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LITTLE TOOLS OR LITTLE WEAPONS? TESTING THE USE OF AURIGNACIAN AND EPIGRAVETTIAN BLADELETS AS PROJECTILE IMPLEMENTS

ABSTRACT

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The morphology and use-wear of lithic implements used as projectile points have been a special topic of prehistoric research for many decades. The present study focuses on a particular category of artifacts from two chronologically distant cultural contexts — the Aurignacian and the Epigravettian. Retouched and unretouched bladelets recovered from three Romanian sites recently excavated are examined in order to asses the possibility of their past use as projectile implements. Two methodological lines of inquiry were followed: the recognition of macroscopic impact-related fractures and the designation of metrical attributes concerning tip cross-sectional area values. Both sets of data were compared with similar considerations issued from previously published comparable collections. Although lacking direct experimental support, the conclusions point towards the possibility of using laterally retouched Aurignacian and Epigravettian bladelets as either distally or laterally inserted projectile implements. A possibly early use of bow and arrow, as part of multiple weapons systems typical of Upper Paleolithic hunting technology, is also discussed.

Key words: Aurignacian; Epigravettian; bladelets; impact fractures; tip cross-sectional area

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INTRODUCTION

As an essential part of the Paleolithic economic behavior, the hunting activity as well as the weaponry system it involved enjoyed a great deal of interest in prehistoric research (e.g. Peterkin et al. [eds.] 1993; Knecht [ed.] 1997;

Stanford 1999). These topics fueled a plethora of social (Alvard 2001), ethnographic (Bunn 2001; MacDonald 2007), primatological (Rayne Pickering, Dominguez-Rodrigo 2010), physical anthropology (Schmitt et al. 2003; Churchill, Rhodes 2009; Rhodes, Churchill 2009) and experimental approaches (Smith et al. 2007; Yaroshevich et al. 2010). Available investigations already cover an impressive array of aspects: origins, causes and consequences of producing and using projectile implements (Shea 2009; Shea, Sisk 2010), strategies followed in particular hunting contexts (open or forested areas, continental/coastal environments, ambush/stalking/natural trapping), production, design and functionality (resistance, launching speed and distance, hafting etc.; *cf.* Straus 1993; Nelson 1997).

Chronologically, studies on hunting and hunting equipment went well beyond the Upper Paleolithic boundary (Shea et al. 2001; Speth, Tchernov 2001; Thieme 2005; Brooks et al. 2006; Villa, Lenoir 2009; Lombard, Phillipson 2010, Sisk, Shea 2011). However, as the Upper Paleolithic witnessed an unprecedented diversification of the technological realm, obvious modifications in implements' morphology, and the spreading of microlithic equipment, it also gave the opportunity for more systematic and experimentally grounded approaches. In fact, even though regular use of standardized lithic projectile points (Levallois, foliates, laminar items) seems to have been widely adopted towards the end of the Middle Paleolithic and during the so-called transitional complexes (Teyssandier 2007), the large scale production and use of microlithic laminar blanks in Eurasia clearly emerged at the beginning of the Upper Paleolithic (Bon 2005).

Identifying the function of lithic implements proves to be essential in clarifying some fundamental aspects in the life of Upper Paleolithic hunter-gatherers. The vital weight the animal based subsistence holds for the societies living in temperate and particularly cold environments is widely documented in hunter-gatherers ethnography (Marlowe 2005; 2007). Given their supposed contribution to one of the major economic areas, namely hunting, the lithic implements could be used not only in identifying specific some basic subsistence patterns, but also in evaluating their changes, which among other reasons also contributed to the differentiation between Paleolithic technocomplexes and shaped their internal dynamic.

However, the diversity of lithic tools functions documented both ethnographically and experimentally gives enough reason to refute the traditional typological practice of associating function to morphology. Caution is all the more required as this naďve association abusively strengthens the archetypal, almost mythical image of the Paleolithic economy as being essentially based on hunting (Hart, Sussman 2009). There are serious reasons to believe that this biased perception is largely due to the poor preservation of vegetal remains. In recent years, meticulous excavation techniques and research methods reveal more and more of the important part played by vegetal resources in Paleolithic alimentation (Koumouzelis et al. 2001; Karkanas et al. 2004; Martinoli 2004; Aranguren et al. 2007; Revedin et al. 2010). A proper identification of the function of lithic armatures remains crucial in assessing the actual importance different subsistence practices played in prehistoric contexts. Consequently, making the difference between tools and weapons or, in different terms, between actual hunting projectiles and cutting/piercing edges/tips, appears quite naturally as a first inferential step.

The present study aims at enlarging the empirical dataset regarding the use microlithic items by means of a series of observations made on Aurignacian and Epigravettian lithic assemblages coming from three settlements recently excavated in Western and Eastern parts of Romania (Fig. 1). The collections belong to an Epigravettian context at Bistricioara-Lutărie 'Mal' (Shore; Bistrița

