Early Neolithic Large Blades from Crno Vrilo (Dalmatia, Croatia): Preliminary Techno-Functional Analysis

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DE GRUYTER Open Archaeology 2022; 8: 256–272

Research Article

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https://doi.org/10.1515/opar-2022-0232
received January 6, 2021; accepted February 17, 2022

Abstract: The excavation of Crno Vrilo site (Zadar, Dalmatia, Croatia), carried out by B. Marijanović, has unearthed the vestiges of an Early Neolithic village dating back to *ca*. 5800–5600 cal BC. The lithic assemblage, with more than 4000 pieces, represents the biggest Impressed Ware assemblage of littoral Croatia. Lithic production at Crno Vrilo is characterised by the pressure Blade flaking on high-quality exogenous cherts (Gargano, southern Italy) reflecting important socio-economic and technical aspects that are specific to the Neolithic. The presence of some débitage elements such as flakes, debris, cortical and technological pieces indicates that standard pressure flaking occured at the site, while the presence of large Blades (with widths exceeding 20 mm) suggests production by lever pressure, a technique that required specialized knowledge and equipment. This article questions whether the lever pressure technique was used in the production of large Blades and examines the status of these Blades in the Crno Vrilo lithic assemblage by examining their technological and functional aspects.

Keywords: Early Neolithic, Adriatic, lithic technology, use-wear analysis, (lever) pressure-flaking

1 Introduction

What do we mean by the term "large Blades?" While there is no unanimous definition of the term "large Blades" because a Blade is only "large" when compared to other Blades (Guilbeau, 2010, p. 8), the archaeological record shows the existence of Blades that stand out from the rest due to their impressive dimensions. In the context of European Prehistory, the best-known examples of such Blades come from the Varna cemetery (Bulgaria), dated to the 5th millennium BC and attributed to the Chalcolithic Kodžadermen-Gumelniţa-Karanovo VI culture (Gurova, 2010; Higham et al., 2007; Manolakakis, 1994). During the Final Neolithic and Chalcolithic, similar Blades were found elsewhere, in France, Spain, southern Italy, Sicily,

Special issue: THE EARLY NEOLITHIC OF EUROPE, edited by F. Borrell, I. Clemente, M. Cubas, J. J. Ibáñez, N. Mazzucco, A. Nieto-Espinet, M. Portillo, S. Valenzuela-Lamas, & X. Terradas.

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Dalmatia[1], and Ukraine (Gibaja, Terradas, Palomo, & Clop, 2009; Guilbeau, 2010; Ihuel, 2008; Marquet & Verjux, 2012; Roux, Mille, & Pelegrin, 2013; Vaquer & Briois, 2006). Between the 5th and 3rd millennium BC, these objects are often, but not exclusively, found in funerary contexts or were purposely buried in the ground ("hoard"), which suggests a certain symbolic/socially valued role of such items (Gurova, Chabot, & Chohadzhiev, 2016; Ihuel, 2008). Nevertheless, according to traceological studies, those Blades were sometimes used before deposition (Gibaja Bao, 2003, 2004; Plisson, Bressy, Briois, & Renault, 2006).

However, the archaeological record suggests that, at least in the context of south/south-eastern Europe, large Blades appear earlier and can even be traced back to the Early Neolithic. Large Blades, i.e., Blades with a width exceeding 20 mm are recorded at Initial, Early, and Middle Neolithic sites in Greece (between *ca*. 6600 and 5500 cal BC) and in southern Italy (from *ca*. 6000 cal BC) (Guilbeau, 2010; Guilbeau & Perlès, 2019; Pelegrin, 2012a,b, p. 22; Perlès, 2004, 2012). Indeed, at several sites[2], mostly fragmented large specimens are found.[3]

In this article, we will focus on large Blades from Crno Vrilo (Dalmatia, Croatia), an Early Neolithic site dating to approximately 5800–5600 cal BC and examine their status relative to other ("ordinary", i.e. narrower) Blades in the assemblage by examining both the technological and functional aspects of these Blades.

1.1 The Production Techniques of Large Blades

How were these Blades manufactured? Archaeological and experimental examples have shown that two distinct techniques were most often used to obtain such large specimens: indirect percussion and lever pressure flaking[4] (Abbès, 2013; Gibaja et al., 2009; Guilbeau, 2010; Marquet & Verjux, 2012; Pelegrin, 2012a,b).

Indirect percussion involves the application of an intermediary tool, called a "punch", which can be made of wood, antler, or bone. The technique of pressure flaking consists of applying force by means of various tools, on one precise point on the core platform. Pressure flaking with a lever is a special kind of pressure flaking: it is the most elaborate technique that involves the application of a lever device, which is sometimes considered the first machine (Demoule, 2017, p. 62).

Although it is not always straightforward to distinguish (lever-)pressure Blades from those made by indirect percussion, there are some technological features that make such distinction possible, i.e., some diagnostic traits occur more frequently with a particular flaking technique (Pelegrin, 2012a,b). The main distinctive feature is the absence of a systematic regularity in indirect percussion. In this sense, it is important to note that the identification of a technique can never be based on an isolated piece, but only on the whole assemblage. Therefore, Blades obtained by indirect percussion are usually less regular, always more curved and often thicker (Manolakakis, 2017; Pelegrin, 2012a,b). In the Balkans and the central Mediterranean, both techniques appear to have been used in the production of large Blades (Guilbeau & Perlès, 2019; Guilbeau, 2010; Gurova et al., 2016). As far as the Neolithic is concerned, large Blades from Greece and southern Italy were mostly made by lever-pressure flaking (Guilbeau, 2010; Guilbeau & Perlès, 2019; Pelegrin, 2012a; Perlès, 2004, 2012, p. 22), while large Blades from central and eastern Balkans were obtained with indirect percussion (Gurova, 2014; Jovanović, 2021). However, it is important to emphasise that reliance on one technique does not mean the absence of another technique. For example, in the case of southern Italy, large Blades obtained by indirect percussion are present alongside Blades produced by lever

1 A 25.4 cm long and 27.7 cm large Blade on Gargano chert was found in Konjevrate in 1979, but was not previously published (Kačar, 2019, p. 491). According to the local priest, the Blade was found in the funeral context which, together with its morphometric features (cf. Guilbeau, 2010), suggests its later attribution (Late Neolithic/Chalcolithic).

2 Such as Argissa, Franchthi, Nea Nikomedeia, Ripa Tetta, and Passo di Corvo.

3 For that reason, when speaking about large Blades in the context of the Early Neolithic, the width of the Blade is more often taken into account than its length.

