Techno-typological variability of the late Middle Paleolithic in the southern Balkans

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CHAPTER 7

Conclusions

The goal of this thesis was to better understand the Middle Paleolithic (hereafter MP) industrial variability in the Balkan peninsula. The archaeological record of this region remained outside of discussions and interpretations of Neandertal behavior for a long time primarily because of the scarcity of Paleolithic sites, assemblages, and studies on technological variability. A better understanding of the MP record from this region would help with interpretations of large-scale patterning of Neandertal behavior and adaptations. For the Balkan record to be relevant for understanding Neandertal adaptations the following questions should be addressed. How does the variability of industries in the Balkans compare to the regions of Europe with better documented MP records? Does the Balkan MP represent a link that can relate techno-typological phenomena known in other regions? Engaging is this task required reevaluation of somewhat outdated terms such as Charentian, Typical Mousterian, Denticulate Mousterian, and Micromousterian, that have been used to describe the industries in the Balkans. Paleolithic research elsewhere in Europe has reconsidered and redefined these terms, but their use persisted longer in the Balkans. Regional research was late to adopt changes in the analysis of lithic technologies that saw a shift from typology to technology and a firmer integration of both in understanding technological processes. The goal of this dissertation was to disentangle the MP variability of the Balkans, to offer a new look on the variability of its industries and to help put the Balkans back on the map of MP research.

The approach to the understanding the MP industries in the Balkans in this dissertation included both analysis of lithic materials and a review of the available record. Analysis of lithic materials included 1) examination of methodological aspects related to the size and shape aspects of lithic blanks using an experimental collection; 2) the variability of MP in the Balkans has been addressed through analysis of archaeological collections on two sites in Montenegro, Bioče and Crvena stijena, with special concern related to the existence of the Micromousterian. Finally, an overview of the record from the entire peninsula is taken into consideration to better integrate the available knowledge of the existing assemblages.

Variability in the MP industries of the Balkans was addressed in this dissertation at several levels, at the level of artifacts, assemblages, and industries.

7.1 Blank Variability

The Balkan MP assemblages primarily contain flake tools and much of the typological variability is related to variation in tool types that results from different resharpening trajectories. To better evaluate the reduction intensity in tools in assemblages studied here, it seemed important to address the existing measures of tool resharpening. Chapter 2 is an attempt to evaluate the ways we assess and measure blank variability in lithic analysis, in particular blank size and overall morphology (Dogandžić et al., 2015). Aside from testing the accuracy of different measurements of flake length and width, this work focused on platform measurements and their ability to predict flake size. Platform variables are informative about blank size since they highly correlate with one another (Clarkson and Hiscock, 2011; Dibble, 1987, 1995, 1997; Muller and Clarkson, 2014, 2016a). Therefore, comparing the original blank size to the one that results from a series of resharpening events is one way to assess the level or intensity of tool modification. Further, platforms are directly related to the question of how knappers control the detachment of a flake and, more importantly, its size and shape. This provides us with a window into knapping practices related to platform management that impact blank variability and that can be used to elucidate past technological processes. Overall, this study was designed within an approach that focuses on economic aspects of artifact production that concerns its costs and functional aspects of blanks.

Firstly, we compared the different systems of measuring linear dimensions of artifacts, length and width. This comparison shed light on the errors that might result from comparing metric attributes of assemblages using different measurement systems.

Since economically oriented studies of lithic technology emphasized the edge length or surface area as a currency for the functional benefit of a blank (Braun and Harris, 2003; Eren et al., 2008; Key and Lycett, 2014; Kuhn, 1994; Lycett and Eren, 2013; Mackay, 2008; Muller and Clarkson, 2016b), precisely and accurately measuring the edge length and flake area became something of interest for lithic analysts. Even though some lithic analysts nowadays rely on digital estimates of edge length and surface area (e.g. Eren et al., 2008; Muller and Clarkson, 2016b), many still use measurements obtained with calipers to calculate the edge length and area. It is, therefore, important to assess errors in their estimates. We showed here that one method is better for estimating edge length (the box) and another (axial measures) for estimating surface area, and both less likely to be affected by the irregularity of the flake.

The second goal of this study was aimed at providing a better prediction of blank size based on platform variables. In both an experimental setting and in archaeological assemblages, it has been repeatedly demonstrated that the platform, essentially its thickness (PD) and exterior angle (EPA), are primary factors affecting the flake size (weight) (Braun et al., 2008; Dibble, 1997; Dibble and Rezek, 2009; Dibble and Whittaker, 1981; Pelcin, 1997b; Režek et al., 2018; Speth, 1972, 1975). The amount of flake size variability explained by these two variables, as measures by r^2, however, remained rather low (Davis and Shea, 1998; Hiscock and Tabrett, 2010; Shott et al., 2000). In this study we used a predictive linear model that included several measurable attributes as predictor variables (platform width, platform thickness, EPA, flake thickness) to estimate flake weight and surface area. The linear regression method uses several independent variables to predict the outcome of an independent/response variable. The resulting r^2 value is higher than reported previously, which appeared promising (Chapter 2). However, this did not fully mitigate the problem of a predictive error involved in this result that jeopardizes the application of this model to archaeological assemblages. If one's interest lies in confidently predicting the original size of a blank before its modification by retouch, to be compared with the discarded size and thus estimate a level of tool resharpening, the results of these predictions can be discouraging as they do not provide necessary power to estimate the size on a piece-by-piece basis. If applied on sites with small samples of tools, such as in examples of Bioče and Crvena stijena (Chapter 3), the noise, or errors, produced by the predictive model are large enough to obscure the amount of mass lost during resharpening. In other words, if the model predicts 75% if the variation of flake weight as predicted by variables, the unexplained variation, i.e., the error of the predictive model, for a particular artifact, may be larger than the amount of weight lost to retouch, making the comparison between the initial and terminal weight complicated. For this reason, other measures of tool resharpening are more useful, namely, geometric index for unifacial stone tools proposed by (Kuhn 1990), which is a better relative measure of the amount of material lost (i.e., the log of the percent of mass lost) (Hiscock, Clarkson 2005). We still need more precise and accurate predictive models to be able to use them for original size predictions.

Another application of this study to archaeological assemblages was related to how informative platform features are about blank morphology and blank production process.

We examined the relationship of platform variables (PD and EPA) on blank morphology – elongation and relative thickness - in the experimental assemblage (Dogandžić et al., 2015) and as applied in archaeological assemblages (Dogandžić and Đuričić, 2017; see also Lin et al., 2013). In particular, higher EPA is relevant for increasing the surface area and edge length of a blank, more so if platform thickness is reduced, while thicker platforms, logically, will tend to produce heavier and thicker blanks. However, the effects of EPA and PD on blank morphology, e.g., elongation and relative thickness, are not so straightforward, since their effects are not consistently observed and in a few instances depend on the raw material in the sample examined here. Finally, the effect of EPA on blank size and shape, however, is not as prominent as it has been shown in controlled experiments (see also Muller and Clarkson, 2016b). One explanation for this is that the model based on variables included here do not provide full explanatory power for flake size/shape. For instance, it has been suggested through replicative experiments (Inizan et al., 1995; Pelegrin, 2005) and shown in controlled experiments (Magnani et al., 2014; Pelcin, 1997a; Rezek et al., 2011; Speth, 1975, 1981) that other variables have varied influence on size and shape, such as angle of blow, hammer type, core morphology (though there is a disagreement between replicative and controlled studies about the relative effect each of these have). Consequently, the effect of EPA, for instance, could diminish if the influence of these others are taken into account. However, this requires a better understanding of how different variables, in isolation but also importantly in their interactions, are affecting the final outcome.

This bring us to the question of how variables are chosen to be included in the model as variables predicting the flake size and shape. We should look somewhere at an intersection of what is available to be measured and what has an effect of the flake outcome. The latter is most often being informed from replicative experimental works (Crabtree, 1972; Pelegrin, 1990) and experiments in flake formation (Dibble and Rezek, 2009; Pelcin, 1997b: 199; Speth, 1972, 1975). Controlled experiments emphasized that PD and EPA have a prominent position in this regard as the main variables affecting size and shape that overcome the influence of others (force, core morphology, etc.) (Magnani et al., 2014; Pelcin, 1997a; Rezek et al., 2011). Adding other variables that are measurable by the analyst (such as platform width and blank thickness) to the model, as done in Chapter 2, in order to boost its predictive power is useful for blank reconstruction and its further use for comparison with discarded tool size. The addition of these variables, however, does not necessarily improve our understanding on the flake formation process; for instance, we have seen in this study that adding thickness to the predictive model significantly improves it (probably because it reflects flake weight), but obviously it is not clear what thickness represents in the flake formation model. Platform width was usually excluded from the models because it was considered a threshold variable (its effect on flake size would be significant if PD and EPA allow for a flake of a certain size to be produced) (Pelcin, 1998); however, the platform width is clearly related to flake shape. It also holds a relationship to platform thickness and the curvature of the core; disentangling these effects within the flake formation model is still a task to be resolved. Potentially, this lack of a clear understanding of flake formation and how different variables are related to each other might be the reason why we fail to precisely and accurately predict flake size as measured by r^2 in regression models.

So far, several models have been proposed, all based on examining different sets of variables (EPA, PD, core morphology hammer type, angle of blow, beveling etc.) (Leader et al., 2017; Magnani et al., 2014; Rezek et al., 2011); however, it remains unclear how all these variables interact and relate to one another in flake formation. For instance, predictions that include platform variables are better for predicting weight than surface area (Dogandžić et al., 2015). While weight and surface area are used interchangeably since they are highly correlated, we understand little whether variables relevant for flake formation (EPA and PD) are predicting mass or area; in other words, does the crack that forms the flake extend until a certain mass is consumed or until it reaches a certain distance from the point of percussion, which then determines the length and thus area of the flake (Pelcin, 1997a, 1997b; Pelcin and Dibble, 1995). Additionally, we showed (Chapter 2) that the EPA does have an effect on blank outcomes as previously demonstrated, especially for surface area and less for weight, but that effect is rather small and it remains to be determined how its effect changes given the state of other variables. This result will certainly be informative for and incorporated into future models of flake formation that should examine these variables in a more interactive way. Furthermore, it will be important to relate these predictions and relationships to archaeological questions. Reconstructing original blank size was one of the main incentives for conducting these experiments. They can provide a more robust understanding of how specific variables are related to the outcome, but other avenues can be explored in controlled experimental conditional as well, e.g., how economic properties of blanks are achieved (Eren et al., 2008; Muller and Clarkson, 2016b; Režek et al., 2018), whether certain outcomes require production complex enough so as not be a result of convergence (e.g., Magnani et al., 2014 on pressure flaking), to name a few.

