Archaeozoological analyses of large mammals from the prehistoric cave site of Lazaret, France: A case study of Archaeostratigraphic Unit 28

Conference Paper · March 2018

CITATION
1

READS
433

3 authors:

Sharada cv
Indian Institute of Technology Gandhinagar
16 PUBLICATIONS **28** CITATIONS
SEE PROFILE

Patricia Valensi
Muséum National d'Histoire Naturelle
90 PUBLICATIONS **1,145** CITATIONS
SEE PROFILE

Ursula Thun Hohenstein
University of Ferrara
97 PUBLICATIONS **783** CITATIONS
SEE PROFILE

Actas de las IX Jornadas de Jóvenes en Investigación Arqueológica

Santander 8-11 junio 2016

Edita:

Lucía Agudo Pérez
Carlos Duarte
Asier García Escárzaga
Jeanne Marie Geiling
Antonio Higuero Pliego
Sara Núñez de la Fuente
Fco. Javier Rodríguez Santos
Roberto Suárez Revilla

Actas de las IX Jornadas de Jóvenes en Investigación Arqueológica

Santander 8-11 junio 2016

Editores

Lucía Agudo Pérez
Carlos Duarte
Asier García Escárzaga
Jeanne Marie Geiling
Antonio Higuero Pliego
Sara Núñez de la Fuente
Fco. Javier Rodríguez Santos
Roberto Suárez Revilla

Comité Organizador del congreso:

Lucía Agudo Pérez
Carlos Duarte
Asier García Escárzaga
Antonio Higuero Pliego
Jeanne Marie Geiling
Sara Nuñez de la Fuente
Fco. Javier Rodríguez Santos
Roberto Suárez Revilla

Instituto Internacional de Investigaciones Prehistóricas de Cantabria, IIIPC
(Gobierno de Cantabria, Universidad de Cantabria y Santander)

Portada: © Andrea Sanz, Elena Miraflores, Pascual Mercé y Pilar Pujol

Fotografía ganadora del Concurso de fotografía arqueológica de la IX JIA que muestra el momento del hallazgo de una pintura mural de finales del s. XV desconocida hasta la fecha y que estaba oculta bajo una capa de pintura azul. Está ubicada frente a la entrada principal, en el interior de la ermita de San Antonio Abad en Villahermosa del río, provincia de Castellón. El descubrimiento se produjo durante los procesos de restauración y conservación del panel mural llevados a cabo por Servicio de Restauración de la Diputación de Castellón.

Maquetación: Roberto S. Revilla

Primera edición: febrero 2018

ISBN: 978-84-697-9482-1

ARCHAEOZOOLOGICAL ANALYSES OF LARGE MAMMALS FROM THE PREHISTORIC CAVE SITE OF LAZARET, FRANCE: A CASE STUDY OF ARCHAEOSTRATIGRAPHIC UNIT 28

Sharada Channarayapatna[1], Patricia Valensi[2], Ursula Thun Hohenstein[1]

[1] Department of Humanities, Section of Prehistoric and Anthropological Sciences, Palazzo Turchi di Bagno, Corso Ercole I d'Este 32, University of Ferrara, Ferrara 44121, Italy. chnsrd@unife.it, u.thun@unife.it
[2] UMR 7194 CNRS, Département préhistoire MNHN, Musée de Préhistoire, 171 Montée du Château, Tourrette-Levens 06690, France. pvalensi06@gmail.com

Resumen

La Cueva de Lazaret en Niza (Francia) constituye un yacimiento clave, excavado sistemáticamente, del Sur de Europa para investigar la transición de la cultura Achelense a la Musteriense. Es una localidad de referencia para las reconstrucciones paleoambientales y bioestratigráficas y para el conocimiento de la evolución de la cultura, el comportamiento y el modo de vida los preneandertales, los últimos habitantes de finales del Pleistoceno Medio. En este trabajo se presentan los resultados relaticos al estudio arqueozoológico de grandes mamíferos recuperados de la Unidad Arqueoestratigráfica 28 del depósito de la cueva, cronológicamente correspondiente a finales del Pleistoceno Medio (Estadio Isotópico Marino 6). Esta unidad ha reportado también un conjunto abundante de industria lítica asociada a claras evidencias de presencia humana en la cueva, teniendo en cuenta la recuperación de cuatro restos de preneandertales. La asociación faunística comprende 8 especies de ungulados y 7 especies de carnívoros. *Cervus elaphus*, *Capra ibex* y *Bos primigenius/Bison priscus* son las especies dominantes, mientras que el resto de especie se encuentra mínimamente representadas. El estudio tafonómico evidencia que los humanos fueron el agento primario de acumulación, ejerciendo tanto caza selectiva como no-selectiva, transportando y explotando/procesando las carcasas de determinadas especies por razones nutritivas. La naturaleza intrusiva de los carnívoros, representados por escasos restos, es confirmada por su presencia en medio de dos niveles de ocupación, como demuestran las modificaciones características realizadas por estos en los elementos. Un estudio de la dentición de los ungulados muestra que la cueva fue provisionalmente ocupada o usada de forma temporal de otoño a finales de invierno. Desde un punto de vista paleoecológico, las especies representan una mezcla de diversos paisajes de montaña, bosque y prado abierto y un clima con una tendencia más fría que en la actualidad.

