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The Proto-Aurignacian and Early Aurignacian retouchers of Labeko Koba (Basque Country, Spain). A techno-economic and chrono-cultural interpretation using lithic and faunal data

Retouchoirs du Proto-Aurignacien et de l'Aurignacien ancien de Labeko Koba (Pays basque, Espagne). Une interprétation techno-économique et chrono-culturelle sur la base de données lithiques et faunistiques

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ABSTRACT

The so-called bone retouchers have been the subjects of numerous studies examining them from different points of view and in various chronological and geographic contexts. However, the study of these tools has rarely been carried out in conjunction with data from lithic typology and technology studies and archaeozoological research, to understand the context in which retouchers were made and used. In this paper, we examined the technological and functional aspects of the retouchers recovered in the Proto-Aurignacian and the Early Aurignacian levels of Labeko Koba. Our study shows that the retouchers of these two techno-complexes of Labeko share several features but also some differences. The exploitation of bones in the Early Upper Palaeolithic EUP levels at Labeko Koba, represented mainly by the retouchers, cannot be regarded as complex. This behaviour is part of a technical tradition that has its roots in the Middle Palaeolithic.

Mots clés :
Proto-Aurignacien
Aurignacien ancien
Retouchoirs en os
Outils en os
Technologie osseuse
Lakebo Koba
Modifications de la surface osseuse

RÉSUMÉ

Les objets dénommés « retouchoirs en os » ont fait l'objet de nombreuses études menées selon différents points de vue et dans des contextes chronologiques et géographiques variés. Cependant, l'analyse de ces outils a rarement été réalisée de manière coordonnée avec les données provenant des études de technologie et de typologie lithique ainsi que des recherches archéozoologiques, de manière à comprendre le contexte dans lequel les retouchoirs ont été faits et utilisés. Dans cet article, nous examinerons les aspects technologiques et fonctionnels des retouchoirs retrouvés dans les niveaux du Proto-Aurignacien et de

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l'Aurignacien ancien de Labeko Koba. Notre travail montre que les retouchoirs de ces deux technocomplexes de Labeko Koba ont en commun plusieurs caractéristiques, mais présentent aussi des différences. L'exploitation des os des niveaux du Paléolithique supérieur initial de Labeko Koba, principalement représentés par des retouchoirs, ne peut pas être considérée comme étant complexe. Ce comportement fait partie des traditions techniques qui ont pris leurs racines au Paléolithique moyen.

1. Introduction

Since their early identification as bone tools for working with lithic artefacts, in the first years of the twentieth century (Henri-Martin, 1907-1910), the so-called retouchers have been the subject of numerous studies examining them from different points of view and in various chronological and geographic contexts. These instruments are found over a period from the Lower Palaeolithic (e.g., Blasco et al., 2013; Roberts and Parfitt, 1999; Rosell et al., 2014) to the end of the Upper Palaeolithic (Schwab, 2002, 2005, 2014). They are equally cited at Middle Stone Age sites in Africa (d'Errico and Henshilwood, 2007) and even as the earliest evidence of the use of human bones as implements (Mussini, 2011; Verna and d'Errico, 2011). However, the period these objects are most often associated with is the Mousterian (e.g., Abrams et al., 2014; Armand and Delagnes, 1998; Giacobini and Malerba, 1996; Jéquier et al., 2012; Mallye et al., 2012, Mozota, 2009, 2015; Vincent, 1993). Aurignacian retouchers have also been studied in several publications (e.g., Castel et al., 2003; Schwab, 2002, 2005, 2014; Tartar, 2009) and have been a topic of scientific meetings (García-Moreno et al., 2015; Patou-Mathis et al., 2002).

Over the last two decades, some studies incorporate technological, traceological and experimental analyses (Armand and Delagnes, 1998; Castel et al., 2003, Daujeard et al., 2014; Mallye et al., 2012, Vincent, 1993), which help to understand functional aspects of this kind of object. Other approaches propose comparative studies between series from different techno-complexes (e.g., Giacobini and Malerba, 1996; Schwab, 2002, 2005 for the Upper Palaeolithic; Jéquier et al., 2012 for the Mousterian and the Uluzzian). However, the study of these tools has rarely been carried out in conjunction with data from lithic typology and technology studies and archaeozoological research to understand the context in which retouchers were made and used (e.g., Daujeard et al., 2014 for the Mousterian). In a similar way, few studies have compared the retouchers from different phases in the same techno-complex (see references above). However, this aspect is of great relevance in connection with the Proto-Aurignacian and the Early Aurignacian. Although the development of an osseous industry, has repeatedly been put forward as one of the main indicators of the change from the Middle to the Upper Palaeolithic, together with the emergence of portable and parietal art, the replacement of Neanderthals by Anatomically Modern Humans, etc., (e.g., Klein, 1995; Mellars, 1989; Mellars and Stringer, 1989), recent studies note continuity, at least in the osseous industry, between the Mousterian and the Early Upper Palaeolithic (EUP) (Tejero, 2010, 2013, 2014; Tejero and Grimaldi, 2015; Tartar, 2012). The real change that took place in the use of raw materials from animal sources would be in the use of antler (Liolios, 1999; Tejero, 2013, 2014). This practice only seems to become widespread in the Upper Palaeolithic record in Europe from the Early Aurignacian onwards, coinciding with the Heinrich 4 (HS4) stadial event, about 40,000 years ago and, anthropologically, with the establishment of Anatomically Modern Humans in the continent (Banks et al., 2013).

This paper presents a technological and functional analysis of retouchers in the Proto-Aurignacian (level VII) and Early Aurignacian (levels VI, V and IV) at the site of Labeko Koba (Basque Country, Spain) (Arrizabalaga, 2000a; Arrizabalaga et al., 2003). The objectives of the study are: to characterise the way the raw material for the retouchers was procured to determine whether or not a technical exploitation of bone existed and if this was integrated into the work of meat processing; to determine how the retouchers were used and assess their correspondence with the lithic assemblage at the site; to verify whether differences and/or similarities exist between the retouchers in each Aurignacian phase at Labeko Koba. In connection with the last objective, it should be pointed out that the conclusions will necessarily be limited because the Proto-Aurignacian level has only yielded four examples of retouchers. As regards the use of this kind of object, the evaluation of the lithic reduction methods identified at the site and the morpho-structural characteristics of the Labeko implements induce a hypothesis of their use which differs from the hypotheses proposed to date for both Mousterian and Aurignacian retouchers (see Section 6.2).

