A C T A A R C H A E O L O G I C A C A R P A T H I C A
VOL. LII, 2017 PL ISSN 0001-5229

ARTICLES

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EPIGRAVETTIAN SHOULDERED POINTS IN THE EASTERN ADRIATIC AND ITS HINTERLAND: RECONSIDERING THEIR CHRONOLOGICAL POSITION

ABSTRACT

N. Vukosavljević, I. Karavanić 2017. *Epigravettian shouldered points in the eastern Adriatic and its hinterland: reconsidering their chronological position,* AAC 52:5–21.

This paper discusses chronological position of Late Upper Paleolithic shouldered points in the eastern Adriatic and its hinterland. Shouldered points in this area are considered to be *fossil directeur* of Early Epigravettian. Using old and new data, and pointing to shortcomings in the literature, we aim to prove that shouldered points are not a reliable chronological indicator of Early Epigravettian in the eastern Adriatic because they can be found in a timespan of approximately 10 000 years.

Key words: Epigravettian; eastern Adriatic; shouldered points; *fossil directeur*

Received: 31.08.2017; Revised: 6.12.2017; Revised: 9.01.2018; Accepted: 10.01.2018

I. INTRODUCTION

Stone points are often used as chronological markers in Paleolithic archaeology (Knecht 1997), therefore shouldered points are also used as chronological indicators of Early Epigravettian in the Balkan Peninsula (Fig. 1). Their appearance in Early Epigravettian lithic assemblages of Balkan and Apennine peninsulas has been interpreted as a marker of cultural influence or even as population movement from central Europe where they appear in the final Danubian Gravettian, to southern Europe during harsh climatic conditions of Last Glacial Maximum (Kozłowski 1999; 2008a; Kozłowski, Kaczanowska 2004). As alternative or complementary explanation for their appearance Borić and Cristiani (2016, 82) suggest that this new hafting technology in Balkan and Apennine peninsulas was a part of knowledge transfer within well connected social networks established in part as a response to climatic deterioration during Last Glacial Maximum (hereinafter: LGM).

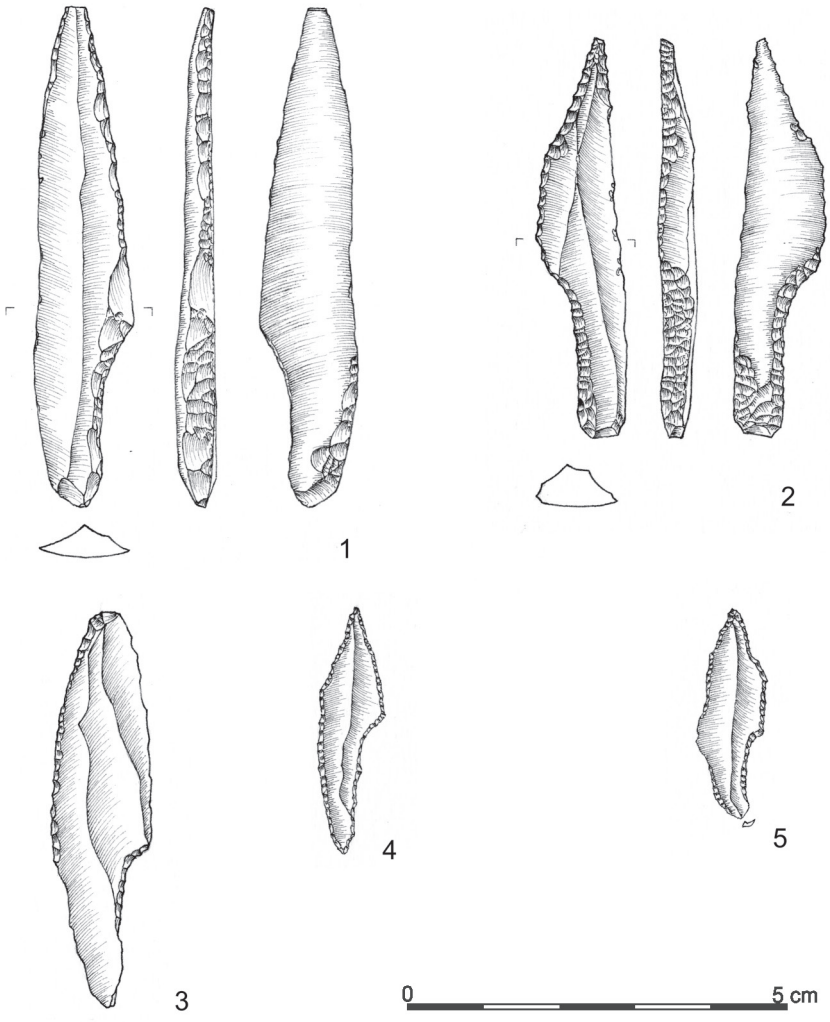

Fig. 1. Epigravettian shouldered points; drawn by M. Rončević.
1 — Šandalja II; 2 — Jama v Lozi; 3–5 — Kastritsa; redrawn after M. Malez 1987 (Šandalja II), Brodar 1986 (Jama v Lozi), Adam 1999 (Kastritsa)

The aim of this paper is to inform about chronological positions of this type of stone tool that is often taken as type fossil of the Early Epigravettian in the eastern Adriatic and its hinterland and not to try to give additional possible explanation for the appearance of this innovation in lithic technology, because both explanations mentioned above could be possible.

Chronological periodization of Epigravettian in the eastern Adriatic and hinterland (see Basler 1979; Karavanić 1999) has traditionally relied on Italian classification differentiating between Early, Developed and Late Epigravettian,

with Romanellian as a final phase of the Late Epigravettian (Bartolomei, Broglio, Palma di Cesnola 1979). This periodization usually considered shouldered points as indicators of Early Epigravettian. This situation was mainly a result of more intense research and better knowledge of Epigravettian in the Apennine peninsula (i.e. western Adriatic) compared to eastern Adriatic which for a long time did not have as many found Epigravettian sites and their lithic assemblages were often not systematically and comprehensively researched. However, such chronological periodization for eastern Adriatic now needs to be reconsidered given the results of new research studies. This paper aims to explore earlier part of the mentioned Epigravettian periodization in the eastern Adriatic and its hinterland.