Palabras clave: Cueva de Lazaret. Unidad Arqueoestratigráfica 28. Grandes mamíferos. Arqueozoología. Tafonomía.

Abstract

The Lazaret Cave in Nice, France, is a systematically excavated key site in Southern Europe for carrying out investigations on the transition between the Acheulean and Mousterian cultures. It is a reference site for the reconstruction of paleoenvironments, bio-stratigraphy and for understanding cultural evolution, behaviour and lifestyle of preneanderthals, the last contemporaries of late Middle Pleistocene. In this paper, we aim to present the results concerning the archaeozoological studies conducted on the large mammal remains recovered from the Archaeostratigraphic Unit 28 of the cave's deposit, which is dated to the Upper Middle Pleistocene (Marine Isotopic Stage 6). This unit has also yielded a rich lithic industry associated with the definite evidence of human presence in the cave in the form of four preneanderthal remains. The faunal spectra comprise 8 species of ungulates and 7 species of carnivores. *Cervus elaphus*, *Capra ibex* and *Bos primigenius* dominate the assemblage while the other taxa are represented minimally. Taphonomic studies reveal that humans were the primary agents of accumulation resulting from hunting activities, transporting and exploiting/processing of carcasses of certain species for nutritive purposes. The intrusive nature of carnivores, with scarce remains, is ascertained by their presence between two human occupation levels as shown by characteristic modifications made by them on bones. A study of ungulate dentition show that the cave was tentatively occupied or used temporarily from autumn to the end of winter. In terms of palaeoecology, the faunal species represent a mixture of varying landscapes with mountain, forest and open grassland habitats and an environment tending towards climate cooler than the present.

Keywords: Lazaret cave. Stratigraphic Unit 28. Large mammals. Archaeozoology. Taphonomy.

1. Introduction

Strategically located on the French Mediterranean coast, the Palaeolithic cave of Lazaret in Nice (Fig. 1a; 43° 41' 25" N, 7° 17' 42" E) qualifies as a reference site for investigating the transition between

