrally truncated type and sometimes bifacial tools (Lengyel et al. 2016). The Early Epigravettian, previously often called Ságvárian (Kozłowski 1979) or Kašovian (Svoboda, Novák 2004), completely lacks the Gravettian armature except for the backed bladelet, sometimes truncated too, and the retouched point. The Late Epigravettian armature includes an abundant number of backed armature, including straight, curved and arched backed points, rectangles and backed-truncated bladelets. The Magdalenian armature also consists of backed bladelets, which are sometimes truncated, but interestingly, its key lithic tool type in ECE is a domestic tool, the Lacan type burin and the borer (Połtowicz-Bobak 2012).

According to the distribution of armature types and radiocarbon dates in the MUP and LUP in ECE, Early Gravettian occupations are scarce and the only firm archaeological record is located at Willendorf II in layer 5 (Moreau 2012) (Fig. 1). Henryków 15, southwestern Poland, was also dated to this period (Wiśniewski et al. 2015), but it differs from Willendorf II layer 5 because the microgravette is absent and there is a bifacially shaped point that is not characteristic to Early Gravettian inventories (Moreau 2009). Within the Carpathian basin, the only human occupation in this period

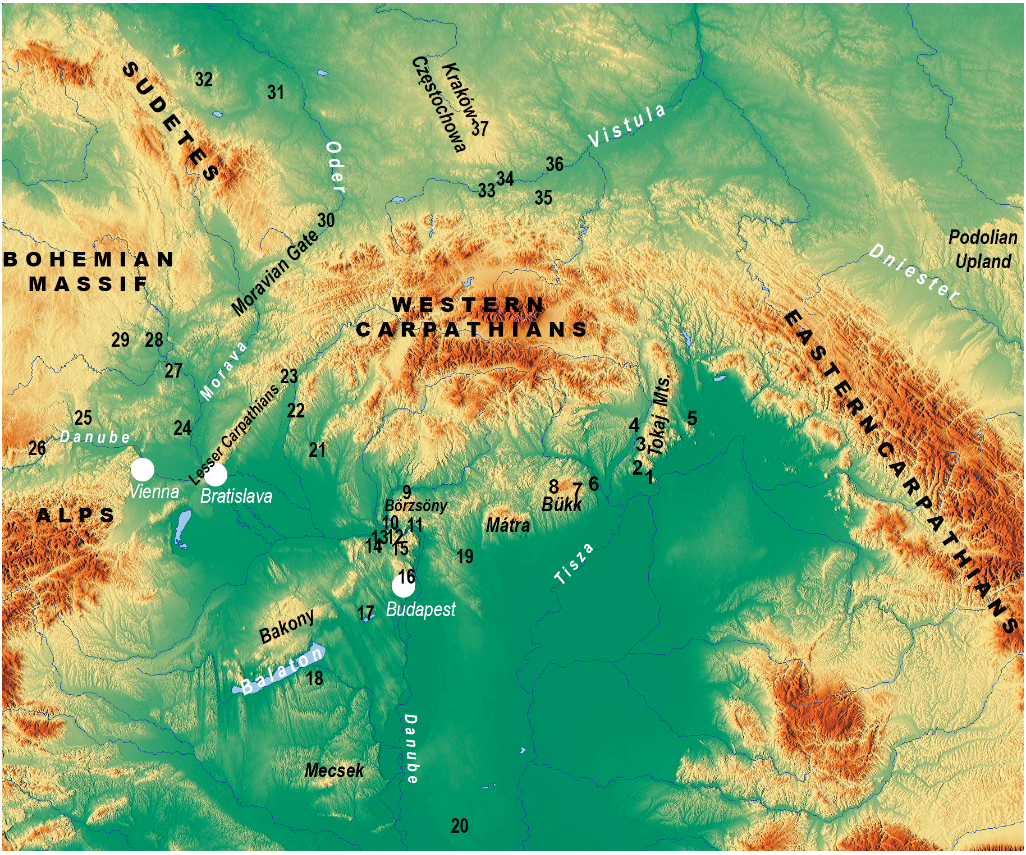

Fig. 1. Major sites mentioned in the text. 1 – Bodrogkeresztúr; 2 – Megyaszó; 3 – Arka; 4 – Hidasnémeti; 5 – Kašov I, Cejkov I; 6 – Sajószentpéter; 7 – Szeleta cave; 8 – Istállóskő Cave; 9 – Hont-Parassa III; 10 – Szob; 11 – Verőce; 12 – Pilismarót; 13 – Esztergom; 14 – Mogyorósbánya; 15 – Pilisszántó I rock-shelter; 16 – Budapest-Csillaghegy; 17 – Nadap; 18 – Ságvár; 19 – Jászfelsőszentgyörgy; 20 – Madaras; 21 – Nitra-I Cěrmáň; 22 – Moravany sites; 23 – Trenčianske Bohuslavice; 24 – Grub-Kranawetberg; 25 – Grubgraben; 26 – Willendorf II; 27 – Dolní Věstonice, Pavlov, Milovice I; 28 – Brno Štýřice III; Stránská skála IV; 29 – Mohelno-Plevovce; 30 – Petřkovice I; 31 – Sowin 7; 32 – Henryków; 33 – Piekary II; 34 – Kraków-Spadzista; 35 – Targowisko 10; 36 – Jaksice II; 36 – Deszczowa Cave

is in Istállóskő cave upper layer (Aurignacian II in Vértes 1955) in Bükk Mountains, Northeast Hungary, which yielded Mladeč point and a mixed character of lithics (Davies, Hedges 2008–2009; Markó 2015; Patou-Mathis et al. 2016).

After the Early Gravettian, between 28 and 26 ka BP, Pavlovian occupations are found solely in Moravia (Dolní Věstonice and Pavlov sites) (Svoboda 2007) and Lower Austria (Händel 2017). Parallel with the disappearance of the Pavlovian archaeological record in Moravia and Lower Austria, Late Gravettian lithics started overtaking the archaeological record between 26 and 21 ka BP (Lengyel, Wilczyński 2018).

In contrast to the preceding Gravettian periods, the Late Gravettian was widely spread from the western edge of the Middle Danube basin to the Dniester basin, including the Carpathian basin (Kozłowski 2008). Most prominent sites in ECE are Kraków-Spadzista in Poland (Kozłowski, Sobczyk 1987; Wilczyński 2016), Petřkovice I (Novák 2008) and Milovice I (Oliva 2009) in the Czech Republic, Willendorf II layer 9 (Otte 1981) in Lower Austria, Trenčianske Bohuslavice (Bárta 1988), Moravany-Banka (Kozłowski 2000) and Nitra-I Cĕrmáň (Kamińska, Kozłowski 2011) in Slovakia. The revised Hungarian MUP and LUP chronology (Lengyel 2015, 2016) showed that sites called Pavlovian by GEM such as Bodrogkeresztúr, Hidasnémeti and Sajószentpéter, suit Late Gravettian taxonomy. The lithic assemblage of Arka, formerly classified Epigravettian, showed strong similarity with Bodrogkeresztúr. Further Late Gravettian armature can be found in Pilisszántó I rock shelter (Dobosi, Vörös 1987; Kormos, Lambrecht 1915), Szeleta Cave layer 6 and 5 (Simán 1990; Lengyel et al. 2016) and Hont-Parassa III (Dobosi, Simán 2003).

With the onset of the LGM, human settlements seem to have disappeared from the north of the Carpathians and the Sudetes, thus Early Epigravettian lithics mostly are found in Moravia, Lower Austria and in the Carpathian basin. In Hungary, taking into account the armature types and their frequencies, Ságvár, Budapest Corvin-tér (Lengyel 2016), the Pilismarót site cluster (Pálrét, Diós, Bitóc and Bánom) (Dobosi 2006, 2014), Jászfelsőszentgyörgy (Dobosi 2001), Szob (Markó 2007), Madaras (Dobosi et al. 1989), Mogyorósbánya (Dobosi 2016), Herman Ottó Cave (Szolyák 2008–2009), Verőce (Bradák et al. 2014) and Tarcal-Citrombánya (Dobosi 1974) can be listed here. Sites of this period outside Hungary are Kašov upper layer (Bánesz et al. 1992) in East Slovakia, Grubgraben (Montet-White 1990; Neugebauer-Maresch et al. 2016) in Lower Austria and Stránská skála IV (Svoboda 1991; Škrdla, Plch 1993) and Mohelno-Plevovce (Demidenko et al. 2018) in Moravia. Often mentioned Epigravettian sites in Poland are Piekary IIa layer 5 and Kraków-Spadzista layer 5 in B+B1 (Wilczyński 2007; Wiśniewski et al. 2017). Kraków-Spadzista C2 area layer 6a yielded a single radiocarbon date of LGM age 17.4 ka BP (Kozłowski, Sobczyk 1987), but this is clearly associated with Late Gravettian lithics and re-dated to 22–24 ka BP (Wilczyński et al. 2015). Layer 5 remained undated, and all we know about it is that it postdates the Late Gravettian with unknown gap of time. Deszczowa Cave layer VIII in the Kraków-Częstochowa Upland northwest of Kraków yielded a few artifacts including a retouched blade and end scraper dated to between 17.4 and 20.8 ka BP (Cyrek et al. 2000; Nadachowski et al. 2009), but the overlying layers IX and X were dated to 22–24 ka BP (Lorenc 2006), which warns for caution interpreting these findings. Therefore, Poland likely was deserted during the LGM.

When EIS started retreating, Late Epigravettian hunters repopulated the north of the Carpathians. Two important sites in Hungary, which are the only ones in the viewpoint of typology, are Esztergom and Nadap. Latter formerly was classified Pavlovian (Dobosi 2009a). Uncertainly, Megyaszó site classified among "Pavlovian" (Dobosi, Simán 1996) could also be listed here, whose armature consists of mostly backed bladelets and points without Gravettian character. Budapest-Csillaghegy (Gábori-Csánk 1986), dated to 15.9 ka BP (Sümegi et al. 1998; Lengyel 2008–2009), seems to be a human occupation of the deglaciation period, however, it does not have Late Epigravettian armature. Sites outside Hungary, Targowisko 10 (Wilczyński 2009), Sowin 7 lower layer (Wiśniewski et al. 2012, 2017) and Brno-Štýřice III (Nerudová, Neruda 2014) were dated to *ca*. 15 ka BP.

The Magdalenian occupation of ECE occurred with the late phase of this culture, but Magdalénian hunters did contribute to the formation of the archaeological record in the Carpathian basin (Maier 2015).

METHODS

The archaeology of human relics from the Pleistocene significantly differs from later periods of the Prehistory. The time between the burial of the finds and their unearthing often faced sever geological processes that altered the Pleistocene landscape and eventually affected the preservation of the finds. Artifacts made of organic materials easily decay in the ground due to physical and chemical effects. But, stones used to make tools for scraping, cutting, carving, engraving and hunting weaponry were resistant to most geochemical and physical processes in the soil. The durability of the stone is the reason for knapped lithic tools to be the most common archaeological find material at Pleistocene hunter-gatherer camps.

Stone tools, therefore, are found wherever hunters established camps. The lithic tools at hunter-gatherer camps are two sorts. One sort of tools was used to make the equipment, clothing, sheltering, butchering, to accomplish domestic activities. The other sort of tools is the hunting weaponry. It is up to the function of the camp which type of tool is found in majority. A residential camp contains many of the domestic tools because it is the place to host the group for a longer period, while a field camp devoted for hunting is likely to yield a wealth of armature lithic types which were abandoned after damage and replaced with new items (Binford 1980, 1982, 1990).

To subsist as a hunter-gatherer, foraging for animal and vegetal food is vital, which needs coordinating apt techniques, knowledge and the technological processes (Shott 1986; Kelly 2013). In arid environment, alike the Pleniglacial Europe, the subsistence was regularly based upon hunting because vegetal resources might be scarce, and migratory preys subsequently made humans mobile (Pryor 2008; Verpoorte 2009; Kelly 2013). Thus, mobility can distribute the archaeological record over vast areas.

A general proxy to recognize human mobility is the lithic raw material provenience (Goodyear 1979). Since raw material procurement often can be embedded within hunting or food gathering activities (Binford 1979), the distance between site and lithic source may mark the annual range of hunter-gatherers (Binford 1982). In eastern Central Europe, there is great potential for mapping Upper Palaeolithic mobility patterns (Féblot-Augustins 1997), because siliceous rock raw materials are highly variable around Carpathians due to being regionally specific (Přichystal 2013). Therefore, studying the lithic technology generates issues of subsistence strategies.

The lithic technology study performed here embraces the production process from lithic raw material procurement to tool making. The lithic raw material provenience classification made the use of the Lithoteca collection at the Hungarian National Museum (Biró, Dobosi 1991; Biró et al. 2000) and the Lithic Reference Collection of the ELTE University of Budapest (Mester 2013).

The lithic raw materials were divided into three categories according to their origin. Local materials were derived from within 10 km radius of a site. This distance was simply defined by time considerations, which means that the raw material can be collected and brought to the site within one day. This correspond with the 6 miles foraging radius of Binford (1982) and also assumes that the site location was not randomly chosen but to locate to maximize foraging efficiency (Vita-Finzi et al. 1970). Beyond the local zone was the regional one between 10 and 100 km from the site. This would fairly correspond with the logistical radius of a hunter-gatherer residential site (Binford 1982). Distant raw materials were those located over 100 km but within the Carpathian basin. Using Binford's (1982) zonation, this can be equal to the extended range. The fourth zone is called here transcarpathian (TC) territory that includes lithic sources beyond the arch of the Carpathians, and may fit the visiting zone of Binford (1982).

Each lithic assemblage was divided into eight technological categories: flakes, blades, debris, platform rejuvenating flakes of blade cores (core tablets included), crest blades, neo-crest blades, blade cores and flake cores following Inizan et al (1999). Contrary to what has been applied widely in lithic technology, blades and bladelets were undifferentiated, and the term "blade" covers all the laminar products regardless their size.

The lithic raw materials were weighed in grams by major technological groups: blades, flakes, debris and cores.

The lithic technology study aimed at revealing the debitage(s) applied. The term debitage here means the flintknapping process that aims at producing blank flakes or blades for tools from a piece of lithic raw material via reducing a core (Inizan et al. 1999). Each debitage is presented from raw material procurement to tool retouching. This was based on the concept of the chaîne opératoire (Inizan et al. 1999). Since blade debitage was found in each assemblage, the production of blades is always separated from that of the flakes. The parameters of the flakes were presented even if no flake debitage was found, because they were regarded as the by-products of the blade debitage.

The blade debitage was divided into two chief core reduction methods: unidirectional and bidirectional. These were traced by the orientation of the scars on the dorsal faces of the blades. Scar orientation parallel with the orientation of the blade was defined unidirectional, while oppositely patterned scars represented bidirectional debitage. Also, the number of the striking platform on the cores were used to define the orientation of the debitage. Single striking platform represented the unidirectional method, and opposed platformed cores were evidences of bidirectional debitage core reduction. A specific mode of the debitage that applies two opposed striking platforms is when the debitage surfaces do not cross each others' way; this is called alternate debitage. In this case the blades have unidirectional scars on their ventral faces. The same considerations were used for the flake debitage. Additionally, a third specific debitage method that used several sides of the core to remove flakes and resulted in multiple platforms was differentiated.

The knapping technique was also defined in the debitages. The knapping technique, direct soft and hard hammer percussions, herein does not mean the matter of the hammer as the names of the techniques refer to it (Inizan et al. 1999). Instead, these are understood as the movement of the knapper's arm holding the hammer. Therefore, direct soft hammer percussion may include any hammer type that tangentially hit the edge of the core. Delivering the strike onto the surface of the striking platform is the direct hard hammer percussion technique. Soft hammer technique was defined when the overhang was abraded and the impact point was missing. Hard hammer technique was defined when the impact point was present and the overhang remained unabraded. When impact point is present and the overhang is abraded, there is a chance that the tangential edge hit was inaccurate and impacted surface of the striking platform. When the overhang remained unabraded and impact point did not occur, the technique was classified hard hammer because of the lack of platform edge abrasion, which means that the platform edge was not prepared for soft hammer technique.

The flake and the blade platforms were classed into plain, dihedral, faceted, cortical, punctiform, linear and irregular types. Platform type was used to investigate the preparation of the core striking platform before removal.

The lithic artefact size was recorded with three measurements following Inizan et al. (1999). Length was measured along the technological axis of the artifact. Thickness was measured at the greatest distance between the dorsal and the ventral face perpendicularly to the plan of the artifact. Width was measured between the left and the right edges of the artifact perpendicularly to the technological axis.

The technological data recording was accomplished solely on complete unretouched artifacts. Broken and retouched artifacts were excluded because the missing parts could have borne vital technological information to classify the given artifact. These artifacts, however, were added to the counts of the technological classes of the lithic assemblages. Retouched artifacts were measured for length, width and thickness.

The length, width and thickness measurements are presented by the minimum and the maximum values, the mean, the median and the standard deviation.

The technological data were broken down by raw material types to find differences in the processing of the different raw materials. To compare two sets of measurements, t-test was applied. Comparing more than two sets of data, ANOVA was used with Tukey post hoc test.

A lithic tool means any lithic artifact whose original edges were modified by retouching or burin spall removal. Studied were the selection of blanks for tools, the ratio of the blank types among the tools, the frequency of the given blank type, for instance blades, were used up to make tools.

The lithic tools were divided into two major groups, armatures and domestic tools. Armature includes tools which were parts of a hunting weaponry (Elston, Brantigham 2002). Armatures are the backed and backed-truncated blades and the points (Fig. 2).

The criterion for backing was restricted for those pieces whose edges were perpendicularly retouched up to the thickest part of the blank. If the perpendicular retouch did not reach the thickest part of the blank, and the retouch was visible only on the

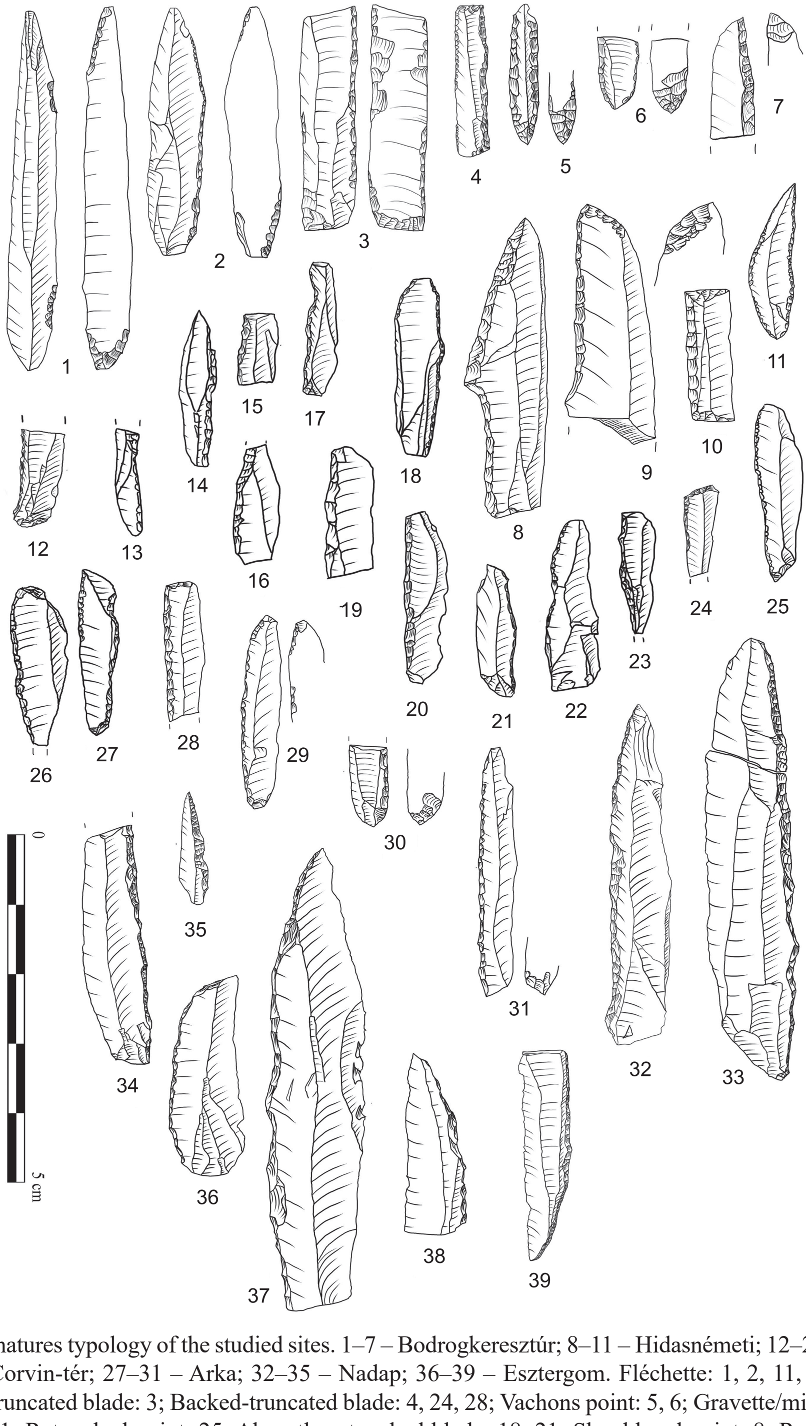

Fig. 2. Armatures typology of the studied sites. 1–7 – Bodrogkeresztúr; 8–11 – Hidasnémeti; 12–24 – Ságvár; 25, 26 – Corvin-tér; 27–31 – Arka; 32–35 – Nadap; 36–39 – Esztergom. Fléchette: 1, 2, 11, 29; Backed ventrally truncated blade: 3; Backed-truncated blade: 4, 24, 28; Vachons point: 5, 6; Gravette/microgravette: 7, 9, 30, 31; Retouched point: 25; Abruptly retouched blade: 18, 21; Shouldered point: 8; Rectangle: 10; Backed blade: 12–17, 19, 20, 22, 23, 26, 27, 34; Curved backed point: 32, 37–39; Arched backed point: 36; Backed point: 33, 35

edge, the piece was classified as an abruptly retouched tool and sorted into the edge retouched tools.

Points were divided into four classes. Retouched points were made with regular edge retouch at the tip of the blank. The Gravette/microgravette point must have a basal inverse flat retouch opposed to the backed edge (Demars, Laurent 1992). Rarely, the inverse retouch might have occurred on the distal part. When a point was backed without further retouching on the opposed edge, it was simply classified backed point. The delineation of the backed edge served to refine the variants of backed point types. Backed blade with straight back ending in a point were backed points. Backed

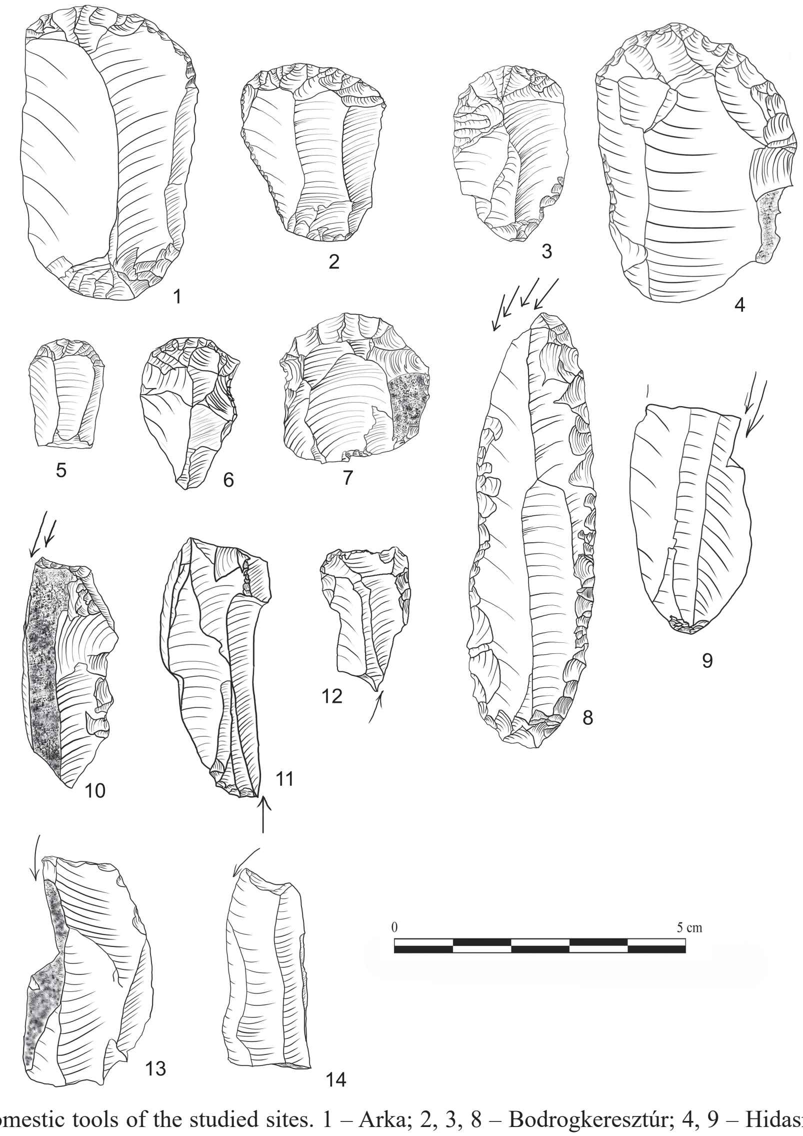

Fig. 3. Domestic tools of the studied sites. 1 – Arka; 2, 3, 8 – Bodrogkeresztúr; 4, 9 – Hidasnémeti; 5, 7, 10, 11 – Ságvár; 6, 12 – Corvin-tér; 13 – Esztergom; 14 – Nadap; 1–7 – end-scrapers; 8–14 – burins

points with slightly convex back were curved back points. Arched backed points have a smaller radius of back curvature near the tip therefore the tip is rather in an offset position. Vachons point, shouldered point, fléchette, and bifacial leaf points were further point types (Demars, Laurent 1992).

The rest of the tools, end-scrapers, burins, edge retouched tools, borer, truncated tools, splintered tool, notched-denticulated and combined tool, were regarded here as domestic tools (Fig. 3). These classes were not further divided into subtypes. This simplification was made to reduce the number of typological classes of the domestic tools that are often impractical to differentiate cultures in contrast to the armature types.

ARKA

The site

The site is located in northeast Hungary in the western zone of Tokaj Mountains, at village Arka. The site was found 255m a.s.l. near stream Arka on the western slope of Magoska hill 734 m a.s.l. The main river of this area is the Hernád that flows 4 km westwards but its view from the site is blocked by a ridge rising up to 280 m a.s.l.

The site was excavated in 1960, 1961, and 1963 by L. Vértes (1962, 1964–1965). The excavation was carried out on a slope where two narrow 2–3 m deep converging gullies cut the surface. Between the gullies the widest area was *ca.* 12 m. The main part of the excavation was carried out in this 12 m wide strip of land.

The stratigraphy consisted of the recent soil cover, than a humic soil of Holocene age, under which the Pleistocene sequence begun. The Pleistocene layers were severely reworked by cryoturbation down to the andesite bedrock. The surface of the Pleistocene layers showed also polygonal forms. The interface with the bedrock was uneven.

The lithic material appeared in varying elevations and the finds were scattered between 30 and 80 cm thickness of the sediment. Vértes claimed the lithics had been recovered from two levels separated by nearly 1 m sterile sediment. The thickness of the lower layer was *ca*. 30 cm. The lower archaeological level preserved a hearth with an andesite structure 2 meters under the actual surface. This feature in the original field notes of Vértes was described as a cluster of charcoals, bones and lithics, and an angular flat surfaced andesite rock. Another rock with a depression in the middle bore ochre stain. The find distribution, however, showed that where material appeared in the lower level, in the very same square, the upper level was empty or scarce of lithics. Lithic refitting tested the displacement of artifacts throughout the two layers and found matching pieces. This result supports Vértes' observation that cryoturbation admixed the sediments and contradicts the existence of two occupational layers at the site.

Besides the hearths, further charcoals were found in pockets and scattered animal bones and teeth of poor preservation.

Vértes (1964–1965) defined the assemblage as Eastern Gravettian. Later the site became a representative of the Epigravettian (Dobosi 2009a). Because the material consists of a large quantity of locally available raw material, it was defined as a workshop site. Vértes claimed that near the site there are rock blocks enclosing limnic silicite, which can be confirmed by a recent field survey.

The first ^{14}C date for Arka, 17 050 ± 350 (GrN-4038), was obtained on charcoals of the 1961 excavation (Vogel, Waterbolk 1964). Its sample derived from the hearth of the lower layer. During the sample cleaning all organic matter dissolved in alkali and this fraction was measured. According to the laboratory, the true age may thus be higher (Vogel, Waterbolk 1964). The second date is 13 230 ± 85 (GrN-4218). The sample is hearth filling from 2 m depth in trench M excavated in 1963 (Vogel, Waterbolk 1967). In the field notes of Vértes, the location of the sample was a small but thick charcoal layer next to which lithic raw material blocks were found. The report on this radiocarbon date by Vogel and Waterbolk (1967) mentions that Vértes submitted the sample as taken from the lower layer but later changed the stratigraphic identity to the upper layer. Henceforth, this date has been associated with the upper archaeological level (Gábori-Csánk 1970; Dobosi, Szántó 2003). The third date, 18 600 ± 1900 (A-518) (Haynes et al. 1966), was obtained from charcoals of the 1963 excavation season. The sample was taken from within a small patch of charcoal 75 cm beneath the former sample of the same excavation block. The sampled level was situated in the lower third part of an archaeologically sterile portion of the site stratigraphy. The next level of finds was located 25 cm beneath this sampled charcoal patch. On the sample submission form the lower archaeological layer is indicated as the sample's relative chronological position. This date appears inaccurately 18 700 ± 190 in summaries of Hungarian ^{14}C dates (Gábori-Csánk 1970; Dobosi, Szántó 2003). The admixture at Arka also might have modified the original position of the organic remains sampled for dating. It is, therefore, difficult to make authentic association between radiocarbon samples and the artifacts. The effect of cryoturbation upon the sediments of the site raises the insecurity of the stratigraphic position of the 13 ka BP date whose sample was originally submitted from the lower layer but after the young dating result compared to the 17 k years date Vértes changed the archaeological stratigraphic position of the sample with the upper layer. The Epigravettian age for the site thus was found unsupportable (Lengyel 2008–2009), and the typological character of the assemblage suited the Late Gravettian inventory of Bodrogkeresztúr (Lengyel 2016).

The lithic sample used in this study derived from adjacent trenches A, B, C, D, M, N, P and L of the 1961 and 1963 excavations. The material does not include the total number of recovered find, because Vértes did not collect all flakes, chunks, and debris of the local raw material, but the blades, cores, tools, and each piece of non-local raw materials. In spite of this, the assemblage may represent a sample from the occupation.

Raw materials

Local materials make up 81.5% of the total assemblage (Tab. 1) which are the limnic silicite outcropping in large quantity in the local stream bed within 100 meters distance west and north of the site. These weigh 101 kg while all the other materials make up a few kilograms of the assemblage. The local raw materials yielded 62.4 item per kg.

Regional raw materials make up 13.6% of the total assemblage. This group consists of the eastern Tokaj materials such as the C1 and C2 obsidian, red jasper, the eastern Slovakian radiolarite, black quartzite and menilite, and the meta-rhyolite of the Bükk Mountains. Latter is present only with a single item. Regional materials yielded 143.7 item per kg.

Transcarpathian (TC) materials make up 4.9% of the total assemblage. These are the Jurassic flint from the Kraków-Częstochowa upland, the erratic flint from Silesia/Moravian Gate, and the Volyn-Podolian flints 270 km northeast. TC materials yielded 197.3 item per kg.

Blade tool production

The local and regional raw materials have all the technological categories while the transcarpathian group lacks flake cores (Tab. 2). According to the dominancy of blade cores and the high ratio of blades in the tool assemblage (70.9%), the dominant knapping activity was the blade production. In spite of the mass of flakes, flake cores make up only 3.1% of the total core assemblage.

Overall, unidirectional removal scars dominate the blades (Tab. 3) and there is a predominance of single striking platform blade cores (Tab. 4). Besides, there is an important percent of perpendicular scars, which is due to the abundancy of neo-crested blades (Tab. 2). The presence of blade cores of two striking platforms shows bidirectional core reduction, as well. The blade platforms are predominantly plain (Tab. 5) and there is an insignificant ratio of platform faceting. The absence of impact point and the frequent overhang abrasion signal soft hammer technique in the blade debitage (Tab. 6).

Different means of blade sizes were measured by raw material groups (Tab. 7). The ANOVA test (Tab. 8) showed that local blades are significantly longer, wider, and thicker than regional and TC ones, while regional and TC items are statistically similar. Also, the measurements of the unbroken blade cores (Tab. 9) showed that local specimens are greater in each dimension (Tab. 10).

Blades highly dominate the tool assemblage (Tab. 11) with 9.3% of all blades being tools, while the tool frequency among flakes is 2.6% (Tab. 12). Breaking down the ratio by raw materials, observed is that the larger the distance between site and lithic source, the greater the ratio of blades used up for making tool.

The blade tools (Tab. 13) are generally shorter than the blanks while there are no differences concerning width and thickness (Tab. 14). The difference in length is due to that 84% of the blade tools are broken or severely shortened by retouching.

Comparing the sizes of the blade tools by raw materials (Tab. 15), ANOVA found that blade tools of local raw material are longer, wider and thicker than the blade tools of the other two raw materials. This coincides with the observation on the blank blade mean values of length, width and thickness.

Most blade tools are domestic types, but the armature group is significant (Tab. 16). Most local blade tools are end-scrapers, while regional and TC blade tools tend to be armatures.

The armatures are mostly backed bladelets (Tab. 17), and backed truncated types also are numerous, including a trapeze-rectangle and a backed ventrally truncated type. Points are tip retouched blades and microgravette types besides a single specimen of fléchette (Tab. 18).

Flake tool production

The very few remains of flake debitage are six flake cores. This allowed to deduce that the numerous flakes of the local material indeed are by-products of the blade debitage. Out of the six flake cores four were made of local raw materials and two are of regional.

Unidirectional scars are the minority on the local and regional flakes, but TC flakes were removed with unidirectional knapping orientation (Tab. 19). The flake platforms are plain in most cases (Tab. 20) and have impact points and unabraded overhangs, showing the extensive use of hard hammer technique (Tab. 21).

The largest flakes were found among the local materials (Tab. 22). When the mean lengths, widths and thicknesses of the flakes are compared by raw materials, ANOVA showed local flakes larger (Tab. 23).

The flakes compose the minority of the toolkit (Tab. 11). Out of all flakes only 2.6% were used for tools, which is a lower portion than what was found concerning the blades (Tab. 12). Most flake tools were made of the local raw materials (Tab. 11), but a greater portion of the regional and TC flakes, respectively, were used for making tools (Tab. 12).

Local flake tools are larger than the others (Tab. 24). There are differences between blank and tool flakes sizes, too (Tab. 25). The t-test comparison showed that local raw material flake tools are narrower than the blank items. Concerning regional and TC raw materials, flake tools are considerably thicker than the blank ones.

Comparing the sizes of the flake tools by raw materials (Tab. 26), ANOVA found local flake tools wider than the others.

End-scrapers and burins are the most common flake tools (Tab. 27). Local materials were used to make all the types made of flakes, while regional material did not yield borer and composite tool. TC items are end-scraper, burin and an edge retouched tool. The notched-denticulated tool production seems to be in sole association with the local materials. There are also two end-scrapers made of core platform rejuvenating flakes of local raw materials.

Table 1. Arka lithic raw material composition by weight in grams

Raw material	Blade	Flake	Core	Raw Block	Total	Total %
Local	10863	64595	20698	4986	101142	88.76076
Within local %	10.74035	63.86565	20.4643	4.929703	100	
Regional	1124	3620	2231	3997	10972	9.628869
Within regional %	10.24426	32.99307	20.33358	36.42909	100	
Transcarpathian	724	696	415		1835	1.61037
Within transcarpathian %	39.45504	37.92916	22.6158	0	100	
Total	12711	68911	23344	8983	113949	100
Within total %	11.15499	60.4753	20.48636	7.883351	100	

Table 2. Arka lithic assemblage composition by raw material types and technological categories

			Raw material			Total
			local	regional	transcarpathian	
Class	flake	count	2086	277	95	2458
		% within raw material	34.7%	27.6%	26.2%	33.4%
	blade	count	1032	410	182	1624
		% within raw material	17.2%	40.9%	50.3%	22.0%
	debris	count	2612	207	59	2878
		% within raw material	43.5%	20.7%	16.3%	39.1%
	rejuvenating flake	count	65	12	4	81
		% within raw material	1.1%	1.2%	1.1%	1.1%
	crest	count	14	2	1	17
		% within raw material	0.2%	0.2%	0.3%	0.2%
	neo-crest	count	74	28	11	113
		% within raw material	1.2%	2.8%	3.0%	1.5%
	blade core	count	116	64	10	190
		% within raw material	1.9%	6.4%	2.8%	2.6%
	flake core	count	4	2	0	6
		% within raw material	0.1%	0.2%	0.0%	0.1%
Total		count	6003	1002	362	7367
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 3. Arka blade assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material			Total
			local	regional	transcarpathian	
Scars	unidirectional	count	144	54	40	238
		% within raw material	49.0%	59.3%	53.3%	51.7%
	opposite	count	58	18	17	93
		% within raw material	19.7%	19.8%	22.7%	20.2%
	perpendicular	count	73	14	14	101
		% within raw material	24.8%	15.4%	18.7%	22.0%
	multiple	count	18	4	4	26
		% within raw material	6.1%	4.4%	5.3%	5.7%
	no scar	count	1	1	0	2
		% within raw material	0.3%	1.1%	0.0%	0.4%
Total		count	294	91	75	460
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 4. Arka blade core types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Types	unidirectional	count	65	21	6	92
		% within raw material	56.0%	32.8%	60.0%	48.4%
	bidirectional	count	7	2	0	9
		% within raw material	6.0%	3.1%	0.0%	4.7%
	alternate	count	19	12	4	35
		% within raw material	16.4%	18.8%	40.0%	18.4%
	multidirectional	count	2	0	0	2
		% within raw material	1.7%	0.0%	0.0%	1.1%
	pre-core	count	2	2	0	4
		% within raw material	1.7%	3.1%	0.0%	2.1%
	core fragment	count	21	27	0	48
		% within raw material	18.1%	42.2%	0.0%	25.3%
Total		count	116	64	10	190
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 5. Arka blade assemblage (complete specimens) platform type frequency by raw material

			Raw material			Total
			local	regional	transcarpathian	
Platform	plain	count	241	68	54	363
		% within raw material	82.0%	74.7%	72.0%	78.9%
	dihedral	count	19	9	1	29
		% within raw material	6.5%	9.9%	1.3%	6.3%
	faceted	count	16	5	3	24
		% within raw material	5.4%	5.5%	4.0%	5.2%
	cortical	count	4	3	3	10
		% within raw material	1.4%	3.3%	4.0%	2.2%
	linear	count	12	6	14	32
		% within raw material	4.1%	6.6%	18.7%	7.0%
	punctiform	count	2	0	0	2
		% within raw material	0.7%	0.0%	0.0%	0.4%
Total		count	294	91	75	460
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 6. Arka blade assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material			Total
			local	regional	transcarpathian	
Impact point -overhang	none	count	166	70	64	300
		% within raw material	56.5%	76.9%	85.3%	65.2%
	yes-no	count	30	1	6	37
		% within raw material	10.2%	1.1%	8.0%	8.0%
	yes-yes	count	42	8	0	50
		% within raw material	14.3%	8.8%	0.0%	10.9%
	no-yes	count	56	12	5	73
		% within raw material	19.0%	13.2%	6.7%	15.9%
Total		count	294	91	75	460
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 7. Arka blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	7.50	6.20	1.50
	Maximum	133.20	93.80	26.90
	Mean	56.5611	21.7852	8.4279
	Median	52.2000	21.0000	7.3000
	N	294	294	294
	Std. deviation	21.83817	9.39898	4.82171
Regional	Minimum	4.10	6.70	2.20
	Maximum	115.60	28.80	15.10
	Mean	39.0144	14.1158	5.4319
	Median	38.4000	13.0000	4.6000
	N	91	91	91
	Std. deviation	14.68085	5.19578	2.67916
Transcarpathian	Minimum	20.30	6.20	1.90
	Maximum	80.00	43.10	12.80
	Mean	42.5560	14.7080	4.6645
	Median	41.4000	13.4000	3.9000
	N	75	75	75
	Std. deviation	13.84572	5.80272	2.26361
Total	Minimum	4.10	6.20	1.50
	Maximum	133.20	93.80	26.90
	Mean	50.8065	19.1141	7.2216
	Median	46.2500	18.0500	6.0000
	N	460	460	460
	Std. deviation	20.91648	8.93358	4.43958

Table 8. Arka blade assemblage (complete specimens) ANOVA and Tukey post hoc test to compare length, width and thickness by raw materials

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	27495.090	2	13747.545	36.249	0.000
	within groups	173316.936	457	379.249		
	Total	200812.027	459			
Width [mm]	between groups	5827.037	2	2913.518	43.223	0.000
	within groups	30805.203	457	67.407		
	Total	36632.240	459			
Thickness [mm]	between groups	1209.715	2	604.857	35.271	0.000
	within groups	7837.100	457	17.149		
	Total	9046.814	459			

Multiple Comparisons
Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length [mm]	local	regional	17.54669	2.33614	0.000	12.0536	23.0398
		transcarpathian	14.00509	2.51925	0.000	8.0814	19.9288
	regional	local	–17.54669	2.33614	0.000	−23.0398	−12.0536
		transcarpathian	–3.54160	3.03714	0.474	−10.6831	3.5999
	transcarpathian	local	–14.00509	2.51925	0.000	−19.9288	−8.0814
		regional	3.54160	3.03714	0.474	−3.5999	10.6831
Width [mm]	local	regional	7.66935	0.98490	0.000	5.3535	9.9852
		transcarpathian	7.07717	1.06209	0.000	4.5798	9.5745
	regional	local	−7.66935	0.98490	0.000	−9.9852	−5.3535
		transcarpathian	−0.59218	1.28043	0.889	−3.6030	2.4186
	transcarpathian	local	−7.07717	1.06209	0.000	−9.5745	−4.5798
		regional	0.59218	1.28043	0.889	−2.4186	3.6030
Thickness [mm]	local	regional	2.99606	0.49677	0.000	1.8280	4.1641
		transcarpathian	3.76339	0.53571	0.000	2.5037	5.0230
	regional	local	–2.99606	0.49677	0.000	−4.1641	−1.8280
		transcarpathian	0.76733	0.64584	0.461	−0.7513	2.2859
	transcarpathian	local	−3.76339	0.53571	0.000	−5.0230	−2.5037
		regional	–0.76733	0.64584	0.461	−2.2859	0.7513