In order to do so, we will consider Epigravettian sites of the modern-day Slovenia, Croatia, Bosnia and Herzegovina, Montenegro and Greece (its northwestern part) where shouldered points or shouldered pieces have been found. Although sites in northwestern Greece are located in the Ionian hinterlands they are also considered in this paper because of their proximity to the south borders of the Adriatic region.

II. EPIGRAVETTIAN SETTLEMENT IN THE EASTERN ADRIATIC AND ITS HINTERLAND

Epigravettian is the best known Paleolithic period in the eastern Adriatic. Initial research of Epigravettian in this area dates from the end of the 19th century (Bulić 1891; Komšo 2008), however it should be noted that Epigravettian age of the excavated sites was recognized much later. Majority of researched sites are caves, and only rarely open-air sites are recorded and excavated (Balbo, Komšo, Miracle 2006). Such bias towards cave sites in the Balkans has been noted earlier by Runnels *et al.* (2004, 22). Epigravettian sites are clustered in northwestern and southeastern part of the Adriatic, i.e. in the Istrian peninsula and Montenegro hinterlands thanks to intensive field work in these areas (Mihailović 1998; Miracle 2006; Komšo 2009; Janković *et al.* 2016), while the area in-between has a lower number of Epigravettian sites.

Only a few sites can be dated based on ^{14}C dates to LGM and to period immediately preceding LGM. Layer C/d from Šandalja II (hereinafter: Šandalja) near Pula in Istria i.e. northwestern Croatia belongs to the period of pre-LGM with caution (Table 1; Karavanić 1999, 90; however also see Karavanić *et al.* 2013, note 52). Archaeological horizon LUP-A discovered in Vela spila cave on the island of Korčula, layers from Blazi cave in north-central Albania and remains found in Badanj cave in Pokrivenik on the island of Hvar (see Table 1 for dates and accompanying references) all belong to the period of LGM. It is important to mention that archaeological layers in Badanj cave in Pokrivenik are mixture of remains from Late Upper Paleolithic and Neolithic (Forenbaher 2002). However, radiocarbon dates, as well as lithic industry characteristics

Table 1

List of radiocarbon dates for eastern Adriatic Epigravettian. Dates calibrated using OxCal 4.3 (Bronk Ramsey 2009) and calibration curve IntCal 13 (Reimer *et al.* 2013). Shaded dates are rejected as unreliable

Site	Layer / Horizon/ Depth	Material	Lab. No.	uncal bp	cal BP 1σ	Climate period	Reference
Slovenia							
Ovčja jama	4	charcoal	KN-48	19540 ± 500	24120–22930	LGM	Osole 1974
Istria							
Savudrija	D	limestone concretion	Z-488	11,155 ± 209	13190–12790	Bølling-Allerød	Malez, Poje 1976; Malez, Sliepčević, Srdoč 1979
Šandalja II	B/g	bone	OxA-26873	8251 ± 39	12750–12690	Younger Dryas	Oros Sršen *et al.* 2014
Šandalja II	B/g	animal bone	GrN-4976	10,830 ± 50			Malez, Vogel 1969
Šandalja II	B/g	bone	OxA-26874	12295 ± 55	14350–14090	Bølling-Allerød	Oros Sršen *et al.* 2014
Šandalja II	B/s	human bone	KIA-23489	11 025 ± 60	12980–12800	Bølling-Allerød	Richards *et al.* 2015
Šandalja II	B/s	charcoal	GrN-4978	12320 ± 100	14570–14100	Bølling-Allerød	Malez, Vogel 1969
Šandalja II	B/d	animal bone	Z-2421	10140 ± 160			Obelić *et al.* 1994
Šandalja II	B/d	charcoal	CAMS-12062	10990 ± 60			Miracle 1995
Šandalja II	B/C	bone	OxA-26872	12035 ± 55			Oros Sršen *et al.* 2014
Šandalja II	B/C	bone	OxA-26871	12680 ± 55	15220–15000	Oldest Dryas	Oros Sršen *et al.* 2014
Šandalja II	B/C	animal bone	Z-2423	13050 ± 220	15940–15290	Oldest Dryas	Obelić et al. 1994
Šandalja II	C/s	bone	OxA-26870	11515 ± 50			Oros Sršen *et al.* 2014
Šandalja II	C/s	bone	OxA-26869	12940 ± 55	15580–15330	Oldest Dryas	Oros Sršen *et al.* 2014
Šandalja II	C/s	animal bone	Z-2424	13120 ± 230	16050–15360	Oldest Dryas	Obelić *et al.* 1994
Šandalja II	C/d	charcoal	Z-193	20750 ± 400	25470–24500	pre-LGM	Srdoč *et al.* 1973
Nugljanska peć	6	?	OxA--X-2462-26	11160 ± 50	13090–12990	Bølling-Allerød	Pilaar Birch, Miracle 2015

Nugljanska peć	8	?	Beta-127705	11520 ± 90	13450–13280	Bølling-Allerød	Miracle, Forenbaher 2000
Nugljanska peć	8	?	OxA--X-2462-22	12510 ± 55	15010–14590	Bølling-Allerød	Pilaar Birch, Miracle 2015
Pupićina peć	39.1 (Horizon T2b)	charcoal	OxA-8449	10140 ± 180	12070–11390	Preboreal/ Younger Dryas	Miracle 2005
Pupićina peć	33	charcoal	Beta-131626	10150 ± 60	11980–11650	Younger Dryas	Miracle 2001
Pupićina peć	31,32,34	charcoal	Z-2574	10610 ± 200	12730–12170	Younger Dryas	Miracle 1997
Pupićina peć	Horizon S	charcoal	Beta-188919	10280 ± 50	12160–11840	Younger Dryas	Miracle 2005
Pupićina peć	373.1 (Horizon U+V)	charcoal	Beta-145095	11150 ± 80	13100–12910	Bølling-Allerød	Miracle 2005
Pupićina peć	207	charcoal	Z-2636	11160 ± 270			Miracle 2001
Vešanska peć	II/3	charcoal	Beta-127706	11410 ± 90	13340–13140	Bølling-Allerød	Miracle, Forenbaher 2000
Vešanska peć	II/3A	charcoal	Beta-120275	11530 ± 50	13430–13310	Bølling-Allerød	Miracle, Forenbaher 2000
Vešanska peć	IX	charcoal	OxA-8448	12490 ± 100	14980–14420	Bølling-Allerød/ Oldest Dryas	Miracle, Forenbaher 2000
Ljubićeva pećina	?	?	LTL5775A	13017 ± 65	15730–15440	Oldest Dryas	Oros Sršen *et al.* 2014
Ljubićeva pećina	Horizon C (niveau 3)	?	GrA 40926	11350 ± 50	13260–13130	Bølling-Allerød	Percan, Komšo, Bekić 2009; Simonet 2013
Ljubićeva pećina	Horizon D (niveau 4)	?	Beta-249371	13230 ± 70	16030–15780	Oldest Dryas	Percan, Komšo, Bekić 2009; Simonet 2013
Croatian Littoral's hinterland							
Zala	100	animal bone	Beta-334806	14100 ± 60	17280–17020	Oldest Dryas	Šošić Klindžić *et al.* 2015a