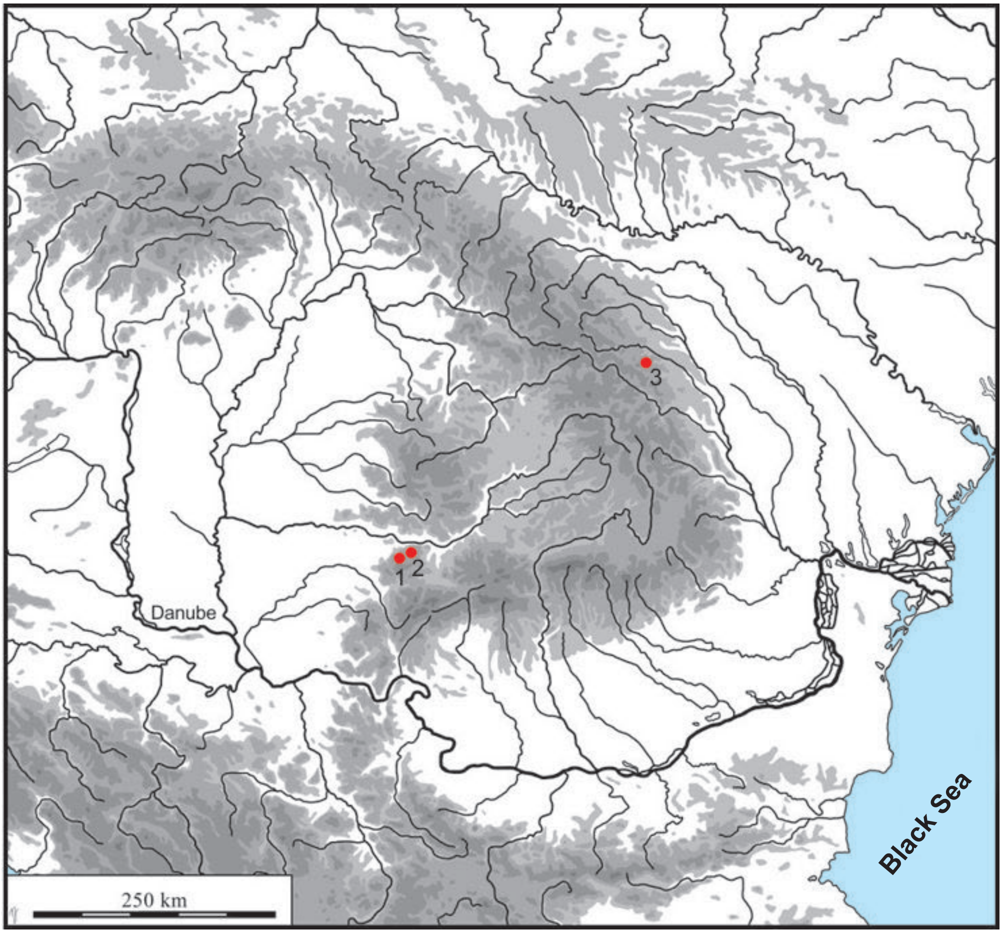

Fig. 1. Location of the sites; drawn by I. Jordan.

1 — Româneşti-Dumbrăvița, județul Timiş, Romania; 2 — Coşava, județul Timiş, Romania; 3 — Bistricioara-Lutărie, județul Neamț, Romania.

Valley, Northeastern Romania), to the Aurignacian at Coşava and to the Aurignacian and Epigravettian layers, respectively, at Româneşti-Dumbrăvița I (Banat, Southeastern Romania). Our main goal is to verify to what extent a sample of unretouched and retouched bladelets might represent former projectile implements.

CULTURAL AND CHRONOLOGICAL BACKROUND

If the impressive cultural/functional variability displayed by Aurignacian assemblages met a large, though contested (Clark 2001) geographical extension, from the Vézère Valley to the Zagros Mountains (Otte, Kozlowski 2004; Otte et al. 2007), the Gravettian is defined as an exclusive European phenomenon (Delpech, Texier 2007), with the Epigravettian as its Mediterranean, Central and Eastern European post-LGM epilogue (Angelucci, Bassetti 2009; Haesaerts et al. 2004; Otte, Noiret 2004). By and large, Aurignacian and Epigravettian technocomplexes are technologically defined by the systematical production of alternatively or abruptly retouched bladelets. In Eastern Europe at least, irrespective of the taxonomical issues involved (Late Aurignacian *vs.* Epigravettian), the later stages of both show a noticeable tendency toward a rich organic hunting and domestic equipment, technological uniformity (Nuzhnyi 2006) and also microlithisation: bladelets resembling the Dufour type obtained from carinated forms (Zelenyi Khutor I, II, Leski, Zolotovka I, Muralovka, Sagaidak I, Rashkov VII — 21–15 kyr BP), or backed items on blanks obtained from prismatic cores (Molodova, Cosăuți, Anetovka II, Bolshaya Akkarzha, Kamennaia Balka I — 20–13 kyr BP; *cf.* Zwyns 2004; Demidenko 2008).

In what Romanian territory is concerned, the constant production of microlithic items is at least indirectly (e.g. bladelet cores) documented in most Upper Paleolithic collections, from the likely early Aurignacian occurrences such as those discussed below, to the Late Gravettian/Epigravettian, best represented in Eastern Romania. It is worth mentioning that in Eastern Romania at least, a strong microlithic tendency is already well documented from the Gravettian on (Niță 2008) and persistently present in all Epigravettian collections post-dating LGM (Chirica, Borziac 2009).

Explaining this general pattern is obviously not our present objective. By selecting distant cultural and chronological settings we avoid explicitly the contentious taxonomical issues regarding, for example, the phyletic relationship between Aurignacian and Gravettian, in favor of a more general, trans-cultural feature of the Upper Paleolithic lithic industries in general, i.e. bladelet use. In the following lines we will focus on analyzing the functional differences/resemblances of this particular lithic category, and also on the extent to which bladelet use and technology might express some behavioral adjustments. The extent to which our rather 'functional' data might contribute to a better 'cultural' understanding of the technocomplexes involved is left for further researches.

SAMPLES AND METHODOLOGY

Româneşti-Dumbrăviţa I site is located on confluence terrace (average altitude of 212 m) between the two arms of Bega River, yielding a condensed geological sequence, in which two major Paleolithic cultural horizons yet undated and lacking organic material were recognized during recent researches (2009–2010; *cf*. Sitlivy et al. in print). The uppermost layer preserves the remains of what appear to have been a short-lived Epigravettian presence. The second (Aurignacian) archaeological accumulation includes numerous local yellow-brownish/black flint, red jasper, and radiolarite flakes, blades, bladelets, cores (together with carinated ones), endscrapers, retouched blades and bladelets (including Dufour and pseudo-Dufour type). The production of the latter involves medium to large cores, with one or more striking platforms, and slightly curved flaking surfaces. We included in the present study 265 retouched and unretouched Epigravettian and Aurignacian bladelets recovered from the whole geological sequence (Table 1).

Table 1

Complete and fragmented bladelets

Technocomplexe/Sites		Retouched bladelets				Unretouched bladelets			
		Complete	Proximal	Median	Distal	Complete	Proximal	Median	Distal
Aurignacian	Româneşti-Dumbrăviţa I	2	11	27	5	4	58	109	25
	Coşava	—	1	5	1	—	11	22	9
Epigravettian	Româneşti-Dumbrăviţa I	1	2	2	1	—	3	13	2
	Bistricioara Lutărie 'Mal' (Shore)	2	4	25	9	5	49	67	46

Coşava is located 4 km north of the former site, revealing a similarly short and eroded geological sequence, with three Upper Paleolithic layers comprising Aurignacian lithic material identified in recent excavation campaigns (2009–2010; see Sitlivy et al. in print). No absolute chronology is yet available for any of these layers as organic material is entirely missing. The small lithic collection consists mostly of local yellow-brownish stripped flint, chalcedony, and radiolarite debitage products and tools, among which several carinated items and Dufour/pseudo-Dufour bladelets. Blades and bladelets cores on blocks or thick flakes show mostly one striking platform and wide flaking surfaces. There were 49 retouched and unretouched bladelets available for this study, once more recovered along the entire geological sequence (Table 1).

Bistricioara-Lutărie 'Mal' (Shore; Bistrița Valley, Northeastern Romania) is part of a quite large network of Paleolithic sites located in the Ceahlău basin (Steguweit et al. 2009). The Epigravettian layer discussed here was single dated around 13.7 kyr uncal. BP. The lithic concentration was recovered in a yellow-grayish sandy loess deposit, close to the modern surface, constantly affected by flooding due to the level variation of the Izvorul Muntelui artificial lake. The lithic assemblage consists mainly of menilith (local) and Cretaceous flint (allogenous) items, representing in various percents almost the entire operational sequence, from cortical flakes (*entames*) and rejuvenation products to blanks, tools, and exhausted cores. The 207 retouched and unretouched bladelets included in this study (Table 1) belong both to the survey trench collection, and to the surface finds recovered on top of the excavated area. For the most part, their production required the maintenance of two or three striking platforms and of relatively long and narrow flaking surfaces.

