The Gravettian site Meča Dupka (Serbia) and its regional context

Die Gravettien-Fundstelle Meča Dupka (Serbien) und ihr regionaler Kontext

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Abstract - In Central and Eastern Europe, the archaeological record of the Gravettian is very well researched. However, Southeast Europe and especially the Balkans contribute only little to the picture of Gravettian hunter-gatherers. Whether this is due to less extensive research in this area or to the different ways of life of Gravettian hunter-gatherers in the Balkans remains to be investigated. Nevertheless, a better understanding of Gravettian communities in the Balkans is of crucial importance for comprehending Gravettian ways of life in late Pleistocene Europe. This paper focuses on the site of Meča Dupka in south-eastern Serbia, which contains a Gravettian layer dating to 25 420 ± 190 BP (OxA-38547). Lithic and faunal analysis show that during the Gravettian, Meča Dupka represented a short-term camp with a specific lithic industry. Comparing similarly dated sites in the Balkan region, it appears that the period between 26-24 000 BP in the Balkans represents a unique episode in Gravettian hunter-gatherer ways of life, which is entirely different from the Central and Eastern European Gravettian of the time.

Zusammenfassung - *In Mittel- und Osteuropa ist der archäologische Nachweis des Gravettien sehr gut erforscht. Südosteuropa und insbesondere der Balkan tragen jedoch nur wenig zum Bild der Jäger und Sammler des Gravettien bei. Ob dies auf weniger umfangreiche Forschungen in diesem Gebiet oder auf die unterschiedliche Lebensweise auf dem Balkan zurückzuführen ist, bleibt noch zu untersuchen. Dennoch ist ein besseres Verständnis der Gemeinschaften des Gravettien auf dem Balkan von entscheidender Bedeutung für das Verständnis der Lebensweise im spätpleistozänen Europa. Dieser Beitrag konzentriert sich auf die Fundstelle Meča Dupka in Südostserbien, die eine Schicht des Gravettien enthält, die auf 25 420 ± 190 BP (OxA-38547) datiert wird. Lithische und faunistische Analysen zeigen, dass Meča Dupka während des Gravettien ein Kurzzeitlager mit einer spezifischen lithischen Industrie darstellte. Vergleicht man ähnlich datierte Fundstellen in der Balkanregion, so zeigt sich, dass der Zeitraum zwischen 26- 24 000 BP auf dem Balkan eine einzigartige Episode in der Lebensweise der Jäger und Sammler des Gravettien darstellt, die sich völlig von dem mittel- und osteuropäischen Gravettien dieser Zeit unterscheidet.*

Keywords - lithic technology, faunal analysis, regional comparison, Balkan, Gravettian
Steinartefakttechnologie, Archäozoologie, regionaler Vergleich, Balkan, Gravettien

Introduction

The Gravettian technocomplex has been intensively studied in Western, Central and Eastern Europe, defining the Middle Upper Paleolithic with a highly developed tool kit, bone tool industry, burials, art and architecture (e.g. Svoboda 2007; Kozlowski 2015; Moreau 2010; Conard & Moreau 2004; Wilczyński et al. 2012; Oliva 1988; Jacobi et al. 2010; Soffer 1985; Pike-Tay & Bricker 1993). Research shows a more or less uniform cultural complex spanning 10 000 years from the Iberian coast to the Eastern European Plain. Gravettian people not only settled many areas but were occupying a wide range of climatic conditions, including glacial areas, dry and cold steppe, and wet, warm forests (Svoboda 2007: 204; Musil 2010: 100-102).

Despite the intensive research on the Gravettian, it is interesting to note the relative lack of data coming from the Balkans. In 1999, Kozlowski wrote *"It is regrettable that data on industries with backed points and blades in the Balkans are so fragmentary"* (Kozlowski 1999: 329), and still to date only a handful of sites attributed to the Gravettian are known from the Balkans. If Gravettian humans were adaptable and capable to survive in different areas and climates, why was the Balkans not more densely settled? As the Balkans is considered a refugium during glacial periods (Tzedakis et al. 2006), it seems peculiar that Gravettian hunter-gatherers would bypass such a prosperous region. Furthermore, Gravettian sites discovered in the Balkans are meagre, lacking many features that define the Gravettian techno-complex in other regions such as a developed bone tool industry, architecture and art.

There are multiple reasons for the present situation. First of all, we can look towards the research pressure

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being put on the region. While Central and Eastern Europe have an extensive history of Paleolithic research dating back to 19th century, Paleolithic research in the Balkans was until recently largely neglected. However, taking into consideration what has been discovered in latest research, the picture is unexpected. A certain number of sites have been discovered but they still lack typical Gravettian characteristics, as was mentioned above. This could be the result of almost all Gravettian sites from the Balkans being located in caves, compared to Central and especially Eastern Europe, where the richest and most representative Gravettian sites are in open air (e.g. Moreau et al. 2016; Zheltova 2015; Svoboda et al. 2016; Soffer 1985).

Any of the above-mentioned reasons can be the answer to the question of why Balkans are not contributing as much to the picture of Gravettian Europe. However, to be certain of our conclusion of the behavior and preferences of Gravettian hunter gatherers, it is imperative to bypass our bias and put the equal research pressure on all the regions in questions, and draw the conclusion by research results, not by lack of research.

To date, the Gravettian in the Balkans is quite scantily known and insufficiently published. A couple of the well-known sites were discovered years ago, and the new sites are published only with scarce information. The situation in Serbia is not a different one but is starting to change. Extensive Paleolithic research started in 2004 with important results for all periods of the Paleolithic (Mihailović 2014). In the last 15 years, therefore, we heard about findings from Lower Palaeolithic (Roksandić et al. 2011; Mihailović & Bogićević 2016), the amazing results in Middle Palaeolithic research (Majkić et al. 2018; Radović et al. 2019) and a bigger number of Upper Palaeolithic sites, putting Serbia on the map of the Aurignacian Danubian corridor (Marin-Arroyo & Mihailović 2017; Ruiz-Redondo 2014; Dogandžić et al. 2014; Chu et al. 2014) and discovering the extensive network of Gravettian and Epigravettian sites (Mihailović & Mihailović 2007; Kuhn, et al. 2014; Dogandžić et al. 2014; Mihailović 2014). If in only 15 years of research such results could be achieved, the late start to research campaigns may partially be the explanation for our poor knowledge of the Gravettian in the Balkans.

In this light, it is important to publish the results of research from the Balkans, and that greater details about the sites are presented. Therefore, this study aims at a better understanding of the behavior and the preferences of Gravettian hunter gatherers and of the role of the Balkans during this time period. This study focuses on the newly discovered Gravettian site, Meča Dupka in southeast Serbia. The site yielded a Gravettian layer with an early date for the region. The paper will focus on lithic and faunal analysis from this layer and will compare the material culture to that of other Gravettian sites in the region with early dates (26-24 000 BP).

The site Meča Dupka

Meča Dupka is a dry, shallow cave located in southeast Serbia near the city of Niš in the Velika Morava basin (Fig. 1). It is located in the valley of the small Provalija River which sinks into the Cerjanska cave complex, a couple of meters further from the site (Nešić 2016a: 11). Meča Dupka along with other caves from the Cerjanska cave complex was formed in a limestone area on the north-eastern part of the mt Kalafat, which is part of the Carpatho-Balkanides in Eastern Serbia (Nešić 2016a: 11-12). Meča Dupka site is small cave, measuring approximately 16 by 7 m with the entrance facing northeast. It is situated at around 550 m a.s.l. and 28 m above the modern Provalija River bed (Nešić 2016c: 48).

Discovered by speleologists during the 1950s (Nešić 2016b: 20), Meča Dupka was first excavated in 2014 as part of the Southeast Serbia Paleolithic Project, a collaboration between the University of Belgrade and the University of Arizona (Kuhn et al. 2014). Arriving at the site, it was documented that the cave was illegally excavated in two places in the central area. The archaeological team worked on minimizing the damage by creating two test trenches on top of the looters' pits (Kuhn et al. 2014: 104). During this campaign lithic artefacts belonging to the Paleolithic were recorded. However, during excavation it was noticed that the layers are heavily disturbed by waterflow. It was hypothesized that water flow affected the central part of the cave, while peripheral parts near the walls might still contain preserved stratigraphy (Kuhn et al. 2014: 105). The lithic analysis of the artefacts implied the Middle Paleolithic origin of the artefacts, although the number of artefacts found (18 in total) did not allow a detailed analysis (Kuhn et al. 2014; Mihailović 2014).

The latest campaign at Meča Dupka cave site occurred in 2018-2019, when another test trench was excavated in the niche near the south wall of the cave (Fig. 2). The major goals were to clarify the stratigraphy of the site and to make sure that there was no significant waterflow in the periphery of the site, specifically in the southern niche.

During the excavations of 2018 and 2019, a 3x2 m test trench was excavated to the bedrock at a depth of approximately 2 m. New excavations showed that unlike in the central part of the cave, stratigraphy was indeed preserved in the periphery of the cave and that waterflow did not significantly affect the stratigraphy in this area. Four different geological layers were identified (Fig. 3): the top layer (layer 1) represented modern sediment mixed with material including lithics, pottery and modern animal bones, layers 2-4 are Pleistocene in origin and contain numerous finds of lithic artefacts and faunal remains. Layers 2 and 3 (sublayers 3a, 3b, 3c) were excavated in 2018, but the bottom of the layer 3 was not reached, which prompted excavations in 2019. The rest of the