2. Archaeological context. The site of Labeko Koba (Arrasate, Basque Country)

The site of Labeko Koba was located in the upper valley of the River Deba, at 246 m above sea level, and 28 km from the modern coastline (Fig. 1). The cave was on the slopes of Kurtzetxiki Hill, but the building of Arrasate ring road caused the destruction of its deposit after it had been excavated and studied (Arrizabalaga, 2000a; Arrizabalaga et al., 2003). The site was placed in a strategic point, overlooking a wide valley formed by the confluence of the River Deba with its tributary, the River Aramaio. The total length of the cave was over 140 metres while the excavation took place in a small passage with a length of 14 m and an average width of 3 m, and whose cross-section varied with depth (Arrizabalaga, 2000a: 22). The deposit had been discovered in 1971, and the excavation was started in 1987, in the face of the cave's imminent destruction. The excavation continued in 1987 and 1988 (Arrizabalaga, 2000a: 31).

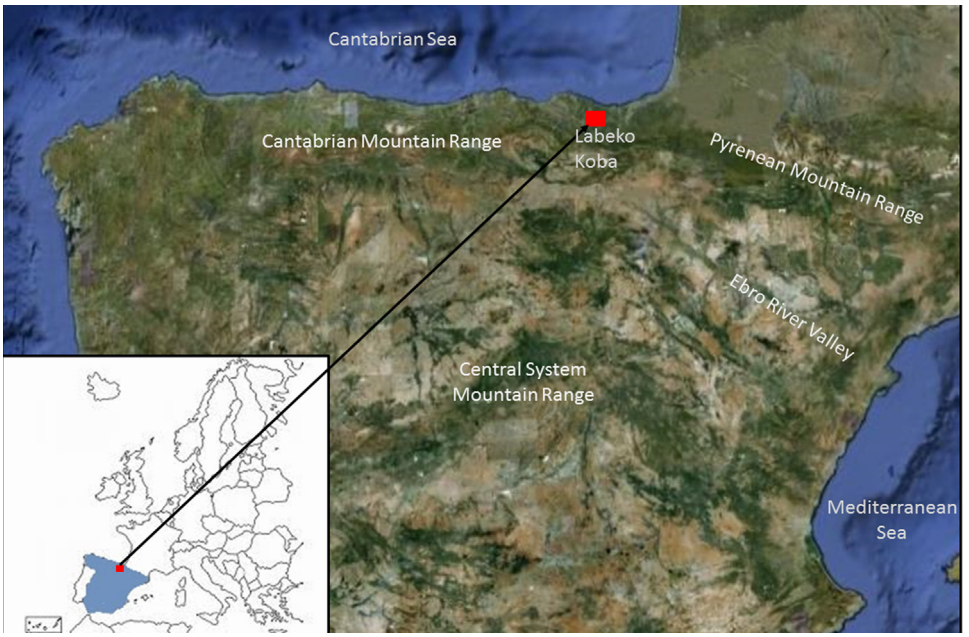


Fig. 1. Location of Labeko Koba site.
Fig. 1. Localisation du site de Labeko Koba.

A total of nine levels were discriminated in the stratigraphic sequence at Labeko Koba, in which the two upper layers (I and II) were archaeologically barren. The base of the sequence was represented by lower level IX, attributed to the Chatelperronian because of the find of three Chatelperron points in a scarce lithic assemblage. Level VII marked the start of the Aurignacian sequence. The composition of its lithic assemblage, with a large number of Dufour bladelets, meant that it was classified as Proto-Aurignacian (Arrizabalaga, 2000b). Levels VI, V and IV were identified as Early Aurignacian. In the first two levels, the presence of split-based points and the modal and group ratios of its lithic techno-complexes corroborate that attribution. Level IV has been more difficult to date, but its industrial structure and the sedimentary and environmental records relate it directly with the underlying level V (Arrizabalaga et al., 2009).

Radiocarbon determinations made for the different levels in the deposit have been problematic because of its taphonomic particularities as the sediment has been subjected to intense leaching (Arrizabalaga, 2000a: 66). The dates initially available were much more recent than expected for the EUP in the region (see Arrizabalaga, 2000a: 67). A paper has recently been published (Wood et al., 2014) which presents 19 new determinations for the Labeko Koba sequence, obtained with new pre-treatment methods (ultrafiltration) for the samples; these are much more consistent internally and construct a new regional framework for the regional EUP. Accordingly, the uncalibrated dates framing the Chatelperronian at the site would be 38,100 ± 900 BP (OxA-22562) and 37,400 ± 800 BP (OxA-22560). The Proto-Aurignacian would cover the period from 36,850 ± 800 BP (OxA-21766) to 35,250 ± 650 BP (OxA-21793). In turn, the three Early Aurignacian levels are dated to 35,100 ± 600 BP (OxA-21778) for level VI, between 34,750 ± 750 BP (OxA-21767) and 34,650 ± 600 BP (OxA-21779) for level V, and between 33,600 ± 500 BP (OxA-21768) and 33,550 ± 550 BP (OxA-21780) for level IV. The calibration, as the paper shows, sets back the age of the levels between four and six millennia. In this way, the probability curve of the oldest dates goes back to over 44,000 cal BP, while the most recent dates reach at least 37,000 cal BP (Wood et al., 2014). These dates are significantly more consistent with the new regional framework established for southwestern Europe (Banks et al., 2013; Higham et al., 2014). It may be added that almost all these new dates were obtained precisely from retouchers, to minimise the risk of dating osseous remains introduced by predators or scavengers, and, therefore, not directly related to human activity (Villaluenga, 2013). From the palaeo-environmental point of view, the beginning of the sequence at Labeko Koba is situated in interstadial conditions, with sporadic human occupation and use by hyenas as a den. Nevertheless, the anthropic occupation of the site (levels VII, VI, V and IV) coincides with stadial conditions (taking, at least, Heinrich 4). Pollen studies confirm this, with the presence of mesothermophile species (such as *Castanea*) at the base of the sequence, whereas the rest of the stratigraphy displays typically stadial botanical taxa (low arboreal percentage, abundance of Ephedra) except at the top of level VII, when the pollen spectrum indicates again more temperate conditions (Iriarte-Chiapuso, 2000). The remains of woolly rhinoceros (*Coelodonta antiquitatis*) found in levels IX and VII; of mammoth (*Mammuthus primigenius*) in the same levels and in levels V and IV; and of reindeer (*Rangifer tarandus*) in upper level IX and levels VII, VI and IV (Altuna and Mariezkurrena, 2000) certify the climatic assessment

of cold conditions for this stage in the formation of the deposit.