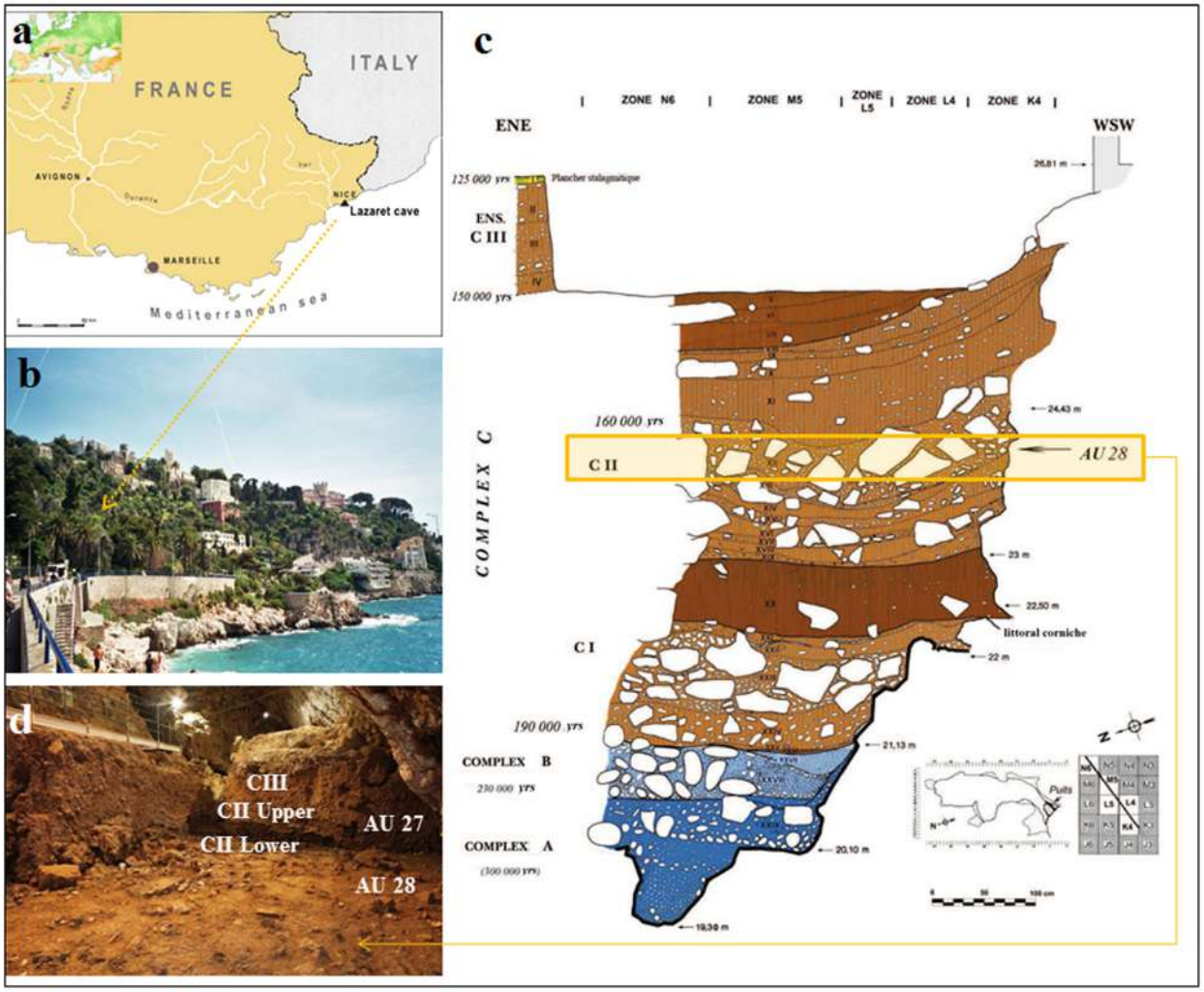

Figura 1. (a) Map showing the location of Lazaret cave in Nice, France; (b) View of western slope of Mont Boron facing the Mediterranean Sea where the cave, pointed with yellow arrow, is situated in Nice, France; (c) Stratigraphic section of the 'well' excavated at the front of Lazaret cave with AU 28 marked in yellow rectangle; (d) View of the excavated floor of AU 28 with stratigraphic section O/P on the left and 17/18 on the right.

Acheulean and Mousterian cultures, for reconstructing the dynamics of palaeoclimate and bio-stratigraphy of South-eastern France and North-western Italy, and for understanding the culturally evolving lifestyle of preneanderthals, who inhabited this cave intermittently. Dug out from dolomitic limestones of Lower Jurassic, it opens out on the western slope of Mont Boron, at 26m absolute altitude and 100m from the sea (Fig. 1b). The cavity's dimensions are 35m length, 4-14m width and ceiling height of 15m. Since its first mention by François Emmanuel Fodéré in 1821, the cave was subsequently subjected to excavations by F.C.E. Octobon (1950-1965) and H. de Lumley (1967-2014) which helped to delineate four main stratigraphic units: basal marine beaches A and B (respectively attributed to Marine Isotope Stage (MIS) 9 and 7) overlain by stratigraphic complex C, made of continental formations 6m thick and topped by stalagmitic floors D and E (Lumley *et al.*, 2001; Lumley *et al.*, 2004). Comprising a succession of gravel with blocks in a red clayey silt matrix correlating to three periodic sedimentary cycles, complex C is further split into CI, CII Lower (archaeostratigraphic units (henceforth AU) 26 to 29), CII Upper (AU 13 to 25), and CIII (AU 1 to 12) (Fig. 1c). Together with 25 hominid fossils assigned to preneanderthals (Lumley *et al.*, 2012) and abundant faunal remains recovered till date, Units CI and CII have yielded a biface rich Acheulian lithic industry whereas Unit CIII is attributed to Epi-acheulean culture, highlighted by the occurrence of flake tools (with few Levallois debitage) and scarcity of bifaces (Cauche, 2012; Cauche and Lebègue, 2008).

Taking account of association of large mammals and rodents, the evolutionary stage of some taxa, as well as palaeoecological data ascertained

from previous multidisciplinary studies at the site, these archaeological sediments were attributed to the last cold period of the Middle Pleistocene (i.e. MIS 6) (Valensi, 2000; Valensi *et al.*, 2007; Hanquet *et al.*, 2010). Paleontological data concord with radiometric dating, done using the combined ESR/U–Th method on well-preserved *Cervus elaphus* tooth enamel, which yields ages between 120 and 190 kyr for the CIII and CII stratigraphic units (Michel *et al.*, 2009; Michel *et al.*, 2011). In particular, Archaeostratigraphic unit 28 (henceforth AU 28), the faunal remains of which form the scope for this paper, belongs to the top of CII Lower between 412- 432cm and is dated to 170 kyr (MIS 6.4) (Fig. 1d). Other salient finds from this unit include a transitional lithic industry (2019 artifacts with 42 bifaces), 4 human remains (frontal, femur, fragment of mandibular molar and a deciduous tooth), a hearth and a profusion of boulders, rocks and stones indicating a cooler climate (Lumley *et al.*, 2012: 51). In this paper, we aim to discuss the composition, source of accumulation and significance of AU 28's faunal spectra.