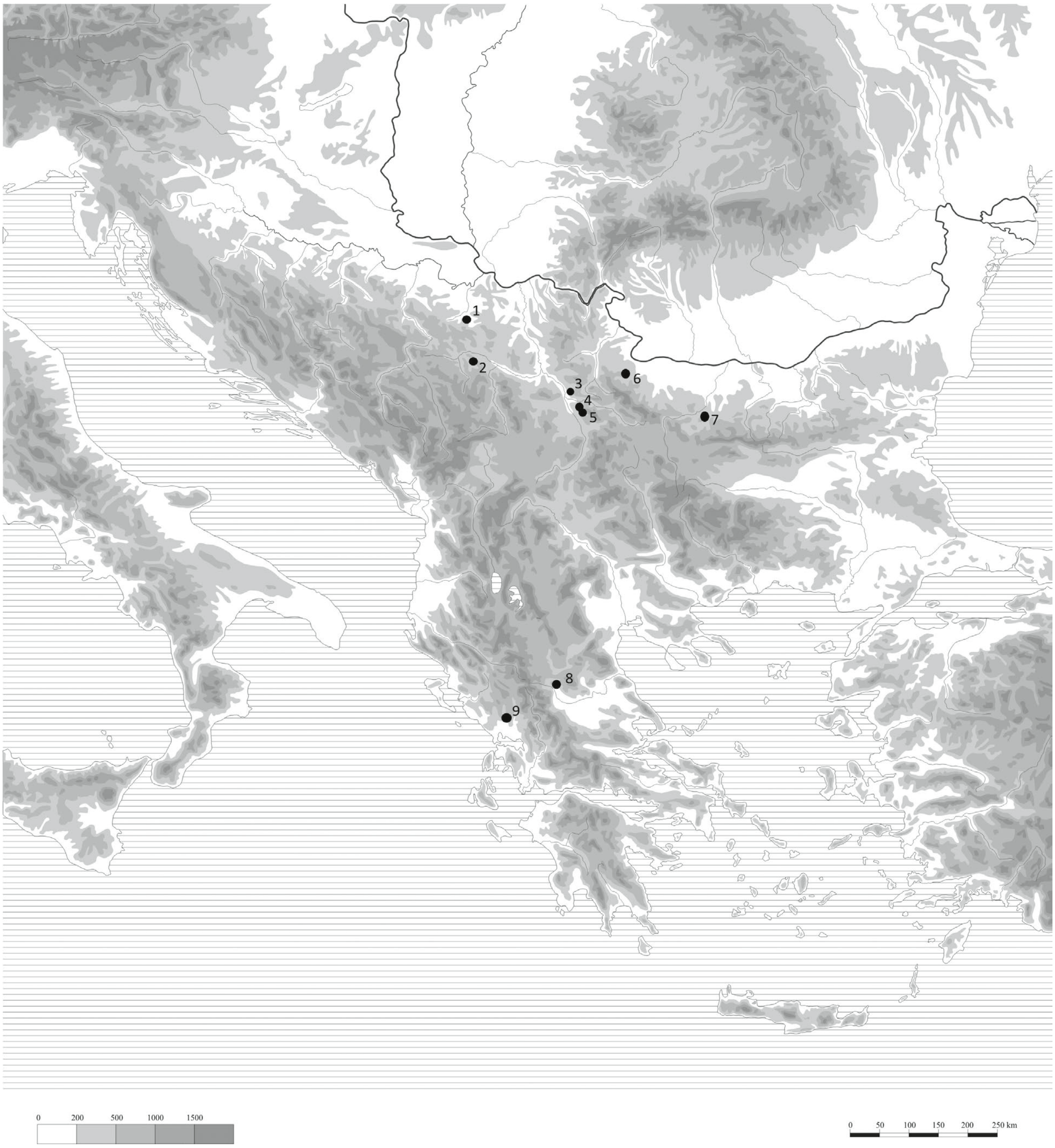

Fig. 1. Map showing the location of Meča Dupka and other sites discussed in the text.: (1) Šalitrena pećina, (2) Hadži Prodanova cave, (3) Meča Dupka, (4) Pešturina, (5) Pećina kod stene, (6) Kozarnika,(7) Temnata Dupka, (8) Theopetra, (9) Asprochaliko (modified after Mihailović 2014: 80).

Abb. 1. *Karte mit dem Standort von Meča Dupka und anderen im Text besprochenen Orten: (1) Šalitrena pećina, (2) Höhle Hadži Prodanova, (3) Meča Dupka, (4) Pešturina, (5) Pećina kod stene, (6) Kozarnika,(7) Temnata Dupka, (8) Theopetra, (9) Asprochaliko (modifiziert nach Mihailović 2014: 80).*

layer 3 (sublayer 3c) was excavated in 2019 and bedrock was reached in the trench in the southern niche. In total around 350 lithic artefacts and around 2 000 faunal remains were collected during the 2018-2019 campaign.

All excavations performed on the site used the same methodology. A square grid was established and excavations were done in 5 cm thick spits in 25x25 cm subsquares. Base of every excavation layer was photographed and elevations were measured. Sediment was screened through 3 mm dry sieves.

Although 2018-2019 excavations took place in the periphery of the cave, considering the amount of material found in previous excavations and the size of the cave, southern niche is not considered to be the periphery of the site. Amount of material found in 2018-2019 excavations is substantial, and considering that unexcavated area of the cave is in its deepest and darkest parts, current circumstances led us to the assumption that most activities on site were performed in the niche in the southern wall.

Layer 3 contained 87 % of the lithic material and

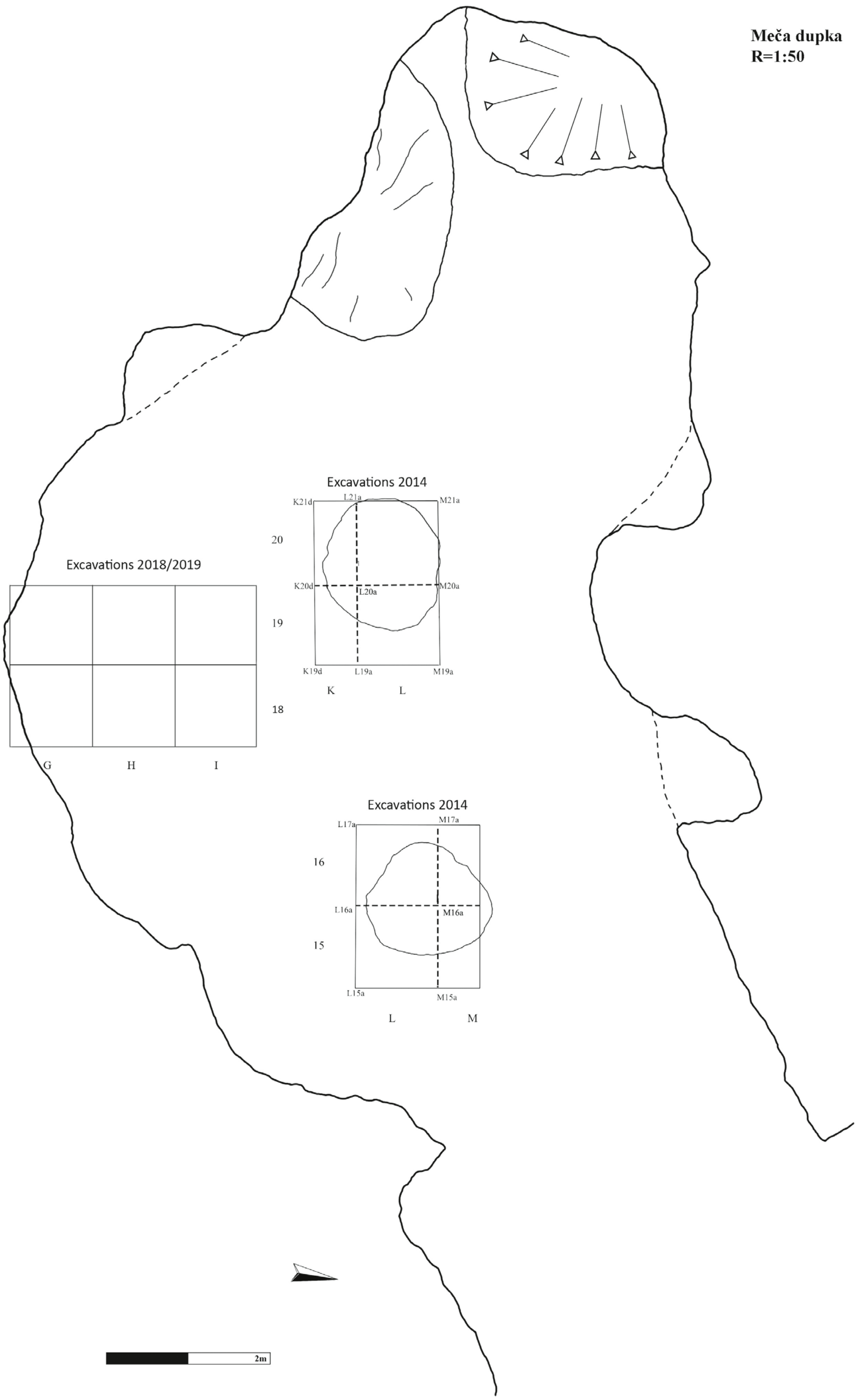

Fig. 2. Map of Meča Dupka showing 2014 and 2018/2019 trenches.
Abb. 2. *Karte von Meča Dupka mit den Gräben von 2014 und 2018/2019.*

80 % of all faunal remains found on the site and is therefore the main interest of this study. Material from the first campaign in 2014 is excluded since the layers were heavily disturbed by water flow. It was possible to distinguish 4 sublayers within layer 3 (sublayer 3a1, 3a2, 3b, 3c). The only radiocarbon date for the site is 25 420 ± 190 BP (OxA-38547) from Bos/Bison bone, for the bottom of the layer 3 (sublayer 3c).

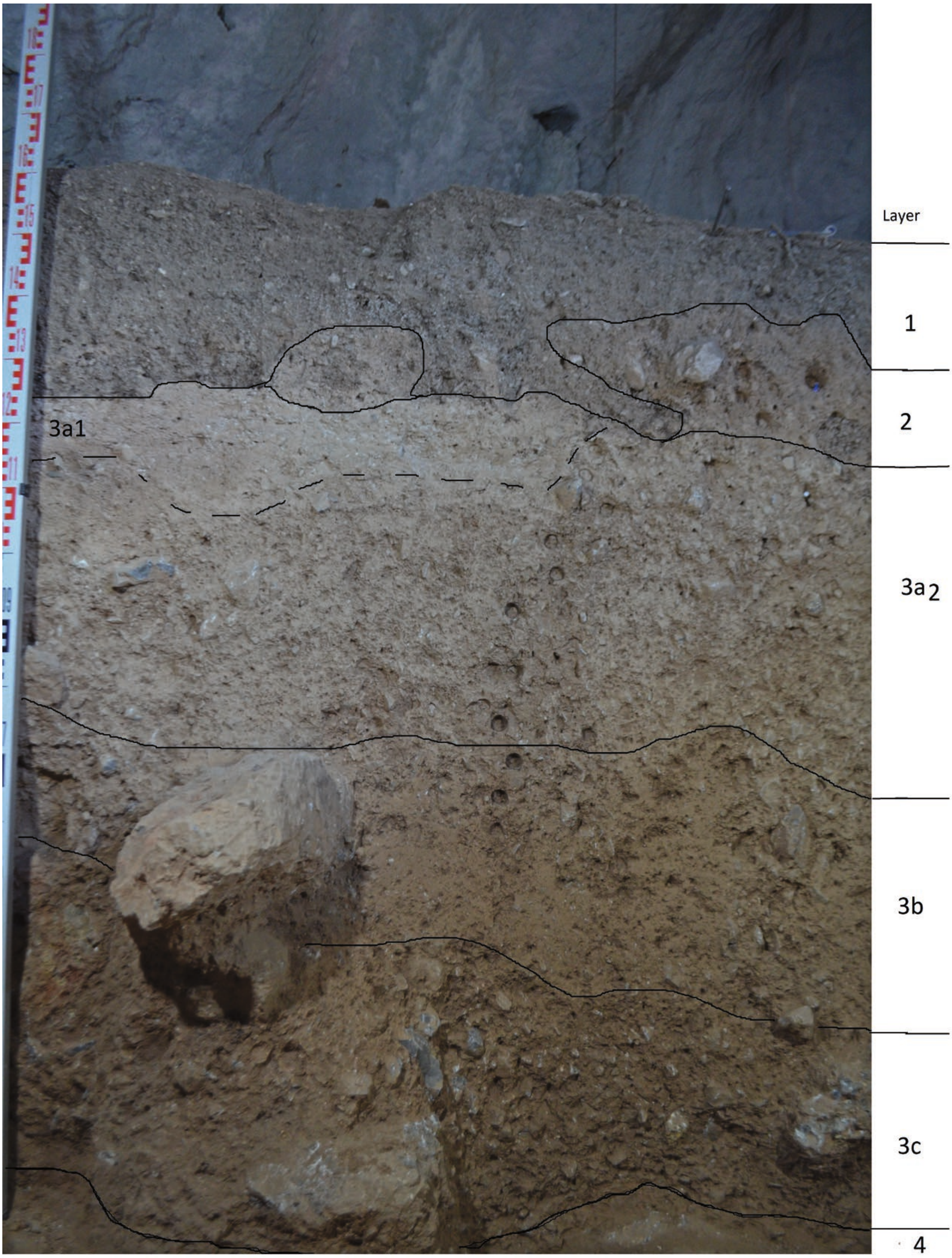

Fig. 3. Part of the western section in squares H-I/19 of the trench 2018/2019.
Abb. 3. *Teil des westlichen Profils in den Quadraten H-I/19 des Grabens von 2018/2019.*

Layer 3 is a light colored, compacted layer more than one meter thick. Sublayers were distinguishable but differed only slightly from each other. The lowest sublayer, 3c, was richest in finds (127 artefacts in total). It had a reddish coloring with significant amount of clay. Sublayer 3b overlying sublayer 3c, contained less clay and was brownish in color. This sublayer was also rich in finds (97 artefacts in total). On top of the sublayer 3b lays sublayer 3a, which was further divided into sublayer 3a1 and 3a2. Sublayer 3a2 was yellowish in color and contained a significant number of rockfall. A fairly low number of artefacts and bones were found in this sublayer. Sublayer 3a1 was a very compact silty whitish sediment that contained a low number of artefacts and bones and represented only a pocket of sediment within sublayer 3a2. Differences in sublayers 3a1 and 3a2 were very small, therefore material from these two sublayers are combined as sublayer 3a and are analyzed together.