Due to the total absence or poor preservation of fauna and to the low energy deposition/massive erosion which most likely mixed several occupation episodes/phases, but also to the small surface affected by modern excavations, none of the three settlements provided so far enough information for a clear-cut definition of the duration and type of occupation. The Banat settlements could be viewed as repeatedly occupied locales with clustered, more or less specialized areas of activities (including knapping/retooling). As for Bistricioara-Lutărie 'Mal' (Shore), the Epigravettian concentration there represents a succession of at least six living floors illustrated by the same number of superimposed hearths and burnt soil areas, later affected by modern clay exploitation and water lodging. Repeated, comparable in time and extent and likely seasonal occupations may have been involved. Thus, as a good deal of mechanical mixing might be responsible for the structure of the lithic assemblages involved, we will only rely on their general cultural classification, for which the size, structure and content of the lithic collections fortunately suffice.

The analysis of the Aurignacian and Epigravettian bladelets from the three sites will follow two main directions, one regarding the macro use-wear traces and another one concerning metrical attributes. For the first one, we will search for diagnostic projectile impact fractures defined in previous studies focused on Aurignacian bladelets, or Gravettian and Mesolithic points (Fischer et al. 1984; Dockal 1997; O'Farrell 1996; 2004; 2005), according to the following criteria: *complex fractures* (e.g. the spin-off fracture with at least 1.5 mm long spin-off) and step terminating bending fracture, both thought as highly diagnostic for projectile function; *plausible complex fractures*, like the hinge terminating bending fracture and the feather terminating bending fracture accounted only for possible projectile function (O'Farrell 2005, 398; *cf*. Fig. 6).

The second approach will be the calculation of the tip cross-sectional area (hereafter TCSA) value, by the following formula: 0.5 × maximum width (in mm) x maximum thickness (in mm; *cf*. Shea 2006), according to which experimentally tested archaeological but also North American ethnographic projectile implements indicated specific metric characteristic of arrow (33 mm^2), spearthrower darts (58 mm^2), and thrusting spears (168 mm^2) points. The European Upper Paleolithic studied sample included Chatelperronian (62 mm^2), Font-Robert (61 mm^2), Gravette (41 mm^2), laurel-leaf (92 mm^2), and Solutreean unifacial points (87 mm^2), all of which use blades or thin bifaces as blanks.

Finally, we will attempt at correlating the two sets of data, in order to find out which TCSA values could be ascribed to Aurignacian and Epigravettian retouched or unretouched bladelets, defined as projectile (*sensu* Shea, Sisk 2010, 102) implements through the presence of specific fracture marks. Both approaches will take into consideration retouched and unretouched laminar blanks, with widths values inferior or equal to 12 mm: Dufour (=alternatively/inversely retouched) bladelets, pseudo-Dufour (directly, marginally retouched) bladelets, backed (abruptly directly retouched) bladelets.

USE-WEAR TRACES AND METRICAL ATTRIBUTES

Româneşti-Dumbrăviţa I

The small Epigravettian bladelets sample (n = 24) includes 18 unretouched and 6 retouched local yellow-brownish/red jasper backed bladelets and Gravette points, with fairly homogenous traits: flat and punctiform butts, triangular cross-sections, rectilinear profiles, 5–8 mm wide and 2–3 mm thick blanks. The mean TCSA value for the whole sample is 11.02 mm^2. There are no complex or plausible complex fractures within the group of retouched bladelets and only two cases of unretouched median bladelets showing step and feather fractures, with TCSA values of 15 mm˛ and 10 mm^2 respectively.

The sample of Aurignacian retouched bladelets (Fig. 2–3) consists of 37 Dufour, 6 pseudo-Dufour bladelets, 1 Krems point, and 1 partially retouched bladelet, most of them made of local yellow-brownish/black flint. For more than 90% of them, the width values vary between 5 and 8 mm, irrespectively of the fragment type, while the thickness values remain between 2 and 3 mm. The two complete Dufour specimens are 26/31 mm long, 7 mm wide and 2 mm thick, with trapezoidal cross-sections and concave profiles, while the rest of the fragmented retouched bladelets have twisted (n = 1), concave (n = 10) and rectilin-

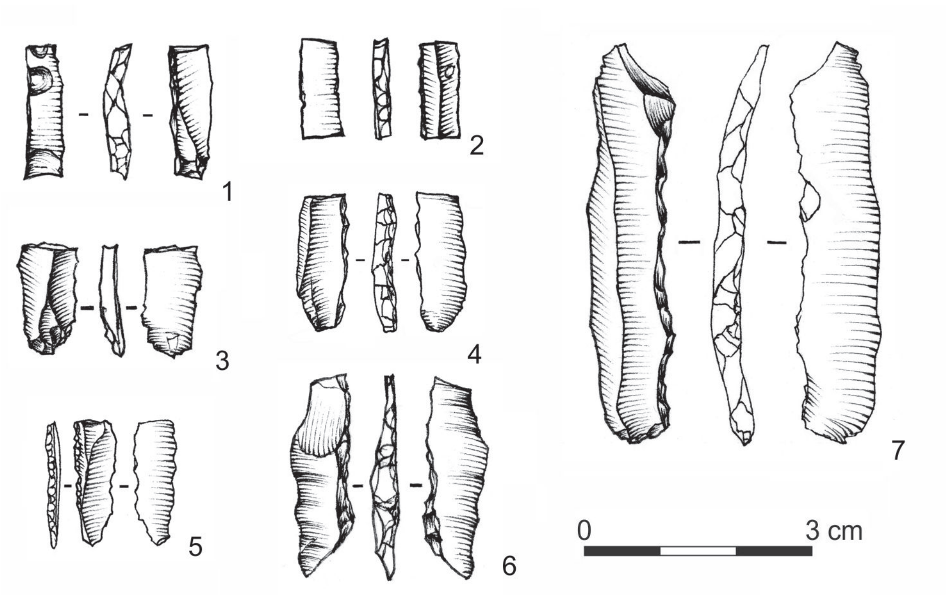

Fig. 2. Româneşti-Dumbrăviţa, judeţul Timiş, Romania, site I. Epigravettian retouched and unretouched bladelets; drawn by F. Dumitru.