7.2 Assemblage Variability

Two Middle Paleolithic sites located in Montenegro were the focus of this dissertation's goal to take a new and closer look at MP variability in the Balkans. Overall, 4 levels at Bioče and 6 at Crvena stijena broadly correspond to late Middle Paleolithic phases, while firm associations with climatic phases are yet to be determined. Crvena stijena is one of the sites that has been essential for the recognition of several Mousterian variants such as Typical Mousterian, Charentian, and its similar variant Pontinian, and Denticulate Mousterian (Basler, 1975; Ivanova, 1979; Kozlowski, 1992; Kozłowski, 1975, 2002). Both of these sites, together with several other in the eastern Adriatic region have been referred to as Micromousterian, which suggested a regional source of variation (Basler, 1975; Đuričić, 2006; Karavanić et al., 2008; Papaconstantinou, 1989a; Vujević et al., 2017). While studying these assemblages, the larger goal was to re-examine them with a new look at MP variability in addition to the typological focus that was the basis of their initial classification. One particular focus was to look at the cause of the small size of the artifacts, so as to tackle the question of the intentionality aspect of this feature and the regional distribution of this phenomenon. In this study, we tried to bypass associations with particular facies. We instead attempted to examine and present the core reduction methods and toolkit production, the ways these two aspects are associated, and how they are related to both core and tool reduction intensities in these assemblages.

The study of the Crvena stijena and Bioče MP showed that, as expected, raw material source and size, as well as the reduction intensity, are the primary factors affecting the size of artifacts at these two sites, and this is best demonstrated when the two are compared. Secondary sources, i.e. pebbles from the nearby river, were used at Bioče where the overall average artifact size is larger. At Crvena stijena, primary resources were used and likely partially reduced off-site at the raw material source location since these assemblages lack cortex. In addition, the production intensity as measured by several factors/variables (Chapter 3), shows that more blanks have been produced per core at Crvena stijena compared to Bioče, which in turn contributed to the comparably smaller average size of artifacts at Crvena stijena.

The main flaking methods practiced at both sites, in most of the levels, fall under the group of centripetal flaking, mainly evidenced by residual cores (Levallois, discoidal *lato-* and rarely *stricto sensu*, radial cores) and the associated products. Proportionally, more products of these flaking methods are present at Bioče than at Crvena stijena, most likely owing to raw material size. Other core forms are present including several kinds of cores-on-flakes: Kombewa, truncated-facetted, reflaked blanks and tools, used as cores. Various forms of one- or two-platform cores are more present at Crvena stijena than at Bioče.

As in many MP assemblages, the majority of the toolkit consists of various scraper forms, denticulates, notches, and some Upper Paleolithic types. The incidence of scrapers is higher where tools are produced at a higher rate, and in turn, this coincides with a higher reduction intensity in tools. There is a general association, across levels, of tool production intensity (tool:blank ratio), incidence of scrapers and the consequential relative proportion of denticulates/notched tools, and the average resharpening in the toolkit. In particular, the more tools are produced, the more scrapers there are in an assemblage, and the higher the resharpening intensity in tools. This pattern has been observed at other MP assemblages and recognized as one of the major factors affecting industrial variability, likely reflecting changes in settlement strategies or durations of occupations (Steven L. Kuhn, 2013; Riel-Salvatore and Barton, 2004; Rolland, 1977, 1981; Rolland and Dibble, 1990).

To evaluate how flaking methods are associated with tool production within an assemblage and how they relate to factors such as reduction intensity, we looked at the relative proportion of products of different flaking methods (cores and blanks), core reduction intensity (core sizes, length:thickness ratio for centripetally flaked cores), blank production intensity, tool type frequencies, and tool reduction intensity (measured by Geometric index of unifacial reduction (Kuhn, 1990)). The summary of assemblage variability follows (from older to younger levels).

Crvena stijena.

Level XVIII is the only level where Levallois/discoidal/radial flaking has been employed less frequently. Residual cores (on thicker raw material chunks, cores-on-flakes, including truncated-facetted pieces, core from bipolar flaking) point to a rather informal production of blanks and also small flake production. The main feature of this assemblage is an increased transformation of blanks into tools, a higher production of scrapers (almost 70%), and tools with more resharpening events. Characteristic is the production of thicker, sometimes cortical blanks that have been transformed into, often heavily retouched scrapers, at times with Quina-like retouch. Aside from this techno-typological aspect, present are also elongated elements, sometimes of Levallois type, and among retouched tools small and lightly retouched flakes, but these are less prevalent.

Compared to other levels at this site, the small assemblage of Level XVI contains more Levallois products with an elongated morphology, with convergent negatives and often with facetted platforms. However, Levallois cores are rare. Typologically, there is a continuation of the Level XVIII trend of high tool and scraper production.

The upper sequence, levels XIV, XIII, XII, share a more frequent use of centripetal, Levallois and discoidal methods of blank production, as evidenced by both core and blank morphologies. Conspicuous is a frequency of small, heavily reduced centripetal cores. In Level XII, the morphology of centripetal cores (taken together), changes with size; namely, the core length to thickness ratio is smaller in smaller cores, suggesting more conical forms of cores towards the end of the reduction. This is also reflected in the smaller average size of discoidal cores. This level has a high artifact density and high blank production. In level XIV, there is no indication that the cores turn conical at the end of their use-life. Large discoidal/radial cores are present, potentially reflecting less blank production here.

Frequent are also small cores. Some of these are rather informal (potentially a result of the extended use of centripetal cores) and some use one or two platforms for detachment of blanks of somewhat elongated morphology. Elongated flakes/bladelets are a feature of these assemblages (though somewhat larger cores for elongated blanks are found as well, e.g. in Level XIV). The exploitation of these cores – small exhausted radial cores and platform cores for small blanks - cannot be unambiguously associated with an increased reduction intensity. All three levels contain these cores, but they exhibit different levels of reduction intensity.

Tool production, use and reuse is less intensive than in the earlier phases. The resharpening index shows that repeated resharpening was not as common as in lower levels, as demonstrated by the resharpening index. Denticulate tools and retouched flakes are more frequent in this part of the sequence compared to Level XVIII. Notable are marginally retouched thin flakes (*raclettes*), especially in Level XIV. Aside from these similarities, tool and blank production are different between the levels. Level XII has a higher blank production ratio and consequently less tool transformation. The opposite is true for Level XIV.

Bioče.

The assemblages of Bioče are rather homogeneous. The most commonly employed flaking methods is centripetal, including Levallois and discoidal reduction. There are also numerous centripetally flaked small cores resulting from increased core exploitation.

Levels 5 and 7 contain evidences of discoidal flaking. In Level 7 discoidal flaking is evidenced by a high number of blanks consistent with this method and discoidal cores, which are as large or larger than Levallois cores, suggesting that they are not the result of increased core reduction. This is further corroborated by the low blank production intensity in this level. Furthermore, centripetal cores do not show size differences between different types. Level 5 features numerous discoidal cores, a smaller average core size, and a corresponding high blank production intensity. Levallois cores are underrepresented, and most cores, irrespective of size, have a more radial/discoidal morphology. Tools in both levels are not heavily modified by retouch.

Levels 3 and 2 have numerous cores of centripetal form. In the smaller, more heavily reduced cores, the morphology changes, becoming more conical/discoidal form. Levallois cores are somewhat more represented than in the lower two levels, and notable are elongated blanks with uni- and bi-directional scar removals. Level 3 features relatively fewer Levallois blanks compared to level 2, potentially due to comparably higher reduction intensity (as measured by blank production). Compared to the lower levels, here we see higher amounts of resharpening in the tools. However, relatively more denticulates are present compared to Levels 5 and 7.

Inquiries into and interpretations of assemblage variability come with an implicit acceptance of two assumptions commonly made in archaeology: 1) that the assemblages we study are homogeneous, resulting from either one occupational event or a few similarly featured events with different events delineated by different geological strata, and 2) that the entire reduction sequence is present at the site and reflected in the assemblage. These assumptions are rarely explicitly stated in most studies, but we often structure our analyses with them in mind. Assemblages are minimum units of analysis of variability and units of comparisons, but they come with caveats: they do not necessarily represent a result of one but rather many occupational episodes that were spread over sometimes long periods of time and could include different technological behaviors (Bailey, 2007; Rezek et al., 2020; Stern, 1994), and each of them likely represent incomplete reduction sequences either due to their fragmentary character, with items imported, exported, or discarded items reused (Turq et al., 2013) or by the very fact that they come from a limited area and thus represent a sample potentially not illustrative of the entire assemblage. Therefore, the behaviors assemblages reflect are not necessarily uniform.

Quantitative approaches such as the one applied here rely on relative proportions of artifact types and use measures of the reduction intensity with ratios such as number of blanks per core, or blanks per kg, mass of residual cores compared to the overall mass (Chapter 3). There is a concern in how to interpret these assemblage level statistics and to what extent they reflect a consistent pattern of behavior throughout the layer or whether they represent an average signature. Again, what makes this issue more complicated is recognition that materials are moved into the sites in different states of reduction and some artifacts types (e.g., cores, tools, large flakes) can be removed from the site. Unlike the palimpsest issue, there is a significant amount of research dedicated to detecting transport and partial reduction sequences (Ditchfield, 2016; Geneste, 1985; Holdaway and Douglass, 2012; Inizan et al., 1995; Roebroeks et al., 1988; Roth and Dibble, 1998; Turq, 1999). However, detecting these phenomena and distinguishing between different transport and reduction patterns is rather difficult (Ditchfield, 2016).

At Crvena ctijena and Bioče, these issues were of a concern. Collections come from old excavation in the case of Crvena stijena, and while there is confidence that the artifacts have been correctly associated with geological layers, we do not, at this moment, know more about the site formation processes. Site formation studies were not available for either site. Extensive refitting is often a remedy for these difficulties, disentangling separate events and identifying transport. Potential refitting attempts were jeopardized by the nature of the collections and curation of these assemblages, and, such as is usually the case with MP assemblages, by the homogeneous character of the raw materials and technologies – especially in the case of Bioče - which hampers sorting the artifact classes, a prerequisite for refitting. That said, the interpretation of the variability of these assemblages comes with the accepted assumptions that the set of artifacts grouped in an assemblage deposited in geological units are the result of either one event or several events of similar character, and that no significant transport and re-use has been happening.