Lithic analysis

As the main interest of this study is the Gravettian occupation from layer 3, we will present in detail a technological analysis of the lithics from this layer. The goal of this analysis is a better understanding of the technology and the behavior of the people using Meča Dupka cave during the deposition of layer 3. Material included in this study was obtained in the excavation campaigns in 2018 and 2019 comprising in total 297 analyzed artefacts.

The first phase of the lithic analysis was to determine the raw material used for the lithic production. Raw material was examined macroscopically noting color, intrusions, transparency and quality of knapping. Therefore, raw materials are broadly identified as chalcedony, good quality flint, low quality flint and quartzite without assigning them to more specific raw material types.

The second phase of analysis dealt with lithic technology, morphology and typology. Lithic artefacts were divided into different categories: cores, blades, bladelets, flakes, rejuvenation pieces, chips, chunk and raw material pieces. Retouched tools are discussed separately. The category of cores includes only formally shaped cores, while tested raw material was assigned to raw material pieces. The blades category includes all flakes that are twice as long as they are wide and wider than 12 mm. Bladelets category includes all flakes that are twice as long as they are wide, with width less than 12 mm. All flakes bigger than 20 mm including tools on flakes are considered as flakes while flakes smaller than 20 mm are considered as chips. In the category of raw material pieces are all tested nodules and untested pieces of raw material.

Results of the analysis for the different sublayers

Sublayer 3c

In total 127 lithic artefacts were discovered in sublayer 3c which comprises 40.6 % of all artefacts from layer 3. A radiocarbon date of 25 420 ± 190 BP (OxA-38547) was obtained for this sublayer. Date was obtained from the Bos/Bison proximal metatarsal bone in Oxford Radiocarbon Accelerator Unit. Most of the artefacts were made on higher quality raw material, specifically chalcedony and good quality flint (Fig. 4). Low quality flint and quartzite were used for producing artefacts at lower frequencies (Fig. 4). Due to thermal or chemical damage it was not possible to determine the raw material on 1.6 % of artefacts.

All technological categories are present, with flakes being most numerous, followed by bladelets, chips, chunk, blades, and raw material pieces (Fig. 5). Rejuvenation pieces and cores are also present, while undetermined fragments are 6.3 % of the total assemblage (Fig. 5). Tools comprise 20.5 % of the whole assemblage of sublayer 3c.

Cores

Only one core was found in sublayer 3c. The core was on a chalcedony nodule. It is a small (31x14x12 mm) bladelet double platform bidirectional-adjacent sub-pyramidal core, discarded in an advanced stage of reduction. Flaking faces are straight and platforms were formed by single blows (Fig. 21: 1).

Flakes

Flakes comprise 29.9 % of the lithic inventory in layer 3c. While cortex was present on 47.3 % of the flakes, only one was completely cortical, while most had less than 50 % of cortex coverage. Among non-cortical flakes those with unidirectional scars predominate, followed by those with multidirectional scars, while only one piece had diagonal scars (Fig. 10). The majority of platforms were unprepared, formed by a single blow or cortical while 7.4 % had prepared,

Raw material distribution in layer 3							
	3a		3b		3c		
	total	*%*	**total**	*%*	**total**	*%*	**total**
Good quality flint	**32**	*43.2*	**43**	*44.8*	**46**	*36.2*	**121**
Low quality flint	**5**	*6.8*	**7**	*7.3*	**22**	*17.3*	**34**
Chalcedony	**34**	*45.9*	**38**	*39.6*	**49**	*38.6*	**121**
Quartzite	**2**	*2.7*	**6**	*6.2*	**8**	*6.3*	**16**
undetermined	**1**	*1.4*	**2**	*2.1*	**2**	*1.6*	**5**
total	**74**	***100***	**96**	***100***	**127**	***100***	**297**

Fig. 4. Raw material distribution in sublayers 3a, 3b, 3c.

Abb. 4. *Rohmaterialverteilung in den Teilschichten 3a, 3b, 3c.*

Technological categories in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
cores	**0**	*0*	**1**	*1.1*	**1**	*0.8*
blades	**12**	*16.3*	**14**	*14.7*	**12**	*9.4*
bladeletes	**17**	*22.9*	**13**	*13.5*	**21**	*16.5*
flakes	**26**	*35.1*	**36**	*37.5*	**38**	*29.9*
rejuvenation pieces	**3**	*4.1*	**3**	*3.1*	**3**	*2.4*
chips	**6**	*8.1*	**8**	*8.3*	**18**	*14.2*
chunk	**4**	*5.4*	**5**	*5.2*	**16**	*12.6*
other	**4**	*5.4*	**8**	*8.3*	**10**	*7.9*
undetermined	**2**	*2.7*	**8**	*8.3*	**8**	*6.3*
total	**74**	***100***	**96**	***100***	**127**	***100***
tools	**28**	*37.8*	**23**	*23.9*	**26**	*20.5*

Fig. 5. Technological categories in sublayers 3a, 3b, 3c.
Abb. 5. *Technologische Kategorien in den Teilschichten 3a, 3b, 3c.*

dihedral platforms (Fig. 13). Complete flakes made up 52.6 % of the assemblage (Fig. 16). The length of the flakes ranges from 5-43 mm with an average of 30.45 mm. Widths range from 15-42 mm with an average of 29 mm, while the thicknesses ranges from 3-22 mm with an average of 11.08 mm.

Blades
Blades represent 9.4 % of the lithic inventory of sublayer 3c. Cortex was present on 16.6 % of the blades, with less than 50 % cortex coverage. Dorsal scar patterns were almost equally represented with multidirectional and unidirectional scar patterns (Fig. 11). Most blades had triangular cross section, followed by trapezoidal, while irregular and polygonal were also represented (Fig. 19). Profile of the blades was straight in majority of cases while curved and twisted profiles are equally represented (Fig. 6). In total 33.3 % of the blades were completely preserved, while the rest were fragmented. All three parts of blades are present with only one distal fragment (Fig. 17). In the cases where platform was preserved it was mostly unprepared, formed by single blow while only one platform shows signs of preparation (dihedral) (Fig. 14). The length of the blades ranges from 31-56 mm with an average of 40.5 mm. Width ranges from 12.5-26 mm with an average of 16.9 mm, while thickness ranges 2-27 mm with an average of 6.8 mm (Fig. 8).

Bladelets
Bladelets represent 16.5 % of the lithic inventory of sublayer 3c. Cortex was present on 14.3 % of the bladelets, but no completely cortical pieces were found. Dorsal scar patterns were mostly unidirectional, followed by multidirectional, while only one piece exhibited bidirectional dorsal scars (Fig. 12). In most cases bladelets had triangular cross-sections, followed by trapezoidal cross-sections (Fig. 20). The profiles of the bladelets were straight followed by twisted, while curved profiles were also present (Fig. 7). Fragmentation was high, with only 9.5 % of the bladelets complete. All three parts of bladelets are represented at similar frequencies (Fig. 18). Due to the high fragmentation, platforms were preserved on only 33.3 % of cases and all were unprepared, formed by single blow or punctiform (Fig. 15). The length of bladelets range from 13-15 mm with an average of 14 mm. Width ranges from 4-12 mm with an average of 7.8 mm, while the thickness ranges 1-6 mm with an average of 2.8 mm (Fig. 9).

Tools
Tools are represented in 20.5 % of the collection of lithics from sublayer 3c. Tools were mostly made on flakes, followed by blades and bladelets. In one case it was not possible to determine the blank used for tool production due to fragmentation. Blades were more often chosen for tool production as the blanks of bladelets (53 % of the tools were made on blades compared to 47 % on bladelets). The composition of tools in layer 3c exhibits a variety of forms: retouched flakes (30.7 %), retouched blades (26.9 %), retouched bladelets (23.1 %) and endscrapers (7.6 %), while notched tools, truncated tools, perforators, sidescrapers and raclettes are all represented with one piece. For one retouched piece it was not possible to determine the typology due to fragmentation.

Blade profiles in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
straight	**5**	*41.7*	**5**	*35.7*	**5**	*41.7*
curved	**2**	*16.6*	**3**	*21.5*	**3**	*25*
twisted	**5**	*41.7*	**4**	*28.6*	**3**	*25*
twisted+curved	**0**	*0*	**1**	*7.1*	**0**	*0*
undetermined	**0**	*0*	**1**	*7.1*	**1**	*8.3*
total	**12**	***100***	**14**	***100***	**12**	***100***

Fig. 6. Profile of the blades in sublayers 3a, 3b, 3c.
Abb. 6. *Profil der Klingen in den Teilschichten 3a, 3b, 3c.*

Bladelet profiles in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
straight	**8**	*47.1*	**6**	*46.2*	**7**	*33.3*
curved	**2**	*11.8*	**0**	*0*	**6**	*28.6*
twisted	**5**	*29.3*	**5**	*38.4*	**8**	*38.1*
twisted+curved	**2**	*11.8*	**1**	*7.7*	**0**	*0*
undetermined	**0**	*0*	**1**	*7.7*	**0**	*0*
total	**17**	***100***	**13**	***100***	**21**	***100***

Fig. 7. Profile of the bladelets in sublayers 3a, 3b, 3c.
Abb. 7. *Profil der Lamellen in den Teilschichten 3a, 3b, 3c.*

Dimensions of blades in layer 3 in mm									
	3a2			3b			3c		
	min	max	avg	min	max	avg	min	max	avg
length				32	42	37	31	56	40.5
width	13	21	15.5	12.5	26	15.2	12.5	26	16.9
thickness	3	7	5.2	3	8	5.4	2	27	6.8

Fig. 8. Dimensions of blades in sublayers 3a, 3b, 3c.

Abb. 8. *Abmessungen der Klingen in den Teilschichten 3a, 3b, 3c.*

Retouched blades and bladelets (n = 11) are represented with nearly equal frequency (54.5 % and 45.5 % respectively) (Fig. 21: 2-4). The majority of the retouch is marginal and only one has stepped retouch. All retouched blades/bladelets have lateral retouch, where most of them have bilateral retouch followed by the retouch on the right side, while the minority of blades/bladelets is retouched on the left side. Retouch made on the left side is always partial.

The majority of the retouched flakes had invasive retouch mostly made on side. One piece had alternating invasive retouch on the left side, while two pieces were retouched on the distal end. All retouched flaks were non-diagnostic specimens (Fig. 21: 5-6).

There were only two endscrapers in sublayer 3c. One endscraper was made on a flake on the right side of the distal end (Fig. 21: 7). The second endscraper was made on the right side of the distal end of a blade (Fig. 21: 8).