3. Materials and methods

A significant part of the bone industry of Labeko Koba was described and published by Mújika (2000: 355–376), including bone retouchers from the Proto-Aurignacian and Early Aurignacian levels. However, in this paper each tool will be described individually, explaining their state of preservation, their taxonomical and anatomical identification, and the technological and functional aspects of these objects. For the technological analysis, the terminology used by Mallye et al. (2012) will be largely followed in the description of the traces on the retouchers. As no specific experimental programme has been carried out to study these objects, a part of the interpretations derived from the use-wear analysis of the remains from Labeko Koba will be based on several studies that have included experimentation and whose results have been published exhaustively and rigorously (Armand and Delagnes, 1998; Castel et al., 2003; Mallye et al., 2012; Vincent, 1993). Butchery (scrape and cut marks) and use-wear (V-shaped marks, notches and incisions) analysis were completed by a detailed microscopic study, including description and photograph various modifications. With this purpose, a digital binocular (up to $\times$ 90 magnifications) was employed.

A taxonomical study of the fauna from Labeko Koba was carried out by Altuna and Mariezkurrena (2000) and revised by one of the present authors (Rios-Garaizar et al., 2012; Villaluenga, 2013; Villaluenga et al., 2012). The taxonomical and anatomical identification of the retouchers was performed following the archaeozoological criteria published by several researchers (Barone, 1976; Driesch Von Den, 1976; Pales and García, 1981). The present study has also been able to use the reference collections of Aranzadi Science Society (Saint Sebastian, Spain) and MONREPOS Research Centre and Museum for Human Behavioural Evolution (Neuwied, Germany). The description of the different biological (hominin and carnivores) and physical (e.g., chemical dissolution or postdepositional fractures) taphonomic agents affecting some of the objects has been based on studies by Lyman (1994) and Patou-Mathis et al. (2002). To assess the consistence of the sample, fractures affecting use areas have been considered, including fresh (straight or spiral fracture planes) and postdepositional fractures (sawtoothed, stepped or irregular perpendicular, different from those observed on fresh bone) (Villa and Mahieu, 1991). Finally, in order to discriminate possible patterns in the selection of bone fragments to be used as retouchers, Length/width index was calculated and compared with non-determinable limb bone shafts (longer than 3 cm) identified in each level (see Tables 2, 3, 4 and 5). These tables give the number of used objects (NR) together with the mean, maximum and minimum coefficients for each of the levels analysed (VII, VI, V and IV) (Villaluenga, 2013; Villaluenga et al., 2012). The absence of diagnostic anatomical elements in many of the retouchers means that many of them could only be classified according to the size of the object (length-width-thickness). Following this criteria, each taxonomically indeterminable specimen has been classed in one of three possible categories: First, bones of large mammals (*Bos primigenius*, *Bison priscus* and *Equus ferus*), with an adult weight over 150 kg. Second, medium-size animals (e.g., *Cervus elaphus*, *Capra pyrenaica*), up to 150 kg. Third, smaller ungulates (e.g., *Rupicapra pyrenaica*, *Capreolus capreolus*), weighing less than 50 kg (Damuth and Macfadden, 1990; Lyman, 2008).

4. Retouchers from the Proto-Aurignacian level (level VII)

The small osseous assemblage found in level VII at Labeko Koba, attributed to the Proto-Aurignacian, includes four retouchers, as well as two awls and an intermediate piece (chisel) (Mújika, 2000; Tejero, 2010, 2013) (Table 1).

4.1. Preservation and taphonomic aspects

The state of preservation of the four retouchers from level VII at Labeko Koba is generally good. Although nearly all the objects are affected by different taphonomic agents, some of which affect all the faunal remains at the site (Villaluenga, 2013), the surface alterations do not prevent their technical analysis. In only one retoucher (LK.15G.247.230), the use area is partially covered with calcite. The surface alterations affecting the retouchers consist of erosion and rounding of the external bone cortical tissue, due to particularly important hydraulic processes in certain levels in the deposit, which experienced intense leaching (Arrizabalaga, 2000a: 66). Two of the objects also display dehydration fissures. These types of alterations are hydrothermal (climatic or weathering, depending on the terminology of different scholars), the consequence of repeated desiccation and rehydration processes (Behrensmeyer, 1978; Brugal, 1994). They may be the result either of the exposure of the bones to climatic agents (sun, wind, cold, rain. . .) before entering the deposit or their removal from the sedimentary environment and later exposure to changing temperature and humidity conditions.

4.2. Taxonomical and anatomical identification

Of the four retouchers in level VII, one has been classified taxonomically as medium size ungulate tibia shaft (LK.11D.242.142). A second tool was anatomically described as a femur shaft from the medial side. However, taxonomical identification was not totally accurate, and probably this fragment belongs to a red deer (*C. elaphus)* (LK.11 C.297.4). Third, retoucher (LK.15G.230.47) is characterised by its size ($62 \times 32 \times 7$ mm), feting with a large ungulate limb bone shaft morphology. Even though, the relevant thickness (7 mm) of the internal side does not reach the medullar cavity or porous surface. Finally, the fourth implement (LK. 9D. 225.401) does not display any particular anatomical characteristics and has been assigned to the small-sized group (Table 1).

