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ORIGINAL PAPER

Neanderthal communities in the heart of the Iberian Peninsula: taphonomic and zooarchaeological study of the Mousterian site of Jarama VI (Guadalajara, Spain)

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Abstract
The Mousterian site of Jarama VI (Guadalajara, Spain) has three archaeological levels corresponding to the final Middle Palaeolithic. Taphonomic and zooarchaeological analyses have determined important changes in the functionality of the site in relation to the species consumed and the nutrients that were sought. The first occupations consisted of a long-term residential camp with consumption and meat and skin treatment actions at different seasons in a cold environment. Level 2 represents an occupation focused on the casual exploitation of plant resources with minimal hunting of animals in summer and autumn. Last, level 1 corresponds to a hunting site focused on the capture and processing of ungulates from the end of spring to summer. The study of bone material at this settlement suggests that Neanderthal communities in the centre of Iberia changed their subsistence strategies over time according to cultural rather than climatic patterns.

Keywords Taphonomy · Zooarchaeology · Neanderthal · Mousterian · Middle Palaeolithic · Subsistence strategies · Hunting

Introduction

Middle Palaeolithic sites in the interior of the Iberian Peninsula

Knowledge of the Middle Palaeolithic in the centre of the Iberian Peninsula has improved in recent years. In the northern plateau, in addition to Valdegoba (Díez 2006), a large number of studies has been carried out on the southern edge of the Cantabrian Cordillera (Prado Vargas, San Quirce, Guantes and Cueva Corazón) (Navazo et al. 2005; Díez Martín et al. 2011; Yravedra et al. 2013) and in the west and the centre of the Iberian System (La Ermita, Millán, Hundidero, Estatuas Gallery and Peña Miel, among others) (Díez et al. 2008; Roselló and Morales 2005-2006).

Recent archaeological excavations in the Central System, between the north and south plateau, in the caves and shelters of Pinilla del Valle (Descubierta or Navalmaillo), provided evidences of Neanderthal occupations (Huguet et al. 2010), in addition to the record at Abrigo del Molino and Cueva del Búho (Íñigo et al. 1998; Sala et al. 2012).

In the southern plateau, such classic sites as Peña Cabra o Tamajón have been complemented by recent surface finds in Guadalajara province (La Olmedilla, La Cañada, Brihuega,

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Los Casares and Porzuna) (Barandiarán 1973; Adán-Álvarez et al. 1995; Aldecoa et al. 1998; Alcaraz-Castaño et al. 2017). In Madrid, several sites are known in fluvial environments, such as Preresa, Arroyo Culebro, Cañaveral and Arriaga (Yravedra et al. 2012, 2014; Panera et al. 2014). In addition, there were intense Neanderthal occupations in Cueva del Ángel, which contrast with the meagre evidence in Extremadura, with the exception of Maltravieso or Santa Ana (Rodríguez-Hidalgo et al. 2010).

Homo neanderthalensis represents the human evidence in this period. Numerous remains were found in Valdegoba, several in Camino, Buena Pinta and Descubierta, while one remains from Los Casares has been lost (Díez et al. 1998; Arsuaga et al. 2012). These remains have now been complemented with the metatarsal from level 2 at Jarama VI (Lorenzo et al. 2012).

The site of Jarama VI

The site of Jarama VI (Guadalajara, Spain) is located in the Central System of the Iberian Peninsula (Fig. 1a, b). It formed in dolomites, dolomitic limestones and limestones (Santonian, Upper Cretaceous) which have been cut through by the Jarama river. The shelter is situated in the left bank, about 23 m above the current course of the river. It is 15 m long and 6 m wide (Fig. 1c). The site has been the subject of several excavations and projects since 1989, always under the direction of one of the authors (Jordá-Pardo 1993; Adán Álvarez et al. 1995; Jordá-Pardo 2007).

The stratigraphy from the bottom to the top is as follows (Jordá-Pardo 1993; Adán Álvarez et al. 1995; Jordá-Pardo 2007) (Fig. 1d):

> JVI.4: Bedrock basal unit. Sterile. Carbonated sands produced by alteration of the substrate.
> JVI.3: Calcareous rocks in a sand and silt matrix formed by autochthonous and sharp calcareous stones produced by gelifraction in the shelter roof, because of fluvial action outside the shelter. Rich in lithic artefacts and faunal remains.
> JVI.2: Sand and silt with parallel and cross lamination, produced by different flood episodes. Presence of lithic artefacts, faunal remains, charcoal and a hearth.
> JVI.1: Gelifraction stones with allochthonous sand and silt. Abundant cultural vestiges with scarce Palaeolithic material due to livestock activity.
> JVI.0: Dolomite breccia and stalagmitic crust with scarce remains in the western wall of the shelter.

Chronological information has varied due to advances in radiometric techniques. ^{14}C conventional dating for the JVI.2 level provided dates of 29,500 ± 2700 BP and 32,600 ± 1860 BP and 23,380 ± 500 BP for JVI.1 (Jordá Pardo 1993, 2001a, b, 2007, 2010). New ^{14}C AMS determinations dated JVI.1 to > 50,200 BP; JVI.2 to 49,400 ± 3700 BP and JVI.3 to > 47,000, using the ultrafiltration method in bones with unequivocally anthropic cut marks (Wood et al. 2013). IRSL dates propose an age of 56.3 ± 2.9 ka for sublevel JVI.2.3 and 53.9 ± 3.3 ka for sublevel JVI.2.1 (Kehl et al. 2013). All the new dates ascribed these levels to the time of Neanderthals.

Lithic artefacts are abundant. Nearly 2000 pieces were shaped in quartz, quartzite and flint (7%). The flint comes from allochthonous sources with depleted and reused parts. The richest level, in number and technical modes including Levallois debitage, is JVI.3 (233.6 pieces/m^2) followed by JVI.1 (80.8 pieces/m^2) and JVI.2 (31.5 pieces/m^2). Cores are very scarce and the tools are mostly scrapers, denticulates, points and above all, a quarter of the tools are unmodified pebbles (cobbles, hammers and manuports), which represent 52% in JVI.2. In the absence of functional studies, it has been hypothesized that these represent a raw material supply for future visits (Navazo and Jordá-Pardo in press).