Only one notched tool was found in sublayer 3c (Fig. 21: 9). It was made on a wide irregular blade. The notch was made on the left side while the right side had marginal retouch. The collection of tools from sublayer 3c contains one perforator made on a flake. The perforator is made on the right side of the distal end. The only raclette is produced on a distal flake fragment with a semi-steep invasive retouch on the distal end (Fig. 21: 11). Further tools are a truncated tool made on a thick flake (Fig. 21: 10) and a small bilateral sidescraper on a chalcedony flake (Fig. 21: 12).

Sublayer 3b

Sublayer 3b contains 96 lithic artefacts which comprises 30.7 % of all artefacts found in layer 3. In this sublayer a preference for good quality flint in comparison to chalcedony (Fig. 4) is noticed. Low quality flint is used to a lesser extent than in sublayer 3c, while quartzite is still present as raw material (Fig. 4). In two cases (2.1 %) it was impossible to determine the raw material type due to thermal/chemical damage.

All technological categories are present in the lithic collection of sublayer 3b (Fig. 5). Flakes are represented with the highest frequency followed by blades and bladelets (Fig. 5).

Tools comprise 23.9 % of the whole collection of sublayer 3b.

Cores

There is only one formal core in sublayer 3b. It is an irregular exhausted core for flakes made on a piece of chalcedony (32x35x20 mm) (Fig. 22: 1).

Flakes

Flakes make up 37.5 % of the lithics in sublayer 3b. Cortex is present on 36.1 % of the cases with 4 completely cortical pieces. On decorticated pieces, scars are mostly unidirectional, followed by multidirectional ones, while bidirectional and diagonal scars are present with one sample each (Fig. 10). The majority of platforms are unprepared, formed by a single blow or punctiform/lineal, while prepared platforms are dihedral or facetted (Fig. 13). More than half of flakes are completely preserved (Fig. 16). The length of the flakes ranges from 14-63 mm with an average of 28.8 mm, the width ranges from 10-44 mm with an average of 23.3 mm while the thickness ranges from 2-28 mm with an average of 8.25 mm.

Blades

Blades are represented with 14.6 % of the collection from sublayer 3b. Cortex is present on 64.3 % of the blades with one completely cortical piece. Most pieces

Dimensions of bladeletes in layer 3 in mm									
	3a2			3b			3c		
	min	max	avg	min	max	avg	min	max	avg
length	21	26	22.6	18	25	21	13	15	14
width	5	12	9.3	4	12	8.6	4	12	7.8
thickness	1	6	3.1	1	6	3.2	1	6	2.8

Fig. 9. Dimensions of bladelets in sublayers 3a, 3b, 3c.

Abb. 9. *Abmessungen der Lamellen in den Teilschichten 3a, 3b, 3c.*

Direction of scars on flakes						
	3a		3b		3c	
	total	%	total	%	total	%
unidirectional	**10**	*38.5*	**10**	*27.8*	**17**	*44.7*
bidirectional	**1**	*3.8*	**2**	*5.5*	**0**	*0*
multidirectional	**5**	*19.2*	**8**	*22.2*	**11**	*28.9*
diagonal	**0**	*0*	**1**	*2.8*	**1**	*2.6*
undetermined	**10**	*38.5*	**15**	*41.7*	**9**	*23.8*
total	**26**	***100***	**36**	***100***	**38**	***100***

Fig. 10. Dorsal scars on flakes in sublayers 3a, 3b, 3c.

Abb. 10. *Dorsale Negative auf den Abschlägen in den Teilschichten 3a, 3b, 3c.*

have <50 % cortex, where of cortex is mainly on the lateral edge forming a naturally backed surface. Dorsal scars are equally unidirectional and multidirectional (Fig. 11). Blades have mostly irregular and trapezoidal cross-section while polygonal and triangular are less represented (Fig. 19). Profile of the blades is equally straight and twisted (Fig 6a). Fragmentation is high, only 21.4 % of blades are completely preserved. All three parts of blades are represented with distal fragments being most frequent (Fig. 17). Due to the high fragmentation rate, platform is recognized only on one artefact where platform was prepared, dihedral (Fig. 14). Length of the blades is measured only on two artefacts with an average length of 37 mm. Width ranges from 12.5-25 mm with an average of 15.2 mm, while thickness ranges 3-8 mm with an average of 5.4 mm.

Bladelets

Blades/bladelets are represented by 13.5 % of the collection from layer 3b. Cortex is present on 30.8 % of the bladelets with most pieces containing <50 % cortex. Cortex is positioned on the left or right lateral edge, forming a naturally backed surface. The direction of dorsal scars is dominantly unidirectional, with just one case of multidirectional scars (Fig. 12). Bladelets had mostly triangular cross-sections, followed by trapezoidal and irregular cross-sections (Fig. 20). Polygonal cross-sections are also present (Fig. 20). The profile of the bladelets is equally straight and twisted (Fig. 7). Platforms are mostly unprepared formed by a single blow, while only one case of prepared platform (facetted) is present (Fig. 15). The fragmentation rate is high, with only 30.8 % of the bladelets being completely preserved (Fig. 18). All three parts of the bladelets are equally represented. The length of the bladelets ranges from 18-25 mm with an average of 21 mm, the width ranges from 4-12 mm with an average of 8.6 mm while thickness ranges from 1-6 mm with an average of 3.2 mm (Fig. 9).

Tools

Tools comprise 23.9 % of the assemblage of sublayer 3b, where most tools were made on flakes (60.9 %), followed by blades (26.1 %) and bladelets (13 %). A variety of tools is present in the collection, dominated by retouched flakes (39.1 %), followed by notched tools (17.4 %) and retouched blades and bladelets (13.1 %). Truncated tools, perforators and endscrapers are equally represented at 8.7 % each. There is also backed bladelet.

Retouched flakes (n = 9) are the most common tool category, although all of them are non-diagnostic specimens (Fig. 22: 2-3). The majority of retouched flakes have marginal lateral retouch, while invasive and stepped retouch are also present. Following retouched flakes are notched tools (n = 4) with notches on the lateral sides (Fig. 22: 4-5). Retouched blades and bladelets (n = 3) are the next frequent tool category (Fig. 22: 6). There was only one retouched bladelet while the rest are retouched blades. The retouched bladelet has fine marginal retouch on the left distal end (Fig. 22: 7). Blades were retouched laterally by marginal retouch. There are two truncated tools (n = 2) (Fig. 22: 8-9). One is made on a massive quartzite flake, while the second truncation was made on a bilaterally retouched blade. From two endscrapers one was made on a massive flake (Fig. 22: 10) while the second one was made on a fragmented blade (Fig. 22: 11). Both perforators were made on flakes: one with lateral retouch (Fig. 22: 12) and the other one with retouch on the right distal end (Fig. 22: 13). One

Direction of scars on blades						
	3a		3b		3c	
	total	%	total	%	total	%
unidirectional	**9**	*75*	**6**	*42.8*	**4**	*33.3*
bidirectional	**0**	*0*	**0**	*0*	**0**	*0*
multidirectional	**1**	*8.3*	**5**	*35.7*	**6**	*50*
undetermined	**2**	*16.7*	**3**	*21.5*	**2**	*16.7*
total	**12**	***100***	**14**	***100***	**12**	***100***

Fig. 11. Dorsal scars on blades in sublayers 3a, 3b, 3c.

Abb. 11. *Dorsale Negative auf den Klingen in den Teilschichten 3a, 3b, 3c.*

Direction of scars on bladelets						
	3a		3b		3c	
	total	%	total	%	total	%
unidirectional	**14**	*82.3*	**10**	*76.9*	**17**	*80.9*
bidirectional	**1**	*5.9*	**0**	*0*	**1**	*4.8*
multidirectional	**0**	*0*	**1**	*7.7*	**2**	*9.5*
undetermined	**2**	*11.8*	**2**	*15.4*	**1**	*4.8*
total	**17**	***100***	**13**	***100***	**21**	***100***

Fig. 12. Dorsal scars on bladelets in sublayers 3a, 3b, 3c.

Abb. 12. *Dorsale Negative auf den Lamellen in den Teilschichten 3a, 3b, 3c.*

Platforms on flakes in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
single blow	10	38.6	16	44.5	22	57.9
linear	1	3.8	1	2.7	0	0
punctiform	1	3.8	1	2.7	0	0
cortical	1	3.8	0	0	3	7.9
dihedarl/faceted	1	3.8	4	11.2	2	5.3
n/a	12	46.2	14	38.9	11	28.9
total	26	100	36	100	38	100

Fig. 13. Platform on flakes in sublayers 3a, 3b, 3c.

Abb. 13. *Schlagflächenreste der Abschläge in den Teilschichten 3a, 3b, 3c.*

Platforms on bladelets in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
single blow	4	23.5	4	30.8	4	19.1
linear	0	0	1	7.7	0	0
punctiform	2	11.8	0	0	3	12.3
cortical	0	0	0	0	0	0
dihedarl/faceted	1	5.9	1	7.7	0	0
n/a	10	58.8	7	53.8	14	66.6
total	17	100	13	100	21	100

Fig. 15. Platform on bladelets in sublayers 3a, 3b, 3c.

Abb. 15. *Schlagflächenreste der Lamellen in den Teilschichten 3a, 3b, 3c.*

backed piece is a fragmented, straightly backed bladelet made on chalcedony (Fig. 22: 14).

Sublayer 3a

There are 74 artefacts in total in sublayer 3a, which makes up 23.6 % of all artefacts found in layer 3. Good quality flint and chalcedony were used for lithic production with similar frequency (Fig. 4). Concerning the technological categories sublayer 3a shows a better representation of laminar components than of flakes unlike the underlying layers. These are followed by chips then chunks, raw material pieces and at last rejuvenation pieces (Fig. 5). It was impossible to determine a category in 2.7 % of the cases due to chemical or thermal damage. Cores are missing from the lithic assemblage of sublayer 3a.

Tools comprise 37.8 % of the lithic assemblage of sublayer 3a.

Flakes

Flakes represent 35.1 % of the lithic assemblage in sublayer 3a. Cortex is present on 46 % of the flakes, where three are completely cortical pieces while most of the pieces containing cortex have <50 % cortex coverage. The direction of scars is unidirectional, followed by multidirectional scars while bidirectional is present on one flake (Fig. 10). The majority of platforms are unprepared; only one flake has a prepared, dihedral platform (Fig. 13). More than half of the flakes were preserved completely, accompanied by similar frequencies of distal, medial and proximal fragments (Fig. 16). The length ranges from 15-45 mm with an average of 24.4 mm, the width ranges from 11-56 mm with an average of 24.1 mm and the thickness ranges from 2-30 mm with an average of 9.23 mm.

Blades

Blades represent 16.3 % of the lithic assemblage in sublayer 3a. Cortex is present on 25 % of the blades and is positioned on left or right lateral side. Majority of blades exhibits unidirectional scar patterning, while only one case has multidirectional scars (Fig 9a). In most cases the cross-section is triangular, followed by trapezoidal (Fig. 19). Profiles of the blades are equally straight and twisted, while curved profiles are also present (Fig. 6). Fragmentation rate is high, more than 90 % of the blades were fragmented, with only one complete blade (Fig. 17). Due to the high fragmentation rate, platforms are recognized in only three cases and all of the recognized platforms were unprepared (Fig. 14). Width ranges from 13-21 mm with an average of 15.5 mm, while thickness ranges from 3-7 mm

Platforms on blades in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
single blow	2	16.7	0	0	4	33.4
linear	0	0	0	0	1	8.3
punctiform	1	8.3	0	0	0	0
cortical	0	0	0	0	0	0
dihedarl/faceted	0	0	1	7.1	1	8.3
n/a	9	75	13	92.9	6	50
total	12	100	14	100	12	100

Fig. 14. Platform on blades in sublayers 3a, 3b, 3c.