4 Besides indirect percussion and lever pressure, a special technique was recognized for a long Blades that circulated in the North-western Europe during the Final Neolithic (*ca*. 3100–2400 cal BC): the so-called Grand Pressigny technique or *livre de beurre* technique (see, e.g., Pelegrin, 2012a).

pressure flaking (Guilbeau, 2010; Guilbeau & Perlès, 2019). Likewise, during the Chalcolithic in Bulgaria, long Blades produced by lever pressure flaking are accompanied by somewhat more irregular Blades obtained by indirect percussion (Manolakakis, 1994, 2017).

The identification of lever pressure in the central Mediterranean assemblages was possible particularly due to the experiments conducted by J. Pelegrin who explored different working positions and tool kits (Guilbeau & Perlès, 2019; Guilbeau, 2010; Pelegrin, 1988, 2012a,b; Perlès, 2004). According to this scholar, the Blades whose width exceeds 20 mm are rarely detached by abdominal pressure alone, i.e., they occur in an anecdotal (non-systematic) way (Pelegrin 2012a, pp. 476–479). Recently, J. Heredia managed to obtain several Blades up to 28 mm wide by abdominal pressure alone.[5] This is important to bear in mind because the sporadic presence of larger Blades (with width ≥20 mm) in Early Neolithic contexts could be explained by the fact that the knapper occasionally exerted greater force on the immobilised core.

2 Crno Vrilo Site in the Context of Dalmatian Early Neolithic

Crno Vrilo is an open-air site located about 12 km northeast of the modern city of Zadar, in the northern part of Dalmatia (Figure 1). Excavations during the early 2000s unearthed the remains of an Early Neolithic village together with rich vestiges of material culture (Marijanović, 2009, Figure 1a). The site is dated to *ca.* 5800–5600 cal BC,[6] and according to ceramic vestiges, it is attributed to the Impressed Ware culture (Marijanović, 2009).

Compared with the rest of the Eastern Adriatic, which is rugged and mountainous, the relief of Northern Dalmatia is less pronounced, and the region is characterised by the relative richness of lowlands, such as plains of Zadar's hinterland (Ravni Kotari) and fields situated in the vicinity of Šibenik. This is the most fertile part of the Eastern Adriatic, and the majority of the Neolithic sites can be found here (Marijanović, 2003).

The first farming communities settled in this area from the *ca.* 6000 cal BC (Forenbaher, Kaiser, & Miracle, 2013; McClure, Podrug, Moore, Culleton, & Kennet, 2014; Podrug et al., 2018), less than a century after the first emergence of the Impressed Ware pottery in the Ionian-Adriatic region (Berger, Metallinou, & Guilaine, 2014). The data available suggest that the transition to farming in Dalmatia was relatively quick, resulting from the colonisation of an open landscape, seemingly linked to the "8,2 ka event" and the onset of a drier climate (Kačar, 2021). The subsistence of these newcomers was almost exclusively based on agriculture and herding, while the lithic Blade production made of cherts from Gargano (southern Italy) testifies to important social aspects and complex management strategies, all marking a break with Late Mesolithic/Castelnovian traditions.

3 A Brief Presentation of the Crno Vrilo Lithic Assemblage

In the framework of the publication of the site (Marijanović, 2009), the lithic assemblage from Crno Vrilo was first studied typo-technologically by M. Korona (Korona, 2009). According to her, the assemblage, now preserved in the Archaeological Museum of Zadar, consists of 4,685 pieces. Recently, the lithic material from sector A, which included 1,412 pieces,[7] was examined using the techno-economical approach (Kačar, 2019a). According to observations made macroscopically by Z. Perhoč, the majority of the lithics was made of high-quality raw materials originating from the Gargano peninsula. Unlike other Early Neolithic

5 Using full body weight on a long crutch with a copper tip (https://www.youtube.com/watch?v=5kvgaEH-Ll0).

6 For C14 dates, see Marijanović (2009, pp. 110–114).

7 Three sectors were opened during the excavations: sector A is the richest. However, our count differs from that of M. Korona, which counted 1,138 pieces for Sector A (Korona, 2009, pp. 166–167, Table 3).