7.3 Industrial Variability

The notion of a broader analytical unit in archaeology, known as industry, sometimes techno-complex or facies, assumes that different assemblages can be grouped together based on a set of technological and morphological features (Clarke, 1978). The history of MP variability research has seen shifts in what are the defining features of an industry and its variants. Initially assemblages were classified according to the retouched tool types frequencies accompanied by the presence of flaking methods, and this gradually shifted to using blank production methods as the primary criteria (as a part of *chaine operatoire* approach) with the sometime inclusion of a combination of both approaches. Balkan MP research has mainly relied on older approaches to facies classification and was slower to adopt changes in research that placed more emphasis on technological processes rather than typologies; e.g., any scraper-rich assemblage is defined as Balkan Charentian, without special attention to the underlying flaking method that differentiate the two Charentian "options" defined in SW France, Ferrassie and Quina, with Levallois and Quina methods. For instance, Level XXIV at Crvena stijena, rich in scrapers and with common Levallois production, is placed in the Charantoid industries (Kozłowski, 1975) and Typical Mousterian variant (Ivanova, 1979), while southeastern Charentian – Croatian sites with scrapers but low Levallois, more resembles non-Levallois Charentian (Gabori, 1976; Ivanova, 1979; Kozlowski, 1992). Another example is a frequent use of the Typical Mousterian designation for assemblages that feature "a little bit of everything" and that are difficult to place in one facies or another.

The review of the Balkan MP record undertaken as a part of this dissertation examined the industries from a technological and typological perspective based on the previously published data. It took a temporal perspective to reveal potential trends in appearance, disappearance, and prevalence of technological and typological features, untied to the industrial designation. Lastly, it explored analogies and comparisons to the broader Eurasian record. The derived conclusions are not definitive, given the nature of the published data, the scarcity of the record, and lack of extensive dating. Rather, the data permitted us to suggest exploratory propositions about Balkan MP features and trajectories to be further investigated and tested.

The chronological view of the MP in the Balkans can be briefly summarized as follows. The earliest MP occurs a bit before MIS 6 and is represented by a strong emphasis on scraper production, especially on thick, often naturally backed, blanks. While present only in a handful of sites, it has been suggested that they resemble Quina technological behavior (Mihailović, 2014a; Mihailović and Bogićević, 2016). Levallois technology sees a frequent use starting from MIS 6 and, when stratified (Velika Balanica, Theopetra), always occurs after Quina-like Charentian. Once these two methods (thick blanks and Levallois) are introduced in the technological repertoire, they are concomitantly used during the early glacial at several sites (mainly in central and western Balkans), and again, oriented towards scraper production, which, in turn, shows varied extents of resharpening. A handful of sites in MIS 6/5 have blade production, sometimes of volumetric type. While not predominant, one can draw parallels with other European records at this time (Bar-Yosef and Kuhn, 1999; Tuffreau, 1995). Bifacial methods might have seen their first use in MIS 5 in the eastern Balkans (Guadelli et al., 2005). In sum, early MP saw the introduction of most flaking methods characteristic of the MP, and hominins shifted between these with few novelties occurring later on.

One can find similarities between these trends and the western European record: while Quina industries in SW France are rather associated with MIS 4 and 3, similar industries are present in MIS 6 (Geneste et al., 1997; Le Tensorer, 1978; Turq, 1992). On the other hand, analogies can be made with nearly contemporaneous industries to the east, e.g. Turkey and the Proto-Charentian at Karain (Otte et al., 1995), potentially introduced *westwards* from the east and the Yabrudian concept (HL Dibble, 1991; Steven L. Kuhn, 2013; Mihailović and Bogićević, 2016), which is similarly followed by the introduction of Levallois. Levallois and blade production are more common in early MP (Delagnes et al., 2007; Richter, 2016; Tuffreau, 1995). Levallois and scraper rich industries in MIS 5 in the Balkans (in particular the ones from Crvena stijena and Karain) have been considered as cultural markers that indicate the movement of Neanderthals *eastwards*, as far as the Zagros (Kozlowski 1992, 2002). In addition, one should bear in mind Mala Balanica's (Serbia) attribution to archaic *Homo* sp. (Roksandic et al., 2011) or *H. Heidelbergensis* s.l. (Skinner et al., 2016), the Apidima 1 (Greece) fossil attributed to early *H. sapiens* and dated to ~200ka (Harvati et al., 2019) and modern human introgression into Neandertals estimated to have happened during the Middle Pleistocene (Posth et al., 2017). With this fossil record in mind and the proposed origins of different industries, one can envision potentially a more complex picture of population movements. This period needs further evaluation and study to better understand the population history and how it might have influenced the visible and distinct changes in technological behaviors.

Later MP (MIS 3) in the Balkans does not necessarily entail the significant introduction of new flaking methods. To the contrary, the late MP is characterized by the diminishing prevalence of certain flaking methods, such as Levallois and Charentian-like flaking, and more frequent use of less formal flaking methods (informal radial and discoidal), with less scraper production, less tool resharpening and an increase in denticulate tools. This lack of Levallois in late MP parallels the development of MP in SW France (Delagnes et al., 2007; Jaubert, 2010; Mellars, 1986; Monnier, 2006; Rolland, 1981).

Two late MP industries that are reflective of this phenomena of less formal techno-typological character are the Denticulate Mousterian and Micromousterian, both often applied to assemblages at sites in the Mediterranean zone but present elsewhere as well.

The criteria for classifying Micromousterian in the Mediterranean zone has been the small average size of artifact, though an explicit cut-off has never been proposed. Contrary to what F. Bordes had suggested - to designate the industry as Micromousterian only if the cultural factor can be identified, and small raw material and reduction intensity can be ruled out (Bordes, 1955, 1975) - most local studies failed to do so. The exception is the Micromousterian of Asprochaliko where a specific method of blank production targeted at small blank production has been identified (Papaconstantinou, 1989a); however, this has been questioned as well since this blank production method rather resembles discoidal flaking (Boëda, 1993). The existence of a Micromousterian entity has been challenged (Papaconstantinou, 1989a) because the size of artifacts cannot serve as a *fossil directeur* and factors such as raw material and economy of blank production need to be taken into account. Assigning assemblages with different techno-typological characteristics into one Micromousterian bundle can be misleading. For instance, Micromousterian includes many assemblages similar to the Pontinian, which is a diminutive Mousterian made on small raw materials, and assemblages like Aprochaliko's Micromousterian which likely represent a deliberate production of small artifacts through cores on flakes.

In the case study of Bioče and Crvena stijena (Chapter 3), the data show that the roles of raw material and the intensity of blank production are rather significant for structuring the assemblages; namely, the overall size of the artifacts does correlate with both of these factors. In other words, it is likely that the reason behind the small artifact size is not cultural and that the Micromousterian is usually just a diminutive version of "regular" Mousterian, resulting from the raw material properties (size, availability) and the overall reduction intensity. The question then arises, how do these factors influence technological behaviors? As seen in other contexts of small raw materials, the size of the nodules is important, noticeable is the rarity of "true" Levallois cores, preferential, uni- or bi-directional, and when present, they are larger than other centripetally flaked cores, likely representing initial stages of reduction. This is also illustrated by the fact that assemblages at Bioče, made on raw materials larger than Crvena stijena, feature more Levallois products than we see at Crvena stijena. In sum, we already see two factors considered to have a role in influencing small average artifact size – raw materials and reduction intensity - at play in these assemblages.

Small blanks were indeed produced at both sites, with varied methods of production. Notable is so-called ramified production where end-products have been reflaked to produce smaller blanks, but small flakes were also taken from small, heavily reduced cores in the last stages of their use-lives. At Crvena stijena, Level XVIII is particularly rich in cores-on-flakes, often of truncated-facetted type, but the level also includes small flake production from thick flakes or through removals from the ventral face of tools.

In the upper part of the sequence (Levels XIV, XIII, XII), cores-on-flakes are still present, particularly in Level XIII; however, small flake production in these levels is rather illustrated by the continuous reduction of cores, as evidenced by heavily reduced cores. These residual cores more often have centripetal form, but notable are cores with one or two platforms, sometimes perpendicularly oriented, from which small flakes and sometimes blanks of elongated form are removed. Whether the latter represent the last stages of reduction where cores have been reoriented in different directions in attempts to remove as many blanks as possible or the intentional production of blanks of this morphology, is not easy to say. It is relevant, however, that in Level XIV there are cores (though only a few) in their earlier stages of reduction that are used to produce blanks of elongated morphology. The products of these cores are not easily recognizable and the intentionality of their production can be demonstrated by the presence of retouch on the respective blanks; however, no significant amount of these blanks are found among the tools. However, notable is the presence of small, thin marginally abruptly retouched flakes (*raclette*), particularly in Level XIV, suggesting a tendency for using small implements.

At Bioče, similarly, small cores were produced through various methods as evidenced by residual cores, except in Level 7 where the sample is small. The Kombewa method is used in Level 5, shown by the presence of Kombewa cores but also by a slightly higher number of Kombewa blanks compared to other levels. In Levels 2 and 3, small flake production was accomplished mainly through truncated-facetted pieces, but these levels also contain extensively reduced centripetal cores that did produce small flakes at the end of the reduction. Levels 3 and 5 have a higher number of cores-on-flakes in comparison to the other levels. Reduction intensity in these levels was higher, suggesting that these cores might occur in the context of a higher need for blank production.

Producing small artifacts is a common feature of many Mousterian industry (Barkai et al., 2010; Bourguignon et al., 2004; Dibble and McPherron, 2006; Goren-Inbar, 1988; Hovers, 2007; Newcomer and Hivernel-Guerre, 1974; Papaconstantinou, 1989b; Rios Garaizar et al., 2014; Tixier and Turq, 1999). Cores aimed at the production of small blanks are found, in variable frequencies, in many MP industries, with variable blank technologies and typological features. They are characteristic of different time periods and are present in many assemblages that feature other flaking methods. While they do occur in the contexts of raw material shortages/exhaustion (Mora et al., 2004; Rios Garaizar et al., 2014), that is not always the case; tendencies toward producing small blanks, either through extensive reduction of cores or a separate blank production method, are often found in assemblages that do not show signs of economization of raw material resources that would trigger repeated reduction of the cores until exhaustion or reuse of blanks as cores (Dibble and McPherron, 2006; Hovers, 2007).

Small flake production oriented towards the production of elongated elements has a particular significance for addressing novelties in MP technological behavior. Namely, the subsequent industry found at several sites in Italy and Greece, Uluzzian, a flake-dominated industry that features novelties such as bone industry and the production of bladelets (Mihailović and Whallon, 2017; Peresani, 2008, 2012; Peresani et al., 2016), is now potentially associated with *H. sapiens* (Benazzi et al., 2011). Therefore, if the MP along the Adriatic coast features bladelet production, then the question is: is there a local continuity from the MP background to the Uluzzian or is Uluzzian technology (bladelet production) rather intrusive in this region. The production of bladelets is a known phenomenon in the MP, but it remains sporadic and anecdotal (Faivre, 2012; Slimak, 1999). Intentionality could be proven by the existence of retouched bladelets, but these have not been recovered; however, significant is the presence of abrupt and marginal retouch on thin flakes, given their importance in transitional assemblages (Chatelperronian, Uluzzian).