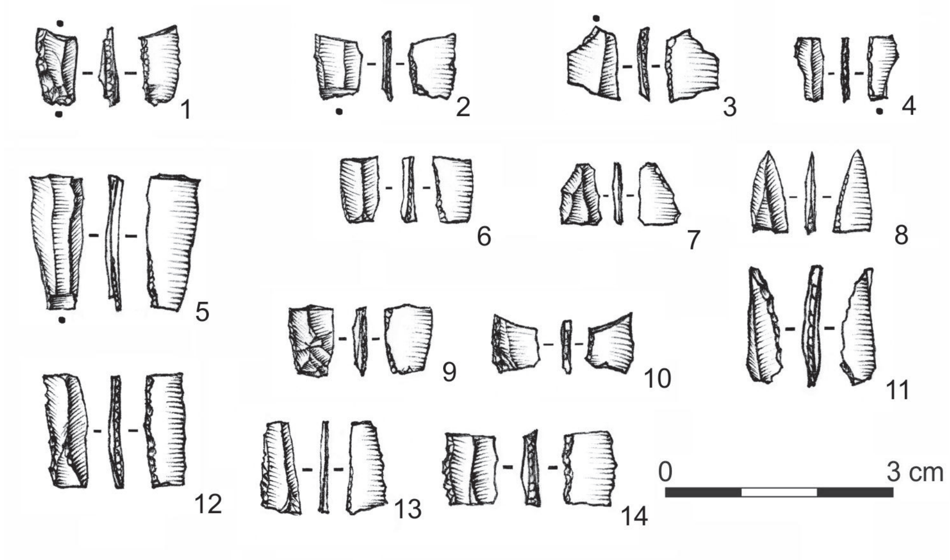

Fig. 3. Româneşti-Dumbrăviţa, judeţul Timiş, Romania, site I. Dufour bladelets; drawn by F. Dumitru.

ear (n = 32) profiles. The proximal fragments exhibit indefinite (n = 1), flat (n = 3) and punctiform butts (n = 9); scarring of the bulb is rather infrequent. Three of the median fragments of Dufour and pseudo-Dufour bladelets show dorsal removal negatives starting from the opposite end. General lateralization for Dufour bladelets places the inverse retouch on the right edge of over 75% of the blanks. Only 10 fragmented Dufour, pseudo-Dufour, and one Krems point (with TCSA mean value of 6.18 mm^2) show complex and plausible complex fracture patterns: step fractures (2 median Dufour and 1 proximal pseudo-Dufour bladelet), spin-off fractures (1 median Dufour bladelet), hinge (3 median Dufour, 1 proximal pseudo-Dufour), and feather fracture (1 distal Krems point); 2 other median Dufour bladelets show small lateral longitudinal removals which could have been originated from spin-off fractures, but their actual length remains unknown.

The yellow-brownish/black flint, radiolarite and red jasper unretouched bladelets (n = 196) are almost equally divided between triangular (n = 106) and trapezoidal (n = 90) cross-sections; most of them have rectilinear profiles (n = 152), with few examples of concave (n = 25) and twisted (n = 19) profiles. The complete and proximal specimens have flat (n = 33), punctiform (n = 25) or undetermined (n = 4) butts. Length values of the four complete items are highly variable: 22 mm/26 mm, 31 mm, and 41 mm. Four of the bladelets (three proximal, one median) show dorsal removal negatives initiated from the opposite end; much like in the case of the retouched bladelets, their small number indicates a negligible preference for exploiting cores with two opposite striking platforms. About 63% of the bladelets are between 5 and 8 mm wide and around 86% are 2–3 mm thick. Complex/plausible complex fractures — step fractures (2 proximal and 6 median fragments), hinge fractures (4 median fragments), and feather fractures (5 median fragments) — appear on specimens with TCSA mean value of 6.72 mm^2.

Coşava

Except for the ones made in chalcedony, the Aurignacian unretouched bladelets (n = 42) fit into the same raw material categories as the sample from Româneşti-Dumbrăvița I. Their morphology is also quite similar: triangular cross-section and rectilinear profiles prevail, the best part of them being 5–8 mm wide and 2–3 mm thick. The proximal specimens show flat (n = 5) and punctiform (n = 6) butts. There are two median fragments showing step and feather fractures with TCSA values of 5 mm^2 and 8 mm^2 respectively. The retouched bladelets (n = 7; *cf*. Fig. 4) do not differ extensively from the previous ones in terms of morphology or dimensions. Only one specimen shows feather bending fracture, with TCSA value of 6 mm^2.

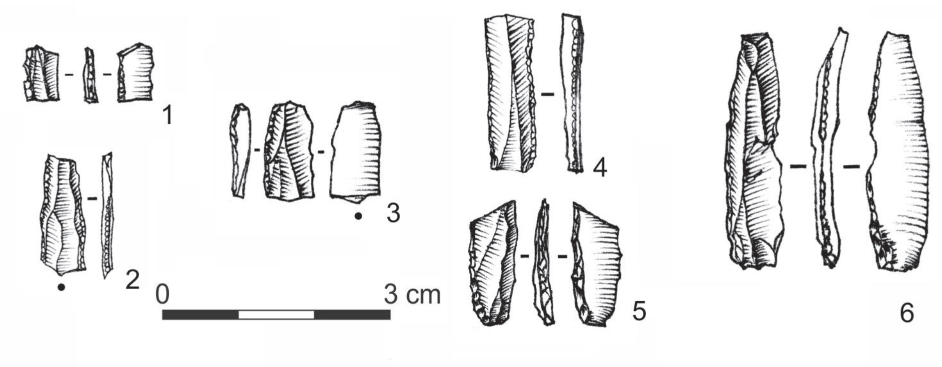

Fig. 4. Coşava, judeţul Timiş, Romania. Dufour and pseudo-Dufor bladelets; drawn by F. Dumitru.