Site	Layer / Horizon/ Depth	Material	Lab. No.	uncal bp	cal BP 1σ	Climate period	Reference
Croatian Littoral's hinterland							
Zala	12	animal bone	Beta-228734	13840 ± 50	16900–16630	Oldest Dryas	Karavanić *et al.* 2007; 2008
Zala	102	animal bone	Beta-334805	13340 ± 60	16160–15940	Oldest Dryas	Šošić Klindžić *et al.* 2015a
Northern Dalmatia							
Vlakno Cave	10	?	Z-3383	10160 ± 100	12040–11610	Preboreal/ Younger Dryas	Brusić 2005; Komšo 2008
Vlakno Cave	underneath tephra (?)	?	Beta-277309	12350 ± 70	14550–14150	Bølling-Allerød	Vujević, Parica 2011
Central Dalmatia							
Badanj u Pokriveniku	?	charcoal	TO-3425	14430 ± 100	17740–17440	LGM	Forenbaher 2002
Badanj u Pokriveniku	?	charcoal	TO-3426	14920 ± 100	18280–18000	LGM	Forenbaher 2002
Kopačina	20–40 cm	animal bone	Z-2404	11980 ± 270	14200–13470	Bølling-Allerød	Obelić *et al.* 1994; Miracle 1995
Kopačina	140–160 cm	animal bone	Z-2403	13160 ± 310	16220–15300	Oldest Dryas	Obelić *et al.* 1994; Miracle 1995
Zemunica	143	charcoal	Beta-218732	11740 ± 90	13710–13460	Bølling-Allerød	Šošić Klindžić *et al.* 2015b
Southern Dalmatia							
Vela spila	8/6	charcoal	VERA-2346	12260 ± 40	14230–14080	Bølling-Allerød	Čečuk, Radić 2002; 2005
Vela spila	8/6 (NYT)	animal bone	VERA-2345	12290 ± 40	14280–14100	Bølling-Allerød	Radić, Lugović, Marjanac 2008; Farbstein *et al.* 2012
Vela spila	LUP-G (Layer 16)	charcoal	Z-3989	12700 ± 100	15290–14930	Bølling Allerød/ Oldest Dryas	Farbstein *et al.* 2012

Vela spila	LUP-E (Layer 24)	charcoal	Z-3991	13300 ± 100	16150–15840	Oldest Dryas	Farbstein *et al.* 2012
Vela spila	LUP-D (Layer 32)	charcoal	Z-3992	14100 ± 100	17340–16990	Oldest Dryas	Farbstein *et al.* 2012
Vela spila	LUP-C (Layer 34)	charcoal	Z-3993	14500 ± 100	17820–17540	LGM	Farbstein *et al.* 2012
Vela spila	8/1 (LUP-A)	charcoal	VERA-2338	16140 ± 60	19590–19380	LGM	Čečuk, Radić 2002; 2005; Farbstein *et al.* 2012
Hercegovina							
Badanj	6	?	OxA-2197	12380 ± 110	14700–14180	Bølling-Allerød	Miracle, Sturdy 1991; Whallon 1999
Badanj	13	animal bone	OxA-2196	13200 ± 150	16090–15630	Oldest Dryas	Miracle, Sturdy 1991; Whallon 1999
Montenegro							
Mališina stijena	3b1	animal bone	OxA-1895	13780 ± 140	16910–16430	Oldest Dryas	Mihailović 1998
Albania							
Blazi Cave	Layer 2 (Trench 5)	charcoal	Beta-426506	14,440 ± 50	17690–17490	LGM	Hauck *et al.* 2017
Blazi Cave	Layer 2-3 (Trench 5)	charcoal	Beta-426508	11,100 ± 40			Hauck *et al.* 2017
Blazi Cave	Layer 3 (Trench 5)	charcoal	Beta-426501	15,360 ± 50	18710–18570	LGM	Hauck *et al.* 2017
Blazi Cave	Layer 3 (Trench 5)	charcoal	Beta-426504	15,140 ± 50	18490–18320	LGM	Hauck *et al.* 2017
Blazi Cave	Layer 2 (Trench 1)	charcoal	COL1959.1.1	15,727 ± 85	19070–18860	LGM	Hauck *et al.* 2016
Konispol	VIII/28	charcoal	Beta-56414	11410 ± 80	13330–13140	Bølling-Allerød	Petruso *et al.* 1994; Harrold *et al.* 1999

are unquestionably proving human presence on this site during Late Upper Paleolithic.

According to radiocarbon dates, slightly higher number of sites belongs to Oldest Dryas. The greatest number of Epigravettian sites belongs to the Late Glacial Interstadial Bølling/Allerød (see Table 1). What is striking from Table 1 is that there is only one available radiocarbon date for all Montenegrin sites. However, on the basis of very detailed techno-typological analyses of lithic assemblages and their comparison with industries from adjacent regions, D. Mihailović (1999) has justly attributed certain Montenegrin lithic assemblages to Late Glacial Interstadial as well as to earlier periods. Greater number of radiocarbon dates for Montenegrin sites could potentially adjust the existing archaeological record due to very intense use of caves and rock-shelters during Epigravettian.

Given the typological characteristics of lithic industries and their stratigraphic positions, a few more sites could be dated to the period from LGM to Late Glacial Interstadial. I. Karavanić (1999, 103) states it is possible to date certain layers in Romuald's cave in Lim channel in Istria (northern Adriatic, Croatia) to Early or Developed Epigravettian on the basis of one shouldered point and one backed bladelet.