Another late feature of the MP in the Balkans in an increase in denticulate and notched occurrence at several sites. An increase in denticulate tools has been recently associated with discoidal core reduction system where assemblages showing predominance of this flaking systems and denticulate tools represent a distinct group in SW France, either related to specific subsistence practice (Delagnes and Rendu, 2011) or cultural choices of a group (Jaubert, 2010; Jaubert et al., 2011a). It has long been acknowledged that denticulates and notches can resemble pseudo-tools and that their high frequency is not necessarily a result of intentional edge modification. At various sites in Europe and Asia, assemblages with unintentional damage modifications resembling retouch that have been classified as Denticulate Mousterian have put into question the existence of the facies itself (Caspar et al., 2005; Kolobova et al., 2012; Theodoropoulou, 2008; Thiébaut, 2005, 2010). At Crvena stijena, Level XIII has been thought of as a reference assemblage for Denticulate Mousterian, but the increase in denticulate tools appears in the context of a greater presence of edge damage overall and a coarse sedimentological substrate that would inflict more extensive damage on flake edges (Chapter 4). Similar concern has been raised for other sites (e.g., Pešturina cave (Михаиловић and Милошевић, 2012)). That said, this increase in denticulates is not necessarily and always a result of an increased damage on the edges. An abundance of tools of less 'formal' type, such as retouched flakes, denticulates and notches, occurs in late MP assemblages.

Overall, the MP in the Balkans shows a limited array of industrial variation that is expressed in a few points: 1) the introduction and use of various blank production methods in the early phases of the MP; 2) geographical variation, mainly expressed in the presence of bifacial technologies in the east and the north and the lack of Charentian (Quina-like methods) in the east of the peninsula; 3) a limited set of flaking methods in the late stages and more 'opportunistic' character of technology. Other than that, to a large extent, and as evidenced at stratified sites (Crvena stijena, Klissoura, Bioče, Temnata dupka, Kozarnika, etc.), the industries can be characterized as rather homogeneous with very little variation in flaking methods and toolkit structure. Several factors are considered to influence the variation in technological behavior in time and space, with two factors often contrasted: cultural transmission of technological knowledge on one hand and adaptation to environmental conditions and foraging behavior on the other.

From the tool life-history perspective, flaking methods produce blanks of different morphologies and potentially different functional properties (Delagnes et al., 2007; Meignen et al., 2009). Blank production methods were directed towards acquiring blanks of preferred properties and qualities, for instance, for their potential for repeated resharpening. A large part of Mousterian variability can be explained by interrelated aspects of morphological trends in blank selection following patterns of tool use and discard (Baumler, 1987; Braun, 2005; H Dibble, 1991; Kuhn, 1992; Meignen et al., 2009). Which one hominins used would largely depend on needs that may arise in a given foraging context. Technological systems would be structured to suit the organization of group movements in the landscape relative to the seasonality and selectivity of hunting practices (Delagnes and Rendu, 2011; Hovers and Kuhn, 2006; Kuhn, 1995), reflected in different life history strategies (Meignen et al., 2009). Levallois blank production follows a strategy of producing new edges by generating more predetermined blanks with not a lot of potential for subsequent reshaping, and with short use-life. Methods such as Quina rely on heavy modification of tools through resharpening and thus prolongating the use life of a tool, while extensive core preparation is not a significant component. Here, transportability and the potential for mobility of the products are the key; Quina blanks, as well as bifaces, are products with extended use lives and higher transportability, while Levallois blanks have low transportability. Features of discoidal flaking on the other hand are: opportunistically extending the use life of the cores and obtaining more fresh edges by producing more blanks, without much concern for predetermination and standardization of their shape, and without extensive resharpening (Delagnes and Rendu, 2011; Meignen et al., 2009).

In the early glacial in several sites in the Balkans, blank production methods were oriented towards producing both Levallois products and thick cortical/naturally backed blanks (level XVIII at Crvena stijena (Chapter 3), Zobište, Krapina, etc.). Both types of blanks were mainly used for scraper production, suggesting parallel production and use of products with different potential for transport and functional properties. In the Later MP, as it is shown in many sites (Chapter 5), there is tendency towards less Levallois and a more frequent use of less prepared centripetal flaking methods followed by a shift in toolkits – scrapers are less relevant and denticulate tools slowly take over. Such changes may correspond to a different mobility patterns and organization of movements in the landscape (Delagnes and Rendu, 2011).

On the other hand, if different flaking methods do tightly correlate with subsistence and mobility patterns, that needs to be demonstrated. As some argue, archaeologists tend to overemphasize the correlation of subsistence practices and technological behavior when the latter is responding to the former, and show evidence of the two aspects not changing concomitantly in the archeological record (Hovers and Belfer-Cohen, 2020). The Quina concept in SW France is associated with the exploitation of migratory animals (reindeer) in cold climatic phases, but a similar technological concept has been used in different climatic contexts and in association with hunting different ungulate species (e.g., Roksandic et al., 2011). Large-scale analyses of the association of technological behavior and hunted fauna showed trends in time and space; however, these associations are rarely exclusive (Discamps et al., 2011). In the example of Crvena stijena and Klissoura (Morin and Soulier, 2017; Starkovich, 2017), faunal compositions do not vary much throughout their long sequences, suggesting more or less constant environmental conditions, that do not necessarily require significant adaptations but rather moderate adjustments in technology. Even if raw material circumstances remain constant and technologies and toolkits are similar, changes in how settlement is organized in the landscape can be reflected in the lithic assemblages through different patterns of transport, reshaprening, etc. (e.g., Soressi, 2004).

At a broader scale, nevertheless, differences in MP technological behavior potentially stem from demography and the related patterns of cultural transmission which affect the levels of material culture homogeneity and the rate at which innovations appear (Hovers and Belfer-Cohen, 2006; S. L. Kuhn, 2013; Powell et al., 2009; Premo and Hublin, 2009; Premo and Kuhn, 2010; Shennan, 2000). Novelties were present in the early MP, but the later MP sees a reiteration of already known options and the pace of technological change is slower. One can invoke demographic factors, especially having in mind the lower population densities of Neandertals and the bottlenecks they experienced (Bocquet-Appel and Degioanni, 2013; Briggs et al., 2009; Churchill, 2014; Degioanni et al., 2019; Green et al., 2010; Krause et al., 2007; Prüfer et al., 2014), in particular during MIS 4. Homogeneity of technological behavior is expected if populations are small, isolated and not well connected (processes would be similar to a drift); innovations would be generated at a slower rate and not have a chance to spread widely, while some behaviors will be lost (Premo and Kuhn, 2010; Richerson et al., 2009; Shennan, 2000). Potentially, demographic factors might have played an important role in how technological variability is structured in time and space in the Balkans. If the south of the peninsula had small populations that were isolated, likely due to topography of the peninsula, the homogeneity of industries (e.g. Crvena stijena, Bioče, Klissoura, etc.) could be in line with such demographic picture. Trends such as the reduction of the use of methods like Levallois in the later MP can be understood, on the one hand, as a loss of technological knowledge related to it, but on the other hand, a contextual change triggered by the subsistence/mobility practices that call for more expedient technological behavior. Potentially, geographical patterns in industries – presence of bifaces in the eastern regions only, lack of Quina/Charentian in the east – can be seen through the prism of demography and geographical barriers (Balkan mountains) that might have played a role in the distribution of certain technologies. Some have, however, expressed that uni-directional causality between technological change/complexity and demography (Collard et al., 2013; Vaesen et al., 2016) should be taken cautiously, since some ethnographic examples of hunter-gatherers do not show this causal link.

7.4 Low density of Paleolithic record – lack of research or occupational gaps?

The MP record in the Balkan peninsula, or the Paleolithic record in general for that matter, is disproportionately sparse compared to some other regions of Europe. Main factors that could cause such discrepancy are comparatively less intensive research in the Balkans and the demographic differences in the Paleolithic occupations across the continent. Geological factors can likewise be considered, as some geological processes could have removed sediments or remains of human activities. All these factors affect how many sites from a particular time period are discovered; however, it is indicative that the densities of archaeological remains at Balkan sites are also rather low. Exception are some sites in the south of the peninsula (e.g. Klissoura). While the overall number of sites and the amount of remains are indicative of population density (Conard et al., 2012; Mellars and French, 2011, 2013) they are not correlated directly and in a straightforward way (Dogandžić and McPherron, 2013). On the other hand, high non-human carnivore activities at many sites suggests that they might have dominated the landscape, which is possible if hominins demographic density was low (e.g., Kuhn et al., 2014; Milošević, 2020).

One way to test the reasons behind the sparce record – at least rule out the research intensity factor - is to conduct more fieldwork directed towards discovering Paleolithic sequences would most certainly contribute to answering the question of relatively sparce record. In recent decade more fieldwork has been conducted in the Balkan region that resulted in the discovery of new Paleolithic locations (Harvati and Roksandic, 2016; Karavanić et al., 2017; Mihailović, 2014b; Tourloukis and Harvati, 2017). With the same goal, a survey has been conducted in central Serbia (Chapter 6). The focus here was to discover MP and early Upper Paleolithic (EUP) occupations. The strategy was to follow the distribution of the known MP and EUP sites and delineate areas with higher chance of finding sites evidencing occupations from these time periods. Known MP locations are scattered over different geographical areas and varied topographic features, while the EUP seem rather restricted to the river valleys related to the Danube and its tributaries (Conard and Bolus, 2003; Mihailović et al., 2011). Therefore, to increase chances of finding human occupations that also include EUP, the survey target areas should cover this zone (Chapter 6).

Survey has been conducted in the Resava river valley in eastern Serbia, some 100 km south of Danube. Resava is a tributary to Velika Morava, one of the largest tributaries of the Danube. It is a carstic area where caves have been researched by geologists and speleologists, yet, not intensively researched from an archeological perspective (Đuričić, 1990). The area encompasses diverse topographies, both valleys close to the wide valley of Velika Morava and the higher elevation mountainous region. Nearly 40 caves and rock shelters have been visited during one survey season, four have been tested the following year, 2 out of them, Bukovac and Orlovača, were in focus for further excavations.

The results published (Chapter 6, Dogandžić et al. 2014) and subsequent work at these two caves contain Pleistocene record spanning from the MP (Orlovača Level 4), Aurignacian (earlier phases at Orlovača Level 3 and most likely later Aurignacian at Bukovac Layer 3), to the Gravettian (Bukovac Layer 2). This work is still in progress and hopefully with interdisciplinary efforts, the results of this project will contribute to tightening the chronology of MP and UP in the region, and address the occupational intensity and subsistence practices through time.

7.5 Future directions

Lastly, based on this evaluation of the MP record of the Balkans, we can put forward a few research questions to be tackled with new analyses and fieldwork.