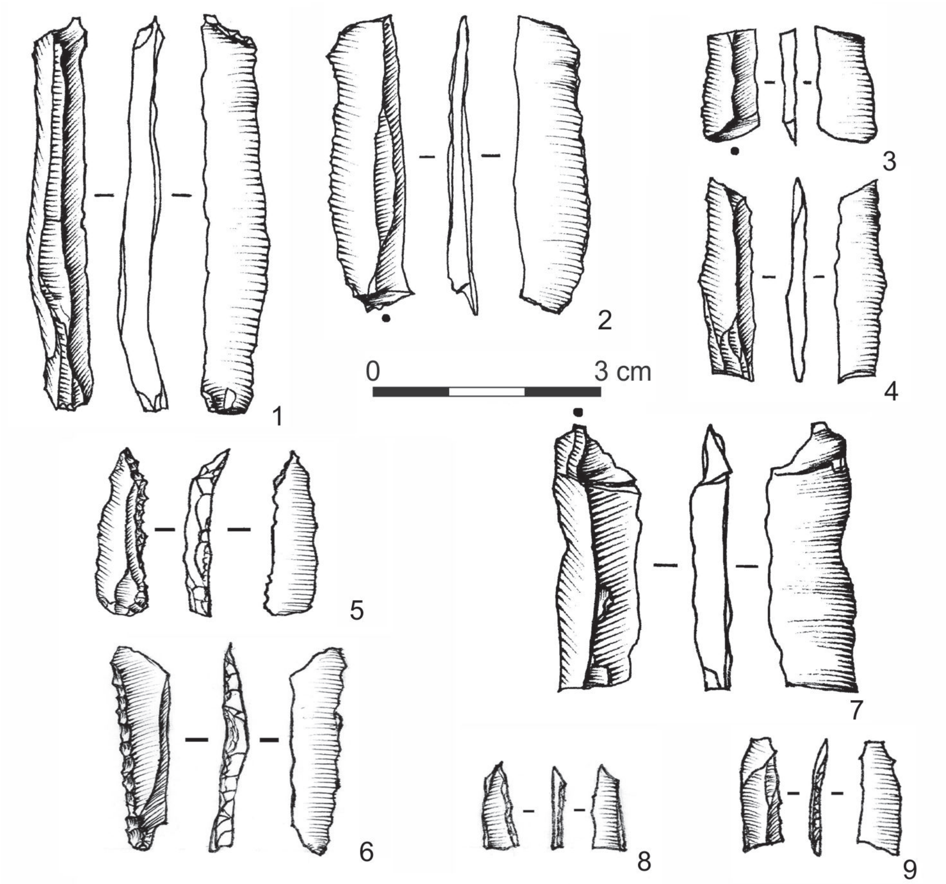

Fig. 5. Bistricioara-Lutărie, judeţul Neamţ, Romania, 'Mal'. Unretouched and backed bladelets; drawn by F. Dumitru.

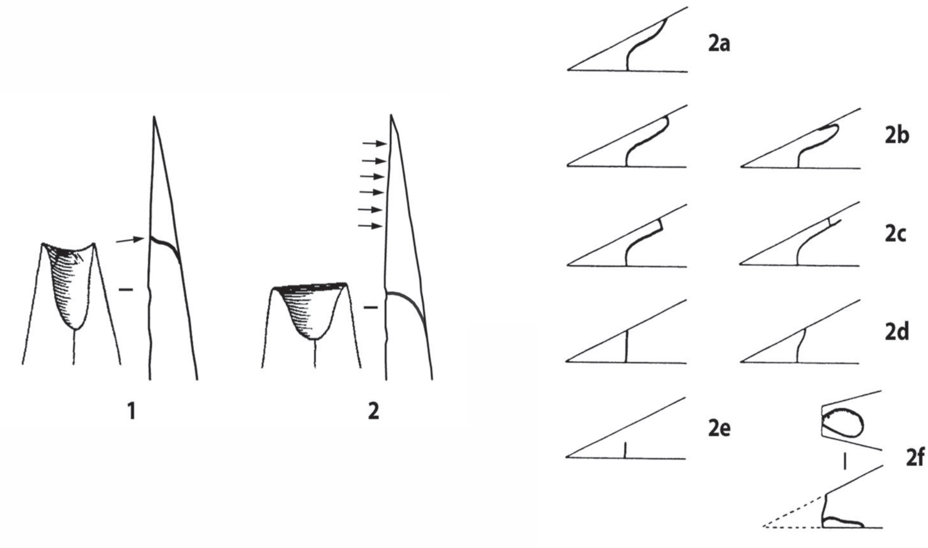

Fig. 6. Types and definitions of fractures; modified after A. Fischer et. al. (1984, 23) and M. O'Farrell (2005, p. 98).

1 — Cone fracture: the fracture initiates from a point or a small, well-defined area, having a concave profile in the area of initiation; 2 — Bending fracture: the fracture initiates from a large area and has a straight or convex profile along its whole area of initiation; 2a — Feather terminating bending fracture (*fracture en plume*): a bending initiating fracture which before meeting the opposite surface of the specimen runs parallel to this, and which meets the surface at an acute angle or in a curve less than or equal to 90!; 2b — Hinge terminating bending fracture (*fracture en charniere*): a bending initiating fracture which before meeting the opposite surface of the specimen runs parallel to this, and which meets the surface in a curve larger than 90!; 2c — Step terminating bending fracture (*fracture en marche*): a bending initiating fracture which before meeting the opposite surface of the specimen run parallel to this, and which thereafter makes an abrupt change of direction to meet the surface in a right angle; 2d — Snap fracture (*fracture nette*): a bending initiating fracture which meets the opposite surface of the specimen without having at any point run parallel to this; 2e — Embryonic bending fracture (*amorce de fracture*): a bending fracture where part of the fracture path ends before having reach the surface of the specimen; 2f — "Spin-off" fracture (*fracture esquillante*): cone fracture which initiates from a bending fracture and which removes parts of the original surface of the specimen (shown in longitudinal section and from the side).

Bistricioara-Lutărie 'Mal' (Shore)

The studied sample consists of 40 retouched and 167 unretouched Cretaceous flint, menilith, black schist, sandstone, and jasper bladelets. The unretouched bladelets, most of which are 7–10 mm wide and 2–5 mm thick, show both triangular and trapezoidal cross-sections, with rectilinear (n = 101), concave (n = 64), and twisted (n = 15) profiles. Complete pieces and proximal fragments exhibit flat (n = 21), punctiform (n = 30), and unidentified (3) butts. Length values for four complete bladelets vary between 41–44 mm, with an isolated example of 22 mm. A TCSA mean value of 17.42 mm^2 was calculated for 13 fragmented unretouched bladelets with complex/plausible complex fractures: step fractures on one proximal, two median, and one distal fragment; hinge fractures on four median and one proximal fragments; feather fractures on three median and one proximal fragment. According to the detachment negatives on the dorsal side, a small percentage of the bladelets (3.59%) indicate the change of debitage direction to an opposite striking platform.

The retouched bladelets (Fig. 5) are mainly trapezoidal in cross-section, with rectilinear (n = 27), concave (n = 10), and few twisted (n = 3) profiles. Several complete and proximal fragments show punctiform (n = 3), flat (n = 1) and unidentified (n = 2) butts. The length of the two complete specimens is 32 mm/44 mm. The right edge of the blanks is usually preferred for applying direct, steep/marginal retouch. Among the retouched bladelets there are only 4 showing patterns of complex/plausible complex fractures (with mean TCSA value of 16 mm^2): step fracture on one distal fragment, hinge fracture on two median fragments, and feather fracture on one median fragment.

DISCUSSION AND CONCLUSIONS

Besides the general chronological gap between the Aurignacian and the Epigravettian, the samples studied here come from geographically remote areas and possibly functionally different habitations. Obviously the function/duration aspects could generate a peculiar noise in what the amount of hunting/domestic implements used and abandoned *in situ* is concerned, not to mention the dissimilarities in the sample size. Nevertheless, several important empirical similitudes/differences are worth mentioning.

According to the metric data, measurements indicate roughly the same morphology and the same prevailing width and thickness values for both Aurignacian and Epigravettian bladelets. The extent of the retouched surfaces brings together most of the Dufour and backed bladelets in a group of 5–8 mm wide items (Chart 1), which fits also most of the unretouched bladelets in the Aurignacian sample, while the majority of the Epigravettian unretouched bladelets seems to be a little wider (7–10 mm; *cf*. Chart 3). In both cases (Aurignacian and Epigravettian samples), retouched and unretouched bladelets show the same prevailing thickness values (2–3 mm; see Charts 2, 4).