Table 9. Arka blade core (complete specimens) size by raw material

Raw material		Length	Width	Depth
Local	Minimum	24.20	16.60	11.10
	Maximum	148.00	96.30	90.00
	Mean	65.9774	40.7645	43.8226
	Median	61.3000	39.9000	39.4000
	N	93	93	93
	Std. deviation	22.07892	15.07795	17.18868
Regional	Minimum	25.00	12.40	11.50
	Maximum	60.70	40.30	41.40
	Mean	35.9057	24.8514	27.2543
	Median	34.6000	24.2000	27.2000
	N	35	35	35
	Std. deviation	8.37777	7.62775	7.71078
Transcarpathian	Minimum	23.90	13.80	11.00
	Maximum	62.60	39.70	56.70
	Mean	43.6200	25.1600	29.9900
	Median	40.7000	24.1000	28.7000
	N	10	10	10
	Std. deviation	11.49355	8.58075	12.43958
Total	Minimum	23.90	12.40	11.00
	Maximum	148.00	96.30	90.00
	Mean	56.7304	35.5978	38.6181
	Median	53.5500	33.6500	34.2500
	N	138	138	138
	Std. deviation	23.12654	15.08386	16.73733

Table 10. Arka blade core assemblage (complete specimens) ANOVA and Tukey post hoc test to compare length, width and thickness by raw materials

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length	between groups	24849.375	2	12424.687	34.639	0.000
	within groups	48423.297	135	358.691		
	Total	73272.672	137			
Width	between groups	7614.065	2	3807.033	21.818	0.000
	within groups	23556.564	135	174.493		
	Total	31170.629	137			
Depth	between groups	7783.266	2	3891.633	17.171	0.000
	within groups	30595.658	135	226.635		
	Total	38378.925	137			

Table 10. Continued

Multiple Comparisons

Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length	local	regional	30.07171	3.75569	0.000	21.1713	38.9721
		transcarpathian	22.35742	6.30286	0.002	7.4206	37.2942
	regional	local	−30.07171	3.75569	0.000	−38.9721	−21.1713
		transcarpathian	−7.71429	6.79098	0.494	−23.8079	8.3793
	transcarpathian	local	−22.35742	6.30286	0.002	−37.2942	−7.4206
		regional	7.71429	6.79098	0.494	−8.3793	23.8079
Width	local	regional	15.91309	2.61950	0.000	9.7053	22.1209
		transcarpathian	15.60452	4.39609	0.002	5.1865	26.0226
	regional	local	−15.91309	2.61950	0.000	−22.1209	−9.7053
		transcarpathian	−0.30857	4.73654	0.998	−11.5334	10.9163
	transcarpathian	local	−15.60452	4.39609	0.002	−26.0226	−5.1865
		regional	0.30857	4.73654	0.998	−10.9163	11.5334
Depth	local	regional	16.56829	2.98533	0.000	9.4935	23.6431
		transcarpathian	13.83258	5.01003	0.018	1.9596	25.7056
	regional	local	−16.56829	2.98533	0.000	−23.6431	−9.4935
		transcarpathian	−2.73571	5.39803	0.868	−15.5282	10.0568
	transcarpathian	local	−13.83258	5.01003	0.018	−25.7056	−1.9596
		regional	2.73571	5.39803	0.868	−10.0568	15.5282

Table 11. Arka tool assemblage product composition by raw materials

		Raw material			Total
		local	regional	transcarpathian	
Flake	count	35	22	8	65
	% within raw material	36.5%	24.4%	18.2%	28.3%
Blade	count	59	68	36	163
	% within raw material	61.5%	75.6%	81.8%	70.9%
Rejuvenating flake	count	2	0	0	2
	% within raw material	2.1%	0.0%	0.0%	0.9%
Total	count	96	90	44	230
	% within raw material	100.0%	100.0%	100.0%	100.0%

Table 12. Arka knapped product frequency in tool assemblage by raw materials

				Raw material			Total
				local	regional	transcarpathian	
Flake	state	blank	count	2051	255	87	2393
			% within raw material	98.3%	92.1%	91.6%	97.4%
		tool	count	35	22	8	65
			% within raw material	1.7%	7.9%	8.4%	2.6%
	total		count	2086	277	95	2458
			% within raw material	100.0%	100.0%	100.0%	100.0%
Blade	state	blank	count	1061	372	158	1591
			% within raw material	94.7%	84.5%	81.4%	90.7%
		tool	count	59	68	36	163
			% within raw material	5.3%	15.5%	18.6%	9.3%
	total		count	1120	440	194	1754
			% within raw material	100.0%	100.0%	100.0%	100.0%
Debris	state	blank	count	2612	207	59	2878
			% within raw material	100.0%	100.0%	100.0%	100.0%
	total		count	2612	207	59	2878
			% within raw material	100.0%	100.0%	100.0%	100.0%
Rejuvenating flake	state	blank	count	63	12	4	79
			% within raw material	96.9%	100.0%	100.0%	97.5%
		tool	count	2	0	0	2
			% within raw material	3.1%	0.0%	0.0%	2.5%
	total		count	65	12	4	81
			% within raw material	100.0%	100.0%	100.0%	100.0%

Table 13. Arka blade tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	10.10	4.20	1.80
	Maximum	113.70	47.20	32.90
	Mean	46.2464	20.3846	9.4027
	Median	40.9000	19.7000	7.8000
	N	59	59	59
	Std. deviation	25.18068	9.59131	6.63280
Regional	Minimum	7.60	3.60	1.00
	Maximum	67.10	29.00	14.00
	Mean	29.9347	13.2813	4.7479
	Median	27.5000	13.1750	4.1000
	N	68	68	68
	Std. deviation	12.27628	5.91327	2.57142
Transcarpathian	Minimum	9.10	3.68	1.48
	Maximum	144.80	50.70	13.20
	Mean	34.7197	14.1292	4.6394
	Median	30.7000	12.1500	4.4000
	N	36	36	36
	Std. deviation	23.32726	9.12088	2.51161
Total	Minimum	7.60	3.60	1.00
	Maximum	144.80	50.70	32.90
	Mean	36.8958	16.0397	6.4088
	Median	32.6000	14.8000	5.2000
	N	163	163	163
	Std. deviation	21.45093	8.73217	4.99665

Table 14. Arka blade blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test									
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Local	length [mm]	1.013	0.315	3.224	351	0.001	10.31465	3.19903
				2.933	76.485	0.004	10.31465	3.51696
	width [mm]	0.244	0.622	1.041	351	0.299	1.40059	1.34539
				1.027	81.907	0.307	1.40059	1.36370
	thickness [mm]	5.489	0.020	−1.323	351	0.187	−0.97479	0.73681
				−1.073	70.797	0.287	−0.97479	0.90815
Regional	length [mm]	0.703	0.403	4.133	157	0.000	9.07969	2.19708
				4.240	154.967	0.000	9.07969	2.14119
	width [mm]	2.213	0.139	0.944	157	0.346	0.83450	0.88378
				0.927	133.523	0.356	0.83450	0.90049
	thickness [mm]	0.382	0.537	1.620	157	0.107	0.68393	0.42218
				1.630	147.521	0.105	0.68393	0.41966
Transcarpathian	length [mm]	0.771	0.382	2.213	109	0.029	7.83628	3.54032
				1.864	47.199	0.069	7.83628	4.20376
	width [mm]	5.069	0.026	0.405	109	0.686	0.57883	1.42757
				0.348	49.045	0.729	0.57883	1.66126
	thickness [mm]	0.201	0.655	0.053	109	0.958	0.02509	0.47569
				0.051	63.077	0.960	0.02509	0.49350

Table 15. Arka blade tool length, width and thickness mean comparison by raw materials with ANOVA and the Tukey post hoc

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	8624.170	2	4312.085	10.466	0.000
	within groups	65918.883	160	411.993		
	Total	74543.053	162			
Width [mm]	between groups	1762.592	2	881.296	13.315	0.000
	within groups	10590.045	160	66.188		
	Total	12352.636	162			
Thickness [mm]	between groups	829.124	2	414.562	20.628	0.000
	within groups	3215.457	160	20.097		
	Total	4044.581	162			

Table 15. Continued

Multiple Comparisons
Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length [mm]	local	regional	16.31173	3.61132	0.000	7.7683	24.8551
		transcarpathian	11.52672	4.29269	0.022	1.3714	21.6821
	regional	local	−16.31173	3.61132	0.000	−24.8551	−7.7683
		transcarpathian	−4.78502	4.18366	0.489	−14.6824	5.1124
	transcarpathian	local	−11.52672	4.29269	0.022	−21.6821	−1.3714
		regional	4.78502	4.18366	0.489	−5.1124	14.6824
Width [mm]	local	regional	7.10325	1.44747	0.000	3.6789	10.5276
		transcarpathian	6.25541	1.72057	0.001	2.1850	10.3258
	regional	local	−7.10325	1.44747	0.000	−10.5276	−3.6789
		transcarpathian	−0.84784	1.67687	0.869	−4.8149	3.1192
	transcarpathian	local	−6.25541	1.72057	0.001	−10.3258	−2.1850
		regional	0.84784	1.67687	0.869	−3.1192	4.8149
Thickness [mm]	local	regional	4.65477	0.79760	0.000	2.7679	6.5417
		transcarpathian	4.76327	0.94808	0.000	2.5204	7.0062
	regional	local	−4.65477	0.79760	0.000	−6.5417	−2.7679
		transcarpathian	0.10850	0.92400	0.992	−2.0774	2.2944
	transcarpathian	local	−4.76327	0.94808	0.000	−7.0062	−2.5204
		regional	−0.10850	0.92400	0.992	−2.2944	2.0774

Table 16. Arka blade tool types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Tooltypes	endscraper	count	23	8	9	40
		% within raw material	39.0%	11.8%	25.0%	24.5%
	burin	count	10	6	0	16
		% within raw material	16.9%	8.8%	0.0%	9.8%
	retouched	count	4	15	7	26
		% within raw material	6.8%	22.1%	19.4%	16.0%
	borer	count	0	0	1	1
		% within raw material	0.0%	0.0%	2.8%	0.6%
	splintered piece	count	1	0	0	1
		% within raw material	1.7%	0.0%	0.0%	0.6%
	truncation	count	6	12	5	23
		% within raw material	10.2%	17.6%	13.9%	14.1%
	notched-denticulated	count	2	2	0	4
		% within raw material	3.4%	2.9%	0.0%	2.5%
	composite	count	1	1	1	3
		% within raw material	1.7%	1.5%	2.8%	1.8%
	armature	count	12	24	13	49
		% within raw material	20.3%	35.3%	36.1%	30.1%
Total		count	59	68	36	163
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 17. Arka armature types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Armatures	backed	count	2	15	7	24
		% within raw material	16.7%	62.5%	53.8%	49.0%
	backed-truncated	count	7	1	3	11
		% within raw material	58.3%	4.2%	23.1%	22.4%
	backed-ventral truncation	count	0	1	0	1
		% within raw material	0.0%	4.2%	0.0%	2.0%
	trapeze-rectangle	count	0	0	1	1
		% within raw material	0.0%	0.0%	7.7%	2.0%
	points	count	3	7	2	12
		% within raw material	25.0%	29.2%	15.4%	24.5%
Total		count	12	24	13	49
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 18. Arka point types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Points	retouched	count	3	2	1	6
		% within raw material	100.0%	28.6%	50.0%	50.0%
	gravette/microgravette	count	0	3	1	4
		% within raw material	0.0%	42.9%	50.0%	33.3%
	backed	count	0	1	0	1
		% within raw material	0.0%	14.3%	0.0%	8.3%
	fléchette	count	0	1	0	1
		% within raw material	0.0%	14.3%	0.0%	8.3%
Total		count	3	7	2	12
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 19. Arka blank flake assemblage dorsal scar pattern

			Raw material			Total
			local	regional	transcarpathian	
Scars	unidirectional	count	281	41	23	345
		% within raw material	35.4%	44.1%	52.3%	37.1%
	opposite	count	101	8	3	112
		% within raw material	12.7%	8.6%	6.8%	12.0%
	perpendicular	count	264	25	12	301
		% within raw material	33.3%	26.9%	27.3%	32.4%
	multiple	count	141	7	4	152
		% within raw material	17.8%	7.5%	9.1%	16.3%
	no scar	count	6	12	2	20
		% within raw material	0.8%	12.9%	4.5%	2.2%
Total		count	793	93	44	930
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 20. Arka blank flake assemblage platform types

			Raw material			Total
			local	regional	transcarpathian	
Platform	plain	count	629	61	34	724
		% within raw material	79.3%	65.6%	77.3%	77.8%
	dihedral	count	80	9	3	92
		% within raw material	10.1%	9.7%	6.8%	9.9%
	faceted	count	33	4	5	42
		% within raw material	4.2%	4.3%	11.4%	4.5%
	cortical	count	45	15	1	61
		% within raw material	5.7%	16.1%	2.3%	6.6%
	linear	count	4	2	1	7
		% within raw material	0.5%	2.2%	2.3%	0.8%
	punctiform	count	0	2	0	2
		% within raw material	0.0%	2.2%	0.0%	0.2%
	irregular	count	2	0	0	2
		% within raw material	0.3%	0.0%	0.0%	0.2%
Total		count	793	93	44	930
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 21. Arka blank flake assemblage impact point-overhang frequency

			Raw material			Total
			local	regional	transcarpathian	
Impact point-overhang	none	count	82	16	12	110
		% within raw material	10.3%	17.2%	27.3%	11.8%
	yes-no	count	52	13	8	73
		% within raw material	6.6%	14.0%	18.2%	7.8%
	yes-yes	count	418	38	10	466
		% within raw material	52.7%	40.9%	22.7%	50.1%
	no-yes	count	241	26	14	281
		% within raw material	30.4%	28.0%	31.8%	30.2%
Total		count	793	93	44	930
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 22. Arka flake assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	14.50	13.60	1.80
	Maximum	140.10	127.00	75.00
	Mean	50.2058	42.4666	12.9763
	Median	47.1000	38.8000	11.6000
	N	793	793	793
	Std. deviation	19.03758	18.42058	7.39474
Regional	Minimum	10.70	9.40	2.00
	Maximum	95.00	49.50	29.00
	Mean	31.3548	25.3937	8.3366
	Median	27.2000	24.4000	7.1000
	N	93	93	93
	Std. deviation	14.04941	9.70546	4.86216
Transcarpathian	Minimum	14.30	12.50	2.60
	Maximum	71.00	81.00	16.80
	Mean	37.7500	28.0205	6.7136
	Median	34.7000	24.8000	6.2500
	N	44	44	44
	Std. deviation	13.43672	13.20801	3.08896
Total	Minimum	10.70	9.40	1.80
	Maximum	140.10	127.00	75.00
	Mean	47.7314	40.0758	12.2161
	Median	44.6500	36.2000	10.4500
	N	930	930	930
	Std. deviation	19.33078	18.43973	7.26878

Table 23. Arka flake length, width and thickness mean comparison by raw materials with ANOVA and the Tukey post hoc

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	34180.750	2	17090.375	50.621	0.000
	within groups	312967.134	927	337.613		
	Total	347147.883	929			
Width [mm]	between groups	30974.915	2	15487.458	50.391	0.000
	within groups	284907.130	927	307.343		
	Total	315882.046	929			
Thickness [mm]	between groups	3190.250	2	1595.125	32.220	0.000
	within groups	45893.549	927	49.508		
	Total	49083.799	929			

Table 23. Continued

Multiple Comparisons
Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length [mm]	local	regional	18.85096	2.01395	0.000	14.1233	23.5787
		transcarpathian	12.45580	2.84583	0.000	5.7753	19.1363
	regional	local	−18.85096	2.01395	0.000	−23.5787	−14.1233
		transcarpathian	−6.39516	3.36203	0.139	−14.2875	1.4971
	transcarpathian	local	−12.45580	2.84583	0.000	−19.1363	−5.7753
		regional	6.39516	3.36203	0.139	−1.4971	14.2875
Width [mm]	local	regional	17.07295	1.92155	0.000	12.5622	21.5837
		transcarpathian	14.44615	2.71526	0.000	8.0721	20.8202
	regional	local	−17.07295	1.92155	0.000	−21.5837	−12.5622
		transcarpathian	−2.62680	3.20778	0.691	−10.1570	4.9034
	transcarpathian	local	−14.44615	2.71526	0.000	−20.8202	−8.0721
		regional	2.62680	3.20778	0.691	−4.9034	10.1570
Thickness [mm]	local	regional	4.63978	0.77121	0.000	2.8294	6.4502
		transcarpathian	6.26271	1.08977	0.000	3.7045	8.8209
	regional	local	−4.63978	0.77121	0.000	−6.4502	−2.8294
		transcarpathian	1.62292	1.28744	0.418	−1.3993	4.6452
	transcarpathian	local	−6.26271	1.08977	0.000	−8.8209	−3.7045
		regional	−1.62292	1.28744	0.418	−4.6452	1.3993

Table 24. Arka flake tool length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	18.40	15.50	4.90
	Maximum	129.20	62.20	43.00
	Mean	46.4654	33.9463	14.7206
	Median	41.4000	32.8000	10.7000
	N	35	35	35
	Std. deviation	22.05995	10.94052	9.65583
Regional	Minimum	16.40	11.30	3.90
	Maximum	71.00	47.90	16.20
	Mean	35.0545	26.1682	10.7091
	Median	32.3000	25.4000	10.6000
	N	22	22	22
	Std. deviation	12.76475	9.01789	3.67422
Transcarpathian	Minimum	23.00	13.20	3.80
	Maximum	51.20	33.80	19.90
	Mean	32.7250	21.9750	10.5250
	Median	30.2000	20.3500	10.0000
	N	8	8	8
	Std. deviation	9.00869	7.87759	4.99535
Total	Minimum	16.40	11.30	3.80
	Maximum	129.20	62.20	43.00
	Mean	40.9122	29.8403	12.8465
	Median	37.5000	29.3500	10.7000
	N	65	65	65
	Std. deviation	18.91844	10.89253	7.80095

Table 25. Arka flake blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test								
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Local	length [mm]	0.026	0.871	1.130	826	0.259	3.74037	3.31130
				0.987	36.270	0.330	3.74037	3.78960
	width [mm]	7.560	0.006	2.714	826	0.007	8.52032	3.13895
				4.344	43.011	0.000	8.52032	1.96157
	thickness [mm]	4.534	0.034	−1.346	826	0.179	−1.74423	1.29563
				−1.055	35.782	0.298	−1.74423	1.65312
Regional	length [mm]	0.058	0.811	−1.129	113	0.261	−3.69971	3.27638
				−1.199	34.121	0.239	−3.69971	3.08687
	width [mm]	0.454	0.502	−0.341	113	0.734	−0.77453	2.27157
				−0.357	33.511	0.723	−0.77453	2.17010
	thickness [mm]	1.487	0.225	−2.145	113	0.034	−2.37253	1.10582
				−2.547	40.419	0.015	−2.37253	0.93158
Transcarpathian	length [mm]	2.096	0.154	1.013	50	0.316	5.02500	4.96144
				1.331	13.450	0.205	5.02500	3.77463
	width [mm]	1.032	0.315	1.248	50	0.218	6.04545	4.84218
				1.766	15.332	0.097	6.04545	3.42372
	thickness [mm]	2.825	0.099	−2.899	50	0.006	−3.81136	1.31465
				−2.087	8.001	0.070	−3.81136	1.82649

Table 26. Arka flake tool length, width and thickness mean comparison by raw materials with ANOVA and the Tukey post hoc

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	2370.451	2	1185.225	3.578	0.034
	within groups	20535.618	62	331.220		
	Total	22906.068	64			
Width [mm]	between groups	1381.631	2	690.815	6.895	0.002
	within groups	6211.793	62	100.190		
	Total	7593.424	64			
Thickness [mm]	between groups	266.547	2	133.274	2.277	0.111
	within groups	3628.165	62	58.519		
	Total	3894.712	64			

Table 26. Continued

Multiple Comparisons
Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length [mm]	local	regional	11.41088	4.95165	0.063	−0.4793	23.3011
		transcarpathian	13.74043	7.13203	0.140	−3.3854	30.8663
	regional	local	−11.41088	4.95165	0.063	−23.3011	0.4793
		transcarpathian	2.32955	7.51385	0.948	−15.7131	20.3722
	transcarpathian	local	−13.74043	7.13203	0.140	−30.8663	3.3854
		regional	−2.32955	7.51385	0.948	−20.3722	15.7131
Width [mm]	local	regional	7.77810	2.72336	0.016	1.2386	14.3176
		transcarpathian	11.97129	3.92254	0.009	2.5522	21.3903
	regional	local	−7.77810	2.72336	0.016	−14.3176	−1.2386
		transcarpathian	4.19318	4.13254	0.570	−5.7301	14.1165
	transcarpathian	local	−11.97129	3.92254	0.009	−21.3903	−2.5522
		regional	−4.19318	4.13254	0.570	−14.1165	5.7301
Thickness [mm]	local	regional	4.01148	2.08132	0.140	−0.9863	9.0093
		transcarpathian	4.19557	2.99780	0.347	−3.0029	11.3941
	regional	local	−4.01148	2.08132	0.140	−9.0093	0.9863
		transcarpathian	0.18409	3.15829	0.998	−7.3998	7.7680
	transcarpathian	local	−4.19557	2.99780	0.347	−11.3941	3.0029
		regional	−0.18409	3.15829	0.998	−7.7680	7.3998

Table 27. Arka flake tool types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Tooltypes	endscraper	count	12	15	3	30
		% within raw material	34.3%	68.2%	37.5%	46.2%
	burin	count	8	3	3	14
		% within raw material	22.9%	13.6%	37.5%	21.5%
	retouched	count	6	3	2	11
		% within raw material	17.1%	13.6%	25.0%	16.9%
	borer	count	1	0	0	1
		% within raw material	2.9%	0.0%	0.0%	1.5%
	composite	count	1	0	0	1
		% within raw material	2.9%	0.0%	0.0%	1.5%
	notched-denticulated	count	7	1	0	8
		% within raw material	20.0%	4.5%	0.0%	12.3%
Total		count	35	22	8	65
		% within raw material	100.0%	100.0%	100.0%	100.0%

BODROGKERESZTÚR

The site

The site was found on a hill (named Henye) 190 m a.s.l. at the village Bodrogkeresztúr located north to Mount Kopasz of Tokaj 513 m a.s.l. in Northeast Hungary. This area is the southwestern edge of Tokaj Mountains where the Great Plain of Hungary begins and river Bodrog flows into Tisza.

Two excavations were carried out at the site, in 1963 and 1982, and both found most of the artifacts in the top soil and the sediment underlying that was disturbed by agriculture (Vértes 1966; Dobosi 2000b). Finds in undisturbed stratigraphic context lay on the border of a typical loess and an underlying limy, whitish loess like layer (Dobosi 2000b). A paleosol also was noticed at the site, which, according to Vértes (1966), lay under the cultural layer. Contrary, Dobosi (2000b) associated the human occupation with the paleosol. The longest stratigraphic sequence of the site was located in unit I/8 of the 1982 excavation, where under the recent top soil a layer of loess, an embryonic soil, another layer of loess, an embryonic soil again, and the bedrock of “andesite tuff” composed the 2.50 m stratum from top to bottom (Dobosi 2000b). A geological investigation (Sümegi et al. 2000) found the strata consisted of 1) the agriculturally disturbed recent soil, 2) a reddish brown (dark brown when wet) paleosol of 10 cm thick woven by roots of recent vegetation and containing bones, lithic chips and charcoals in, 3) a yellowish brown calcareous loess layer with carbonate concretions 30 cm thick, 4) a 10 cm thick regolith layer of pebble and weathered fragments of rhyolite 1 m below the surface, and 5) the “rhyolite bedrock”. These descriptions shows that the level of the archaeological finds was not related consistently with a single geological unit, and there are contradictions in the definitions of the geological units.

Vértes (1966) published charcoal samples ^{14}C dated to 28 700 ± 3000 (GXO-195). Vértes recorded in the excavation diary that the sample had been taken from trench F, 10–15 cm thick amorphous patches of charcoals in two levels (100–110 cm and 140–150 cm beneath the top soil), within which artifacts were not found. Vértes did not specify which level yielded the samples for dating. The second radiocarbon date of the site was obtained from samples taken during the geological investigation (Sümegi et al. 2000). The samples (pine tree charcoals) were derived from a 5 kg sample of the paleosol taken for malacology and the charcoals found within sample were dated to 26 318 ± 365 (Deb-2555). Two further dates on bone samples were obtained, 18 575 ± 208 (Deb-3381) and 10 630 ± 270 (Hv-12986) (Dobosi 2000b).

Dobosi (2000) classified the lithic assemblage Pavlovian, but the latest typological analysis pointed out a cultural affiliation with the Late Gravettian (Lengyel 2015, 2016).

The archaeological material, besides the lithic tools, contains faunal remains (Vörös 2000) and an incised flat pebble interpreted as a lunar calendar (Vértes 1965). According to Vörös (2000), the most frequent hunted animals were the horse (MNI = 50) and the elk (MNI = 34). Further prey remains are deer, bison, mammoth, lion and hare.

Knapped lithic analysis here contains material from the two excavation campaigns, including finds from the surface of the trenches, from the disturbed matrix and the undisturbed archaeological layer. Lithic artifacts collected by other field surveys were excluded. In spite of the poor preservation of archaeological features, the lithic assemblage is handled as a whole. Separating finds of the surface from those found buried was unnecessary because the agriculture distorted the most of the original settlement features. This decision most likely has not resulted in studying an admixture of finds from different periods of the Upper Palaeolithic because the only diagnostic tools are of Late Gravettian origin.

Raw materials

Local raw materials dominate the assemblage (Tab. 28). The most frequent kind among these are the metasomatically silicified rhyolite tuff and the limnic silicite. Further locally available materials are the obsidian of Carpathian 2 type and the red jasper. The local materials yielded 64.9 items per kg.

Regional materials are the Carpathian 1 type obsidian, the radiolarite, the black Ondava chert and menilite of East Slovakia. The only regional material from west is the meta-rhyolite of Bükk mountains. Regional materials yielded 146.4 items per kg.

Transcarpathian materials are mostly the Cretaceous flints of Volhynian and Silesian origin, and in smaller portion the Jurassic flint from the Kraków-Częstochowa upland. Transcarpathian materials yielded 199 items per kg.

Blade tool production

Materials of each procurement zone were processed with a full debitage cycle at the site (Tab. 29). By technological categories, flakes dominate the assemblage, but counting together the blades, neo-crested blades and crested blades, the number of blades becomes only slightly lower than that of the flakes. The predominance of the blade technology is also supported by that blade cores almost three times outnumber flake cores.

The scar pattern on the blades (Tab. 30) and the number of striking platforms of the cores (Tab. 31) identify unipolar blade technology, which kept the striking platforms plain (Tab. 32), and applied soft hammer technique (Tab. 33).

Local blades are longer, wider and thicker than the others (Tab. 34). ANOVA test (Tab. 35), however, found these differences significant only between local and transcarpathian specimens. Regional blades are only wider than local ones, and generally those do not differ from transcarpathian blades.

Overall, blades were the prime blanks of tools (Tab. 36). Blade usage ratio for tools is 19.2% opposing the 11.2% for the flakes (Tab. 37). Most of the blade tools were made of local and TC materials.

The length of local blade tools is shorter than that of the blank blades, but the thicknesses and the widths have the same mean value (Tabs 38, 39). Regional blades do not show difference in this comparison. Tool blades of TC are thicker and wider than the blank specimens. Comparing the sizes of the blade tools by raw materials, ANOVA (Tab. 40) found no difference between the raw materials.

The blades are mostly edge retouched tools, burins, end-scrapers, and armatures (Tabs 41–43). Among regional blade tools edge retouched items are highly dominant and the majority of the transcarpathian blade tools are burins. Armatures mostly are local and transcarpathian blades. Between these two materials there is no significant difference in the shares of the types. The armature class typically is composed of points and backed bladelets (Tab. 42). The points are tip retouched and Gravette/microgravette types (Tab. 43).

Flake tool production

The number of flake cores showed that part of the flakes were produced by a flake debitage (Tab. 39). Flake debitage was applied mostly to local and regional materials reduction. It is uncertain to separate the blade production by-product flakes and flakes made by their own debitage.

The flake cores typically have multiple debitage surfaces or a single striking platform (Tab. 44). Unidirectional scars dominate the dorsal faces of the flakes in each raw material group (Tab. 45), but the multiple direction is the most frequent on local raw material flakes in accordance with the multi-platform core frequency. Platforms of the flakes are plain (Tab. 46). A greater difference was found concerning the use of knapping technique in the flake production: local flakes bear more impact point and unabraded overhang (Tab. 47), signaling more frequent hard hammer technique.

The largest flakes are in the local material assemblage concerning all three measured parameters (Tab. 48). The mean length, width and thickness by raw materials are different (Tab. 49). The post hoc test showed that the mean lengths and widths of local flakes are greater compared to regional and transcarpathian flakes. Regarding thickness, local flakes have greater mean value than transcarpathian flakes.

Local flake tools (Tab. 50) are longer and thicker than flake blanks (Tab. 51). Transcarpathian flake tools are greater by all three measured parameter than blank flakes while regional flake tool and blank mean values are not different. Also tools of local material are greater in length, width and thickness than those in the other two groups (Tab. 52).

Most of the flake tools are end-scrapers, burins and retouched items (Tab. 53). There is no raw material which would have yielded all the flake tool types. Local and regional flakes tend to be end-scrapers while the transcarpathians are rather burins.

There are 12 tools made of debris, mostly burins, and except one splintered tool these were made of local raw material (Tab. 57). Rejuvenating flakes were also used from each raw material group for making end-scraper, burin, edge retouched and a borer.

Table 28. Bodrogkeresztúr lithic raw material composition by weight in grams

Raw material	Blade	Flake	Debris	Core	Raw block	Total	%
Local	3878	14945	4623	11287	116	34849	88.98223
Within local %	11.12801	42.88502	13.2658	32.3883	0.332865	100	
Regional	562	882	147	985		2576	6.577469
Within regional %	21.81677	34.23913	5.706522	38.23758	0	100	
Transcarpathian	1184	444	86	25		1739	4.440302
Within transcarpathian %	68.08511	25.53191	4.945371	1.437608	0	100	
Total	5624	16271	4856	12297	116	39164	100
Within total %	14.36013	41.54581	12.39914	31.39873	0.29619	100	

Table 29. Bodrogkeresztúr lithic assemblage composition by raw material types and technological categories

		Raw material			Total
		local	regional	transcarpathian	
Flake	count	1089	186	102	1377
	% within raw material	48.3%	49.3%	29.5%	46.3%
Blade	count	657	140	204	1001
	% within raw material	29.2%	37.1%	59.0%	33.6%
Debris	count	212	22	14	248
	% within raw material	9.4%	5.8%	4.0%	8.3%
Rejuvenating flake	count	46	4	4	54
	% within raw material	2.0%	1.1%	1.2%	1.8%
Crest	count	21	0	3	24
	% within raw material	0.9%	0.0%	0.9%	0.8%
Neo-crest	count	66	5	14	85
	% within raw material	2.9%	1.3%	4.0%	2.9%
Blade core	count	118	11	5	134
	% within raw material	5.2%	2.9%	1.4%	4.5%
Flake core	count	44	9	0	53
	% within raw material	2.0%	2.4%	0.0%	1.8%
Total	count	2253	377	346	2976
	% within raw material	100.0%	100.0%	100.0%	100.0%

Table 30. Bodrogkeresztúr blade assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material			Total
			local	regional	transcarpathian	
Scars	unidirectional	count	110	10	19	139
		% within raw material	58.8%	43.5%	67.9%	58.4%
	opposite	count	23	5	4	32
		% within raw material	12.3%	21.7%	14.3%	13.4%
	perpendicular	count	41	5	5	51
		% within raw material	21.9%	21.7%	17.9%	21.4%
	multiple	count	9	3	0	12
		% within raw material	4.8%	13.0%	0.0%	5.0%
	no scar	count	4	0	0	4
		% within raw material	2.1%	0.0%	0.0%	1.7%
Total		count	187	23	28	238
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 31. Bodrogkeresztúr blade core types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Types	unidirectional	count	89	9	3	101
		% within raw material	75.4%	81.8%	60.0%	75.4%
	bidirectional	count	10	0	0	10
		% within raw material	8.5%	0.0%	0.0%	7.5%
	alternate	count	11	0	1	12
		% within raw material	9.3%	0.0%	20.0%	9.0%
	multidirectional	count	1	0	1	2
		% within raw material	0.8%	0.0%	20.0%	1.5%
	pre-core	count	1	0	0	1
		% within raw material	0.8%	0.0%	0.0%	0.7%
	core fragment	count	6	2	0	8
		% within raw material	5.1%	18.2%	0.0%	6.0%
Total		count	118	11	5	134
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 32. Bodrogkeresztúr blade assemblage (complete specimens) platform type frequency by raw material

			Raw material			Total
			local	regional	transcarpathian	
Platform	plain	count	132	13	17	162
		% within raw material	70.6%	56.5%	60.7%	68.1%
	dihedral	count	14	1	3	18
		% within raw material	7.5%	4.3%	10.7%	7.6%
	faceted	count	17	4	6	27
		% within raw material	9.1%	17.4%	21.4%	11.3%
	cortical	count	6	0	0	6
		% within raw material	3.2%	0.0%	0.0%	2.5%
	linear	count	12	1	1	14
		% within raw material	6.4%	4.3%	3.6%	5.9%
	punctiform	count	4	3	1	8
		% within raw material	2.1%	13.0%	3.6%	3.4%
	irregular	count	2	1	0	3
		% within raw material	1.1%	4.3%	0.0%	1.3%
Total		count	187	23	28	238
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 33. Bodrogkeresztúr blade assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material			Total
			local	regional	transcarpathian	
Impact point-overhang	none	count	119	15	26	160
		% within raw material	63.6%	65.2%	92.9%	67.2%
	yes-no	count	16	3	0	19
		% within raw material	8.6%	13.0%	0.0%	8.0%
	yes-yes	count	20	2	0	22
		% within raw material	10.7%	8.7%	0.0%	9.2%
	no-yes	count	32	3	2	37
		% within raw material	17.1%	13.0%	7.1%	15.5%
Total		count	187	23	28	238
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 34. Bodrogkeresztúr blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	6.10	6.30	1.70
	Maximum	125.90	50.00	28.50
	Mean	50.5225	19.0535	7.0856
	Median	47.2000	17.6000	6.2000
	N	187	187	187
	Std. deviation	18.19229	6.80854	3.66159
Regional	Minimum	18.20	5.50	1.50
	Maximum	77.20	33.00	14.00
	Mean	42.4043	15.2957	5.7957
	Median	39.0000	13.0000	5.1000
	N	23	23	23
	Std. deviation	16.44977	7.03753	3.07918
Transcarpathian	Minimum	19.50	6.20	1.70
	Maximum	89.10	31.00	9.90
	Mean	40.2857	12.6500	4.1321
	Median	37.0000	9.8000	3.6000
	N	28	28	28
	Std. deviation	18.09112	6.94574	1.90808
Total	Minimum	6.10	5.50	1.50
	Maximum	125.90	50.00	28.50
	Mean	48.5336	17.9370	6.6134
	Median	45.5000	16.8000	5.7000
	N	238	238	238
	Std. deviation	18.35616	7.17198	3.57564

Table 35. Bodrogkeresztúr blade assemblage (complete specimens) ANOVA and Tukey post hoc test to compare length, width and thickness by raw materials

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	3508.522	2	1754.261	5.400	0.005
	within groups	76348.310	235	324.886		
	Total	79856.831	237			
Width [mm]	between groups	1176.230	2	588.115	12.548	0.000
	within groups	11014.425	235	46.870		
	Total	12190.655	237			
Thickness [mm]	between groups	229.455	2	114.728	9.627	0.000
	within groups	2800.642	235	11.918		
	Total	3030.097	237			

Multiple Comparisons
Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length [mm]	local	regional	8.11811	3.98282	0.105	−1.2760	17.5122
		transcarpathian	10.23675	3.65246	0.015	1.6218	18.8517
	regional	local	−8.11811	3.98282	0.105	−17.5122	1.2760
		transcarpathian	2.11863	5.07234	0.908	−9.8453	14.0826
	transcarpathian	local	−10.23675	3.65246	0.015	−18.8517	−1.6218
		regional	−2.11863	5.07234	0.908	−14.0826	9.8453
Width [mm]	local	regional	3.75782	1.51277	0.036	0.1897	7.3259
		transcarpathian	6.40348	1.38729	0.000	3.1313	9.6756
	regional	local	−3.75782	1.51277	0.036	−7.3259	−0.1897
		transcarpathian	2.64565	1.92659	0.357	−1.8985	7.1898
	transcarpathian	local	−6.40348	1.38729	0.000	−9.6756	−3.1313
		regional	−2.64565	1.92659	0.357	−7.1898	1.8985
Thickness [mm]	local	regional	1.28991	0.76282	0.211	−0.5093	3.0891
		transcarpathian	2.95342	0.69954	0.000	1.3034	4.6034
	regional	local	−1.28991	0.76282	0.211	−3.0891	0.5093
		transcarpathian	1.66351	0.97149	0.203	−0.6279	3.9549
	transcarpathian	local	−2.95342	0.69954	0.000	−4.6034	−1.3034
		regional	−1.66351	0.97149	0.203	−3.9549	0.6279

Table 36. Bodrogkeresztúr tool assemblage product composition by raw materials

		Raw material			Total
		local	regional	transcarpathian	
Flake	count	91	40	23	154
	% within raw material	47.2%	50.0%	20.7%	40.1%
Blade	count	89	38	86	213
	% within raw material	46.1%	47.5%	77.5%	55.5%
Debris	count	11	1	0	12
	% within raw material	5.7%	1.3%	0.0%	3.1%
Rejuvenating flake	count	2	1	2	5
	% within raw material	1.0%	1.3%	1.8%	1.3%
Total	count	193	80	111	384
	% within raw material	100.0%	100.0%	100.0%	100.0%

Table 37. Bodrogkeresztúr knapped product frequency in tool assemblage by raw materials

				Raw material			Total
				local	regional	transcarpathian	
Flake	state	blank	count	998	146	79	1223
			% within raw material	91.6%	78.5%	77.5%	88.8%
		tool	count	91	40	23	154
			% within raw material	8.4%	21.5%	22.5%	11.2%
	total		count	1089	186	102	1377
			% within raw material	100.0%	100.0%	100.0%	100.0%
Blade	state	blank	count	655	107	135	897
			% within raw material	88.0%	73.8%	61.1%	80.8%
		tool	count	89	38	86	213
			% within raw material	12.0%	26.2%	38.9%	19.2%
	total		count	744	145	221	1110
			% within raw material	100.0%	100.0%	100.0%	100.0%
Debris	state	blank	count	201	21	14	236
			% within raw material	94.8%	95.5%	100.0%	95.2%
		tool	count	11	1	0	12
			% within raw material	5.2%	4.5%	0.0%	4.8%
	total		count	212	22	14	248
			% within raw material	100.0%	100.0%	100.0%	100.0%
Rejuvenating flake	state	blank	count	44	3	2	49
			% within raw material	95.7%	75.0%	50.0%	90.7%
		tool	count	2	1	2	5
			% within raw material	4.3%	25.0%	50.0%	9.3%
	total		count	46	4	4	54
			% within raw material	100.0%	100.0%	100.0%	100.0%

Table 38. Bodrogkeresztúr blade tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	10.10	5.10	1.70
	Maximum	107.90	44.30	18.80
	Mean	42.3674	19.8798	7.7146
	Median	34.6000	19.5000	7.1000
	N	89	89	89
	Std. deviation	22.97158	9.09991	4.19533
Regional	Minimum	12.50	6.80	2.50
	Maximum	123.50	33.80	12.80
	Mean	42.5921	18.5474	6.6632
	Median	40.4000	17.4500	6.2500
	N	38	38	38
	Std. deviation	20.89442	6.94125	2.88035
Transcarpathian	Minimum	14.00	4.10	2.00
	Maximum	110.00	39.00	13.90
	Mean	46.5965	19.9826	6.7674
	Median	45.2000	20.4500	6.8000
	N	86	86	86
	Std. deviation	21.35264	7.90186	2.80044
Total	Minimum	10.10	4.10	1.70
	Maximum	123.50	44.30	18.80
	Mean	44.1150	19.6836	7.1446
	Median	39.0000	20.0000	6.9000
	N	213	213	213
	Std. deviation	21.95991	8.25232	3.48339

Table 39. Bodrogkeresztúr blade blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test								
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Local	length [mm]	7.949	0.005	3.190	274	0.002	8.15504	2.55662
				2.939	142.375	0.004	8.15504	2.77470
	width [mm]	13.728	0.000	−0.842	274	0.400	−0.82630	0.98127
				−0.761	136.552	0.448	−0.82630	1.08551
	thickness [mm]	4.284	0.039	−1.272	274	0.205	−0.62905	0.49465
				−1.212	153.809	0.227	−0.62905	0.51909
Regional	length [mm]	0.934	0.338	−0.037	59	0.971	−0.18776	5.11379
				−0.039	54.848	0.969	−0.18776	4.82223
	width [mm]	0.234	0.630	−1.764	59	0.083	−3.25172	1.84330
				−1.758	46.044	0.085	−3.25172	1.84966
	thickness [mm]	0.020	0.888	−1.111	59	0.271	−0.86751	0.78095
				−1.092	44.116	0.281	−0.86751	0.79408
Transcarpathian	length [mm]	0.886	0.349	−1.407	112	0.162	−6.31080	4.48517
				−1.531	53.547	0.132	−6.31080	4.12195
	width [mm]	0.882	0.350	−4.387	112	0.000	−7.33256	1.67153
				−4.686	51.637	0.000	−7.33256	1.56493
	thickness [mm]	4.894	0.029	−4.635	112	0.000	−2.63530	0.56862
				−5.603	67.591	0.000	−2.63530	0.47034

Table 40. Bodrogkeresztúr blade tool length, width and thickness mean comparison by raw materials with ANOVA

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	889.520	2	444.760	0.922	0.399
	within groups	101344.892	210	482.595		
	Total	102234.412	212			
Width [mm]	between groups	60.170	2	30.085	0.439	0.645
	within groups	14377.182	210	68.463		
	Total	14437.352	212			
Thickness [mm]	between groups	49.958	2	24.979	2.080	0.128
	within groups	2522.448	210	12.012		
	Total	2572.406	212			