Abb. 14. *Schlagflächenreste der Klingen in den Teilschichten 3a, 3b, 3c.*

Fragmentation in flakes in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
complete	14	53.8	21	58.3	20	52.6
distal	6	23.2	8	22.2	4	10.6
medial	3	11.5	3	8.4	2	5.3
proximal	3	11.5	3	8.4	11	28.9
half	0	0	1	2.7	1	2.6
undetermined	0	0	0	0	0	0
total	26	100	36	100	38	100

Fig. 16. Fragmentation in flakes in sublayers 3a, 3b, 3c.

Abb. 16. *Fragmentierung der Abschläge in den Teilschichten 3a, 3b, 3c.*

Fragmentation of blades in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
complete	1	8.3	3	21.4	4	33.3
distal	5	41.7	6	42.8	1	8.3
medial	4	33.3	4	28.6	3	25.1
proximal	2	16.7	1	7.2	4	33.3
longitudinal fragment	0	0	0	0	0	0
total	12	100	14	100	12	100

Fig. 17. Fragmentation in blades in sublayers 3a, 3b, 3c.

Abb. 17. *Fragmentierung der Klingen in den Teilschichten 3a, 3b, 3c.*

Cross-section of blades in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
triangular	9	75	3	21.4	6	50
trapezoidal	3	25	4	28.6	3	25
polygonal	0	0	2	14.3	1	8.3
irregular	0	0	5	35.7	1	8.3
undetermined	0	0	0	0	1	8.3
total	12	100	14	100	12	99.9

Fig. 19. Cross-section in blades in sublayers 3a, 3b, 3c.

Abb. 19. *Querschnitte der Klingen in den Teilschichten 3a, 3b, 3c.*

with an average of 5.2 mm. Length was measured only on one blade and thus is not relevant (Fig. 8).

Bladelets

Bladelets comprise 22.9 % of the lithic collection of sublayer 3a. Cortex is present on 17.6 % of bladelets, and there are no completely cortical bladelets. Unidirectional scars are present on the majority of the bladelets, with bidirectional scars present in only one case (Fig. 12). In most cases the cross-section is triangular, with one case of trapezoidal and irregular each (Fig. 20). The profile of the bladelets is almost equally straight and twisted while curved profile is least represented (Fig. 7). The majority of platforms were unprepared with just one case of a prepared facetted platform (Fig. 15). Only 17.6 % of the bladelets are complete (Fig. 18). The length ranges from 21-26 mm with an average of 22.6 mm, the width ranges from 5-12 mm with an average 9.3 mm while the thickness ranges from 1-6 mm with an average of 3.1 mm (Fig. 9). It must be noted that the uniformity of the length is only due to a very low number of complete pieces and thus is unreliable.

Tools

Tools comprise 37.8 % of the collection of sublayer 3a, where the majority of tools were made on blades/bladelets (57.1 %). Tools on blades or bladelets are equally represented. Flakes were used as blanks for 39.3 % of the tools, while one tool was made on a piece of raw material. A wide variety of tools is present, comprising retouched blades and bladelets (28.6 %), retouched flakes (21.4 %), notched and denticulated tools (21.4 %), and endscrapers (14.3 %) while burins, backed bladelets, shouldered pieces and sidescrapers are all represented by one piece each.

Retouched blades and bladelets (n = 9) are mostly represented by retouched blades (n = 6) (Fig. 23: 2 & 12), while there are fewer retouched bladelets (n = 3) (Fig. 23: 1). All of them have lateral marginal retouch. Retouched flakes (n = 6) are mostly marginally, sometimes alternately retouched and retouch is located on all sides of the flakes (Fig. 23: 3-4). Notched/denticulated tools (n = 5) are mostly made on the lateral sides of blades and bladelets, while only one is made on a flake (Fig. 23: 5-6). Endscrapers (n = 4) are predominantly on flakes while only one was made on a blade (Fig. 23: 7-9). There is one irregular endscraper (Fig. 23: 7). Two other endscrapers are also bilaterally retouched. One sidescraper is made on a thick flake and has steep scalar retouch on a lateral side (Fig. 23: 10). A burin (or core) is made on a piece of raw material (Fig. 23: 11). It is a dihedral burin formed by two laminar negatives and one flake negative. Also, one backed piece was found, a straight backed bladelet (Fig. 23: 13).

Fragmentation of bladelets in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
complete	3	17.6	4	30.8	2	9.6
distal	8	47.1	3	23.1	7	33.3
medial	1	5.9	4	30.8	7	33.3
proximal	4	23.5	2	15.3	5	23.8
longitudinal fragment	1	5.9	0	0	0	0
total	17	100	13	100	21	100

Fig. 18. Fragmentation in bladelets in sublayers 3a, 3b, 3c.

Abb. 18. *Fragmentierung der Lamellen in den Teilschichten 3a, 3b, 3c.*

Cross-section of bladelets in layer 3						
	3a		3b		3c	
	total	%	total	%	total	%
triangular	15	88.2	7	53.8	11	52.4
trapezoidal	1	5.9	3	23.1	9	42.8
polygonal	0	0	1	7.7	0	0
irregular	1	5.9	2	15.4	1	4.8
undetermined	0	0	0	0	0	0
total	17	100	13	100	21	100

Fig. 20. Cross-section in bladelets in sublayers 3a, 3b, 3c.

Abb. 20. *Querschnitte der Lamellen in den Teilschichten 3a, 3b, 3c.*

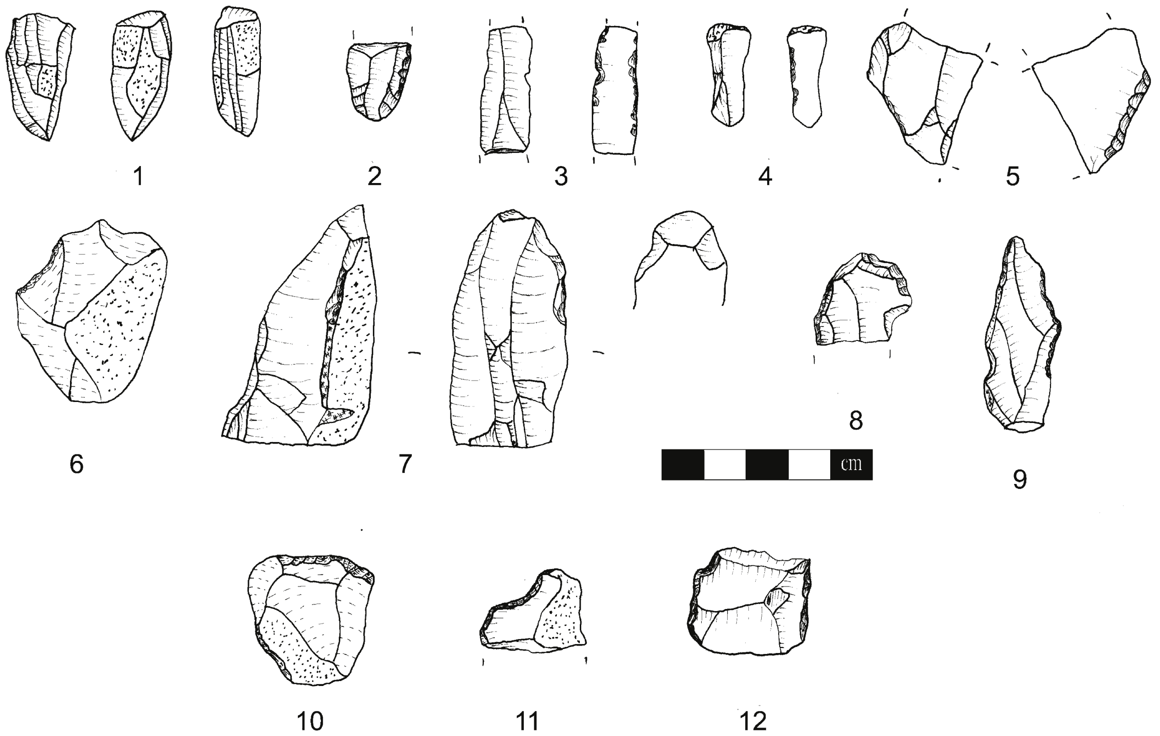

Fig. 21. Lithic artefacts from sublayer 3c: (1) core, (2) retouched blade, (3-4) retouched bladelets, (5-6) retouched flakes, (7-8) endscrapers, (9) notched tool, (10) truncation, (11) raclette and (12) sidescraper.

Abb. 21. *Steinartefakte aus Teilschicht 3c: (1) Kern, (2) retuschierte Klinge, (3-4) retuschierte Lamellen, (5-6) retuschierte Abschläge, (7-8) Kratzer, (9) gekerbtes Stück, (10) gebrochenes Stück, (11) Raclette und (12) Schaber.*

Technology of the Gravettian assemblage throughout layer 3

Throughout layer 3, similar choices of raw materials were made for lithic production. Overall, it is noticeable that good quality raw material was used for the lithic production throughout layer 3, where good quality flint and chalcedony amount to more than 70 % of the raw material in all sublayers. In sublayer 3c good quality flint and chalcedony are used in equal frequency while the trend seems to shift towards good quality flint in sublayer 3b (Fig. 4), while in sublayer 3a, chalcedony has a slightly higher frequency then good quality flint (Fig. 4). Low quality flint shows a decreasing frequency from layer 3c to 3a (Fig. 4). There is a constant use of quartzite in the tool production of Meča Dupka. Although not a very usual phenomenon, this is not an isolated case, as more Gravettian sites contain quartzite artefacts (Pentek 2019). The fact that most of the quartzite in Meča Dupka was found as final products is thought-provoking. As local material found in local streams, quartzite is usually used for expedient tool making, but it is usually present with part or complete chaîne opératoire. Its presence in Meča Dupka only as final products may have different explanations. It is possible that quartzite was worked at another part of the site and brought to the niche in southern wall to perform certain activities. It is also possible that it was brought to Meča Dupka from another nearby site.