<u>Variability of lithic industries.</u> One of the major tasks for a better understanding of MP variability in the Balkans is to inspect more closely the association of technological methods and typological aspects of assemblages and industries. One such task relates to further disentangling of taxonomical units in use in the Balkans. For instance, under the "Charantoid" umbrella (Kozlowski, 1992), we see industries with high scraper production but varied flaking methods, i.e., variable use of Levallois and

the presence of cobble cores for the production of naturally backed blanks. Any scraper rich assemblage is designated as Charentian, even when its technological background is unclear; e.g., surface-collections (Vujević et al., 2017). On the other hand, industries with similar flaking methods have been named differently (e.g., Pontinian and the Charentian – southeast version). The use of the size-related denominator in the Micromousterian is another example of unclear taxonomic grouping of industries given that size can be caused by many factors.

The typological variability of the Balkan MP is reflected in the variation in tool types – primarily scrapers - that results from different resharpening intensities. For instance, earlier MP assemblages are rich in scrapers but the rate of tool production and edge modification seem to differ between assemblages. In later MP both scraper reduction and tool resharpening are less common. Therefore, evaluating tool reduction intensity in an assemblage is an important task before addressing reasons behind variable tool production and resharpening. To tackle these issues we need to work on better understanding flake formation to be able to improve our techniques for flake size prediction and further estimate the resharpening amount.

The association of Crvena stijena's Denticulate Mousterian with coarse gravel substrate and the consequential high edge damage frequency (Chapter 4) suggests further investigation of other sites with high percentages of denticulate and notched tools where the potential taphonomic background may be influencing the took-kit structure (Temnata Dupka, Vindija, Mujina pecina, Pešturina). Once taphonomic factors have been ruled out, it remains to be evaluated whether the high frequency of this tool type is to be understood as a feature of Late MP, whether it only reflects lower scraper production, and whether there is a particular association with flaking methods and other behavioral aspects (mobility, subsistence) (Delagnes and Rendu, 2011; Discamps, 2014; Jaubert et al., 2011b; Thiébaut, 2010).

Another avenue to explore is regional variation in industrial variability across the Balkan peninsula. In particular, are we confident enough about the distribution of bifacial elements in the northern regions and their lack in the interior of the peninsula?

Are they associated mainly with open-air sites and if so, what does it tell us about the subsistence and mobility context of their production and use?

In the context of the population replacement in MIS 3, it remains to be further explored how late MP industries are related to transitional industries or the Initial Upper Paleolithic. For instance, in the south, the late MP contains some elements of Uluzzian, which is apparently associated with *H. sapiens* (Benazzi et al., 2011). In the north, the Initial Upper Paleolithic at Bacho Kiro, that bears some similarities with the underlying MP (Tsanova, 2008, 2012; Tsanova and Bordes, 2003) is associated with *H. sapiens* (Fewlass et al., 2020; Hublin et al., 2020). Looking in the late MP for examples of the distinctive elements of these new industries could help resolve questions of potential continuity or transmission between them (Mihailović and Whallon, 2017; Peresani et al., 2016; Ruebens et al., 2015). Likewise, it is worth examining the bifacial elements in the north and the east of the peninsula and their potential relationship with transitional industries such as the Szeletian.

Last, but not the least, if there are trends in time and space in the Balkan MP that partially correspond to developments and changes in the MP in other parts of Europe, how are we to disentangle the broad trends from local and regional variations? For instance, if trends towards opportunistically oriented technology are noted in the late MP in many regions of Europe, what does that mean for the adaptation and connectedness of Neandertal populations? Are many Neandertal groups finding similar adaptive and technological solutions to similar environmental changes?

<u>Occupational history.</u> Another set of models to be further explored relate to occupational history and habitation preference in different time periods of the Paleolithic in the Balkans. The current record, while not as dense as in other regions of Europe, is sufficient for providing models of human occupations in different time periods in the Balkans. One major question to be further addressed relates to the notion of refugia in the Balkans and continuous or intermittent occupation of certain areas. Thus far, the Balkans has been considered a refugium in its entirety; however, it would be beneficial to address this question with consideration of different topographic, environmental, and climatic characteristics of different regions of the peninsula and

examine whether there are more favorable areas, e.g. Mediterranean coast (as long sequences of Crvena stijena and Klissoura would suggest) or can we expect micro-refugia in the interior of the peninsula. Second, a better chronological resolution would most definitely contribute to the question of the Neandertal presence in MIS 4.

An interesting avenue for future research is to examine the differences in habitation preferences relative to topography and site location, from the Lower to the Upper Paleolithic. The pattern emerging from the available data suggests that MP hominins occupied varied topographic and environmental areas including karstic areas in sometimes higher elevations as well as lower valleys. That said, the central regions of the Balkans still remained relatively underexplored, with only a handful of MP sites found in the mountainous areas. This is contrary to the Lower Paleolithic, which is mainly present on low elevations and on river terraces, and contrary to the early Upper Paleolithic, which again sees a "preference" for low elevation regions in the river valleys, along the northern fringes of the peninsula and the Mediterranean coast. Further focus on how these changes might correspond to subsistence and mobility patterns will help elucidate this apparent pattern.

This geographical delineation is of particular importance for understanding the time period of late Neandertals and their replacement by modern humans in this part of Europe. To confirm the pattern of modern human habitation along the valleys, a GIS model of the least-cost path for the dispersal trajectory of the incoming populations is an avenue worth pursuing, in order to test the reality of the pattern already observed. It is to be further investigated whether such a pattern relates to subsistence practices or potentially to demographic circumstances (e.g., avoidance) (Mihailović, 2019) in case there was a contemporaneous occupation of this region by Neandertals and modern humans (Hublin et al., 2020).

A better understanding of the habitation preferences in different time periods would help us propose favorable areas for human occupation where we might expect more continuous presence, which, in turn, will provide direction for future surveys and the search for new Paleolithic stratified sites. For instance, one such area might be the valley of the Velika Morava river as it represents a "transitional" zone encompassing both lowlands and higher elevation areas and a migration route for large herbivores (Ducić and Radovanović, 2005; Forsten and Dimitrijevic, 2003). In this zone, sequences containing MP, Aurignacian and Gravettian occupations have been discovered (Chapter 6, Dogandžić et al. 2014). The discovery of Aurignacian occupation in an area that is not only higher in elevation than average for an Aurignacian site (400m), but much further south from the Danube valley, will certainly contribute to a better understanding of the dynamics of the *H. sapiens* occupation and to questions related to the chronological relations of their and Neandertal presence in the area.

Needless to say, more fieldwork is needed to be able to evaluate the reasons behind the low density of Paleolithic record in the Balkans. Survey conducted as a part of work has shown that more sites can certainly be located. Indeed, surveys conducted often result in the discovery of many sites of ephemeral occupations (with only a handful of finds) (e.g., Kuhn et al., 2014; Mihailović et al., 1997). The combination of surveys and predictive modeling will help build a more solid picture of the intensity of human occupations in different time periods, its relation to topography, subsistence practices, migrations.

REFERENCES:

Bailey G (2007) Time perspectives, palimpsests and the archaeology of time. *Journal of Anthropological Archaeology* 26(2): 198–223. DOI: 10.1016/j.jaa.2006.08.002.

Barkai R, Lemorini C and Gopher A (2010) Palaeolithic cutlery 400 000–200 000 years ago: tiny meat-cutting tools from Qesem Cave, Israel. *Antiquity* 84(325): 2–6.

Bar-Yosef O and Kuhn (1999) The Big Deal about Blades: Laminar Techonologies and Human Evolution. *American Antiquity* 101(2): 322–338. DOI: 10.1525/aa.1999.101.2.322.

Basler Đ (1975) Stariji litički periodi u Crvenoj stijeni. In: Basler D (ed.) *Crvena Stijena:Zbornik Radova*. Zajednica kulturnih ustanova, Nikšić, pp. 11–120.

Baumler MF (1987) *Core Reduction Sequences: An analysis of Blank Production in the Middle Paleolithic of Northern Bosnia (Yugoslavia)*.

Benazzi S, Douka K, Fornai C, et al. (2011) Early dispersal of modern humans in Europe and implications for Neanderthal behaviour. *Nature* 479(7374): 525–8. DOI: 10.1038/nature10617.

Bocquet-Appel J-P and Degioanni A (2013) Neanderthal Demographic Estimates. *Current Anthropology* 54(S8): S202–S213. DOI: 10.1086/673725.

Boëda E (1993) Le débitage discoïde et le débitage Levallois récurrent centripède. *Bulletin de la Société préhistorique française* 90(6): 392–404.

Bordes F (1955) Le Paléolithique inférieur et Moyen de Yabrud (Syrie) et la question du Pré aurignacien. *L'Anthropologie* 59: 486–507.

Bordes F (1975) Le gisement du Pech de l'Azé IV. Note préliminaire. *Bulletin de la Société préhistorique française* 72(1): 293–308. DOI: 10.3406/bspf.1975.8335.

Bourguignon L, FAIVRE J-P and Turq Alain (2004) Ramification des chaînes opératoires: Une spécificité du moustérien? *Paléo* 16(16). Société des amis du Musée national de préhistoire et de la recherche archéologique: 37–48.

Braun DR (2005) Examining Flake Production Strategies: Examples from the Middle Paleolithic of Southwest Asia. *Lithic Technology* 30(2): 107–125.

Braun DR and Harris JWK (2003) Technological Developments in the Oldowan of Koobi Fora: Innovative Techniques of Artifact Analysis. In: Martinez Moreno J, Mora R, and de la Torre I (eds) *Oldowan: Rather More than Smashing Stones*. Treballs d'Arqueologia 9, pp. 117–144.

Braun DR, Rogers MJ, Harris JWK, et al. (2008) Landscape-scale variation in hominin tool use: Evidence from the Developed Oldowan. *Journal of human evolution* 55(6): 1053–63. DOI: 10.1016/j.jhevol.2008.05.020.

Briggs AW, Good JM, Green RE, et al. (2009) Targeted retrieval and analysis of five Neandertal mtDNA genomes. *Science (New York, N.Y.)* 325(5938): 318–21. DOI: 10.1126/science.1174462.

Caspar J-P, Bertrand M and Luc V (2005) Le Moustérien à denticulés, un faciès taphonomique du Moustérien? In: Molines N, Moncel M-H, and Monnier J-L (eds) *Les Premiers Peuplements En Europe*. BAR International Series 1364, pp. 467–478.

Churchill SE (2014) Thin on the Ground: Neandertal Biology, Archeology and Ecology. John Wiley & Sons, Inc. DOI: 10.1002/9781118590836.

Clarke DL (1978) *Analytical Archaeology (Second Edition)*. New York: Columbia University Press.

Clarkson C and Hiscock P (2011) Estimating original flake mass from 3D scans of platform area. *Journal of Archaeological Science* 38(5): 1062–1068. DOI: 10.1016/j.jas.2010.12.001.

Collard M, Buchanan B and O'Brien MJ (2013) Population Size as an Explanation for Patterns in the Paleolithic Archaeological Record: More Caution Is Needed. *Current Anthropology* 54(S8): S388–S396. DOI: 10.1086/673881.