Table 1
Morphometry and Taxonomic description of Labeko Koba Proto-Aurignacian and Early Aurignacian retouchers.
Tableau 1
Morphométrie et description taxonomique des retouchoirs du Proto-Aurignacien et de l'Aurignacien ancien de Labeko Koba.

Levels	*N*	Piece number	Taxa	Anatom. Supp.	(L × W × T mm)	Index (L × W)	Use areas (L × W mm)	Use area (mm^2)	Scraping area (mm^2)	Modification marks (long. axis)
Proto-Aurig. (VII)	1	LK.11 C. 297.4	*Cervus elaphus*	Femur	100 × 34 × 10	2.94	14 × 13	182	–	Perpendicular
	2	LK.15G.230.47	Big	Diaphysis	62 × 32 × 7	1.93	14 × 13/18 × 9	182/162	–	Parallel/perpendicular
	3	LK.11D. 242. 142	Middle	Tibia	68 × 23 × 13	2.95	14 × 11/13 × 8	154/104	–	Perpend./perpend.
	4	LK.9D.225.401	Small	Diaphysis	85 × 23 × 10	3.69	22 × 14/24 × 12	308/288	–	Perpend./perpend.
Early Aurignacian (VI, V, IV)	5	LK.11H. 145. 67	Middle	Diaphysis	74 × 21 × 9	3.52	24 × 12	288	490	Perpendicular
	6	LK.13F. 197.243	Middle	Diaphysis	96 × 29 × 9	3.31	19 × 15/21 × 14	285/294	–	Perpend./perpend.
	7	LK.13F.207. 255	Big	Radius	104 × 35 × 16	2.97	25 × 17	425	1710	Perpendicular
	8	LK.13G.203.129	Middle	Diaphysis	41 × 40 × 8	1.025	17 × 28	476	–	Perpendicular
	9	LK.13H.159.232	Big	Diaphysis	85 × 31 × 17	2.74	15 × 15	225	–	Perpendicular
	10	LK.13H.204.330	Small	Diaphysis	55 × 22 × 11	2.5	20 × 10	200	630	Perpendicular
	11	LK.13I.139.20	Big	Diaphysis	71 × 16 × 13	4.43	–	–	–	–
	12	LK.13I.143.37	Big	Diaphysis	81 × 44 × 8	1.84	18 × 9	162	630	Perpendicular
	13	LK.13J.140. 27	*Cervus elaphus*	Humerus	113 × 38 × 10	2.97	20 × 14	280	1081	Perpendicular
	14	LK.13J.147.46	Middle	Diaphysis	60 × 30 × 10	2	10 × 5/–	50	–	Perpend./perpend.
	15	LK.13J.147.46b	Middle	Humerus/Femur	67 × 40 × 9	1.67	19 × 10	190	–	Perpendicular
	16	LK.13J.150. 62	Middle	Diaphysis	72 × 19 × 11	3.78	11 × 8	88	–	Oblique
	17	LK.13J.160.100	Middle	Diaphysis	126 × 33 × 22	3.81	25 × 12	300	1040	Oblique
	18	LK.13J.175.139	Big	Tibia	70 × 31 × 11	2.25	17 × 10/12 × 10	170/120	–	Parallel/oblique
	19	LK.13J.188.174	Middle	Diaphysis	78 × 48 × 18	1.62	15 × 17	255	440	Perpendicular
	20	LK.13K.162.15	Middle	Humerus	77 × 34 × 16	2.26	19 × 13	247	–	Perpendicular
	21	LK.15F.204.98	*Rupicapra pyrenaica*	Horn	59 × 25 × 6	2.68	8 × 6/11 × 8	48/88	–	Perpend./perpend.
	22	LK.15G.165. 63	Middle	Diaphysis	45 × 18 × 9	2.5	15 × 4	60	–	Perpendicular
	23	LK.15G.170.81	Middle	Diaphysis	71 × 35 × 11	2.02	12 × 8/18 × 10	96/180	200/200	Perpend./perpend.
	24	LK.15G.170.81b	Middle	Diaphysis	75 × 28 × 13	2.67	17 × 16	272	540	Perpendicular
	25	LK.15G.CANTIL	Middle	Diaphysis	79 × 33 × 12	2.39	16 × 14	224	–	Perpendicular
	26	LK.15H.141.13	Middle	Humerus	85 × 31 × 11	2.74	22 × 10	220	–	Perpendicular
	27	LK.15H.164.88	Middle	Diaphysis	82 × 31 × 7	2.64	18 × 8	144	–	Perpendicular
	28	LK.15H.173.122	*Cervus elaphus*	Metatarsus	92 × 38 × 13	2.42	25 × 16	400	798	Oblique
	29	LK.15I.145. 26	Middle	Diaphysis	66 × 26 × 9	2.53	22 × 15	330	525	Perpendicular
	30	LK.9D.146.170b	Middle	Diaphysis	71 × 42 × 7	1.65	18 × 14	252	–	Perpendicular
	31	LK.9D.146.170	*Cervus elaphus*	Humerus	112 × 35 × 6	3.2	14 × 8/25 × 9	112/225	–	Perpend./oblique
	32	LK.9D.180.293	Big	Diaphysis	62 × 32 × 13	1.93	13 × 16	208	–	Perpendicular
	33	LK.13 J.140. 27	*B. primigenius*/ *B. priscus*	Tibia	177 × 63 × 26	2.8	–	–	–	Perpendicular
	34	LK.13 J.175.139	*Cervus elaphus*	Tibia	67X31X9	2.16	–	–	–	Perpendicular
	35	LK.13G.177.285	*Cervus elaphus*	Humerus	73X43X7	1.69	–	–	–	Perpendicular
	36	LK.15F.167.17	Middle	Diaphysis	73X33X13	2.21	–	–	–	Perpendicular

Provenance of each tool is assured by the identification number, site (LK), square (11C, 15G, etc.), depth (from 297 to 140 cm) and number of each element in that square metre. Retoucher 29 was identified by Mújika (2000) as LK.15J.142.26, in our opinion should be identified as LK.15I.142.26.