According to A. Montet-White (1999) layers IX and X from Crvena stijena could have been deposited in the period from 30 000 to 12 000 uncal bp. Layer X from Crvena stijena, layer 3b1 from Mališina stijena and layers X and IX from Medena stijena could chronologically be attributed to Early Epigravettian (Mihailović, Mihailović 2007; Mihailović 2009). D. Mihailović (2009, 91) considers that layers IX from Crvena stijena and VIII from Medena stijena could be attributed to middle phase of Late Upper Paleolithic which is older than Bølling-Allerød Interstadial. Horizon 5 from Vela špilja cave on the island of Lošinj is also attributed on the basis of lithic artefacts to Late Upper Paleolithic, i.e. to the period of Late Glacial Interstadial Bølling-Allerød and Late Glacial Stadial Younger Dryas (Pilaar Birch, Miracle 2017).

There could be several reasons for relatively small number of sites in the eastern Adriatic and its hinterland which are older than ca. 14000 uncal bp. The first reason could be lower population density compared to Late Glacial Interstadial. Another reason could be the erosion of cave sediments which has been recorded from Jura Mountains to Carpathians and Dinarides (Montet-White 1994). Such an erosion could have happened in Šandalja where a stratigraphic hiatus of approximately 7 000 radiocarbon years was found between layer C/d and upper layers of complex C (Miracle 1995; Montet-White 1999). G. Bailey (1999, 162) considers, when taking into account Epirus where erosion and geological instability was recorded, that lack of layers from certain periods within a single site or even absence of sites in a certain area, is probably a consequence of destroyed or removed sediments and not necessarily a result of true absence of human presence. However, in the case of Klithi and its surroundings, the same author states that lack of traces of human stay during

certain Paleolithic phases is a result of true absence of human activity in this area. Probably a combination of these two factors mentioned by G. Bailey can be taken as possible explanations for archaeological record of eastern Adriatic and its hinterlands from LGM to Late Glacial Interstadial Bølling-Allerød.

III. CHRONOLOGICAL DISTRIBUTION OF SHOULDERED POINTS AND SHOULDERED PIECES

Lithic assemblages from the Balkan peninsula dated approximately between 20 000 and 16 000 years uncal bp, or even to 14 000 years uncal bp, according to A. Montet-White and J. Kozłowski (1983) and J. K. Kozłowski (1992; 1999; 2008a; 2008b), are characterized by the presence of shouldered points (Fig. 2). Shouldered point from Epigravettian layer from Klissoura Cave 1

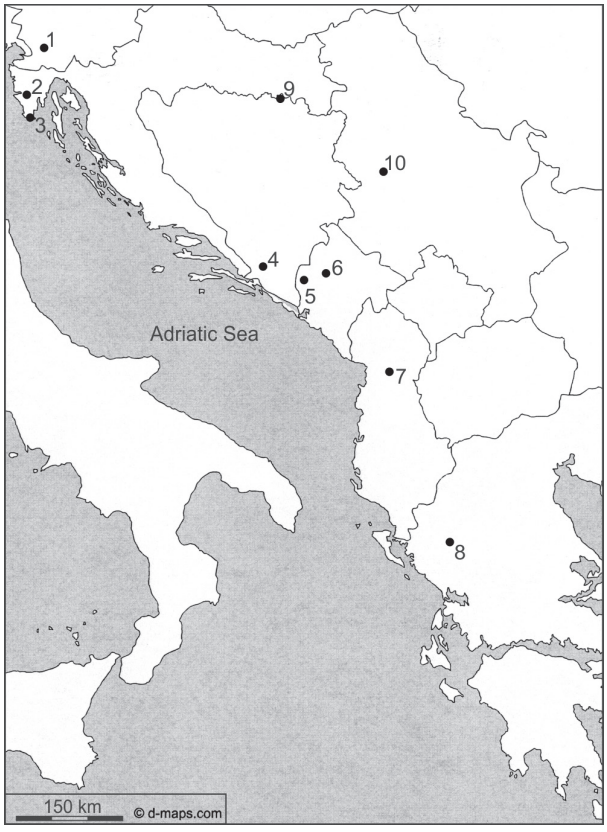

Fig. 2. Map showing position of sites with shouldered points mentioned in the text; drawn by Authors.

1 — Jama v Lozi and Ovčja jama; 2 — Romuald's cave; 3 — Šandalja II; 4 — Badanj; 5 — Crvena stijena; 6 — Vrbička cave; 7 — Blazi cave; 8 — Kastritsa; 9 — Kadar; 10 — Šalitrena cave

has minimum age of 14 280 ± 90 uncal bp (Gd-3872), as the date was obtained from a carbonate fraction (Koumouzelis *et al.* 2001; Kaczanowska, Kozłowski, Sobczyk 2010).

According to Montet-White and Kozlowski (1983) the earliest appearance of shouldered points was recorded in Šandalja and Kastritsa (Epirus, NW Greece) before approximately 20 000 and 19 000 years uncal bp, respectively.

Recent research in Vrbička cave in northwest Montenegro suggests appearance of shouldered points in Adriatic hinterlands before approximately 23 000 years uncal bp (28 000–27 000 cal BP), which would shift their first appearance further into the past to the Gravettian (Borić, Cristiani 2016).

Here it is necessary to clarify stratigraphic and chronological position of shouldered points from Šandalja which for some time have been referenced in the literature as the earliest specimens of this type of tool that we associate with a new way of hafting. J. K. Kozłowski (1999, 320) gives a radiocarbon date from layer C/d for shouldered points from Šandalja that are labeled as coming from complex C. I. Karavanić (1999, 61) and P. T. Miracle (1995, 149) state that archeological finds from Šandalja labeled as coming from complex C could actually to a great extent originate from layers C/g and C/s, albeit allowing for a possibility that part of the finds belong to layer C/d as well, but that that is less likely. Mammal faunal remains from complex C are more similar in terms of their composition to layers C/s and C/g than they are to layer C/d (Miracle 1995, 149). If we take into account such a possibility of stratigraphic origin of finds labeled as coming from complex C then we cannot exclude that the age of shouldered points from Šandalja is somewhat younger, meaning that they can be present in lithic assemblage dated to approximately 13 000 years uncal bp, as is the age of layers C/s and C/g (Table 1). Moreover, newest radiocarbon dates presented by P. T. Miracle and D. Brajković suggest younger age of layer C/d (Karavanić *et al.* 2013, note 52). Hereby proposed upper age limit of shouldered point's appearance in Šandalja would not be significantly different than the age of stratum 1 from Kastritsa (on the basis of earlier set of radiocarbon dates, please see below), which also contains shouldered points and is also the youngest stratum where shouldered points appear on this site.