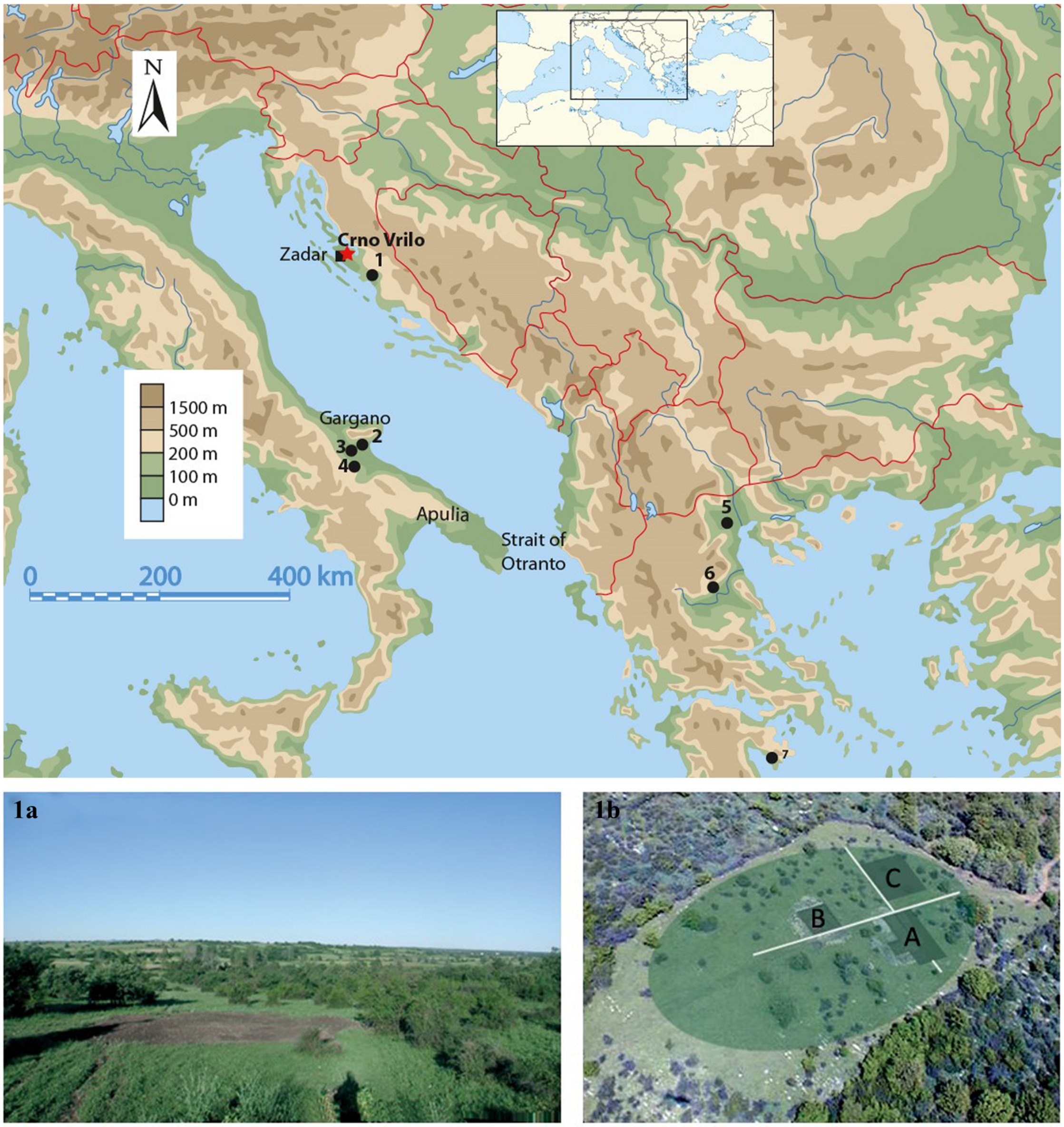

Figure 1: Location of the Crno Vrilo site and the sites mentioned in text: (1) Pokrovnik, (2) Passo di Corvo, (3) Ripa Tetta, (4) Rendina, (5) Nea Nikomedeia, (6) Argissa, and (7) Franchthi (base map E. Tessier). 1a Position of the site. 1b. Presumed settlement size (oval shaped) and excavated areas (sectors A, B, and C), modified after Marijanović (2009, p. 20).

assemblages studied from the region (Kačar, 2019a,b), the Crno Vrilo specimens are not entirely covered by a white patina meaning that their surfaces are not altered and their appearance has remained intact. For this reason, it was possible to observe them macro- and microscopically and to conclude that the different varieties of Gargano cherts, probably originating from different mines, were used in Blade/lithic production.[8] Apart from these exogenous cherts of superior quality, raw materials of poorer quality (of local origin according to Z. Perhoč) have also been recognised in the corpus.

8 A petrographic analysis of the samples was conducted using a trinocular stereomicroscope (Zeiss Stemi 508 equipped with a camera Axiocam 105 Color) with a magnification of 80× to 200×. The raw materials were examined according to their general characteristics such as colour, properties of the cortex, texture, homogeneity, grain size, and occurrence of microfossils, in the framework of the PhD thesis (Kačar, 2019a). However, due to the absence of labelling, only part of the material (i.e., Blades) was examined this way making these observations preliminary. Further analysis may indicate more pronounced trends.

Table 1: Crno Vrilo Sector A: Lithic assemblage breakdown by main raw material groups and technological categories

	High-quality Gargano	Mediocre local cherts	Indet.	Total Blanc
Full debitage Blades	200		55	255
First Blade (entirely cortical)			1	1
Cortical Blades	14		2	16
Core rejuvenation Blades	3		3	6
Crested Blades	7		2	9
Burin spalls	21		1	22
Total Blades	**245**		**64**	**309**
Flakes	405	73	127	605
Opening flake (*calotte*)		1		1
Cortical flakes	43	20	14	77
Cortical core rejuvenation flakes	4		1	5
Core rejuvenation flakes	39	9	14	62
Crested flakes	11		1	12
Tablets	9	2	1	12
Flakes with laminar negatives	85		15	100
Total flakes	**596**	**105**	**173**	**874**
Core	1	6		7
Core fragments		4	1	5
Total cores	**1**	**10**	**1**	**12**
Debris	**96**	**25**	**59**	**180**
Small flakes/chips (≥1 cm)	**32**		**4**	**36**
Tested blocs		**1**		**1**
Total	**970**	**141**	**301**	**1412**

Therefore, two main operating schemes could be individualised: one on local, Dalmatian raw materials of mediocre quality oriented towards the expedient production of flakes and the other on exogenous cherts of superior quality, most probably of Gargano origin, oriented towards the production of Blades. The first is characterised by an almost complete operating scheme carried out on site (decortication – abandoned cores – tools), while the second shows only a partial contribution on site, with the absence of the first phases of debitage (absence of large or cortical flakes) as well as the last phases (absence of Blade cores).

The group of local raw materials with 141 pieces is poorly represented numerically (12.7% of total determinable cherts) and would not be further examined here.

With 970 pieces, i.e., 87.3% of the identifiable raw materials, superior quality cherts dominate the corpus: the most numerous are flakes ($n = 596$, i.e., 61.4% of the total Gargano chert assemblage), followed by Blades ($n = 245$, i.e., 25.3%), debris ($n = 96$, i.e., 9.9%), and small flakes/chips ($n = 32$, i.e., 3.3%; Table 1). One core was also found. It is small in size, with multiple striking platforms, and testifies to the production of flakes. Despite its provenance, it does not differ morphologically from the cores made on local flints.

Among the flakes, it is interesting to note the presence of those bearing Blade negatives on the dorsal side ($n = 85$). In general, these flakes testify to accidents that occurred during the Blade debitage – the removal of the Blade accidentally occurred earlier than planned, which shortened the final product. However, some fragments may have been detached at the end of production, i.e., after the series of Blades, which might indicate that, after Blade production, the exploitation of the cores continues to obtain flakes. The presence of these flakes, as well as the aforementioned small core, could suggest that an expedient production of flakes was carried out after the Blade debitage.

The high incidence of Blades (309 pieces[9], i.e., 21.9% of the total chert assemblage) in Sector A indicates that the Crno Vrilo lithic system is oriented towards the production of Blades.