Table 41. Bodrogkeresztúr blade tool types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Tooltypes	endscraper	count	19	11	10	40
		% within raw material	21.3%	28.9%	11.6%	18.8%
	burin	count	15	5	31	51
		% within raw material	16.9%	13.2%	36.0%	23.9%
	retouched	count	26	17	28	71
		% within raw material	29.2%	44.7%	32.6%	33.3%
	borer	count	0	0	1	1
		% within raw material	0.0%	0.0%	1.2%	0.5%
	splintered piece	count	1	0	0	1
		% within raw material	1.1%	0.0%	0.0%	0.5%
	truncation	count	6	1	4	11
		% within raw material	6.7%	2.6%	4.7%	5.2%
	notched-denticulated	count	5	0	0	5
		% within raw material	5.6%	0.0%	0.0%	2.3%
	composite	count	1	1	1	3
		% within raw material	1.1%	2.6%	1.2%	1.4%
	armature	count	16	3	11	30
		% within raw material	18.0%	7.9%	12.8%	14.1%
Total		count	89	38	86	213
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 42. Bodrogkeresztúr armature types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Armatures	backed	count	6	1	3	10
		% within raw material	37.5%	33.3%	27.3%	33.3%
	backed-truncated	count	2	0	2	4
		% within raw material	12.5%	0.0%	18.2%	13.3%
	backed-ventral truncation	count	0	0	1	1
		% within raw material	0.0%	0.0%	9.1%	3.3%
	trapeze-rectangle	count	0	0	1	1
		% within raw material	0.0%	0.0%	9.1%	3.3%
	points	count	8	2	4	14
		% within raw material	50.0%	66.7%	36.4%	46.7%
Total		count	16	3	11	30
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 43. Bodrogkeresztúr point types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Points	retouched	count	3	0	1	4
		% within raw material	37.5%	0.0%	25.0%	28.6%
	gravette/microgravette	count	3	1	1	5
		% within raw material	37.5%	50.0%	25.0%	35.7%
	vachons	count	1	0	1	2
		% within raw material	12.5%	0.0%	25.0%	14.3%
	shouldered	count	0	1	0	1
		% within raw material	0.0%	50.0%	0.0%	7.1%
	fléchette	count	1	0	1	2
		% within raw material	12.5%	0.0%	25.0%	14.3%
Total		count	8	2	4	14
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 44. Bodrogkeresztúr flake core types by raw material

			Raw material		Total
			local	regional	
Types	unidirectional	count	15	2	17
		% within raw material	34.1%	22.2%	32.1%
	bidirctional	count	4	0	4
		% within raw material	9.1%	0.0%	7.5%
	alternate	count	1	0	1
		% within raw material	2.3%	0.0%	1.9%
	multidirectional	count	19	6	25
		% within raw material	43.2%	66.7%	47.2%
	core fragment	count	5	1	6
		% within raw material	11.4%	11.1%	11.3%
Total		count	44	9	53
		% within raw material	100.0%	100.0%	100.0%

Table 45. Bodrogkeresztúr flake assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material			Total
			local	regional	transcarpathian	
Scars	unidirectional	count	165	22	14	201
		% within raw material	47.0%	48.9%	42.4%	46.9%
	opposite	count	36	8	3	47
		% within raw material	10.3%	17.8%	9.1%	11.0%
	perpendicular	count	90	11	15	116
		% within raw material	25.6%	24.4%	45.5%	27.0%
	multiple	count	49	2	1	52
		% within raw material	14.0%	4.4%	3.0%	12.1%
	no scar	count	11	2	0	13
		% within raw material	3.1%	4.4%	0.0%	3.0%
Total		count	351	45	33	429
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 46. Bodrogkeresztúr flake assemblage (complete specimens) platform type frequency by raw material

			Raw material			Total
			local	regional	transcarpathian	
Platform	plain	count	220	26	20	266
		% within raw material	62.7%	57.8%	60.6%	62.0%
	dihedral	count	47	4	4	55
		% within raw material	13.4%	8.9%	12.1%	12.8%
	faceted	count	37	4	6	47
		% within raw material	10.5%	8.9%	18.2%	11.0%
	cortical	count	33	5	1	39
		% within raw material	9.4%	11.1%	3.0%	9.1%
	linear	count	5	3	1	9
		% within raw material	1.4%	6.7%	3.0%	2.1%
	punctiform	count	1	1	0	2
		% within raw material	0.3%	2.2%	0.0%	0.5%
	irregular	count	8	2	1	11
		% within raw material	2.3%	4.4%	3.0%	2.6%
Total		count	351	45	33	429
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 47. Bodrogkeresztúr flake assemblage (complete specimens) impact point-overhang presence frequency by raw material

			Raw material			Total
			local	regional	transcarpathian	
Impact point-overhang	none	count	60	13	10	83
		% within raw material	17.1%	28.9%	30.3%	19.3%
	yes-no	count	52	7	7	66
		% within raw material	14.8%	15.6%	21.2%	15.4%
	yes-yes	count	129	15	9	153
		% within raw material	36.8%	33.3%	27.3%	35.7%
	no-yes	count	110	10	7	127
		% within raw material	31.3%	22.2%	21.2%	29.6%
Total		count	351	45	33	429
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 48. Bodrogkeresztúr flake assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	9.00	3.70	1.40
	Maximum	97.20	103.20	44.10
	Mean	39.5276	33.4875	9.8385
	Median	36.7000	31.3000	8.1000
	N	351	351	351
	Std. deviation	16.97545	15.41051	6.21462
Regional	Minimum	9.70	10.50	2.10
	Maximum	67.50	46.20	18.80
	Mean	29.1489	24.2889	7.6800
	Median	28.0000	23.8000	7.2000
	N	45	45	45
	Std. deviation	10.89668	8.08307	4.03837
Transcarpathian	Minimum	13.20	7.30	1.90
	Maximum	45.10	50.20	11.20
	Mean	27.5182	23.1727	6.0303
	Median	28.0000	22.1000	5.6000
	N	33	33	33
	Std. deviation	7.39368	8.39391	2.38124
Total	Minimum	9.00	3.70	1.40
	Maximum	97.20	103.20	44.10
	Mean	37.5152	31.7291	9.3191
	Median	33.8000	28.9000	7.9000
	N	429	429	429
	Std. deviation	16.44171	14.83877	5.91787

Table 49. Bodrogkeresztúr flake length, width and thickness mean comparison by raw materials with ANOVA and the Tukey post hoc

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	7869.328	2	3934.664	15.544	0.000
	within groups	107831.823	426	253.126		
	Total	115701.152	428			
Width [mm]	between groups	5992.271	2	2996.136	14.463	0.000
	within groups	88248.715	426	207.157		
	Total	94240.986	428			
Thickness [mm]	between groups	572.511	2	286.255	8.459	0.000
	within groups	14416.532	426	33.842		
	Total	14989.043	428			

Multiple Comparisons
Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length [mm]	local	regional	10.37875	2.51916	0.000	4.4538	16.3037
		transcarpathian	12.00945	2.89684	0.000	5.1963	18.8226
	regional	local	−10.37875	2.51916	0.000	−16.3037	−4.4538
		transcarpathian	1.63071	3.64630	0.896	−6.9452	10.2066
	transcarpathian	local	−12.00945	2.89684	0.000	−18.8226	−5.1963
		regional	−1.63071	3.64630	0.896	−10.2066	6.9452
Width [mm]	local	regional	9.19858	2.27896	0.000	3.8386	14.5585
		transcarpathian	10.31474	2.62062	0.000	4.1512	16.4783
	regional	local	−9.19858	2.27896	0.000	−14.5585	−3.8386
		transcarpathian	1.11616	3.29863	0.939	−6.6420	8.8743
	transcarpathian	local	−10.31474	2.62062	0.000	−16.4783	−4.1512
		regional	−1.11616	3.29863	0.939	−8.8743	6.6420
Thickness [mm]	local	regional	2.15846	0.92111	0.051	−0.0079	4.3249
		transcarpathian	3.80816	1.05921	0.001	1.3170	6.2993
	regional	local	−2.15846	0.92111	0.051	−4.3249	0.0079
		transcarpathian	1.64970	1.33324	0.432	−1.4860	4.7854
	transcarpathian	local	−3.80816	1.05921	0.001	−6.2993	−1.3170
		regional	−1.64970	1.33324	0.432	−4.7854	1.4860

Table 50. Bodrogkeresztúr flake tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	12.10	9.80	3.90
	Maximum	139.20	97.00	35.70
	Mean	45.2890	36.0560	13.2857
	Median	40.6000	31.2000	11.5000
	N	91	91	91
	Std. deviation	19.96260	16.44593	6.49319
Regional	Minimum	12.00	11.00	4.10
	Maximum	56.00	39.00	15.50
	Mean	32.3525	24.6000	8.7275
	Median	31.1500	24.3000	8.2500
	N	40	40	40
	Std. deviation	9.58193	5.40370	2.79826
Transcarpathian	Minimum	9.70	17.50	4.20
	Maximum	63.10	45.80	16.00
	Mean	35.4000	28.4348	8.7565
	Median	33.3000	28.0000	8.2000
	N	23	23	23
	Std. deviation	12.31998	7.70222	2.79575
Total	Minimum	9.70	9.80	3.90
	Maximum	139.20	97.00	35.70
	Mean	40.4519	31.9422	11.4253
	Median	36.1000	28.0500	10.1500
	N	154	154	154
	Std. deviation	17.73545	14.18031	5.74045

Table 51. Bodrogkeresztúr flake blank and tool length, width and thickness mean t-test comparison

Independent Samples Test								
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Local	length [mm]	0.708	0.401	−2.778	440	0.006	−5.76138	2.07363
				−2.526	125.772	0.013	−5.76138	2.28039
	width [mm]	0.258	0.612	−1.397	440	0.163	−2.56858	1.83839
				−1.345	133.856	0.181	−2.56858	1.91018
	thickness [mm]	0.968	0.326	−4.672	440	0.000	−3.44725	0.73788
				−4.553	135.854	0.000	−3.44725	0.75720
Regional	length [mm]	0.752	0.388	−1.431	83	0.156	−3.20361	2.23822
				−1.442	82.993	0.153	−3.20361	2.22125
	width [mm]	6.686	0.011	−0.206	83	0.837	−0.31111	1.51112
				−0.211	77.317	0.834	−0.31111	1.47713
	thickness [mm]	1.397	0.241	−1.373	83	0.173	−1.04750	0.76289
				−1.402	78.523	0.165	−1.04750	0.74711
Transcarpathian	length [mm]	3.084	0.085	−2.989	54	0.004	−7.88182	2.63677
				−2.743	33.002	0.010	−7.88182	2.87329
	width [mm]	0.001	0.974	−2.386	54	0.021	−5.26206	2.20540
				−2.423	49.961	0.019	−5.26206	2.17127
	thickness [mm]	0.928	0.340	−3.923	54	0.000	−2.72622	0.69489
				−3.811	42.416	0.000	−2.72622	0.71531

Table 52. Bodrogkeresztúr flake tool length, width and thickness mean comparison by raw materials with ANOVA and the Tukey post hoc

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	5340.196	2	2670.098	9.423	0.000
	within groups	42785.389	151	283.347		
	Total	48125.584	153			
Width [mm]	between groups	3979.319	2	1989.660	11.216	0.000
	within groups	26786.096	151	177.391		
	Total	30765.416	153			
Thickness [mm]	between groups	769.904	2	384.952	13.607	0.000
	within groups	4271.868	151	28.291		
	Total	5041.771	153			

Multiple Comparisons
Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length [mm]	local	regional	12.93651	3.19333	0.000	5.3777	20.4953
		transcarpathian	9.88901	3.92850	0.034	0.5900	19.1880
	regional	local	−12.93651	3.19333	0.000	−20.4953	−5.3777
		transcarpathian	−3.04750	4.40490	0.769	−13.4741	7.3791
	transcarpathian	local	−9.88901	3.92850	0.034	−19.1880	−0.5900
		regional	3.04750	4.40490	0.769	−7.3791	13.4741
Width [mm]	local	regional	11.45604	2.52669	0.000	5.4752	17.4368
		transcarpathian	7.62126	3.10838	0.040	0.2636	14.9790
	regional	local	−11.45604	2.52669	0.000	−17.4368	−5.4752
		transcarpathian	−3.83478	3.48532	0.515	−12.0847	4.4152
	transcarpathian	local	−7.62126	3.10838	0.040	−14.9790	−0.2636
		regional	3.83478	3.48532	0.515	−4.4152	12.0847
Thickness [mm]	local	regional	4.55821	1.00903	0.000	2.1698	6.9466
		transcarpathian	4.52919	1.24133	0.001	1.5909	7.4675
	regional	local	−4.55821	1.00903	0.000	−6.9466	−2.1698
		transcarpathian	−0.02902	1.39186	1.000	−3.3236	3.2656
	transcarpathian	local	−4.52919	1.24133	0.001	−7.4675	−1.5909
		regional	0.02902	1.39186	1.000	−3.2656	3.3236

Table 53. Bodrogkeresztúr flake tool types by raw material

			Raw material			Total
			local	regional	transcarpathian	
Tooltypes	endscraper	count	27	14	6	47
		% within raw material	29.7%	35.0%	26.1%	30.5%
	burin	count	21	6	12	39
		% within raw material	23.1%	15.0%	52.2%	25.3%
	retouched	count	23	12	1	36
		% within raw material	25.3%	30.0%	4.3%	23.4%
	borer	count	2	0	0	2
		% within raw material	2.2%	0.0%	0.0%	1.3%
	splintered piece	count	1	1	3	5
		% within raw material	1.1%	2.5%	13.0%	3.2%
	truncation	count	0	3	0	3
		% within raw material	0.0%	7.5%	0.0%	1.9%
	composite	count	2	0	1	3
		% within raw material	2.2%	0.0%	4.3%	1.9%
	notched-denticulated	count	15	4	0	19
		% within raw material	16.5%	10.0%	0.0%	12.3%
Total		count	91	40	23	154
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 54. Bodrogkeresztúr rejuvenating flake and debris tool types

				Raw material			Total
				local	regional	transcarpathian	
Debris	tooltypes	burin	count	7	0		7
			% within raw material	63.6%	0.0%		58.3%
		retouched	count	2	0		2
			% within raw material	18.2%	0.0%		16.7%
		splintered piece	count	0	1		1
			% within raw material	0.0%	100.0%		8.3%
		notched-denticulated	count	2	0		2
			% within raw material	18.2%	0.0%		16.7%
	total		count	11	1		12
			% within raw material	100.0%	100.0%		100.0%
Rejuvenating flake	tooltypes	endscraper	count	0	0	1	1
			% within raw material	0.0%	0.0%	50.0%	20.0%
		burin	count	0	1	1	2
			% within raw material	0.0%	100.0%	50.0%	40.0%
		retouched	count	1	0	0	1
			% within raw material	50.0%	0.0%	0.0%	20.0%
		borer	count	1	0	0	1
			% within raw material	50.0%	0.0%	0.0%	20.0%
	total		count	2	1	2	5
			% within raw material	100.0%	100.0%	100.0%	100.0%

HIDASNÉMETI

The site

The site is situated on the right bank terrace of river Hernád in northeast Hungary at an elevation of 190 m a.s.l. facing east towards river Hernád. After field surveys in 1982, the excavations were carried out between 1983 and 1985 and ten trenches recovered 150 square meters of the site (Simán 1989).

The site stratigraphy consisted of five layers: 1) the recent topsoil 20 cm, 2) a red sandy clay 25 cm, 3) a brown sandy clay 10–50 cm, 4) a yellow hard clay of undefined thickness and 5) the gravel of the tertiary Hernád terrace. Two main levels of artifact were claimed to had been found in trenches VII–IX, but the exact stratigraphic position of these levels and the elevation difference between them remained unknown. Other trenches yielded finds throughout the whole sequence. Today it is impossible to separate all finds from the two levels because many has lost the inventory number that would indicate the archaeological level.

Besides the lithics, Simán (1989) described three hearts, charred residues of four pointed wooden sticks, and two postholes of 10 and 20 cm diameter in the upper level. In the lower level two hearths were found, one of which was hewn into the ground 15 cm deep on a surface of 20 × 40 cm and 90 × 30 cm, respectively. Both contained calcined bones but charcoals. Also, a chunk of charred wood was fund in this level. The preservation of the bones was poor, thus none of them was identified to species, and the wood remains were not saved and analyzed either.

The dating of the site solely relies on the typology of the shouldered points which are typical to the Late Gravettian or Willendorf-Kostenkian dated elsewhere to 25–21 ka BP (Simán 1989; Lengyel 2014a). All the knapped lithics were analyzed here.

Raw materials

The assemblage almost entirely consists of regional limnic silicite (Tab. 55). The most popular type is the white variant that has a fine and heterogeneous body texture. Further types are brown in original colour, but the patina turns the colours into reddish, blue and white. These colours are often stripped on the materials. A third type is a greyish-blue silicite. Further materials present with a few items are the obsidian Carpathian 2 type, radiolarite, and the meta-rhyolite of Bükk Mountains. Regional materials yielded 134.9 items per kg. Raw material from the longest distance is the Cretaceous flint, which provided 22.2 items per kg.

Blade tool production

The technological composition of the assemblage showed that only the regional materials went through a complete processing, providing all the elements of a laminar debitage, except the crest blade (Tab. 56). Transcarpathian materials yielded only two flakes and two blades.

The blade technology primarily used unidirectional debitage (Tabs 57, 58), and often adjusted the striking platform of the core before detaching a blade with a few minute flake removals (Tab. 59). Soft hammer technique was dominant in blade debitage (Tab. 60) which produced products between 20 and 110 mm (Tab. 61).

The majority of the tools (80.0%) were made of blades (Tab. 62). Out of the total number of regional blades, 8.1% was used up for tools, while this ratio is much higher for transcarpathian blades, from which both specimens are tools (Tab. 63).

The mean length of the blade tools shows that regional specimens are similar to the transcarpathian ones (Tab. 64). The t-test found that blade tools (only regional items are involved) are shorter, but wider and thicker than blank blades (Tab. 65), and there is no difference between regional and transcarpathian blade tools in length, width and thickness (Tab. 66).

Most of the blade tools are burins and armature (Tab. 67). TC blade tools are a burin and a composite tool. The armatures are chiefly backed bladelets and points (Tab. 68). Among the points the shouldered, Gravette and tip retouched blades are present with more than one specimen, and the fléchette has a single occurrence (Tab. 69).

Flake tool production

The evidences of flake debitage are the few cores, and a half of them has multiplatform (Tab. 70). On the flakes unidirectional scars are prevalent (Tab. 71), plain butts are frequent (Tab. 72), and many of them have well visible impact points that are signs of hard hammer technique (Tab. 73). The mean size of the flakes is rather small (Tab. 74).

The flakes are the minority in the tools (Tab. 62) and only a small portion of the total flake assemblage was used up for tools (Tab. 63). Flake tool sizes differ from the blanks by the former being longer and thicker (Tabs 75, 76).

Most of the flake tools are edge retouched types, and endscrapers, burins, and notch-denticulates are in equal share (Tab. 77). A few tools were made of debris. These are two burins and one notched-denticulated type made of local material. There is a single notched-denticulated item made of a rejuvenating flake (Tab. 78).

Table 55. Hidasnémeti lithic raw material composition by weight in grams

Raw material	Flake	Blade	Debris	Core	Total	%
Regional	7861	7109	3295	4634	22899	99.9
Within regional %	34.32901	31.04502	14.38927	20.23669	100	
Transcarpathian		18			18	0.1
Within transcarpathian %		100			100	
Total	7861	7127	3295	4634	22917	
%	34.30205	31.09918	14.37797	20.2208	100	

Table 56. Hidasnémeti lithic assemblage composition by raw material types and technological categories

			Raw material		Total
			regional	transcarpathian	
Class	flake	count	1076	2	1078
		% within raw material	34.8%	50.0%	34.9%
	blade	count	1146	2	1148
		% within raw material	37.1%	50.0%	37.1%
	debris	count	546	0	546
		% within raw material	17.7%	0.0%	17.7%
	rejuvenating flake	count	160	0	160
		% within raw material	5.2%	0.0%	5.2%
	crest	count	22	0	22
		% within raw material	0.7%	0.0%	0.7%
	neo-crest	count	86	0	86
		% within raw material	2.8%	0.0%	2.8%
	blade core	count	47	0	47
		% within raw material	1.5%	0.0%	1.5%
	flake core	count	6	0	6
		% within raw material	0.2%	0.0%	0.2%
Total		count	3089	4	3093
		% within raw material	100.0%	100.0%	100.0%

Table 57. Hidasnémeti blade assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material	Total
			regional	
Scars	unidirectional	count	48	48
		% within raw material	56.5%	56.5%
	opposite	count	20	20
		% within raw material	23.5%	23.5%
	perpendicular	count	17	17
		% within raw material	20.0%	20.0%
Total		count	85	85
		% within raw material	100.0%	100.0%

Table 58. Hidasnémeti blade core types by raw material

			Raw material	Total
			regional	
Types	unidirectional	count	32	32
		% within raw material	68.1%	68.1%
	bidirectional	count	2	2
		% within raw material	4.3%	4.3%
	alternate	count	2	2
		% within raw material	4.3%	4.3%
	multidirectional	count	2	2
		% within raw material	4.3%	4.3%
	core fragment	count	9	9
		% within raw material	19.1%	19.1%
Total		count	47	47
		% within raw material	100.0%	100.0%

Table 59. Hidasnémeti blade assemblage (complete specimens) platform type frequency by raw material

			Raw material regional	Total
Platform	plain	count	38	38
		% within raw material	44.7%	44.7%
	dihedral	count	14	14
		% within raw material	16.5%	16.5%
	faceted	count	28	28
		% within raw material	32.9%	32.9%
	linear	count	2	2
		% within raw material	2.4%	2.4%
	irregular	count	1	1
		% within raw material	1.2%	1.2%
	spur	count	2	2
		% within raw material	2.4%	2.4%
Total		count	85	85
		% within raw material	100.0%	100.0%

Table 60. Hidasnémeti blade assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material regional	Total
Impact point-overhang	none	count	75	75
		% within raw material	88.2%	88.2%
	yes-no	count	1	1
		% within raw material	1.2%	1.2%
	no-yes	count	9	9
		% within raw material	10.6%	10.6%
Total		count	85	85
		% within raw material	100.0%	100.0%

Table 61. Hidasnémeti blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	19.30	6.80	2.00
	Maximum	111.50	37.31	17.30
	Mean	58.6071	20.1046	6.9004
	Median	55.0000	19.3000	6.9000
	N	85	85	85
	Std. deviation	20.84511	6.03526	2.86517
Total	Minimum	19.30	6.80	2.00
	Maximum	111.50	37.31	17.30
	Mean	58.6071	20.1046	6.9004
	Median	55.0000	19.3000	6.9000
	N	85	85	85
	Std. deviation	20.84511	6.03526	2.86517

Table 62. Hidasnémeti tool assemblage product composition by raw materials

		Raw material		Total
		regional	transcarpathian	
Flake	count	22	0	22
	% within raw material	17.2%	0.0%	16.9%
Blade	count	102	2	104
	% within raw material	79.7%	100.0%	80.0%
Debris	count	3	0	3
	% within raw material	2.3%	0.0%	2.3%
Rejuvenating flake	count	1	0	1
	% within raw material	0.8%	0.0%	0.8%
Total	count	128	2	130
	% within raw material	100.0%	100.0%	100.0%

Table 63. Hidasnémeti knapped product frequency in tool assemblage by raw materials

				Raw material		Total
				regional	transcarpathian	
Flake	state	blank	count	1054	2	1056
			% within raw material	98.0%	100.0%	98.0%
		tool	count	22	0	22
			% within raw material	2.0%	0.0%	2.0%
	total		count	1076	2	1078
			% within raw material	100.0%	100.0%	100.0%
Blade	state	blank	count	1152	0	1152
			% within raw material	91.9%	0.0%	91.7%
		tool	count	102	2	104
			% within raw material	8.1%	100.0%	8.3%
	total		count	1254	2	1256
			% within raw material	100.0%	100.0%	100.0%
Debris	state	blank	count	543		543
			% within raw material	99.5%		99.5%
		tool	count	3		3
			% within raw material	0.5%		0.5%
	total		count	546		546
			% within raw material	100.0%		100.0%
Rejuvenating flake	state	blank	count	159		159
			% within raw material	99.4%		99.4%
		tool	count	1		1
			% within raw material	0.6%		0.6%
	total		count	160		160
			% within raw material	100.0%		100.0%

Table 64. Hidasnémeti blade tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	3.40	5.72	1.50
	Maximum	94.90	49.90	28.00
	Mean	40.7355	22.2472	9.1966
	Median	39.0500	21.9500	8.7000
	N	102	102	102
	Std. deviation	17.99811	9.86050	5.03526
Transcarpathian	Minimum	38.00	18.80	11.20
	Maximum	42.40	23.60	11.30
	Mean	40.2000	21.2000	11.2500
	Median	40.2000	21.2000	11.2500
	N	2	2	2
	Std. deviation	3.11127	3.39411	0.07071
Total	Minimum	3.40	5.72	1.50
	Maximum	94.90	49.90	28.00
	Mean	40.7252	22.2270	9.2361
	Median	39.0500	21.9500	8.8350
	N	104	104	104
	Std. deviation	17.82531	9.77109	4.99418

Table 65. Hidasnémeti blade blank and tool length, width and thickness mean t-test comparison for regional raw material

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	2.012	0.158	6.291	185	0.000	17.87157	2.84074
			6.208	167.140	0.000	17.87157	2.87885
Width [mm]	20.262	0.000	−1.748	185	0.082	−2.14257	1.22541
			−1.823	170.733	0.070	−2.14257	1.17548
Thickness [mm]	16.699	0.000	−3.730	185	0.000	−2.29622	0.61558
			−3.909	164.816	0.000	−2.29622	0.58749

Table 66. Hidasnémeti blade tool length, width and thickness mean comparison by raw materials with t-test

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	2.383	0.126	0.042	102	0.967	0.53549	12.78949
			0.189	2.731	0.863	0.53549	2.83122
Width [mm]	1.860	0.176	0.149	102	0.882	1.04716	7.00996
			0.404	1.358	0.741	1.04716	2.59099
Thickness [mm]	2.842	0.095	−0.574	102	0.567	−2.05343	3.57754
			−4.098	102.000	0.000	−2.05343	0.50107

Table 67. Hidasnémeti blade tool types by raw material

			Raw material		Total
			regional	transcarpathian	
Tooltypes	endscraper	count	14	0	14
		% within raw material	13.7%	0.0%	13.5%
	burin	count	37	1	38
		% within raw material	36.3%	50.0%	36.5%
	retouched	count	17	0	17
		% within raw material	16.7%	0.0%	16.3%
	truncation	count	4	0	4
		% within raw material	3.9%	0.0%	3.8%
	notched-denticulated	count	1	0	1
		% within raw material	1.0%	0.0%	1.0%
	composite	count	0	1	1
		% within raw material	0.0%	50.0%	1.0%
	armature	count	29	0	29
		% within raw material	28.4%	0.0%	27.9%
Total		count	102	2	104
		% within raw material	100.0%	100.0%	100.0%

Table 68. Hidasnémeti armature types by raw material

			Raw material	Total
			regional	
Armatures	backed	count	16	16
		% within raw material	55.2%	55.2%
	backed-truncated	count	3	3
		% within raw material	10.3%	10.3%
	rectangle	count	1	1
		% within raw material	3.4%	3.4%
	points	count	9	9
		% within raw material	31.0%	31.0%
Total		count	29	29
		% within raw material	100.0%	100.0%

Table 69. Hidasnémeti point types by raw material

			Raw material	Total
			regional	
Points	retouched	count	2	2
		% within raw material	22.2%	22.2%
	gravette/ microgravette	count	2	2
		% within raw material	22.2%	22.2%
	shouldered	count	4	4
		% within raw material	44.4%	44.4%
	fléchette	count	1	1
		% within raw material	11.1%	11.1%
Total		count	9	9
		% within raw material	100.0%	100.0%

Table 70. Hidasnémeti flake core types by raw material

			Raw material regional	Total
Types	unidirectional	count	2	2
		% within raw material	33.3%	33.3%
	bidirectional	count	1	1
		% within raw material	16.7%	16.7%
	multidirectional	count	3	3
		% within raw material	50.0%	50.0%
Total		count	6	6
		% within raw material	100.0%	100.0%

Table 71. Hidasnémeti flake assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material regional	Total
Scars	unidirectional	count	83	83
		% within raw material	61.5%	61.5%
	opposite	count	6	6
		% within raw material	4.4%	4.4%
	perpendicular	count	37	37
		% within raw material	27.4%	27.4%
	multiple	count	9	9
		% within raw material	6.7%	6.7%
Total		count	135	135
		% within raw material	100.0%	100.0%

Table 72. Hidasnémeti flake assemblage (complete specimens) platform type frequency by raw material

			Raw material regional	Total
Platform	plain	count	97	97
		% within raw material	71.9%	71.9%
	dihedral	count	15	15
		% within raw material	11.1%	11.1%
	faceted	count	21	21
		% within raw material	15.6%	15.6%
	cortical	count	2	2
		% within raw material	1.5%	1.5%
Total		count	135	135
		% within raw material	100.0%	100.0%

Table 73. Hidasnémeti flake assemblage (complete specimens) impact point-overhang frequency by raw material

			Raw material	Total
			regional	
Impact point-overhang	none	count	51	51
		% within raw material	37.8%	37.8%
	yes-no	count	12	12
		% within raw material	8.9%	8.9%
	yes-yes	count	24	24
		% within raw material	17.8%	17.8%
	no-yes	count	48	48
		% within raw material	35.6%	35.6%
Total		count	135	135
		% within raw material	100.0%	100.0%

Table 74. Hidasnémeti flake blank assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	13.09	14.57	2.15
	Maximum	69.82	92.45	23.80
	Mean	34.3324	31.4639	7.5630
	Median	32.9500	28.4400	6.5400
	N	135	135	135
	Std. deviation	11.91791	12.05520	3.80593
Total	Minimum	13.09	14.57	2.15
	Maximum	69.82	92.45	23.80
	Mean	34.3324	31.4639	7.5630
	Median	32.9500	28.4400	6.5400
	N	135	135	135
	Std. deviation	11.91791	12.05520	3.80593

Table 75. Hidasnémeti flake tool length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	18.24	9.15	3.06
	Maximum	128.59	82.87	30.10
	Mean	46.7668	38.0186	14.0623
	Median	42.4050	35.8800	13.3000
	N	22	22	22
	Std. deviation	26.22509	16.28582	6.56994
Total	Minimum	18.24	9.15	3.06
	Maximum	128.59	82.87	30.10
	Mean	46.7668	38.0186	14.0623
	Median	42.4050	35.8800	13.3000
	N	22	22	22
	Std. deviation	26.22509	16.28582	6.56994

Table 76. Hidasnémeti flake blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test									
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Regional	length [mm]	13.051	0.000	−3.680	155	0.000	−12.43445	3.37887
				−2.187	22.433	0.039	−12.43445	5.68452
	width [mm]	1.398	0.239	−2.243	155	0.026	−6.55471	2.92250
				−1.809	24.887	0.083	−6.55471	3.62385
	thickness [mm]	13.677	0.000	−6.595	155	0.000	−6.49931	0.98545
				−4.518	23.349	0.000	−6.49931	1.43851

Table 77. Hidasnémeti flake tool types by raw material

			Raw material	Total
			regional	
Tooltypes	endscraper	count	4	4
		% within raw material	18.2%	18.2%
	burin	count	4	4
		% within raw material	18.2%	18.2%
	retouched	count	9	9
		% within raw material	40.9%	40.9%
	borer	count	1	1
		% within raw material	4.5%	4.5%
	notched-denticulated	count	4	4
		% within raw material	18.2%	18.2%
Total		count	22	22
		% within raw material	100.0%	100.0%

Table 78. Hidasnémeti complete tool assemblage by raw material

			Raw material		Total
			regional	transcarpathian	
Tooltypes	endscraper	count	18	0	18
		% within raw material	14.1%	0.0%	13.8%
	burin	count	43	1	44
		% within raw material	33.6%	50.0%	33.8%
	retouched	count	26	0	26
		% within raw material	20.3%	0.0%	20.0%
	borer	count	1	0	1
		% within raw material	0.8%	0.0%	0.8%
	truncation	count	4	0	4
		% within raw material	3.1%	0.0%	3.1%
	notched-denticulate	count	7	0	7
		% within raw material	5.5%	0.0%	5.4%
	composite	count	0	1	1
		% within raw material	0.0%	50.0%	0.8%
	armature	count	29	0	29
		% within raw material	22.7%	0.0%	22.3%
Total		count	128	2	130
		% within raw material	100.0%	100.0%	100.0%

SAJÓSZENTPÉTER

The site

The site is found 150 m a.s.l. in the Sajó valley the northeast Hungary, on the eastern edge of Bükk mountains, on a slope facing east. Excavations were carried out at the site between 1990 and 1992 (Ringer, Holló 2001). The stratigraphy consisted of mostly eolian sediments of six meters under the recent top soil. Layer 2 of unspecified thickness yielded most of the archaeological finds but artifacts were found sporadically in layers 1, 5, 6, and 12. Layer 2 was identified as forest-steppe soil level A developed at the end of MIS3. Ringer and Holló (2001) identified the Gravettian occupation in layer 2 Pavlovian, while in layer 5 carinated end scrapers were found which most probably belonged to an Aurignacian occupation. The material studied here includes the artifacts of layer 2.

Raw materials

The majority of the raw materials is limnic silicite of two types: a white and the dark colored. Of these two, the white is dominant. The white was earlier identified as a local material (Ringer, Holló 2001). However, no such outcrop is known within 10 km area of the site. This most probably derived from the southern Bükk Mountains, from where the white variant was mentioned (Biró, Dobosi 1991). The dark variant could have derived from the Zemplén. Further materials are the meta-rhyolite of Bükk mountains, the radiolarite, and a single piece of Świeciechów flint from Poland. Except the latter, all the lithic raw materials are of regional origin, which yielded 79.2 item per kg (Tab. 79).

Blade tool prodcution

The complete sequence of lithic production was found in the assemblage (Tab. 80). The sole piece of transcarpathian material does not seem to have been produced at the site.

Blade debitage was accomplished applying unidirectional debitage (Tab. 81), however, single platform blade cores only rule the assemblage if pre-cores are included, otherwise, cores with more than one platform are abundant (Tab. 82). The blade platforms are plain (Tab. 83), and soft hammer technique ruled the knapping (Tab. 84). The mean length of the blades is 47.4 mm (Tab. 85).

Blades are prevalent in the tool kit (Tab. 86). Also, over 20% of the blades are tools (Tab. 87). The mean size of the blade tools are similar to the blanks (Tab. 88) and the t-test showed there is no difference between blank and tool blades (Tab. 89).

Most blade tools are burins and then armatures (Tab. 90). The armatures are generally points (Tab. 91), especially the Gravette type beside the only Vachons point (Tab. 92).

Flake tool production

Flakes did not have a debitage and their production completely could be the by-product of the blade debitage. Flakes have mostly unidirectional scars (Tab. 93), their platforms are typically plain (Tab. 94), and the frequency of impact point and unabraded overhang show frequent soft hammer percussion (Tab. 95).

The flakes are small (Tab. 96) but the tools (Tab. 97) are greater in length and thickness (Tab. 98). Only two types of tools were made of flakes: burin and end scraper (Tab. 99).

Table 79. Sajószentpéter lithic raw material composition by weight in grams

Raw material	Blade	Flake	Debris	Core	Total	%
Regional	770.92	852.57	597.06	1845.06	4065.61	99.78402
Within regional %	18.96198	20.97028	14.68562	45.38212	100	
Transarpathian		8.8			8.8	0.215982
Within transcarpathian %		100			100	
Total	770.92	861.37	597.06	1845.06	4074.41	100
%	18.92102	21.14098	14.6539	45.2841	100	

Table 80. Sajószentpéter lithic assemblage composition by raw material types and technological categories

			Raw material		Total
			regional	transcarpathian	
Class	flake	count	82	1	83
		% within raw material	25.5%	100.0%	25.7%
	blade	count	108	0	108
		% within raw material	33.5%	0.0%	33.4%
	debris	count	95	0	95
		% within raw material	29.5%	0.0%	29.4%
	rejuvenating flake	count	11	0	11
		% within raw material	3.4%	0.0%	3.4%
	crest	count	8	0	8
		% within raw material	2.5%	0.0%	2.5%
	neo-crest	count	8	0	8
		% within raw material	2.5%	0.0%	2.5%
	blade core	count	10	0	10
		% within raw material	3.1%	0.0%	3.1%
Total		count	322	1	323
		% within raw material	100.0%	100.0%	100.0%

Table 81. Sajószentpéter blade assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material regional	Total
Scars	unidirectional	count	15	15
		% within raw material	60.0%	60.0%
	opposite	count	3	3
		% within raw material	12.0%	12.0%
	perpendicular	count	5	5
		% within raw material	20.0%	20.0%
	multiple	count	1	1
		% within raw material	4.0%	4.0%
	no scar	count	1	1
		% within raw material	4.0%	4.0%
Total		count	25	25
		% within raw material	100.0%	100.0%

Table 82. Sajószentpéter blade core types by raw material

			Raw material regional	Total
Types	unidirectional	count	3	3
		% within raw material	30.0%	30.0%
	bidirectional	count	3	3
		% within raw material	30.0%	30.0%
	multidirectional	count	1	1
		% within raw material	10.0%	10.0%
	pre-core	count	3	3
		% within raw material	30.0%	30.0%
Total		count	10	10
		% within raw material	100.0%	100.0%

Table 83. Sajószentpéter blade assemblage (complete specimens) platform type frequency by raw material

			Raw material regional	Total
Platform	plain	count	15	15
		% within raw material	60.0%	60.0%
	faceted	count	5	5
		% within raw material	20.0%	20.0%
	cortical	count	2	2
		% within raw material	8.0%	8.0%
	linear	count	2	2
		% within raw material	8.0%	8.0%
	damaged	count	1	1
		% within raw material	4.0%	4.0%
Total		count	25	25
		% within raw material	100.0%	100.0%

Table 84. Sajószentpéter blade assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material	Total
			regional	
Impact point-overhang	none	count	21	21
		% within raw material	84.0%	84.0%
	yes-no	count	1	1
		% within raw material	4.0%	4.0%
	yes-yes	count	1	1
		% within raw material	4.0%	4.0%
	no-yes	count	2	2
		% within raw material	8.0%	8.0%
Total		count	25	25
		% within raw material	100.0%	100.0%

Table 85. Sajószentpéter blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	19.98	9.37	1.98
	Maximum	97.55	31.97	17.85
	Mean	47.3896	17.6184	6.6948
	Median	45.0900	16.1400	5.5100
	N	25	25	25
	Std. deviation	18.10467	6.41317	3.31909

Table 86. Sajószentpéter tool assemblage product composition by raw materials

		Raw material		Total
		regional	transcarpathian	
Flake	count	15	1	16
	% within raw material	34.1%	100.0%	35.6%
Blade	count	27	0	27
	% within raw material	61.4%	0.0%	60.0%
Debris	count	2	0	2
	% within raw material	4.5%	0.0%	4.4%
Total	count	44	1	45
	% within raw material	100.0%	100.0%	100.0%

Table 87. Sajószentpéter knapped product frequency in tool assemblage by raw materials

				Raw material		Total
				regional	transcarpathian	
Flake	state	blank	count	67	0	67
			% within raw material	81.7%	0.0%	80.7%
		tool	count	15	1	16
			% within raw material	18.3%	100.0%	19.3%
	total		count	82	1	83
			% within raw material	100.0%	100.0%	100.0%
Blade	state	blank	count	97		97
			% within raw material	78.2%		78.2%
		tool	count	27		27
			% within raw material	21.8%		21.8%
	total		count	124		124
			% within raw material	100.0%		100.0%
Debris	state	blank	count	93		93
			% within raw material	97.9%		97.9%
		tool	count	2		2
			% within raw material	2.1%		2.1%
	total		count	95		95
			% within raw material	100.0%		100.0%

Table 88. Sajószentpéter blade tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	15.89	5.91	2.83
	Maximum	92.04	41.90	16.71
	Mean	48.8670	19.0722	8.4748
	Median	49.2500	18.8400	6.9400
	N	27	27	27
	Std. deviation	21.07666	9.07632	4.53766

Table 89. Sajószentpéter blade blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test								
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Regional	length [mm]	1.031	0.315	−0.270	50	0.788	−1.47744	5.46954
				−0.272	49.734	0.787	−1.47744	5.43728
	width [mm]	1.291	0.261	−0.662	50	0.511	−1.45382	2.19566
				−0.671	46.844	0.506	−1.45382	2.16708
	thickness [mm]	6.472	0.014	−1.604	50	0.115	−1.78001	1.11004
				−1.623	47.534	0.111	−1.78001	1.09693

Table 90. Sajószentpéter blade tool types by raw material

			Raw material regional	Total
Tooltypes	endscraper	count	3	3
		% within raw material	11.1%	11.1%
	burin	count	9	9
		% within raw material	33.3%	33.3%
	retouched	count	5	5
		% within raw material	18.5%	18.5%
	borer	count	1	1
		% within raw material	3.7%	3.7%
	armature	count	5	5
		% within raw material	18.5%	18.5%
	truncation	count	1	1
		% within raw material	3.7%	3.7%
	composite	count	1	1
		% within raw material	3.7%	3.7%
	notched-denticulated	count	2	2
		% within raw material	7.4%	7.4%
Total		count	27	27
		% within raw material	100.0%	100.0%

Table 91. Sajószentpéter armature types by raw material

			Raw material regional	Total
Armature	backed	count	1	1
		% within raw material	20.0%	20.0%
	point	count	4	4
		% within raw material	80.0%	80.0%
Total		count	5	5
		% within raw material	100.0%	100.0%

Table 92. Sajószentpéter point types by raw material

			Raw material regional	Total
Point	grav	count	3	3
		% within raw material	75.0%	75.0%
	vachons	count	1	1
		% within raw material	25.0%	25.0%
Total		count	4	4
		% within raw material	100.0%	100.0%

Table 93. Sajószentpéter flake assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material	Total
			regional	
Scars	unidirectional	count	12	12
		% within raw material	46.2%	46.2%
	opposite	count	3	3
		% within raw material	11.5%	11.5%
	perpendicular	count	4	4
		% within raw material	15.4%	15.4%
	multiple	count	7	7
		% within raw material	26.9%	26.9%
Total		count	26	26
		% within raw material	100.0%	100.0%

Table 94. Sajószentpéter flake assemblage (complete specimens) platform type frequency by raw material

			Raw material	Total
			regional	
Platform	plain	count	19	19
		% within raw material	73.1%	73.1%
	dihedral	count	3	3
		% within raw material	11.5%	11.5%
	faceted	count	3	3
		% within raw material	11.5%	11.5%
	punctiform	count	1	1
		% within raw material	3.8%	3.8%
Total		count	26	26
		% within raw material	100.0%	100.0%

Table 95. Sajószentpéter flake assemblage (complete specimens) impact point-overhang presence frequency by raw material

			Raw material	Total
			regional	
Impact point-overhang	none	count	10	10
		% within raw material	38.5%	38.5%
	yes-no	count	2	2
		% within raw material	7.7%	7.7%
	yes-yes	count	6	6
		% within raw material	23.1%	23.1%
	no-yes	count	8	8
		% within raw material	30.8%	30.8%
Total		count	26	26
		% within raw material	100.0%	100.0%

Table 96. Sajószentpéter flake assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	12.41	12.49	2.42
	Maximum	67.44	58.97	21.18
	Mean	33.7927	31.2938	8.4531
	Median	30.9950	28.0050	7.7400
	N	26	26	26
	Std. deviation	13.17213	13.70176	4.42157
Total	Minimum	12.41	12.49	2.42
	Maximum	67.44	58.97	21.18
	Mean	33.7927	31.2938	8.4531
	Median	30.9950	28.0050	7.7400
	N	26	26	26
	Std. deviation	13.17213	13.70176	4.42157

Table 97. Sajószentpéter flake tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	27.59	12.49	4.40
	Maximum	77.08	52.54	22.89
	Mean	44.0473	30.0647	11.9013
	Median	42.4000	27.8200	10.6400
	N	15	15	15
	Std. deviation	12.41200	11.55739	5.23638
Transcarpathian	Minimum	42.40	21.69	10.92
	Maximum	42.40	21.69	10.92
	Mean	42.4000	21.6900	10.9200
	Median	42.4000	21.6900	10.9200
	N	1	1	1
	Std. deviation	–	–	–
Total	Minimum	27.59	12.49	4.40
	Maximum	77.08	52.54	22.89
	Mean	43.9444	29.5413	11.8400
	Median	42.4000	26.6600	10.7800
	N	16	16	16
	Std. deviation	11.99820	11.36010	5.06476

Table 98. Sajószentpéter flake blank and tool length, width and thickness mean t-test comparison

Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Flake	length [mm]	0.563	0.458	−2.507	40	0.016	−10.15168	4.04952
				−2.564	34.211	0.015	−10.15168	3.95861
	width [mm]	0.803	0.376	0.428	40	0.671	1.75260	4.09053
				0.448	36.383	0.657	1.75260	3.90979
	thickness [mm]	0.863	0.358	−2.281	40	0.028	−3.38692	1.48487
				−2.207	28.596	0.036	−3.38692	1.53466

Table 99. Sajószentpéter flake tool types by raw material

			Raw material		Total
			regional	transcarpathian	
Tooltypes	endscraper	count	1	0	1
		% within raw material	6.7%	0.0%	6.3%
	burin	count	14	1	15
		% within raw material	93.3%	100.0%	93.8%
Total		count	15	1	16
		% within raw material	100.0%	100.0%	100.0%

SÁGVÁR

The site

Village Ságvár is located about 10 km south of Lake Balaton. The Palaeolithic site is situated outside of the village's core, in the hilly area of this region, on a hill (Lyukas-domb) rising 228 m a.s.l. above creek Jaba.