About 11.61% (Româneşti-Dumbrăvița I) and 7.5% (Coşava) of the Aurignacian samples represent retouched and unretouched bladelets with complex/plausible complex fractures, while in the Epigravettian group the same bladelets amount to 8.33% (Româneşti-Dumbrăvița I) and 8.21% (Bistricioara-Lutărie 'Mal'). Among their common features, one might also point towards the dominant median fragments, the small percentage of twisted profile bladelets and the general preference for one striking platform cores.

Nevertheless, in what the projectile impact fractures are concerned, the Aurignacian group holds the lowest TCSA values (Chart 5), while the Epigravettian group holds the highest ones. In each of the two groups the most numer-

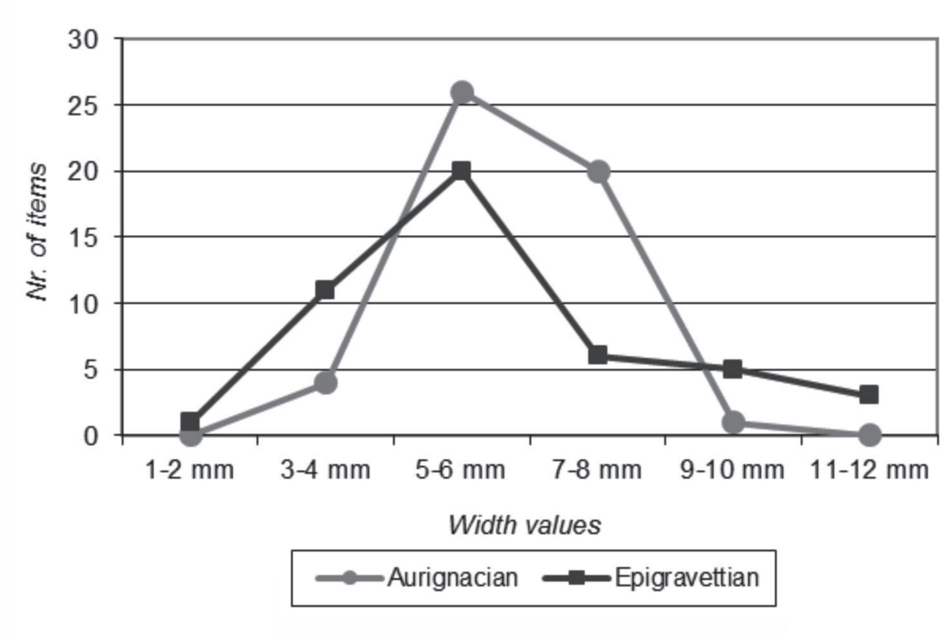

Chart 1. Aurignacian and Epigravettian retouched bladelets.

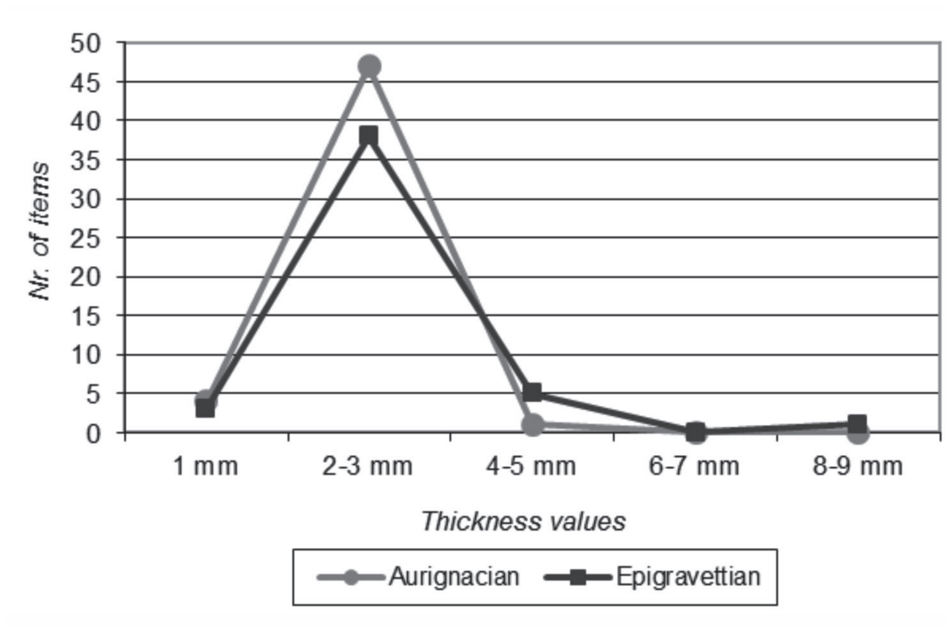

Chart 2. Aurignacian and Epigravettian retouched bladelets.

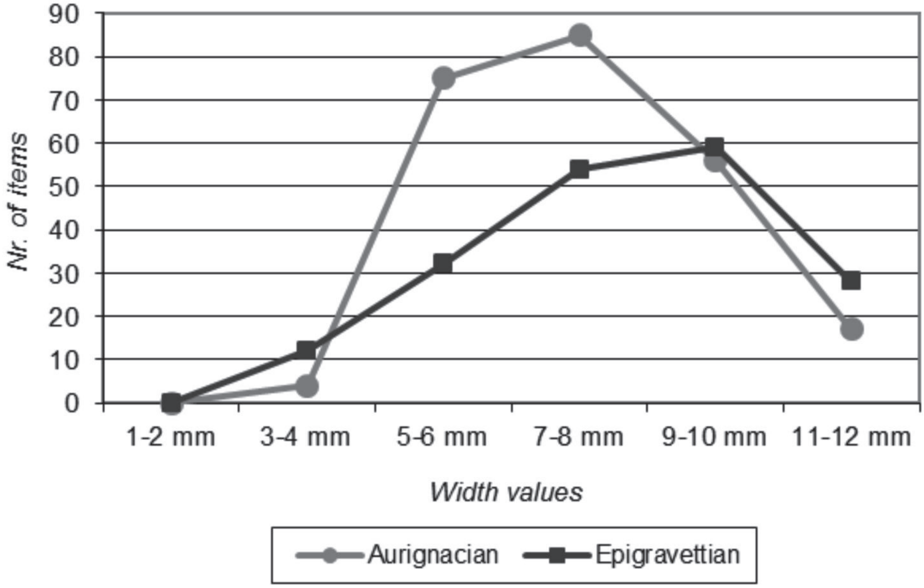

Chart 3. Aurignacian and Epigravettian unretouched bladelets.