2. Material and Methods

The 7346 faunal remains of AU 28 came from 90m^2 floor area excavated from 2010-12. Restoration was carried out for remains found heavily coated with limestone encrustations containing calcite and iron oxides. Water was minimally used for cleaning and some fragile or altered bones were consolidated using paraloid B72. Internationally established standard protocols for archaeozoological analyses were followed (Lyman, 1994, 2008; Reitz and Wing, 1999). Remains were primarily categorised into identifiable and unidentifiable. Anatomic and taxonomic classification was achieved chiefly through comparison with reference skeletons, both modern and those recovered from previous excavations housed at the Laboratory of Lazaret for identifiable remains. Publications such as Barone (1976), Hillson (2005), Pales and Garcia (1981), Pales and Lambert (1971) and Schmid (1972) were additionally consulted for identification of anatomy and taxon in the absence of reference skeletal specimens. During analysis, some remains could not be conclusively ascertained to a particular species. For instance, for closely related species with morphological similarity like *Bos primigenius* and *Bison priscus*, a broad category '*Bos/Bison*' was created and elements were assigned to it. Apart from general dimensions, remains were recorded by part, portion, side, fusion state, long bone fracture morphology and fragmentation indices (shaft circumference and length- Bunn 1982, 1983; Villa and Mahieu, 1991). The tooth-eruption and wear stages were determined using detailed data from modern populations of deer (Riglet, 1977; Klein *et al.*, 1981; Klein *et al.*, 1983), ibex (Couturier, 1961) and roe deer (Paulus, 1973; van Laere *et al.*, 1998; Valensi and Psathi 2004). Taphonomic study concentrated on both pre- and post- depositional alterations produced by natural and anthropic agents. Comprehensive information of each remain was fed into a database management software. Quantification of identified remains addressed queries related to relative frequencies of taxa through Number of identified specimens (NISP) and Minimum number of individuals combination (MNIc) (Lyman, 2008; Reitz and Wing, 2008). The latter was calculated considering the most abundant element with laterality, age, sex and size variations. Age profile of species was assessed from dentition wear stages and epiphyseal fusion of long bones. While some remains were photographed *in situ*, some select others were photographed after their restoration and analysis.

3. Results

By virtue of their nature and composition, compact bones (as well as teeth and extremities of limbs) were better preserved. The cave's karstic environment played a favourable role in their fairly good preservation as evidenced by the presence of fragile yet intact bones like sternum, rib cartilage and foetal bones in the assemblage. Taxonomically identified remains amounted to 2256 (31%) and anatomic identification without taxonomic specificity was possible for 243 remains. In this category, 77 additional remains were attributed to the Order Artiodactyla since distinguishing morphological features for more precise identification were absent. High degree of fragmentation rendered 4770 (65%) fragments unidentifiable (Table. 1). The rate of determination was 30.7%. Altogether, 4 Orders comprising 7 families, 15 genera and 16 species composed the faunal diversity of AU 28. The whole values, percentages of NISP per taxon and total NISP revealed the predominance of same genera and species.

3.1. Species

The ungulates dominate the assemblage with 97.9% remains while the carnivores comprised 2.1%.

Order	Family	Genus	NISP	% NISP	MNIc	%MNIc	Age	Sex
Carnivora	*Canidae*	*Canis lupus*	16	0.7%	2	4	2A	-
		Vulpes vulpes	3	0.1%	1	2	1A	-
	Ursidae	*Ursus spelaeus*	10	0.4%	2	4	1J, 1A	-
		Ursus arctos	5	0.2%	2	4	1J, 1A	-
		Ursus sp.	3	0.1%	1	2	-	-
	Felidae	*Panthera pardus*	3	0.1%	2	4	2A	-
		Lynx spelaeus	4	0.2%	2	4	1J, 1A	-
		Felis silvestris	3	0.1%	1	2	1J	-
Total Carnivora			**47**	**2.1%**				
Proboscidea	*Elephantidae*	*Palaeoloxodon antiquus*	2	0.1%	1	2	1A	-
Perissodactyla	*Equidae*	*Equus taubachensis*	2	0.1%	1	2	1A	-
Artiodactyla	*Bovidae*	*Bos primigenius*	9	0.4%	4	8	1J, 3A	-
		Bos/Bison	117	5.2%				-
		Capra ibex	323	14.3%	9	18	3J, 2JA, 4A	3 Males (1J), 1 Female (JA)
		Rupicapra rupicapra	61	2.7%	4	8	1SA, 1J, 1JA, 1A	-
	Cervidae	*Megaloceros giganteus*	1	0.0%	1	2	-	-
		Cervus elaphus	1690	74.9%	16	32	3J (6M, 9M, 18M), 3JA (2.5Y, 2-4Y, 3-4Y), 3A (6-8Y), 2MA (8-10A, 10-12A), 5SA (3x 12-14A, 2x 14-17A)	4 Males (1J, 1JA, 1A, 1MA) 2 Females
		Capreolus capreolus	4	0.2%	1	2	-	-
Total identified ungulates			**2209**	**97.9%**				
Anatomically identified Artiodactyla remains			77	-				
Total Ungulates			2286	-				
Anatomically identified and taxonomically unidentified remains			243	-				
Taxonomically identified total remains			2256	**100.0%**				
Total identified remains			2576	-				
Number of unidentified remains			4770					
Total number of remains			**7346**					

Figura 2. Summary of identification, species composition and population structure of the fauna from AU 28 of Lazaret cave. NISP, Number of identified specimens; MNIc, Minimum number of individuals combination; J, Juvenile; JA, Juvenile adult; A, Adult; MA, Mature adult; SA, Senile adult; M, Month; Y, Years.

Out of 2209 ungulate remains, the families of *Cervidae* (75.1% NISP and 76.7% NISP per taxon) and *Bovidae* (22.6% NISP and 20.3% NISP per taxon) had better representation than the families of *Equidae* and *Elephantidae* (0.1% NISP and NISP per taxon each). The carnivores in an otherwise herbivore-dominated AU 28 assemblage were 47 in total. The family of *Canidae* (0.8% NISP and 40.4% NISP per taxon) was better represented than *Ursidae* (0.7% NISP and 38.3% NISP per taxon) and *Felidae* (0.4% NISP and 21.3% NISP per taxon) (Fig. 2).