Several excavations were conducted at the site between 1928 and 1959 (Lengyel 2010). The site preserved two archaeological layers imbedded in loess. According to Gábori and Gábori-Csánk (1957) two dark organic material rich bands represented the layers. In trench I of Gábori's excavation (Gábori 1959) the upper archaeological level appeared 1.2 m below the topsoil surface and its thickness was 8–10 cm. Its general color was gray with blackish-brown hue, and it consisted of small red granules, bone morsels, and ash. The layer included hearths, which had been remarkable features of the site since the 1930s.

Also, a hut basement with post holes that abundantly contained bones, antlers, and knapped lithics was recovered (Gábori 1965). The lower archaeological layer lay 1.5 m beneath the upper level, separated by archaeologically sterile loess. Expanding over a maximum 2 square meters area, it contained seven hearths.

The fauna consisted of reindeer, horse and the mammoth (Vörös 1982). A perforated shell of Arca diluvia and pieces of red ochre were also found.

Microscopic analysis of charred wood pieces 1 to 5 cm large from the hearths excavated in the 1930s identified pine tree tissue (Laczkó et al. 1930; Csalogovits et al. 1931).

Charcoals from the upper layer hut base recovered in 1957 were sampled for radiocarbon dating and resulted in 17 760 ± 150 BP (GrN-1959) (Vogel, Waterbolk 1964). The lower layer also yielded charcoal samples from one of the hearth features and resulted in 18 900 ± 100 (GrN-1783) (Vogel, Waterbolk 1964). Mollusk shells and charcoals taken from near the excavation area also were dated to 18 510 ± 160 (Deb-8822) and 19 770 ± 150 (Deb-8821), respectively (Krolopp, Sümegi 2002). These dates were associated with the lower layer.

Excavations in 1957–1959 recovered sand stone slabs and a number of antler tools including a perforated specimen. Many of the antler tools were made of shed specimens and the burr was worked down. These pieces showed traces of flint knapping and therefore they can be interpreted as soft hammers. The osseous tool assemblage contains a fragment of a polished point, as well.

Due to the unique character of the lithic artifacts, Ságvár Lyukas-domb archaeological site is the eponym for the Late Upper Palaeolithic archaeological culture called Ságvárian, dated to between 20 and 17 k years BP (Kozłowski 1979; Tolnai-Dobosi 2001).

Besides its archaeological importance, the site appeared in the terminology of the Late Pleistocene period in Hungary. While Gábori-Csánk (1978) concluded that the organic material rich humic levels at Ságvár were equal to the Lascaux interstadial in France and henceforth called this period Lascaux-Ságvár interstadial. Vörös (1982) pointed out no correspondence to interstadial features on the basis of the faunal remains. The land snail fauna analysis (Krolopp, Sümegi 2002) claimed that the human occupation took place during a cold and humid climate with the mean temperature of July 12–12.6 Celsius. This result supports the conclusion of the faunal analysis mentioned above which also did not reveal real interstadial features, as well as the analysis of the loess stratum (Bösken et al. 2018). The age of the site is most probably the Last Glacial Maximum between 21 and 17 ka BP.

The lithic assemblage of Ságvár has undergone a systematic refitting analysis for breakage surfaces and removal negatives. A total of 40% of the refitted flakes, blades and cores derived from the two archaeological layers (Lengyel 2010). The high percentage of interlayer refitting at Ságvár suggested that the lithic material of the two archaeological layers most probably is the product of a single knapping activity and therefore they may constitute a single lithic industry.

The lithic assemblage studied here was excavated in 1957–1959 and due to the results of refitting, the two layers were studied unseparated.

Raw materials

The largest portion of the lithic raw materials are of regional origin from the northern Transdanubia (Bakony, Gerecse, and Vértes Mountains) (Tab. 100). These are chiefly different types of radiolarite, but there are some limnic silicite and silicified lime stone types. The southern Transdanubia was also exploited for radiolarites from Mecsek Mountains. Regional materials weigh 18.047 kg and yielded 125.1 item per kilogram.

The distant lithic raw materials are mostly limnic silicites. Distant sources are located in Cserhát and Mátra Mountains. These weigh 8.6 kg and yielded 86.1 item per kilogram.

A small portion of the assemblage, 42 g, was made of flints of Jurassic and Cretaceous transcarpathian sources, which yielded 380.1 item per kilogram.

Blade tool production

Basically, all three types of raw materials produced all necessary elements of lithic production. TC material contains the least elements of the full sequence, which is due to that this raw material was used to make flakes and the missing elements are all from blade technology. The other two material groups produced all elements of both flake and blade debitage.

Within each group of raw material flakes are dominant (Tab. 101). Blade cores are also less numerous than flake cores, and within the distant material group the flake cores significantly outnumber blade cores. Blade debitage elements were found in regional and distant material processing, while the TC production seems to have been devoted to making flakes (Tab. 101).

The blades are the minority in the assemblage, and each raw material yielded a small amount of blades. The blade production is chiefly unidirectional (Tab. 102) exploiting single platform cores (Tab. 103). This feature is uniform in the whole assemblage regardless to raw material type. Plain platforms are the most frequent, but preparation that results in dihedral and facetted platforms also occurred (Tab. 104). Blades were generally detached by soft hammer percussion (Tab. 105).

Regional blades tend to be shorter and thinner than distant ones (Tab. 106). The t-test showed this difference significant (Tab. 107).

The blades make up only 26.5% of the toolkit (Tab. 108), but while 13.8% of all flakes are tools, 19.0% of the blades were used to make tools (Tab. 109).

The blade tools are smaller than blank blades (Tab. 110), but the t-test found no difference in the mean length, width and thickness (Tab. 111). However, there is a difference between the tool sizes by raw materials: regional blade tools are thinner than distant blade tools (Tab. 112).

Blades were commonly edge retouched tools and burins, and they are the sole blanks for backed tools (Tab. 113). The armature is composed of a few backed bladelets and a single backed-truncated bladelet, all made of regional raw material (Tab. 114).

Flake tool production

Flakes are the most abundant products of the industry. The flake debitage used multiple striking platform cores (Tab. 115), but unidirectional scars dominate the flakes (Tab. 116). Flake platforms are primarily plain (Tab. 117), and hard hammer percussion is the dominant technique (Tab. 118).

The mean length, width and thickness of the flakes (Tab. 119) differ by raw materials. ANOVA (Tab. 120) showed that regional flakes are shorter, narrower and thinner than distant flakes, but these two do not differ from TC flakes.

Flakes are the main blanks for tools (Tab. 108), but a smaller portion of the total flake assemblage was used up to make tools than that of the blades (Tab. 109). The mean size of the flake tools is greater than that of the blanks (Tab. 121). The t-test found this difference significant among regional flakes, also the mean thickness of distant flakes tools is greater than that of the blank flakes (Tab. 122). The t-test also showed that the sizes of the flakes by raw materials are different when regional and distant materials are compared (Tab. 123). The only TC flake tool was excluded from this analysis.

Flake tools are most often burin, splintered item and endscraper (Tab. 124). There is a significant amount of tools made on debris (Tab. 108), especially of the regional raw material. The tool type list is similar to that of the flake tools, but tools made by debris are chiefly splintered items (Tab. 125). Rejuvenating flakes are few among the tools, these are mostly end-scrapers. Besides the flakes numerous debris and a few blade core platform rejuvenating flakes are also tools. A few flake and blade cores are also tools.

Table 100. Ságvár lithic raw material composition by weight in grams

Raw material	Blade	Flake+debris	Core	Total	%
Regional	537	6033	11477	18047	67.46794
Within regional %	2.975564	33.42938	63.59506	100	
Distant	179	4745	3736	8660	32.37504
Within distant %	2.066975	54.79215	43.14088	100	
Transcarpathian	4	17	21	42	0.157015
Within transcarpathian %	9.52381	40.47619	50	100	
Total	720	10795	15234	26749	100

Table 101. Ságvár lithic assemblage composition by raw material types and technological categories

			Raw material			Total
			regional	distant	transcarpathian	
Class	flake	count	857	346	11	1214
		% within raw material	38.0%	46.4%	68.8%	40.2%
	blade	count	318	72	1	391
		% within raw material	14.1%	9.7%	6.3%	12.9%
	debris	count	862	251	3	1116
		% within raw material	38.2%	33.6%	18.8%	37.0%
	rejuvenating flake	count	18	9	0	27
		% within raw material	0.8%	1.2%	0.0%	0.9%
	crest	count	9	1	0	10
		% within raw material	0.4%	0.1%	0.0%	0.3%
	neo-crest	count	23	7	0	30
		% within raw material	1.0%	0.9%	0.0%	1.0%
	blade core	count	83	23	0	106
		% within raw material	3.7%	3.1%	0.0%	3.5%
	flake core	count	88	37	1	126
		% within raw material	3.9%	5.0%	6.3%	4.2%
Total		count	2258	746	16	3020
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 102. Ságvár blade assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material		Total
			regional	distant	
Scars	unidirectional	count	79	19	98
		% within raw material	54.9%	57.6%	55.4%
	opposite	count	19	7	26
		% within raw material	13.2%	21.2%	14.7%
	perpendicular	count	36	7	43
		% within raw material	25.0%	21.2%	24.3%
	multiple	count	9	0	9
		% within raw material	6.3%	0.0%	5.1%
	no scar	count	1	0	1
		% within raw material	0.7%	0.0%	0.6%
Total		count	144	33	177
		% within raw material	100.0%	100.0%	100.0%

Table 103. Ságvár blade core types by raw material

			Raw material		Total
			regional	distant	
Types	unidirectional	count	60	21	81
		% within raw material	72.3%	91.3%	76.4%
	bidirectional	count	8	1	9
		% within raw material	9.6%	4.3%	8.5%
	alternate	count	15	1	16
		% within raw material	18.1%	4.3%	15.1%
Total		count	83	23	106
		% within raw material	100.0%	100.0%	100.0%

Table 104. Ságvár blade assemblage (complete specimens) platform type frequency by raw material

			Raw material		Total
			regional	distant	
Platform	plain	count	82	19	101
		% within raw material	56.9%	57.6%	57.1%
	dihedral	count	9	1	10
		% within raw material	6.3%	3.0%	5.6%
	faceted	count	14	5	19
		% within raw material	9.7%	15.2%	10.7%
	cortical	count	6	3	9
		% within raw material	4.2%	9.1%	5.1%
	linear	count	17	3	20
		% within raw material	11.8%	9.1%	11.3%
	punctiform	count	12	2	14
		% within raw material	8.3%	6.1%	7.9%
	irregular	count	4	0	4
		% within raw material	2.8%	0.0%	2.3%
Total		count	144	33	177
		% within raw material	100.0%	100.0%	100.0%

Table 105. Ságvár blade assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material		Total
			regional	distant	
Impact point-overhang	none	count	88	17	105
		% within raw material	61.1%	51.5%	59.3%
	yes-no	count	15	4	19
		% within raw material	10.4%	12.1%	10.7%
	yes-yes	count	8	1	9
		% within raw material	5.6%	3.0%	5.1%
	no-yes	count	33	11	44
		% within raw material	22.9%	33.3%	24.9%
Total		count	144	33	177
		% within raw material	100.0%	100.0%	100.0%

Table 106. Ságvár blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	3.80	4.00	1.20
	Maximum	73.50	32.40	27.70
	Mean	30.8167	12.7910	5.3944
	Median	29.2000	12.3000	4.6000
	N	144	144	144
	Std. deviation	11.36026	4.82232	3.30490
Distant	Minimum	20.30	6.10	2.00
	Maximum	67.40	22.80	17.50
	Mean	36.9636	14.4212	7.1879
	Median	34.9000	13.7000	6.2000
	N	33	33	33
	Std. deviation	12.30886	4.70809	3.33923
Total	Minimum	3.80	4.00	1.20
	Maximum	73.50	32.40	27.70
	Mean	31.9627	13.0949	5.7288
	Median	30.0000	12.7000	5.0000
	N	177	177	177
	Std. deviation	11.75450	4.83013	3.37526

Table 107. Ságvár blade assemblage (complete specimens) t-test to compare length, width and thickness by raw materials

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.552	0.458	−2.760	175	0.006	−6.14697	2.22709
			−2.624	45.326	0.012	−6.14697	2.34251
Width [mm]	0.234	0.629	−1.759	175	0.080	−1.63024	0.92670
			−1.786	48.608	0.080	−1.63024	0.91279
Thickness [mm]	1.563	0.213	−2.806	175	0.006	−1.79343	0.63905
			−2.788	47.444	0.008	−1.79343	0.64323

Table 108. Ságvár tool assemblage product composition by raw materials

		Raw material			Total
		regional	distant	transcarpathian	
Flake	count	122	44	1	167
	% within raw material	50.8%	64.7%	100.0%	54.0%
Blade	count	72	10	0	82
	% within raw material	30.0%	14.7%	0.0%	26.5%
Debris	count	42	13	0	55
	% within raw material	17.5%	19.1%	0.0%	17.8%
Rejuvenating flake	count	4	1	0	5
	% within raw material	1.7%	1.5%	0.0%	1.6%
Total	count	240	68	1	309
	% within raw material	100.0%	100.0%	100.0%	100.0%

Table 109. Ságvár knapped product frequency in tool assemblage by raw materials

				Raw material			Total
				regional	distant	transcarpathian	
Flake	state	blank	count	735	302	10	1047
			% within raw material	85.8%	87.3%	90.9%	86.2%
		tool	count	122	44	1	167
			% within raw material	14.2%	12.7%	9.1%	13.8%
	total		count	857	346	11	1214
			% within raw material	100.0%	100.0%	100.0%	100.0%
Blade	state	blank	count	278	70	1	349
			% within raw material	79.4%	87.5%	100.0%	81.0%
		tool	count	72	10	0	82
			% within raw material	20.6%	12.5%	0.0%	19.0%
	total		count	350	80	1	431
			% within raw material	100.0%	100.0%	100.0%	100.0%
Debris	state	blank	count	820	238	3	1061
			% within raw material	95.1%	94.8%	100.0%	95.1%
		tool	count	42	13	0	55
			% within raw material	4.9%	5.2%	0.0%	4.9%
	total		count	862	251	3	1116
			% within raw material	100.0%	100.0%	100.0%	100.0%
Rejuvenating flake	state	blank	count	14	8		22
			% within raw material	77.8%	88.9%		81.5%
		tool	count	4	1		5
			% within raw material	22.2%	11.1%		18.5%
	total		count	18	9		27
			% within raw material	100.0%	100.0%		100.0%

Table 110. Ságvár blade tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	10.30	4.00	1.80
	Maximum	78.50	28.80	15.60
	Mean	28.0085	12.9028	5.5000
	Median	25.4000	12.4000	5.0000
	N	71	71	71
	Std. deviation	11.41980	5.29954	2.72229
Distant	Minimum	19.30	6.50	3.50
	Maximum	59.40	33.60	17.80
	Mean	33.4800	18.0200	8.6600
	Median	31.4500	18.3000	8.1500
	N	10	10	10
	Std. deviation	13.09926	9.49313	3.92349
Total	Minimum	10.30	4.00	1.80
	Maximum	78.50	33.60	17.80
	Mean	28.6840	13.5346	5.8901
	Median	26.0000	12.5000	5.4000
	N	81	81	81
	Std. deviation	11.69165	6.13042	3.05130

Table 111. Ságvár blade blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test								
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Regional	length [mm]	0.319	0.573	1.702	213	0.090	2.80822	1.65024
				1.699	138.799	0.092	2.80822	1.65318
	width [mm]	1.906	0.169	−0.155	213	0.877	−0.11184	0.72278
				−0.150	128.351	0.881	−0.11184	0.74636
	thickness [mm]	0.003	0.956	−0.233	213	0.816	−0.10556	0.45323
				−0.249	165.833	0.804	−0.10556	0.42453
Distant	length [mm]	0.002	0.961	0.773	41	0.444	3.48364	4.50737
				0.747	14.175	0.467	3.48364	4.66371
	width [mm]	10.088	0.003	−1.637	41	0.109	−3.59879	2.19818
				−1.156	10.375	0.273	−3.59879	3.11186
	thickness [mm]	0.009	0.925	−1.173	41	0.247	−1.47212	1.25472
				−1.074	13.206	0.302	−1.47212	1.37014

Table 112. Ságvár blade tool length, width and thickness mean comparison by raw materials with t-test

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.437	0.510	−1.394	79	0.167	−5.47155	3.92596
			−1.255	11.014	0.235	−5.47155	4.35842
Width [mm]	8.709	0.004	−2.555	79	0.013	−5.11718	2.00258
			−1.668	9.805	0.127	−5.11718	3.06717
Thickness [mm]	1.150	0.287	−3.243	79	0.002	−3.16000	0.97428
			−2.465	10.256	0.033	−3.16000	1.28209

Table 113. Ságvár blade tool types by raw material

			Raw material		Total
			regional	distant	
Tooltypes	endscraper	count	10	0	10
		% within raw material	13.9%	0.0%	12.2%
	burin	count	14	2	16
		% within raw material	19.4%	20.0%	19.5%
	retouched	count	27	3	30
		% within raw material	37.5%	30.0%	36.6%
	borer	count	1	0	1
		% within raw material	1.4%	0.0%	1.2%
	splintered piece	count	5	0	5
		% within raw material	6.9%	0.0%	6.1%
	truncation	count	1	0	1
		% within raw material	1.4%	0.0%	1.2%
	notched-denticulated	count	4	5	9
		% within raw material	5.6%	50.0%	11.0%
	composite	count	2	0	2
		% within raw material	2.8%	0.0%	2.4%
	armature	count	8	0	8
		% within raw material	11.1%	0.0%	9.8%
Total		count	72	10	82
		% within raw material	100.0%	100.0%	100.0%

Table 114. Ságvár armature types by raw material

			Raw material	Total
			regional	
Armature	backed	count	7	7
		% within raw material	87.5%	87.5%
	backed-truncated	count	1	1
		% within raw material	12.5%	12.5%
Total		count	8	8
		% within raw material	100.0%	100.0%

Table 115. Ságvár flake core types by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Types	unidirectional	count	24	10	0	34
		% within raw material	26.4%	29.4%	0.0%	27.0%
	bidirectional	count	16	1	1	18
		% within raw material	17.6%	2.9%	100.0%	14.3%
	multidirectional	count	51	23	0	74
		% within raw material	56.0%	67.6%	0.0%	58.7%
Total		count	91	34	1	126
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 116. Ságvár flake assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Scars	unidirectional	count	246	94	3	343
		% within raw material	48.4%	47.0%	42.9%	48.0%
	opposite	count	70	19	1	90
		% within raw material	13.8%	9.5%	14.3%	12.6%
	perpendicular	count	132	52	2	186
		% within raw material	26.0%	26.0%	28.6%	26.0%
	multiple	count	59	32	1	92
		% within raw material	11.6%	16.0%	14.3%	12.9%
	no scar	count	1	3	0	4
		% within raw material	0.2%	1.5%	0.0%	0.6%
Total		count	508	200	7	715
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 117. Ságvár flake assemblage (complete specimens) platform type frequency by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Platform	plain	count	289	128	4	421
		% within raw material	56.9%	64.0%	57.1%	58.9%
	dihedral	count	39	16	1	56
		% within raw material	7.7%	8.0%	14.3%	7.8%
	faceted	count	53	9	0	62
		% within raw material	10.4%	4.5%	0.0%	8.7%
	cortical	count	29	19	0	48
		% within raw material	5.7%	9.5%	0.0%	6.7%
	linear	count	62	13	1	76
		% within raw material	12.2%	6.5%	14.3%	10.6%
	debitage surface	count	0	1	0	1
		% within raw material	0.0%	0.5%	0.0%	0.1%
	punctiform	count	12	1	0	13
		% within raw material	2.4%	0.5%	0.0%	1.8%
	irregular	count	24	13	1	38
		% within raw material	4.7%	6.5%	14.3%	5.3%
Total		count	508	200	7	715
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 118. Ságvár flake assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Impact point-overhang	none	count	187	60	3	250
		% within raw material	36.8%	30.0%	42.9%	35.0%
	yes-no	count	65	25	2	92
		% within raw material	12.8%	12.5%	28.6%	12.9%
	yes-yes	count	86	39	0	125
		% within raw material	16.9%	19.5%	0.0%	17.5%
	no-yes	count	170	76	2	248
		% within raw material	33.5%	38.0%	28.6%	34.7%
Total		count	508	200	7	715
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 119. Ságvár flake blank length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	3.20	5.50	.90
	Maximum	59.50	52.60	31.60
	Mean	23.3673	18.7679	6.2185
	Median	21.6000	17.3000	5.2500
	N	508	508	508
	Std. deviation	9.14829	7.70581	4.02021
Distant	Minimum	11.00	10.60	1.90
	Maximum	73.50	63.40	30.40
	Mean	33.1260	27.8495	9.3275
	Median	32.2500	25.5000	8.5000
	N	200	200	200
	Std. deviation	11.87486	10.37833	4.77363
Transcarpathian	Minimum	13.80	13.00	3.40
	Maximum	41.60	27.70	8.50
	Mean	25.4286	23.5714	6.0571
	Median	24.1000	25.0000	6.4000
	N	7	7	7
	Std. deviation	10.06921	4.90500	1.83835
Total	Minimum	3.20	5.50	.90
	Maximum	73.50	63.40	31.60
	Mean	26.1172	21.3552	7.0866
	Median	23.7000	19.5000	5.8000
	N	715	715	715
	Std. deviation	10.89616	9.43459	4.45075

Table 120. Ságvár flake blank length, width and thickness mean comparison by raw materials with ANOVA and the Tukey post hoc

ANOVA

		Sum of squares	df	Mean square	F	Sig.
Length [mm]	between groups	13669.382	2	6834.691	68.442	0.000
	within groups	71101.237	712	99.861		
	Total	84770.618	714			
Width [mm]	between groups	11870.147	2	5935.073	81.762	0.000
	within groups	51684.021	712	72.590		
	Total	63554.168	714			
Thickness [mm]	between groups	1394.569	2	697.285	38.941	0.000
	within groups	12749.182	712	17.906		
	Total	14143.751	714			

Multiple Comparisons
Tukey HSD

Dependent variable	(I) raw material	(J) raw material	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
						Lower bound	Upper bound
Length [mm]	regional	distant	−9.75868	0.83420	0.000	−11.7179	−7.7995
		transcarpathian	−2.06125	3.80296	0.851	−10.9930	6.8705
	distant	regional	9.75868	0.83420	0.000	7.7995	11.7179
		transcarpathian	7.69743	3.84255	0.112	−1.3273	16.7221
	transcarpathian	regional	2.06125	3.80296	0.851	−6.8705	10.9930
		distant	−7.69743	3.84255	0.112	−16.7221	1.3273
Width [mm]	regional	distant	−9.08159	0.71123	0.000	−10.7520	−7.4112
		transcarpathian	−4.80352	3.24236	0.300	−12.4186	2.8116
	distant	regional	9.08159	0.71123	0.000	7.4112	10.7520
		transcarpathian	4.27807	3.27612	0.392	−3.4163	11.9724
	transcarpathian	regional	4.80352	3.24236	0.300	−2.8116	12.4186
		distant	−4.27807	3.27612	0.392	−11.9724	3.4163
Thickness [mm]	regional	distant	−3.10900	0.35324	0.000	−3.9386	−2.2794
		transcarpathian	0.16136	1.61036	0.994	−3.6208	3.9435
	distant	regional	3.10900	0.35324	0.000	2.2794	3.9386
		transcarpathian	3.27036	1.62713	0.111	−0.5512	7.0919
	transcarpathian	regional	−0.16136	1.61036	0.994	−3.9435	3.6208
		distant	−3.27036	1.62713	0.111	−7.0919	0.5512

Table 121. Ságvár flake tool length, width and thickness

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	10.60	7.90	1.60
	Maximum	48.50	53.80	20.70
	Mean	27.6721	20.9779	8.3148
	Median	27.0000	19.7500	7.7500
	N	122	122	122
	Std. deviation	8.12857	7.75472	3.75312
Distant	Minimum	15.60	9.40	5.00
	Maximum	73.70	54.00	28.50
	Mean	33.9636	25.3977	11.5477
	Median	33.6500	24.1000	11.1000
	N	44	44	44
	Std. deviation	9.13682	9.38129	4.36793
Transcarpathian	Minimum	23.50	20.80	8.50
	Maximum	23.50	20.80	8.50
	Mean	23.5000	20.8000	8.5000
	Median	23.5000	20.8000	8.5000
	N	1	1	1
	Std. deviation	–	–	–
Total	Minimum	10.60	7.90	1.60
	Maximum	73.70	54.00	28.50
	Mean	29.3048	22.1413	9.1677
	Median	29.0000	20.5000	8.5000
	N	167	167	167
	Std. deviation	8.81487	8.39331	4.15311

Table 122. Ságvár flake blank and tool length, width and thickness mean t-test comparison

Independent Samples Test								
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Regional	length [mm]	1.002	0.317	−4.765	628	0.000	−4.30481	0.90346
				−5.122	201.364	0.000	−4.30481	0.84044
	width [mm]	0.855	0.356	−2.841	628	0.005	−2.20996	0.77787
				−2.830	182.739	0.005	−2.20996	0.78090
	thickness [mm]	0.052	0.820	−5.237	628	0.000	−2.09625	0.40028
				−5.462	193.368	0.000	−2.09625	0.38376
Distant	length [mm]	8.473	0.004	−0.440	242	0.660	−0.83764	1.90432
				−0.519	78.553	0.605	−0.83764	1.61319
	width [mm]	2.076	0.151	1.442	242	0.150	2.45177	1.69983
				1.539	68.204	0.128	2.45177	1.59334
	thickness [mm]	1.243	0.266	−2.834	242	0.005	−2.22023	0.78330
				−3.000	67.559	0.004	−2.22023	0.73996

Table 123. Ságvár flake tool length, width and thickness mean comparison by raw materials with t-test

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.113	0.737	−4.257	164	0.000	−6.29151	1.47797
			−4.029	69.053	0.000	−6.29151	1.56170
Width [mm]	1.585	0.210	−3.060	164	0.003	−4.41986	1.44417
			−2.799	65.393	0.007	−4.41986	1.57896
Thickness [mm]	0.059	0.809	−4.686	164	0.000	−3.23297	0.68998
			−4.363	67.254	0.000	−3.23297	0.74099

Table 124. Ságvár flake tool types by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Tooltypes	endscraper	count	24	12	0	36
		% within raw material	19.7%	27.3%	0.0%	21.6%
	burin	count	32	7	0	39
		% within raw material	26.2%	15.9%	0.0%	23.4%
	retouched	count	21	6	0	27
		% within raw material	17.2%	13.6%	0.0%	16.2%
	borer	count	4	0	0	4
		% within raw material	3.3%	0.0%	0.0%	2.4%
	splintered piece	count	27	11	1	39
		% within raw material	22.1%	25.0%	100.0%	23.4%
	truncation	count	3	1	0	4
		% within raw material	2.5%	2.3%	0.0%	2.4%
	notched-denticulated	count	9	7	0	16
		% within raw material	7.4%	15.9%	0.0%	9.6%
	composite	count	2	0	0	2
		% within raw material	1.6%	0.0%	0.0%	1.2%
Total		count	122	44	1	167
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 125. Ságvár debris and rejuvenating flake tool types by raw material

Debitage				Raw material		Total
				regional	distant	
Debris	tooltypes	endscraper	count	4	1	5
			% within raw material	9.5%	7.7%	9.1%
		burin	count	10	2	12
			% within raw material	23.8%	15.4%	21.8%
		retouched	count	4	3	7
			% within raw material	9.5%	23.1%	12.7%
		borer	count	1	0	1
			% within raw material	2.4%	0.0%	1.8%
		splintered piece	count	17	3	20
			% within raw material	40.5%	23.1%	36.4%
		notched-denticulated	count	6	4	10
			% within raw material	14.3%	30.8%	18.2%
	total		count	42	13	55
			% within raw material	100.0%	100.0%	100.0%
Rejuvenating flake	tooltypes	endscraper	count	2	0	2
			% within raw material	50.0%	0.0%	40.0%
		burin	count	0	1	1
			% within raw material	0.0%	100.0%	20.0%
		retouched	count	1	0	1
			% within raw material	25.0%	0.0%	20.0%
		splintered piece	count	1	0	1
			% within raw material	25.0%	0.0%	20.0%
	total		count	4	1	5
			% within raw material	100.0%	100.0%	100.0%
Total	tooltypes	endscraper	count	6	1	7
			% within raw material	13.0%	7.1%	11.7%
		burin	count	10	3	13
			% within raw material	21.7%	21.4%	21.7%
		retouched	count	5	3	8
			% within raw material	10.9%	21.4%	13.3%
		borer	count	1	0	1
			% within raw material	2.2%	0.0%	1.7%
		splintered piece	count	18	3	21
			% within raw material	39.1%	21.4%	35.0%
		notched-denticulated	count	6	4	10
			% within raw material	13.0%	28.6%	16.7%
	total		count	46	14	60
			% within raw material	100.0%	100.0%	100.0%

CORVIN-TÉR

The site

Corvin-tér is situated on the right bank of Danube in the hearth of Budapest 105 m a.s.l. (Ringer, Lengyel 2008–2009). The archaeological site was found during a construction in 1997. The Upper Palaeolithic site covered a topographically tilting area 3.50–4.20 m below the actual surface.

All together 30 square meters were recovered from the Upper Palaeolithic settlement. The archaeological layer 1–3 cm thick lay above a loamy clay and under a silt loam layer. The silt loam layer 30–50 cm thick consisted of 2–4 cm thick laminae. This structure is characteristic to water lain sediments. The abandonment of the site was followed by water level rise of the Danube. The layer covering the archaeological remains was formed during suffusions of the Danube which lay down the fine silt loam up to 1.40 m thickness.

A total of 1.50 m thick Pleistocene sediment was studied at the site. Accordingly, changes in the sedimentation could have been observed on the interface of the loamy clay and the silt loam, where the human settlement itself was preserved.

The archaeological layer partially was reddish and dark gray. These hues in the sediment most probably were signs of fire, although hearths and charcoals were not found. The low velocity water flow of the Danube, as seen in the sediment, might have washed away the combustion features. Contrary to the charcoals, minute knapping chips, <5 mm, are present in the archaeological assemblage. A few organic remains were recovered at the site. Botanical remains were Pinus silvestris, including a large piece of bark. The fauna was dominated by bison.

Interesting features were footprints of animals and humans in the silt loam. A total of ten postholes were reported from the site, which ambiguously could have been dated to the human settlement.

Most of the finds are lithics. Lithic refitting study found close spatial distribution of finds. The knapped lithic artefacts lay scattered in the excavation area. A few refitted specimens lay next to each other. Animal remains were concentrated in the western, southwestern squares of the site.

Raw materials

Four types of lithic raw materials compose the assemblage: radiolarite, a dark green silicified sand stone, a dark grey silicified clay stone, and silicified lime stone (Tab. 126). By count, radiolarite is the dominant raw material (Tab. 127), which weighs 0.632 kg. In contrast, the quartzite that counts less but weighs a few grams more (Tab. 126). The silicified limestone is also a small group of finds but its weight is heavy compared to the number of finds it yielded.

The radiolarite derived from regional sources, the Bakony Mountains, Western Hungary. Its colour is brown, reddish and yellowish, which is typical for that area.

The silicified materials are of yet unknown origin, but their pebble cortex may refer to that they have been collected from the locally available Danube gravel. Local material yielded 60.13 items per kg, while the regional did 295.1.

Blade tool production

The distribution of the technological categories between the regional and the local materials is different. Regional materials yielded all blade technological categories, while the local materials were used for making flakes (Tab. 127).

Blades were unidirectionally detached (Tab. 128) and out of the four blade cores three have single striking platform. The blades have plain platforms (Tab. 129) with impact points missing and overhangs abraded (Tab. 130) showing soft hammer percussion. The blades are regularly short (Tab. 131) and the blade cores are also small sized (Tab. 132).

All the tools were made of the regional material, and 53.8% of the tools were made of blades. A total of 10.2% of the flakes are tools while this percent is 14.1 for the blades.

The mean length of the blade tools also is short (Tab. 133), even shorter than the blank items, however, this difference is rather insignificant (Tab. 134).

Blade tools are mostly edge retouched types (Tab. 135) and the few armatures are three backed bladelets.

Flake tool production

Unidirectional flake debitage characterizes the local material processing (Tab. 136). Flake platforms are chiefly cortical in the local group or plain, while regional specimens are plain (Tab. 137). Local and regional flakes bear no impact point but unabraded overhangs as a result of hard hammer percussion (Tab. 138). However, overhang abrasion on the regional flakes shows minor use of soft hammer percussion, too. Regional flakes are smaller than local ones (Tab. 139), and this difference is significant (Tab. 140).

Flake tools tend to be longer and thicker than the blank flakes (Tab. 141) and this difference is insignificant (Tab. 142). Flake tools are end scrapers, burins, edge retouched items and notches-denticulates (Tab. 143).

Table 126. Corvin-tér lithic raw material composition by weight in grams

Raw material	Blade	Flake	Debris	Blade core	Flake core	Total	%
Regional	145.38	318.67	116.9	52.02		632.97	36.00
Within regional %	22.96	50.34	18.46	8.21		100	
Local		306.81	406.01		412.2	1125.02	63.99
Within local %		47.58	62.975		63.93	100	
Total	145.38	625.48	522.91	52.02	412.2	1757.99	100
%	8.26	35.57	29.74	2.95	23.44	100	

Table 127. Corvin-tér lithic assemblage composition by raw material types and technological categories

			Raw material		Total
			local	regional	
Class	flake	count	27	118	145
		% within raw material	71.1%	35.5%	39.2%
	blade	count	0	93	93
		% within raw material	0.0%	28.0%	25.1%
	debris	count	10	105	115
		% within raw material	26.3%	31.6%	31.1%
	rejuvenating flake	count	0	6	6
		% within raw material	0.0%	1.8%	1.6%
	neo-crest	count	0	6	6
		% within raw material	0.0%	1.8%	1.6%
	blade core	count	0	4	4
		% within raw material	0.0%	1.2%	1.1%
	flake core	count	1	0	1
		% within raw material	2.6%	0.0%	0.3%
Total		count	38	332	370
		% within raw material	100.0%	100.0%	100.0%

Table 128. Corvin-tér blade assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material	Total
			regional	
Scars	unidirectional	count	17	17
		% within raw material	47.2%	47.2%
	opposite	count	10	10
		% within raw material	27.8%	27.8%
	perpendicular	count	7	7
		% within raw material	19.4%	19.4%
	multiple	count	2	2
		% within raw material	5.6%	5.6%
Total		count	36	36
		% within raw material	100.0%	100.0%

Table 129. Corvin-tér blade assemblage (complete specimens) platform type frequency by raw material

			Raw material regional	Total
Platform	plain	count	27	27
		% within raw material	75.0%	75.0%
	dihedral	count	2	2
		% within raw material	5.6%	5.6%
	faceted	count	5	5
		% within raw material	13.9%	13.9%
	linear	count	1	1
		% within raw material	2.8%	2.8%
	irregular	count	1	1
		% within raw material	2.8%	2.8%
Total		count	36	36
		% within raw material	100.0%	100.0%

Table 130. Corvin-tér blade assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material regional	Total
Impact point-overhang	none	count	20	20
		% within raw material	55.6%	55.6%
	yes-no	count	4	4
		% within raw material	11.1%	11.1%
	yes-yes	count	3	3
		% within raw material	8.3%	8.3%
	no-yes	count	9	9
		% within raw material	25.0%	25.0%
Total		count	36	36
		% within raw material	100.0%	100.0%

Table 131. Corvin-tér blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	16.50	7.60	1.40
	Maximum	45.00	17.60	11.20
	Mean	28.4833	11.7333	4.9806
	Median	27.9500	11.2000	4.8000
	N	36	36	36
	Std. deviation	7.34534	3.09442	2.37785
Total	Minimum	16.50	7.60	1.40
	Maximum	45.00	17.60	11.20
	Mean	28.4833	11.7333	4.9806
	Median	27.9500	11.2000	4.8000
	N	36	36	36
	Std. deviation	7.34534	3.09442	2.37785

Table 132. Corvin-tér core size

Debitage		Length	Width	Depth
Flake	Minimum	37.70	111.50	67.96
	Maximum	37.70	111.50	67.96
	Mean	37.7000	111.5000	67.9600
	Median	37.7000	111.5000	67.9600
	N	1	1	1
	Std. deviation	–	–	–
Blade	Minimum	27.00	18.77	9.80
	Maximum	31.30	28.50	30.38
	Mean	28.9600	21.3775	19.7650
	Median	28.7700	19.1200	19.4400
	N	4	4	4
	Std. deviation	1.79473	4.75347	11.33641

Table 133. Corvin-tér blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	15.50	6.00	1.50
	Maximum	35.70	23.20	17.00
	Mean	25.7286	11.2857	4.4714
	Median	25.4500	10.0500	3.1000
	N	14	14	14
	Std. deviation	6.31925	4.81278	4.01467
Total	Minimum	15.50	6.00	1.50
	Maximum	35.70	23.20	17.00
	Mean	25.7286	11.2857	4.4714
	Median	25.4500	10.0500	3.1000
	N	14	14	14
	Std. deviation	6.31925	4.81278	4.01467

Table 134. Corvin-tér blade blank and tool length, width and thickness mean t-test comparison

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.422	0.519	1.235	48	0.223	2.75476	2.23066
			1.321	27.437	0.198	2.75476	2.08592
Width [mm]	3.258	0.077	0.390	48	0.698	0.44762	1.14674
			0.323	17.349	0.751	0.44762	1.38581
Thickness [mm]	1.490	0.228	0.555	48	0.582	0.50913	0.91764
			0.445	16.674	0.662	0.50913	1.14382

Table 135. Corvin-tér blade tool types by raw material

			Raw Material	Total
			regional	
Tooltypes	burin	count	1	1
		% within raw material	7.1%	7.1%
	retouched	count	5	5
		% within raw material	35.7%	35.7%
	borer	count	1	1
		% within raw material	7.1%	7.1%
	truncation	count	3	3
		% within raw material	21.4%	21.4%
	composite	count	1	1
		% within raw material	7.1%	7.1%
	armature	count	3	3
		% within raw material	21.4%	21.4%
Total		count	14	14
		% within raw material	100.0%	100.0%

Table 136. Corvin-tér flake assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material		Total
			local	regional	
Scars	unidirectional	count	6	18	24
		% within raw material	42.9%	36.7%	38.1%
	opposite	count	1	6	7
		% within raw material	7.1%	12.2%	11.1%
	perpendicular	count	4	16	20
		% within raw material	28.6%	32.7%	31.7%
	multiple	count	1	9	10
		% within raw material	7.1%	18.4%	15.9%
	no scar	count	2	0	2
		% within raw material	14.3%	0.0%	3.2%
Total		count	14	49	63
		% within raw material	100.0%	100.0%	100.0%

Table 137. Corvin-tér flake assemblage (complete specimens) platform type frequency by raw material

			Raw material		Total
			local	regional	
Platform	plain	count	3	32	35
		% within raw material	21.4%	65.3%	55.6%
	dihedral	count	1	6	7
		% within raw material	7.1%	12.2%	11.1%
	faceted	count	0	9	9
		% within raw material	0.0%	18.4%	14.3%
	cortical	count	10	0	10
		% within raw material	71.4%	0.0%	15.9%
	irregular	count	0	2	2
		% within raw material	0.0%	4.1%	3.2%
Total		count	14	49	63
		% within raw material	100.0%	100.0%	100.0%

Table 138. Corvin-tér flake assemblage (complete specimens) impact point-overhang frequency by raw material

			Raw material		Total
			local	regional	
Impact point-overhang	none	count	0	11	11
		% within raw material	0.0%	22.4%	17.5%
	yes-no	count	0	11	11
		% within raw material	0.0%	22.4%	17.5%
	yes-yes	count	3	10	13
		% within raw material	21.4%	20.4%	20.6%
	no-yes	count	11	17	28
		% within raw material	78.6%	34.7%	44.4%
Total		count	14	49	63
		% within raw material	100.0%	100.0%	100.0%

Table 139. Corvin-tér flake blank assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Local	Minimum	19.10	17.90	4.50
	Maximum	76.30	76.10	27.00
	Median	36.0500	32.8000	9.4000
	Mean	40.7571	38.4143	11.0500
	N	14	14	14
	Std. deviation	16.97599	17.66421	6.91640
Regional	Minimum	10.60	7.30	1.30
	Maximum	35.90	34.00	15.90
	Median	23.4000	16.2000	5.5000
	Mean	22.4959	16.7204	5.9163
	N	49	49	49
	Std. deviation	6.75811	5.39274	3.10922
Total	Minimum	10.60	7.30	1.30
	Maximum	76.30	76.10	27.00
	Median	24.5000	17.9000	6.1000
	Mean	26.5540	21.5413	7.0571
	N	63	63	63
	Std. deviation	12.42383	13.06115	4.70565

Table 140. Corvin-tér flake blank length, width and thickness mean comparison by raw materials with t-test

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	26.312	0.000	6.107	61	0.000	18.26122	2.99011
			3.937	14.196	0.001	18.26122	4.63861
Width [mm]	39.785	0.000	7.572	61	0.000	21.69388	2.86504
			4.535	13.699	0.000	21.69388	4.78340
Thickness [mm]	9.956	0.002	4.015	61	0.000	5.13367	1.27861
			2.700	14.531	0.017	5.13367	1.90110

Table 141. Corvin-tér flake tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	12.10	13.20	3.30
	Maximum	51.00	34.00	18.10
	Mean	27.7167	20.6500	8.8667
	Median	26.8500	18.6000	8.5500
	N	12	12	12
	Std. deviation	9.48260	6.01899	3.66193
Total	Minimum	12.10	13.20	3.30
	Maximum	51.00	34.00	18.10
	Mean	27.7167	20.6500	8.8667
	Median	26.8500	18.6000	8.5500
	N	12	12	12
	Std. deviation	9.48260	6.01899	3.66193

Table 142. Corvin-tér flake blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.662	0.418	−0.307	73	0.760	−1.16270	3.78807
			−0.369	19.009	0.716	−1.16270	3.15331
Width [mm]	1.971	0.165	0.231	73	0.818	0.89127	3.86204
			0.372	34.638	0.712	0.89127	2.39308
Thickness [mm]	0.517	0.475	−1.259	73	0.212	−1.80952	1.43742
			−1.493	18.680	0.152	−1.80952	1.21200

Table 143. Corvin-tér flake tool types by raw material

			Raw material regional	Total
Tooltypes	endscraper	count	5	5
		% within raw material	41.7%	41.7%
	burin	count	3	3
		% within raw material	25.0%	25.0%
	retouched	count	2	2
		% within raw material	16.7%	16.7%
	notched-denticulated	count	2	2
		% within raw material	16.7%	16.7%
Total		count	12	12
		% within raw material	100.0%	100.0%

ESZTERGOM

The site

The site is located in North Hungary, the western edge of Visegrád Mountains, on the right bank of Danube, northeast to the core of town Esztergom (Dobosi, Kövecses-Varga 1991). This is a plateau at 160 m a.s.l. slightly sloping towards north under Sípoló hill 317 m a.s.l. An excavation in 1984 uncovered an area ~145 square meters, which yielded ~1200 archaeological finds.