Objective

The objective of this work is to understand the relationship between Neanderthal societies and the animal community, as well as to know the role of Jarama VI in the subsistence strategies of Middle Palaeolithic human groups in this environment.

Materials and methods

All the bone materials from the sequence at Jarama VI (JVI.1, JVI.2 and JVI.3) have been studied. Our analysis is based on general principles of taphonomy and zooarchaeology (i.e. Lyman 1994, 2008).

First, all the elements have been identified. This process has been carried out by determining the nature of the remains in the following stages: (a) anatomical element and (b) taxa (species, genus or size in function of the integrity and determining features).

Following classical authors (e.g. Bunn 1982), we differentiate between: (a) very small size (lagomorpha, small carnivores, e.g. *Vulpes vulpes*, and birds); (b) small size (members of the subfamily *Caprinae* and *Capreolus capreolus*, *Canis lupus*); (c) medium size (*Cervus elaphus*, *Panthera* sp.); (d) large (*Equus ferus*, *Bos primigenius*, *Ursus arctos*); and (e) very large (*Rhinocerotidae*).

In order to estimate the age at death, the height of the tooth has been measured in all cases when they were complete and had a good state of conservation, following standard osteometric techniques (Eisenmann et al. 1988; Van der Made 1996). The age of the equids was determined in relation to the occlusal wear, on upper and lower premolars and

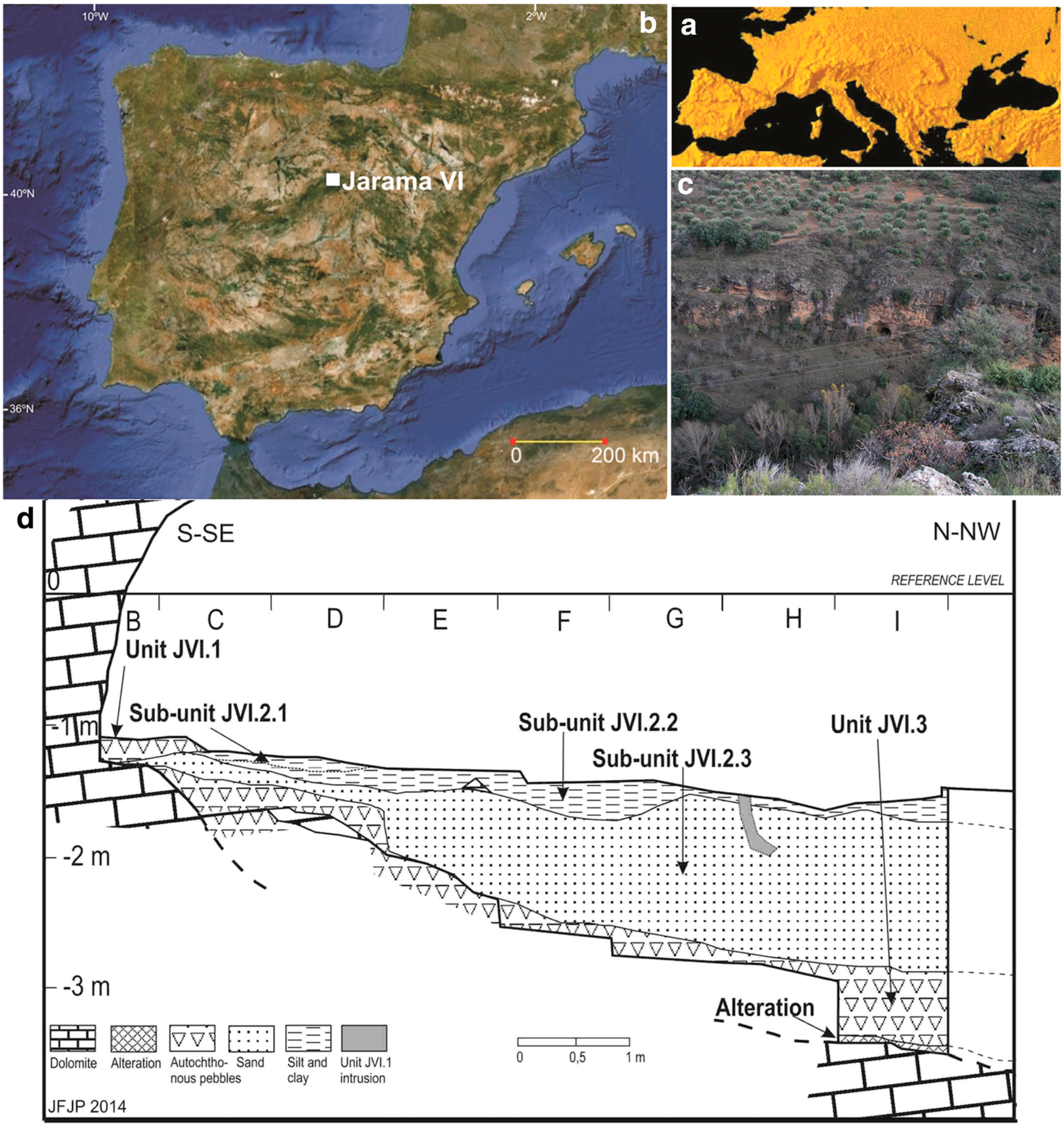

Fig. 1 Mediterranean Europe map (**a**); Jarama VI situation in Iberian Peninsula (**b**); rock shelter of Jarama VI in Jarama Valley (**c**); longitudinal stratigraphic cut (**d**)

molars, according to the tables of Levine (1979). The equations of Klein and Cruz-Uribe (1984) have been used in artiodactyls from the occlusal wear of the upper and lower molars. In these cases, in artiodactyls, the maximal age and the age of eruption of each tooth came from Klein and Cruz-Uribe (1984) for *Cervus elaphus*, Pérez-Barbería (1994) for *Rupicapra pyrenaica* and Vigal and Machordom (1985) for *Capra pyrenaica*. The height of the tooth without wear for each species came from Arceredillo (2016).