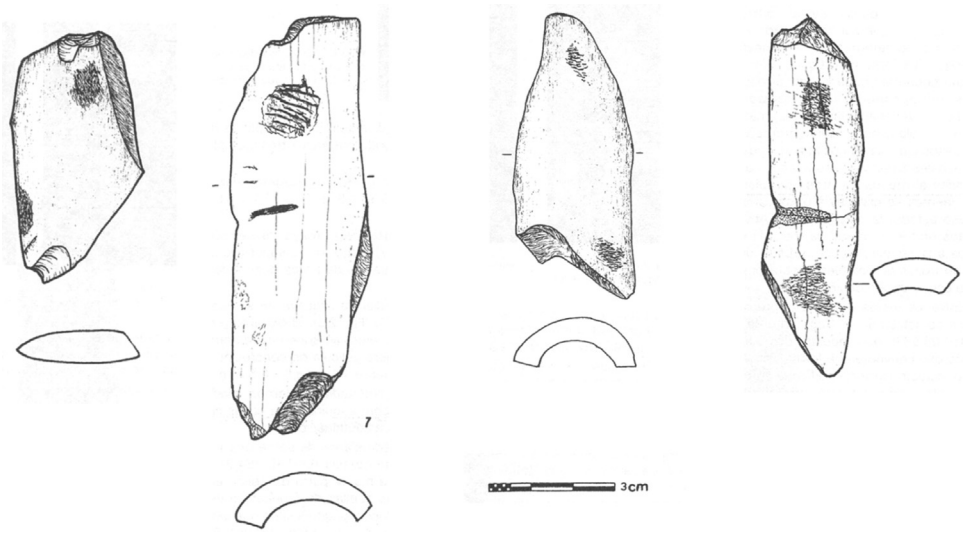


Fig. 2. Set of retouchers of level VII (Proto-Aurignacian) [drawings by J.M. Mújika, 2000 figs. 2.7, 2.9: pag. 360 and 3.2, 3.3: pag. 362].
Fig. 2. Collection de retouchoirs du niveau VII (Proto-Aurignacien) [dessins de J.M. Mújika, 2000 figs. 2.7, 2.9 : page 360 et 3.2, 3.3 : page 362].

4.3. Technological and functional analysis

The cross-section of the objects is convex-concave except for one that is semi-rectangular. They are between 62 and 100 mm long, while their width is very regular, between 23 and 34 mm, which gives the impression that the bone fragments were selected from limb bone shaft fragments produced during butchery activities (see Section 6.1) (Table 1. Fig. 2). They are between 7 and 13 mm thick. Some of the objects exhibit the traces of percussion to break the bone. This is the case of the tibia fragment of *Capra pyrenaica* (LK.11D.242.142). It was fractured by direct percussion while the bone was still fresh as shown by the helical fracture plane and the point of impact at one end of the object (Lyman, 1994). Later, the shape of the tool was modified slightly by retouching, also by direct percussion, especially at the end of the ventral and lateral face. The use areas are always on the cortical (external) face of the bone. They consist on scores nearly always with V-shaped cross-sections that may be symmetrical or more often asymmetrical and of variable depth, from very fine notches to others that cut deeply into the bone (Fig. 3). The lack of symmetry in the incision planes indicates the direction in which the tool penetrated in the bone matter (abrupt plane) and the extraction of the matter that this caused (extraction plane) as it came out (Malerba and

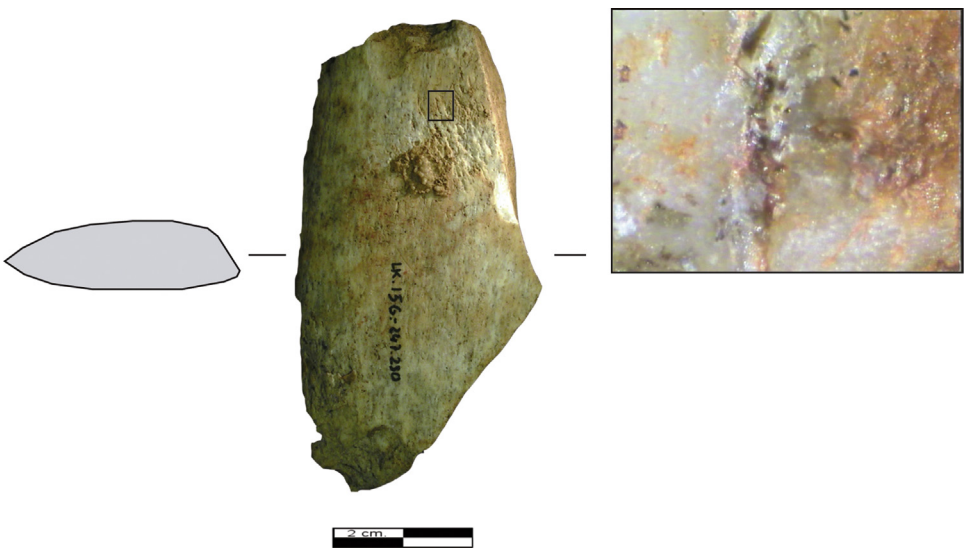


Fig. 3. Retoucher from level VII (Proto-Aurignacian) on diaphysis of big mammal with detail of use stigmata (right, magnification 90 ×).
Fig. 3. Retouchoir du niveau VII (Proto-Aurignacien) sur une diaphyse d'un grand mammifère ; détail des traces d'usure (à droite, agrandissement × 90).

Giacobini, 2002; Mallye et al., 2012). Microscopic observation systematically appreciates a series of fine striations that start on the edge of the extraction plane and correspond, as has been shown experimentally, to the slippage of the lithic tool when it comes out of the bone matter, in this way indicating the use of kinematics. The same traces have been described on Aurignacian retouchers at sites like Isturitz, La Ferrassie and Castanet (France) (Castel et al., 2003; Schwab, 2002; Tartar, 2009). Inside of the scores, flint particles still conserved, visible with a microscope, have been described at other sites, proving that these bone tools were used with lithic materials (e.g., Abrams et al., 2014; Mallye et al., 2012).