Conard N and Bolus M (2003) Radiocarbon dating the appearance of modern humans and timing of cultural innovations in Europe: new results and new challenges. *Journal of Human Evolution* 44: 331–371.

Conard NJ, Bolus M and M??nzel SC (2012) Middle Paleolithic land use, spatial organization and settlement intensity in the Swabian Jura, southwestern Germany. *Quaternary International* 247(1): 236–245. DOI: 10.1016/j.quaint.2011.05.043.

Crabtree DE (1972) An introduction to flintworking. 28. Occasional papers of the Idaho State University Museum.

Davis ZJ and Shea JJ (1998) Quantifying Lithic Curation: An Experimental Test of Dibble and Pelcin's Original Flake-Tool Mass Predictor. *Journal of Archaeological Science* 25(7): 603–610. DOI: 10.1006/jasc.1997.0255.

Degioanni A, Bonenfant C, Cabut S, et al. (2019) Living on the edge: Was demographic weakness the cause of Neanderthal demise? *PLOS ONE* Petraglia MD (ed.) 14(5): e0216742. DOI: 10.1371/journal.pone.0216742.

Delagnes A and Rendu W (2011) Shifts in Neandertal mobility, technology and subsistence strategies in western France. *Journal of Archaeological Science* 38(8). Elsevier Ltd: 1771–1783. DOI: 10.1016/j.jas.2011.04.007.

Delagnes A, Jaubert J and Meignen L (2007) Les technocomplexes du Paléolithique moyen en Europe occidentale dans leur cadre diachronique et géographique. In: Vandermeersch B and Maureille B (eds) *Les Neandertaliens. Biologie et Cultures*. Editions d. Paris, pp. 213–229.

Dibble H (1991) Local raw material exploitation and is effects on Lower and Middle Paleolithic assemblage variability. In: Montet-White A and Holen S (eds.) *Raw material economies among prehistoric hunter-gatherers*. University o Kanzas publications in anthropology 19: pp. 33–47.

Dibble HL (1987) The Interpretation of Middle Paleolithic Scraper Morphology. *American Antiquity* 52(1): 109–117.

Dibble HL (1991) Mousterian Assemblage Variability on an Interregional Scale. *Journal of Anthropological Research* 47(2): 239–257.

Dibble HL (1995) Middle Paleolithic Scraper Reduction : Background, Clarification, and Review of the Evidence to Date. *Journal of Archaeological Method and Theory* 2(4): 299–368.

Dibble HL (1997) Platform variability and flake morphology: A comparison of experimental and archaeological data and implications for interpreting prehistoric lithic technological strategies. *Lithic Technology* 22(2): 150–170.

Dibble HL and McPherron SP (2006) The Missing Mousterian. *Current Anthropology* 47(5): 777–803. DOI: 10.1086/506282.

Dibble HL and Rezek Z (2009) Introducing a new experimental design for controlled studies of flake formation: results for exterior platform angle, platform depth, angle of blow, velocity, and force. *Journal of Archaeological Science* 36(9): 1945–1954. DOI: 10.1016/j.jas.2009.05.004.

Dibble HL and Whittaker JC (1981) New experimental evidence on the relation between percussion flaking and flake variation. *Journal of Archaeological Science* 8(3): 283–296. DOI: 10.1016/0305-4403(81)90004-2.

Discamps E (2014) Ungulate biomass fluctuations endured by Middle and Early Upper Paleolithic societies (SW France, MIS 5-3): The contributions of modern analogs and cave hyena paleodemography. *Quaternary International* 337: 64–79. DOI: 10.1016/j.quaint.2013.07.046.

Discamps E, Jaubert J and Bachellerie F (2011) Human choices and environmental constraints : deciphering the variability of large game procurement from Mousterian to Aurignacian times (MIS 5-3) in southwestern France. *Quaternary Science Reviews* 30(19–20): 2755–2775. DOI: 10.1016/j.quascirev.2011.06.009.

Ditchfield K (2016) An experimental approach to distinguishing different stone artefact transport patterns from debitage assemblages. *Journal of Archaeological Science* 65: 44–56. DOI: 10.1016/j.jas.2015.10.012.

Dogandžić T and Đuričić L (2017) Lithic production strategies in the Middle Paleolithic of the southern Balkans. *Quaternary International* 450: 68-102. DOI: 10.1016/j.quaint.2017.03.011.

Dogandžić T and McPherron SP (2013) Demography and the demise of Neandertals: A comment on 'Tenfold population increase in Western Europe at the Neandertal-to-modern human transition'. *Journal of Human Evolution* 64(4): 311–313. DOI: 10.1016/j.jhevol.2013.01.005.

Dogandžić T, Braun DR and McPherron SP (2015) Edge length and surface area of a blank: Experimental assessment of measures, size predictions and utility. *PLoS ONE* 10(9): e0133984–e0133984. DOI: 10.1371/journal.pone.0133984.

Ducić V and Radovanović M (2005) *Klima Srbije*. Beograd: Zavod za udžbenike i nastavna sredstva.

Đuričić L (1990) Rekognosciranje pećina i potkapina u slivu Resave. *Glasnik Srpskog arheološkog društva* 6: 181–190.

Đuričić Lj (2006) A contribution to research on Bioce Mousterian. *Journal of the Serbian Archaeological Society* 22: 179–196.

Eren MI, Greenspan A and Sampson CG (2008) Are Upper Paleolithic blade cores more productive than Middle Paleolithic discoidal cores? A replication experiment. *Journal of human evolution* 55(6): 952–61. DOI: 10.1016/j.jhevol.2008.07.009.

Faivre J-P (2012) A Material Anecdote But Technical Reality. *Lithic Technology* 37: 5–24. DOI: 10.1179/lit.2012.37.1.5.

Fewlass H, Talamo S, Wacker L, et al. (2020) A 14C chronology for the Middle to Upper Palaeolithic transition at Bacho Kiro Cave, Bulgaria. *Nature Ecology & Evolution* 4(6): 794–801. DOI: 10.1038/s41559-020-1136-3.

Forsten A and Dimitrijevic V (2003) Pleistocene horses (genus Equus) in the central Balkans. *Geoloski anali Balkanskog poluostrva* 65(65): 55–75. DOI: 10.2298/GABP0301055F.

Gabori M (1976) *Les Civilisations Du Paléolithique Moyen Entre Les Alpes et l'Oural*. Budapest: Akadémiai Kiadó.

Geneste J-M (1985) *Analyse lithique d'industries moustériennes du Périgord : une approche technologique du comportement des groupes humains au Paléolithique moyen*. Doctoral Dissertation. University of Bordeaux

Geneste J-M, Jaubert J, Lenoir M, et al. (1997) Approche technologique des Moustériens Charentiens du Sud-Ouest de la France et du Languedoc oriental. *Paléo* 9(1): 101–142. DOI: 10.3406/pal.1997.1230.

Goren-Inbar N (1988) Too small to be true? Reevaluation of Cores On Flakes In Levantine Mousterian Assemblages. *Lithic Technology* 17(1): 37–44.

Green RE, Krause J, Briggs AW, et al. (2010) A draft sequence of the Neandertal genome. *Science (New York, N.Y.)* 328(5979): 710–22. DOI: 10.1126/science.1188021.

Guadelli J-LJ-L, Sirakov N, Ivanova S, et al. (2005) Une séquence du paléolithique inférieur au paléolithique récent dans les Balkans : la grotte Kozarnika à Orechets (Nord-Ouest de la Bulgarie). In: *Les premiers peuplements en Europe. Colloque international: Données récentes sur les modalités de peuplement et sur le cadre* *chronostratigraphique des industries du Paléolithique inférieur et moyen en Europe* (eds N Molines, M-H Moncel, and MJ Monnier), 2005, pp. 87–103. British Archaeological Reports International Series 1364.

Harvati K and Roksandic M (2016) *Paleoanthropology of the Balkans and Anatolia. Human Evolution and Its Context* (eds K Harvati and M Roksandic). Vertebrate. Springer.

Harvati K, Röding C, Bosman AM, et al. (2019) Apidima Cave fossils provide earliest evidence of Homo sapiens in Eurasia. *Nature* 571(7766): 500–504. DOI: 10.1038/s41586-019-1376-z.

Hiscock P and Tabrett A (2010) Generalization, inference and the quantification of lithic reduction. *World Archaeology* 42(4): 545–561. DOI: 10.1080/00438243.2010.517669.

Holdaway S and Douglass M (2012) *A Twenty-First Century Archaeology of Stone Artifacts*. DOI: 10.1007/s10816-011-9103-6.

Hovers E (2007) The many faces of cores-on-flakes. A perspective from the Levantine Mousterian. In: McPherron SP (ed.) *Tools versus Cores*. Cambridge Scholars Publishing, Newcastle, pp. 42–74.

Hovers E and Belfer-Cohen A (2006) 'Now you see it, now you don't' – modern human behavior in the Middle Paleolithic. In: Hovers E and Kuhn SL (eds) *Transitions Before The Transition: Evolution and Stability in the Middle Paleolithic and Middle Stone Age*. Springer New York, pp. 295–304.

Hovers E and Belfer-Cohen A (2020) Are Lithics and Fauna a Match Made in (Prehistoric) Heaven? *Journal of Paleolithic Archaeology* 3(2): 108–125. DOI: 10.1007/s41982-018-0007-9.

Hovers E and Kuhn S (eds) (2006) *Transitions before the Transition: Evolution and Stability in the Middle Paleolithic and Middle Stone Age*. New York: Springer.

Hublin J-J, Sirakov N, Aldeias V, et al. (2020) Initial Upper Palaeolithic Homo sapiens from Bacho Kiro Cave, Bulgaria. *Nature* 581(7808): 299–302. DOI: 10.1038/s41586-020-2259-z.

Inizan M-L, Reduron-Ballinger M, Roche H, et al. (1995) *Préhistoire de La Pierre Taillée - t. 4: Technologie de La Pierre Taillée*. CREP, Meudon.

Ivanova S (1979) Cultural Differentiation in the Middle Palaeolithic of Balkan Peninsula. In: *Middle and Early Upper Palaeolithic in Balkans*. Warszawa and Krakow: Zeszyty Naukowe Uniwersytetu Jagiellonskiego, pp. 13–33.

Jaubert J (2010) Les archéoséquences du Paléolithique moyen en Poitou-Charentes. In: Buisson-Catil J and Primault J (eds) *Préhistoire Entre Vienne et Charente. Hommes et Sociétés Du Paléolithique.* Association des Publications Chauvinoises, pp. 51–55.

Jaubert J, Bordes J and Gravina B (2011a) A New Look t the End of the Middle Palaeolithic Sequence in Southwestern France. In: Derevjanko AP and Shunkov M V. (eds)

Characteristic Features of the Middle to Upper Paleolithic Transition in Eurasia. Asian Palaeolithic Association, Novosibirsk, pp. 102–115.