When taking the example of Kastritsa, it can be concluded that the shouldered point horizon lasts also after 16 000 uncal bp given the fact that they were recorded in stratum 1 which is dated to 13 400 ± 210 uncal bp (16 430–15 810 cal BP 1σ) (I-1960). Shouldered points in Kastritsa appear from stratum 5 which is dated to 19 900 ± 370 uncal bp (24 410–23 500 cal BP; I-2465), with their frequency increasing from older to younger strata, and their greatest number is recorded in the youngest stratum 1 (Bailey *et al.* 1983; Adam 1999). This interpretation is based on old set of radiocarbon dates, while the newest series of radiocarbon dates gives a different view on chronological distribution of shouldered points in Kastritsa. According to new dates, the age of stratum 1 would be 15 930 ± 130 uncal bp (B-143304; Galanidou, Tzedakis 2001) or 19 400–19 030 cal BP (1σ), and age of the stratum 5 is 22 230 ± 210 uncal

bp (26 730–26 150 cal BP), which gives us quite a different perspective. These newest dates shift the appearance and disappearance of shouldered points in Kastritsa for approximately 2 000–3 000 years back to past and therefore their earlier presence on this site would precede LGM and the latest ones would belong to the time of LGM.

Here it is important to emphasize that one shouldered point was recorded in younger phase of Badanj rock-shelter near Stolac in Bosnia and Herzegovina in layer 2a, which is dated to approximately 12 380 uncal bp (Whallon 1999, Table 31.4). Also one atypical shouldered point was recorded in layer IX of Crvena stijena and it belongs to Early Epigravettian (Mihailović 2009).

A shouldered point was also found at a Slovenian cave site Jama v Lozi in layer 5, but unfortunately we do not have radiocarbon dates to more precisely determine Late Upper Paleolithic age of the layer in which this type of tool appeared (Brodar 1986). Fragments of shouldered points or shouldered pieces were also discovered at another Slovenian site in Ovčja jama cave in lower cultural horizon (layer 4) whose age is approximately 19 000 uncal bp (Osole 1962; see Table 1).

Recent paper of Hauck *et al*. (2017) refers to two shouldered points from layer 4 (trench 5) of Blazi cave in north-central Albania whose minimal age is approximately 18 500 cal BP and therefore belong to LGM.

Besides Šandalja there is another Istrian site where a shouldered point was found, the Romuald's cave, in stratum C, whose age cannot be precisely determined due to lack of radiometric dates (Malez 1987).

The closest Pannonian site with recorded shouldered points is the open-air site Kadar located in the northern part of Bosnia and Herzegovina, just above Sava River (Montet-White, Basler 1977). Epigravettian horizon with shouldered points from Kadar is dated to the period between 20 000 and 16 500 BP on the basis of thermoluminescence dating (Montet-White, Laville, Lezine 1986). Some other shouldered points were found in the central Balkans, in Šalitrena cave located in northwest Serbia, in Gravettian layers whose age could be between 25 000 and 21 000 years BP (Mihailović 2008).

As discussed in the text above, we can see that shouldered points in eastern Adriatic and its hinterland appear already before 23 000 uncal bp in Vrbička cave and Kastritsa, and last up to approximately 13 000 uncal bp, or somewhat later when we find them in Kastritsa (according to the earlier date for stratum 1) and in Badanj, and maybe even in Šandalja. Earlier, J. K. Kozłowski (2008b) also stressed that shouldered point tradition in Balkan Epigravettian continued after LGM but he does not indicate for how long shouldered points were part of Epigravettian lithic assemblages.

Shouldered points on the Apennine peninsula appear at the time of Early Epigravettian (20 000–16 000 uncal bp) but, albeit smaller in numbers, appear in Late Epigravettian (e.g., at the site Riparo Tagliente before approximately 13 400 uncal bp; Mussi 2002).

IV. CONCLUSION

To sum up, newly discovered site (Vrbička cave), new radiocarbon dates for an old site (Kastritsa), clarification of some earlier uncertainties associated with a certain site (Šandalja), as well as the literature review of published data for Late Upper Paleolithic sites of eastern Adriatic and its hinterland all suggest there is a need to reconsider chronological position of shouldered points and whether they are justly used as *fossil directeur* for Early Epigravettian.

According to Gamble (1986, 132) *„useful type fossils are those which have a short and well-defined chronological existence within the wider development of culture"*. Following Gamble's description of type fossils we conclude that, due to their wide timespan of appearance, shouldered points are not reliable as *fossil directeur* for Early Epigravettian on eastern Adriatic coast and on the Balkan peninsula in general. The same has been observed some time ago for the western Europe (see Straus 1993). According to available archaeological data, in particularly the newest results of radiocarbon dating, the earliest appearance of shouldered points and shouldered pieces in the eastern Adriatic and its hinterlands precedes LGM (Borić, Cristiani 2016), and they appear in lithic assemblages until Late Glacial Interstadial Bølling-Allerød, therefore encompassing a long period of approximately 10 000 years. Although they are not reliable as *fossil directeur* for the Early Epigravettian shouldered points were certainly part of the Epigravettian hunters' toolkit.

REFERENCES

Adam E.
1999 *The Upper Palaeolithic stone industries of Epirus in their regional setting*, [in:] G. N. Bailey, E. Adam, E. Panagopoulou, C. Perlès, K. Zachos (eds.), *The Palaeolithic Archaeology of Greece and adjacent areas (Proceedings of the ICOPAG Conference, Ioannina 1994)*, British School at Athens Studies 3. London (Noyes Data Corporation / Noyes Publications), p. 137–147.

Bailey G.
1999 *The Palaeolithic archaeology and palaeogeography of Epirus with particular reference to the investigations of the Klithi rockshelter*, [in:] G. N. Bailey, E. Adam, E. Panagopoulou, C. Perlès, K. Zachos (eds.), *The Palaeolithic Archaeology of Greece and adjacent areas (Proceedings of the ICOPAG Conference, Ioannina 1994)*, British School at Athens Studies 3. London (Noyes Data Corporation / Noyes Publications), p. 159–169.