9 Or 287 pieces if we exclude the burin spalls.

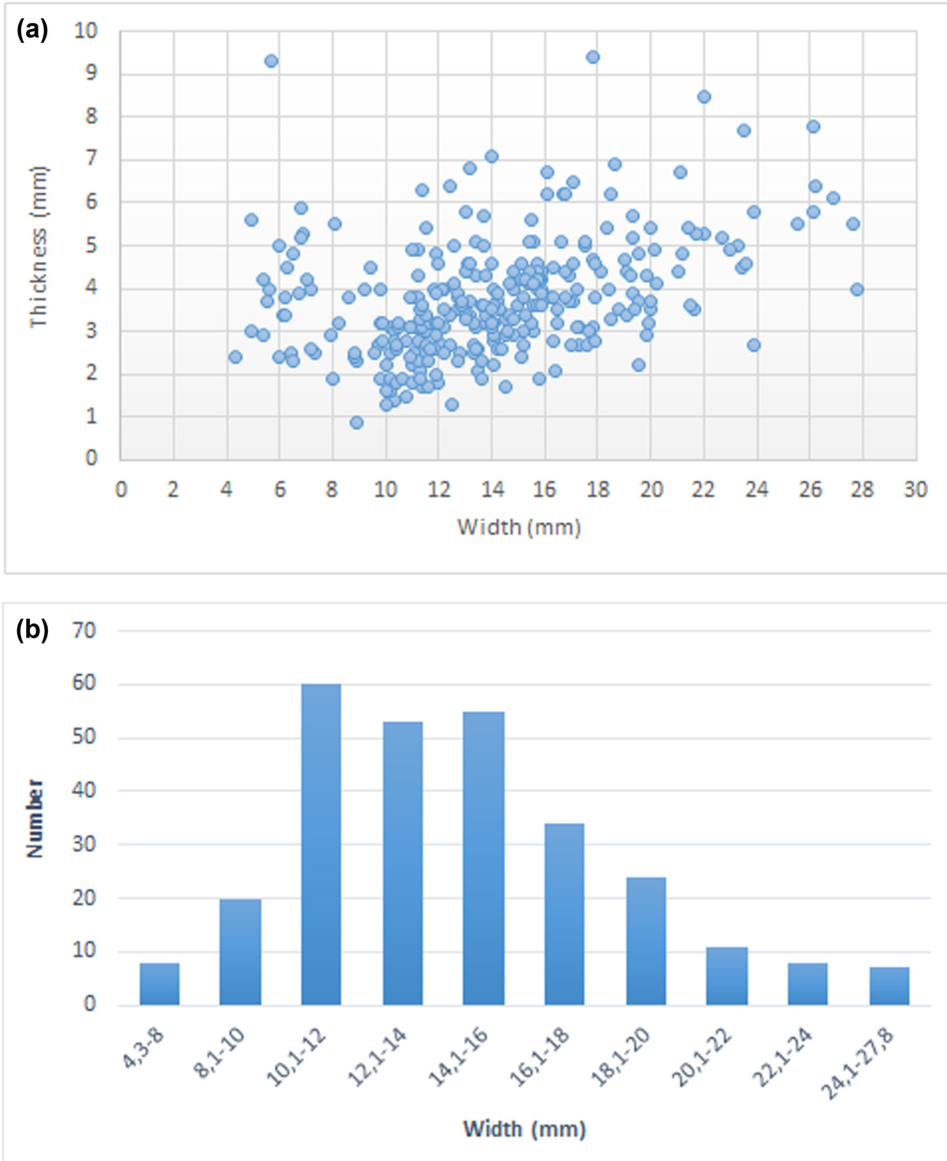

Figure 2: (a) Crno Vrilo Sector A: dispersion of the thickness (ordinate) and width (abscissa) of the Blade products (*n* = 280 excluding Blade(let)s with very invasive lateral retouch and burin spalls) (b) Crno Vrilo Sector A: Distribution of the Blade(let)s according to their width (*n* = 280 excluding Blade(let)s with very invasive lateral retouch and burin spalls).

The majority (245 pieces) relate to Gargano cherts, and for the remaining 64 pieces, the raw material could not be precisely identified due to alterations: 30 pieces are burnt and 34 are covered with patina. However, it should be noted that the structure and nature of the raw material of these Blades also refer to a high-quality chert comparable to the Gargano type. Excluding the burin spalls, 33 Blades are preserved completely. There is a great variability in length, ranging from 28.8 mm (the smallest) to 132.5 mm (the largest). The average length is 50.9 mm. In 62 cases, the butts have been preserved: 35 are plain, 12 are faceted, 7 are linear, 6 are dihedral, 1 is punctiform, and 1 cortical. Regarding the width/thickness relation, the scatter plot (Figure 2a) indicates the presence of two main groups. One refers to the Bladelets and contains products whose width is preferably situated between 10 and 12 mm and the thickness between 1.5 and 3.3 mm. The other group refers to Blades whose width exceeds 12.5 mm and can reach up to 16 mm, while the thickness is preferably between 2.5 and 4.5 mm. However, these values probably do not represent

Table 2: Composition of the analysed large Blade samples

	Nb	Present part of the Blades				Nb used	Nb of IUZ
		Complete	Distal part	Mesial part	Proximal part		
Unretouched technical Blades	3	1		2	1	1	1
Cortical	*2*	*1*		*1*		*0*	
Crested	*1*			*1*	*1*	*1*	*1*
Retouched technical Blades	4	3		1		3	8
Cortical, burin and notch	*1*	*1*				*1*	*1*
Cortical, burin and irregular retouch	*1*			*1*			*0*
Crested, truncation	*1*	*1*				*1*	*5*
Crested, burin, IR,	*1*	*1*				*1*	*2*
Unretouched central Blades	3		1		2	2	5
Retouched central Blades	9	1		5	3	9	20
Irregular retouch	*2*			*1*	*1*	*2*	*5*
Truncation	*1*	*1*				*1*	*2*
Notched	*1*				*1*	*1*	*1*
Splintered	*1*			*1*		*1*	*2*
Burin and lateral retouch	*4*			*3*	*1*	*4*	*10*
Indeterminate	1			1		1	1
Total	20	5	1	8	6	16	35

two separate productions – in which one is oriented towards the production of Bladelets and another one in the production of Blades – but rather point to the variability that occurs during the debitage (i.e., with the core reduction). The frequency histogram (Figure 2b) indicates that the majority of Blades are between 10 and 16 mm wide, which therefore corresponds to the main objective of the Blade(let) production.

Besides the full debitage Blades ($n = 255$), the presence of technical pieces (such as crested Blades, core renewal Blades, and overshot Blades) and cortical Blades alongside the cortical and core rejuvenation flakes and debris could indicate that the Blades (or part of the Blades) on Gargano cherts were produced on site. The same has been recorded at other northern Dalmatian sites (Kačar, 2019b).