Cervus elaphus (74.9% NISP and 32% MNI), *Capra ibex* (14.3% NISP and 18% MNI) and *Bos/Bison* (5.6% NISP and 8% MNI), in descending order of representation, formed the major portion of ungulate remains. Among the 1690 red deer remains, all skeletal elements were well represented. The population structure of red deer, derived from wearing stages of mandibular dentition which were in majority, was distributed over all age groups (Fig. 2). Interesting information about their mortality came from 2 maxillae with varying wear stages of deciduous molars and different eruption stages of first permanent molar. They indicated two different periods of slaughter. In accordance with Riglet (1977), the first maxilla (Fig. 3a) was attributed to a 5 month young individual as second lobe of D4 was not used and the M1 was in the course of eruption (slaughter in October). In the second maxilla attributed to a young individual of 9 months (slaughter in February), molars had greater wear and M1 had completely erupted with a worn first lobe. The examination of red deer skulls with or without pedicles of antlers allowed to decipher that both sexes were impartially hunted (Fig. 2). The second dominant species was ibex (323 remains) with individuals referable to all age groups. Sexing of the horn cores was possible in case of 13 fragments, 11 to males and 2 to females (Fig. 3b). Morphological study conducted on P3 and the lower P4 as well as upper M3 confirmed that the Lazaret ibex belonged to the Alpine line, while also presenting an archaic morphology (Crégut-Bonnoure, 1995; Valensi, 2009). Similar to red deer, the skeletal remains of ibex were abundant and came from all parts of the skeleton. In this AU, unlike previous units, aurochs (determined precisely from dental remains) were better represented with 9 remains (0.4% NISP) while 117 remains were attributed to the combined *Bos/Bison* category.

Figura 3. Faunal remains of ungulates and carnivores identified in AU 28 of Lazaret cave. (a) Left maxilla with D2, D3, D4 and an erupting M1 (R10-CR96-4050) of a juvenile red deer (*Cervus elaphus*); (b) View of the horn core (S15-HG94-4692) of female ibex (*Capra ibex*); (c) On top, right rib (S13-FE109-4707) and at bottom, 14th left rib (O8-AE103-2749) of cave bear (*Ursus spelaeus*); (d) Right maxilla (R16-IB90-5505) of cave lynx (*Lynx spelaeus*). Scale bars are 2cm each.

One juvenile individual's left tibia, 2 adult individuals' left radii aided in MNI derivation. Auroch was well represented by mandible, scapula, radius-ulna, pelvis and short bones. Strong presence of nutritious parts such as long bones, crania and elements of thorax (ribs and vertebrae) over others in auroch/bison category revealed a change in selective transport strategy probably influenced by the animal's size and carcass weight. Long bones of red deer, ibex and auroch/bison, whose length and circumference fragmentation indices were recorded, revealed that majority of them had lengths less than half of the original length and incomplete circumferences, characteristic of anthropogenic assemblages (Bunn, 1983; Villa and Mahieu, 1991; Valensi, 2000; Valensi *et al.*, 2013). The long bones in case of fresh breakage had spiral fractures while in dry bones, the breakage had fracture morphology rather transverse or longitudinal. Long bones shafts with more than half of the original length or nearly complete circumferences, attributed to carnivore accumulated and modified assemblages, were hardly present (Bunn 1983; Villa and Mahieu, 1991; Valensi, 2000; Valensi *et al.*, 2013).

A more sporadic presence was recorded for other ungulate species. Diaphyses of femur and rib accounted for at least 1 individual of *Palaeoloxodon antiquus* (0.1% NISP and 2% MNI). The *Equus taubachensis* (0.1% NISP and 2% MNI) at Lazaret was of a large size. While the cranium was represented by a fragment of zygomatic, post-cranial element identified was a left humerus diaphysis, together attributed to 1 individual. A pelvic fragment yielded evidence of 1 adult individual of *Megaloceros giganteus* (0.05% NISP and 2% MNI). *Capreolus capreolus* (0.2% NISP and 2% MNI) was represented by 4 elements, namely a proximal fragment of ulna, a cervical vertebra, a fragment of caudal face of femur diaphysis and a first phalanx, attributable to 1 adult individual. The *Rupicapra rupicapra* (2.7% NISP and 8% MNI) with 61 remains had the highest representation of this species in this AU at Lazaret cave. A minimum number of 4 individuals from all age groups was estimated. Both axial and appendicular elements were well represented.