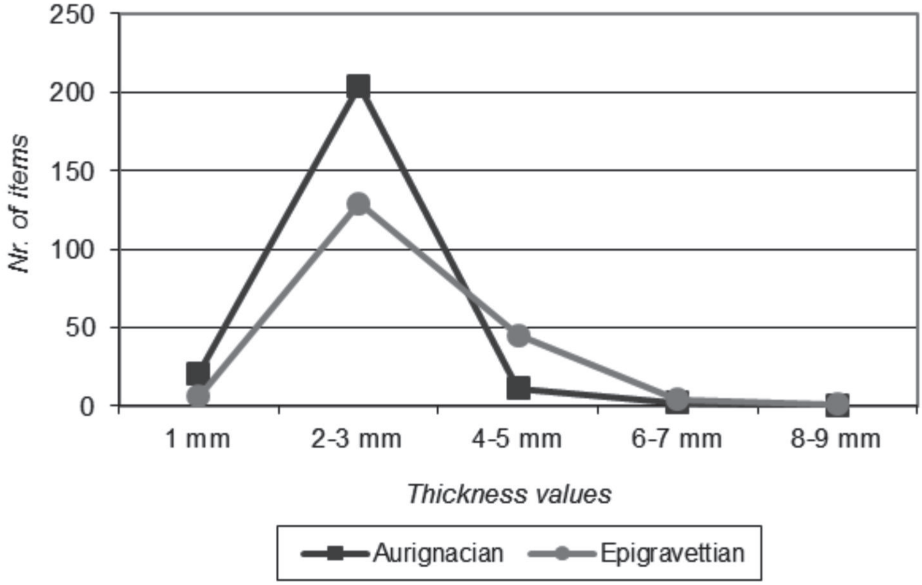

Chart 4. Aurignacian and Epigravettian unretouched bladelets.

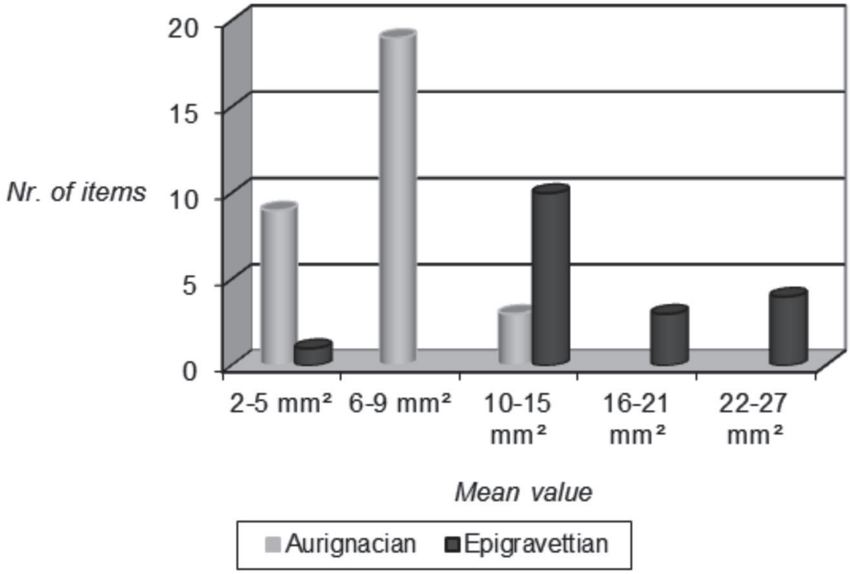

Chart 5. TCSA mean value (all bladelets with complex and plausible fractures).

ous to show complex/plausible complex fracture marks are the unretouched fragmented bladelets (Table 2). We therefore need to stress strongly the partially counter-intuitive importance of raw blanks certainly used as projectiles. It is possible that their higher fragmentation rate correlates precisely with the lack of retouch, which, apart from facilitating hafting, certainly had the additional role of increasing the mechanical resistance of the implements.

Table 2

Types and frequency of fractures

Technocomplexes/Sites		Retouched bladelets				Unretouched bladelets			
		Step fracture	Spin-off fracture	Feather fracture	Hinge fracture	Step fracture	Spin-off fracture	Feather fracture	Hinge fracture
Aurignacian	Românesti-Dumbrăvița I	3	1(+2?)	1	4	8	—	5	4
	Coşava	—	—-	1	—	1	—	1	—
Epigravettian	Româneşti-Dumbrăvița I	—	—	—	—	1	—	1	—
	Bistricioara-Lutărie 'Mal' (Shore)	1	—	1	2	4	—	5	4

Whatever the case, it is quite clear that impact-related macrowear affects a relatively small number of retouched and unretouched Aurignacian and Epigravettian bladelets, which also display low TCSA mean values. Put differently, only a small number of light and regular implements document *directly* their use as projectiles. Certainly, this can be the result of several variables being at work, such as sites' functionality and occupation length or some particular regime of hunting equipment retooling.

Interestingly enough, when projected against a broader context, our data do not actually stand out as peculiar. Previous reports on fracture patterns or traceology results indicating the use of bladelets as projectile implements involved Aurignacian (Fumane Cave — Broglio et al. 2005; Castanet — Pelegrin, O'Farrell 2005; Brassempouy — O'Farrell 2005; Isturitz — Normand et al. 2008), Gravettian (Sire — Hays, Surmely 2005; Geißen-klösterle — Moreau 2010; Grotta Paglicci, Grotta della Calla — Borgia 2008) and Epigravettian (Amvrosievka — Nuzhnyj 1989; Mezhirich — Nuzhnyi, Shydlovskyi 2009) collections. Some of them revealed various percentages of retouched bladelets with diagnostic impact fractures — 3% (Isturitz), 11% (Castanet), 16% (Geißenklösterle), 37% (Fumane Cave).

According to the published information and to the illustrated items, one could trace their TCSA mean value between 3.37 mm^2 (Castanet)/3.75 mm^2 (Isturitz) — 5 mm^2 (Geißenklösterle) — 9 mm^2 (Mezhirich)/9.8 mm^2 (Sire) — 7.5 mm^2/17.5 mm^2 (Amvrosievka). Our group of Aurignacian (Româneşti-Dumbrăvița I/Coşava — mostly 6–9 mm^2) and Epigravettian (Româneşti-Dumbrăvița I/Bistricioara-Lutărie 'Mal' — mostly 10–15 mm^2) bladelets showing complex/plausible complex fractures fits well within this range, and so does the overall percentage of bladelets with projectile impact use-wear.

Several functional studies identified different performed activities for these microlithic items: arrow implements for the *microgravettes* (Hays, Surmely 2005) and Gravette points (Borgia 2008); arrow implements and processing wood, antler, or meat for the Aurignacian bladelets (Hays, Surmely 2005; Normand et al. 2008), etc. Apparently, irrespective of the cultural context, there is apparently no restricted functioning of bladelets as projectile inserts, which makes them likely candidates for serving a relatively large spectrum of activities.

However, at least in the archaeological contexts discussed here the fragmented projectiles belong to a large, sometimes massive series of bladelets with *similar* metric features, some even used as projectiles in a raw state. Their dimensions point rather clearly towards a deliberate investment in standardization, portability and light weight. Although possible, the differential use (e.g. cutting edges/piercing tips for domestic tools) of these systematically produced light bladelets seems less likely and probably reduced to opportunistic occurrences. It is actually worth stressing that, at least in the case of Gravettian laterally mounted implements, use-wear traces such as polishing were experimentally documented as resulting from hafting and projectile use (Borgia 2008).