Additionally, the approximate age of the animal (foetus, infantile, juvenile adult, adult or senile) was noted whenever possible from the porosity of postcranial remains.

The seasonality was determined from the current dates of ungulates' birth (Hayssen et al. 1993; Pérez-Barbería 1994; Alados and Escos 2003) when metric data allowed it. In this regard, only those species in which the age of death is estimated in months (cervids and caprids) were considered. Equids have been considered to calculate seasonality in early ages.

The age at death of mammals is obtained from dental replacement data (e.g. Sisson and Grossman 2001), occlusal wear (i.e. Levine 1979) and the equations with crown height (Klein and Cruz-Uribe 1984). The season of death of each level was determined from the actual dates of birth (Pérez-Barbería 1994).

In addition, the counts were made with several units: NR (number of remains, total of bone fragments analyzed), NISP (number of identified specimens, including remains classified by species, genus and sizes) and MNI (minimal number of individuals) (Klein and Cruz-Uribe 1984; Lyman 1994).

Finally, a detailed examination was performed with a Nikon SMZ 1500 × 7.5-125 stereo microscope. The presence of the following phenomena was noted: (a) anthropic alterations (cut marks, percussion marks, burnt bones and technological applications of bones—essentially, retouchers); (b) biostratinomic alterations (or processes made by others animals: tooth marks—distinguishing between primary marks—pits, punctures and scores—and secondary marks—furrowing and scooping-out-rodent marks and digestive processes);(c) diagenetic processes (abrasion, rounded bones, trampling, microorganism actions, splitting apart, fissures, manganese impregnations, oxidation, dissolution and concretion (Fernández-Jalvo and Andrews 2016).

Cut marks were differentiated into incisions, scraping, sawing and chopping (Noe-Nygaard 1989). Likewise, butcheries activities on the animal carcass (Binford 1981) were deduced from the cut marks' position on anatomical elements and their characteristics (flesh removing, disassembling, filleting, periosteum elimination, evisceration or skinning). For the primary marks, the bone surface displaying the damage was noted (cortical or spongy surface, epiphysis or diaphysis) and its morphological and metrical characteristics (Maguire et al. 1980; Binford 1981; Brain 1981; Fernández-Jalvo and Andrews 2011; Saladié et al. 2013, Romero et al. 2016). The purpose of this analysis is to differentiate which agents were contributing and/or intervening on the remains.

At the same time, it was noted whether the remains were complete or incomplete. The classification of Villa and Mahieu (1991) was used to classify fractures according to three criteria: delineation (curved or transverse), angle (oblique, right or mixed) and texture (smooth or jagged).

Results

The study of the bone remains from Jarama VI includes a total of 3582 NR (2281 NISP, 47 MNI). The number of skeletal vestiges varies in the same way as the quantity of stone artefacts within the different layers (first, the most fertile level is JVI.3: 233.6 bone remains/m^2; the second is JVI.1: 165.7 bone remains/m^2; and the third is JVI.2: 20.2 bone remains/m^2) (Table 1). Thus, the scarcity of faunal remains in JVI.2 is very conspicuous.

In general terms, all the items are very fragmented. There are only two complete bones among the scarce remains from JVI.2 (0.92%). Besides, these bones belong to two species with a minor frequency in the sequence (*Sus scrofa* and *Castor* sp.).

Although the more numerous taxa tend to maintain their presence throughout the sequence, some particularities are found. In JVI.1, *Equus ferus* stands out (in both NISP and MNI). JVI.2 has very few remains, although the presence of *Castor* sp. is remarkable for its peculiar environmental conditions, since it is always associated with flowing water. *Cervus elaphus* stands out in JVI.3 (in both NISP and MNI). *Capra pyrenaica*, *Rupicapra pyrenaica* and *Bos primigenius* are documented throughout the sequence.

Carnivore representation is generally rare. There are several remains of *Ursus arctos* and *Canis lupus* in JVI.1; whereas *Vulpes vulpes* and *Panthera* sp. are present in JVI.2, and an unidentified carnivore has been observed in both levels. However, carnivores are totally absent in JVI.3.

Differences are seen in the anatomical distribution in the three levels (Table 2). A significant number of isolated teeth have been found in JVI.1, as well as a larger number of rib fragments than in the other levels. In JVI.2, remains are generally scarcer compared with JVI.1 and JVI.3, and a high percentage of flat bones, tibias and metapods have been identified. In this level, the percentages of the different types of remains are more balanced than in the other horizons. Finally, long bone fragments are very abundant in JVI.3.

Almost all identified animals are adults, although there is an immature deer in levels 2 and 3, and most bone remains come from mature animals. As a general rule, *Artiodactyla* and *Equidae* were hunted after they reached sexual maturity and never in senile phases. The exact time of death has been determined for some specimens. All quantitative data appear in Table 3. It shows the results of the seasonality study in months, all the teeth used in the study as well as the height and the results of age at death analysis.

JVI.3 animals were slaughtered at many times in the year, whereas in JVI.1, ungulates died around the end of spring and summer coinciding with births and the lactation period. In JVI.2, the times of death were restricted to summer-autumn, when the lactation is finished and come the rut period.

Numerous taphonomic alterations are of anthropogenic origin (Table 4, Fig. 2). Abundant cut marks have been identified in all levels (Fig. 2e). In JVI.2 and JVI.3, the frequency exceeds 20% of the total number of remains, while in JVI.1, it exceeds 10% of the total remains. On the other hand, percussion marks are especially present in JVI.1 and JVI.3 (Fig. 2d). The presence of burned bones is more common in JVI.3, although hearths were only documented in JVI.2 (Fig. 2b, c). The technological use of bones as retouchers during knapping can be appreciated throughout the sequence.

Some differences are evident on cut marks affection among the different taxa and sizes (Table 5). Thus, in level 1, cut marks are concentrated on the majority species, *Equus ferus*, as well as on medium and large-sized animals. In contrast, in level 2, these alterations are concentrated on small animals, despite deer and horse predominating in this level. Finally, in level 3, cut marks are seen primarily on *Cervus elaphus* and on medium-sized animals, rather than on such other well-represented taxa as ibex, horses or chamois.