The carnivores' contribution was characterized mainly by *Canis lupus* (0.7% NISP and 4% MNI), *Ursus spelaeus* (0.4% NISP and 4% MNI), *Ursus arctos*

Figura 4. Examples of faunal remains from AU 28 of Lazaret cave with taphonomic marks. (a) Right mandible (O12-EF90-2686) of red deer (*Cervus elaphus*) with cut marks marked with a white rectangle; (b) Tibia diaphysis (T9-BT44-1770) of chamois (*Rupicapra rupicapra*) with percussion notch shown by an arrow mark; (c) Right radius diaphysis (U15-HT96-3670) of red deer (*Cervus elaphus*) with an adherent flake marked with a white square; (d) Medial view of right scapula (N8-AB93-3162) of ibex (*Capra ibex*) with a pit mark made by carnivore tooth on the supraglenoidal tubercle marked with a white circle. Scale bars are 2cm each

and *Lynx spelaeus* (0.2% NISP and 4% MNI each) in descending order while the other species were scarcely represented. Nearly 1000 wolf remains from the beginning of the excavations till present, including 16 remains (2 adult individuals) from this level, made it the most abundant carnivore on site in terms of remains. Post cranial skeletal elements included a patella, a lumbar vertebra and long bones. Cranial remains included 3 fragments of mandible and isolated teeth. Three remains such as mandibular elements related to the same adult individual through association and a calcaneum were positively attributed to *Vulpes vulpes* (0.1% NISP and 2% MNI). The 2 species of bear had a minimum of 1 juvenile and 1 adult individual each in both cases. While skeletal parts of cave bear included long bones, limb extremities, ribs (Fig. 3c), vertebrae and tarsus; brown bear was represented by an incomplete cranial fragment (palatine), an upper second left incisor, a lumbar vertebra, a patella and an unfused distal end of first phalanx. Three elements, a fragment of right temporal (cranium), a lumbar vertebra, and the distal portion of second phalanx, could not be accurately attributed to a particular species and were thus placed under the broader category of genus *Ursus*. Merely 4 *Lynx spelaeus* (0.2% NISP and 4% MNI) remains were identified, represented by dental elements (Fig. 3d), scapula and femur attributable to 1 juvenile and 1 adult individual. *Panthera pardus* (0.1% NISP and 4% NISP) represented by radii and a phalanx was identified in the assemblage. The presence of *Felis silvestris* (0.1% NISP and 2% MNI) was attested by 3 remains, 2 unfused femurs of both lateralities and an unfused ulna, reasoned to belong to the same juvenile individual.

2.2. Taphonomy

Taphonomical studies clearly established AU 28 to be an anthropic unit. Out of 215 evidences of modifications by biological agents on identified remains, 87% were anthropic marks while only 13% were of carnivore origin. Altogether, 16 red deer, 9

ibex, 4 aurochs, 4 chamois and 1 roe deer were transported back to the cave by humans during this unit's occupation period. Anthropic marks indicated that the aim of processing was definitely food extraction and optimum exploitation of carcasses. All necessary successive stages in the butchery process such as skinning (on mandible) (Fig. 4a), limb disarticulation, defleshing (vertebrae, ribs, and long bones), tendon recuperation, extraction of brain (cranium) and long bone fracturing to procure marrow were observed in the assemblage. 42 cut marks (33 on red deer, 7 on ibex, and rest on other ungulates) caused by lithic tools were documented primarily on meat rich remains such as upper front limb (8), lower hind limb (10) and axial elements (11). Percussion notches/inner conchoidal scars (86 on red deer and 12 on ibex) were present mostly found on 75 long bone diaphysis (Fig. 4b) and the rest on other elements. Adhering flakes (5 on red deer (Fig. 4c), 2 on bovine and rest on other ungulates) only on the long bone diaphysis further confirmed this observation. Red deer long bone diaphyses also evidenced the impact of percussion. Moreover, scraping marks were observed primarily on limb bones (14), axial elements (3) of red deer (14) and ibex (3) and the rest on other skeletal elements of remaining ungulates. Roe deer bones demonstrated fresh anthropic fractures.

An interesting evidence of wolf consuming other animals came from 2 skeletal elements, which showed conspicuous teeth marks in the form of gnawing and pits. The size and shape of these marks matched well with the size of wolf teeth. The tibia of wolf bore a distinct pit mark at the proximal end. By its dimensions and appearance, it can be said that another wolf or a different carnivore of similar comparable size gnawed it. The other remain is an unfused long bone of wolf, which bore gnaw marks on the metaphysis that are typical of carnivore tooth action. The dorsal part of scapula of cave lynx also bore a pit mark left by the tooth of a wolf-sized carnivore. Carnivorous alterations on other species or meat-rich bones are related primarily to small ungulates (chamois) or larger ungulates of juvenile age (red deer and ibex (Fig. 4d)).

The remains of elephant, giant deer, bear and leopard had no distinct alterations. Hence, low representation and insufficient taphonomic information made it difficult to infer how they got incorporated in the assemblage. Taphonomic marks pertaining to natural post-depositional agents were few. Weathering (4 remains) and root impressions (3 remains) were visible only on long and flat bones of principal ungulates, which suggests rapid burial and subsequently good preservation by the cave's sediments. Manganese oxide (295 remains) and concretions (253 remains) were present in greater numbers mostly on red deer and ibex remains.