Technological categories are distributed similarly in all sublayers of layer 3. However, certain differences can be noticed. Flakes are dominant over blades in the two lower sublayers, while laminar component is dominant over flakes in sublayer 3a (Fig. 5). By-products of knapping (rejuvenation pieces, chips, chunk, raw material pieces) show the highest frequency in the lowermost sublayer, sublayer 3c, and this frequency declines from layer 3c to 3a (Fig. 5). This corresponds to an increase in the percentage of tools (Fig. 5). Cortex is equally represented in all sublayers of layer 3, where 30-40 % of the flakes, blades and bladelets were found with cortex. Completely cortical and flakes/blades/bladelets having >50 % cortex coverage are least represented in sublayer 3c with 7 %, while their frequency is highest in layer 3b with 20.7 %. In all three sublayers the majority of dorsal scars patterns on flakes, blades and bladelets are unidirectional (Figs. 10-12). However, in all sublayers there is a certain amount of bidirectional and multidirectional scars patterns. Considering the directions of dorsal scars it is noticed that knapping technique was similar in all sublayers. Profiles of the blades are in almost equal frequency straight and twisted throughout the sequence with exception of sublayer 3c where straight profiles dominate (Fig. 6). Profiles of the bladelets are equally straight and twisted (Fig. 7). Platforms are dominantly unprepared, which remains constant in all three sublayers (Figs. 13-15). More than 50 % of the

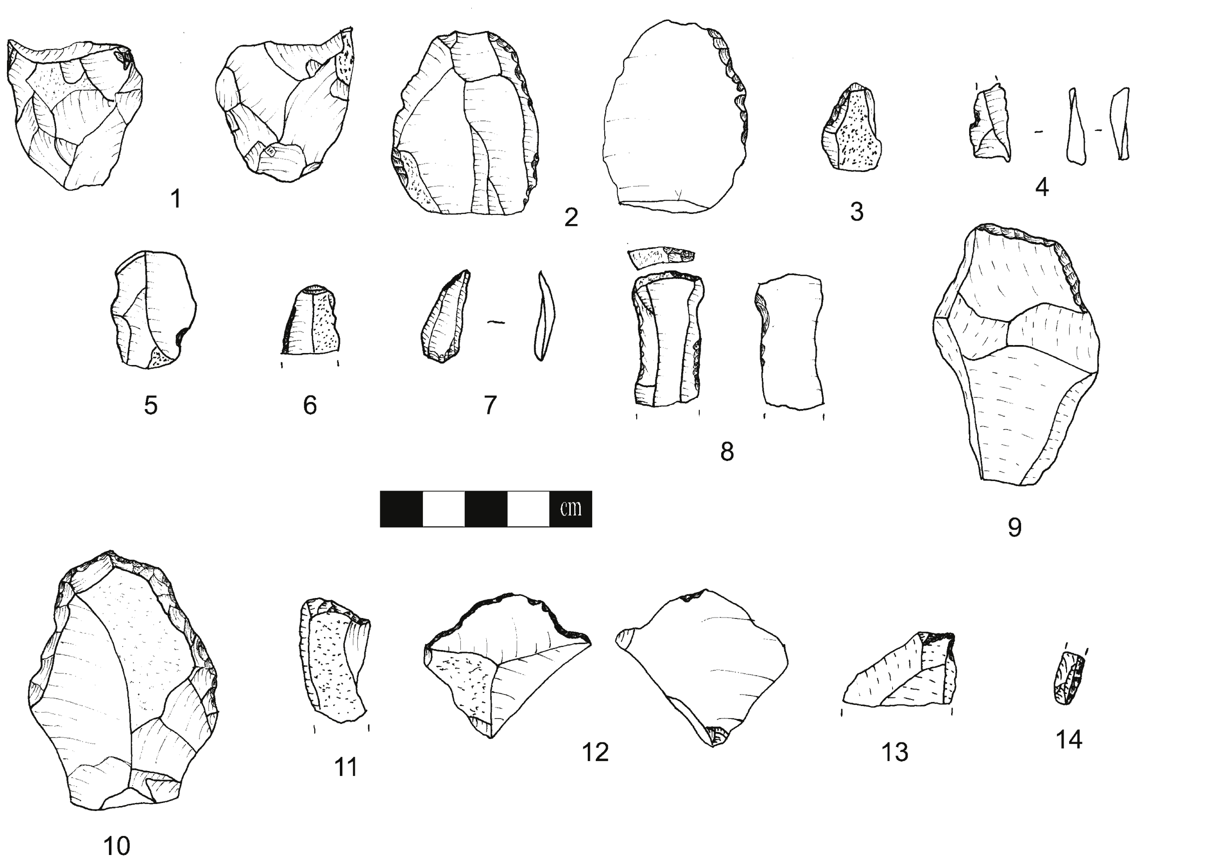

Fig. 22. Artefacts from sublayer 3b: (1) core, (2-3) retouched flakes, (4-5) notched tools, (6) retouched blade, (7) retouched bladelet, (8-9) truncations, (10-11) endscrapers, (12-13) perforators and (14) backed bladelet.

Abb. 22. *Artefakte aus Teilschicht 3b: (1) Kern, (2-3) retuschierte Abschläge, (4-5) gekerbte Stücke, (6) retuschierte Klinge, (7) retuschierte Lamelle, (8-9) gebrochene Stücke, (10-11) Kratzer, (12-13) Bohrer and (14) rückengestumpfte Lamelle.*

debitage is fragmented in all three sublayers, while blades and bladelets show very high fragmentation rates, where only around 20 % is completely preserved. Considering the dimensions, a tendency is noticed towards a decrease in size in lower sublayers, especially in length of bladelets (Figs. 8 & 9). As far as blades and bladelets are concerned standardization is noticed in width and thickness of the blades and bladelets, where the average width and thickness of the blades and bladelets throughout the sequence remains constant.

The composition of tools is somewhat similar throughout the sequence. Whereas flakes dominate as blanks in layer 3b, in sublayers 3a and 3c laminar component in blanks is more represented. In the case of sublayer 3c the difference is subtle (50 % to 46 %), while in sublayer 3a the difference is more distinct (57 % to 39 %). An increase of endscrapers and notched/denticulate tools is noticed from sublayer 3c to 3a. In all sublayers the most represented tool type is simply retouched blanks.

Considering the above-mentioned characteristics, it is possible to draw certain conclusions about sublayers 3a, 3b, 3c at Meča Dupka. First, all three sublayers contain a very high percentage of tools in the assemblages, which is an indication of the short-term occupation of the site. A preference towards better quality raw material is noticeable from layer 3c to layer 3a. It corresponds to the decrease in the frequency of by-products of knapping and the increase in the percentage of tools in the assemblages. All of this points towards a conclusion that in the lower sublayers, Meča Dupka was settled for longer periods of time than in the upper sublayers, as evidence of flintknapping on site is more obvious in the lower sublayers. These lower sublayers also have a lower frequency of tools. It can also be concluded that knapping techniques were similar in all three sublayers, since the direction of dorsal scars, platform types and blades and bladelets profiles are uniform throughout the sequence. Debitage was produced mostly from single platform cores, but double platform cores were used, as is indicated by the double platform core from layer 3c. There was also a significant decrease in the dimension of the debitage over time, especially with bladelets.

Attribution of these assemblages to Gravettian is based on the date and two diagnostic backed pieces. However, since the date is obtained for the lowermost layer, the possibility of upper layers being much younger in age is not excluded. Epigravettian may be considered as the possible technological complex for the upper sublayers, although for now there is no

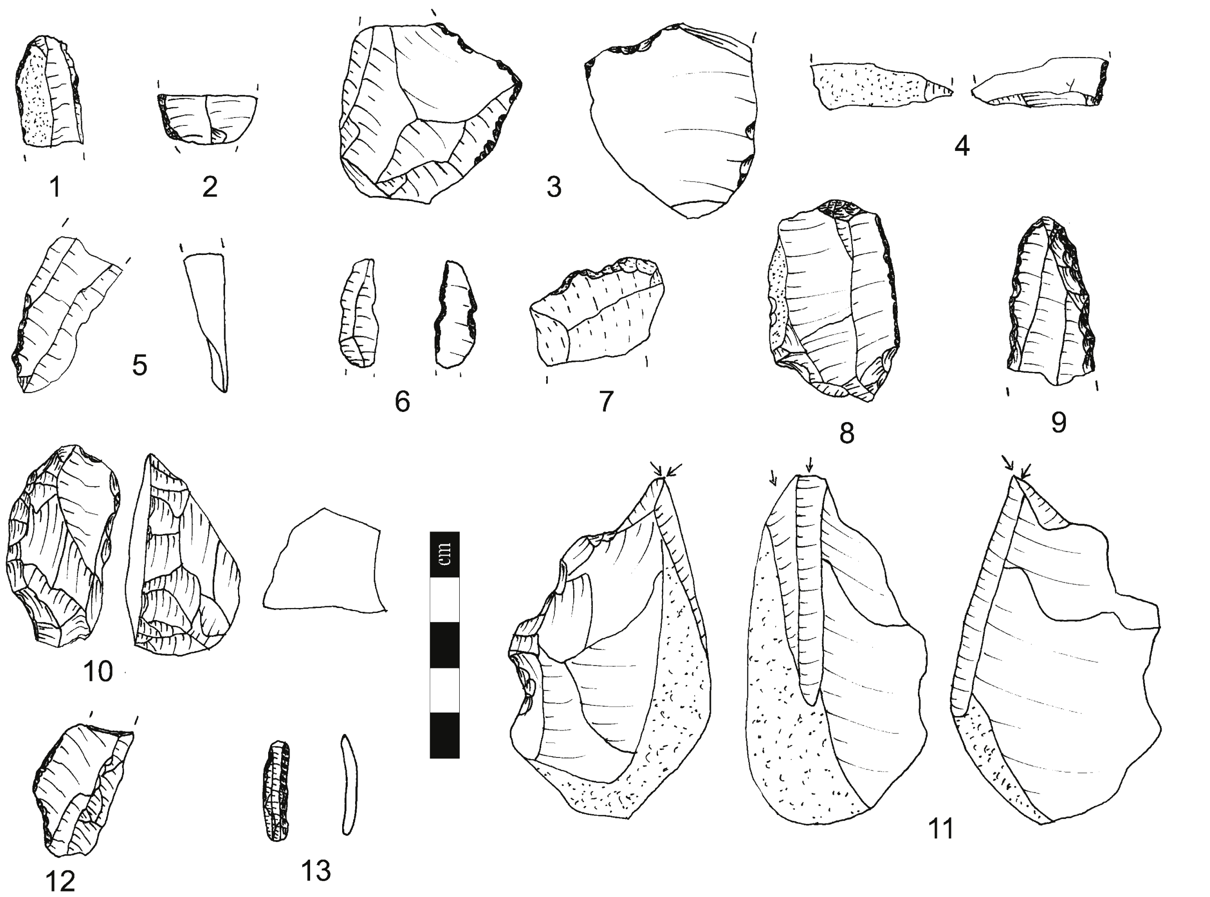

Fig. 23. Artefacts from sublayer 3a: (1) retouched bladelet, (2) retouched blade, (3-4) retouched flakes, (5-6) notched tools, (7-9) endscrapers, (10) sidescraper, (11) burin, (12) atypical shouldered point and (13) backed bladelet.

Abb. 23. *Artefakte aus Teilschicht 3a: (1) retuschierte Lamelle, (2) retuschierte Klinge, (3-4) retuschierte Abschläge, (5-6) gekerbte Stücke, (7-9) Kratzer, (10) Schaber, (11) Stichel, (12) atypische Kerbspitze und (13) rückengestumpfte Lamelle.*

empirical evidence to back this assumption. All of this allows us to conclude that sublayers represent different occupations, however, similarities in technology and tool composition may indicate that the hiatuses between the occupations at Meča Dupka were short.

Regional comparison

The lithic composition of layer 3 indicates attribution to the Gravettian technocomplex, with the presence of straight backed bladelets. The date for the lower sublayer (sublayer 3c) also supports this conclusion. However, the lithic assemblage of Meča Dupka cave site is not very characteristic of the Gravettian. Unlike an evolved Gravettian, layers at Meča Dupka show almost a complete lack of typical Gravettian tool types with the exception of two backed bladelets. The high frequency of twisted blades and bladelets are also uncharacteristic of the Gravettian. The composition of tools is far from the typical Gravettian tool kit, which usually contains a high frequency of burins (Conard & Moreau 2004; Lengyel et al. 2016: 180).

As was previously mentioned, little has been published concerning the Gravettian in the Balkans, compared to the well-researched Gravettian industries of other parts of Europe. Consequently, interpreting the industry at Meča Dupka layer 3 is even more challenging.