Table 1 Species present in Jarama VI

	JVI.1				JVI.2				JVI.3				Total			
	NR	%NR	MNI	%MNI	NR	%NR	MNI	%MNI	NR	%NR	MNI	%MNI	Total (NR)	Total (%NR)	Total (MNI)	Total (%MNI)
Ursus arctos	2	0.13	1	5.26	0	0.00	0	0.00	0	0.00	0	0.00	2	0.06	1	2.13
Canis lupus	3	0.20	1	5.26	0	0.00	0	0.00	0	0.00	0	0.00	3	0.08	1	2.13
Vulpes vulpes	0	0.00	0	0.00	1	0.45	1	7.69	0	0.00	0	0.00	1	0.03	1	2.13
Panthera sp.	0	0.00	0	0.00	1	0.45	1	7.69	0	0.00	0	0.00	1	0.03	1	2.13
Carnivora indet.	1	0.07	1	5.26	1	0.45	1	7.69	0	0.00	0	0.00	2	0.06	2	4.26
Rhinocerotidae indet.	1	0.07	1	5.26	0	0.00	0	0.00	1	0.05	1	6.67	2	0.06	2	4.26
Equus ferus	88	5.90	4	21.05	11	4.95	2	15.38	35	1.87	2	13.33	132	3.69	8	17.02
Bos primigenius	5	0.34	1	5.26	5	2.25	1	7.69	20	1.07	3	20.00	30	0.84	5	10.64
Cervus elaphus	36	2.41	2	10.53	10	4.50	1	7.69	147	7.87	4	26.67	191	5.34	7	14.89
Capreolus capreolus	0	0.00	0	0.00	0	0.00	0	0.00	6	0.32	1	6.67	6	0.17	1	2.13
Capra pyrenaica	32	2.15	3	15.79	7	3.15	1	7.69	20	1.07	1	6.67	59	1.65	5	10.64
Rupicapra pyrenaica	14	0.94	3	15.79	5	2.25	1	7.69	11	0.59	3	20.00	30	0.84	7	14.89
Sus scrofa	0	0.00	0	0.00	1	0.45	1	7.69	0	0.00	0	0.00	1	0.03	1	2.13
Castor sp.	0	0.00	0	0.00	1	0.45	1	7.69	0	0.00	0	0.00	1	0.03	1	2.13
Oryctolagus sp.	2	0.13	1	5.26	1	0.45	1	7.69	0	0.00	0	0.00	3	0.08	2	4.26
Lepus sp.	0	0.00	0	0.00	1	0.45	1	7.69	0	0.00	0	0.00	1	0.03	1	2.13
Birds	6	0.40	1	5.26	0	0.00	0	0.00	0	0.00	0	0.00	6	0.17	1	2.13
Very small size	3	0.20			0	0.00			2	0.11			5	0.14		
Small size	151	10.13			67	30.18			213	11.40			431	12.05		
Medium size	569	38.16			0	0.00			441	23.60			1010	28.23		
Big size	220	14.76			54	24.32			84	4.49			358	10.01		
Very big size	0	0.00			0	0.00			2	0.11			2	0.06		
Indet.	358	24.01			56	25.23			887	47.46			1284	35.89		
Total	1491	100.00	19	100.00	222	100.00	13	100.00	1869	100.00	15	100.00	3578	100.00	47	100.00

Table 2 Bone remains (NR) by anatomical parts

	JVI.1	%JVI.1	JVI.2	%JVI.2	JVI.3	%JVI.3
Antler/horn	6	0.59	1	0.50	1	0.06
Cranium	8	0.79	4	1.99	6	0.38
Maxilla	7	0.69	0	0.00	5	0.32
Jaw	1	0.10	7	3.48	7	0.44
Hyoid	0	0.00	0	0.00	1	0.06
Tooth	134	13.27	15	7.46	125	7.92
Rib	86	8.51	12	5.97	22	1.39
Vertebra	28	2.77	9	4.48	13	0.82
Scapula	5	0.50	2	1.00	5	0.32
Humerus	30	2.97	9	4.48	29	1.84
Radio	6	0.59	12	5.97	11	0.70
Ulna	6	0.59	2	1.00	0	0.00
Carpo	0	0.00	0	0.00	0	0.00
Metacarpo	10	0.99	8	3.98	19	1.20
Pelvis	4	0.40	5	2.49	0	0.00
Femur	6	0.59	1	0.50	19	1.20
Tibia	19	1.88	13	6.47	21	1.33
Fibula	0	0.00	1	0.50	0	0.00
Calcaneus	1	0.10	1	0.50	1	0.06
Astragalus	1	0.10	0	0.00	3	0.19
Tarsus	1	0.10	0	0.00	2	0.13
Metatarsus	7	0.69	4	1.99	19	1.20
Metapodium	26	2.57	10	4.98	14	0.89
Sesamoid	5	0.50	2	1.00	1	0.06
Phalange	11	1.09	2	1.00	8	0.51
Spongy bone	12	1.19	0	0.00	12	0.76
Long bone	570	56.44	73	36.32	1228	77.77
Flat bone	20	1.98	8	3.98	7	0.44
Total	1010	100.00	201	100.00	1579	100.00

Cut marks are usually located on long bones and other meat-rich elements such as ribs and pelvis (Table 6), a phenomenon which appears to be accentuated on level 2. Levels 1 and 3 exhibit a more even representation of anatomical zones. Level 3 is also distinguished by more cut marks on bones with little flesh, such as phalanges or tarsals.

According to the actions detected in the record, as well as their position and orientation on the anatomy of prey (Binford 1981; Noe-Nygaard 1989), it is possible to interpret the butchery tasks performed during the processing of animal carcasses (Table 7). There are often several actions on the same bone. Defleshing marks are predominant in the three levels. However, other activities indicate significant differences between levels. Disarticulation activities are relevant among the scarce bones in level 2. In contrast, filleting (Binford 1981) is frequent in level 3 and, to a lesser extent, in level 1. Evisceration of animals is particularly present in level 1 and somewhat less so in level 2. Finally, in level 3, more skinning activities were observed, as well as some minor actions, such as extraction of tendons and bone marrow or cleaning off the periosteum by scraping.