3. Discussion

Considering the faunal association of AU 28 at Lazaret cave, which delivered 16 species, and their taphonomic modifications, this unit was clearly an accumulation of anthropic origin. In general, the Palaeolithic humans intentionally and consistently broke long bones, jaws and skulls of ungulates to extract marrow, brain and other nutritive tissues by implementing strategies of non-selective hunting (all age groups and both sexes) and non-selective transport of entire or nearly complete carcasses of small and medium-sized ungulates but selective hunting and selective transport of large sized mammals using an acheulian lithic tool-kit. The anthropic marks observed on the material indicate that the aim of processing was food extraction and optimum utilisation or exploitation of carcasses: skinning (mandible), limb disarticulation, defleshing (vertebrae, ribs, long bones), tendon recuperation, extraction of the brain (cranium) and long bone fracturing (humerus, radius, tibia and metapodia) to extract the marrow, were observed. The deer and ibex were, as in overlying units, the most abundant species in the assemblage. A study of red deer teeth and antlers showed a long duration occupation of the cave for several months, mainly from autumn to the end of winter. These results are similar with those obtained in AU 26 (M'Hamdi, 2012) and quite different from AU 25 where an autumn hunting episode has been highlighted (Valensi *et al*., 2013). In AU 28, antlers were numerous as documented in the preceding units and continued to be so in this unit. They indicated intentional collection for usage by humans and need to be studied further in detail. Nevertheless, many skeletal elements of auroch and chamois brought originality to this unit. The assemblage also comprised ungulates infrequent in Lazaret cave such as elephant and giant deer.

Fragmentation due to post-depositional factors played a secondary role. The origin of accumulation of carnivore bones came under heavy speculation in this unit because of few numbers and random distribution on the cave floor. Nearly all cranial, axial and appendicular bones are represented in the combined

assemblage of all carnivore species in AU 28. It is more likely that most of these carnivores were between 2 human occupation levels (AU 27 and AU 28 or AU 28 and AU 29). It cannot be asserted if the carnivores had themselves intruded, occupied the cave briefly, died there and hence their bones got incorporated with the rest of the assemblage or if one carnivore hunted its co-species or other carnivores, and whether some or whole carcass of the prey was brought into the cave for consumption by the predator. There is some evidence for this presumption as there are marks made by carnivore teeth such as gnawing and pits on vertebrae and shafts and ends of bones. If carnivores had areas of preference for their activities inside the cave and if these could be discerned in the archaeological record and its distribution, then in the case of AU 28, it was not clearly possible. The anthropogenic cause of such modifications cannot be ruled out completely but to corroborate this premise, there were no visible alterations on bones such as butchering marks, percussion marks or filleting marks to suggest so.

Palaeoenvironmentally, the faunal spectra of AU 28 reflected a climate tending towards increasing cooling. A mosaic landscape comprising open environments was well represented by the abundance of chamois and the presence of horse and giant deer. Cats, bears and red deer highlighted the establishment of temperate forests. Presence of red deer, auroch, roe deer and elephant demonstrated that this micro-region acted as a refuge for temperate species during the glacial periods of Quaternary.

Acknowledgements

We thank Prof. Henry de Lumley for providing us access to the faunal material from AU 28 for analysis. We also extend our gratitude to the laboratory staff and students in the excavation team who worked from 2010 to 2012 at Lazaret cave.

Bibliography

Barone, R., 1976. Anatomie Comparée des Animaux Domestiques, Tome I. Ostéologie, Paris.

Bunn, H.T., 1982. Meat-eating and Human Evolution: Studies on the Diet and Subsistence Patterns of Plio-Pleistocene Hominids in East-Africa. Unpublished PhD thesis. University of California, Berkeley.

Bunn, H.T., 1983. Comparative analysis of modern bone assemblages from a San hunter-gatherer camp in the Kalahari Desert, Botswana, and from a spotted hyena den near Nairobi, Kenya, in: Clutton-Brock, J., Girgson, C. (Eds.), Animals and Archaeology 1: Hunters and their Prey. BAR International Series 163., Oxford, pp. 143-148.

Cauche, D., 2012. Productions lithiques et comportements techno-économiques de groupes humains acheuléens et moustériens en région liguro-provençale. C R Palevol. 11, 519-527.

Cauche, D., Lebègue, F., 2008. Technologie et typologie moustériennes des grottes de Grimaldi dans le contexte des cultures du Paléolithique moyen de l'Europe méditerranéenne. Arch. I.P.H. 39, Paris, 95-100.

Couturier, M. A. J., 1961. Détermination de l'âge du Bouquetin des Alpes (Capra aegagrus ibex ibex) l'aide des dents et des cornes. Mammalia. 25, 453-461.

Crégut-Bonnoure, E., 1995. Les grands Mammifères, in : Defleur, A., Crégut-Bonnoure, E. (Eds.), Le gisement paléolithique moyen de la grotte des Cèdres (Le Plan d'Aups, Var). DAF 49, pp. 54-147.

Hanquet, C., Valensi, P., Bailon, S., Desclaux, E., El Guennouni, K., Roger, T., Lumley, H. de., 2010. Caractérisation du climat et de la biodiversité au Pléistocène moyen final, d'après les faunes de vertébrés de la grotte du Lazaret (Nice, France). Quaternaire. 21 (3), 215-226.

Hillson, S., 2005. Teeth. Cambridge University Press, Cambridge.

Klein, R. G., Wolf, C., Freeman, L. G., Allwarden, K., 1981. The use of dental crown heights for constructing age profiles of Red deer and similar species in archaeological samples. J. Archaeol. Sci. 8, 1-31.