4 Large Blades: Methodology, Sampling, and Results of the Preliminary Techno-functional Study

As already mentioned *supra*, the lithic assemblage of Crno Vrilo (sectors A, B, and C, see Figure 1a) consists of 4,685 pieces (Korona, 2009). While a detailed technological study was carried out only on the lithic material from sector A (Kačar, 2019a), a total number of 47 large Blades were found in all sectors (sectors A, B, and C). All those specimens, i.e., Blades whose width is equal to or exceeds 20 mm, were selected for the detailed techno-functional analysis and are now under study.

Large Blades made up *ca*. 10.7%[10] to 12.5%[11] of the total Blades.

Technological analysis was conducted on all 47 specimens, and the preliminary functional analysis was conducted on a sample of 20 large Blades (5 complete and 15 fragmented; Table 2). In addition to the state of preservation, which is generally good, the selection was made on the basis of technological criteria

10 This proportion refers to sector A, where 30 large Blades are found of a total 280 Blades (excluding specimens with very invasive lateral retouch and burin spalls).

11 This proportion refers to all sectors A, B, and C, where 47 large Blades are found of a total 376 Blades (excluding specimens with very invasive lateral retouch and burin spalls).

such as general conservation of the Blades, Blade's regularity, and flaking rhythm (*rythme du débitage*). The latter refers to the Blades illustrating different stages of the chaîne opératoire, such as Blades pointing to the beginning of Blade debitage (cortical Blades, $n = 4$) or to the core rejuvenation (crested Blades, $n = 3$), the Blades produced during the "full debitage phase" (*lames de plein débitage*, i.e. central Blades, $n = 12$), and the irregular Blades for which the production sequence ("flaking rhythm") cannot be determined ($n = 1$).

The techno-typological analysis was conducted according to the concepts of chaîne and schema opératoire (Inizan, 1980; Inizan, Redouron-Balinger, Roche, & Tixier, 1999; Leroi-Gourhan, 1965; Pelegrin, 1988; Perlès, 1980, 1990; Soressi & Geneste, 2011), whereas special attention is given to the chronology of technical gesture ("flaking rhythm") (Binder, 1987; Léa, 2004). The functional study was conducted according to protocols that have now been proven in use-wear analysis (Marreiros, Gibaja Bao, & Ferreira Bicho, 2015; Semenov, 1964) combining low-power approach by means of a stereomicroscope (Nikon ZMZ 800, magnification from ×6 to ×50) and high-power approach using an illuminated reflective light microscope (Nikon Eclipse LV150, magnification from ×50 to ×200, with a Nikon DS-Fi2 camera and NIS software).

4.1 Preliminary Techno-functional Analysis

Macroscopically, all the large Blades were made from high-quality Gargano cherts (Z. Perhoč, pers. comm.). However, there is obvious variability in the colour and structure of this Upper Cretaceous chert, which could indicate different sources of procurement within the Gargano area, although these claims need to be confirmed by more detailed petrographic analysis.

Technological analysis was conducted on all 47 Blades, coming from all sectors (A, B, and C).

Among 47 Blades, only 5 were preserved completely. As already mentioned *supra*, the longest Blade is 132.5 mm, while the smallest measures only 15.6 mm.

Other Blades were broken into fragments and preserved in the following way: medial ($n = 23$), proximal ($n = 12$), and distal ($n = 7$) segments.

The Blades are between 20 and 32.9 mm wide (average 23 mm) and between 2.6 and 8.5 mm thick (average 5.2 mm).

Seven specimens are considered as "cortical Blades" ("rhythm A1") since they have a remaining cortex, but at only 5, the cortex covers more than ¼ of a dorsal side.[12]

Four Blades fall into the category of "technical Blades" since they show signs of core rejuvenation and all of them are crested Blades.

Thirty-two Blades technologically belong to the central phase of Blade production (*lames de plein débitage*). Twelve show characteristics of so-called debitage optimum in the form of prismatic Blades with a trapezoidal cross-section, two parallel dorsal ridges, and three longitudinal surfaces.

The flaking rhythm (*rythme du débitage*) could not be determined for four specimens.

While proximal parts, which are essential to the identification of the technique employed in the manufacture of large Blades, are preserved in 17 specimens, only in 11 cases are the butts determinable. They differ in morphology and size, can be either reduced to a small surface (Figure 5) or large, stretching over the entire lower proximal part (Figure 7(2)), often (slightly) inclined (Figures 3–6) and sometimes slightly concave (Figure 3). Typologically, most of the butts ($n = 8$) are plain, two are faceted, and one is linear.

In most of the cases, the overhangs are abraded, sometimes simultaneously with the correction of *angle de chasse* by small Bladelet-like removals (Figure 7(2)), and only in one case, they were left intact (Figure 6), probably because they were not impending the debitage.

Bulbs are usually pronounced and often high.

12 Including three Blades with one cortical dorsal ridge and one Blade on which the cortex covers the dorsal surface up to 75%.