Jaubert J, Bordes J and Gravina B (2011b) A New Look t the End of the Middle Palaeolithic Sequence in Southwestern France. In: Derevjanko AP and Shunkov MV (eds) *Characteristic Features of the Middle to Upper Paleolithic Transition in Eurasia*. Asian Palaeolithic Association, Novosibirsk, pp. 102–115.

Karavanić I, Miracle PT, Culiberg M, et al. (2008) The Middle Paleolithic from Mujina Pećina, Dalmatia, Croatia. *Journal of Field Archaeology* 33: 259–277.

Karavanić I, Vukosavljević N, Janković I, et al. (2017) Paleolithic hominins and settlement in Croatia from MIS 6 to MIS 3: Research history and current interpretations. *Quaternary International* 494: 151–166. DOI: 10.1016/j.quaint.2017.09.034.

Key AJM and Lycett SJ (2014) Are bigger flakes always better? An experimental assessment of flake size variation on cutting efficiency and loading. *Journal of Archaeological Science* 41: 140–146. DOI: 10.1016/j.jas.2013.07.033.

Kolobova K a., Krivoshapkin a. I, Pavlenok KK, et al. (2012) The Denticulate Mousterian as a supposedly distinct facies in Western Central Asia. *Archaeology, Ethnology and Anthropology of Eurasia* 40(1): 11–23. DOI: 10.1016/j.aeae.2012.05.003.

Kozłowski JK (1975) Badania nad przejsciem od srodkowego do gornego paleolitu na Balkanach. *Przeglad archeologiczny* 23: 5–48.

Kozlowski JK (1992) The Balkans in the Middle and Upper Palaeolithic: The Gate to Europe or a Cul-de-sac? *Proceedings of the Prehistoric Society* 58: 1–20.

Kozłowski JK (2002) The Middle and the Early Upper Paleolithic around the Black Sea. In: Akazawa T, Aoki K, and Yosef OB (eds) *Neandertals and Modern Humans in Western Asia*. Kluwe Academic Publishers, pp. 461–482.

Krause J, Orlando L, Serre D, et al. (2007) Neanderthals in central Asia and Siberia. *Nature* 449(7164): 902–904. DOI: 10.1038/nature06193.

Kuhn SL (1990) A geometric index of reduction for unifacial stone tools. *Journal of Archaeological Science* 17(5): 583–593. DOI: 10.1016/0305-4403(90)90038-7.

Kuhn SL (1992) Blank Form and Reduction as Determinants of Mousterian Scraper Morphology. *American Antiquity* 57(1): 115–128.

Kuhn SL (1994) A Formal Approach to the Design and Assembly of Mobile Toolkits. *American Antiquity* 59(3): 426–442.

Kuhn SL (1995) *Mousterian Lithic Technology: An Ecological Perspective*. Princeton: Princeton University Press.

Kuhn S. L. (2013) Cultural Transmission, Institutional Continuity and the Persistence of the Mousterian. In: Akazawa T, Nishiaki Y, and Aoki K (eds) *Dynamics of Learning in*

Neanderthals and Modern Humans, Volume 1. Tokyo: Springer Japan, pp. 105–113. DOI: 10.1007/978-4-431-54511-8.

Kuhn Steven L. (2013) Roots of the Middle Paleolithic in Eurasia. *Current Anthropology* 54(S8): S255–S268. DOI: 10.1086/673529.

Kuhn SL, Mihailović D and Dimitrijević V (2014) The Southeast Serbia Paleolithic Project: An Interim Report. In: Mihailović D (ed.) *Paleolithic and Mesolithic Research in the Central Balkans*. Belgrade: Serbian Archaeological Society, pp. 97–106.

Le Tensorer J-M (1978) Le Moustérien type Quina et son évolution dans le Sud de la France. *Bulletin de la Société préhistorique française* 75(5): 141–149. DOI: 10.3406/bspf.1978.8559.

Leader G, Abdolahzadeh A, Lin SC, et al. (2017) The effects of platform beveling on flake variation. *Journal of Archaeological Science: Reports* 16(March): 213–223. DOI: 10.1016/j.jasrep.2017.09.026.

Lin SC, Rezek Z, Braun D, et al. (2013) On the Utility and Economization of Unretouched Flakes: the Effects of Exterior Platform Angle and Platform Depth. *American Antiquity* 78(4): 724–745.

Lycett SJ and Eren MI (2013) Levallois economics: an examination of 'waste' production in experimentally produced Levallois reduction sequences. *Journal of Archaeological Science* 40(5): 2384–2392. DOI: 10.1016/j.jas.2013.01.016.

Mackay A (2008) A method for estimating edge length from flake dimensions: use and implications for technological change in the southern African MSA. *Journal of Archaeological Science* 35(3): 614–622. DOI: 10.1016/j.jas.2007.05.013.

Magnani M, Rezek Z, Lin SC, et al. (2014) Flake variation in relation to the application of force. *Journal of Archaeological Science* 46: 37–49. DOI: 10.1016/j.jas.2014.02.029.

Meignen L, Delagnes A and Bourguignon L (2009) Patterns of Lithic Material Procurement and Transformation During the Middle Paleolithic in Western Europe. In: Adams B and Blades B (eds) *Lithic Materials and Palaeolithic Societies*. Blackwell Publishing LTD, pp. 15–24.

Mellars P (1986) A new chronology for the French Mousterian period. *Nature* 322(410–411).

Mellars P and French JC (2011) Tenfold population increase in Western Europe at the Neandertal-to-modern human transition. *Science* 333(6042): 623–627. DOI: 10.1126/science.1206930.

Mellars P and French JC (2013) Population changes across the Neanderthal-to-modern-human transition in western France: A reply to Dogandžić and McPherron (2013). *Journal of Human Evolution* 65(3): 330–333. DOI: 10.1016/j.jhevol.2013.03.006.

Mihailović D (2014a) *Paleolit Na Centralnom Balkanu. Kulturne Promene i Populaciona Kretanja*. Beograd: Srpsko arheološko društvo.

Mihailović D (2014b) *Paleolithic and Mesolithic Research in the Central Balkans*. Belgrade: Serbian Archaeological Society.

Mihailović D (2019) Push-and-pull factors of the Middle to Upper Paleolithic transition in the Balkans. *Quaternary International* 551: 47-61. DOI: 10.1016/j.quaint.2019.10.010.

Mihailović D and Bogićević K (2016) Technological Changes and Population Movements in the Late Lower and Early Middle Paleolithic of the Central Balkans. In: Harvati K and Roksandic M (eds) *Paleoanthropology of the Balkans and Anatolia. Human Evolution and Its Context*. Vertebrate. Springer Science+Business Media Dodrecht, pp. 139–152.

Mihailović D and Whallon R (2017) Crvena stijena Revisited: The Late Mousterian Asemblages. *Quaternary International* 450:36-49. DOI: 10.1016/j.quaint.2016.12.026.

Mihailović D, Đuričić L and Kaluđerović Z (1997) Istraživanje paleolita na području istočne Srbije. In: Lazić M (ed.) *Arheologija Istočne Srbije*. Filozofski fakultet - Centar za arheološka istraživanja, pp. 33–44.

Mihailović D, Mihailović B and Lopičić M (2011) The Paleolithic of Northern Serbia. In: Draşovean F and Jovanović B (eds) *The Prehistory of Banat I. The Palaeolithic and Mesolithic*. Bucharest: The Publishing House of the Romanian Academy., pp. 77–101.

Mihailović D and Milošević S (2012) Istraživanja paleolitskog nalazišta Pešturina kod Niša. *Glasnik srpskog arheološkog društva* 28: 87–106.

Milošević S (2020) *Competition Between Humans and Large Carnivores: Case Studies from the Late Middle and Upper Palaeolithic of the Central Balkans*. BAR International Series S2963.

Monnier GF (2006) The Lower / Middle Paleolithic Periodization in Western Europe. *Current Anthropology* 47(5): 709–744.

Mora R, de la Torre I and Martínez-Moreno J (2004) Middle Palaeolithic Mobility and Land Use in the Southwester Pyrenees: the Example of Level 10 in La Roca dels Bous (Noguera, Catalunya, Northeast Spain). In: Conard NJ (ed.) *Settlement Dynamics of the MIddle Paleolithic and the Middle Stone Age, Vol. 2*. Kern Verlag, Tuebingen, pp. 415–435.

Morin E and Soulier MC (2017) The Paleolithic Faunal Remains from Crvena Stijena. In: Whallon R (ed.) *Crvena Stijena in Cultural and Ecological Context - Multidisciplinary Archaeological Research in Montenegro*. National Museum of Montenegro, Montenegrin Academy of Sciences and Arts, pp. 266–294.

Muller A and Clarkson C (2014) Estimating original flake mass on blades using 3D platform area: problems and prospects. *Journal of Archaeological Science* 52: 31–38. DOI: 10.1016/j.jas.2014.08.025.

Muller A and Clarkson C (2016a) A new method for accurately and precisely measuring flake platform area. *Journal of Archaeological Science: Reports* 8: 178–186. DOI: 10.1016/j.jasrep.2016.06.015.

Muller A and Clarkson C (2016b) Identifying Major Transitions in the Evolution of Lithic Cutting Edge Production Rates. *PLOS ONE* Macchiarelli R (ed.) 11(12): e0167244. DOI: 10.1371/journal.pone.0167244.

Newcomer MH and Hivernel-Guerre F (1974) Nucléus sur éclat; technologie et utilisation par différents cultures préhistoriques. *Bulletin de la Société préhistorique française* 71(1): 119–128.

Otte M, Yalcinkaya I, Taskiran H, et al. (1995) The Anatolian Middle Paleolithic: New Research at Karain Cave. *Journal of Anthropological Research* 51(4): 287–299.

Papaconstantinou E (1989) *Micromousterien, les idées et les pierres. Asprochaliko (Grèce) et le problème des industries microlithiques du Moustérien*. Université Paris X-Nanterre.

Pelcin AW (1997a) The Effect of Core Surface Morphology on Flake Attributes: Evidence from a Controlled Experiment. *Journal of Archaeological Science* 24(8): 749–756. DOI: 10.1006/jasc.1996.0156.

Pelcin AW (1997b) The Formation of Flakes: The Role of Platform Thickness and Exterior Platform Angle in the Production of Flake Initiations and Terminations. *Journal of Archaeological Science* 24(12): 1107–1113. DOI: 10.1006/jasc.1996.0190.

Pelcin AW (1998) The Threshold Effect of Platform Width: A Reply to Davis and Shea. *Journal of Archaeological Science* 25(7): 615–620. DOI: 10.1006/jasc.1997.0253.

Pelcin AW and Dibble HL (1995) The Effect of Hammer Mass and Velocity on Flake Mass. *Journal of Archaeological Science* 22(3): 429–439. DOI: 10.1006/jasc.1995.0042.