The remaining question is therefore why so few (occasionally from so many) of these implements preserve macro-traces of projectile use. One possible explanation stands in the nature and quality of adhesives and/or ligatures used and in the actual position in the haft, which may limit the fragmentation of the lithic inserts and therefore hamper their proper identification as projectiles. Also, the same (hafting-related) circumstances might favor the development of diagnostic micro-wear; when the analysis focuses on the latter, the results have been known to prove the use as projectile implements of a quite large amount of retouched and unretouched Epigravettian bladelets (Gyurova 1995), which, in turn, did not seem to exhibit any diagnostic macro-fractures.

In fact, while there is little doubt about the possible use of Dufour/backed bladelets as projectile implements, the debate still goes on about the shafting system, the type of projectile (arrow or spear), and the propulsion device (bow or spearthrower). Some ethnographic accounts (e.g. Ellis 1997) show that, except in the case of thrusting spears, on which mounting a lithic point could result in liability, stone tipped projectiles are almost always favored, as their brittleness and cutting properties make them more lethal. According to recent experimental studies, the use of spears with reindeer antler points and mounted flint backed bladelets provided interesting results (Pétillon et al. 2011): the mean penetration depth of antler points nearly doubles when they are equipped with flint inserts; the latter were subjected to a high loss rate of about 40% during shooting and also to a low rate of macroscopic impact traces development (about 20%); finally, composite tips efficiency and durability varies according to the connection between shaft, point, and inserts. Experimental results have also shown bow launching to leave more extensive marks of bending and lateral fractures, and the spearthrower launching generally to cause more fractures than the bow does. Although fracture frequency is also related to the location of the impact point on the target, both the use of bow and spearthrower might equally explain the low percentage of fragmented projectiles in most archaeological samples. Unfortunately, morphological and metric criteria alone seem to be insufficient for an unambiguous differentiation between arrow and spear lithic points (Cattelain 1997).

Surely, both TCSA values criterion and the ethnographic comparative sample available are mostly concerned with distal, longitudinally mounted projectile implements, and when bow and arrow technology is discussed, laterally retouched bladelets are usually not involved. The latter constituted more the subject of experimental and archaeological studies involving side-slotted shafts of spears or darts and lithic implements inserted along parallel lines (Pétillon et al. 2011). Only a few studies considered both tipping and lateral insertion as possible functions of backed implements (Nuzhnyj 1990; Borgia 2008), or evaluated the hypothesis of Protoaurignacian axially hafted bladelets (O'Farrell 2005). However, there is a high possibility that light, narrow retouched implements like Dufour bladelets or backed bladelets were actually used in *laterally mounting the distal end* of relatively slender hafts, thus forming the sharp tip of an arrow.

Although the first direct evidence of bow use is much later and admittedly unconvincing (e.g. Rosendahl et al. 2006), tracing the bow-and-arrow system back to the beginning of the European Upper Paleolithic does not seem an impossible endeavor anymore. After decades of experimental shooting workshops and use-wear studies, the refusal to do so would only attest the application of double standards (*cf.* Cattelain 2006). The issue actually goes way beyond the technological systems themselves. As the North American Plains archaeology suggests, the adoption of bow and arrow entailed important changes not only in what hunting tactics were concerned, but also in the social realm (Bettinger, Eerkens 1999), a point which should be carefully assessed given the many changes associated to the emergence of the Upper Paleolithic in Europe, particularly as older African occurrences of bow and arrow use were in fact already proposed (Bretzke et al. 2006; Lombard, Phillipson 2010).

As several ethnographical and archaeological cases suggest (Rasic, Slobodina 2008), the parallel, complementary use of multiple weapon systems (bow and arrow, spearthrower darts, spears) seems rather the norm as the exception among most forager communities. In fact, many archaeological data, including the bone and antler/ivory industry point to a similar flexibility during the Upper Paleolithic.

In the organic (antler, ivory, bone) weaponry domain, experimental studies (Guthrie 1983; Arndt, Newcomber 1986; Pokines 1998; Stodiek 2000; Pétillon 2006) highlighted the special resilience of organic points, as well as, unlike the lithic points, the undemanding rejuvenation needed in case of breakage, both virtually encouraging a more frequent use of the organic projectiles when compared with the lithic ones. Ironically, the latter are most likely to experience the destructive effects of time, thus providing archaeology a seriously biased sample.

Unfortunately, none of the Romanian contexts discussed here provided direct evidence for the organic industry. In fact, the only genuine Aurignacian context in Romania to provide one reindeer antler proximal Mladeč point and one median point belongs to Mitoc Malu Galben settlement (Chirica 2001; Beldiman 2005). All other five organic points tagged as Aurignacian come from insecure, undated contexts which could only be referred to as Upper Paleolithic: two proximal bone and reindeer antler points and one distal reindeer antler point — Muierii Cave (Păunescu 2000; Beldiman 2005); one horse bone proximal point — Bistricioara-Lutărie I (Păunescu 1996; Beldiman 2005; 2007); one cave bear bone distal point — Igrița Cave (Dobrescu 2008). The Epigravettian organic weaponry record in Romania is not much richer: three ivory and three antler median and distal points — Piatra Neamț (Cârciumaru et al. 2007–2008); one distal bone point — Crasnaleuca; two median antler points — Cotu Miculinți (Brudiu 1980; 1994; Beldiman 2007). Whether or not the small number of such finds is rather due to poor preservation, it is hard to assess. However, things look fairly different for other East European areas. The Aurignacian layer at Corpaci provided two Mladeç points (Chirica, Borziac 1992; Chirica et al. 1996), while the Epigravettian records richer contexts: Cosăuți — two ivory points, one bone point and eight reindeer antler points; Molodova V, layers 6–3: fourteen ivory points (Chirica, Borziac 1992; Borziac et al. 1998); Yudinovo — five ivory points (Abramova, Grigorieva 1992), etc.

Viewed from a larger, continental perspective, the Aurignacian technology, much like in Epigravettian (or its Western and Central European counterpart, the Magdalenian), seems to display a clear bias towards organic points and microlithic bladelets. Also, Gravettian contexts point to multiple weapon systems, displaying a wide range of projectile lithic implements of various sizes.

To conclude, there is, therefore, enough evidence to suggest the early use of multiple weapons systems, such as organic spear points, light armatures for spearthrower darts and arrows from the very beginning of the Upper Paleolithic and constantly after. Among other factors, these complementary technological solutions may explain the explosive adaptive success and the longevity of both Aurignacian and Gravettian/Epigravettian technological systems. Hopefully, fresh experimental studies coupled with a careful assessment of better preserved archaeological contexts will shed further light on the relative importance of each weapon system, on both diachronic and synchronic grounds.

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Abbreviations

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