The stratigraphy consisted of the recent soil on top, then a loess layer, in which the archaeological layer occurred 100 cm below the ground surface. Beneath the loess was the andesite bedrock. In the center of the site area was a hearth. The archaeological layer was reddish brown and contained charcoal grains and small ochre lumps. Besides this layer, finds occurred in the pure loess, too. The fauna is dominated by horse and rein deer, and also mammoth bones were found. The fauna was very fragmented and poorly preserved.

The find assemblage consisted of lithic artifacts, ochre lumps, shell ornaments and animal bones. A remarkable feature of the lithic assemblage of Gyurgyalag is the frequency of exotic raw material originating from the Prut river valley (Varga 1991), which counts over a thousand pieces (Dobosi, Kövecses-Varga 1991) making up over 90% of the total lithic assemblage. Esztergom has long been a lonely assemblage in the Hungarian archaeological record due to its lithic character. This site represented alone the second phase of the Epigravettian what Dobosi (2004) named Epigravettian rich in backed blades. Recently, Nadap was found to be closely similar by lithic tool typology (Lengyel 2016). Charcoals from one of the hearths were dated to 16 160 ± 200 BP (Deb-1160) (Hertelendi 1991).

Raw materials

Transcarpathian material dominate the assemblage (Tab. 144). According to chemical analyses (Varga 1991), these originate east of the Carpathians where the Prut cuts through the Podolian upland. However, macroscopically these flints are more similar to those found further east near the Dniester called Volhynian flint. A few items among the flints with brown hue are similar to Jurassic flint of the Kraków-Częstochowa upland, especially the Wołowice type. Transcarpathian materials yielded 431 item per kg.

Regional materials consist of a few items of a brown limnic silicite, the origin of which could have been the Börzsöny Mountains, and radiolarite, most probably of Gerecse origin. Regional materials yielded 109.6 items per kg.

A single piece of obsidian is the distant lithic raw material. No local raw materials were identified in the assemblage.

Blade tool production

Except the obsidian, all materials yielded complete sets of operational sequences and the frequency of blades suggests that blade debitage was the prime method to obtain blanks (Tab. 145).

Unidirectional reduction characterizes the blades (Tab. 146). Two blade cores, one made of cretaceous flint and the other made of a regional limnic silicite, also have single striking platform. Plain platforms dominate the blades (Tab. 147) and there are evidences for soft hammer percussion (Tab. 148). Transcarpathian blades are the longest items among blank blades (Tab. 149), but the t-test found no difference between the mean values of the blades by raw materials (Tab. 150).

The greatest percent of the tools are blades (Tab. 151) and out of the total number of blades more than 50% are tools (Tab. 152). The blade selection among flint blades was oriented toward the finer specimens (Tab. 153). T-test (Tab. 154) found the mean length of tool blades shorter than blank ones, which is due to that most of the blade tools are broken. The mean widths and thicknesses are not different. The other raw materials yielded insufficient number of specimens to be compared within groups. Comparing the sizes of the blade tools between raw materials (regional and transcarpathian), the t-test (Tab. 155), again, found no differences in the means.

Most of the blade tools are armatures (Tab. 156), dominated by backed bladelets, backed-truncated types, and points (Tab. 157). A few specimens have geometric shapes such as the trapeze-rectangle and the trapeze. The regional armatures are backed bladelets and one item is a backed-truncated type. The variability of armature types in the transcarpathian assemblage is greater, and all the points and geometric items belong here (Tab. 158). The majority of the points are curved backed points. There is a single specimen that has an inverse though not flat basal retouch, classified here eventually as a Gravette point. Burins were made only of transcarpathian blades.

Flake tool production

The flakes have dorsal scar orientation patterning from more than one direction (Tab. 159). This could be related with blade core shaping. The flakes have plain platforms (Tab. 160), overhangs and impact points as a result of hard hammer percussion besides the soft hammer percussion (Tab. 161).

Among blank specimens, the limnic silicite yielded the largest items (Tab. 162), and the t-test showed this difference significant (Tab. 163).

The flakes were rarely blanks of tools (Tabs 151 and 152). Only the transcarpathian material was used to make flake tools. Only 11.7% of the flakes are tools, which are rather short (Tab. 164). The t-test (Tab. 165) found no difference in mean length between tools and blank specimens of flakes concerning either the length, the width or the thickness.

The flakes are habitually edge retouched items (Tab. 166), however they also take a minor part of the armatures with a backed tool and a rectangle (Tab. 167). Although the number of burins is low, there is a considerable amount of burin spalls among the waste material.

Table 144. Esztergom lithic raw material composition by weight in grams

Raw material	Blade	Flake	Core	Total	%
Regional	44	494	55	593	20.25
Within regional %	7.419899	83.30523	9.274874	100	
Distant	2			2	0.06
Within distant %	100			100	
Transcarpathian	1667	626	41	2334	79.69
Within transcarpathian	71.42245	26.82091	1.756641	100	
Total	1713	1120	96	2929	100
%	58.48412	38.23831	3.277569	100	

Table 145. Esztergom lithic assemblage composition by raw material types and technological categories

			Raw material			Total
			regional	distant	transcarpathian	
Class	flake	count	34	0	189	223
		% within raw material	52.3%	0.0%	18.8%	20.8%
	blade	count	19	1	515	535
		% within raw material	29.2%	100.0%	51.2%	49.9%
	debris	count	11	0	282	293
		% within raw material	16.9%	0.0%	28.0%	27.3%
	rejuvenating flake	count	0	0	10	10
		% within raw material	0.0%	0.0%	1.0%	0.9%
	neo-crest	count	0	0	9	9
		% within raw material	0.0%	0.0%	0.9%	0.8%
	blade core	count	1	0	1	2
		% within raw material	1.5%	0.0%	0.1%	0.2%
Total		count	65	1	1006	1072
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 146. Esztergom blade assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Scars	unidirectional	count	1	0	14	15
		% within raw material	50.0%	0.0%	63.6%	60.0%
	opposite	count	1	1	3	5
		% within raw material	50.0%	100.0%	13.6%	20.0%
	perpendicular	count	0	0	4	4
		% within raw material	0.0%	0.0%	18.2%	16.0%
	multiple	count	0	0	1	1
		% within raw material	0.0%	0.0%	4.5%	4.0%
Total		count	2	1	22	25
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 147. Esztergom blade assemblage (complete specimens) platform type frequency by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Platform	plain	count	0	1	13	14
		% within raw material	0.0%	100.0%	59.1%	56.0%
	dihedral	count	1	0	1	2
		% within raw material	50.0%	0.0%	4.5%	8.0%
	faceted	count	0	0	5	5
		% within raw material	0.0%	0.0%	22.7%	20.0%
	linear	count	1	0	2	3
		% within raw material	50.0%	0.0%	9.1%	12.0%
	irregular	count	0	0	1	1
		% within raw material	0.0%	0.0%	4.5%	4.0%
Total		count	2	1	22	25
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 148. Esztergom blade assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Impact point-overhang	none	count	1	1	16	18
		% within raw material	50.0%	100.0%	72.7%	72.0%
	yes-yes	count	0	0	1	1
		% within raw material	0.0%	0.0%	4.5%	4.0%
	no-yes	count	1	0	5	6
		% within raw material	50.0%	0.0%	22.7%	24.0%
Total		count	2	1	22	25
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 149. Esztergom blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	30.00	8.10	3.70
	Maximum	37.60	14.50	5.10
	Median	33.8000	11.3000	4.4000
	Mean	33.8000	11.3000	4.4000
	N	2	2	2
	Std. deviation	5.37401	4.52548	0.98995
Distant	Minimum	36.70	11.00	8.20
	Maximum	36.70	11.00	8.20
	Median	36.7000	11.0000	8.2000
	Mean	36.7000	11.0000	8.2000
	N	1	1	1
	Std. deviation	–	–	–
Transcarpathian	Minimum	21.20	6.60	2.50
	Maximum	93.30	32.20	12.50
	Median	46.9000	14.3000	5.1000
	Mean	48.2045	15.7364	5.7545
	N	22	22	22
	Std. deviation	21.31783	7.14793	2.73996
Total	Minimum	21.20	6.60	2.50
	Maximum	93.30	32.20	12.50
	Median	38.7000	13.4000	5.1000
	Mean	46.5920	15.1920	5.7440
	N	25	25	25
	Std. deviation	20.46812	6.91562	2.64797

Table 150. Esztergom blade assemblage (complete specimens) t-test to compare length, width and thickness by raw materials

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	3.888	0.061	−0.935	22	0.360	−14.40455	15.40553
			−2.431	5.383	0.056	−14.40455	5.92426
Width [mm]	1.041	0.319	−0.852	22	0.403	−4.43636	5.20671
			−1.252	1.501	0.371	−4.43636	3.54435
Thickness [mm]	1.700	0.206	−0.683	22	0.502	−1.35455	1.98320
			−1.486	2.813	0.240	−1.35455	0.91173

Table 151. Esztergom tool assemblage product composition by raw materials

		Raw material		Total
		regional	transcarpathian	
Flake	count	0	26	26
	% within raw material	0.0%	7.8%	7.6%
Blade	count	9	309	318
	% within raw material	100.0%	92.2%	92.4%
Total	count	9	335	344
	% within raw material	100.0%	100.0%	100.0%

Table 152. Esztergom knapped product frequency in tool assemblage by raw materials

				Raw material			Total
				regional	distant	transcarpathian	
Flake	state	blank	count	34		163	197
			% within raw material	100.0%		86.2%	88.3%
		tool	count	0		26	26
			% within raw material	0.0%		13.8%	11.7%
	total		count	34		189	223
			% within raw material	100.0%		100.0%	100.0%
Blade	state	blank	count	10	1	215	226
			% within raw material	52.6%	100.0%	41.0%	41.5%
		tool	count	9	0	309	318
			% within raw material	47.4%	0.0%	59.0%	58.5%
	total		count	19	1	524	544
			% within raw material	100.0%	100.0%	100.0%	100.0%
Debris	state	blank	count	11			
			% within raw material	100.0%			
	total		count	11			
			% within raw material	100.0%			

Table 153. Esztergom blade tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	14.30	6.20	2.40
	Maximum	56.20	27.60	11.60
	Mean	30.5444	13.9667	4.9333
	Median	29.8000	13.1000	3.6000
	N	9	9	9
	Std. deviation	14.73067	5.80668	2.77669
Transcarpathian	Minimum	9.10	5.80	1.60
	Maximum	103.80	32.20	14.80
	Mean	34.2045	15.0278	4.9667
	Median	32.2000	14.2000	4.5000
	N	309	309	309
	Std. deviation	15.05228	4.26573	1.99083
Total	Minimum	9.10	5.80	1.60
	Maximum	103.80	32.20	14.80
	Mean	34.1009	14.9978	4.9657
	Median	32.1000	14.2000	4.5000
	N	318	318	318
	Std. deviation	15.03277	4.30834	2.01134

Table 154. Esztergom flint blade blank and tool length, width and thickness mean t-test comparison

Independent Samples Test									
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Regional	length [mm]	1.110	0.320	0.297	9	0.773	3.25556	10.94685
				0.524	5.285	0.621	3.25556	6.20889
	width [mm]	0.014	0.910	−0.601	9	0.563	−2.66667	4.43918
				−0.713	1.835	0.556	−2.66667	3.73984
	thickness [mm]	0.750	0.409	−0.259	9	0.802	−0.53333	2.06269
				−0.460	5.465	0.664	−0.53333	1.16046
Transcarpathian	length [mm]	9.774	0.002	4.086	329	0.000	14.00001	3.42639
				3.027	22.515	0.006	14.00001	4.62494
	width [mm]	18.731	0.000	0.713	329	0.477	0.70853	0.99410
				0.459	22.078	0.651	0.70853	1.54314
	thickness [mm]	5.762	0.017	1.744	329	0.082	0.78788	0.45166
				1.324	22.606	0.199	0.78788	0.59504

Table 155. Esztergom blade tool length, width and thickness mean comparison by raw materials with t-test and the Tukey post hoc

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.117	0.733	−0.719	316	0.472	−3.66009	5.08725
			−0.734	8.494	0.483	−3.66009	4.98433
Width [mm]	0.184	0.668	−0.728	316	0.467	−1.06117	1.45796
			−0.544	8.253	0.601	−1.06117	1.95071
Thickness [mm]	0.935	0.334	−0.049	316	0.961	−0.03333	0.68121
			−0.036	8.241	0.972	−0.03333	0.93247

Table 156. Esztergom blade tool types by raw material

			Raw material		Total
			regional	transcarpathian	
Tooltypes	endscraper	count	0	4	4
		% within raw material	0.0%	1.3%	1.3%
	burin	count	0	25	25
		% within raw material	0.0%	8.1%	7.9%
	retouched	count	2	48	50
		% within raw material	22.2%	15.5%	15.7%
	borer	count	0	2	2
		% within raw material	0.0%	0.6%	0.6%
	truncation	count	0	8	8
		% within raw material	0.0%	2.6%	2.5%
	notched-denticulated	count	0	1	1
		% within raw material	0.0%	0.3%	0.3%
	composite	count	0	1	1
		% within raw material	0.0%	0.3%	0.3%
	armature	count	7	220	227
		% within raw material	77.8%	71.2%	71.4%
Total		count	9	309	318
		% within raw material	100.0%	100.0%	100.0%

Table 157. Esztergom armature types by raw material

			Raw material		Total
			regional	transcarpathian	
Armatures	backed	count	6	129	135
		% within raw material	85.7%	58.6%	59.5%
	backed-truncated	count	1	50	51
		% within raw material	14.3%	22.7%	22.5%
	trapeze	count	0	3	3
		% within raw material	0.0%	1.4%	1.3%
	trapeze-rectangle	count	0	5	5
		% within raw material	0.0%	2.3%	2.2%
	points	count	0	33	33
		% within raw material	0.0%	15.0%	14.5%
Total		count	7	220	227
		% within raw material	100.0%	100.0%	100.0%

Table 158. Esztergom point types by raw material

			Raw material	Total
			transcarpathian	
Points	retouched	count	6	6
		% within raw material	18.2%	18.2%
	gravette/ microgravette	count	1	1
		% within raw material	3.0%	3.0%
	backed	count	5	5
		% within raw material	15.2%	15.2%
	arched backed	count	2	2
		% within raw material	6.1%	6.1%
	curved backed	count	19	19
		% within raw material	57.6%	57.6%
Total		count	33	33
		% within raw material	100.0%	100.0%

Table 159. Esztergom flake assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material		Total
			regional	transcarpathian	
Scars	unidirectional	count	4	15	19
		% within raw material	40.0%	40.5%	40.4%
	opposite	count	1	3	4
		% within raw material	10.0%	8.1%	8.5%
	perpendicular	count	5	13	18
		% within raw material	50.0%	35.1%	38.3%
	multiple	count	0	5	5
		% within raw material	0.0%	13.5%	10.6%
	no scar	count	0	1	1
		% within raw material	0.0%	2.7%	2.1%
Total		count	10	37	47
		% within raw material	100.0%	100.0%	100.0%

Table 160. Esztergom flake assemblage (complete specimens) platform type frequency by raw material

			Raw material		Total
			regional	transcarpathian	
Platform	plain	count	5	22	27
		% within raw material	50.0%	59.5%	57.4%
	dihedral	count	1	1	2
		% within raw material	10.0%	2.7%	4.3%
	faceted	count	2	7	9
		% within raw material	20.0%	18.9%	19.1%
	cortical	count	1	1	2
		% within raw material	10.0%	2.7%	4.3%
	linear	count	0	4	4
		% within raw material	0.0%	10.8%	8.5%
	punctiform	count	0	2	2
		% within raw material	0.0%	5.4%	4.3%
	irregular	count	1	0	1
		% within raw material	10.0%	0.0%	2.1%
Total		count	10	37	47
		% within raw material	100.0%	100.0%	100.0%

Table 161. Esztergom flake assemblage (complete specimens) impact point-overhang frequency by raw material

			Raw material		Total
			regional	transcarpathian	
Impact point-overhang	none	count	1	17	18
		% within raw material	10.0%	45.9%	38.3%
	yes-no	count	0	4	4
		% within raw material	0.0%	10.8%	8.5%
	yes-yes	count	2	7	9
		% within raw material	20.0%	18.9%	19.1%
	no-yes	count	7	9	16
		% within raw material	70.0%	24.3%	34.0%
Total		count	10	37	47
		% within raw material	100.0%	100.0%	100.0%

Table 162. Esztergom flake assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	22.10	22.10	3.70
	Maximum	61.50	82.60	19.80
	Mean	41.4100	40.1800	11.9800
	Median	42.4000	35.2500	12.6000
	N	10	10	10
	Std. deviation	14.42625	20.56085	4.39060
Transcarpathian	Minimum	13.40	9.90	2.00
	Maximum	64.10	45.90	11.60
	Mean	30.1919	22.9027	5.7243
	Median	30.4000	22.5000	4.8000
	N	37	37	37
	Std. deviation	13.79872	9.00313	2.84316
Total	Minimum	13.40	9.90	2.00
	Maximum	64.10	82.60	19.80
	Mean	32.5787	26.5787	7.0553
	Median	32.2000	24.7000	6.0000
	N	47	47	47
	Std. deviation	14.53505	14.04395	4.09819

Table 163. Esztergom flake assemblage (complete specimens) t-test to compare length, width and thickness by raw materials

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.042	0.838	2.260	45	0.029	11.21811	4.96352
			2.202	13.790	0.045	11.21811	5.09487
Width [mm]	8.136	0.007	3.966	45	0.000	17.27730	4.35628
			2.591	9.950	0.027	17.27730	6.66825
Thickness [mm]	1.351	0.251	5.463	45	0.000	6.25568	1.14508
			4.270	11.120	0.001	6.25568	1.46499

Table 164. Esztergom flake tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Transcarpathian	Minimum	14.90	11.30	2.60
	Maximum	59.30	56.40	17.90
	Median	30.2500	23.0000	5.6500
	Mean	34.6731	25.4808	6.2269
	N	26	26	26
	Std. deviation	14.90921	12.06758	3.54644
Total	Minimum	14.90	11.30	2.60
	Maximum	59.30	56.40	17.90
	Median	30.2500	23.0000	5.6500
	Mean	34.6731	25.4808	6.2269
	N	26	26	26
	Std. deviation	14.90921	12.06758	3.54644

Table 165. Esztergom flake blank and tool length, width and thickness mean t-test comparison (only transcarpathian raw material)

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.436	0.511	−0.584	71	0.561	−2.09435	3.58503
			−0.580	50.598	0.565	−2.09435	3.61171
Width [mm]	0.105	0.747	0.336	71	0.738	1.09795	3.27060
			0.351	58.613	0.727	1.09795	3.13009
Thickness [mm]	1.232	0.271	0.866	71	0.389	0.82840	0.95634
			0.903	58.290	0.370	0.82840	0.91711

Table 166. Esztergom flake tool types (only transcarpathian raw material)

			Raw material	Total
			transcarpathian	
Tooltypes	burin	count	5	5
		% within raw material	19.2%	19.2%
	retouched	count	9	9
		% within raw material	34.6%	34.6%
	borer	count	1	1
		% within raw material	3.8%	3.8%
	armature	count	8	8
		% within raw material	30.8%	30.8%
	notched-denticulated	count	3	3
		% within raw material	11.5%	11.5%
Total		count	26	26
		% within raw material	100.0%	100.0%

Table 167. Esztergom flake armature types (only transcarpathian raw material)

			Raw material	Total
			transcarpathian	
Armature	backed	count	7	7
		% within raw material	87.5%	87.5%
	rectangle	count	1	1
		% within raw material	12.5%	12.5%
Total		count	8	8
		% within raw material	100.0%	100.0%

NADAP

The site

The site is located in the south eastern part of Velencei Mountains, near Lake Velencei, at an elevation of about 180 m a.s.l. at the margin of an abandoned stone quarry (Dobosi et al. 1988). About 40 square meter area was recovered in 1985. By the time of the excavation the loess cover was already truncated by mining activity for sand.

The archaeological level was embedded in sandy slope loess. The first finds appeared 30 cm under the surface and the lowest finds lay at the depth of 40 cm. No regularity was observed in the spatial distribution of the finds. Bones and knapped stones lay randomly. Two burnt spots, interpreted as hearths, were found in block E and in block H, respectively. These had vague outlines and their area contained poorly preserved charcoal grains. Animal bones in the area of the hearths bore signs of burning. Near the burnt spot in block E, a plastered surface of palm size was recovered.

The first chronological consideration of the site was based upon the Upper Pleistocene stratigraphy of Hungary (Pécsi 1985). According to the excavators the human occupation lay under an embryonic soil called h_2 and above the so called Mende Upper soil complex. The embryonic soil h_2 was dated elsewhere to 20.5–21.7 ka BP and the Mende Upper soil complex to 32–27 ka BP (Pécsi 1985). Based on this geological consideration, the human occupation at Nadap was placed to between 32 and 20 k years BP. In contrast, the biostratigraphy of the site claimed that the hunted animal remains belonged to the Pilisszántó–Bajót fauna stage 18–12 ka BP (Vörös 2000). Radiocarbon dating of a horse phalange without stratigraphic precision of block D (Dobosi et al. 1988; A. Verpoorte personal communication 2009) yielded a date 13 050 ± 70 BP (GrA-16563) (Verpoorte 2004), which eventually corresponds with the biostratigraphy. Supporting what Verpoorte (2004) noticed, the detailed typological analysis of the assemblage pointed out a great similarity with the Late Epigravettian site of Esztergom (Lengyel 2016). Thus the fauna, radiocarbon dating and the lithic tool composition seem confirming the revised age of the assemblage.

The archaeological collection consists of animal bones and knapped lithics. This fauna is highly dominated by horse remains (MNI = 35) and a few specimens of asinus, rein deer and bison.

Raw materials

The assemblage is dominated by cretaceous flints originating from the glacier outcrops (Tab. 168). Among the flints there are a few items that are similar to Jurassic flints. The transcarpathian material yielded 505.3 item per kilogram.

The second largest group of materials is the radiolarite of regional origin, from Gerecse Mountains (Dobosi et al. 1988), however these radiolarite items are also similar to those outcropping in the Pieniny Klippen Belt of the White Carpathians. The regional material yielded 400.4 per kilogram.

Blade tool production

Both types of raw materials yielded products from a full sequence of debitage. The only element missing in transcarpathian material is the crest blade. Overall, blades dominate the industry and only blade cores were found in the assemblage (Tab. 169).

Although unidirectional scars are the most abundant on the blades (Tab. 170), they make up only less than 50% of the blade assemblage, which is in accordance with that out of the nine blade cores only two have single striking platform (Tab. 171). Blade platforms are plain (Tab. 172) without impact point and overhangs (Tab. 173) as a result of soft hammer percussion.

The mean length of the blades are very similar (Tab. 174) and the t-test found no differences between regional and transcarpathian blades mean size values (Tab. 175).

Blades rule the tool kit (Tab. 176) and out of the total blade assemblages 11.1% of the specimens are tools (Tab. 177).

Blade tools of both raw materials have similar sizes (Tab. 178). Regional blade tools are shorter and narrower than the blank blades (Tab. 179). Regarding transcarpathian items, the length and the width of the tools is smaller, and only the thicknesses are similar.

The size of the tools by raw materials is also very similar, the t-test found no difference (Tab. 180).

Most of the blade tools are armature (Tab. 181). Transcarpathian material yielded all the types of blade tools while the radiolarite was more used for armature. Among the armatures backed bladelets are common (Tab. 182). Among points, only two have straight back and the other three are curved or ached (Tab. 183).

Flake tool production

The flakes often were detached with unidirectional flaking (Tab. 184), their platforms are plain (Tab. 185), and several flakes have impact points of hard hammer percussion (Tab. 186).

The flakes are often short (Tab. 187) and their mean length, width and thickness do not differ by raw materials (Tab. 188).

Four flakes were retouched into tools (Tab. 176). The flake tools have similar mean lengths, widths and thicknesses compared to the blanks (Tab. 189). Comparing them with a statistical test gave no result due to low number of sample.

Flake tools were more frequently made of transcarpathian material, which are an end-scraper, a burin, an edge retouched tool and a truncated item (Tab. 190).

Table 168. Nadap lithic raw material composition by weight in grams

Raw material	Blade	Flake	Core	Total	%
Regional	391	113	63	567	24.98
Within regional	68.95944	19.92945	11.11111	100	
Transcarpathian	915	469	318	1702	75.02
Within transcarpathian	53.76028	27.55582	18.6839	100	
Total	1306	582	381	2269	
%	57.5584	25.65007	16.79154	100	

Table 169. Nadap lithic assemblage composition by raw material types and technological categories

			Raw material		Total
			regional	transcarpathian	
Class	flake	count	30	82	112
		% within raw material	13.2%	9.5%	10.3%
	blade	count	148	375	523
		% within raw material	65.2%	43.6%	48.1%
	debris	count	30	337	367
		% within raw material	13.2%	39.2%	33.8%
	rejuvenating flake	count	9	29	38
		% within raw material	4.0%	3.4%	3.5%
	crest	count	1	0	1
		% within raw material	0.4%	0.0%	0.1%
	neo-crest	count	7	30	37
		% within raw material	3.1%	3.5%	3.4%
	blade core	count	2	7	9
		% within raw material	0.9%	0.8%	0.8%
Total		count	227	860	1087
		% within raw material	100.0%	100.0%	100.0%

Table 170. Nadap blade assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material		Total
			regional	transcarpathian	
Scars	unidirectional	count	13	30	43
		% within raw material	52.0%	42.3%	44.8%
	opposite	count	10	26	36
		% within raw material	40.0%	36.6%	37.5%
	perpendicular	count	2	11	13
		% within raw material	8.0%	15.5%	13.5%
	multiple	count	0	4	4
		% within raw material	0.0%	5.6%	4.2%
Total		count	25	71	96
		% within raw material	100.0%	100.0%	100.0%

Table 171. Nadap blade core types by raw material

			Raw material			Total
			regional	distant	transcarpathian	
Types	unidirectional	count	0	0	2	2
		% within raw material	0.0%	0.0%	28.6%	22.2%
	bidirectional	count	1	0	1	2
		% within raw material	100.0%	0.0%	14.3%	22.2%
	alternate	count	0	1	4	5
		% within raw material	0.0%	100.0%	57.1%	55.6%
Total		count	1	1	7	9
		% within raw material	100.0%	100.0%	100.0%	100.0%

Table 172. Nadap blade assemblage (complete specimens) platform type frequency by raw material

			Raw material		Total
			regional	transcarpathian	
Platform	plain	count	24	58	82
		% within raw material	96.0%	81.7%	85.4%
	dihedral	count	0	3	3
		% within raw material	0.0%	4.2%	3.1%
	faceted	count	0	6	6
		% within raw material	0.0%	8.5%	6.3%
	linear	count	1	3	4
		% within raw material	4.0%	4.2%	4.2%
	irregular	count	0	1	1
		% within raw material	0.0%	1.4%	1.0%
Total		count	25	71	96
		% within raw material	100.0%	100.0%	100.0%

Table 173. Nadap blade assemblage (complete specimens) impact point-overhang co-presence by raw material

			Raw material		Total
			regional	transcarpathian	
Impact point-overhang	none	count	23	57	80
		% within raw material	92.0%	80.3%	83.3%
	yes-no	count	0	4	4
		% within raw material	0.0%	5.6%	4.2%
	yes-yes	count	0	5	5
		% within raw material	0.0%	7.0%	5.2%
	no-yes	count	2	5	7
		% within raw material	8.0%	7.0%	7.3%
Total		count	25	71	96
		% within raw material	100.0%	100.0%	100.0%

Table 174. Nadap blade assemblage (complete specimens) length, width and thickness by raw material

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	27.00	8.90	2.80
	Maximum	75.90	31.90	8.70
	Mean	46.8640	16.7200	5.1000
	Median	45.1000	14.8000	4.8000
	N	25	25	25
	Std. deviation	14.90785	5.49788	1.70514
Transcarpathian	Minimum	19.00	8.20	1.80
	Maximum	99.40	28.09	17.05
	Mean	45.0428	16.3897	5.5804
	Median	41.7400	16.5000	4.9000
	N	71	71	71
	Std. deviation	15.78441	4.64617	2.77533
Total	Minimum	19.00	8.20	1.80
	Maximum	99.40	31.90	17.05
	Mean	45.5171	16.4757	5.4553
	Median	42.1500	15.8000	4.8500
	N	96	96	96
	Std. deviation	15.50400	4.85423	2.54066

Table 175. Nadap blade assemblage (complete specimens) t-test to compare length, width and thickness by raw materials

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.003	0.958	0.503	94	0.616	1.82118	3.61988
			0.517	44.319	0.608	1.82118	3.52120
Width [mm]	1.187	0.279	0.291	94	0.772	0.33028	1.13438
			0.269	36.790	0.790	0.33028	1.23008
Thickness [mm]	3.608	0.061	−0.812	94	0.419	−0.48042	0.59192
			−1.013	69.056	0.314	−0.48042	0.47412

Table 176. Nadap tool assemblage product composition by raw materials

		Raw material		Total
		regional	transcarpathian	
Flake	count	1	3	4
	% within raw material	6.7%	5.9%	6.1%
Blade	count	14	48	62
	% within raw material	93.3%	94.1%	93.9%
Total	count	15	51	66
	% within raw material	100.0%	100.0%	100.0%

Table 177. Nadap knapped product frequency in tool assemblage by raw materials

				Raw material		Total
				regional	transcarpathian	
Flake	state	blank	count	29	79	108
			% within raw material	96.7%	96.3%	96.4%
		tool	count	1	3	4
			% within raw material	3.3%	3.7%	3.6%
	total		count	30	82	112
			% within raw material	100.0%	100.0%	100.0%
Blade	state	blank	count	142	357	499
			% within raw material	91.0%	88.1%	88.9%
		tool	count	14	48	62
			% within raw material	9.0%	11.9%	11.1%
	total		count	156	405	561
			% within raw material	100.0%	100.0%	100.0%

Table 178. Nadap blade tool assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	9.70	5.90	2.10
	Maximum	65.60	21.00	5.20
	Mean	30.4714	10.8000	3.3643
	Median	28.9500	9.3000	3.2500
	N	14	14	14
	Std. deviation	15.94763	4.42354	0.81958
Transcarpathian	Minimum	7.90	4.90	1.40
	Maximum	87.10	32.20	18.90
	Mean	31.5190	12.1494	5.0117
	Median	26.6200	9.1500	3.6000
	N	48	48	48
	Std. deviation	16.69667	6.82689	3.74654
Total	Minimum	7.90	4.90	1.40
	Maximum	87.10	32.20	18.90
	Mean	31.2824	11.8447	4.6397
	Median	27.0700	9.2500	3.5000
	N	62	62	62
	Std. deviation	16.40709	6.35638	3.38237

Table 179. Nadap blade blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test								
Raw material		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Regional	length [mm]	0.005	0.946	3.214	37	0.003	16.39257	5.10102
				3.151	25.525	0.004	16.39257	5.20153
	width [mm]	1.879	0.179	3.446	37	0.001	5.92000	1.71779
				3.667	32.177	0.001	5.92000	1.61455
	thickness [mm]	12.106	0.001	3.570	37	0.001	1.73571	0.48626
				4.282	36.438	0.000	1.73571	0.40531
Transcarpathian	length [mm]	0.098	0.754	4.479	117	0.000	13.52386	3.01916
				4.431	97.142	0.000	13.52386	3.05238
	width [mm]	7.798	0.006	4.034	117	0.000	4.24034	1.05105
				3.755	76.037	0.000	4.24034	1.12916
	thickness [mm]	1.117	0.293	0.951	117	0.344	0.56876	0.59817
				0.898	80.868	0.372	0.56876	0.63318

Table 180. Nadap blade tool length, width and thickness mean comparison by raw materials with t-test

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	0.046	0.831	−0.209	60	0.836	−1.04753	5.02313
			−0.214	22.019	0.833	−1.04753	4.89633
Width [mm]	4.214	0.044	−0.696	60	0.489	−1.34937	1.93894
			−0.877	32.939	0.387	−1.34937	1.53905
Thickness [mm]	7.440	0.008	−1.625	60	0.109	−1.64738	1.01384
			−2.824	58.039	0.006	−1.64738	0.58344

Table 181. Nadap blade tool types by raw material

			Raw material		Total
			regional	transcarpathian	
Tooltypes	end-scraper	count	0	4	4
		% within raw material	0.0%	8.3%	6.5%
	burin	count	0	10	10
		% within raw material	0.0%	20.8%	16.1%
	truncation	count	0	1	1
		% within raw material	0.0%	2.1%	1.6%
	armature	count	14	33	47
		% within raw material	100.0%	68.8%	75.8%
Total		count	14	48	62
		% within raw material	100.0%	100.0%	100.0%

Table 182. Nadap armature types by raw material

			Raw material		Total
			regional	transcarpathian	
Armatures	backed	count	11	25	36
		% within raw material	78.6%	75.8%	76.6%
	backed-truncated	count	1	5	6
		% within raw material	7.1%	15.2%	12.8%
	points	count	2	3	5
		% within raw material	14.3%	9.1%	10.6%
Total		count	14	33	47
		% within raw material	100.0%	100.0%	100.0%

Table 183. Nadap point types by raw material

			Raw material		Total
			regional	transcarpathian	
Points	backed	count	1	1	2
		% within raw material	50.0%	33.3%	40.0%
	arched backed	count	0	1	1
		% within raw material	0.0%	33.3%	20.0%
	curved backed	count	1	1	2
		% within raw material	50.0%	33.3%	40.0%
Total		count	2	3	5
		% within raw material	100.0%	100.0%	100.0%

Table 184. Nadap flake assemblage (complete specimens) dorsal scar pattern frequency by raw material

			Raw material		Total
			regional	transcarpathian	
Scars	unidirectional	count	2	9	11
		% within raw material	18.2%	42.9%	34.4%
	opposite	count	2	1	3
		% within raw material	18.2%	4.8%	9.4%
	perpendicular	count	6	8	14
		% within raw material	54.5%	38.1%	43.8%
	multiple	count	1	2	3
		% within raw material	9.1%	9.5%	9.4%
	no scar	count	0	1	1
		% within raw material	0.0%	4.8%	3.1%
Total		count	11	21	32
		% within raw material	100.0%	100.0%	100.0%

Table 185. Nadap flake assemblage (complete specimens) platform type frequency by raw material

			Raw material		Total
			regional	transcarpathian	
Platform	plain	count	10	15	25
		% within raw material	90.9%	71.4%	78.1%
	dihedral	count	1	2	3
		% within raw material	9.1%	9.5%	9.4%
	faceted	count	0	2	2
		% within raw material	0.0%	9.5%	6.3%
	cortical	count	0	2	2
		% within raw material	0.0%	9.5%	6.3%
Total		count	11	21	32
		% within raw material	100.0%	100.0%	100.0%

Table 186. Nadap flake assemblage (complete specimens) impact point-overhang frequency by raw material

			Raw material		Total
			regional	transcarpathian	
Impact point-overhang	none	count	3	5	8
		% within raw material	27.3%	23.8%	25.0%
	yes-no	count	3	2	5
		% within raw material	27.3%	9.5%	15.6%
	yes-yes	count	3	9	12
		% within raw material	27.3%	42.9%	37.5%
	no-yes	count	2	5	7
		% within raw material	18.2%	23.8%	21.9%
Total		count	11	21	32
		% within raw material	100.0%	100.0%	100.0%

Table 187. Nadap flake blank assemblage length, width and thickness by raw materials

Raw material		Length [mm]	Width [mm]	Thickness [mm]
Regional	Minimum	14.60	9.70	2.20
	Maximum	40.50	30.30	8.20
	Mean	25.6455	22.4455	4.9909
	Median	21.3000	22.2000	4.2000
	N	11	11	11
	Std. deviation	10.02161	6.21375	1.92377
Transcarpathian	Minimum	10.00	10.20	2.80
	Maximum	52.12	42.60	9.27
	Mean	24.7890	22.1071	6.0486
	Median	22.7000	21.1900	6.5000
	N	21	21	21
	Std. deviation	9.52437	7.18257	2.10816
Total	Minimum	10.00	9.70	2.20
	Maximum	52.12	42.60	9.27
	Mean	25.0834	22.2234	5.6850
	Median	22.0000	21.5500	5.7500
	N	32	32	32
	Std. deviation	9.54428	6.76500	2.07886

Table 188. Nadap flake blank length, width and thickness mean comparison by raw materials with t-test

Independent Samples Test							
	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Length [mm]	1.044	0.315	0.237	30	0.814	0.85641	3.60765
			0.234	19.516	0.818	0.85641	3.66742
Width [mm]	0.002	0.967	0.132	30	0.896	0.33831	2.55876
			0.139	23.211	0.891	0.33831	2.44268
Thickness [mm]	0.215	0.647	−1.387	30	0.176	−1.05766	0.76246
			−1.429	22.154	0.167	−1.05766	0.74033

Table 189. Nadap flake blank and tool length, width and thickness mean t-test comparison by raw material

Independent Samples Test							
Raw material	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std. error difference
Transcarpathian	0.037	0.850	−0.859	22	0.400	−5.05095	5.88031
			−0.857	2.603	0.463	−5.05095	5.89536
	0.020	0.888	1.289	22	0.211	5.62381	4.36201
			1.523	2.962	0.226	5.62381	3.69169
	6.340	0.020	−2.369	22	0.027	−3.55143	1.49901
			−1.340	2.126	0.306	−3.55143	2.65047

Table 190. Nadap flake tool types by raw material

			Raw material		Total
			regional	transcarpathian	
Tooltypes	endscraper	count	1	0	1
		% within raw material	100.0%	0.0%	25.0%
	burin	count	0	1	1
		% within raw material	0.0%	33.3%	25.0%
	retouched	count	0	1	1
		% within raw material	0.0%	33.3%	25.0%
	truncation	count	0	1	1
		% within raw material	0.0%	33.3%	25.0%
Total		count	1	3	4
		% within raw material	100.0%	100.0%	100.0%

CONSIDERATIONS ON TECHNOLOGICAL DATA

Raw materials

The technological data provided here showed that local raw material procurement was dominant solely in the Late Gravettian (LG) and only at two sites, Arka and Bodrogkeresztúr. Further sites of LG, also the Early Epigravettian (EE) camps, exploited regional sources, making this strategy the most common in the MUP and LUP. In contrast, the Late Epigravettian (LE) lithic procurement relied mostly on transcarpathian sources (TC). Latter case is an unusual strategy because regional lithic raw material sources in the Carpathian basin always were available. The abundance of TC material in LE is rather just apparently unique, because Arka and Bodrogkeresztúr comprise 1835 g and 1739 g of TC material, respectively, which are higher than the 1702 g at Nadap, and just slightly lower than the 2334 g at Esztergom. This means that possessing approximately 2 kg of TC material in LE is not unusual in the archaeological record of the Carpathian basin. The uniqueness of LE assemblages, indeed, is the low percentage of regional materials.

The frequency of the lithic raw material types were tested with K-mean cluster analysis to see if the raw material procurement areas can be linked with the archaeological period. The analysis made one cluster for Corvin-tér, Hidasnémeti, Ságvár and Sajószentpéter; another for Arka and Bodrogkeresztúr; and a third for Nadap and Esztergom. The first cluster corresponds with assemblages containing no or very low frequency of TC material. Cluster two have a considerable but not dominating frequency of TC material. Cluster three is composed of those assemblages dominated by TC material. These three clusters do not fit completely the three chronological panels. Only TC material dominance may identify LE assemblages.

The technological analyses showed that determining the dominant raw material processed at a site after the number of knapped items sometimes might be misleading. For example, Corvin-tér yielded most of its knapped products from regional radiolarite material, but the locally available coarse grain material with smaller number outweighs the regional material. Leaving the mass of the local material unworked seems to be related with its coarser quality, which is less apt for fine tool production.