The use-wear marks are arranged in more or less oval areas. Three retouchers have two areas on their surface while the fourth has only one. After end butchery process, including bone breakage with marrow extraction purposes, no preparation before the use of the objects can be observed. The size of the use areas is very homogeneous, both among the different retouchers and on those retouchers with two use areas. They are between 24 and 13 mm long and 14 and 9 mm wide (Table 1). The double areas are always at opposite ends of the objects and the distances between them range from 42 to 32 mm. The distance from the use areas to the ends of the retouchers varies from 2 to 23 mm. The latter parameter shows that there is no generalised laterality of the use areas as recognised at other Aurignacian sites like La Ferrassie (Castel et al., 2003). At Labeko Koba, in contrast, some use areas are found near to one of the edges of the object whereas others are more or less central. Except for one of the two use areas on one object, whose scores are vertical (parallel to the long axis of the object) (LK.15G.230.47), the other six use areas display horizontal scores (perpendicular or slightly oblique to the long axis). The direction of the scores is directly related to the direction of the object when in use, as its long axis may be held perpendicular to the lithic edge (horizontal scores) or parallel to it (vertical scores) (Schwab, 2002, 2014; Vincent, 1993).

The use intensity of the retouchers is one of the most often discussed aspects of these objects. It can be assessed by measuring two parameters: the size of the use area and the penetration in the matter caused by their use, according to the experimental data offered by some researchers (Mallye et al., 2012). It has been seen that the use areas on these retouchers are relatively homogeneous in size, and this does not depend on the size of the objects, as the largest retoucher (100 × 34 × 10 mm) has a smaller use area than some smaller retouchers from this level (e.g., LK.9D.225.401). At the same time, the formation of only one of the six use areas has involved the modification of the natural bone surface, causing a relatively large pitted area. However, the length of the implement would have allowed its use to continue, by starting a new use area at the opposite end, but this did not happen. The sizes indicate that the retouchers were used with a similar intensity, and this was, in any case, exhaustive. A use fracture affected the active zone in only one retoucher (LK.15G.230.47) but did not stop the object being used as shown by the fracture plane that cuts the use-wear marks. In the other retouchers, no use fracture affected the development of the use areas.

5. Retouchers in the Early Aurignacian levels (levels VI, V and IV)

Retouchers form practically the whole osseous industry assemblage in the Early Aurignacian levels at Labeko Koba (Mújika, 2000: 373). The sample consists of 32 retouchers, one of which was also used as an intermediary piece (LK.13G.203.129) (Mújika, 2000: 364). The other objects are a smoothing tool and a distal end, possibly of an awl (Mújika, 2000; Tejero, 2013). The number of retouchers in each level is level VI, NR = 4; level V, NR = 12, and level IV, NR = 16 (Table 1).

5.1. Preservation and taphonomic aspects

Like the objects from the Proto-Aurignacian level, most of the retouchers in the Early Aurignacian levels show different degrees of alteration of the bone. These levels were also affected by water action to a greater or lesser extent (Arrizabalaga, 2000a: 66). This has caused the erosion of the outer cortical tissue of the bones, but very few of the use areas of the retouchers have suffered damage. Some of the objects also display solution pits (Villaluenga, 2013). This type of erosion is related to biochemical processes (the solution of elements in the bone tissue by the circulation of acidic solutions), related to low intensity water action (the objects were exposed to water or conditions of high humidity at the time of their deposit or after becoming buried) (Laafar, 1994). However, the alterations have only affected the interpretation of four of the retouchers, where calcite and/or erosion on the external surface of the bones have affected the use areas (the objects LK.15H.164.88; LK.13 J.188.174; LK.13I.143.37; and LK.13F.197.243). Taphonomic alterations have not prevented the measurements of the use areas. Most of the objects are complete, just in three cases postdepositional fractures have been identified (LK.9D.146.170; LK.13G.203.129 and LK.9D.180.293), and the last one also revealed recent post-depositional fracture (excavation or storage accident).

5.2. Taxonomical and anatomical identification

None of the four retouchers found in level VI could be taxonomically identified. However, two of them have been classified as a medium-sized ungulate, and in each case limb bone shaft fragments were used as support. Fourth tool (LK. 9D.180.293; 62 × 32 × 13 mm) would have been made on a large animal bone fragment. Twelve retouchers have been identified in level V, it has been possible to ascribe two of them to a species and anatomical element, LK.15H.173.122 and LK. 9D.146.170 correspond to *C. elaphus* metatarsal and humerus shafts. Exceptionally, a third retoucher/pressure-flaker (LK.15F. 204. 98) was made on a *R. pyrenaica* horn fragment. The other seven objects could not be identified, although according to their size and shape, three of them should produce on large ungulates limb bone shafts, including two tibia fragments. Finally, the last tool was made on a medium-sized ungulate large shaft fragment (LK.13F.197.243; 96 × 29 × 9 mm). Out of 16 retouchers in level IV, a single tool (LK. 13 J.140.27) could

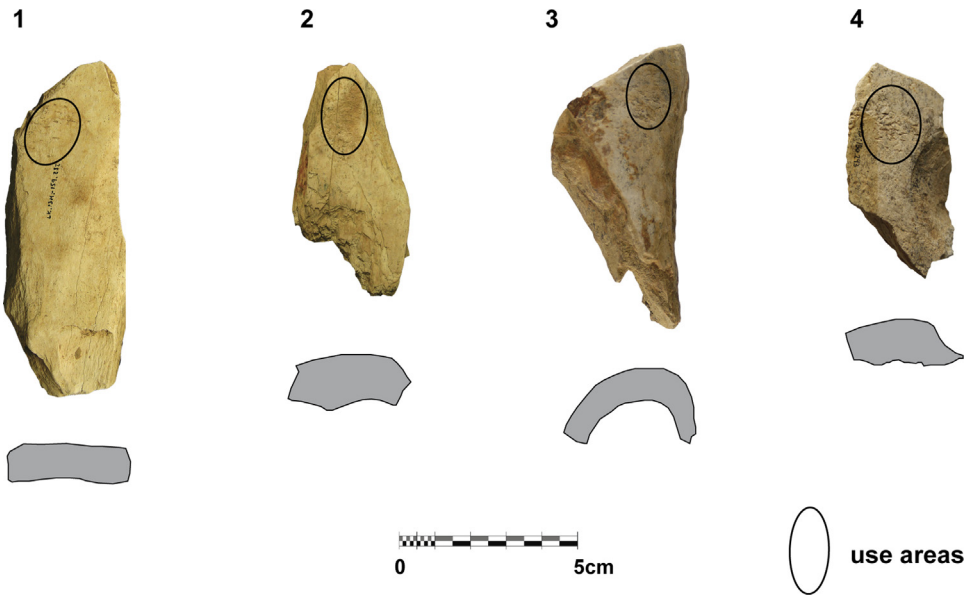


Fig. 4. Retouchers of Early Aurignacian levels with indication of use areas. 1–3, level IV; 4 level VI.
Fig. 4. Retouchoirs des niveaux de l'Aurignacien ancien, indication des zones d'usure. 1–3, niveau IV ; 4 niveau VI.