Bailey G. N., Carter P. L., Gamble C. S., Higgs H. P.
1983 *Asprochaliko and Kastritsa: Furter Investigations of Palaeolithic Settlement and Economy in Epirus (North-West Greece)*, Proceedings of the Prehistoric Society 49, p. 15–42.

Balbo A. L., Komšo D., Miracle P. T.
2006 *Prehistory of open karst, further discoveries from the geoarchaeological survey of Polje Čepić, Croatia*, Histria archaeologica 35 (2004), p. 31–40.

Bartolomei G., Broglio A., Palma di Cesnola A.
1979 *Chronostratigraphie et écologie de l'Epigravettien en Italie*, [in:] D. de Sonneville-Bordes (ed.), *La fin des Temps glaciaires en Europe: chronostratigraphie et écologie des cultures du Paléolithique final*, Actes du Colloques International nº 271du CNRS, Paris (Éditions du CNRS), p. 297–324.

Basler Dj.
1979 *Le Paléolithique final en Herzégovine*, [in:] D. de Sonneville-Bordes (ed.), *La fin des Temps glaciaires en Europe: chronostratigraphie et écologie des cultures du Paléolithique final*, Actes du Colloques International nº 271du CNRS, Paris (Paris Éditions du CNRS), p. 345–354.

Borić D., Cristiani E.
2016 *Social Networks and Connectivity among the Palaeolithic and Mesolithic Foragers of the Balkans and Italy*, [in:] R. Krauss, H. Floss (eds.), *Southeast Europe before Neolithisation. Proceedings of the International Workshop within the Collaborative Research Centres SFB 1070 "RessourcenKulturen", Schloss Hohentübingen, 9th of May 2014*, Ressourcen Kulturen 1, Tübingen (Eberhard Karls Universität Tübingen), p. 73–112.

Brodar M.
1986 *Jama v Lozi*, Arheološki vestnik 37, p. 23–76.

Bronk Ramsey C.
2009 *Bayesian analysis of radiocarbon dates*, Radiocarbon 51:1, p. 337–360.

Brusić Z.
2005 *Pećina Vlakno*, Hrvatski arheološki godišnjak 1 (2004), p. 197–199.

Bulić F.
1891 *Iscrizioni inedite. Salona*, Bullettino di archeologia e storia Dalmatia 1891:4, p. 52–53.

Čečuk B., Radić D.
2002 *Vela spila. Naslage gornjeg pleistocena i donjeg holocena*, Vjesnik za arheologiju i historiju dalmatinsku 95, p. 7–51.

Čečuk B., Radić D.
2005 *Vela spila. Višeslojno pretpovijesno nalazište — Vela Luka, otok Korčula*, Vela Luka (Centar za kulturu Vela Luka).

Farbstein R., Radić D., Brajković D., Miracle P. T.
2012 *First Epigravettian Ceramic Figurines from Europe (Vela Spila, Croatia)*, PLoS ONE 7(7): e41437; doi: 10.1371/journal.pone.0041437.

Forenbaher S.
2002 *Prehistoric Populations of the Island of Hvar*, Collegium Antropologicum 26, p. 361–378.

Galanidou N., Tzedakis P. C.
2001 *New AMS dates from Upper Palaeolithic Kastritsa*, Proceedings of the Prehistoric Society 67, p. 271–278.

Gamble C.
1986 *The Palaeolithic Settlement of Europe*, Cambridge (Cambridge University Press).

Harrold B. H., Korkuti M. M., Ellwood B. B., Petruso K. M., Schuldenrein J.
1999 *The Palaeolithic of Southernmost Albania*, [in:] N. Bailey, E. Adam, E. Panagopoulou, C. Perlès, K. Zachos (eds.), *The Palaeolithic Archaeology of Greece and adjacent areas (Proceedings of the ICOPAG Conference, Ioannina 1994)*, British School at Athens Studies 3. London (Noyes Data Corporation / Noyes Publications), p. 361–372.

Hauck T. C., Ruka R., Gjipali I., Richter J., Vogels O.
2016 *Recent discoveries of Aurignacian and Epigravettian sites in Albania*, Journal of Field Archaeology 41:2, p. 148–161; doi: 10.1080/00934690.2016.1156463.

Hauck T. C., Nolde N., Ruka R., Gjipali I., Dreier J., Mayer N.
2017 *After the cold: Epigravettian hunter-gatherers in Blazi Cave (Albania)*, Quaternary International 450, p. 150–163; doi: 10.1016/j.quaint.2016.11.045.

Janković I., Komšo D., Ahern J.C.M., Becker R., Gerometta K., Mihelić S., Zubčić K.
2016 *Archaeological Investigation of the Lim Channel in 2014 and 2015 at Romuald's Cave, Abri Kontija 002, Pećina Cave near Rovinjsko Selo, Lim 001 and an Underwater Survey of the Lim Channel*, Histria archaeologica, Bulletin of the Archaeological Museum of Istria 46 (2015), p. 5–23.

Kaczanowska M., Kozłowski J. K., Sobczyk K.
2010 *Upper Palaeolithic human occupations and material culture at Klissoura Cave 1*, Eurasian Prehistory 7:2, p. 133–285.

Karavanić I.
1999 *Gornji paleolitik Šandalje II u okviru Jadranske regije* (PhD Thesis, University of Zagreb, Croatia).

Karavanić I., Ahern J. C. M., Šošić R., Vukosavljević N.
2007 *Pećina Zala*, Hrvatski arheološki godišnjak 3 (2006), p. 213–216.

Karavanić I., Šošić R., Vukosavljević N., Ahern J.
2008 *Sustavna arheološka istraživanja špilje Zale kod Tounja*, Modruški zbornik 2, p. 31–35.

Karavanić I., Vukosavljević N., Šošić Klindžić R., Kurtanjek D., Zupanič J.
2013 *The Lithic and Bone Industries of the Epigravettian Layers from* Šandalja *II Near Pula*, Vjesnik za Arheologiju i Povijest Dalmatinsku 106, p. 7-73

Knecht H.
1997 *The History and Development of Projectile Technology Research*, [in:] H. Knecht (ed.), *Projectile Technology*, Interdisciplinary Contributions to Arcaheology, New York and London (Plenum Press), p. 3–35.