The lower rate of local material fragmentation, nonetheless, seems to be a very general phenomenon. When local material is available in large quantity, the number of products per one kilogram of the raw material is always lower compared to other materials. At Arka, Bodrogkeresztúr and Corvin-tér, 60–64 items were produced from one kilogram of local material, while the regional material yield was at least twice greater, and TC material always yielded the greatest number of artifact per kilogram. TC yield was also high at Nadap and Esztergom, 431 and 505 items, respectively. These observations showed that the greater the distance between the site and the lithic source, the greater the reduction of the raw material.

The blade production

The most common debitage product in the MUP and LUP is the blade. The blade component of a toolkit in most cases is greater than 50%, which also reflects the importance of blade production. Out of the studied assemblages, the LE sites have the highest blade portions. Blade frequency, therefore, seemingly correlates with the threefold chronological division of the assemblages by the Gravettian Entity Model (GEM), which means that out of the three periods the smallest amount of blades was produced by EE, the greatest ratio by LE, and a moderate ratio by LG. The drop of blade proportion in the EE assemblages on the expense of the flakes in comparison with LG assemblages, however, is not significant ($r_s = -0.621$, $n = 6$, $p = 0.188$). This is most likely due to that local raw material processing, which is characteristic only to two LG sites, produces a vast number of flakes which pulls down overall blade ratio. When local raw materials are excluded from the correlation test, the decrease of blade ratio from LG to EE becomes significant ($r_s = -0.828$, $n = 6$, $p = 0.042$). The low blade production rate in EE also is demonstrable in comparison with LE ($r_s = 0.961$, $n = 6$, $p = 0.039$). The low blade frequency therefore can be a marker of EE lithic assemblages.

Considering the blade yield by raw materials, local and regional materials regularly produced a lower rate compared to TC. This is the case at Arka, Bodrogkeresztúr, Esztergom and Hidasnémeti. Nadap and Ságvár are outliers of this tendency with making a greater percent of blades from regional material. Therefore, the raw material consumption by blade debitage seems to increase parallel with the distance between the site and the lithic source, similarly to the growth of the reduction intensity.

At Arka and Bodrogkeresztúr, the blade yield from the total weight of local raw material is 11.16% and 11.29%, of regional material is 16.11% and 21.81%, and of TC material is 39.5% and 68.1%, respectively. At Esztergom, 71.4% of all TC material is blade by weight, and at Nadap this is 53.6%. These percentages showed that TC materials in any case were consumed chiefly for blade production. This can be observed even at Ságvár through 2–3% blade yield from the regional and distant materials, and 9.52% from TC materials. The outstandingly high blade yield at LE sites, however, could also be related with the high frequency of armatures, the fabrication of which requires merely blades.

The blade knapping modality did not show clear differences between the assemblages. The two basic methods studied here, the single platform and double platform reduction, did not seem to correlate neither with raw material type nor period. Unidirectional blade exploitation was the most common, and except for Corvin-tér and Esztergom, the assemblages contain double platform cores in varying frequency. Nadap is the only site with double platform core dominance, and this is the sole assemblage with the lowest ratio of unidirectional scars on blades. Testing the correlation between unidirectional scar frequency on blades and the chronology of the assemblages found no relationship regarding neither LG and EE ($r_s = -0.587$, $n = 6$, $p = 0.220$) nor EE and LE ($r_s = -0.236$, $n = 4$, $p = 0.764$). The failed correlation and the different ratio of unidirectional versus bidirectional reduction between Nadap and Esztergom demonstrates the blade debitage modalities were culturally unfixed.

The blade dimension is also an unstable variable ($F_{(7,\ 1134)} = 30.003$, $p < 0.001$). EE assemblages contain the shortest blades and these are the only ones which are not similar to any other blade assemblage according to the post hoc test (Tab. 191). However, Arka, while being similar to Bodrogkeresztúr and Sajószentpéter, is also similar to the two LE sites, Esztergom and Nadap, and differs from the contemporaneous Hidasnémeti, which is, in turn, similar to the LE Esztergom and the LG Sajószentpéter. Comparing the blade lengths by the three age clusters, the longest blades were made in LG and the shortest in EE assemblages. ANOVA ($F_{(2,\ 1139)} = 93.264$, $p < 0.001$) found these differences significant. But, LE blades also differ from the other two groups, by being shorter than LG and longer than EE (Tab. 192).

Studying the blade length by raw material within LG assemblages showed that Arka made longer local blades in average than Bodrogkeresztúr ($t_{(445.584)} = 3.279$, $p = 0.002$). Comparing regional blades from Arka, Bodrogkeresztúr, Hidasnémeti and Sajószentpéter, the means are also different ($F_{(3,\ 220)} = 18.538$, $p < 0.001$) because Hidasnémeti produced the longest blades, but the lengths of the other three LG assemblages are similar (Tab. 193). Comparing TC blades from Arka and Bodrogkeresztúr, there is no difference in blade length ($t_{(101)} = 0.679$, $p = 0.499$). Within EE, only the regional blade lengths can be compared, and the t-test showed that Ságvár and Corvin-tér yielded the same size ($t_{(82.182)} = -1.508$, $p = 0.135$). In LE assemblages, both the regional ($t_{(25)} = -1.214$, $p = 0.236$) and the TC ($t_{(28.494)} = 0.643$, $p = 0.525$) blade length means are similar.

Disregarding the chronology, the blade production from local raw materials can be compared only between Arka and Bodrogkeresztúr, which has already shown differences. In the regional blade production of all assemblages, the lengths are different ($F_{(7,\ 423)} = 31.115$, $p < 0.001$). In details it means that Corvin-tér is similar to Esztergom and Ságvár, but differs from all the others, which are in turn, similar, except Hidasnémeti that differs from each assemblage, except Esztergom (Tab. 194). The TC blade material length from Arka, Bodrogkeresztúr, Nadap and Esztergom showed no differences ($F_{(3,\ 192)} = 1.277$, $p = 0.283$).

At sites yielding both local and TC raw materials, Arka and Bodrogkeresztúr, the size of the local blades are always greater than that of TC blades. This situation can be interpreted with the greater reduction of the TC material due to the long time spent in the lithic production process and use-rejuvenation-reuse cycle. But, when there is no local material (Nadap), there is no correlation between distance and blade size diminishment.

These comparisons may illustrate that the length of the blades can be highly influenced by the raw material property and the reduction intensity. Except EE sites, blade length does not decode archaeological period. This can be demonstrated with the similar mean lengths ($t_{(377)} = -0.768$, $p = 0.443$) of the local blade assemblage of Arka and the regional blade assemblage of Hidasnémeti, because the raw materials of these two blade assemblages derived from similar geological outcrops with the same properties of the knappeable rock including size and quality. Also, Ságvár showed that distant material blades are greater than regional blades. This is due to that most regional material for Ságvár is small sized pebble that is not eligible for producing long blades, but distant materials provided larger blocks that were apt for increasing the size of the blade products.

Comparing the thicknesses of the blades, also there are differences between the assemblages ($F_{(7, 1134)} = 5.644$, $p < 0.001$). Arka is the sole assemblage that differs by being constantly thicker from Corvin-tér, Nadap and Ságvár (Tab. 195). This is in accordance with Arka blades being generally larger than the average.

By raw material origin, the two local material user sites, Arka and Bodrogkeresztúr, are different ($t_{(464.137)} = 3.457$, $p = 0.001$) by Arka making thicker blades. Blade thicknesses are also different ($F_{(7, 423)} = 3.283$, $p = 0.002$) in the regional group by Hidasnémeti being thicker than Arka, Corvin-tér and Ságvár (Tab. 196). TC material thicknesses are also different ($F_{(3, 192)} = 3.576$, $p = 0.015$) with Nadap blades being thicker than Bodrogkeresztúr, but these two by one by one are similar with the other two TC user assemblages, Arka and Esztergom (Tab. 197).

By chronological groups, regional blades of LG are thicker than EE blades, but EE samples are similar to LE blades (Tab. 198). Concerning TC blades, LG assemblages yielded thicker specimens than LE assemblages ($t_{(174.900)} = -3.086$, $p = 0.002$). Disregarding the raw material type, the difference in thickness is pronounced ($F_{(2, 1139)} = 16.922$, $p < 0.001$) by LG being thicker than EE and LE blades (Tab. 199).

The flake production

The flake sizes also differ among the assemblages ($F_{(7, 2369)} = 117.111$, $p < 0.001$). Arka differs from all other sites by making the largest flakes, and the smallest difference was found with Bodrogkeresztúr (Tab. 200). Bodrogkeresztúr is similar to Esztergom, Hidasnémeti and Sajószentpéter. Esztergom and Sajószentpéter are the only sites which differ from Arka. Comparing the flake lengths by period, the longest specimens were made by LG assemblages and the shortest ones in EE assemblages. ANOVA ($F_{(2, 2374)} = 293.703$, $p < 0.001$) found these differences significant. LE and EE flake sizes are similar (Tab. 201).

Studying the length of the flakes by raw materials in LG, the t-test ($t_{(745,986)} = 9.446$, $p < 0.001$) showed that local flakes at Arka are longer than at Bodrogkeresztúr. Comparing the regional flakes from Arka, Bodrogkeresztúr, Hidasnémeti and Sajószentpéter, the means are similar ($F_{(3, 295)} = 2.360$, $p = 0.072$). The smallest difference is between Hidasnémeti and Sajószentpéter, the two assemblages which do not have local raw material production (Tab. 202). Comparing the TC flakes in LG assemblages, Arka made larger flakes than Bodrogkeresztúr ($t_{(69.505)} = 4.263$, $p < 0.001$).

In EE assemblages, there is no difference between the lengths of the regional flakes ($t_{(555)} = -0.650$, $p = 0.516$).

In LE, there are differences between the regional flakes ($t_{(19)} = 2.932$, $p = 0.009$) by Esztergom making longer flakes than Nadap. But, the TC flake size means at Esztergom and Nadap are similar ($t_{(53.698)} = 1.756$, $p = 0.085$).

Without sorting the assemblages into their chronological group, the local flake production can be compared between Arka, Bodrogkeresztúr and Corvin-tér ($F_{(2, 1155)} = 41.684$, $p < 0.001$). The first two assemblages have already showed differences, but Corvin-tér flakes have similar size with Bodrogkeresztúr and Arka (Tab. 203). Concerning the regional flake production, the lengths are different ($F_{(7, 869)} = 26.528$, $p < 0.001$). Corvin-tér and Ságvár are the most dissimilar compared to the other assemblages and they are similar only to Nadap (Tab. 204). The TC flake lengths in Arka, Bodrogkeresztúr, Ságvár, Nadap and Esztergom showed differences ($F_{(4, 137)} = 6.296$, $p < 0.001$) with Arka being different from all but Ságvár (Tab. 205).

The flake size comparisons showed that the size of the products can be affected by the properties of the used lithic raw material. The only correlation we can see is that when local raw materials were used to make blades, the length of the flakes are greater, which is most likely due to that the locally available raw material could have been brought to the site in larger blocks, thus the blade core shaping produced greater flakes. This is in contrast with the TC materials, which usually entered the sites in smaller size, most probably as cores or smaller nodules. Therefore, the initial size of the lithic raw material seems to affect the size of the flakes. Again, comparing the flakes of Hidasnémeti and Arka, which were made of raw materials having similar properties, but the raw material is local for Arka and regional for Hidasnémeti, Arka made 15.9 mm longer flakes compared to Hidasnémeti and this difference is significant ($t_{(926)} = 9.378$, $p < 0.001$). This supports that local raw material processing results in larger flakes as by-products of the blade technology. The same difference was found when Hidasnémeti regional flake mean length was found smaller than the Bodrogkeresztúr local flake mean length ($t_{(344.424)} = 3.796$, $p < 0.001$).

Another aspect of local raw material exploitation and flake production concerns the knapping technique. Comparing the ratio of the impact point and overhang presence on the local raw material flakes at Arka and Bodrogkeresztúr with Hidasnémeti, 62.2% of the regional material flake assemblage of Hidasnémeti has impact point or unabraded overhang, while Arka and Bodrogkeresztúr flakes showed this feature reached up 89.7% and 82.9%, respectively. The hard hammer technique use in flake production generally decreases towards the production of regional, distant and TC materials ($r_s = -0227$, $n = 2377$, $p < 0.001$) and this correlation is valid for Arka, Bodrogkeresztúr and Esztergom.

The tool blank selection

Selecting the blanks for tools is quite similar between the assemblages. Ságvár is the only outlier with using more flakes than blades for tools. Although Corvint-tér has more blade tools than flake tools, these EE assemblages yielded the lowest percent of blade tools while the highest blade tool ratio is in LE assemblages. Indeed, blade tool frequency declines when LG and EE assemblages are compared ($r_s = -0.745$, $n = 348$, $p < 0.001$), and grows from EE towards LE ($r_s = 0.836$, $n = 267$, $p < 0.001$). This increase is still strong from LG to LE ($r_s = -0.866$, $n = 453$, $p < 0.001$). The flake selection for tools is in negative relation with the blade selection.

The ratio of raw materials in the blade toolkit diminishes with the distance to source. Bodrogkeresztúr is the only assemblage, which yielded almost equal numbers of local and TC blade tools, and Nadap and Esztergom showed a reverse order. The use of raw materials for flake tools showed the same pattern, but in the Bodrogkeresztúr flake toolkit the TC material is much fewer than the local material. Therefore, the proportion of raw materials in the toolkit mostly depends on the most frequent raw material. However, concerning the blades, there is a tendency to use up most TC items for tools, while from the local and regional material more items remained unretouched.

If we study how much of the blades from each raw material was used for tool, we see that when TC material was involved into the lithic production, the degree of blade usage for tools increases as the distance between site and raw material source grows. At Arka, 3.5 times greater the TC blade usage for tools compared to the local material, and regional blades were also used 2.9 times more to make tools than local blades. At Bodrogkeresztúr, 38.9% of all TC blades are tools, which is 3.2 times greater than the local blade usage, and regional blades were selected 2.2 times more for making tools than local blades. This pattern fits even Esztergom and Nadap where TC materials are the most frequent. Ságvár is deviant in this comparison because distant materials were less frequently selected for tools. At Corvin-tér and Sajószentpéter, this comparison is not applicable because only regional raw materials were used for making blade tools. Concerning the flakes, the same pattern can be seen: the usage rate increases as the distance grows between the site and the source. At Nadap, however, the rate is almost the same for regional and TC material (although the complete flake tool assemblage counts four items).

Local raw materials were used for tools only in two assemblages, Arka and Bodrogkeresztúr. At both sites, most local raw materials are domestic tools, and armature makes up 12.5% and 8.3% of the local material toolkit, respectively. Regional materials in Arka make up 26.7% of the armature, but it is 3.8% in Bodrogkeresztúr, which is similar to Ságvár 3.3%. In Esztergom and Nadap the regional materials were highly used for armature with 77.8% and 93.3%. Distant materials cannot be evaluated in the same way, but at Ságvár distant materials were not used for armature, only for domestic tasks. The use of TC material is also not biased towards the armature at Arka and Bodrogkeresztúr, but in the Arka toolkit 29.5% of TC specimens is armature while at Bodrogkeresztúr this percent is 9.9. At Hidasnémeti, Ságvár and Sajószentpéter, TC material was expended only for domestic tools. At LE sites, the TC usage in armatures is the highest, 68.1% and 64.7%, but since this material yielded the essence of the assemblages, and armature is the most common type, this is no surprise. Except for Esztergom and Nadap, domestic tools were mostly made of the locally available or the closest raw material types, but at Bodrogkeresztúr 44.4% of the burins were made of TC material, and the armatures were made from TC materials with 10% higher frequency than domestic tools. Correlating typological features and technological features, the frequency of blade production correlates with the frequency of the armatures in the assemblages ($r_s = 0.738$, $n = 8$, $p = 0.037$). However, the frequency of TC material has no effect on this. The use of the different raw materials therefore is not straightforwardly correlate with tool types.

Comparing the size of the blade tools with that of the blade blanks showed that the lengths usually differ. This parameter almost always change when a blade was retouched into a tool. The width differences were less frequent and the thickness was the last that may have changed. However, for the flakes this is the very revers. The thicknesses of blank and tool specimens were commonly different, which showed that thicker items were selected for making tools among the flakes. These comparisons showed that the average blade was eligible for blade tools, and the flakes were selected according to their parameters fitting best for the type of the tool.

Comparing the sizes of the domestic tool types between the assemblages ANOVA found flake tool lengths diverse ($F_{(7, 450)} = 10.502$, $p < 0.001$) by Ságvár being different from all assemblages except for Corvin-tér, Esztergom and Nadap. Out of these three the greatest similarity ($p = 1.000$) was found with Corvint-tér (Tab. 206). Concerning the blade tools, also there are differences ($F_{(7, 576)} = 8.216$, $p < 0.001$), by Ságvár being different from all sites but Corvin-tér, and Corvin-tér being different from Bodrogkeresztúr, Nadap and Sajószentpéter (Tab. 207). Therefore, small sized domestic tools seem to correspond with EE assemblages.

Measuring backed bladelet lengths (Sajószentpéter excluded), ANOVA ($F_{(6, 231)} = 3.275$, $p = 0.004$) showed that some assemblages are different from the others, but the post hoc pairwise comparison did not realize this difference (Tab. 208). The widths of the backed bladelets are also different ($F_{(6, 231)} = 31.299$, $p < 0.001$), but in this case the post hoc test pointed out Esztergom specimens wider than the others, except for Hidasnémeti (Tab. 209). The mean thicknesses of the backed bladelets are also different ($F_{(6, 231)} = 10.740$, $p < 0.001$), which is due to that Esztergom and Hidasnémeti specimens are similarly thick and thicker than the others (Tab. 210). Other armatures, like trapeze–rectangles are also not different by length ($F_{(2, 4)} = 0.810$, $p = 0.506$), width ($F_{(2, 4)} = 4.309$, $p = 0.100$) and thickness ($F_{(2, 4)} = 4.370$, $p = 0.099$). The complete point assemblage also does not show differences by length ($F_{(5,71)} = 0.311$, $p = 0.905$), width ($F_{(5,71)} = 1.174$, $p = 0.330$) and thickness ($F_{(5,71)} = 0.482$, $p = 0.788$). By sub-types of points, only the Gravette point widths were found different ($F_{(3, 10)} = 6.541$, $p = 0.010$) between Arka and Hidasnémeti ($p = 0.009$), latter assemblage having wider specimens.

Table 191. Blade lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	71142.930	7	10163.276	30.003	0.000
Within groups	384131.315	1134	338.740		
Total	455274.245	1141			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	2.27284	1.46958	0.782	−2.1896	6.7353
	Corvin-tér	22.32312	3.18525	0.000	12.6509	31.9954
	Esztergom	4.21446	3.77968	0.954	−7.2628	15.6917
	Hidasnémeti	−7.80060	2.17292	0.008	−14.3988	−1.2024
	Nadap	5.28937	2.06517	0.171	−0.9817	11.5604
	Ságvár	18.84374	1.62794	0.000	13.9004	23.7871
	Sajószentpéter	3.41686	3.77968	0.986	−8.0604	14.8941
Bodrogkeresztúr	Arka	−2.27284	1.46958	0.782	−6.7353	2.1896
	Corvin-tér	20.05028	3.29131	0.000	10.0560	30.0446
	Esztergom	1.94161	3.86948	1.000	−9.8083	13.6916
	Hidasnémeti	−10.07345	2.32561	0.000	−17.1353	−3.0116
	Nadap	3.01653	2.22527	0.877	−3.7407	9.7737
	Ságvár	16.57090	1.82676	0.000	11.0238	22.1180
	Sajószentpéter	1.14401	3.86948	1.000	−10.6059	12.8940
Corvin-tér	Arka	−22.32312	3.18525	0.000	−31.9954	−12.6509
	Bodrogkeresztúr	−20.05028	3.29131	0.000	−30.0446	−10.0560
	Esztergom	−18.10867	4.79156	0.004	−32.6586	−3.5587
	Hidasnémeti	−30.12373	3.65987	0.000	−41.2372	−19.0103
	Nadap	−17.03375	3.59694	0.000	−27.9561	−6.1114
	Ságvár	−3.47938	3.36500	0.969	−13.6975	6.7387
	Sajószentpéter	−18.90627	4.79156	0.002	−33.4562	−4.3563
Esztergom	Arka	−4.21446	3.77968	0.954	−15.6917	7.2628
	Bodrogkeresztúr	−1.94161	3.86948	1.000	−13.6916	9.8083
	Corvin-tér	18.10867	4.79156	0.004	3.5587	32.6586
	Hidasnémeti	−12.01506	4.18746	0.080	−24.7306	0.7005
	Nadap	1.07492	4.13257	1.000	−11.4739	13.6238
	Ságvár	14.62929	3.93235	0.005	2.6884	26.5702
	Sajószentpéter	−0.79760	5.20569	1.000	−16.6051	15.0099
Hidasnémeti	Arka	7.80060	2.17292	0.008	1.2024	14.3988
	Bodrogkeresztúr	10.07345	2.32561	0.000	3.0116	17.1353
	Corvin-tér	30.12373	3.65987	0.000	19.0103	41.2372
	Esztergom	12.01506	4.18746	0.080	−0.7005	24.7306
	Nadap	13.08998	2.74112	0.000	4.7664	21.4136
	Ságvár	26.64435	2.42878	0.000	19.2692	34.0195
	Sajószentpéter	11.21746	4.18746	0.130	−1.4981	23.9330

Table 191. Continued

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Nadap	Arka	−5.28937	2.06517	0.171	−11.5604	0.9817
	Bodrogkeresztúr	−3.01653	2.22527	0.877	−9.7737	3.7407
	Corvin-tér	17.03375	3.59694	0.000	6.1114	27.9561
	Esztergom	−1.07492	4.13257	1.000	−13.6238	11.4739
	Hidasnémeti	−13.08998	2.74112	0.000	−21.4136	−4.7664
	Ságvár	13.55437	2.33288	0.000	6.4704	20.6383
	Sajószentpéter	−1.87252	4.13257	1.000	−14.4214	10.6763
Ságvár	Arka	−18.84374	1.62794	0.000	−23.7871	−13.9004
	Bodrogkeresztúr	−16.57090	1.82676	0.000	−22.1180	−11.0238
	Corvin-tér	3.47938	3.36500	0.969	−6.7387	13.6975
	Esztergom	−14.62929	3.93235	0.005	−26.5702	−2.6884
	Hidasnémeti	−26.64435	2.42878	0.000	−34.0195	−19.2692
	Nadap	−13.55437	2.33288	0.000	−20.6383	−6.4704
	Sajószentpéter	−15.42689	3.93235	0.002	−27.3678	−3.4860
Sajószentpéter	Arka	−3.41686	3.77968	0.986	−14.8941	8.0604
	Bodrogkeresztúr	−1.14401	3.86948	1.000	−12.8940	10.6059
	Corvin-tér	18.90627	4.79156	0.002	4.3563	33.4562
	Esztergom	0.79760	5.20569	1.000	−15.0099	16.6051
	Hidasnémeti	−11.21746	4.18746	0.130	−23.9330	1.4981
	Nadap	1.87252	4.13257	1.000	−10.6763	14.4214
	Ságvár	15.42689	3.93235	0.002	3.4860	27.3678

Table 192. Blade lengths comparison between periods (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	64065.983	2	32032.992	93.264	0.000
Within groups	391208.262	1139	343.466		
Total	455274.245	1141			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) age	(J) age	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
LG	EEG	19.47722	1.42745	0.000	16.1273	22.8271
	LEG	5.11270	1.80656	0.013	0.8731	9.3523
EEG	LG	−19.47722	1.42745	0.000	−22.8271	−16.1273
	LEG	−14.36453	2.10976	0.000	−19.3157	−9.4134
LEG	LG	−5.11270	1.80656	0.013	−9.3523	−0.8731
	EEG	14.36453	2.10976	0.000	9.4134	19.3157

Table 193. Local blade lengths comparison within LG (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	17624.140	3	5874.713	18.538	0.000
Within groups	69716.801	220	316.895		
Total	87340.941	223			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	−3.38995	4.15456	0.847	−14.1452	7.3653
	Hidasnémeti	−19.59266	2.68524	0.000	−26.5442	−12.6412
	Sajószentpéter	−8.37520	4.01972	0.162	−18.7814	2.0309
Bodrogkeresztúr	Arka	3.38995	4.15456	0.847	−7.3653	14.1452
	Hidasnémeti	−16.20271	4.18404	0.001	−27.0342	−5.3712
	Sajószentpéter	−4.98525	5.14333	0.767	−18.3002	8.3297
Hidasnémeti	Arka	19.59266	2.68524	0.000	12.6412	26.5442
	Bodrogkeresztúr	16.20271	4.18404	0.001	5.3712	27.0342
	Sajószentpéter	11.21746	4.05018	0.031	0.7325	21.7025
Sajószentpéter	Arka	8.37520	4.01972	0.162	−2.0309	18.7814
	Bodrogkeresztúr	4.98525	5.14333	0.767	−8.3297	18.3002
	Hidasnémeti	−11.21746	4.05018	0.031	−21.7025	−0.7325

Table 194. Regional blade lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	49133.898	7	7019.128	31.115	0.000
Within groups	95422.868	423	225.586		
Total	144556.766	430			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	−3.38995	3.50529	0.979	−14.0677	7.2877
	Corvin-tér	10.53106	2.95724	0.010	1.5228	19.5393
	Esztergom	5.21440	10.73648	1.000	−27.4907	37.9195
	Hidasnémeti	−19.59266	2.26559	0.000	−26.4940	−12.6913
	Nadap	−7.84960	3.39152	0.288	−18.1807	2.4815
	Ságvár	8.19773	2.01135	0.001	2.0708	14.3246
	Sajószentpéter	−8.37520	3.39152	0.212	−18.7063	1.9559
Bodrogkeresztúr	Arka	3.38995	3.50529	0.979	−7.2877	14.0677
	Corvin-tér	13.92101	4.00928	0.013	1.7081	26.1340
	Esztergom	8.60435	11.07254	0.994	−25.1245	42.3332
	Hidasnémeti	−16.20271	3.53016	0.000	−26.9562	−5.4492
	Nadap	−4.45965	4.33953	0.970	−17.6786	8.7593
	Ságvár	11.58768	3.37263	0.015	1.3141	21.8613
	Sajószentpéter	−4.98525	4.33953	0.945	−18.2042	8.2337
Corvin-tér	Arka	−10.53106	2.95724	0.010	−19.5393	−1.5228
	Bodrogkeresztúr	−13.92101	4.00928	0.013	−26.1340	−1.7081
	Esztergom	−5.31667	10.91143	1.000	−38.5547	27.9214
	Hidasnémeti	−30.12373	2.98668	0.000	−39.2216	−21.0258
	Nadap	−18.38067	3.91021	0.000	−30.2918	−6.4695
	Ságvár	−2.33333	2.79872	0.991	−10.8587	6.1920
	Sajószentpéter	−18.90627	3.91021	0.000	−30.8174	−6.9951
Esztergom	Arka	−5.21440	10.73648	1.000	−37.9195	27.4907
	Bodrogkeresztúr	−8.60435	11.07254	0.994	−42.3332	25.1245
	Corvin-tér	5.31667	10.91143	1.000	−27.9214	38.5547
	Hidasnémeti	−24.80706	10.74462	0.291	−57.5370	7.9229
	Nadap	−13.06400	11.03705	0.936	−46.6847	20.5567
	Ságvár	2.98333	10.69390	1.000	−29.5921	35.5588
	Sajószentpéter	−13.58960	11.03705	0.922	−47.2103	20.0311
Hidasnémeti	Arka	19.59266	2.26559	0.000	12.6913	26.4940
	Bodrogkeresztúr	16.20271	3.53016	0.000	5.4492	26.9562
	Corvin-tér	30.12373	2.98668	0.000	21.0258	39.2216
	Esztergom	24.80706	10.74462	0.291	−7.9229	57.5370
	Nadap	11.74306	3.41722	0.015	1.3336	22.1525
	Ságvár	27.79039	2.05439	0.000	21.5324	34.0484
	Sajószentpéter	11.21746	3.41722	0.024	0.8080	21.6269

Table 194. Continued

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Nadap	Arka	7.84960	3.39152	0.288	−2.4815	18.1807
	Bodrogkeresztúr	4.45965	4.33953	0.970	−8.7593	17.6786
	Corvin-tér	18.38067	3.91021	0.000	6.4695	30.2918
	Esztergom	13.06400	11.03705	0.936	−20.5567	46.6847
	Hidasnémeti	−11.74306	3.41722	0.015	−22.1525	−1.3336
	Ságvár	16.04733	3.25423	0.000	6.1344	25.9603
	Sajószentpéter	−0.52560	4.24816	1.000	−13.4662	12.4150
Ságvár	Arka	−8.19773	2.01135	0.001	−14.3246	−2.0708
	Bodrogkeresztúr	−11.58768	3.37263	0.015	−21.8613	−1.3141
	Corvin-tér	2.33333	2.79872	0.991	−6.1920	10.8587
	Esztergom	−2.98333	10.69390	1.000	−35.5588	29.5921
	Hidasnémeti	−27.79039	2.05439	0.000	−34.0484	−21.5324
	Nadap	−16.04733	3.25423	0.000	−25.9603	−6.1344
	Sajószentpéter	−16.57293	3.25423	0.000	−26.4859	−6.6600
Sajószentpéter	Arka	8.37520	3.39152	0.212	−1.9559	18.7063
	Bodrogkeresztúr	4.98525	4.33953	0.945	−8.2337	18.2042
	Corvin-tér	18.90627	3.91021	0.000	6.9951	30.8174
	Esztergom	13.58960	11.03705	0.922	−20.0311	47.2103
	Hidasnémeti	−11.21746	3.41722	0.024	−21.6269	−0.8080
	Nadap	0.52560	4.24816	1.000	−12.4150	13.4662
	Ságvár	16.57293	3.25423	0.000	6.6600	26.4859

Table 195. Blade thicknesses comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Thickness [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	557.923	7	79.703	5.644	0.000
Within groups	16015.339	1134	14.123		
Total	16573.263	1141			

Multiple Comparisons

Dependent variable: thickness [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	0.60819	0.30007	0.464	−0.3030	1.5194
	Corvin-tér	2.24107	0.65039	0.014	0.2661	4.2160
	Esztergom	1.47763	0.77176	0.541	−0.8659	3.8211
	Hidasnémeti	0.32128	0.44368	0.996	−1.0260	1.6685
	Nadap	1.76632	0.42168	0.001	0.4859	3.0468
	Ságvár	1.49282	0.33240	0.000	0.4834	2.5022
	Sajószentpéter	0.52683	0.77176	0.997	−1.8167	2.8703

Table 195. Continued

Multiple Comparisons

Dependent variable: thickness [mm]

Tukey HSD

(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Bodrogkeresztúr	Arka	−0.60819	0.30007	0.464	−1.5194	0.3030
	Corvin-tér	1.63289	0.67204	0.228	−0.4078	3.6736
	Esztergom	0.86945	0.79010	0.957	−1.5297	3.2686
	Hidasnémeti	−0.28691	0.47486	0.999	−1.7289	1.1550
	Nadap	1.15813	0.45437	0.176	−0.2216	2.5379
	Ságvár	0.88463	0.37300	0.256	−0.2480	2.0173
	Sajószentpéter	−0.08135	0.79010	1.000	−2.4805	2.3178
Corvin-tér	Arka	−2.24107	0.65039	0.014	−4.2160	−0.2661
	Bodrogkeresztúr	−1.63289	0.67204	0.228	−3.6736	0.4078
	Esztergom	−0.76344	0.97837	0.994	−3.7344	2.2075
	Hidasnémeti	−1.91980	0.74730	0.168	−4.1890	0.3494
	Nadap	−0.47476	0.73445	0.998	−2.7050	1.7555
	Ságvár	−0.74826	0.68709	0.959	−2.8347	1.3381
	Sajószentpéter	−1.71424	0.97837	0.653	−4.6852	1.2567
Esztergom	Arka	−1.47763	0.77176	0.541	−3.8211	0.8659
	Bodrogkeresztúr	−0.86945	0.79010	0.957	−3.2686	1.5297
	Corvin-tér	0.76344	0.97837	0.994	−2.2075	3.7344
	Hidasnémeti	−1.15635	0.85502	0.878	−3.7527	1.4400
	Nadap	0.28869	0.84382	1.000	−2.2736	2.8510
	Ságvár	0.01519	0.80294	1.000	−2.4230	2.4534
	Sajószentpéter	−0.95080	1.06293	0.987	−4.1785	2.2769
Hidasnémeti	Arka	−0.32128	0.44368	0.996	−1.6685	1.0260
	Bodrogkeresztúr	0.28691	0.47486	0.999	−1.1550	1.7289
	Corvin-tér	1.91980	0.74730	0.168	−0.3494	4.1890
	Esztergom	1.15635	0.85502	0.878	−1.4400	3.7527
	Nadap	1.44504	0.55970	0.164	−0.2545	3.1446
	Ságvár	1.17154	0.49593	0.261	−0.3344	2.6775
	Sajószentpéter	0.20555	0.85502	1.000	−2.3908	2.8019
Nadap	Arka	−1.76632	0.42168	0.001	−3.0468	−0.4859
	Bodrogkeresztúr	−1.15813	0.45437	0.176	−2.5379	0.2216
	Corvin-tér	0.47476	0.73445	0.998	−1.7555	2.7050
	Esztergom	−0.28869	0.84382	1.000	−2.8510	2.2736
	Hidasnémeti	−1.44504	0.55970	0.164	−3.1446	0.2545
	Ságvár	−0.27350	0.47634	0.999	−1.7200	1.1730
	Sajószentpéter	−1.23949	0.84382	0.824	−3.8018	1.3228
Ságvár	Arka	−1.49282	0.33240	0.000	−2.5022	−0.4834
	Bodrogkeresztúr	−0.88463	0.37300	0.256	−2.0173	0.2480
	Corvin-tér	0.74826	0.68709	0.959	−1.3381	2.8347
	Esztergom	−0.01519	0.80294	1.000	−2.4534	2.4230
	Hidasnémeti	−1.17154	0.49593	0.261	−2.6775	0.3344
	Nadap	0.27350	0.47634	0.999	−1.1730	1.7200
	Sajószentpéter	−0.96599	0.80294	0.931	−3.4042	1.4722
Sajószentpéter	Arka	−0.52683	0.77176	0.997	−2.8703	1.8167
	Bodrogkeresztúr	0.08135	0.79010	1.000	−2.3178	2.4805
	Corvin-tér	1.71424	0.97837	0.653	−1.2567	4.6852
	Esztergom	0.95080	1.06293	0.987	−2.2769	4.1785
	Hidasnémeti	−0.20555	0.85502	1.000	−2.8019	2.3908
	Nadap	1.23949	0.84382	0.824	−1.3228	3.8018
	Ságvár	0.96599	0.80294	0.931	−1.4722	3.4042

Table 196. Regional blade thicknesses comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Thickness [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	197.737	7	28.248	3.283	0.002
Within groups	3639.117	423	8.603		
Total	3836.854	430			

Multiple Comparisons

Dependent variable: thickness [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	−0.36378	0.68453	0.999	−2.4490	1.7214
	Corvin-tér	0.45131	0.57751	0.994	−1.3079	2.2105
	Esztergom	1.03187	2.09669	1.000	−5.3550	7.4187
	Hidasnémeti	−1.46848	0.44244	0.022	−2.8162	−0.1207
	Nadap	0.33187	0.66232	1.000	−1.6857	2.3494
	Ságvár	0.03742	0.39279	1.000	−1.1591	1.2339
	Sajószentpéter	−1.26293	0.66232	0.547	−3.2805	0.7546
Bodrogkeresztúr	Arka	0.36378	0.68453	0.999	−1.7214	2.4490
	Corvin-tér	0.81510	0.78296	0.968	−1.5699	3.2001
	Esztergom	1.39565	2.16231	0.998	−5.1911	7.9824
	Hidasnémeti	−1.10470	0.68939	0.749	−3.2047	0.9953
	Nadap	0.69565	0.84745	0.992	−1.8858	3.2771
	Ságvár	0.40121	0.65863	0.999	−1.6051	2.4075
	Sajószentpéter	−0.89915	0.84745	0.964	−3.4806	1.6823
Corvin-tér	Arka	−0.45131	0.57751	0.994	−2.2105	1.3079
	Bodrogkeresztúr	−0.81510	0.78296	0.968	−3.2001	1.5699
	Esztergom	0.58056	2.13085	1.000	−5.9104	7.0715
	Hidasnémeti	−1.91980	0.58326	0.024	−3.6965	−0.1431
	Nadap	−0.11944	0.76361	1.000	−2.4455	2.2066
	Ságvár	−0.41389	0.54655	0.995	−2.0788	1.2510
	Sajószentpéter	−1.71424	0.76361	0.327	−4.0403	0.6118
Esztergom	Arka	−1.03187	2.09669	1.000	−7.4187	5.3550
	Bodrogkeresztúr	−1.39565	2.16231	0.998	−7.9824	5.1911
	Corvin-tér	−0.58056	2.13085	1.000	−7.0715	5.9104
	Hidasnémeti	−2.50035	2.09828	0.934	−8.8921	3.8914
	Nadap	−0.70000	2.15538	1.000	−7.2657	5.8657
	Ságvár	−0.99444	2.08837	1.000	−7.3560	5.3671
	Sajószentpéter	−2.29480	2.15538	0.964	−8.8605	4.2709
Hidasnémeti	Arka	1.46848	0.44244	0.022	0.1207	2.8162
	Bodrogkeresztúr	1.10470	0.68939	0.749	−0.9953	3.2047
	Corvin-tér	1.91980	0.58326	0.024	0.1431	3.6965
	Esztergom	2.50035	2.09828	0.934	−3.8914	8.8921
	Nadap	1.80035	0.66734	0.126	−0.2325	3.8332
	Ságvár	1.50591	0.40119	0.005	0.2838	2.7280
	Sajószentpéter	0.20555	0.66734	1.000	−1.8273	2.2384

Table 196. Continued

Multiple Comparisons

Dependent variable: thickness [mm]
Tukey HSD

(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval Lower bound	Upper bound
Nadap	Arka	−0.33187	0.66232	1.000	−2.3494	1.6857
	Bodrogkeresztúr	−0.69565	0.84745	0.992	−3.2771	1.8858
	Corvin-tér	0.11944	0.76361	1.000	−2.2066	2.4455
	Esztergom	0.70000	2.15538	1.000	−5.8657	7.2657
	Hidasnémeti	−1.80035	0.66734	0.126	−3.8332	0.2325
	Ságvár	−0.29444	0.63551	1.000	−2.2303	1.6414
	Sajószentpéter	−1.59480	0.82961	0.536	−4.1219	0.9323
Ságvár	Arka	−0.03742	0.39279	1.000	−1.2339	1.1591
	Bodrogkeresztúr	−0.40121	0.65863	0.999	−2.4075	1.6051
	Corvin-tér	0.41389	0.54655	0.995	−1.2510	2.0788
	Esztergom	0.99444	2.08837	1.000	−5.3671	7.3560
	Hidasnémeti	−1.50591	0.40119	0.005	−2.7280	−0.2838
	Nadap	0.29444	0.63551	1.000	−1.6414	2.2303
	Sajószentpéter	−1.30036	0.63551	0.452	−3.2362	0.6355
Sajószentpéter	Arka	1.26293	0.66232	0.547	−0.7546	3.2805
	Bodrogkeresztúr	0.89915	0.84745	0.964	−1.6823	3.4806
	Corvin-tér	1.71424	0.76361	0.327	−0.6118	4.0403
	Esztergom	2.29480	2.15538	0.964	−4.2709	8.8605
	Hidasnémeti	−0.20555	0.66734	1.000	−2.2384	1.8273
	Nadap	1.59480	0.82961	0.536	−0.9323	4.1219
	Ságvár	1.30036	0.63551	0.452	−0.6355	3.2362

Table 197. Transcarpathian blade thicknesses comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Thickness [mm]

	Sum of squares	df	Mean square	F	Sig.
Between groups	65.618	3	21.873	3.576	0.015
Within groups	1174.299	192	6.116		
Total	1239.917	195			

Multiple Comparisons

Dependent variable: thickness [mm]
Tukey HSD

(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval Lower bound	Upper bound
Arka	Bodrogkeresztúr	0.53239	0.54771	0.766	−0.8871	1.9519
	Esztergom	−1.09001	0.59963	0.268	−2.6441	0.4640
	Nadap	−0.91589	0.40950	0.117	−1.9772	0.1454
Bodrogkeresztúr	Arka	−0.53239	0.54771	0.766	−1.9519	0.8871
	Esztergom	−1.62240	0.70458	0.101	−3.4485	0.2037
	Nadap	−1.44828	0.55188	0.046	−2.8786	−0.0180

Table 197. Continued

Multiple Comparisons

Dependent variable: thickness [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Esztergom	Arka	1.09001	0.59963	0.268	−0.4640	2.6441
	Bodrogkeresztúr	1.62240	0.70458	0.101	−0.2037	3.4485
	Nadap	0.17412	0.60345	0.992	−1.3898	1.7381
Nadap	Arka	0.91589	0.40950	0.117	−0.1454	1.9772
	Bodrogkeresztúr	1.44828	0.55188	0.046	0.0180	2.8786
	Esztergom	−0.17412	0.60345	0.992	−1.7381	1.3898

Table 198. Regional blade thicknesses comparison between periods (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Thickness [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	86.869	2	43.434	4.957	0.007
Within groups	3749.986	428	8.762		
Total	3836.854	430			

Multiple Comparisons

Dependent variable: thickness [mm]						
Tukey HSD						
(I) age	(J) age	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
LG	EEG	0.85574	0.29629	0.011	0.1589	1.5526
	LEG	1.11926	0.60301	0.153	−0.2990	2.5375
EEG	LG	−0.85574	0.29629	0.011	−1.5526	−0.1589
	LEG	0.26352	0.61089	0.903	−1.1732	1.7003
LEG	LG	−1.11926	0.60301	0.153	−2.5375	0.2990
	EEG	−0.26352	0.61089	0.903	−1.7003	1.1732

Table 199. Blade thicknesses comparison between periods (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Thickness [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	478.237	2	239.118	16.922	0.000
Within groups	16095.026	1139	14.131		
Total	16573.263	1141			

Multiple Comparisons

Dependent variable: thickness [mm]						
Tukey HSD						
(I) age	(J) age	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
LG	EEG	1.39004	0.28954	0.000	0.7106	2.0695
	LEG	1.47743	0.36643	0.000	0.6175	2.3374
EEG	LG	−1.39004	0.28954	0.000	−2.0695	−0.7106
	LEG	0.08739	0.42793	0.977	−0.9169	1.0916
LEG	LG	−1.47743	0.36643	0.000	−2.3374	−0.6175
	EEG	−0.08739	0.42793	0.977	−1.0916	0.9169