In addition, some biostratinomic modifications result from the activity of other animals on the bone ensemble (Table 4). Thus, the presence of carnivore marks is very uneven among the different levels in the rock shelter, although in general terms, they are very limited (Fig. 3a, b). Carnivore alterations are seen on barely 1% of the remains in level 3. However, the impact of carnivore marks is greater on the scarce bones in level 2 and moderate in level 1. It is also of great interest to note that some carnivore marks overlap cut marks (Fig. 3a). Gnawed or digested bones are almost absent in the whole sequence (they never exceed 0.5%). The majority of the carnivore marks are primary marks (pits and scores), and secondary marks (like furrowing or scooping-out) are not relevant.

Some diagenetic modifications have also been recorded (Fig. 4). There are no significant differences in the frequency of diagenetic alterations between taxa at any level. In level 1, the most habitual modifications are splitting (Fig. 4f), fissured bones (Fig. 4c) and manganese impregnations (Fig. 4e, f). In level 2, the most common alterations are fissured bones, concretions (Fig. 4a), manganese impregnations and oxidation. These modifications are habitual in humid environments (Hill 1982). Lastly, level 3 is characterized by a high frequency of manganese impregnations (over 24% of the remains), splitting and fissured bones, dissolution and some corrosion.

In general terms, alterations due to weathering (Fig. 4b) are infrequent or absent in the sequence. A small number of bones display weathering in level 2. Root alterations are also scarce in levels 1 and 2, but very common in level 3 (Fig. 4d). Finally, rolled bones only surpass 1% in level 3.

Following Villa and Mahieu's (1991) descriptive methodology, there are high levels of fresh fractures in the sequence at Jarama VI, including numerous curved outlines, oblique angles and smooth surfaces (Table 8). There are no significant differences between different taxa or anatomical elements. With the exception of level 1, which displays slightly more significant dry fractures than the other layers, the whole sequence seems to follow a notable fresh fracture dynamic, indicative of intense anthropic activity.

Discussion

The results obtained in this study contribute relevant details to knowledge of the Neanderthal communities that occupied Jarama VI at different times and, therefore, also of Middle Palaeolithic occupations in the central Iberian Peninsula in general. Humans were the principal agents of the input and exploitation of ungulate carcasses. Other predators only occasionally scavenged the waste left by the Neanderthals.

Table 3 Age of death and seasonality of herbivores (Artiodactyla and Equidae) present in Jarama VI

Level	Species	Piece	Upper/lower	Right/left	Height	Age (months)	Month	Season
JVI.1	*Capra pyrenaica*	m1	Lower	Left	15.1	75	August	Summer
JVI.1	*Capra pyrenaica*	m2	Lower	Right	23.7	49	June	Summer
JVI.1	*Capra pyrenaica*	m2	Upper	Left		13	June	Summer
JVI.1	*Capra pyrenaica*	m2	Upper	Right		13	June	Summer
JVI.1	*Rupicapra pyrenaica*	m1	Upper	Left	15.45	25	June	Summer
JVI.1	*Rupicapra pyrenaica*	m2	Lower	Right	15.4	46	March	Spring
JVI.1	*Rupicapra pyrenaica*	m2	Upper	Right		12	May	Spring
JVI.1	*Rupicapra pyrenaica*	m2	Upper	Left	15.2	48	May	Spring
JVI.1	*Rupicapra pyrenaica*	m3	Lower	Right	18.4	40	September	Autumn
JVI.1	*Rupicapra pyrenaica*	Phalanges				Foetus		Spring
JVI.1	*Equus ferus*	d2	Upper			Young	Without wear	Summer
JVI.1	*Equus ferus*	d3–4	Lower			Young	Light wear	Summer
JVI.2	*Capra pyrenaica*	m2	Upper	Left	19.8	64	September	Autumn
JVI.2	*Cervus elaphus*	d4	Lower	Right	10	4	September	Autumn
JVI.2	*Rupicapra pyrenaica*	Coxal, long bone				Foetus		Winter
JVI.2	*Rupicapra pyrenaica*	i1	Lower				July	Summer
JVI.3	*Capra pyrenaica*	m1	Lower	Left	28	13	June	Spring/summer
JVI.3	*Capreolus capreolus*	d4	Lower	Left	61.5	< 12		
JVI.3	*Cervus elaphus*	d4	Upper	Right	7.4	6	November	Autumn
JVI.3	*Cervus elaphus*	m1	Lower	Left	11.8	43	December	Winter
JVI.3	*Cervus elaphus*	m1	Lower	Right	7.7	81	February	Winter
JVI.3	*Cervus elaphus*	d3	Lower	Left		Young		Spring
JVI.3	*Rupicapra pyrenaica*	m3	Lower	Left	23.12	24	May	Spring
Level	SpecieS	Piece	Upper/lower	Right/left	Height	Age (years)		
JVI.1	*Equus ferus*	m1–2	Upper	Right	51.77	7–9		
JVI.3	*Equus ferus*	p2	Lower	Right	17.7	12–13		
JVI.3	*Equus ferus*	p2	Lower	Left	32.3	8–9		
JVI.3	*Equus ferus*	p3–4	Lower	Left	72.83	5–7		

JVI.3

Seasonality data for level 3 indicates the frequentation of the shelter by Neanderthal communities during different times of the year. Together with the total absence of carnivores and the high anthropization of the assemblage, this suggests the site was a long stay residential camp for the Middle Palaeolithic societies. The favourite prey of the Neanderthals was *Cervus elaphus*. Its advantages include its large weight (which in current Iberian populations reaches 160 k in the case of males and about 100 k for females) (Carranza 2004) and the maintenance of stable populations in fixed places throughout the year. Human groups captured deer in their surroundings, eviscerating and skinning them in the place where they killed them or near the prey sites, and transporting the long bones (the richest parts of meat) to the site. The animals were defleshed and intensively consumed on the site, judging by the large amount of defleshing marks, scraping, burning, percussion marks and fresh fractures present.