Pelegrin J (1990) Prehistoric Lithic Technology: Some aspects of research. *Archaeological Review From Cambridge* 9(1):116-125.

Pelegrin J (2005) Remarks about archaeological techniques and methods of knapping: elements of a cognitive approach to stone knapping. In: Roux V and Bril (eds) *Stone Knapping: The Necessary Conditions for a Uniquely Hominin Behaviour*. Cambridge: McDonald Institute for Archaeological Research Monographs, pp. 23–33.

Peresani M (2008) A New Cultural Frontier for the Last Neanderthals: The Uluzzian in Northern Italy. *Current Anthropology* 49(4): 725–731. DOI: 10.1086/588540.

Peresani M (2012) Fifty thousand years of flint knapping and tool shaping across the Mousterian and Uluzzian sequence of Fumane cave. *Quaternary International* 247(1): 125–150. DOI: 10.1016/j.quaint.2011.02.006.

Peresani M, Cristiani E and Romandini M (2016) The Uluzzian technology of Grotta di Fumane and its implication for reconstructing cultural dynamics in the Middle e Upper Palaeolithic transition of Western Eurasia. *Journal of Human Evolution* 91. Elsevier Ltd: 36–56. DOI: 10.1016/j.jhevol.2015.10.012.

Posth C, Wißing C, Kitagawa K, et al. (2017) Deeply divergent archaic mitochondrial genome provides lower time boundary for African gene flow into Neanderthals. *Nature Communications* 8: 1–9. DOI: 10.1038/ncomms16046.

Powell A, Shennan S and Thomas MG (2009) Late Pleistocene demography and the appearance of modern human behavior. *Science* 324(5932): 1298–301. DOI: 10.1126/science.1170165.

Premo LS and Hublin J (2009) Culture, population structure, and low genetic diversity in Pleistocene hominins. *Proceedings of the National Academy of Sciences* 106(1):33-37.

Premo LS and Kuhn SL (2010) Modeling Effects of Local Extinctions on Culture Change and Diversity in the Paleolithic. *PLoS ONE* Shennan S (ed.) 5(12): e15582. DOI: 10.1371/journal.pone.0015582.

Prüfer K, Racimo F, Patterson N, et al. (2014) The complete genome sequence of a Neanderthal from the Altai Mountains. *Nature* 505(7481): 43–9. DOI: 10.1038/nature12886.

Rezek Z, Lin S, Iovita R, et al. (2011) The relative effects of core surface morphology on flake shape and other attributes. *Journal of Archaeological Science* 38(6): 1346–1359. DOI: 10.1016/j.jas.2011.01.014.

Režek Ž, Dibble HL, McPherron SP, et al. (2018) Two million years of flaking stone and the evolutionary efficiency of stone tool technology. *Nature Ecology and Evolution* 2(4): 628–633. DOI: 10.1038/s41559-018-0488-4.

Rezek Z, Holdaway SJ, Olszewski DI, et al. (2020) Aggregates, Formational Emergence, and the Focus on Practice in Stone Artifact Archaeology. *Journal of Archaeological Method and Theory* 27:887-928. DOI: 10.1007/s10816-020-09445-y.

Richerson PJ, Boyd R and Bettinger RL (2009) Cultural innovations and demographic change. *Human biology* 81(2–3): 211–35. DOI: 10.3378/027.081.0306.

Richter J (2016) Leave at the height of the party: A critical review of the Middle Paleolithic in Western Central Europe from its beginnings to its rapid decline. *Quaternary International* 411A: 107-128. DOI: 10.1016/j.quaint.2016.01.018.

Riel-Salvatore J and Barton CM (2004) Late Pleistocene Technology, Economic Behavior, and Land-Use Dynamics in Southern Italy. *American Antiquity* 69(2): 257–274.

Rios Garaizar J, Eixea A and Villaverde V (2014) Ramification of lithic production and the search of small tools in Iberian Peninsula Middle Paleolithic. *Quaternary International* 361: 188–199.

Roebroeks W, Kolen J and Rensink E (1988) Panning Depth, Anticipation and the Organization of Middle Paleolithic Technology" The ‘Archaic Natives’ Meets Eve’s Descendants. *Hellinium* XXVIII(1): 17–34.

Roksandic M, Mihailović D, Mercier N, et al. (2011) A human mandible (BH-1) from the Pleistocene deposits of Mala Balanica cave (Sićevo Gorge, Niš, Serbia). *Journal of Human Evolution* 61(2): 186–196. DOI: 10.1016/j.jhevol.2011.03.003.

Rolland N (1977) New aspects of Middle Palaeolithic variability in western Europe. *Nature* 266: 251–252.

Rolland N (1981) The Interpretation of Middle Palaeolithic Variability. *Man, New Series* 16(1): 15–42.

Rolland N and Dibble HL (1990) A New Synthesis of Middle Paleolithic Variability. *American Antiquity* 55(3): 480–499.

Roth BJ and Dibble HL (1998) Production and Transport of Blanks and Tools at the French Middle Paleolithic Site of Combe-Capelle Bas. *American Antiquity* 63(1): 47–62.

Ruebens K, McPherron SJP and Hublin J-J (2015) On the local Mousterian origin of the Châtelperronian: Integrating typo-technological, chronostratigraphic and contextual data. *Journal of Human Evolution* 86: 55–91. DOI: 10.1016/j.jhevol.2015.06.011.

Shennan S (2000) Population, Culture History, and the Dynamics of Culture Change. *Current Anthropology* 41(5): 811–835. DOI: 10.1086/317403.

Shott MJ, Bradbury AP, Carr PJ, et al. (2000) Flake Size from Platform Attributes: Predictive and Empirical Approaches. *Journal of Archaeological Science* 27(10): 877–894. DOI: 10.1006/jasc.1999.0499.

Skinner M, de Vries D, Gunz P, et al. (2016) Title: A dental perspective on the taxonomic affinity of the Balanica mandible (BH-1). *Journal of Human Evolution* 93: 63–81. DOI: 10.1016/j.jhevol.2016.01.010.

Slimak L (1999) Mise en évidence d ' une composante laminaire et lamellaire dans un complexe moustérien du Sud de la France complex from Southern France. *Paléo* 11: 89–109.

Soressi M (2004) From Mousterian of Acheulean Tradition Type A to Type B: A Change in Technical Tradition, Raw Material, Task, or Settlement Dynamics? In: Conard N (ed.) *Settlement Dynamics of the Middle Paleolithic and Middle Stone Age, Volume II*. Tübingen: Kern Verlag, pp. 343–366.

Speth JD (1972) Mechanical Basis of Percussion Flaking. *American Antiquity* 37(01): 34–60. DOI: 10.2307/278884.

Speth JD (1975) Miscellaneous Studies in Hard-Hammer Percussion Flaking: The Effects of Oblique Impact. *American Antiquity* 40(2): 203–207.

Speth JD (1981) The Role of Platform Angle and Core Size in Hard-Hammer Percussion Flaking. *Lithic Technology* 10(1): 16–21. DOI: 10.1080/01977261.1981.11720840.

Starkovich BM (2017) Paleolithic subsistence strategies and changes in site use at Klissoura Cave 1 (Peloponnese, Greece). *Journal of Human Evolution* 111: 63–84. DOI: 10.1016/j.jhevol.2017.04.005.

Stern N (1994) The implications of time-averaging for reconstructing the land-use patterns of early tool-using hominids. *Journal of Human Evolution* 27: 89–105.

Theodoropoulou A (2008) *Le Denticulé Cet Inconnu. Les Assemblages Lithiques à Denticulés Du Paléolithique Moyen En Europe*. BAR Intern.

Thiébaut C (2005) *Le Moustérien à denticulés : Variabilité ou diversité techno-économique?* Available at: http://tel.ccsd.cnrs.fr/halshs-00009633.

Thiébaut C (2010) Denticulate Mousterian: Myth or Reality? *Acta Universitatis Wratislaviensis* 3207.

Tixier J and Turq A (1999) Kombewa et alii. *Paléo* 11: 135–143.

Tourloukis V and Harvati K (2017) The Palaeolithic record of Greece: A synthesis of the evidence and a research agenda for the future. *Quaternary International* 466A:48-65. DOI: 10.1016/j.quaint.2017.04.020.

Tsanova T (2008) *Les Débuts Du Paléolithique Supérieur Dans l'Est Des Balkans. Réflexion à Partir Des Études Taphonomique et Techno-Économique Des Ensembles Lithiques Des Grottes Bacho Kiro. (Couche 11), Temnata (Couche VI et 4) et Kozarnika (Niveau VII). BAR Inter*. Oxford: Archaeopress.

Tsanova T and Bordes J-G (2003) Contribution au debat sur l'origine de l'Aurignacien: Principaux resultats d'une etude technologique de l'industrie lithique de la couche 11 de Bacho Kiro. In: *The Humanized Mineral World: Towards Social and Symbolic Evaluation of Prehistoric Technologies in South Eastern Europe. Proceedings of the ESF Workshop*, 2003, pp. 41–50. Sofia: ERAUL.

Tsanova TR (2012) A Diachronic View of Flake Production from the Beginning of the Upper Palaeolithic. In Pastoors A & Peresani M (sds.), *Flakes not Blades: The role of flake production at the onset of the Upper Palaeolithic in Europe.* Mettmann: Neanderthal Museum (pp. 215-237).

Tuffreau A (1995) Variability of Levallois Technology in Northern France and Neighboring Areas. In: Dibble HL and Yosef OB (eds) *The Definition and Interpretation of Levallois Technology*. Madison: Prehistory Press, pp. 413–431.

Turq A (1992) Raw material and technological studies of the Quina Mousterian in Perigord. In: Dibble HL and Mellars P (eds) *The Middle Paleolithic: Adaptation, Behavior, and Variability*. The University Museum, University of Pennsylvania, Philadelphia, pp. 75–85.

Turq A (1999) Reflections on the Middle Palaeolithic of the Aquitaine Basin. In: Gamble C and Roebroeks W (eds) *The Middle Palaeolithic Occupation of Europe*. Leiden: University of Leiden, pp. 107–120.

Turq A, Roebroeks W, Bourguignon L, et al. (2013) The fragmented character of Middle Palaeolithic stone tool technology. *Journal of human evolution* 65(5): 641–55. DOI: 10.1016/j.jhevol.2013.07.014.

Vaesen K, Collard M, Cosgrove R, et al. (2016) Population size does not explain past changes in cultural complexity. *Proceedings of the National Academy of Sciences*: 201520288–201520288. DOI: 10.1073/pnas.1520288113.

Vujević D, Perhoč Z and Ivančić T (2017) Micro-Mousterian in Northern Dalmatia. *Quaternary International* 450: 50-67. DOI: 10.1016/j.quaint.2016.11.019.