Table 200. Flake lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	205238.406	7	29319.772	117.111	0.000
Within groups	593102.184	2369	250.360		
Total	798340.590	2376			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	10.21625	0.92347	0.000	7.4148	13.0177
	Corvin-tér	21.17743	2.05990	0.000	14.9285	27.4263
	Esztergom	15.15267	2.36559	0.000	7.9764	22.3289
	Hidasnémeti	13.39903	1.45730	0.000	8.9782	17.8199
	Nadap	22.64796	2.84481	0.000	14.0179	31.2780
	Ságvár	21.61420	0.78699	0.000	19.2268	24.0016
	Sajószentpéter	13.93871	3.14618	0.000	4.3945	23.4830
Bodrogkeresztúr	Arka	−10.21625	0.92347	0.000	−13.0177	−7.4148
	Corvin-tér	10.96118	2.13484	0.000	4.4849	17.4374
	Esztergom	4.93643	2.43113	0.461	−2.4387	12.3115
	Hidasnémeti	3.18278	1.56144	0.456	−1.5540	7.9196
	Nadap	12.43171	2.89954	0.000	3.6357	21.2278
	Ságvár	11.39795	0.96630	0.000	8.4666	14.3293
	Sajószentpéter	3.72246	3.19575	0.942	−5.9722	13.4171

Table 200. Continued

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Corvin-tér	Arka	−21.17743	2.05990	0.000	−27.4263	−14.9285
	Bodrogkeresztúr	−10.96118	2.13484	0.000	−17.4374	−4.4849
	Esztergom	−6.02476	3.04972	0.499	−15.2764	3.2269
	Hidasnémeti	−7.77840	2.41422	0.028	−15.1022	−0.4546
	Nadap	1.47053	3.43478	1.000	−8.9492	11.8903
	Ságvár	0.43677	2.07945	1.000	−5.8715	6.7450
	Sajószentpéter	−7.23872	3.68825	0.508	−18.4274	3.9500
Esztergom	Arka	−15.15267	2.36559	0.000	−22.3289	−7.9764
	Bodrogkeresztúr	−4.93643	2.43113	0.461	−12.3115	2.4387
	Corvin-tér	6.02476	3.04972	0.499	−3.2269	15.2764
	Hidasnémeti	−1.75365	2.67980	0.998	−9.8831	6.3758
	Nadap	7.49529	3.62637	0.437	−3.5057	18.4962
	Ságvár	6.46152	2.38264	0.119	−0.7665	13.6895
	Sajószentpéter	−1.21397	3.86730	1.000	−12.9458	10.5179
Hidasnémeti	Arka	−13.39903	1.45730	0.000	−17.8199	−8.9782
	Bodrogkeresztúr	−3.18278	1.56144	0.456	−7.9196	1.5540
	Corvin-tér	7.77840	2.41422	0.028	0.4546	15.1022
	Esztergom	1.75365	2.67980	0.998	−6.3758	9.8831
	Nadap	9.24893	3.11099	0.060	−0.1886	18.6864
	Ságvár	8.21517	1.48481	0.000	3.7108	12.7195
	Sajószentpéter	0.53968	3.38877	1.000	−9.7405	10.8198
Nadap	Arka	−22.64796	2.84481	0.000	−31.2780	−14.0179
	Bodrogkeresztúr	−12.43171	2.89954	0.000	−21.2278	−3.6357
	Corvin-tér	−1.47053	3.43478	1.000	−11.8903	8.9492
	Esztergom	−7.49529	3.62637	0.437	−18.4962	3.5057
	Hidasnémeti	−9.24893	3.11099	0.060	−18.6864	0.1886
	Ságvár	−1.03377	2.85900	1.000	−9.7068	7.6393
	Sajószentpéter	−8.70925	4.17767	0.425	−21.3827	3.9641
Ságvár	Arka	−21.61420	0.78699	0.000	−24.0016	−19.2268
	Bodrogkeresztúr	−11.39795	0.96630	0.000	−14.3293	−8.4666
	Corvin-tér	−0.43677	2.07945	1.000	−6.7450	5.8715
	Esztergom	−6.46152	2.38264	0.119	−13.6895	0.7665
	Hidasnémeti	−8.21517	1.48481	0.000	−12.7195	−3.7108
	Nadap	1.03377	2.85900	1.000	−7.6393	9.7068
	Sajószentpéter	−7.67549	3.15901	0.227	−17.2587	1.9077
Sajószentpéter	Arka	−13.93871	3.14618	0.000	−23.4830	−4.3945
	Bodrogkeresztúr	−3.72246	3.19575	0.942	−13.4171	5.9722
	Corvin-tér	7.23872	3.68825	0.508	−3.9500	18.4274
	Esztergom	1.21397	3.86730	1.000	−10.5179	12.9458
	Hidasnémeti	−0.53968	3.38877	1.000	−10.8198	9.7405
	Nadap	8.70925	4.17767	0.425	−3.9641	21.3827
	Ságvár	7.67549	3.15901	0.227	−1.9077	17.2587

Table 201. Flake lengths comparison between periods (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	158354.008	2	79177.004	293.703	0.000
Within groups	639986.582	2374	269.582		
Total	798340.590	2376			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) age	(J) age	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
LG	EEG	17.26696	0.72378	0.000	15.5696	18.9644
	LEG	13.87687	1.89467	0.000	9.4335	18.3202
EEG	LG	−17.26696	0.72378	0.000	−18.9644	−15.5696
	LEG	−3.39009	1.93880	0.187	−7.9369	1.1567
LEG	LG	−13.87687	1.89467	0.000	−18.3202	−9.4335
	EEG	3.39009	1.93880	0.187	−1.1567	7.9369

Table 202. Regional flake lengths comparison within LG (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	1122.153	3	374.051	2.360	0.072
Within groups	46754.486	295	158.490		
Total	47876.639	298			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	2.20595	2.28609	0.769	−3.7007	8.1126
	Hidasnémeti	−2.97753	1.69652	0.297	−7.3609	1.4058
	Sajószentpéter	−2.43785	2.79284	0.819	−9.6538	4.7781
Bodrogkeresztúr	Arka	−2.20595	2.28609	0.769	−8.1126	3.7007
	Hidasnémeti	−5.18348	2.16702	0.081	−10.7825	0.4155
	Sajószentpéter	−4.64380	3.10125	0.440	−12.6566	3.3690
Hidasnémeti	Arka	2.97753	1.69652	0.297	−1.4058	7.3609
	Bodrogkeresztúr	5.18348	2.16702	0.081	−0.4155	10.7825
	Sajószentpéter	0.53968	2.69625	0.997	−6.4267	7.5061
Sajószentpéter	Arka	2.43785	2.79284	0.819	−4.7781	9.6538
	Bodrogkeresztúr	4.64380	3.10125	0.440	−3.3690	12.6566
	Hidasnémeti	−0.53968	2.69625	0.997	−7.5061	6.4267

Table 203. Local flake lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	28269.557	2	14134.779	41.684	0.000
Within groups	391648.610	1155	339.090		
Total	419918.167	1157			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	10.67817	1.18054	0.000	7.9078	13.4486
	Corvin-tér	9.44866	4.96471	0.138	−2.2022	21.0995
Bodrogkeresztúr	Arka	−10.67817	1.18054	0.000	−13.4486	−7.9078
	Corvin-tér	−1.22951	5.01864	0.967	−13.0069	10.5479
Corvin-tér	Arka	−9.44866	4.96471	0.138	−21.0995	2.2022
	Bodrogkeresztúr	1.22951	5.01864	0.967	−10.5479	13.0069

Table 204. Regional flake lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	20141.377	7	2877.340	26.528	0.000
Within groups	94255.599	869	108.464		
Total	114396.976	876			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	2.20595	1.89119	0.941	−3.5401	7.9520
	Corvin-tér	8.85892	1.83844	0.000	3.2732	14.4447
	Esztergom	−10.05516	3.46594	0.074	−20.5858	0.4754
	Hidasnémeti	−2.97753	1.40347	0.402	−7.2417	1.2866
	Nadap	5.70938	3.32065	0.675	−4.3798	15.7985
	Ságvár	7.98752	1.17465	0.000	4.4186	11.5565
	Sajószentpéter	−2.43785	2.31041	0.966	−9.4576	4.5819

Table 204. Continued

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Bodrogkeresztúr	Arka	−2.20595	1.89119	0.941	−7.9520	3.5401
	Corvin-tér	6.65297	2.15032	0.042	0.1196	13.1863
	Esztergom	−12.26111	3.64098	0.018	−23.3236	−1.1987
	Hidasnémeti	−5.18348	1.79270	0.076	−10.6303	0.2633
	Nadap	3.50343	3.50296	0.974	−7.1396	14.1465
	Ságvár	5.78157	1.61983	0.009	0.8600	10.7031
	Sajószentpéter	−4.64380	2.56555	0.613	−12.4387	3.1511
Corvin-tér	Arka	−8.85892	1.83844	0.000	−14.4447	−3.2732
	Bodrogkeresztúr	−6.65297	2.15032	0.042	−13.1863	−0.1196
	Esztergom	−18.91408	3.61386	0.000	−29.8941	−7.9340
	Hidasnémeti	−11.83645	1.73695	0.000	−17.1139	−6.5591
	Nadap	−3.14954	3.47476	0.985	−13.7069	7.4079
	Ságvár	−0.87140	1.55791	0.999	−5.6048	3.8620
	Sajószentpéter	−11.29677	2.52691	0.000	−18.9743	−3.6192
Esztergom	Arka	10.05516	3.46594	0.074	−0.4754	20.5858
	Bodrogkeresztúr	12.26111	3.64098	0.018	1.1987	23.3236
	Corvin-tér	18.91408	3.61386	0.000	7.9340	29.8941
	Hidasnémeti	7.07763	3.41319	0.433	−3.2927	17.4480
	Nadap	15.76455	4.55048	0.013	1.9388	29.5903
	Ságvár	18.04268	3.32565	0.000	7.9383	28.1470
	Sajószentpéter	7.61731	3.87533	0.506	−4.1571	19.3918
Hidasnémeti	Arka	2.97753	1.40347	0.402	−1.2866	7.2417
	Bodrogkeresztúr	5.18348	1.79270	0.076	−0.2633	10.6303
	Corvin-tér	11.83645	1.73695	0.000	6.5591	17.1139
	Esztergom	−7.07763	3.41319	0.433	−17.4480	3.2927
	Nadap	8.68692	3.26555	0.136	−1.2349	18.6087
	Ságvár	10.96505	1.00844	0.000	7.9011	14.0290
	Sajószentpéter	0.53968	2.23050	1.000	−6.2373	7.3166
Nadap	Arka	−5.70938	3.32065	0.675	−15.7985	4.3798
	Bodrogkeresztúr	−3.50343	3.50296	0.974	−14.1465	7.1396
	Corvin-tér	3.14954	3.47476	0.985	−7.4079	13.7069
	Esztergom	−15.76455	4.55048	0.013	−29.5903	−1.9388
	Hidasnémeti	−8.68692	3.26555	0.136	−18.6087	1.2349
	Ságvár	2.27813	3.17394	0.996	−7.3653	11.9216
	Sajószentpéter	−8.14724	3.74595	0.368	−19.5286	3.2341
Ságvár	Arka	−7.98752	1.17465	0.000	−11.5565	−4.4186
	Bodrogkeresztúr	−5.78157	1.61983	0.009	−10.7031	−0.8600
	Corvin-tér	0.87140	1.55791	0.999	−3.8620	5.6048
	Esztergom	−18.04268	3.32565	0.000	−28.1470	−7.9383
	Hidasnémeti	−10.96505	1.00844	0.000	−14.0290	−7.9011
	Nadap	−2.27813	3.17394	0.996	−11.9216	7.3653
	Sajószentpéter	−10.42537	2.09409	0.000	−16.7879	−4.0629
Sajószentpéter	Arka	2.43785	2.31041	0.966	−4.5819	9.4576
	Bodrogkeresztúr	4.64380	2.56555	0.613	−3.1511	12.4387
	Corvin-tér	11.29677	2.52691	0.000	3.6192	18.9743
	Esztergom	−7.61731	3.87533	0.506	−19.3918	4.1571
	Hidasnémeti	−0.53968	2.23050	1.000	−7.3166	6.2373
	Nadap	8.14724	3.74595	0.368	−3.2341	19.5286
	Ságvár	10.42537	2.09409	0.000	4.0629	16.7879

Table 205. Transcarpathian flake lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	3454.263	4	863.566	6.296	.000
Within groups	18789.952	137	137.153		
Total	22244.215	141			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	10.23182	2.69690	0.002	2.7764	17.6872
	Esztergom	7.55811	2.61227	0.035	0.3366	14.7796
	Nadap	12.96095	3.10616	0.001	4.3742	21.5478
	Ságvár	12.32143	4.76554	0.079	−0.8527	25.4955
Bodrogkeresztúr	Arka	−10.23182	2.69690	0.002	−17.6872	−2.7764
	Esztergom	−2.67371	2.80410	0.875	−10.4255	5.0781
	Nadap	2.72913	3.26913	0.919	−6.3082	11.7665
	Ságvár	2.08961	4.87334	0.993	−11.3825	15.5617
Esztergom	Arka	−7.55811	2.61227	0.035	−14.7796	−0.3366
	Bodrogkeresztúr	2.67371	2.80410	0.875	−5.0781	10.4255
	Nadap	5.40284	3.19968	0.444	−3.4425	14.2482
	Ságvár	4.76332	4.82702	0.861	−8.5807	18.1074
Nadap	Arka	−12.96095	3.10616	0.001	−21.5478	−4.3742
	Bodrogkeresztúr	−2.72913	3.26913	0.919	−11.7665	6.3082
	Esztergom	−5.40284	3.19968	0.444	−14.2482	3.4425
	Ságvár	−0.63952	5.11120	1.000	−14.7692	13.4901
Ságvár	Arka	−12.32143	4.76554	0.079	−25.4955	0.8527
	Bodrogkeresztúr	−2.08961	4.87334	0.993	−15.5617	11.3825
	Esztergom	−4.76332	4.82702	0.861	−18.1074	8.5807
	Nadap	0.63952	5.11120	1.000	−13.4901	14.7692

Table 206. Flake domestic tool lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	17245.894	7	2463.699	10.502	0.000
Within groups	105567.626	450	234.595		
Total	122813.520	457			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	0.46021	2.26550	1.000	−6.4388	7.3592
	Corvin-tér	13.19549	4.81235	0.113	−1.4593	27.8503
	Esztergom	0.74549	4.07948	1.000	−11.6776	13.1685
	Hidasnémeti	−5.85466	3.77790	0.780	−17.3593	5.6500
	Nadap	16.25715	7.89036	0.442	−7.7710	40.2853
	Ságvár	11.60736	2.23918	0.000	4.7885	18.4262
	Sajószentpéter	−3.03222	4.27450	0.997	−16.0491	9.9847
Bodrogkeresztúr	Arka	−0.46021	2.26550	1.000	−7.3592	6.4388
	Corvin-tér	12.73528	4.59052	0.104	−1.2440	26.7146
	Esztergom	0.28528	3.81528	1.000	−11.3332	11.9038
	Hidasnémeti	−6.31487	3.49095	0.614	−16.9457	4.3159
	Nadap	15.79695	7.75706	0.458	−7.8252	39.4191
	Ságvár	11.14716	1.71117	0.000	5.9362	16.3581
	Sajószentpéter	−3.49243	4.02312	0.989	−15.7438	8.7590
Corvin-tér	Arka	−13.19549	4.81235	0.113	−27.8503	1.4593
	Bodrogkeresztúr	−12.73528	4.59052	0.104	−26.7146	1.2440
	Esztergom	−12.45000	5.70812	0.365	−29.8326	4.9326
	Hidasnémeti	−19.05015	5.49663	0.013	−35.7888	−2.3115
	Nadap	3.06167	8.84298	1.000	−23.8674	29.9907
	Ságvár	−1.58812	4.57759	1.000	−15.5280	12.3518
	Sajószentpéter	−16.22771	5.84908	0.104	−34.0396	1.5842
Esztergom	Arka	−0.74549	4.07948	1.000	−13.1685	11.6776
	Bodrogkeresztúr	−0.28528	3.81528	1.000	−11.9038	11.3332
	Corvin-tér	12.45000	5.70812	0.365	−4.9326	29.8326
	Hidasnémeti	−6.60015	4.86790	0.876	−21.4241	8.2238
	Nadap	15.51167	8.46651	0.598	−10.2710	41.2943
	Ságvár	10.86188	3.79971	0.084	−0.7092	22.4329
	Sajószentpéter	−3.77771	5.26262	0.996	−19.8037	12.2483
Hidasnémeti	Arka	5.85466	3.77790	0.780	−5.6500	17.3593
	Bodrogkeresztúr	6.31487	3.49095	0.614	−4.3159	16.9457
	Corvin-tér	19.05015	5.49663	0.013	2.3115	35.7888
	Esztergom	6.60015	4.86790	0.876	−8.2238	21.4241
	Nadap	22.11182	8.32539	0.139	−3.2411	47.4647
	Ságvár	17.46203	3.47393	0.000	6.8831	28.0410
	Sajószentpéter	2.82244	5.03245	0.999	−12.5026	18.1475

Table 206. Continued

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Nadap	Arka	−16.25715	7.89036	0.442	−40.2853	7.7710
	Bodrogkeresztúr	−15.79695	7.75706	0.458	−39.4191	7.8252
	Corvin-tér	−3.06167	8.84298	1.000	−29.9907	23.8674
	Esztergom	−15.51167	8.46651	0.598	−41.2943	10.2710
	Hidasnémeti	−22.11182	8.32539	0.139	−47.4647	3.2411
	Ságvár	−4.64979	7.74942	0.999	−28.2487	18.9491
	Sajószentpéter	−19.28938	8.56218	0.322	−45.3633	6.7846
Ságvár	Arka	−11.60736	2.23918	0.000	−18.4262	−4.7885
	Bodrogkeresztúr	−11.14716	1.71117	0.000	−16.3581	−5.9362
	Corvin-tér	1.58812	4.57759	1.000	−12.3518	15.5280
	Esztergom	−10.86188	3.79971	0.084	−22.4329	0.7092
	Hidasnémeti	−17.46203	3.47393	0.000	−28.0410	−6.8831
	Nadap	4.64979	7.74942	0.999	−18.9491	28.2487
	Sajószentpéter	−14.63958	4.00836	0.007	−26.8460	−2.4331
Sajószentpéter	Arka	3.03222	4.27450	0.997	−9.9847	16.0491
	Bodrogkeresztúr	3.49243	4.02312	0.989	−8.7590	15.7438
	Corvin-tér	16.22771	5.84908	0.104	−1.5842	34.0396
	Esztergom	3.77771	5.26262	0.996	−12.2483	19.8037
	Hidasnémeti	−2.82244	5.03245	0.999	−18.1475	12.5026
	Nadap	19.28938	8.56218	0.322	−6.7846	45.3633
	Ságvár	14.63958	4.00836	0.007	2.4331	26.8460

Table 207. Blade domestic tool lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	21350.389	7	3050.056	8.216	0.000
Within groups	213828.464	576	371.230		
Total	235178.853	583			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	−5.06483	2.29891	0.351	−12.0583	1.9287
	Corvin-tér	14.70383	6.08314	0.235	−3.8017	33.2093
	Esztergom	1.41891	2.70848	1.000	−6.8205	9.6584
	Hidasnémeti	−4.08833	2.86464	0.844	−12.8028	4.6262
	Nadap	−8.77660	5.29198	0.714	−24.8753	7.3221
	Ságvár	11.28926	2.88821	0.003	2.5030	20.0755
	Sajószentpéter	−11.29708	4.48670	0.190	−24.9461	2.3519

Table 207. Continued

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Bodrogkeresztúr	Arka	5.06483	2.29891	0.351	−1.9287	12.0583
	Corvin-tér	19.76865	5.98137	0.022	1.5727	37.9646
	Esztergom	6.48374	2.47144	0.150	−1.0346	14.0021
	Hidasnémeti	0.97650	2.64165	1.000	−7.0597	9.0127
	Nadap	−3.71177	5.17467	0.996	−19.4536	12.0301
	Ságvár	16.35408	2.66719	0.000	8.2402	24.4680
	Sajószentpéter	−6.23226	4.34772	0.841	−19.4585	6.9939
Corvin-tér	Arka	−14.70383	6.08314	0.235	−33.2093	3.8017
	Bodrogkeresztúr	−19.76865	5.98137	0.022	−37.9646	−1.5727
	Esztergom	−13.28492	6.15042	0.378	−31.9951	5.4253
	Hidasnémeti	−18.79216	6.22076	0.053	−37.7163	0.1320
	Nadap	−23.48042	7.64832	0.046	−46.7474	−0.2135
	Ságvár	−3.41457	6.23165	0.999	−22.3719	15.5427
	Sajószentpéter	−26.00091	7.11493	0.007	−47.6452	−4.3566
Esztergom	Arka	−1.41891	2.70848	1.000	−9.6584	6.8205
	Bodrogkeresztúr	−6.48374	2.47144	0.150	−14.0021	1.0346
	Corvin-tér	13.28492	6.15042	0.378	−5.4253	31.9951
	Hidasnémeti	−5.50724	3.00486	0.598	−14.6483	3.6338
	Nadap	−10.19551	5.36918	0.552	−26.5291	6.1381
	Ságvár	9.87034	3.02734	0.026	0.6609	19.0798
	Sajószentpéter	−12.71599	4.57750	0.103	−26.6412	1.2092
Hidasnémeti	Arka	4.08833	2.86464	0.844	−4.6262	12.8028
	Bodrogkeresztúr	−0.97650	2.64165	1.000	−9.0127	7.0597
	Corvin-tér	18.79216	6.22076	0.053	−0.1320	37.7163
	Esztergom	5.50724	3.00486	0.598	−3.6338	14.6483
	Nadap	−4.68827	5.44962	0.989	−21.2666	11.8900
	Ságvár	15.37759	3.16782	0.000	5.7408	25.0144
	Sajószentpéter	−7.20875	4.67160	0.784	−21.4202	7.0027
Nadap	Arka	8.77660	5.29198	0.714	−7.3221	24.8753
	Bodrogkeresztúr	3.71177	5.17467	0.996	−12.0301	19.4536
	Corvin-tér	23.48042	7.64832	0.046	0.2135	46.7474
	Esztergom	10.19551	5.36918	0.552	−6.1381	26.5291
	Hidasnémeti	4.68827	5.44962	0.989	−11.8900	21.2666
	Ságvár	20.06585	5.46205	0.006	3.4497	36.6820
	Sajószentpéter	−2.52048	6.45157	1.000	−22.1468	17.1058
Ságvár	Arka	−11.28926	2.88821	0.003	−20.0755	−2.5030
	Bodrogkeresztúr	−16.35408	2.66719	0.000	−24.4680	−8.2402
	Corvin-tér	3.41457	6.23165	0.999	−15.5427	22.3719
	Esztergom	−9.87034	3.02734	0.026	−19.0798	−0.6609
	Hidasnémeti	−15.37759	3.16782	0.000	−25.0144	−5.7408
	Nadap	−20.06585	5.46205	0.006	−36.6820	−3.4497
	Sajószentpéter	−22.58634	4.68609	0.000	−36.8419	−8.3308
Sajószentpéter	Arka	11.29708	4.48670	0.190	−2.3519	24.9461
	Bodrogkeresztúr	6.23226	4.34772	0.841	−6.9939	19.4585
	Corvin-tér	26.00091	7.11493	0.007	4.3566	47.6452
	Esztergom	12.71599	4.57750	0.103	−1.2092	26.6412
	Hidasnémeti	7.20875	4.67160	0.784	−7.0027	21.4202
	Nadap	2.52048	6.45157	1.000	−17.1058	22.1468
	Ságvár	22.58634	4.68609	0.000	8.3308	36.8419

Table 208. Backed bladelet lengths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Length [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	2551.548	6	425.258	3.275	0.004
Within groups	29991.577	231	129.834		
Total	32543.125	237			

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval Lower bound	Upper bound
Arka	Bodrogkeresztúr	5.03333	4.28872	0.903	−7.7235	17.7902
	Corvin-tér	0.28333	6.97765	1.000	−20.4718	21.0385
	Esztergom	−5.11526	2.51477	0.396	−12.5955	2.3650
	Hidasnémeti	−3.41667	3.67755	0.968	−14.3556	7.5222
	Nadap	0.33028	3.00270	1.000	−8.6013	9.2619
	Ságvár	6.46905	4.89463	0.841	−8.0901	21.0282
Bodrogkeresztúr	Arka	−5.03333	4.28872	0.903	−17.7902	7.7235
	Corvin-tér	−4.75000	7.50075	0.996	−27.0611	17.5611
	Esztergom	−10.14859	3.72796	0.097	−21.2375	0.9403
	Hidasnémeti	−8.45000	4.59325	0.523	−22.1127	5.2127
	Nadap	−4.70306	4.07306	0.910	−16.8184	7.4123
	Ságvár	1.43571	5.61525	1.000	−15.2669	18.1384
Corvin-tér	Arka	−0.28333	6.97765	1.000	−21.0385	20.4718
	Bodrogkeresztúr	4.75000	7.50075	0.996	−17.5611	27.0611
	Esztergom	−5.39859	6.64772	0.984	−25.1723	14.3752
	Hidasnémeti	−3.70000	7.16886	0.999	−25.0239	17.6239
	Nadap	0.04694	6.84722	1.000	−20.3202	20.4141
	Ságvár	6.18571	7.86292	0.986	−17.2027	29.5741
Esztergom	Arka	5.11526	2.51477	0.396	−2.3650	12.5955
	Bodrogkeresztúr	10.14859	3.72796	0.097	−0.9403	21.2375
	Corvin-tér	5.39859	6.64772	0.984	−14.3752	25.1723
	Hidasnémeti	1.69859	3.00482	0.998	−7.2393	10.6365
	Nadap	5.44554	2.12622	0.143	−0.8789	11.7700
	Ságvár	11.58431	4.41157	0.123	−1.5380	24.7066
Hidasnémeti	Arka	3.41667	3.67755	0.968	−7.5222	14.3556
	Bodrogkeresztúr	8.45000	4.59325	0.523	−5.2127	22.1127
	Corvin-tér	3.70000	7.16886	0.999	−17.6239	25.0239
	Esztergom	−1.69859	3.00482	0.998	−10.6365	7.2393
	Nadap	3.74694	3.42361	0.929	−6.4366	13.9305
	Ságvár	9.88571	5.16355	0.473	−5.4733	25.2448
Nadap	Arka	−0.33028	3.00270	1.000	−9.2619	8.6013
	Bodrogkeresztúr	4.70306	4.07306	0.910	−7.4123	16.8184
	Corvin-tér	−0.04694	6.84722	1.000	−20.4141	20.3202
	Esztergom	−5.44554	2.12622	0.143	−11.7700	0.8789
	Hidasnémeti	−3.74694	3.42361	0.929	−13.9305	6.4366
	Ságvár	6.13877	4.70682	0.849	−7.8617	20.1393

Table 208. Continued

Multiple Comparisons

Dependent variable: length [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Ságvár	Arka	−6.46905	4.89463	0.841	−21.0282	8.0901
	Bodrogkeresztúr	−1.43571	5.61525	1.000	−18.1384	15.2669
	Corvin-tér	−6.18571	7.86292	0.986	−29.5741	17.2027
	Esztergom	−11.58431	4.41157	0.123	−24.7066	1.5380
	Hidasnémeti	−9.88571	5.16355	0.473	−25.2448	5.4733
	Nadap	−6.13877	4.70682	0.849	−20.1393	7.8617

Table 209. Backed bladelet widths comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Width [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	1576.446	6	262.741	31.299	0.000
Within groups	1939.135	231	8.395		
Total	3515.581	237			

Multiple Comparisons

Dependent variable: width [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	1.25125	1.09052	0.913	−1.9925	4.4950
	Corvin-tér	1.29792	1.77425	0.991	−3.9796	6.5754
	Esztergom	−5.53988	0.63944	0.000	−7.4419	−3.6378
	Hidasnémeti	−3.86875	0.93511	0.001	−6.6502	−1.0873
	Nadap	−0.92181	0.76351	0.891	−3.1929	1.3493
	Ságvár	1.24554	1.24458	0.953	−2.4565	4.9476
Bodrogkeresztúr	Arka	−1.25125	1.09052	0.913	−4.4950	1.9925
	Corvin-tér	0.04667	1.90726	1.000	−5.6265	5.7198
	Esztergom	−6.79113	0.94793	0.000	−9.6108	−3.9715
	Hidasnémeti	−5.12000	1.16795	0.000	−8.5941	−1.6459
	Nadap	−2.17306	1.03568	0.357	−5.2537	0.9076
	Ságvár	−0.00571	1.42782	1.000	−4.2528	4.2414
Corvin-tér	Arka	−1.29792	1.77425	0.991	−6.5754	3.9796
	Bodrogkeresztúr	−0.04667	1.90726	1.000	−5.7198	5.6265
	Esztergom	−6.83779	1.69035	0.001	−11.8658	−1.8098
	Hidasnémeti	−5.16667	1.82286	0.073	−10.5888	0.2555
	Nadap	−2.21972	1.74108	0.863	−7.3986	2.9591
	Ságvár	−0.05238	1.99935	1.000	−5.9995	5.8947

Table 209. Continued

Multiple Comparisons

Dependent variable: width [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Esztergom	Arka	5.53988	0.63944	0.000	3.6378	7.4419
	Bodrogkeresztúr	6.79113	0.94793	0.000	3.9715	9.6108
	Corvin-tér	6.83779	1.69035	0.001	1.8098	11.8658
	Hidasnémeti	1.67113	0.76405	0.307	−0.6016	3.9438
	Nadap	4.61807	0.54065	0.000	3.0099	6.2262
	Ságvár	6.78541	1.12175	0.000	3.4487	10.1221
Hidasnémeti	Arka	3.86875	0.93511	0.001	1.0873	6.6502
	Bodrogkeresztúr	5.12000	1.16795	0.000	1.6459	8.5941
	Corvin-tér	5.16667	1.82286	0.073	−0.2555	10.5888
	Esztergom	−1.67113	0.76405	0.307	−3.9438	0.6016
	Nadap	2.94694	0.87054	0.014	0.3575	5.5364
	Ságvár	5.11429	1.31296	0.002	1.2089	9.0197
Nadap	Arka	0.92181	0.76351	0.891	−1.3493	3.1929
	Bodrogkeresztúr	2.17306	1.03568	0.357	−0.9076	5.2537
	Corvin-tér	2.21972	1.74108	0.863	−2.9591	7.3986
	Esztergom	−4.61807	0.54065	0.000	−6.2262	−3.0099
	Hidasnémeti	−2.94694	0.87054	0.014	−5.5364	−0.3575
	Ságvár	2.16734	1.19683	0.542	−1.3926	5.7273
Ságvár	Arka	−1.24554	1.24458	0.953	−4.9476	2.4565
	Bodrogkeresztúr	0.00571	1.42782	1.000	−4.2414	4.2528
	Corvin-tér	0.05238	1.99935	1.000	−5.8947	5.9995
	Esztergom	−6.78541	1.12175	0.000	−10.1221	−3.4487
	Hidasnémeti	−5.11429	1.31296	0.002	−9.0197	−1.2089
	Nadap	−2.16734	1.19683	0.542	−5.7273	1.3926

Table 210. Backed bladelet thicknesses comparison between assemblages (complete specimens) with ANOVA and Tukey post hoc test

ANOVA

Thickness [mm]					
	Sum of squares	df	Mean square	F	Sig.
Between groups	105.832	6	17.639	10.740	0.000
Within groups	379.381	231	1.642		
Total	485.214	237			

Table 210. Continued

Multiple Comparisons

Dependent variable: thickness [mm]						
Tukey HSD						
(I) assemblage	(J) assemblage	Mean difference (I–J)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
Arka	Bodrogkeresztúr	0.17250	0.48235	1.000	−1.2623	1.6073
	Corvin-tér	1.07917	0.78478	0.815	−1.2552	3.4135
	Esztergom	−1.34947	0.28284	0.000	−2.1908	−0.5082
	Hidasnémeti	−1.65625	0.41362	0.002	−2.8866	−0.4259
	Nadap	−0.21778	0.33772	0.995	−1.2223	0.7868
	Ságvár	0.21250	0.55050	1.000	−1.4250	1.8500
Bodrogkeresztúr	Arka	−0.17250	0.48235	1.000	−1.6073	1.2623
	Corvin-tér	0.90667	0.84361	0.935	−1.6027	3.4160
	Esztergom	−1.52197	0.41929	0.006	−2.7691	−0.2748
	Hidasnémeti	−1.82875	0.51661	0.009	−3.3654	−0.2921
	Nadap	−0.39028	0.45810	0.979	−1.7529	0.9723
	Ságvár	0.04000	0.63155	1.000	−1.8386	1.9186
Corvin-tér	Arka	−1.07917	0.78478	0.815	−3.4135	1.2552
	Bodrogkeresztúr	−0.90667	0.84361	0.935	−3.4160	1.6027
	Esztergom	−2.42864	0.74767	0.022	−4.6526	−0.2047
	Hidasnémeti	−2.73542	0.80628	0.014	−5.1337	−0.3371
	Nadap	−1.29694	0.77011	0.627	−3.5876	0.9938
	Ságvár	−0.86667	0.88435	0.958	−3.4972	1.7638
Esztergom	Arka	1.34947	0.28284	0.000	0.5082	2.1908
	Bodrogkeresztúr	1.52197	0.41929	0.006	0.2748	2.7691
	Corvin-tér	2.42864	0.74767	0.022	0.2047	4.6526
	Hidasnémeti	−0.30678	0.33795	0.971	−1.3120	0.6985
	Nadap	1.13169	0.23914	0.000	0.4204	1.8430
	Ságvár	1.56197	0.49617	0.030	0.0861	3.0378
Hidasnémeti	Arka	1.65625	0.41362	0.002	0.4259	2.8866
	Bodrogkeresztúr	1.82875	0.51661	0.009	0.2921	3.3654
	Corvin-tér	2.73542	0.80628	0.014	0.3371	5.1337
	Esztergom	0.30678	0.33795	0.971	−0.6985	1.3120
	Nadap	1.43847	0.38505	0.004	0.2931	2.5838
	Ságvár	1.86875	0.58075	0.025	0.1413	3.5962
Nadap	Arka	0.21778	0.33772	0.995	−0.7868	1.2223
	Bodrogkeresztúr	0.39028	0.45810	0.979	−0.9723	1.7529
	Corvin-tér	1.29694	0.77011	0.627	−0.9938	3.5876
	Esztergom	−1.13169	0.23914	0.000	−1.8430	−0.4204
	Hidasnémeti	−1.43847	0.38505	0.004	−2.5838	−0.2931
	Ságvár	0.43028	0.52938	0.983	−1.1444	2.0049
Ságvár	Arka	−0.21250	0.55050	1.000	−1.8500	1.4250
	Bodrogkeresztúr	−0.04000	0.63155	1.000	−1.9186	1.8386
	Corvin-tér	0.86667	0.88435	0.958	−1.7638	3.4972
	Esztergom	−1.56197	0.49617	0.030	−3.0378	−0.0861
	Hidasnémeti	−1.86875	0.58075	0.025	−3.5962	−0.1413
	Nadap	−0.43028	0.52938	0.983	−2.0049	1.1444

THE TECHNOLOGICAL DATA IN THE MUP AND LUP OF EASTERN CENTRAL EUROPE

The Late Gravettian period

In Hungary, apart from what has been presented here, no complex lithic technology study was performed on the assemblages of the "Gravettian Entity". The often presented technological feature is the lithic raw material provenience (Dobosi 2009c).

Among Late Gravettian sites not studied here, Hont-Parassa III (Dobosi, Simán 2003) yielded mostly regional materials and the assemblage contains several obsidian artifacts which show connection towards the Tokaj Mountains. The transcarpathian (TC) material group consisting of seven items makes up 0.5% of the assemblage. Pilisszántó I rockshelter (Dobosi, Vörös 1987) lower layer yielded 33% of regional material and 22% of TC origin. There is a piece of obsidian in this layer that is of distant origin. The upper layer yielded only 14% TC artifact and the rest was made of regional material. The material which cannot be sorted into any of the layers of Pilisszántó I rockshelter also is dominated by regional materials (77%).

Outside the territory of Hungary, in the northern Carpathian basin, local and regional raw material use dominate the Late Gravettian assemblages, but TC materials also are present. Nitra-I Cěrmáň in Western Slovakia contained 5% TC material and so did Cejkov I 6% in Eastern Slovakia (Kaminská 2016). Nitra-I Cěrmáň also contained a piece of obsidian as an example for distant material (Kaminská, Kozłowski 2011). The highest TC material use (87.8%) was recorded from the Moravany-Banka Horné fraské role shouldered point assemblage (Kozłowski 2000). Trenčianske Bohuslavice assemblage contains 42.2% TC flints, and the rest of the material was made from the locally available radiolarite, and 56 items are of obsidian (Žaár 2007). In eastern Slovakia, Kašov I lower layer yielded 49.3% of TC materials (Novák 2004) and the rest consists of mostly local, and in smaller percent regional lithic raw materials. This list showed that the TC use is more often greater at Slovakian than Hungarian sites, especially near the western periphery of the Carpathian basin.

In Lower Austria, Willendorf II layer 9 assemblage contains 55.2% of TC materials and the rest was made of locally and regionally available radiolarite and different silicites (Otte 1981). This pattern of raw material use is similar to what was found at the Váh valley sites. Grub-Kranawetberg main layer yielded mostly white patinated flint artifacts, part of which could have been derived from southern Moravian sources and from the erratic outcrops of Odera basin (Antl-Weiser et al. 2010). The upper layer yielded mostly radiolarite artifacts.

In Moravia, Petřkovice I used chiefly local material (Novák 2008), which is Cretaceous flint at the Moravian Gate (Přichystal 2008). There are 17 items of radiolarite which seem to have been derived from the White Carpathians. It is of interest that the most complete shouldered point found in the 1953 excavation was made of radiolarite. The 55% of Milovice I lithic industry was made of regionally available radiolarite, 20% of the lithics are flints from the Moravian gate and the Kraków-Częstochowa

Upland (Oliva 2009). Among the radiolarite pieces a few are of the Transdanubian Bakony type. Moreover, there are seven items of limnic silicites which might have derived from Central Slovakia or the Tokaj Mountains. Tokaj mountains connection was shown by the single piece of obsidian, as well.

In Poland, Jaksice II lithic tools were made of regional materials such as the Jurassic flint 38.9% and 51.6% of erratic cretaceous flint that might have been originated from Silesia (Wilczyński 2015, 2016). Also, the 4.4% radiolarite material could have been collected from the Pieniny Klippen Belt outcrops in the Polish Carpathians. Kraków-Spadzista Late Gravettian hunters highly were local raw material users. Obsidian and radiolarite appear sporadically in at Spadzista (Kozłowski, Sobczyk 1987; Wilczyński 2015).

Going deeper into the lithic technology of the Late Gravettian, lesser data can be compared with the Hungarian sites. Universal feature of the lithic technology is the blade debitage, which is similar to what has been revealed from Hungary. Late Gravettian sites in Slovakia are dominated by unidirectional debitage (Kozłowski 1998) and Trenčianske Bohuslavice is the only with more frequent use of opposite platform cores (Žaár 2007). Plain platforms dominate the blades, and again Trenčianske Bohuslavice is the only with more prepared/faceted platform.

In Poland, Kraków-Spadzista layer 6 from areas B+B1 and C2 involved both the uni- and the bidirectional core reduction in the blade technology, and their proportions change from one excavated area to the other (Wilczyński 2016; Wilczyński et al. 2015). But, the blade platforms are also plain. Jaksice II chiefly performed unidirectional debitage and also plain platform preparation (Wilczyński 2015).

Milovice I technology in southern Moravia included mostly single platform cores but about 40% of all cores have two striking platforms (Oliva 2009). The blades of Milovice I have chiefly punctiform platforms. Petřkovice I (Novák 2008) showed the same features, but this industry contains the greatest amount of flake cores (11.6%) among the Late Gravettian assemblages surveyed here, which is similar to Trenčianske Bohuslavice (10.7%) (Žaár 2007).

The Early Epigravettian (*Last Glacial Maximum*)

EE assemblages of Hungary are dominated by local or regional and distant raw materials. The proportion of TC material is 6% at Mogyorósbánya, 3.5% at Madaras, and none was found at Szob (Dobosi et al. 1989; Markó 2007; Dobosi 2016). The Mogyorósbánya TC material percent is higher than what was found at most LG sites except Bodrogkeresztúr, and the two EE sites, which was not predicted by present study based on the known raw material circulation in the Carpathian basin (Lengyel 2014a). Szob and Mogyorósbánya also yielded a set of obsidian artifacts showing relations towards the Tokaj Mountains area (Markó 2007, 2017). The Gravettian Entity Model describes Ságvár and the Ságvárian culture as Pebble Gravettian (Dobosi 2016). At Ságvár, although pebble raw material is abundant, it far does not dominate the whole assemblage (Lengyel 2011). The pebbles are chiefly of radiolarite, mostly Bakony types, which seem to be the closest raw material source to Ságvár. Among Ságvárian sites not analysed here, Mogyorósbánya and Szob were presented as pebble consumers (Markó 2007, 2011; Dobosi 2016). The exploitation of pebbles at these sites seems to be related with the fact that this raw material was the closest available to the knappers. Also, the observations of Dobosi (2016) on the low blade frequency and short size of the blades suits the technological features of EE assemblages studied here. Indeed, Ságvár hunter-gatherers never were able to produce most of their blades long from the small sized pebble materials, but from the distant raw materials they made larger blades. The pebble use in the Ságvárian seems rather a Transdanubian lithic resource constrain observed also from the Lower Palaeolithic (Dobosi 2016). Among the sites which have been reclassified as Early Epigravettian on the basis of their typological features (Lengyel 2016), at Jászfelsőszentgyörgy the lithic raw material usage is similar to Ságvár with regional and distant materials (Priskin 2011). The proportions of the Bükk and Tokaj Mountains raw materials are greater in this assemblage due to the presence meta-rhyolite, obsidian and limnic silicite, all together 27.4%. The ratio of TC materials is 1.66% that is similarly low in EE assemblages. In the Pilismarót site cluster the lithic raw material composition in details was not published (Dobosi 2006, 2014), but it is known that there are TC materials in these assemblages.