The abundance of filleting marks on long bones of these prey allows the interpretation of the possible extraction of strip steaks, perhaps for subsequent conservation (sun-dried or smoked), given the rigorous environment in the central Iberian Peninsula. This hypothesis has previously been

Table 4 Anthropic and biostratinomic alterations (NR) in faunal remains of Jarama VI

	JVI.1	%JVI.1	JVI.2	%JVI.2	JVI.3	%JVI.3
Cut marks	154	10.33	52	23.42	384	20.55
Percussion marks	71	4.76	6	2.70	77	4.12
Retouchers	6	0.40	2	0.90	10	0.54
Burnt bones	23	1.54	10	4.50	104	5.56
Carnivore marks	76	5.10	32	14.41	18	0.96
Rodent marks	1	0.07	1	0.45	1	0.05
Digested bones	6	0.40	1	0.45	0	0.00

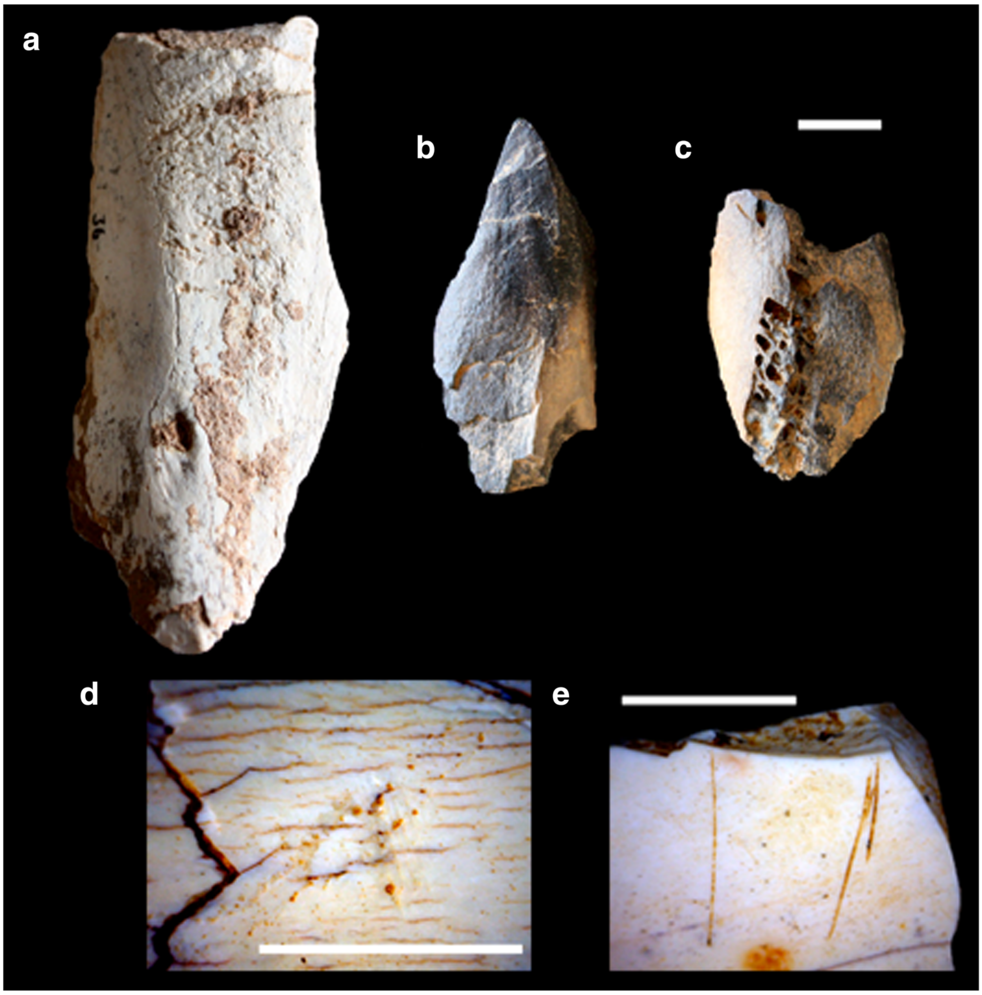

Fig. 2 Anthropic modifications in Jarama VI: retoucher on humerus (**a**); burnt bones (**b**, **c**); detail of percussion mark (**d**); cut marks on green broken bone (**e**). Scale = 10 mm

proposed for the Arlanza Valley (Díez et al. 2008). It seems plausible that Neanderthal communities processed part of the meat after hunting medium- and large-sized animals. After transporting the richest parts of meat to the site, Neanderthals extracted part of the abundant meat from the long bones into strip steaks. This would make it possible to defer the consumption of the meat and provide supplies for mobile Neanderthal groups. In addition, the relative frequency of skinning marks in this level compared with the others indicates that the extraction and treatment of skins

Table 5 Anthropic incisions according to taxa or size and levels (NISP)

	JVI.1		JVI.2		JVI.3	
	Cut marks	(%)	Cut marks	(%)	Cut marks	(%)
Bos primigenius	0	0.00	1	2.33	4	1.56
Capreolus capreolus	0	0.00	0	0.00	1	0.39
Cervus elaphus	2	1.40	1	2.33	49	19.14
Equus ferus	13	9.09	2	4.65	8	3.13
Capra pyrenaica	1	0.70	0	0.00	1	0.39
Rupicapra pyrenaica	1	0.70	0	0.00	0	0.00
Caprinae	0	0.00	0	0.00	1	0.39
Small size	23	16.08	24	55.81	22	8.59
Medium size	74	51.75	0	0.00	147	57.42
Big size	29	20.28	15	34.88	23	8.98
Total NISP with cut marks	143	100.00	43	100.00	256	100.00

Table 6 Anthropic incisions according to anatomic element (NR)