One of the few well-researched and published sites in the Balkans is Temnata Dupka in Bulgaria, which contains an extensive sequence belonging to the Gravettian (Fig. 1). The lowermost Gravettian layers of Temnata Dupka (VIII-X) are dated to 28 900 ± 1 100 BP. Layer VII which lies on top of the layer VIII was dated to 23 400 ± 1 600 BP. Therefore, layers at Temnata Dupka are slightly older and slightly younger than the Gravettian industry from Meča Dupka (25 420 ± 190 BP). Layers in Temnata Dupka are very rich in finds, with around 1 000 finds per layer. The lower layers of Temnata Dupka are similar to layer 3 in Meča Dupka in the lack of the typical Gravettian tool types and low number of backed pieces. However, the layers from Temnata Dupka contain a high amount of Aurignacoid elements such as nosed endscrapers, carinated endscrapers and Dufour bladelets (Drobniewicz et al. 1992: 309). Layer VII shows a higher similarity to layer 3 at Meča Dupka. Tool composition is very similar with a low number of backed pieces, an absence of burins and lack of characteristic tools apart from microgravettes (Drobniewicz et al. 1992: 309). In this sense, it should be noted that layer 3 from Meča Dupka does not only fall chronologically in between layer VII and layer VIII of Temnata Dupka, but also represents a mixture of the technologies from these two layers. Layer 3 from Meča Dupka does not show a high resemblance to the Aurignacian as layer VIII of Temnata Dupka does, but also does not have typical microgravettes represented in layer VII of Temnata Dupka. Layer 3 from Meča Dupka contains a very high proportion of tools which is a big difference compared to layers at Temnata Dupka. Differences seen in the technology and tool types may also be the consequence of the different settlement patterns.

A little earlier date than that of from Meča Dupka was obtained for Kozarnika (Fig. 1) layer IVb (26 120 ± 120 BP) in western Bulgaria (Tsanova 2003: 33). The industry of layer IVb at Kozarnika is similar with Meča Dupka layer 3 industry in some aspects, while in other ways it resembles more closely the Central European Gravettian. In Kozarnika layer IVb flakes are dominant over blades, the profiles of blades and bladelets are rectilinear, unprepared platforms and triangular cross sections are dominant. More than half of the pieces are fragmented. In the tool composition retouched blades are most represented, then denticulate/notched tools, followed by endscrapers and truncations. Burins are represented at 4.2 % (Tsanova 2003). Tool composition is in some ways similar to Meča Dupka as burins are not dominant as in the Central European Gravettian, and simple retouched blanks are very well represented. However, in Kozarnika layer IVb industry, backed pieces are very well represented. Kozarnika also exhibits some local aspects such as the points of Kozarnika (Tsanova 2003). Therefore, differences from the rest of the sites with similar radiocarbon dates may be attributed to local variations.

Similar dates have been obtained for two sites in Greece. Theopetra (Fig. 1) yielded a date of 25 820 ± 270 BP and 25 625 ± 500 BP but the level corresponding to these dates is very scarce in artefacts. While a few backed bladelets are reported, diagnostic tool types and organic artefacts are absent (Adam 2007). A slightly earlier date (26 100 ± 900 BP) comes from Aprochalico (Fig. 1) where the tool inventory consists predominantly of bladelet tools followed by endscrapers and a limited number of backed tools, with burins and organic artefacts completely absent from the collection (Adam 2007). In Kastritsa, stratum 9 is dated to a similar period (23 880 ± 100 BP), however, no artefacts are reported from this level, while in the upper levels (stratum 3 and 5) an evolved Gravettian industry is present (Adam 2007). The Gravettian industry from Meča Dupka, therefore corresponds to the similarly dated industry from Greece, especially in the absence of burins and organic artefacts while tool composition is also comparable.

Closer to Meča Dupka are three sites from Serbia, which have similar dates and industries as layer 3. Pešturina cave is located some 20 km southeast of Meča Dupka (Fig. 1) and contains a Gravettian industry in layer 2, which yielded a date of 26 121 ± 622 BP (Alex et al. 2014). The industry from layer 2 in Pešturina has a great similarity with the industry from Meča Dupka as tools also occur at high frequencies (almost 30 % in the assemblage) (Mihailović 2014: 87). Tool composition is broadly similar, although at Pešturina the tool assemblage is dominated by backed tools (Mihailović & Milošević 2012). Pećina kod stene is another site containing Gravettian industry, but it was not yet dated (Fig. 1). The industry is quite similar to Meča Dupka layer 3, however, the low number of artefacts found (around 30 pieces) does not allow any further comparisons (Mihailović et al. 2017). Another Gravettian site in Serbia is Šalitrena pećina (Fig. 1) and was dated to 24-25 000 BP (Mihailović 2013). Šalitrena pećina represents the richest Gravettian site in the region with the industry being similar to the Gravettian industries of Willendorf II in Austria and sites belonging to the Pavlovian (Mihailović 2008: 106). Therefore, Šalitrena pećina is more connected to the Central European Gravettian than other sites in the region (Mihailović 2008), which might be the consequence of the location of the site at the edge of the Carpathian basin, while other sites in the region are in the interior. Two more sites in Serbia, Hadži Prodanova cave (Fig. 1) and Bukovac yielded industries resembling the Gravettian, but limited details are published. Hadži Prodanova cave had only a couple of artefacts among which are backed bladelets, a single truncated tool and one point (Mihailović 2014: 91), while in Bukovac 120 lithic artefacts were reported with mostly flaking by-products (Dogandžić et al. 2014: 90).

There are other sites in the region with Gravettian industries, however, they date to later periods, and the goal of this assessment was to compare only sites that are chronologically close together. Apart from Šalitrena pećina, which has a different location than the other sites discussed here and a very clear connection to the Central European Gravettian, all of the sites dated 26-24 000 BP in the region share similarities, although there are differences in site functions, with base camps like Temnata Dupka or temporary camps like Pešturina and Meča Dupka. This factor has an impact on the lithic assemblage of the site. However, despite these differences, that are mostly in the technological composition of the assemblages (ratio of tools to rest of the assemblage, frequency of flaking byproducts, etc), similarities between the industries dated to the same period can be seen. First of all, all the sites in the region lack organic artefacts. On some sites that have an extensive Gravettian sequence, organic artefacts start to appear later in the sequence, but in the period from 26-24 000 BP, they are completely absent. Furthermore, burins are - compared to the Central European Gravettian where they dominate - also scarce in these assemblages. It is also noticed that backed tools are present but not a dominant part of the tool composition.

Faunal analysis

The osteological material presented was collected during the excavations of 2018, and was found in all sublayers of layer 3. Since sublayer 3c was mostly excavated in 2019, the results for sublayer 3c presented in this paper are not conclusive. All excavated sediment was dry sieved, through sieves of 3 mm diameter. This enabled the collection of smaller fragments of large mammals, as well as remains of micromammals. Specimens were identified based on the comparative collections at the Laboratory for Bioarchaeology of the Department of Archaeology, Faculty of Philosophy - University of Belgrade. Remains of large mammals, micromammals, birds and fish were quantified separately.

The remains were quantified using two methods: NISP (Number of Identified Specimens) and MNI (Minimum number of Individuals) (Lyman 1994). For large mammals only specimens longer than 2 cm were counted, since for smaller pieces taphonomy features are often unobservable, and they can bias the NISP count. All specimens were closely observed in order to identify traces of human activity (cut marks, percussion marks, and evidence of burning), as well as marks resulting from weathering, trampling and predator gnawing (Shipman & Rose 1983; Olsen & Shipman 1988; Lyman 1994; Haynes 1980). Every specimen with marks suspected to originate from human activity was examined under low-power magnification. Location and orientation of such marks were recorded in order to link them to a specific butchery practice (skinning, disarticulation or filleting) (Binford 1981; Lyman 1987).

Due to the high level of fragmentation of the material throughout layer 3 and the low number of identified specimens, results for layer 3 can be completely presented, while only significant differences in sublayers 3a, 3b and 3c will be discussed.

Taphonomy

The osteological material is highly fragmented. Specimens between 2 and 5 cm in length are dominant in all layers (>80 %). Most of the bones in layer 3 are black and grey, with mineral oxide coating, and lightly polished surface. During the excavations none of the bones were discovered in anatomical order.

Faunal composition and skeletal representation

We analyzed 1 058 bones and teeth from different mammal species. Because the osteological material is highly fragmented only 4,6 % of specimens could be identified to taxon (NISP = 49), and 19 specimens were identified to a higher taxonomic category (Fig. 24). Among the mammals, the remains of hare are most numerous (NISP = 14), followed by fox (NISP = 13), steppe bison (NISP = 9) and horse (NISP = 7). Other taxa are mostly represented by one specimen.

The largest number of specimens belongs to hare (*Lepus* sp.) (NISP = 14). Hare remains were found in all sublayers, but most of them were found in layer 3b. Hare is represented mostly by long and short limb bones, but axial elements are present as well (Fig. 25). NISP comprises the complete layer 3, however, the fact that hare bones are found in all three sublayers it indicates a minimum of three individuals. The next most common taxon in the osteological material from Meča Dupka is fox (*Vulpes vulpes*). The fox remains belong to a minimum of two individual, found in layers 3a and 3b. Fox is represented only by limb bones. Phalanges are the most numerous (NISP = 10), followed by metatarsal bones (NISP = 2) and one calcaneus (Fig. 25).

Large mammals from Pleistocene layers at Meča Dupka cave are represented by remains of steppe bison (*Bison priscus*), horse (*Equus ferus*), red deer (*Cervus elaphus*), ibex/chamois (*Capra ibex/Rupicapra rupicapra*), and cave bear (*Usrsus spelaeus*). It should be noted that most of the remains were found in layer 3a (Fig. 26). Remains of steppe bison (*Bison priscus*) are the most numerous fragments among large mammals (NISP = 9). The remains of steppe bison are dominated by isolated complete and fragmented lower teeth (NISP = 5) (Fig 10: 1 & 2). Limb bones were also discovered including tibia (NISP = 3) and one fragment of a metacarpal bone (Fig. 25). Different

Taxon	Layer		
	3a	3b	3c
Talpa sp.	1		
Lepus sp.	3	9	2
Meles meles	1		
Vulpes vulpes	6	7	
Ursus spelaeus		1	
Equus ferus	6	1	
Cervus elaphus	2		
Bison priscus		1	1
Bos/Bison	7		
Capra/Rupicapra		1	
Small mammal (fox-hare sized)	2	1	
Medium mammal (chamois-red deer sized)	3	3	
Large mammal (bison-horse sized)	7	2	1
Mammals size unidentified	439	416	135
Total	**477**	**442**	**139**
Total all layers	**1 058**		

Fig. 24. Animal remains discovered during excavations in 2018, layer 3, expressed as NISP.

Abb. 24. *Tierreste, die bei Ausgrabungen im Jahr 2018 entdeckt wurden, Schicht 3, dargestellt als NISP.*

Skeletal parts	Taxon			
	Lepus sp.	*Bison priscus*	*Equus ferus*	*Vulpes vulpes*
Maxilla				
Isolated upper teeth			4	
Mandible				
Isolated lower teeth		5		
Vertebrae				
Sacrum	1			
Pelvis				
Scapula	2			
Humerus				
Radius	1			
Ulna	1			
Carpals				
Metacarpals	2	1	1	
Femur				
Patella				
Tibia		3		
Fibula				
Calcaneus	1			1
Astragalus				
Tarsals				
Metatarsals	3			2
Phalanx	3		1	10
Total	**14**	**9**	**6**	**13**

Fig. 25. Skeletal element representation of hare (*Lepus* sp.), steppe bison (*Bison priscus*), horse (*Equus ferus*) and fox (*Vulpes vulpes*), from layer 3, excavations 2018, expressed as NISP.