Klein, R. G., Allwarden, K., Wolf, C., 1983. The calculation and interpretation of ungulate age profiles from dental crown heights, in: Bailey, G. N. (Ed.), Hunter-Gatherer Economy in Prehistory: A European Perspective. Cambridge University Press, Cambridge, pp. 47-57.

Lumley, H. de., Khatib, S., Echassoux, A., Todicso, D., 2001. Les lignes de rivage quaternaires en relation avec les sites paléolithiques des Alpes-Maritimes et de la Ligurie occidentale. Rev. Archéom. 25 (25), 125-134.

Lumley, H. de., Echassoux, A., Bailon, S., Cauche, D., Marchi, M. P. De., Declaux, E., El Guennouni, K., Khatib, S., Lacombat, F., Roger, T., Valensi,

P., 2004. Le sol d'occupation acheuléen de l'unité archéostratigraphique UA 25 de la Grotte du Lazaret. Editions Edisud, Aix-en-Provence.

Lumley, H. de., Cauche, D., Khatib, S., Lumley, M. A. de., Valensi, P., 2012. Grotte du Lazaret, Nice. Bilan scientifique 2011, DRAC PACA, Service Régional de l'Archéologie, pp. 63-65.

Lyman, R. L., 1994. Vertebrate Taphonomy. Cambridge University Press, Cambridge.

Lyman, R. L., 2008. Quantitative Paleozoology. Cambridge University Press, Cambridge.

M'hamdi, M., 2012. Chasseurs Cueilleurs Acheuléens de la Grotte du Lazaret << UA 26>>, Nice, Alpes Maritimes. Approche Comportementale et Analyse Spatial. Unpublished PhD Thesis. University of Nice Sophia- Antipolis, Nice.

Michel, V., Shen, G., Valensi, P., Lumley, H. de., 2009. ESR dating of dental enamel from Middle Palaeolithic levels at Lazaret cave, France. Quat Geochronol. 4, 233-240.

Michel, V., Shen, G., Fornari, M., Verati, C., Gallet, S., Sabatier, D., 2011. Les derniers Homo heidelbergensis et leurs descendants les Néandertaliens: Datation des Sites d'Orgnac 3, du Lazaret et de Zafarraya. C.R. Palevol. 10 (7), 577-587.

Pales, L., Lambert, C., 1971. Atlas Ostéologique pour servir à l'identification des Mammifères du Quaternaire. Éditions du Centre National de la Recherche Scientifique, Paris.

Pales, L., Garcia, M. A., 1981. Atlas Ostéologique pour servir à l'identification des Mammifères du Quaternaire. Éditions du Centre National de la Recherche Scientifique, Paris.

Paulus, M., 1973. Contribution à l'étude de l'âge du Chevreuil (*Capreolus capreolus*) d'après les Dents, Thèse de l'École Nationale Vétérinaire d'Alfort. n° 4, 105.

Reitz, Elizabeth, J., Wing, Elizabeth, S., 1999. Zooarchaeology, first ed. Cambridge University Press, Cambridge.

Reitz, Elizabeth, J., Wing, Elizabeth, S., 2008. Zooarchaeology, second ed. Cambridge University Press, Cambridge.

Riglet, P. H., 1977. Contribution à l'étude de l'âge du cerf élaphe (*Cervus elaphus* L.). PhD thesis. Doctorat Vétérinaire, Faculté de Médecine de Créteil, France.

Schmid, E., 1972. Atlas of Animal Bones. Elsevier, Amsterdam.

Valensi, P., 2000. The archaeozoology of Lazaret cave (Nice, France). Int J Osteoarchaeol. 10, 357–367.

Valensi, P., 2009. Evolution des peuplements de grands mammifères en Europe Méditerranéenne Occidentale durant le Pléistocène Moyen et Supérieur. Un exemple régional: les Alpes du Sud Françaises et Italiennes. Quaternaire. 20 (4), 551-567.

Valensi, P., Psathi, E., 2004. Faunal exploitation during the Middle Palaeolithic in South Eastern France and North Western Italy. Int J Osteoarchaeol. 14, 256-272.

Valensi, P., Bailon, S., Michel, V., Desclaux, E., Rousseau, L., Onoratini, G., Genty, D., Blamart, D., Lumley, H. de., 2007. Cadre climatique et environnemental des acheuléens de la Grotte du Lazaret, à Nice. Données paléontologiques, biogéochimiques et radiométriques établies sur les faunes de vertébrés et d'invertébrés. Archaeosciences. 31, 137-150.

Valensi P., Michel V., El Guennouni K., Liouville M., 2013. New data on human behavior from a 160,000 year old Acheulean occupation level at Lazaret cave, south-east France : An archaeozoological approach. Quat. Int. 316, 213-139.

Van Laere, G., Maillard, D., Boutin J. M., Delorme, D., 1998. Le suivi des populations de chevreuils des méthodes traditionnelles d'estimation aux indicateurs biologiques. Proceedings of the XXI Colloque francophone de Mammalogie, Amiens, 1997.

Villa, P., Mahieu, E., 1991. Breakage patterns of human long bones. J Hum Evol. 21, 27 48.