	JVI.1.		JVI.2		JVI.3.	
	Cut marks	(%)	Cut marks	(%)	Cut marks	(%)
Antler/horn	1	0.65	0	0.00	0	0.00
Jaw	1	0.65	1	1.92	3	0.78
Rib	14	9.09	5	9.62	16	4.17
Vertebra	2	1.30	1	1.92	5	1.30
Scapula	2	1.30	0	0.00	2	0.52
Humerus	7	4.55	2	3.85	19	4.95
Radio	1	0.65	3	5.77	6	1.56
Ulna	0	0.00	2	3.85	1	0.26
Metacarpo	0	0.00	2	3.85	8	2.08
Pelvis	1	0.65	0	0.00	0	0.00
Femur	3	1.95	0	0.00	15	3.91
Tibia	5	3.25	2	3.85	11	2.86
Astragalus	0	0.00	0	0.00	1	0.26
Metatarso	1	0.65	1	1.92	4	1.04
Metapodium	4	2.60	3	5.77	2	0.52
Sesamoid	0	0.00	1	1.92	0	0.00
Phalange	1	0.65	0	0.00	2	0.52
Long bone	82	53.25	26	50.00	274	71.35
Flat bone	4	2.60	1	1.92	4	1.04
Indet.	25	16.23	2	3.85	11	2.86
Total	154	100.00	52	100.00	384	100.00

and hides was also carried out in the rock shelter. These evidences demonstrate that level 3 represents the most intense occupational phase.

Finally, the notable presence of root marks on the bone surfaces is indicative of plant cover on the floor of the rock shelter. Similarly, the diagenetic alterations recorded here, such as the impregnations of manganese, oxides and concretions, are characteristic of rapid sedimentation that was not skewed, with high humidity conditions, occurring within the karst environment of the rock shelter itself and with few post-depositional alterations.

JVI.2

In contrast, the first notable characteristic of level 2 (a thick bed formed by several stages of inundation) is the scarcity of fauna remains in comparison with the other sedimentary horizons. We have no reasons to link this with precarious differential conservation, since there is no abundance of isolated teeth. The number of artefacts is similarly lower than in the other levels. Seasonality here seems to be constrained to between summer and autumn. All this suggests that, in this level, hunting herbivores was not the main

Table 7 Butchery activities according to levels (NR)

Butchery activity	JVI.1	(%)	JVI.2	(%)	JVI.3	(%)
Disassembling	1	0.57	14	26.92	17	3.61
Flesh removing	110	63.22	30	57.69	278	59.02
Filleting	20	11.49	1	1.92	62	13.16
Periosteum removing	33	18.97	5	9.62	91	19.32
Evisceration	9	5.17	2	3.85	9	1.91
Skinning	1	0.57	0	0.00	8	1.70
Tendon removing	0	0.00	0	0.00	5	1.06
Narrow removing	0	0.00	0	0.00	1	0.21
Total bones with cut marks	174	100.00	52	100.00	471	100.00

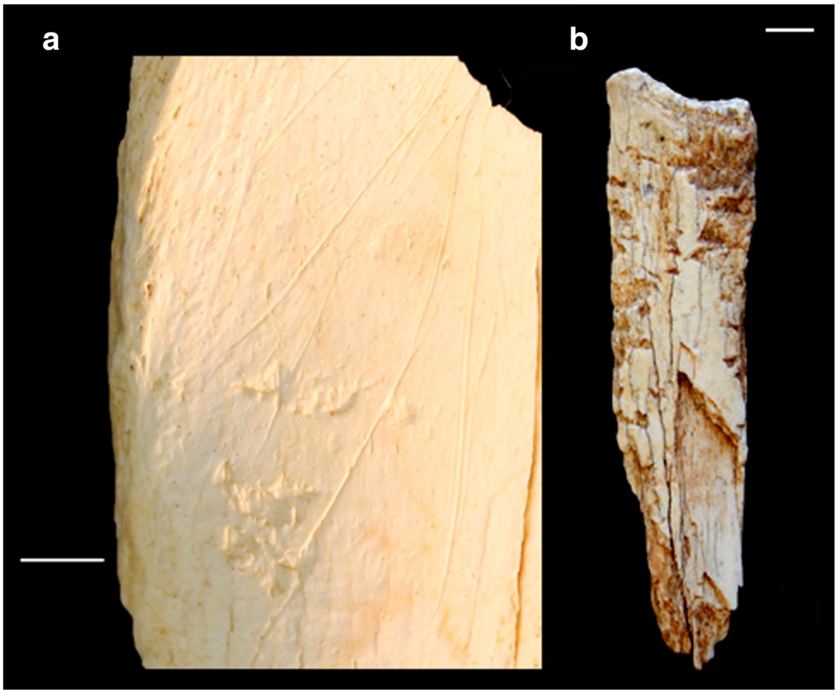

Fig. 3 Carnivore action in Jarama VI: pits and scores over filleting marks (**a**); bone splinter with pitting and scoring. Scale = 5 mm

reason for the visits of Neanderthal groups. In fact, the largest number of immature postcranial bones is found in this level. This indicates that hunting was not as selective as in the other phases. Hunting was a minor activity mostly focused on small ungulates in the environment. Neanderthals contributed partial carcasses to the site that did not follow a concrete pattern. Probably, the scarce animal portions were provided already disarticulated from other kill site.

Therefore, the abundance of manuports (Navazo and Jordá-Pardo in press) here does not seem to be linked, at least exclusively, to the percussion of bones for nutritional purposes. The existence of allochthonous pebbles, added to the presence of *Castor* sp., means that this fluvial environment could offer Neanderthal communities attractive plant resources, in a situation similar to the open-air camp of San Quirce (Terradillos-Bernal et al. 2017) or in the cave of La Ermita (Díez et al. 2008). Therefore, this expeditive industry