Abb. 25. *Skelettelementdarstellung von Hase (Lepus sp.), Steppenbison (Bison priscus), Pferd (Equus ferus) und Fuchs (Vulpes vulpes), aus Schicht 3, Ausgrabungen 2018, dargestellt als NISP.*

tooth wear on two M^2 indicates that the remains belong to a minimum of two individuals. Horse (*Equus ferus*) remains (NISP = 7) belong to a minimum of one individual. The most abundant specimens are isolated complete upper teeth (NISP = 5). Four of them form the teeth row P^3-M^2. Since P^3, M^1 and M^2 erupted, and P^4 did not, it could be estimated that the age of this individual was not higher than *c.* 3.5 years (Levine 1982; Hillson 2005). Besides teeth, other skeletal elements are scarce. Only a complete second phalanx and a fragment of a metacarpus were recovered (Figs. 20 & 21: 5-9). The remains of red deer (*Cervus elaphus*) are poorly represented in the osteological material from Meča Dupka (Fig. 24). Only two specimens were identified: an almost complete p2 (Fig. 26: 4) and a fragment of a third phalanx. Bovids which inhabit rocky terrains are represented in the osteological material from Meča Dupka only by a single, nearly complete astragalus of ibex/chamois (*Capra/Rupicapra*). Due to some damage on the bone it was not possible to determine if it was chamois or ibex, but the dimensions indicate that it could be a male chamois, or a female ibex (Bosold 1968).

Large carnivores of the osteological material found at Meča Dupka are represented by only one deciduous upper canine with resorbed root belonging to a cave bear (*Ursus spelaeus*) found in layer 3b (Figs. 24 & 26: 3). This shows that at some point the cave was occupied by bears. Since it was found in layer 3b it should be noted here that the date from level 3c is near the time of cave bear extinction and the possibility of it being redeposited cannot be excluded. Future geoarchaeological analysis may contribute to this discussion.

Human activity

Signs of human activity were recorded on three bones from Meča Dupka cave. Cut marks made during different butchering processes were detected on steppe bison, caprine and hare bones (Fig. 27). A longitudinal cut mark on the upper tibial shaft fragment, belonging to steppe bison, is located on the anterior surface, probably created during filleting. On the lateral side of a right caprine astragalus a transverse cut mark was recorded, probably created during dismembering (Binford 1981; Lyman 1987). Similar marks were present on the sacrum of a hare. It should be noted here that no carnivore (e.g. gnawing marks) activity was detected.

Discussion of the faunal composition

Although the bone assemblage discovered at Meča Dupka cave layer 3 is relatively small, comprising 1 058 bones and teeth, it is possible to gather some useful data that can contribute to our knowledge about subsistence strategies in Gravettian hunter-gatherer societies. It is very important to bear in mind that large carnivores that could be responsible for accumulation of herbivore remains in caves (e.g. wolf or cave hyena) are completely absent from Meča Dupka as are gnawing marks on the bones, indicating that remains in layer 3 were deposited by humans. While remains of large and medium-sized mammals are more present in the younger sublayer 3a, hare and fox dominate the assemblage of the lower sublayers (3b). Since most of the material from layer 3c was collected during the second excavation in 2019, it was not analyzed to this date, and therefore we do not have the real picture of the faunal composition in this sublayer. However, this might indicate the change in the procurement of resources from lower to upper sublayers, that is, from smaller game in the layer 3b to larger animals in the most recent sublayer 3a.

Faunal remains from layer 3 in Meča Dupka correspond to faunal remains found in other Gravettian sites in the region such as Bukovac, Pećina kod stene and Pešturina (Dimitrijević et al. 2018; Mihailović 2014; Mihailović et al. 2017; Milošević 2016). In all of these sites it is noticed that steppe bison, horse, ibex, chamois and red deer were the main sources of meat, which corresponds to sublayer 3a from Meča Dupka. The

Fig. 26. Faunal remains: (1) *Bison priscus*, $M_{1/2}$ sin. (buccal), (2) *Bison priscus*, M_2 sin (buccal), (3) *Ursus spelaeus*, shed milk canine, (4) *Cervus elaphus*, P_2 sin. (lingual), (5) *Equus ferus*, second phalanx dext., (6) *Equus ferus*, M^2 sin. (buccal), (7) *Equus ferus*, M^1 sin. (buccal), (8) *Equus ferus*, P^4 sin. (buccal) and (9) *Equus ferus*, P^3 sin. (buccal).

Abb. 26. *Faunenreste: (1) Bison priscus, $M_{1/2}$ sin. (bukkal), (2) Bison priscus, M_2 sin (bukkal), (3) Ursus spelaeus, verlorener Milchzahn, (4) Cervus elaphus, P_2 sin. (lingual), (5) Equus ferus, zweiter phalanx dext., (6) Equus ferus, M^2 sin. (bukkal), (7) Equus ferus, M^1 sin. (bukkal), (8) Equus ferus, P^4 sin. (bukkal) und (9) Equus ferus, P^3 sin. (bukkal).*

most evident similarity is seen in Pešturina and Meča Dupka where the low quantity of animal remains and cut marks along with the high frequency of tools indicate short term occupation (or transit camps) (Milošević 2016). However, on all other sites remains of carnivores were discovered, which could be at least partially responsible for the bone accumulation in caves (Milošević 2016), This might have resulted in the subsequently larger collections in these sites, compared to Meča Dupka.

Interestingly, fox and hare were discovered in all Gravettian sites mentioned and cut marks were recorded on their elements at Bukovac (Dimitrijević et al. 2018) and Meča Dupka. This indicates deliberate hunting of fox and hare in the Gravettian, possibly for the fur.

Sites in the region with similar date, show similarities in the faunal composition with Meča Dupka. In the Upper Palaeolithic layers of Theopetra cave the most numerous animals are ibex, red deer and hare (Newton 2003: 118). This composition is characteristic for the entire Upper Palaeolithic sequence and probably includes different phases of Gravettian. For Asprohalico, it was reported that cervides and caprinae dominate, but the assemblage was not fully studied (Adam 2007). In the Gravetian layers of Temnata Cave remains of horse are dominant, followed by ibex, bison, red deer, giant deer and elk (Kozłowski 1999).

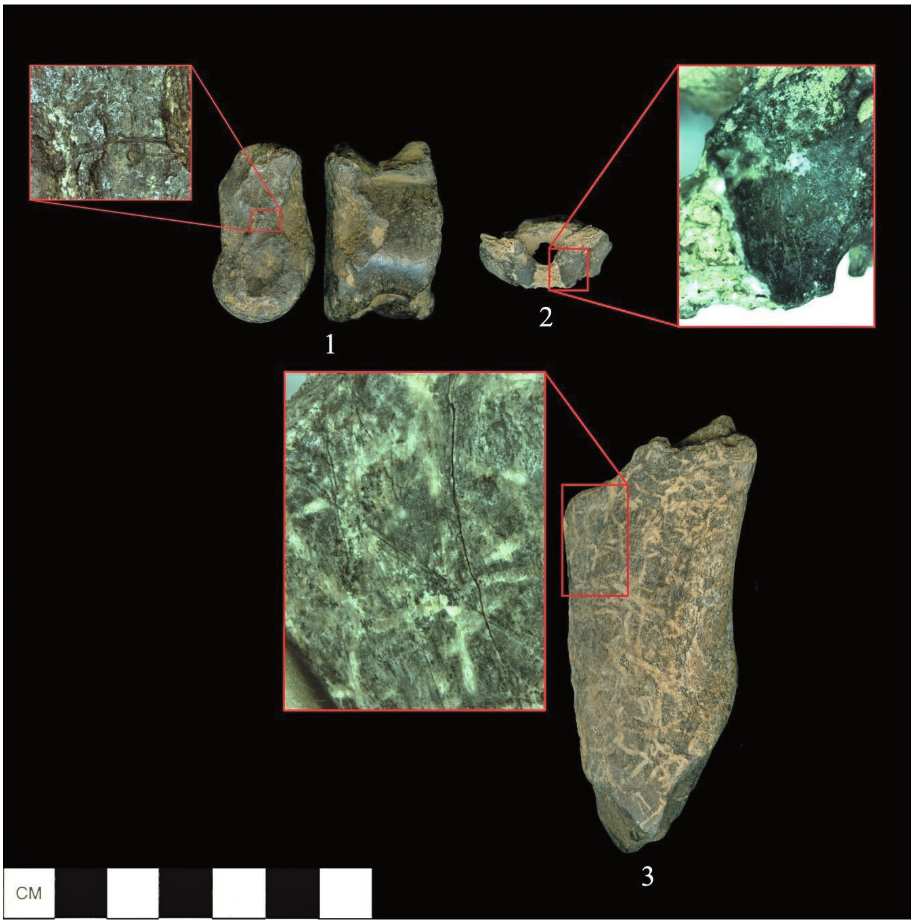

Fig. 27. Faunal remains with cut marks in layer 3: (1) *Capra/Rupicapra*, astragalus dext., (2) *Lepus* sp., sacrum fragment and (3) *Bison priscus*, tibia fragment.

Abb. 27. *Faunenreste mit Schnittspuren in Schicht 3: (1) Capra/Rupicapra, Astragalus dext., (2) Lepus sp., Kreuzbein-Fragment und (3) Bison priscus, Schienbeinfragment.*

Even with such scarce data it is evident that Gravettian communities in the Balkan region relied heavily on large herbivores and that different ecological niches were exploited. Furthermore, cut marks on fox and hare remains indicate that these animals were part of the subsistence strategies of Gravettian people. Besides the probable exploitation of these animals for meat, it is highly probable that these animals were hunted for their fur as well. In this sense it is interesting that in Meča Dupka layer 3b, we see the very short occupation with dominance of hare and fox.

Conclusion

Analysis of the lithics and fauna from layer 3 of Meča Dupka yielded some interesting conclusions about the people inhabiting the site. The early date associated with layer 3 puts Meča Dupka in an important period of the Gravettian, especially in the region of the Balkans. With a very high frequency of tools in the collection and a low number of faunal remains, it is evident that the occupation of Meča Dupka was very short. Since the sublayers of layer 3 are similar yet still show some differences it is possible that Meča Dupka was settled in very short episodes during the short period of time when layer 3 formed. The time span during which Meča Dupka was inhabited will be better understood after more dates are obtained for the site.

Both lithic and faunal analysis imply that the period of 24-26 000 BP in the Balkans represents a separate event in the development of Gravettian in the region as all the sites dated to that period exhibit similar characteristics. The absence of burins and typical Gravettian tools, presence of backed bladelets, significant frequency of endscrapers and low number of artefacts are characteristics present on all sites from this period from the inland Balkans. Subsistence strategies do not differ from the other periods of the Gravettian and are characterized by the high reliance on large and middle-sized herbivores with the presence of small sized mammals and small carnivores, possibly hunted for fur.

These conclusions are, however, drawn on the very scarce data available for the Gravettian sites on Balkans during 26-24 000 BP. Nevertheless, this study shows the importance of the more intensive and closer studies into Gravettian of the Balkans. The question of the difference between Central European and East European Gravettian compared to Balkan Gravettian still stands and is more evident than ever. Šalitrena pećina as a contrast to all other studied Balkan sites from the same period of time still remains a solitary phenomenon. If what we are seeing is a difference between cultural complexes, subsistence strategies, climatic events or something else, remains to be resolved.

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