be taxonomically classified as a medial tibia of a large bovid (*B. primigenius* or *B. priscus*). The other fifteen pieces were classified according to their size. Eight of them were made on medium-size ungulate bone fragments, including three humerus or femur fragments. A single piece was made on a large animal shaft, and it was not possible to determinate the support of the remaining eight implements. In two cases due to the small size and other two cases, bone surface modification caused by dissolution did not allow an accurate identification (Villaluenga, 2013).

5.3. Technological and functional analysis

The objects are always formed by between a half and a quarter of the total circumference of the bone shaft. They are, therefore, convex-concave in cross-section, while some of them tend towards rectangular (Fig. 4). The lengths of the retouchers vary from 41 to 177 mm; the widths from 16 to 63 mm, and the thicknesses from 6 to 26 mm. The use areas are on the external bone surface of all the retouchers. The marks are grouped in areas with an oval shape; 23 of the objects possess a single use area, whereas the other six display two areas. In the latter cases, the active areas are at opposite ends of the objects (proximal and distal areas). The size of the use areas ranges from 8 to 25 mm in length and from 4 to 28 mm in width (Fig. 5). The maximum distance between the areas and the nearest end of the object is 18 mm, while the minimum distance is 2 mm. The retouchers with double use areas display a separation between the areas varying from 12 to 42 mm. Except for the area on one object with vertical impressions (parallel to the long axis of the bone), in the other 34 use areas, the traces associated with the use of the bone are horizontal (perpendicular or slightly oblique to the long axis). A total of 15 of the 35 active zones were prepared by scraping before the objects were used. In these cases, the scraping was parallel to the long axis of the bone. The time when the scraping was carried out, which was always before the retouchers were used, is shown by the superimposition of the use marks, as the functional scores are always above the scrape marks (Figs. 6 and 7). The initial observation of the size and shape of the scraped areas, which are always associated with the active zones and only seen beneath the use marks, leaves no doubts about their technical nature. The measurement of the size of the scraped surfaces, about the areas that they contain, supports this observation. All the use areas occupy between 20 and 40% of the area previously scraped. This result means the idea that the scraping was related exclusively to processing the meat on the bones, as proposed for retouchers from some Mousterian sites (Daujeard et al., 2014) can be discarded. The scraping did not occur before the preliminary fracturing of the bone, which is logical as the point of impact is not seen in this part of the bone shaft. In contrast, the effect of the scraping on the cross-section of the bones is inappreciable. Therefore, its purpose was not to regularise the surface or prepare a working plane but was probably to eliminate remains of the periosteum and/or fat or meat, which might affect the functionality of the retoucher. The size of the areas, which is always small in comparison with the available surface areas of the bone fragments, and the faintness of the use marks show that these retouchers were not used until they became exhausted. Five of them present a moderate impact on the active surface (with a slight modification of the cross-section of the bone) and only one retoucher exhibits pits in the active areas indicating an intense use involving a change to the curvature of the external surface (Mallye et al., 2012). This object was also used as an intermediary piece. In the other bones with traces, the functional, technical action did not change the external shape of the bone. The four retouchers with fractures on their edges affecting the development of the use areas were abandoned without

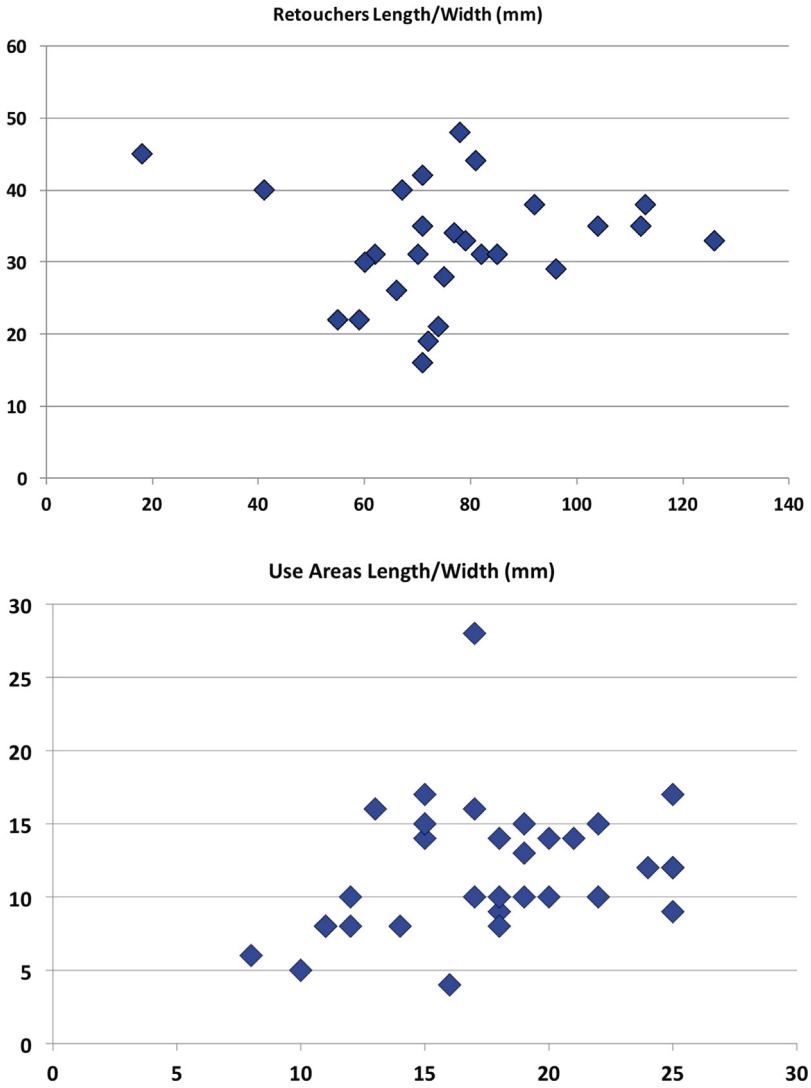


Fig. 5. Morphometric features of retouchers of Early Aurignacian levels (VI, V, IV). Ratio length/width of the retouchers blanks.
Fig. 5. Caractéristiques morphométriques des retouchoirs des niveaux de l'Aurignacien ancien (VI, V, IV). Proportion longueur/largeur des zones d'usure.