Komšo D.
2008 *Mezolitik u Hrvatskoj*, Opuscula archaeologica 30 (2006), p. 55–92.

Komšo D.
2009 *Limski kanal*, Hrvatski arheološki godišnjak 5 (2008), p. 338–342.

Koumouzelis M., Ginter B., Kozłowski J. K., Pawlikowski M., Bar-Yosef O., Albert R. M., Litynska-Zajac M., Stworzewicz E., Wojtal P., Lipecki G., Tomek T., Bochenski Z. M., Pazdur A.
2001 *The Early Upper Palaeolithic in Greece: The Excavations in Klisoura Cave*, Journal of Archaeological Science 28, p. 515–539.

Kozłowski J. K.
1992 *The Balkans in the Middle and Upper Palaeolithic: The Gate to Europe or a Cul-de sac?*, Proceedings of the Prehistoric Society 58, p. 1–20.

Kozłowski J. K.
1999 *Gravettian/Epigravettian sequences in the Balkans: environment, technologies, hunting strategies and raw material procurement*, [in:] G. N. Bailey, E. Adam, E. Panagopoulou, C. Perlès, K. Zachos (eds.), *The Palaeolithic Archaeology of Greece and adjacent areas (Proceedings of the ICOPAG Conference, Ioannina 1994)*, British School at Athens Studies 3. London (Noyes Data Corporation / Noyes Publications), p. 319–329.

Kozłowski J. K.
2008a *End of the Aurignacian and the beginning of the Gravettian in the Balkans*, [in:] A. Darlas, D. Mihailović (eds.), *The Palaeolithic of the Balkans*, BAR International Series 1819. Oxford (Archaeopress), p. 3–14.

Kozłowski J. K.
2008b *The shouldered point horizon and the impact of the LGM on human settlement distribution in Europe*, [in:] J. Svoboda (ed.), *Petřkovice. On shouldered points and female figurines*, The Dolní Věstonice Studies 15, Brno (Archeologický ústav AV ČR), p. 181–192.

Kozłowski J. K., Kaczanowska M.
2004 *Gravettian/Epigravettian sequences in the Balkans and Anatolia*, Mediterranean Archaeology and Archaeometry 4:1, p. 5–18.

Malez M.
1987 *Pregled paleolitičkih i mezolitičkih kultura na području Istre*, Izdanja Hrvatskog arheološkog društva 11:2 (1986), p. 3–47.
Malez M., Vogel J. C.
1969 *Rezultati određivanja apsolutne starosti pleistocenskih naslaga Šandalje II kod Pule u Istri*, Geološki vjesnik 22 (1968), p. 121–133.
Malez M., Poje M.
1976 *Quartäre lössartige Ablagerungen bei Savudrija in nordwestlichen Istrien*, Bulletin Scientifique. Conseil des Academies des Sciences et des Arts de la RSF de Yougoslavie (section A) 21:3–6, p. 70–72.
Malez M., Sliepčević A., Srdoč D.
1979 *Određivanje starosti metodom radioaktivnog ugljika kvartarnim naslagama na nekim lokalitetima u dinarskom kršu*, Rad Jugoslavenske akademije znanosti i umjetnosti 383, p. 227–271.
Mihailović B.
2008 *The Gravettian site Šalitrena pećina near Mionica (Western Serbia)*, [in:] A. Darlas, D. Mihailović (eds.), *The Palaeolithic of the Balkans*, BAR International Series 1819, Oxford (Archaeopress), p. 101–106.
Mihailović D.
1998 *Gornji paleolit i mezolit Crne Gore* (PhD Thesis, University of Belgrade, Serbia).
Mihailović D.
2009 *Upper Palaeolithic and Mesolithic chipped stone industries from Crvena stijena*, Prehistoric settlements in caves and rock-shelters of Serbia and Montenegro, fasc. II, Beograd (University of Belgrade, Faculty of Philosophy, Center for Archaeological Research).
Mihailović D., Mihailović B.
2007 *Considérations sur le Gravettien et l'Épigravettien ancien des Balkans de l'Ouest*, Paleo 19, p. 115–130.
Miracle P. T.
1995 *Broad-Spectrum Adaptations Re-Examined: Hunther-Gatherer Responses to Late Glacial Environmental Changes in the Eastern Adriatic* (PhD Thesis, University of Michigan, Ann Arbor, USA).
Miracle P.
1997 *Early Holocene foragers in the karst of northern Istria*, Poročilo o raziskovanju paleolitika, neolitika in eneolitika v Sloveniji 24, p. 43–61.
Miracle P.
2001 *Feast or Famine? Epipalaeolithic subsistence in the northern Adriatic basin*, Documenta Praehistorica 28, p. 177–197.
Miracle P. T.
2005 *Excavations at Pupićina Cave: Preliminary results of the 1999, 2001 and 2002 field seasons*, Histria archaeologica 34 (2003), p. 5–37.
Miracle P.
2006 *Introduction to the Pupićina Cave Project*, [in:] P. T. Miracle, F. Forenbaher (eds.), *Prehistoric herders of northern Istria. The Archaeology of Pupićina Cave*, vol. 1, Monografije i katalozi 14, Pula (Arheološki muzej Istre), p. 1–29.
Miracle P. T., Forenbaher S.
2000 *Pupićina Cave Project: Brief summary of the 1998 season*, Histria archaeologica 29 (1998), p. 27–48.
Miracle P., Sturdy D.
1991 *Chamois and the Karst of Herzegovina*, Journal of Archaeological Science 18, p. 89–108.
Montet-White A.
1994 *Alternative interpretations of the Late Upper Paleolithic in Central Europe*, Annual Review of Anthropology 23, p. 483–508.

Montet-White A.
1999 *A scarcity of MUP sites in the Sava Valley, stratigraphic hiatus and/or depopulation*, [in:] W. Roebroeks, M. Mussi, J. Svoboda, K. Fennema (eds.), *Hunters of the Golden Age. The mid Upper Palaeolithic of Eurasia 30,000–20,000 BP*, Analecta Praehistorica Leidensia 31, Leiden (University of Leiden), p. 241–247.