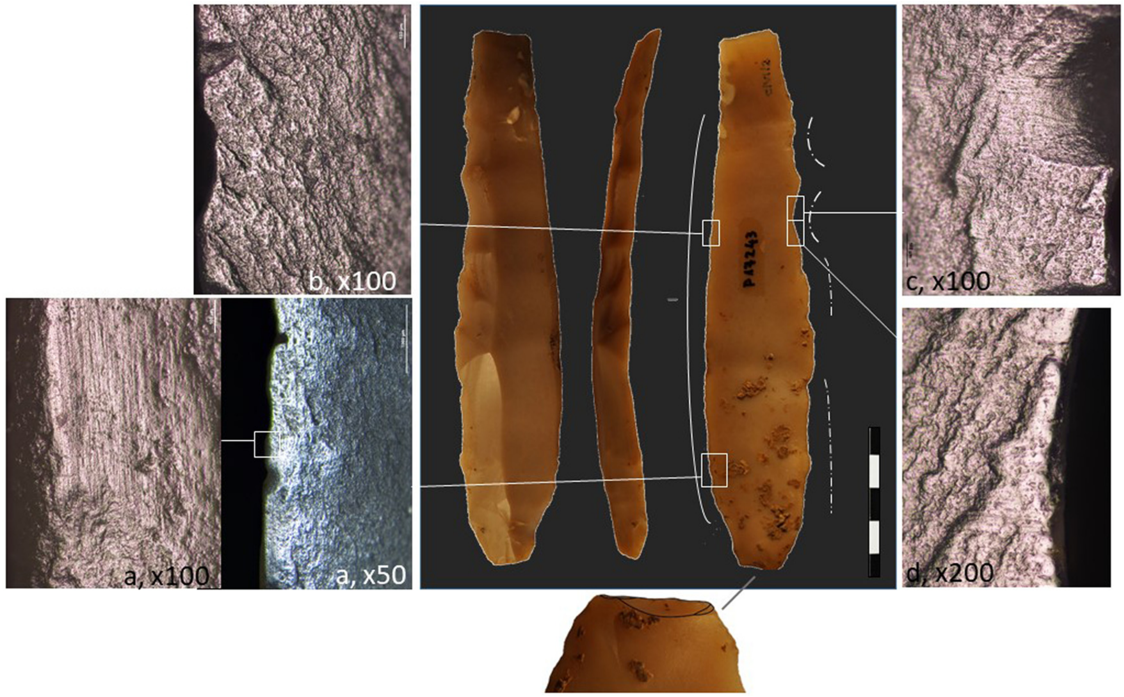

Figure 3: Crested Blade with one flat versant, obtained by lever pressure, used on both edges, to cut soft mineral material (a) and vegetal material (b), to scrape abrasive material (c) and wood (d).

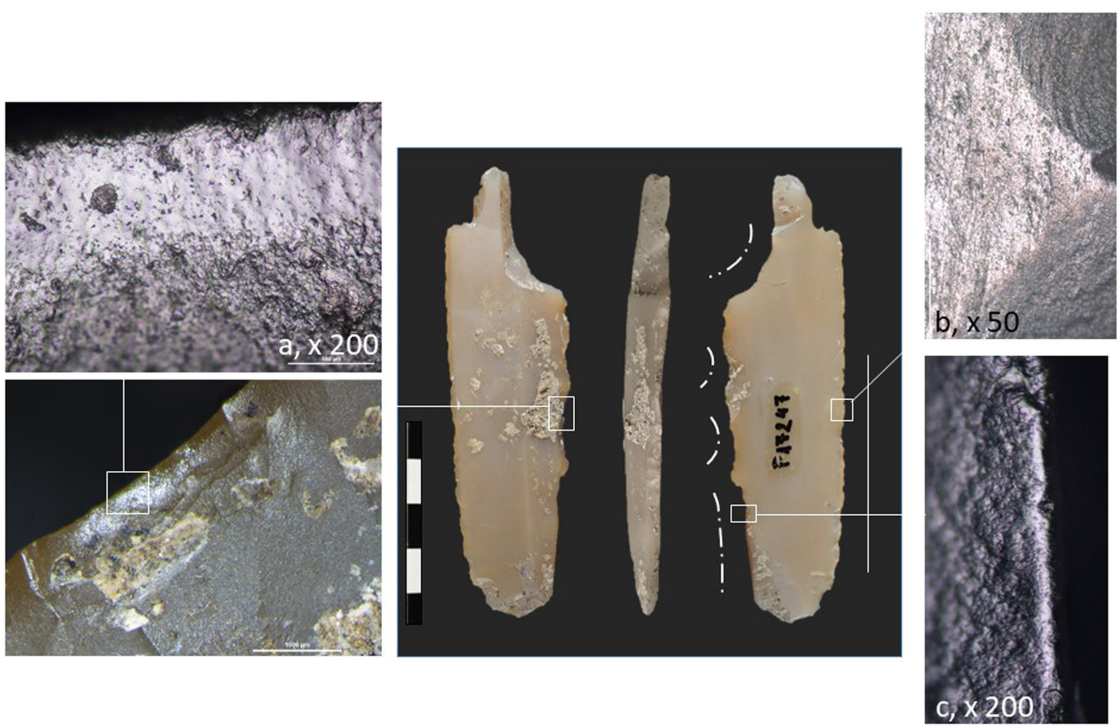

Figure 4: Central Blade («*débitage optimum*», rhythm C2), obtained by (lever) pressure, used to scrape soft plant (a, non-contact surface), to cut abrasive material (b) and scrape hard organic material (c).

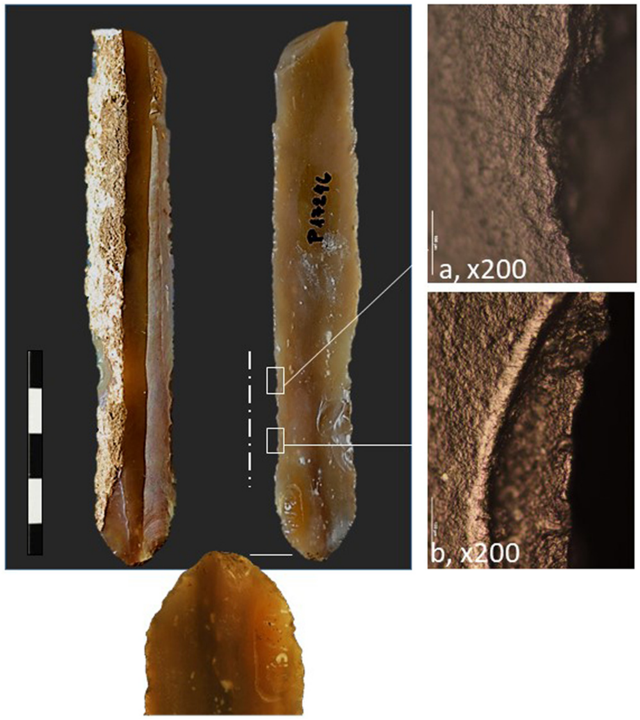

Figure 5: Cortical Blade obtained by (lever) pressure, used to scrape hard organic material (a and b).