Early Epigravettian lithic technology data, compared to the Late Gravettian, is less abundant due to that most of the sites are found in Hungary and their technological studies have not yet been performed. As far as the raw material concerned, Kašov I upper layer in eastern Slovakia used mainly the local obsidian sources (Bánesz et al. 1992). Grubgraben, Lower Austria, in layers 1 and 2 regional material dominate and TC materials make up less than 5%. In layers 3 and 4, however, the TC material proportion grows up to 23–24% on the expense of the regional materials (Montet-White 1990). This elevated frequency of TC material is the highest among all Last Glacial Maximum (LGM) EE sites. Stránská skála IV processed regional and local materials the most, and TC material makes up 2.1% of the lithic assemblage. A single piece of obsidian in this industry shows connections with the northeastern corner of the Carpathian basin (Svoboda 1991; Škrdla, Plch 1993). Mohelno-Plevovce KSA and KSB lithic assemblages (Škrdla et al. 2016) together yielded 19.7% TC flint, and the rest of the material was regionally available, such as the rock crystal and Krumlovsky les chert. The radiolarite, 0.9% of the assemblage, probably derived from the Danube gravels south from the site, but the White Carpathians and the Bakony Mountain in the Transdanubian range was also mentioned as a source of a few items. The obsidian is the farthest raw material in this assemblage.

This dataset illustrated that LGM hunters exploited regional raw material sources. This was one of the character noticed by Svoboda and Novák (2004) to separate LGM industries from the preceding and the later cultures. The chief use of Middle Danube basin raw materials may refer to that the main foraging zone was located south of the Carpathians and the Sudetes, east–west direction along the Middle Danube basin. Eventually, the mobility in LGM could have been less intense and shorter ranged than in the preceding period.

Beyond the lithic raw material provenience, further technological data from the LGM period, which is comparable with what has been obtained from the Hungarian assemblages is sparse. Flake production seems to be more pronounced for the tool kits at Kašov I upper layer (Bánesz et al. 1991), Stránská skála IV (Svoboda 1991; Škrdla, Plch 1993), and throughout the sequence of Grubgraben (Montet-White 1990). Plain platforms are however not dominant. Mohelno Plevovce KSA and KSB assemblages have small flake cores and proper blade production is missing (Škrdla et al. 2016). Small blades and bladelets were produced from single platform cores, and flake production seems to make up half of the debitage process. This industry was found similar to Ságvár (Škrdla et al. 2016), and the presented lithic technology indeed seems similar.

The Late Epigravettian

Among the few LE assemblages in Hungary, the Budapest-Csillaghegy material can be mentioned here, where TC material makes up 72.5% of the assemblage,but the armature typology does not support LE affiliation. If the prediction that Megyaszó (Dobosi, Simán 1996) could be re-dated to LE is correct (Lengyel 2016), then this would be the only LE industry with 2.9% of TC material and the dominance of local and regional materials.

Late Epigravettian comparable materials are also few outside Hungary. The westernmost occurrence of LE hunters is Sowin 7 in Silesia (Wiśniewski et al. 2017). The lithic assemblage of this site exploited solely local raw material sources available right at the location of the site. Brno-Štýřice III lithic assemblage consists of regional and TC material in almost equal share (Nerudová, Neruda 2014). Targowisko 10 used local materials the most (56.9%), then regional sources, and obsidian accounts for 3%, which is the greatest portion of Carpathian basin material ever in the Palaeolithic archaeological record of Poland (Wilczyński 2009).

The proportion of the TC material in LE assemblages in the Middle Danube basin is greater than in the LGM. In the case of Polish and Prut-Dniester sites, again local and regional lithic raw material source exploitation is prevalent, but this is the first time when obsidian left the Carpathian basin northward in a greater amount.

Further details of lithic technology from Targowisko 10 and Sowin 7 are the unidirectional blade knapping method, soft hammer technique and plain platform preparation (Wilczyński 2009; Wiśniewski et al. 2012).

CONCLUSION

An important feature of the studied periods is how raw material sources were exploited and what they mean in the sense of hunter-gatherer subsistence. Most Late Gravettian sites are located near raw material sources (i.e. within 10 km): Kraków-Spadzista, Petřkovice I, Trenčianske Bohuslavice, Arka, Bodrogkeresztúr and Moravany sites; a few are found at localities where lithic sources are available on regional level (Milovice I, Sajószentpéter and Hidasnémeti); and it is exceptional when most of the lithics were retrieved from distant sources (Willendorf II layer 9 and Moravany-Banka). The distribution of a considerable amount of TC material over the territory of the Western Carpathians in LG times (Kozłowski 2013) likely marks the range of a hunter-gatherer foraging zone (Goodyear 1979). This archaeological record suggests that LG site location choice, besides the necessary food availability, was also based upon the closeness of the lithic source. The co-occurrence of domestic tools and armatures at every LG site shows both domestic and hunting, activity at the sites, which is rather an emblem of residential bases (Binford 1980). Altogether, this illustrates that LG hunter-gatherers could have been residentially mobile (Binford 1979; Kelly 1983).

The Váh valley record shows that the northernmost site in the Carpathian basin with abundant settlement remains is Trenčianske Bohuslavice. All other sites are located southward. If we consider LG hunters following the prey (Pryor 2008), which might be supported by the changes of ^{86}Sr/^{87}Sr ratio through a reindeer molar enamel in the Trenčianske Bohuslavice fauna (Vlačiky et al. 2013), than any valley passing from Moravia to Trenčianske Bohuslavice could have been one of the migratory routes of reindeers. If we pair this with the ratio of TC material in LG sites within the Carpathian Basin, we see that Váh valley sites more often have a greater ratio of TC material than sites located inward the Carpathian basin. Studies on the peopling of North America (Graf, Goebel 2009) demonstrated that the first entry to a new land brings lithic raw material from the former foraging area and the new camps contain mostly remote materials. Exploring the new land identify local sources, thus the distant lithic component erodes out from the tool kit only if the former territory is not visited again. In the frame of this theory, it can be proposed that the greater ratio of TC material at Váh valley sites marks the first major camping location within the Carpathian basin. Similarly to the Váh valley sites, Grub-Kranawetberg in Lower Austria, located on the western side of the Lesser Carpathians in river Morava valley, showed that the lower occupation dated to the same period as the upper layer consists of remote Cretaceous flint material and the upper layer already is dominated by radiolarite from the nearby White Carpathians (Antl-Weiser et al. 2010). This superposition could have been formed shortly after the first settlement, possibly during foraging arrays to the eastern side of the White Carpathians. Similar first base camps from possibly eastern routes across the Carpathians could have been Kašov I lower layer, Arka and Bodrogkeresztúr, where relatively a significant amount of TC material was left at the abundant local lithic sources.

The raw material circulation in Late Gravettian times, however, was unbalanced between the northern and the southern sides of the Western Carpathians. While TC materials flowed into the Carpathian basin, the raw materials of the Carpathian basin hardly travelled beyond the Carpathians. The very few obsidians and radiolarite are the sole markers of the mobility range of LG hunters. This raw material pattern can be due to that TC materials were more important for managing the mobile toolkit, since TC flint nodules usually provide better access to quality in greater quantity than the limnic silicites and better options to obtain more blades in greater size with low rate of knapping accidents (Lengyel 2013). And large flint blades might have fulfilled better the task of a mobile lithic gear (Morrow 1996; Lengyel, Chu 2016). In LG, the only considerable amount of obsidian outside the Tokaj Mountains was found in the Trenčianske Bohuslavice assemblage (Žaár 2007), which eventually did not leave the Carpathian basin towards Moravia, in contrast with the radiolarite.

In the EE period, due to the low integrity or lack of radiocarbon dates, there is no compelling evidence for settlements north of the Carpathians and the Sudetes. Thus, the human foraging territory seems to have been restricted to Moravia, Lower Austria and Carpathian basin during LGM (Lengyel 2014a). Among EE sites Grubgraben layer 3 and 4 (Montet-White 1990) and Mohelno-Plevovce KSA-KSB (Škrdla et al. 2016) are the sole ones with a high percent of erratic flint, which eventually could have been collected from northern Moravia alike the case of Petřkovice I LG site (Přichystal 2008). Towards the Carpathian basin, TC material drastically decreases in the assemblages, and the highest ratio, 6%, was reported from Mogyorósbánya (Dobosi 2016), which might have originated in Moravian sources. Most LGM sites are not located near lithic raw material sources (ie within 10 km), and their assemblages are characterized with regionally available tool stones. The absence of northward mobility was found related with the effect of the Eurasian Ice Sheet advance between 21 and 17 ka BP (Lengyel 2014a). The Carpathian basin could have become a refugee area that provided sufficient resources for surviving near the edge of the Eurasian Ice Sheet. Besides the hints from the lithic raw material provenience and the lithic tool types, EE hunter-gatherers might have established residential bases with abundant site furniture, such as the stone structures in Grubgraben and Mohelno-Plevovce, and the huts at Ságvár, thus, similarly to LG hunters, they also might have been residentially mobile, but on a shorter scale with less frequency.

The LE period raw material circulation was found different from what characterizes the LG and EE. The TC material proportion increased again up to ~40% in Moravia (Brno-Štýřice III) and in the Carpathian basin over 70%. The farther the location of the site from the TC materials source, the greater the percent of the TC material. The absence of local material and the dwindled frequency of regional material in the Carpathian basin and the high ratio of armature refers to that LE hunter-gatherers equipped themselves for long range mobility and established short term hunting camps (Hiscock 1994, 2005; Ellis 1997; Elston, Brantigham 2002; Yaroshevich 2006; Robertson et al. 2009; Yaroshevich et al. 2010; Hiscock et al. 2011; Lengyel 2014b). This theory implies very quick movement across the land and the Carpathian basin could not have been populated as much as it was during the LGM period (Verpoorte 2004). The fact that this is the first time in the Paleolithic when the obsidian appear in "greater" amount (3%) over the arch of the Carpathians at Targowisko 10 site, also supports this theory.

The rest of the lithic technology in most cases consisted of blade production. The sole blade technological element that would allow predicting the age of an assemblage is the length, according to which EE blades are shorter than others. On the other hand, blade length was found to be affected by the properties of the raw material. The increased flake production on the expense of the blades also seems to be an EE feature. The highly standardized blade production in LE sites is in relation with the long distances mobility and consequently logistical issues (Lengyel 2014b; Lengyel, Chu 2016). The most frequent blade knapping modality, the unipolar debitage, certainly is the simplest way to produce blades. In striking contrast with the typology of the MUP and LUP, which is apt to differentiate the three archaeological cultures studied here (Lengyel 2016), the blade debitage modalities seem to have been applied flexibly to achieve the desired products with the simplest method adjusted to the raw material properties. This means that none of the hunter-gatherer groups were determined by specific traditions but to maximize efficiency of the production.

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REFERENCES

Andrefsky W. Jr., 1994a. The geological occurrence of lithic material and stone tool production strategies. Geoarchaeology: An International Journal **9**(5): 375–391.

Andrefsky W., 1994b. Raw-material availability and the organization of technology. American Antiquity **59**(1): 21–34.

Andrefsky W. Jr., 2009. The analysis of stone tool procurement, production, and maintenance. Journal of Archaeological Research **17**(1): 65–103.

Antl-Weiser W., Fladerer F. A., Nigst Ph. R., Verpoorte A., 2010. Grub/Kranawetberg (Lower Austria) – Insights into a Gravettian micro-region in Eastern Austria. In: Neugebauer-Maresch Ch., Owen L., (Eds) New aspects of the Central and Eastern European Upper palaeolithic – methods, chronology, technology and subsistence. MPK 72: 231–245.

Bánesz L., Hromada J., Desbrosse R., Margerand I., Kozłowski J. K., Sobczyk K., Pawlikowski M., 1992. Le site de plein air du Paléolithique supérieur de Kasov 1 en Slovaquie orientale. Slovenská Archeológia **40**(1): 5–27.

Bárta J., 1988. Trenčianske Bohuslavice un habitat gravettien en Slovaquie occidentale. L'Anthropologie **92**(4): 173–182.

Binford L. R., 1979. Organization and formation processes: looking at curated technologies. Journal of Anthropological Research **35**(3): 255–273.

Binford L. R., 1980. Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. American Antiquity **45**(1): 4–20.

Binford L. R., 1982. The archaeology of place. Journal of Anthropological Archaeology **1**: 5–31.

Binford L. R., 1990. Mobility, Housing, and Environment: A Comparative Study. Journal of Anthropological Research **46**(2): 119–152.

Biró K. T., Dobosi V. T., 1991. Lithotheca – The comparative raw material collection of the Hungarian National Museum. Magyar Nemzeti Múzeum, Budapest.

Biró K. T., Dobosi V. T., Schléder Z., 2000. Lithitheca – The comparative raw material collection of the Hungarian National Museum. Magyar Nemzeti Múzeum, Budapest.

Boulton G.S., Dongelmans P., Punkari M., Broadgate M., 2004. Evidence of European ice sheet fluctuation during the last glacial cycle. In: Ehlers J., Gibbard P.L, (Eds) Quaternary Glaciations. Extent and Chronology. Part I: Europe. Elsevier, Amsterdam: 441–460.

Bösken J., Sümegi P., Zeeden C., Klasen N., Gulyás S., Lehmkuhl F., 2018. Investigating the last glacial Gravettian site 'Ságvár Lyukas Hill' (Hungary) and its paleoenvironmental and geochronological context using a multi-proxy approach. Palaeogeography, Palaeoclimatology, Palaeoecology **509**: 77–90.

Bradák B, Kiss K, Barta G, Varga Gy, Szeberényi J, Józsa S, Novothny Á, Kovács J, Markó A, Mészáros E, Szalai Z., 2014. Different paleoenvironments of Late Pleistocene age identified in Verőce outcrop, Hungary: preliminary results. Quaternary International **319**: 119–136.

Clark P. U., Dyke A. S., Shakun J. D., Carlson A. E., Clark J., Wohlfarth B., Mitrovica J. X., Hostetler S. W., Mccabe A. M., 2009. The Last Glacial Maximum. Science **325**: 710–714.

Csalogovits J., Gaál I., Hollendonner F., Hillebrand J., 1931 Az 1931. évi ságvári ásatások eredménye. Archaeológiai Értesítő **45**: 240–247.

Cyrek K., Nadachowski A., Madeyska T., Bocheński Z., Tomek T., Wojtal P., Miękina B., Lipecki G., Garapich A., Rzebik-Kowalska B., Stworzewicz E., Wolsan M., Godawa J., Kościów R., Fostowicz-Frelik Ł., Szyndlar Z., 2000. Excavation in the Deszczowa Cave (Kroczyckie Rocks, Częstochowa Upland, Central Poland). Folia Quaternaria **71**: 5–84.

Davies W., Hedges R., 2008–2009. Dating a Type Site: Fitting Szeleta Cave into Its Regional Chronometric Context. Praehistoria **9–10**: 35–45.

Demars P.-Y., Laurent P., 1992. Types d'outils lithiques du Paléolithique supérieur en Europe. Cahiers du Quaternaire No7. Presses du CNRS, Paris.

Demidenko Y. E., Škrdla P., Rios-Garaizar J., 2018. European perspectives of the East European LGM Epi-Aurignacian with Sagaidak-Muralovka-type microliths. In: Valde-Nowak P., Sobczyk K., Nowak M., Zralka J., (Eds), Multas per gentes et multa per saecula amici magistro et collegae suo Ioanni Christopho Kozłowski dedicant. Krakow: Institute of Archaeology, Jagiellonian University: 85–92.

Dobosi V. T., 1974. Adatok a Bodrog–völgy őskőkorához. Folia Archaeologica **25**: 9–32.

Dobosi V. T., 2000a. Upper Palaeolithic research in Hungary – a situation report from 2000. Praehistoria **1**: 149–159.

Dobosi V. T., (ed.) 2000b. Bodrogkeresztúr–Henye (NE Hungary), Upper Palaeolithic site. Hungarian National Museum, Budapest.

Dobosi V. T., 2001. Antecedents: Upper Paleolithic in the Jászság region. In: Kertész R., Makkay J., (Eds) From the Mesolithic to the Neolithic. Archaeolingua, Budapest: 177–191.

Dobosi V. T., 2004. After the golden age (Hungary between 20 and 16 ka BP). In: Dewez M., Noiret P., Teheux E., (Eds) The Upper Palaeolithic. General Sessions and Posters. Acts of the XIVth UISPP Congress, University of Liege, 2–8 September 2001, BAR International Series 1240, Oxford: 153–168.

Dobosi V. T., 2006. Gravetti lelőhelyek Pilismarót környékén. Folia Archaeologica **52**: 21–48.

Dobosi V. T., 2009a. A hazai felső paleolitikum vázlata. Tisicum **19**: 13–27.

Dobosi V. T., 2009b. Constancy and Change in Upper Palaeolithic, Hungary. In: Djindjian F., Kozłowski J., Bicho N., (Eds), Le concept de territoires dans le Paléolithique supérieur européen. 15th International Congress of Prehistoric and Protohistoric Sciences (15th: 2006: Lisbon, Portugal), Proceedings of the XV World Congress (Lisbon, 4–9 September 2006), BAR International Series 1938, Archaeopress, Oxford: 123–133.

Dobosi V. T., 2009c. Filling the void: Lithic raw material utilization during the Hungarian Gravettian. In: Adams B., Blades B. S., (Eds) Lithic Materials and Paleolithic Societies. Oxford: 116–126.

Dobosi V. T., 2014. A Dunakanyar felső paleolitikuma. Archaeológiai Értesítő **139**: 7–33.

Dobosi V. T., 2016. Tradition and modernity in the lithic assemblage of Mogyorósbánya Late Palaeolithic site. Acta Archaeologica Academiae Scientiarum Hungaricae **67**: 5–30.

Dobosi V. T., Kövecses-Varga E., 1991. Upper Palaeolithic Site at Esztergom–Gyurgyalag. Acta Archaeologica Academiae Scientiarum Hungaricae **43**: 233–255.

Dobosi V. T., Simán K., 1996, New Upper Paleolitic Site at Megyaszó–Szelestető. Communicationes Archaeologicae Hungariae **1996**: 5–22.

Dobosi V. T., Simán K., 2003. Hont–Parassa III Orgonás, Upper Palaeolithic Settlement. Communicationes Archaeologicae Hungariae **2003**: 15–29.

Dobosi V. T., Szántó Zs., 2003. A gravetti időszak hagyományos és radiokarbon koradatai. Archaeologiai Értesítő **128**: 5–16.

Dobosi V. T., Vörös I. 1987. The Pilisszántó I. Rock-shelter revision. Folia Archaeologica **38**: 7–64.

Dobosi V. T., Jungbert B., Ringer Á., Vörös I., 1988. Palaeolithic settlement in Nadap. Folia Archaeologica **39**: 13–40.

Dobosi V., Kőhegyi M., Krolopp E., Vörös I., Bíró K. T., 1989. Felsőpaleolit telep Madaras-Téglavetőben, ásatások 1966-1974. Cumania **11**: 9–66.

Ellis C. J., 1997. Factors influencing the use of stone projectile tips. An ethnographic perspective. In: Knecht H., (Ed.) Projectile Technology, Plenum Press, New York: 37–74.

Elston R. G., Brantingham P. J., 2002. Microlithic Technology in Northern Asia: A Risk–Minimizing Strategy of the Late Paleolithic and Early Holocene. In: Elston G. R., Kuhn S. L. (Eds) Thinking Small: Global Perspectives on Microlithization Archeological Papers of the American Anthropological Association 12. Arlington, Virginia: 103–116.

Féblot-Augustins J., 1997. La circulation des matieres premieres au paléolithique. Synthese des données perspectives comportementales. Tome I–II. ERAUL 75. Liège.

Gábori M., 1959. A ságvgári paleolitikus telep újabb ásatásának eredményei. Archaeológiai Értesítő **86**: 3–19.

Gábori M., 1965. Der Zweite Palaolithische Hausgrundriss von Ságvár. Acta Archaeologica Academiae Scientiarum Hungaricae **17**: 111–127.

Gábori-Csánk V., 1970. C-14 dates of the Hungarian Palaeolithic. Acta Archaeologica Academiae Scientiarum Hungaricae **22**: 3–11.

Gábori-Csánk V., 1978. Une oscillation climatique a la fin du Würm en Hongrie. Acta Archaeologica Academiae Scientiarum Hungaricae **30**: 3–11.

Gábori-Csánk V., 1986. Spuren des Jung paläolithikums in Budapest. Acta Archaeologica Academiae Scientiarum Hungaricae **38**: 3–12.

Gábori M., Gábori-Csánk V., 1957. Études archéologiques et stratigraphiques dans les stations de loess paléolithiques de Hongrie. Acta Archaeologica Academiae Scientiarum Hungaricae **8**: 3–117.

Goodyear A.C., 1979. A hypothesis for the use of cryptocrystalline raw materials among paleo–indian groups of North America. Research Manuscript Series. Book **127**.

Graf K. E. Goebel T., 2009. Upper Paleolithic Toolstone Procurement and Selection Across Beringia. In: Adams B., Blades B. S., (Eds) Lithic Materials and Paleolithic Societies. Oxford: 54–77.

Grosswald M. G., 1980. Late Weichselian ice sheet of Northern Eurasia. Quaternary Research **13**(1): 1–32.

Händel M., 2017. The stratigraphy of the Gravettian sites at Krems. Quartär **64**: 129–155.

Haynes C. V., Damon P. E., Grey D. C., 1966. Arizona Radiocarbon dates VI. Radiocarbon **8**: 1–21.

Hertelendi E., 1991. Radiocarbon dating of a wood sample from an excavation near Esztergom-Gyurgyalag. Acta Archaeologica Academiae Scientiarum Hungaricae **43**: 271.

Hiscock P., 1994. Technological Responses to Risk in Holocene Australia. Journal of World Prehistory **8**(3): 267–292.

Hiscock P., 2005. Blunt and to the Point: Changing Technological Strategies in Holocene Australia. In: Lilley I., (Ed.) Archaeology of Oceania: Australia and the Pacific Islands, Blackwell: 69–95.

Hiscock P., Clarkson C., Mackay A., 2011. Big debates over little tools: ongoing disputes over microliths on three continents. World Archaeology **43**(4): 653–664.

Hughes P. D, Gibbard P. D, Ehlers J., 2013. Timing of glaciation during the last glacial cycle: evaluating the concept of a global 'Last Glacial Maximum' (LGM). Earth Science Reviews **125**: 171–198.

Hughes A. L. C., Gyllencreutz R., Lohne Ř. S., Mangerud J., Svendsen J. I., 2016. The last Eurasian ice sheets – a chronological database and time-slice reconstruction, DATED-1. Boreas **45**: 1–45.

Inizan M.-L., Reduron-Ballinger M., Roche H., Tixier J., 1999. Technology and Terminology of Knapped Stone. Meudon: CREP, Nanterre.

Kaminská Ľ., 2016. Gravettian and Epigravettian lithics in Slovakia. Quaternary International **406**(A): 144–165.

Kaminská Ľ., Kozłowski J.K., 2011. Nitra I-Čermáň V Rámci Štruktúry Osídlenia Gravettienskej Kultúry Na Slovensku. Slovenská Archeológia *41*(1): 1–85.

Kelly R. L., 1983. Hunter-Gatherer Mobility Strategies. Journal of Anthropological Research **39**(3): 277–306.

Kelly R. L., 2013. The lifeways of hunter-gatherers. The foraging spectrum. Cambridge University Press, Cambridge.

Kormos T., Lambrecht K., 1915. A pilisszántói kőfülke. Tanulmányok a postglaciális kor geológiája, ősipara és faunája köréből. Földtani Intézet Évkönyve **23**: 307–498.

Kozłowski J. K., 1979. La fin des temps glaciaires dans le bassin du Danube moyen et inferéeur. In: de Sonneville-Bordes D., (Ed.) La fin des temps glaciaires en Europe, CNRS: 821–835.

Kozłowski J. K., 1996. The Danubian Gravettian as seen from the northern perspective. In: Svoboda J., (Ed.) Palaeolithic in the Middle Danube region, Archeologický ústav AV ČR, Brno: 11–22.

Kozłowski, J. K., (Ed.) 1998. Complex of Upper Palaeolithic sites near Moravany, Western Slovakia, Vol. 2, Moravany-Lopata II (excavations 1993–1996), Kraków: Jagellonian University, Institute of Archaeology.

Kozłowski J. K., (Ed.) 2000. Complex of Upper Palaeolithic sites near Moravany, Western Slovakia, Vol. **3**, Late Gravettien shouldered points horizon sites in the Moravany – Banka area, Nitra.

Kozłowski J. K., 2008. The shouldered point horizon and the impact of the LGM on human settlement distribution in Europe. In: Svoboda J., (Ed.) Petřkovice: on shouldered points and female figurines, The Dolní Věstonice Studies Vol 15, Institute of Archaeology at Brno, Academy of Sciences of the Czech Republic, Brno: 181–192.

Kozłowski J. K., 2013. Raw materials procurement in the Late Gravettian of the Carpathian Basin. In: Mester Z., (Ed.) The lithic raw material sources and the interregional human contacts in the Northern Carpathian regions, Polska Akademia Umiejętności, Kraków–Budapest: 63–85.

Kozłowski J. K., 2015. The origin of the Gravettian, Quaternary International **359**–**360**: 3–18.

Kozłowski J. K., Sobczyk K., 1987. The Upper Paleolithic site Kraków-Spadzista street C2, Excavations 1980. Prace Archeologiczne **42**: 7–68.

Krolopp E., Sümegi P., 2002. A ságvári lösz rétegsor csigafaunája. Malakológiai Tájékoztató **20**: 7–14.

Laczkó D., Gaál I., Hollendonner F., Hillebrand J. 1930. A ságvári felső diluviális lösztelep. Archaeológiai Értesítő **44**: 213–220.

Lengyel G., 2008–2009. Radiocarbon dates of the "Gravettian Entity" in Hungary. Praehistoria **9**–**10**: 241–263.

Lengyel G., 2010. An aspect to the re-evaluation of Ságvár (Lyukas-domb) Upper Palaeolithic site. Folia Archaeologica **54**: 25–37.

Lengyel G., 2011. The pebble, the block and the tabular. Lithic raw material use at Ságvár Lyukas-domb Upper Palaeolithic site. In: Biró K. T., Markó A., (Eds) Emlékkönyv Violának, Tanulmányok T. Dobosi Viola tiszteletére. (Papers in Honour of Viola T. Dobosi) Magyar Nemzeti Múzeum, Budapest: 93–102.

Lengyel G., 2013. Knapping experiments on lithic raw materials of the Early Gravettian in Hungary. In: Mester Z., (Ed.) The lithic raw material sources and interregional human contacts in the Northern Carpathian regions. Polish Academy of Arts and Sciences – Institute of Archaeological Sciences of the Eötvös Loránd University, Kraków–Budapest: 39–51.

Lengyel G., 2014a. Distant connection changes from the Early Gravettian to the Epigravettian in Hungary. In: Otte M., le Brun-Ricalens F., (Eds) Modes de contacts et de déplacements au Paléolithique eurasiatique: Modes of contact and mobility during the Eurasian Palaeolithic ERAUL 140 – ArhéoLogiques 5. Université de Liege, Liege–Luxembourg: 331–347.

Lengyel G., 2014b. Backed tool technology at Esztergom-Gyurgyalag Epigravettian site in Hungary. In: Biró K.T., Markó A., Bajnok K.P., (Eds) Aeolian Scripts: New Ideas On The Lithic World, Studies In Honour Of Viola T. Dobosi. Budapest: Magyar Nemzeti Múzeum: 121–129.

Lengyel G., 2015. Lithic raw material procurement at Bodrogkeresztúr-Henye Gravettian site, northeast Hungary. Quaternary International **359**–**360**: 292–303.

Lengyel G., 2016. Reassessing the Middle and Late Upper Palaeolithic in Hungary. Acta Archaeologica Carpathica **51**: 47–66.

Lengyel G., Chu W., 2016. Long thin blade production and Late Gravettian hunter-gatherer mobility in Eastern Central Europe. Quaternary International **406**(A): 166–173.

Lengyel G., Wilczyński J., 2018. The Gravettian and the Epigravettian chronology in eastern central Europe: a comment on Bösken et al. 2017. Palaeogeography, Palaeoclimatology, Palaeoecology **506**: 265–269.

Lengyel G., Mester Z., Szolyák P., 2016. The Late Gravettian and Szeleta Cave, northeast Hungary. Quaternary International **406**(A): 174–183.

Lorenc M., 2006. Radiocarbon dating of some Late Pleistocene faunal assemblages in caves in Poland. Acta zoologica cracoviensia, **49A**(1–2): 41–61.

Maier A., 2015. The Central European Magdalenian. Regional Diversity and Internal Variability, Springer.

Markó A., 2007. The Upper Palaeolithic site at Szob. Folia Archaeologica **53**: 7–22.

Markó A., 2011. A little puzzle: further studies on the Upper Palaeolithic assemblage of Szob. Folia Archaeologica **54**: 9–24.

Markó A., 2015. Istállóskő revisited: Lithic artefacts and assemblages, sixty years after. Acta Archaeologica Academiae Scientiarum Hungaricae **66**: 5–38.

Markó A., 2017. Use of Obsidian During the LGM: Case Studies from the Pebble Gravettian Sites in Hungary. Archeometriai Műhely **14**(3): 131–142.

Marks L., 2012. Timing of the Late Vistulian (Weichselian) glacial phases in Poland. Quaternary Science Reviews **44**: 81–88.

Mester Z., 2013. The lithic raw material sources and interregional human contacts in the northern Carpathian regions: aims and methodology. In: Mester Z. (Ed.), The lithic raw material sources and interregional human contacts in the northern Carpathian regions. Polish Academy of Arts and Sciences, Kraków–Budapest: 9–21.

Montet-White A., (Ed.) 1990. The Epigravettian Site of Grubgraben, Lower Austria: The 1986 and 1987 Excavations, ERAUL 40, l'Université de Liège, Liège.

Moreau L., 2009. Geißenklösterle. Das Gravettien der Schwäbischen Alb im europäischen Kontext, Kerns Verlag, Tübingen.

Moreau L., 2012. Le Gravettien ancien d'Europe centrale revisité: mise au point et perspectives. L'Anthropologie **116**: 609–638.

Morrow T. A., 1996. Bigger is Better: Comments on Kuhn's Formal Approach to Mobile Tool Kits. American Antiquity **61**(3): 581–590

Nadachowski A., Żarski M., Urbanowski M., Wojtal P., Miękina B., Lipecki G., Ochman K., Krawczyk M., Jakubowski G., Tomek T., 2009. Late Pleistocene environment of the Częstochowa Upland (Poland) reconstructed on the basis of faunistic evidence from archaeological cave sites. Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków

Nerudová Z., Neruda P., 2014. Štýřice III (Koněvova St. or Vídeňská St.) – an Epigravettian Site in Brno (Czech Republic). Interdisciplinaria Archaeologica **5**: 7–18.

Neugebauer-Maresch C., Einwögerer T., Richter J., Maier A., Hussain S.T., 2016. Kammern–Grubgraben. Neue Erkenntnisse zu den Grabungen 1985–1994. Archaeologia Austriaca **100**: 225–254.

Novák M., 2004. Gravettian occupation in the lower layer of Kašov I. In: Svoboda J.A., Sedlácková L., (Eds) The Gravettian Along the Danube. Proceedings of the Mikulov Conference, The Dolní Vestonice Studies, Vol. **11**. Brno: 217–242.

Novák M., 2008. Flint and radiolarite assemblages: technology and typology. In: Svoboda J.A., (Ed.) Petřkovice: On Shouldered Points and Female Figurines, The Dolní Věstonice Studies, Vol 15. Institute of Archaeology at Brno, Academy of Sciences of the Czech Republic, Brno: 70–142.

Oliva M., (Ed.) 2009. Sídliště mamutího lidu, u Milovic pod Pálavou: otázka strukturs mamutími kostmi (Milovice, site of the mammoth people below the Pavlov hills: the question of mammoth bone structures). Studies in Anthropology, Palaeoethnology and Quaternary Geology **27**, ns 19, Brno.

Otte M., 1981. Le Gravettien en Europe centrale, Dissertationes Archaeologicae Gandenses XX, 2 vol. Bruges, De Tempel.

Patou-Mathis M., Vercoutère C., Lengyel G., Szolyák P., Mester Z. 2016. New interpretation of the Upper Palaeolithic human occupations at Istállóskő Cave (Bükk Mountains, Hungary). Eurasian Prehistory **13**(1–2): 77–90.

Pelegrin J., 2011. Sur les débitages laminaires du Paléolithique supérieur. In: Delpech F., Jaubert J., (Eds) François Bordes et la préhistoire. Actes du colloque international François Bordes, Bordeaux, 22–24 avril 2009, éditions du CTHS, coll. Documents préhistoriques, n° 29, Bordeaux: 141–152.

Pécsi M., 1985. Chronostratigraphy of Hungarian loesses and the underlying subaerial formation. In: Pécsi M., (Ed.) Loess and the Quaternary. Chinese and Hungarian case studies. Studies in Geography in Hungary **18**. Akadámiai Kiadó, Budapest: 33–49.

Poltowicz-Bobak M., 2012. Observations on the late Magdalenian in Poland. Quaternary International **272**–**273**: 297–307.

Priskin A., 2011. Jászfelsőszentgyörgy-Szúnyogos és – Székes-dűlő felső paleolit lelőhelyek pattintott kőeszköz anyaga (tipológia és nyersanyag felhasználás). Unpublished MA thesis, University of Pécs.

Pryor A.J.E., 2008. Following the fat: food and mobility in the European Upper Palaeolithic 45,000 to 18,000 BP. Archaeological Review from Cambridge **23**(2): 161–179.

Přichystal A., 2008. Lithic raw materials. In: Svoboda J.A., (Ed.) Petřkovice: On Shouldered Points and

Female Figurines, The Dolní Věstonice Studies, Vol 15. Institute of Archaeology at Brno, Academy of Sciences of the Czech Republic, Brno: 67–69.

Přichystal A., 2013. Lithic raw materials in prehistoric times of Eastern Central Europe. Masaryk University, Brno.

Ringer Á., Holló Z., 2001. Sajószentpéter Margit-kapu-dűlő, egy felső-paleolit lelőhely a Sajó völgyében, A Herman Ottó Múzeum Évkönyve **40**: 63–72.

Ringer Á., Lengyel G., 2008–2009. The Upper Palaeolithic Site at Budapest Corvin-tér, Praehistoria **9**–**10**: 205–211.

Robertson G., Attenbro, V., Hiscock P., 2009. Multiple uses for Australian backed artefacts. Antiquity **83**(320): 296–308.

Shott M., 1986. Technological Organization and Settlement Mobility: An Ethnographic Examination. Journal of Anthropological Research **42**(1): 15–51.

Simán K., 1989. Hidasnémeti – Upper Palaeolithic Site in the Hernád valley (Northeast Hungary), Acta Archaeologica Carpathica 28: 5–24.

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

Sümegi P., Krolopp E., Hertelendi E., 1998. A Ságvár-Lascaux Interstadiális paleoökológiai rekonstrukciója. Közlemények a Debreceni Kossuth Lajos Tudományegyetem Ásvány- és Földtani Intézetéből **71**: 165–180.

Sümegi P., Rudner E., Deszeda I., 2000. Stratigraphical and palaeoecological investigation of the fossil soil comprising Upper Palaeolithic tools at Bodrogkeresztúr–Henye. In: Dobosi V.T., (Ed.) Bodrogkeresztúr–Henye (NE Hungary), Upper Palaeolithic site. Hungarian National Museum, Budapest: 217–220.

Stroeven A. P., Hattestrand C., Kleman J., Heyman J., Fabel D., Fredin O., Goodfellow B. W., Harbor J. M., Jansen J. D., Olsen L., Caffee M. W., Fink D., Lundqvist J., Rosqvist G. C., Stromberg B., Jansson K. N., 2015. Deglaciation of Fennoscandia. Quaternary Science Reviews **147**: 91–121.

Svoboda J., 1991. Stránská skála. Výsledky výzkumu v letech 1985–1987. Památky archeologické **82**: 5–47.

Svoboda J., 1996. The Pavlovian: typology and behavior. In: Svoboda J., (Ed.) Palaeolithic in the Middle Danube region, Archeologický ústav AV ČR, Brno: 283–301.

Svoboda J. A., 2007. The Gravettian on the Middle Danube. Paléo **19**: 203–220.

Svoboda J., 2016. Settlement units and human fossils. Spatial context, stratigraphies and chronology. In: Svoboda J., (Ed) Dolní Vestonice II. Chronostratigraphy, paleoethnology, paleoanthropology. Th Dolní Vestonice Studies vol. **21**: 16–48.

Svoboda J. A., Novák M., 2004. Eastern Central Europe after the Upper Pleniglacial: Changing points of observation. Archäologisches Korrespondenzblatt **34**: 463–477.

Szolyák P., 2008–2009. New Radiocarbon Data with Stratigraphical, Climatic and Archaeological Contexts to the Palaeolithic Assemblage of the Herman Ottó Cave, Miskolc-Alsóhámor, Northeast Hungary. Praehistoria **9**–**10**: 213–224.

Škrdla P., Plch M., 1993. Osídlení epigravettienu v okolí Stránské skály (okr. Brno–město). Archeologické rozhledy **45**: 429–435.

Škrdla P., Nejman L., Bartík J., Rychtaříkova T., Nikolajev P., Eigner J., Nývltova Fišáková M., Novák J., Polanská M., 2016. Mohelno – A terminal Last Glacial Maximum industry with microlithic tools made on carenoidal blanks, Quaternary International **406**(A): 184–194.

Tallavaaraa M., Luotob M., Korhonenc N., Järvinend H., Seppä H., 2015. Human population dynamics in Europe over the Last Glacial Maximum. PNAS **112**(27): 8232–8237.

Tixier J., 2012. A method for the study of stone tools. ArchéoLogique 4. Centre National de Recherche Archéologique Musée National d'Histoire et d'Art, Luxemburg.

Tolnai-Dobosi V. T., 2001. About Ságvárian: chronological-cultural sketch of the Upper Palaeolithic in Hungary. In: Ginter B., Drobniewicz B., Kazior B., Nowak M., Poltowicz M., (Eds) Problems of the Stone Age in the Old World, Jagellonian University, Institute of Archaeology, Kraków: 195–201.

Varga I., 1991. Mineralogical analysis of the lithic material from Esztergom-Gyurgyalag. Acta Archaeologica Academaiae Scientiarum Hungariae **43**: 267–269.

Verpoorte A., 2004. Eastern Central Europe during the Pleniglacial. Antiquity **78**: 257–266.

Verpoorte A., 2009. Limiting factors on early modern human dispersals: The human biogeography of late Pleniglacial Europe. Quaternary International **201**: 77–85.

Vértes L., 1955. Neuere Ausgrabungen und paläolithische Funde in der Höhle von Istállóskő. Acta Archaeologica Academiae Scientiarum Hungaricae **5**: 111–131.

Vértes L., 1962. Ausgrabungen der altsteinzeitlichen Siedlung von Arka 1960–61, Acta Archaeologica Academiae Scientiarum Hungaricae **14**: 143–157.

Vértes L., 1964–1965. Das Jungpaläolithikum von Arka in Nord–Ungarn. Quartär **15**–**16**: 79–132.

Vértes L., 1965. "Lunar Calendar" from the Hungarian Upper Paleolithic. Science **149**(3686): 855–856.

Vértes L., 1966. The Upper Palaeolithic Site on Mt. Henye at Bodrogkeresztúr, Acta Archaeologica Academiae Scientiarum Hungaricae **18**: 3–14.

Vita-Finzi C., Higgs E. S., Sturdy D., Harriss J., Legge A. J., Tippett H., 1970. Prehistoric Economy in the Mount Carmel Area of Palestine: Site Catchment Analysis. Proceeding sof the Prehistoric Society **36**: 1–37.

Vlačiky M., Michalík T., Nývltová Fišáková M., Nývlt D., Moravcová M., Králík M., Kovanda J., Péková K., Přichystal A., Dohnalová A., 2013. Gravettian occupation of the Beckov Gate in Western Slovakia as viewed from the interdisciplinary research of the Trenčianske Bohuslavice – Pod Tureckom site. Quaternary International **294**: 41–60.

Vogel J.C., Waterbolk H.T., 1964. Groningen Radiocarbon Dates V. Radiocarbon **6**: 349–369.

Vogel J.C., Waterbolk H.T., 1967. Groningen Radiocarbon Dates VII. Radiocarbon **9**: 107–155.

Vörös I., 1982. Faunal remains from the Gravettian reindeer hunter's campsite at Ságvár. Folia Archaeologica **33**: 43–71.

Vörös I., 2000. Macro-mammal remains on Hungarian Upper Pleistocene sites. In: Dobosi V. T., (Ed.) Bodrogkeresztúr-Henye (NE Hungary), Upper Palaeolithic site, Hungarian National Museum, Budapest: 186–212.

Žaár O., 2007. Gravettienska stanice v Trenčianskich Bohuslavicach. Unpublished MA thesis, Filozofická Fakulta, Univerzita Konštantína Filozofa v Nitre. Nitra.

Wilczyński J., 2007. The Gravettian and Epigravettian lithic assemblages from Kraków-Spadzista B+B1: dynamic approach to the technology. Folia Quaternaria **77**: 37–96.

Wilczyński J., 2009. Targowisko – a new Late Glacial site in southern Poland. Eurasian Prehistory **6**: 95–118.

Wilczyński J., (Ed.) 2015. A Gravettian Site in Southern Poland, Jaksice II. Plosh Academy of Sciences, ISEA PAS, Kraków.

Wilczyński J., 2016. Variability of Late Gravettian lithic industries in southern Poland: A case study of the Krakow Spadzista and Jaksice II sites, Quaternary International **406**(A): 129–143.

Wilczyński J., Wojtal P., Sobieraj D., Sobczyk K., 2015. Kraków Spadzista trench C2: New research and interpretations of Gravettian settlement. Quaternary International **359–360**: 96–113.

Wiśniewski A., Furmanek M., Borowski M., Kądziołka K., Rapiński A., Winnicka K., 2012. Lithic raw material and Late Palaeolithic strategies of mobility: a case study from Sowin 7, SW Poland. Anthropologie **50**(4): 391–409.

Wiśniewski A., Płonka T., Jary Z., Lisa L., Traczyk A., Kufel-Diakowska B., Raczyk J., Bajer A., 2015. The early Gravettian in a marginal area: New evidence from SW Poland. Quaternary International **359–360**: 131–152.

Wiśniewski A., Poltowicz-Bobak M., Bobak D., Jary Z., Moska P., 2017. The Epigravettian and the Magdalénian in Poland: new chronological data and old problem. Geochronometria **44**: 16–29.

Yaroshevich A., 2006. Techno-morphological aspects of microlithic projectile implements: examples from the Levantine Geometric Kebaran and the east European Epigravettian. Archaeology, Ethnology & Anthropology of Eurasia **4**(28): 8–17.

Yaroshevich A., Kaufman D., Nuzhnyy D., Bar-Yosef O., Weinstein-Evron M., 2010. Design and performance of microlith implemented projectiles during the Middle and the Late Epipaleolithic of the Levant: experimental and archaeological evidence Journal of Archaeological Science **37**: 368–388.