Montet-White A., Kozłowski J.
1983 *Les industries à pointes à dos dans les Balkans*, Rivista di Scienze Preistoriche 38:1–2, p. 371–399.

Montet-White A., Basler Dj.
1977 *L'industrie gravettienne de Kadar en Bosnie du Nord (Yougoslavie)*, Bulletin de la Société préhistorique française. Études et travaux 74:2, p. 531–544.

Montet-White A., Laville H., Lezine A.-M.
1986 *Le Paléolithique en Bosnie du Nord. Chronologie, environment et préhistoire*, L'Anthropologie 90:1, p. 29–88.

Mussi M.
2002 *The Earliest Italy. An Overview of the Italian Palaeolithic and Mesolithic*, New York (Kluwer Academic Publisher).

Obelić B., Horvatinčić N., Srdoč D., Krajcar Bronić I., Sliepčević A., Grgić S.
1994 *Rudjer Bošković Institute radiocarbon measurements XIII*, Radiocarbon 36:2, p. 303–324.

Oros Sršen A., Brajković D., Radović S., Mauch Lenardić J., Miracle P. T.
2014 *The Avifauna of Southern Istria (Croatia) During the Late Pleistocene: Implications for the Palaeoecology and Biodiversity of the Northern Adriatic Region*, International Journal of Osteoarchaeology 24, p. 289–299.

Osole F.
1974 *Radiokarbonske datacije v slovenskem paleolitiku*, [in:] *Opuscula Iosepho Kastelic sexagenario dicata*, Situla 14/15, p. 25–33.

Osole R.
1962 *Mlajši paleolitik iz Ovčje jame*, Arheološki vestnik 13/14, p. 129–144.

Percan T., Komšo D., Bekić L.
2009 *Ljubićeva pećina*, Hrvatski arheološki godišnjak 5 (2008), p. 344–347.

Petruso K. M., Ellwood B. B., Harrold F. B., Korkuti M.
1994 *Radiocarbon and archaeomagnetic dates from Konispol Cave, Albania*, Antiquity 68, p. 335–339.

Pilaar Birch S. E., Miracle P.
2015 *Subsistence continuity, change, and environmental adaptation at the site of Nugljanska, Istria, Croatia*, Environmental Archaeology 20:1, p. 30–40; doi: 10.1179/1749631414Y.0000000051.

Pilaar Birch S. E., Miracle P.
2017 *Human Response to Climate Change in the Northern Adriatic During the Late Pleistocene and Early Holocene*, [in:] G. G. Monks (ed.), *Climate Change and Human Responses. A Zooarchaeological Perspective*, Vertebrate Paleobiology and Paleoanthropology Series. Dordrecht (Springer), p. 87–100.

Radić D., Lugović B., Marjanac L. J.
2008 *Napuljski žuti tuf (NYT) iz pleistocenskih naslaga u Veloj spili na Korčuli: dragocjeni marker prijelaza iz paleolitika u mezolitik*, Opuscula archaeologica 31, p. 7–26.

Reimer P. J., Bard E., Bayliss A., Beck J. W., Blackwell P. G., Bronk Ramsey C., Buck C. E., Cheng H., Edwards R. L., Friedrich M., Grootes P. M., Guilderson T. P., Haflidason H., Hajdas I., Hatté C., Heaton T. J., Hoffmann D. L., Hogg A. G., Hughen K. A., Kaiser K. F., Kromer B., Manning S. W., Niu M., Reimer R. W., Richards D. A., Marian Scott E., Southon J. R., Staff R. A., Turney C. S. M, van der Plicht J.
2013 *IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0-50,000 Years cal BP*, Radiocarbon 55:4, p. 1869–1887.

Richards M. P., Karavanić I., Pettitt P., Miracle P.
2015 *Isotope and faunal evidence for high levels of freshwater fish consumption by Late Glacial humans at the Late Upper Palaeolithic site of Sandalja II, Istria, Croatia*, Journal of Archaeological Science 61, p. 204–212.
Simonet A.
2013 *Premier bilan des fouilles effectuées dans la Grotte de Ljubić (2008–2011) (mission archéologique Monaco-Croatie)*, Bulletin du Musée d'anthropologie préhistorique de Monaco 53, p. 93–102.
Srdoč D., Sliepčević A., Planinić J., Obelić B., Breyer B.
1973 *Rudjer Bošković radiocarbon measurements II*, Radiocarbon 15:2, p. 435–441.
Straus L. G.
1993 *Upper Paleolithic Hunting Tactics and Weapons in Western Europe*, [in:] G. Peterkin, H. Bricker, P. Mellars (eds.), *Hunting and Animal Exploitation in the Later Paleolithic and Mesolithic of Eurasia*, Archaeological Papers of the American Anthropological Association 4, Washington, DC (American Anthropological Association), p. 83-93.
Šošić Klindžić R., Karavanić I., Vukosavljević N., Ahern J. C. M.
2015a *Smještaj, stratigrafija, kronologija i tijek iskopavanja špilje Zale*, [in:] N. Vukosavljević, I. Karavanić (eds.), *Arheologija špilje Zale. Od paleolitičkih lovaca skupljača do rimskih osvajača*, Modruš (Katedra Čakavskog sabora Modruše), p. 15–48.
Šošić Klindžić R., Radović S., Težak-Gregl T., Šlaus M., Perhoč Z., Altherr R., Hulina M., Gerometta K., Boschian G., Vukosavljević N., Ahern J. C. M., Janković I., Richards M., Karavanić I.
2015b *Late Upper Paleolithic, Early Mesolithic and Early Neolithic from the cave site Zemunica near Bisko (Dalmatia, Croatia)*, Eurasian Prehistory 12:1–2, p. 3–46.
Vujević D., Parica M.
2011 *Nakit i umjetnost pećine Vlakno*, Archaeologia Adriatica 3 (2009), p. 23–34.
Whallon R.
1999 *The lithic tool assemblages at Badanj within their regional context*, [in:] G. N. Bailey, E. Adam, E. Panagopoulou, C. Perlès, K. Zachos (eds.), *The Palaeolithic Archaeology of Greece and adjacent areas (Proceedings of the ICOPAG Conference, Ioannina 1994)*, British School at Athens Studies 3. London (Noyes Data Corporation / Noyes Publications), p. 330–342.

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