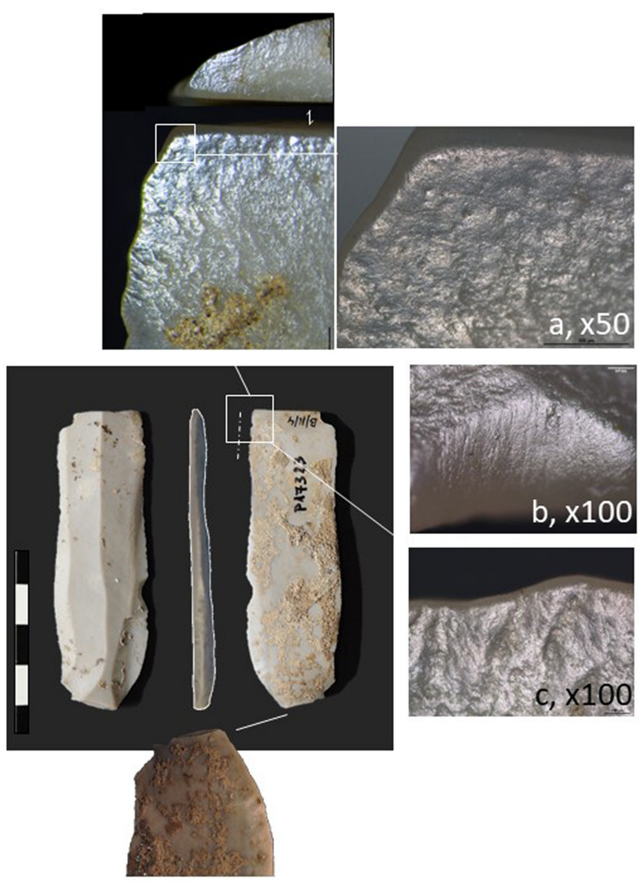

Figure 6: Central Blade (rhythm B2), slightly hinged, probably obtained by (lever) pressure, used to work as a soft mineral material: (a) micropolish on the fracture/edge angle; (b) non-contact surface, and (c) contact surface.

Figure 7: Unused Blades. (1) Undetermined Blade (rhythm D), obtained by (lever) pressure, direct or indirect percussion; (2) Central Blade ("*débitage optimum*," rhythm C2) obtained by (lever) pressure, the butt is out of scale; (3) Cortical Blade (cortex covering single ridge), obtained by lever pressure or indirect percussion, profile slightly on "S," wavy dorsal surface, undulations on ventral side.

Most Blades display important regularity of edges and arrises, criteria which, taken together with other traits such as constant thickness (with the relative thinness of section), straightness of profile (except for distal curvature) and sometimes high bulb, pronounced lip and absence of impact point on the Blades proximal parts, imply that the pressure flaking was the principal technique used in the production of large Blades.

As such, these Blades do not differ from the "narrower" Blades from Crno Vrilo assemblage, except by their size. In this sense, it is reasonable to assume that the large Blades were likewise produced by pressure flaking, be it with forced abdominal pressure or lever pressure.

However, the use of (in)direct percussion cannot be ruled out for some more irregular Blades. For example, a 32.9 mm wide and 7.3 mm thick fragment of one cortical Blade bears very marked undulations on the both ventral and dorsal sides (Figure 7(3)).

Another example is one completely preserved irregular Blade (Figure 7(1)). The Blade is 71.7 mm long, 26.1 mm wide, and 5.8 mm thick and has a slightly S-curved profile. While the "flaking rhythm" of this Blade is undetermined, it is possible that the Blade was detached to repair the flaking surface of the core. The slightly hinged termination indicates that the Blade was accidentally detached earlier than planned.

However, the employment of direct or indirect percussion besides the pressure flaking is not surprising, and it is a commonly used among modern flintknappers mainly for repairing the knapping surface or detaching the Blades, which would have been too difficult to detach by pressure alone.

Following this, pressure flaking remains the principal technique used in the production of large Blades.

Among 20 analysed Blades, the majority (16) can be referred to as tools since they are showing use-wear traces (11 central Blades, 3 crested Blades, 1 cortical, and 1 undetermined Blade). Nevertheless, the degree of exploitation of these Blades appears to vary. Some Blades show the signs of relatively intense or prolonged use such as bilateral utilisation (n = 9), several independent use zones that can be involved in different tasks, and high degree of wear development (macro blunting, gloss, or edge resharpening) (Figures 3 and 4). But, independently of the possible biases linked to the taphonomy and differential conservation of micropolis, this management strategy is not systematic and many large Blades have only one working area and/or show short uses (Figures 5 and 6). Whether technical or central, the Blades do not seem to have any functional specialisation. They have been used for various activities, demonstrating various movements, such as scraping, planing, or cutting, and in treatment of different materials (mainly plant and wood, skin, soft mineral material, and an unidentified material with an abrasive component).

Only four Blades do not show any traces of utilisation: two cortical Blades, one central Blade, and one irregular Blade whose rhythm could not be determined (Figure 7). While one might expect a lower rate of

Blade use at a production site, at Crno Vrilo the mere presence of four unused Blades does not necessarily indicate a Blade production site, especially considering the variability observed in the degree of large Blade optimisation. To assess this possibility, it is necessary to evaluate tool management strategies across the whole assemblage, at both the site-specific and regional scale.

The combined techno-functional study shows that the majority of the large Blades were used (Table 3). They thus do not differ from the rest of the Blades since they also illustrate a utilitarian rather than a strictly social/symbolic role.

5 Discussion

Although it is not always evident to distinguish flaking techniques, the diagnostic traits recognised on most of the Blades (regularity of the Blade edges and ridges and straightness of the section, abraded overhangs, *angle de chasse* close to 90°, high bulb, and absence of impact point) suggest that the pressure flaking technique was the principal technique used in the production of both "ordinary" and large Blades. Yet, it remains open whether all Blades were obtained in the same way,[13] i.e., by abdominal pressure on the core with the help of a long crutch, or another *mode* of pressure flaking (reinforced by a lever), was used to obtain large Blades.

If pressure flaking with a long crutch was used alone in the Blade production, large Blades could appear occasionally when the knapper exerted a greater force on the core. This is demonstrated by the experiments carried out by J. Heredia who managed to obtain several large Blades using abdominal pressure alone. The products obtained by Heredia exceed 20 mm in width and go up to 28 mm.

On this point, it should be noted that only two Blades from Crno Vrilo are in fact wider than 28 mm: the aforementioned cortical fragment 32.9 mm wide (Figure 7(3)) and the almost whole[14] 15.6 mm long, 28.7 wide, and 8.2 thick crested Blade (Figure 3). While the cortical fragment may be produced by some other technique, such as direct or indirect percussion, the morphology of the crested Blade suggests that it was obtained by pressure flaking (with a lever).

The use of a lever would imply that some of the Blades from the assemblage were manufactured separately as it seems excessive that the lever would also be used to produce smaller Blades and Bladelets.

The employment of a complex system such as a lever implies high technological investment and socio-economic specialisation (Guilbeau, 2010, 2011; Guilbeau & Perlès, 2019; Perlès, 2001, 2012). Indeed, pressure flaking with a lever is the most demanding technique in Blade production. As such, large Blades must have been produced by specialised, well-trained knappers possessing both the particular skills and necessary equipment. They invested time to obtain the important knowledge and know-how needed for mastering the core preparation as the technologically most demanding part of the chaîne opératoire.