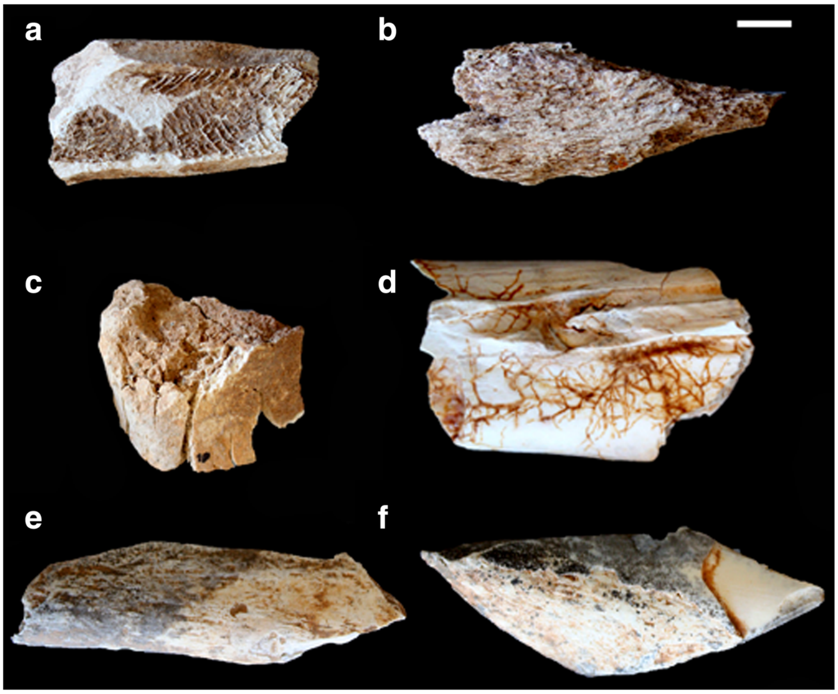

Fig. 4 Diagenetic alterations in Jarama VI: concretion (**a**); weathering (**b**); cracks (**c**); root effects (**d**); manganese impregnations (**e**, **f**) and splitting apart (**f**). Scale = 10 mm

Table 8 Fracture plane percentages according to outline (curved or transversal), angle (oblique, mixed or right) and texture (smooth of jagged) (Villa and Mahieu 1991) in different levels of the site

		%JVI.1	%JVI.2	%JVI.3
Outline	C	91	93	93
	T	9	7	7
Angle	O	67	76	78
	M	18	17	14
	R	15	7	8
Texture	S	81	82	88
	I	19	18	12
Total		100	100	100

(Kehl et al. 2013) could be linked, as in these sites, to the processing of plants that grew by the side of the river. Thus, Middle Palaeolithic people may have frequented this site motivated by lithic reduction activities and exploitation of plant resources perhaps linked to aquatic environments, while at the same time accumulating carcasses and disarticulating their long bones for consumption in occasional visits. The minimal presence of *Sus scrofa* and *Castor* sp. may to be due to the natural death of the animals in the vicinity, as the remains display no alterations caused by predators. However, predators like *Panthera* sp. and *Vulpes vulpes* frequented the area, scavenging the scarce wastes left by Neanderthals and, perhaps, accumulating a few animal remains, bearing in mind that this is the level with the largest number of tooth marks on bones. Even the Neanderthal metapod is tooth-marked (Lorenzo et al. 2012; Camarós et al. 2017), which seems to evidence a more relevant role of predators in taphocoenosis, although not as intensely as in other European cases (Germonpré et al. 2012; Daujeard et al. 2016).

The presence of weathering on some osseous remains shows that sedimentation was less rapid than in the other levels. This resulted in increased bone exposure, within a humid environment with no large temperature contrasts.

JVI.1

Lastly, the human communities responsible for level 1 occupied the site between the end of spring and summer. The main motivation for these visits was the hunting, processing and consumption of *Equus ferus* in particular. Although of nomadic behaviour, the gregarious character of the horse, together with its large weight, made it a prey with numerous advantages for those communities. As a consequence of their heat (between May and July) (Boyd 1988), around the end of spring and summer, wild horses have a marked gregarious behaviour. In this time, herds would be formed by females close to bear, apart from small groups of males or lone males that fight among themselves to mate with females (Pacheco and Herrera 1997). Neanderthals would know the movements of these herds, probably along the Jarama Valley, and would employ communal hunting strategies with the use of spears and javelins (White et al. 2016). The capture of the equids would occur in the vicinity of the site, since the primary processing of the horses was carried out in the rock shelter, judging by the significant percentage of anatomical elements linked to the trunk such as ribs and the existence of evisceration marks. Again, very intensive consumption of animal carcasses can be appreciated, judging by the large number of percussion marks and fresh fractures on bones. The site of Jarama VI would therefore be a strategic place for the hunting of horses. A similar situation can be observed for the same period in Valdegoba (Díez 2006), Cueva Corazón (Yravedra et al. 2013) and Cueva de Gabasa 1 (Blasco 1995), as well as other European sites (White et al. 2016). In this case, the close correlation between the environment and Neanderthals (Castaños 2005) is not valid.

The burial took place quickly in the karst, with abrupt changes in temperature during the diagenetic phase, according to the high frequency of manganese impregnations, splitting and fissures in bones.

Conclusions

New remains from Jarama VI help to improve our knowledge of subsistence strategies and the exploitation of the territory by Neanderthals in the centre of the Iberian Peninsula.

Thus, the analysis of the site is able to infer a continuous presence of Neanderthals as well as drastic variability in occupation modes and rhythms throughout the sequence. Middle Palaeolithic societies knew how to diversify their activities according to the moment and applied different strategies to exploit the same territory. A long-term occupation is registered in JVI.3, with processing and consumption, including evidence of skinning and filleting activities, of ungulates, mostly adult deer, at different periods in the year. These activities indicate medium-term planning, with Jarama VI as the centre of the territorial exploitation. Carnivores and humans are present in level 2 (JVI.2). Hunting was a minor activity for Neanderthals here. They only hunted occasionally some ungulates in the environment. However, Neanderthal occupations focused on the processing of plant and lithic resources mainly in summer and autumn. Other uses are inferred for level 1. The shelter was used as a hunting camp, mainly of adult horses, around the end of spring or in summer.

It is noteworthy that two levels formed under cold conditions, the upper and lower levels, reflect different functions, revealing different human responses.

In sum, the study of this site allows us to question two fundamental socioeconomic aspects of Neanderthal communities. First, these societies did not necessarily depend totally on their animal environment, but developed their own preferences in relation to the resources and their availability. Beyond opportunistic hunting and their relation with the environment, the inhabitants of Jarama VI selected their prey according their interests. Secondly, Neanderthal groups modified their systems of resource procurement over time according to certain cultural or socioeconomic patterns. Thus, the Neanderthal groups carried out diverse activities at Jarama VI and integrated it within their circuits of land use in variable ways at different times in the excavated sequence.

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