According to some scholars, the use of lever-pressure flaking for a production of large Blades can be traced back to the Early Neolithic. Blades made by this technique were recorded at several sites in Greece (Argissa, Franchthi, Nea Nikomedeia), Apulia (Ripa Tetta, Rendina), and Dalmatia (Pokrovnik) (Collina, 2015; Guilbeau, 2010, 2011; Guilbeau & Perlès, 2019; Mazzucco et al., 2018; Perlès, 2004, 2012).

However, regional differences pointing to different technical procedures in the production of lever-pressured Blades between Greece and southern Italy can be observed (see Guilbeau & Perlès, 2019, pp. 514–515).

In the Crno Vrilo assemblage, some Blades stand out for their impressive size and regularity and as such look like a textbook example of Blades made by lever pressure. Yet, given the relatively small number of Blades that can be surely attributed to this technique, there is still no consensus as to whether the lever device was employed during the Early Neolithic. In that sense, some questions still remain open. Why did

13 By the same "mode" of pressure technique, Cf. Pelegrin (1988; 2012a, p. 468).

14 The Blade is truncated.

Table 3: Use-wear traces identified among large Blades

				Cross-cutting action, scraping				Longitudinal action, cutting			
	Nb	**Nb used**	**Nb of IUZ**	**Hard organic material**	**Soft plant**	**Hide**	**Ind.**	**Soft animal material**	**Abrasive material**	**Woody plant**	**Cereal**
Unretouched technical Blades	3	1	1					1			
Cortical	2	0									
Crested	1	1	1					1			
Retouched technical Blades	4	3	8	2	2				4		
Cortical, burin and notch	1	1	1	1							
Cortical, burin, and irregular retouch	1		0								
Crested, truncation	1	1	5		2				3		
Crested, burin, IR,	1	1	2	1					1		
Unretouched central Blades	3	2	5			4 (2?)	1				
Retouched central Blades	9	9	20	7	2	3			4	4	
Irregular retouch	2	2	5	2	1	2					
Truncation	1	1	2						2		
Notched	1	1	1						1		
Splintered	1	1	2	1						1	
Burin and lateral retouch	4	4	10	4	1	1			1	3	
Indeterminate	1	1	1								1
Total	20	16	35	9	4	7	1	1	8	4	1

? = uncertain.

the lever pressure technique not spread beyond eastern/central Mediterranean before, but only from the final Neolithic/Chalcolithic? In other words, why would this technique appear, disappear, and then reappear?[15,16]

In addition, given the special skills and equipment that such production demands, it is very unlikely that every village was able to produce such Blades. In this sense, it is reasonable to presume that they were produced elsewhere and then imported to sites. But if they were imported, then why were they used (Table 3) just as "ordinary" Blades that were probably produced on the site (Kačar, 2019a, 2019b)? In other words, why resort to a complex technique to obtain products used for daily activities? And yet, perhaps it was precisely through these Blades' practical use that they acted as signals of status. Everyday practices offer a forum of display, not just funerary contexts.

A preliminary use-wear study shows that both fragments and whole large Blades were used which points to the utilitarian function of these blanks. Therefore, it is important to note that whole specimens do not seem to have been the object of a particular valorisation in the Crno Vrilo village, as may be the case in other contexts (Guilbeau, 2010; Perlès, 2012; Perlès & Vitelli, 1999).

Most of the large Blades show an intense use, whereas few blanks have been recycled, pointing to a long-term maintenance strategy.

These tools are involved in various chaînes opératoires in which they are preferentially devoted to the manufacture or repairing of objects, affecting the domestic or artisan sphere more than the economic one. They seem to constitute individual, non-specialised equipment, which does not seem to meet a specific functional need.

When compared to the other products, i.e., narrower Blades demanding less technical investment, the place of large Blades within the Crno Vrilo Blade assemblage can be understood as complementary. Indeed, Blade supports of more modest dimensions (with an average width of *ca*. 14 mm and generally used unretouched or slightly modified by the resharpening retouch) were systematically selected as sickle elements, whereas the large Blades seem not to be privileged in the harvest activities.

This last point distinguishes the large Blades of Crno Vrilo from other Early Neolithic lever-pressured Blades of the central Mediterranean, in particular, the Blades of Franchthi (Peloponnese, Greece). At the Greek site, the large imported Blades made from exogenous cherts are used unretouched, in harvesting, just like the "ordinary" Blades. They were first and foremost sickle elements before being very intensively exploited, sharpened, and recycled (Guilbeau & Perlès, 2019; Perlès, 2004; Perlès & Vaughan, 1983).

6 Conclusion and Perspectives

The preliminary techno-functional analysis indicates that the majority of the large Blades from Crno Vrilo were obtained by pressure technique on different varieties of Gargano cherts and that Blades derived from different stages of chaîne opératoire were used for various tasks.

The use of a lever device in the production of (some) large Blades remains possible given both their morphology and claims about the existence of this technique in neighbouring areas (southern Italy, Greece) during the Early Neolithic.

If we consider that the large Blades from Crno Vrilo were produced by pressure-flaking with a lever then they undoubtedly represent a Neolithic innovation and as such should be regarded as an integral part of the Neolithic package transmitted from the East. However, during the Early (Middle) Neolithic, large Blades did not have the same status in the entire central Mediterranean. Therefore, far from being uniform, it is

15 Provided that the lever pressure with a lever did not exist at the time (it is also possible that this technique was simply not recognized on some large Blades).

16 "Large Blades" become longer, narrower, and thinner with time and their primary utilitarian function changes in favour of a symbolic sphere (Guilbeau, 2010).

advisable to consider the variability of the status of these productions according to context, cultural traditions, site function, origin of raw materials, modalities of diffusion, and so on.

Finally, given the small sample size, questions of production techniques, mode of acquisition of large Blades, and their status within Crno Vrilo Blade assemblage remain open and should be studied further, by combining both a techno-functional approach and more in-depth petroarcheological analysis.

Acknowledgments: We would like to thank the curator Natalija Čondić, the director of the Archaeological Museum of Zadar Jakov Vučić, and the sites excavator Brunislav Marijanović for giving us permission to study the Crno Vrilo material. Special thanks to Natalija who provided generous help and logistic support to our team and to TRACES laboratory for their assistance. We also wish to thank reviewers for their constructive comments and suggestions; and Open Archaeology's editors for their guidance and patience. Finally, thanks to Rory Connolly and Ryan Lash, Sonja's postdoc comrades for proofreading the article.

Conflict of interest: Authors state no conflict of interest.

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