using the opposite end of the bone fragment, which was still functional.

6. Discussion

6.1. Raw material procurement

Three variables have been analysed to discriminate possible operational patterns in procuring bone fragments exclusively intended to be used as retouchers, from those related to the fracturing of bones for nutritional purposes. First is the correspondence between bone shafts used as retouchers, in comparison to most frequent anatomical element and taxa abundance per level (Tables 6 and 7). Second considers bone retouchers supports fracture pattern (Fig. 8) against limb bone shafts. Finally, third assesses the size and shape of the retouchers in relation to the rest of the bone fragments. Nearly all supports were ungulate limb bone shafts, specific areas with a concave profile in their external face were selected (where the use areas are located). This morphology is common to all studied levels (VII, VI, V and IV) and should be in connection with the functionality of the objects. On this point, some authors have suggested that they were used to re-sharpen lithic tools (Mallye et al., 2012; Patou-Mathis et al., 2002). In the case of Labeko Koba in the following point are considered the possible ways in which these objects were used. A comparative analysis of retouchers taxonomical attribution and taxa abundance in each level at Labeko Koba (see Table 6) shows that bone supports belong to most frequently hunted animals (bovids, *C. elaphus* and *E. ferus*). In consequence, in VI, V and IV levels, bovid bones were chosen. However, for level VII, there is no correspondence between the most common taxa (*E. ferus*), and the fragments chosen as blanks for the retouchers (bovid bones). Nevertheless, the large amount of remains brought

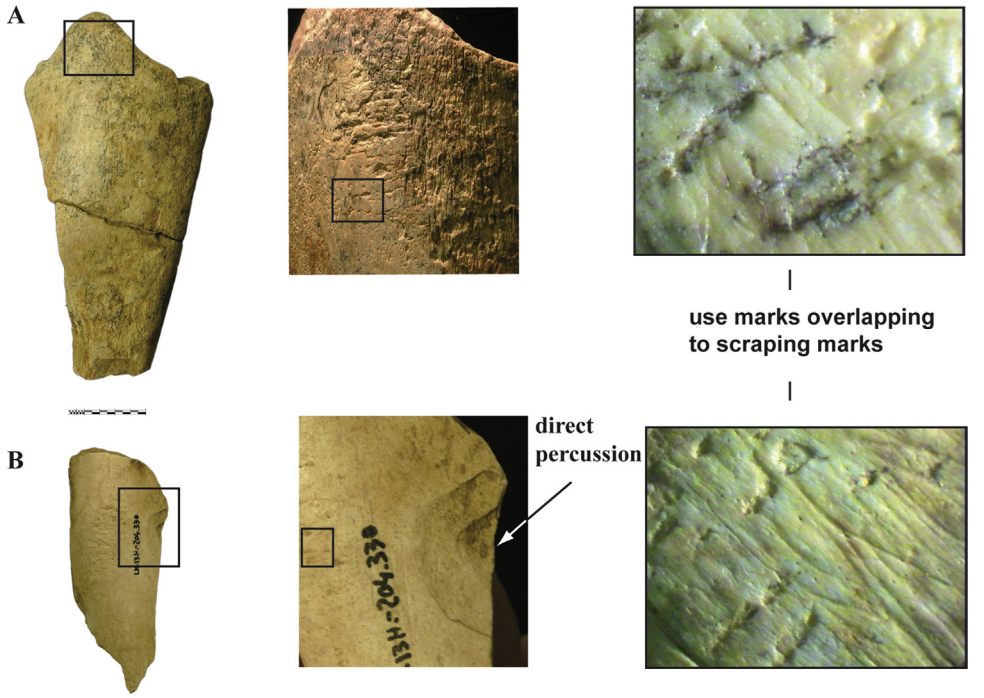


Fig. 6. Detail of use stigmata of two retouchers of level IV (A) and level VI (B). Note that use marks overlapping the scraping marks showing the sequence of preparation and use of retouchers (Magnification detail 20 ×). On bottom, detail of impact point to fracture the bone by direct percussion.
Fig. 6. Détail des traces d'usure de deux retouchoirs du niveau IV (A) et du niveau VI (B). Notez que les marques d'usure chevauchent celles de raclages (*scraping*), démontrant la séquence de préparation et d'usure des retouchoirs (augmentation détail × 20). En bas, détail du point d'impact de la fracture de l'os par percussion directe.

by carnivores (*Crocuta crocuta spelaea*) and the remains of *Ursus spelaeus*, (Villaluenga, 2013) have completely altered the taxonomical composition of this level, which hinders its direct comparison with the other three assemblages (levels VI, V and IV) of exclusively anthropogenic origin. At the same time, in the upper levels (VI, V and IV) a clear correlation is seen between the animals hunted and the source of the retouchers, as bovids became increasingly important in the faunal assemblage (42.99% NISP in level IV and 71.25% NISP in level IV). In general terms, bones from large and medium size ungulates are used more than those from small ungulates (see Tables 2, 3, 4 and 5). Most of the objects display marks caused by breaking the bones by direct percussion on the fresh bone, with helical fracture planes and impact marks (Lyman, 1994). These kinds of fractures are identical to those seen on bone fragments not selected to be used as retouchers (remains of consumed animals) (Villaluenga, 2013). Therefore, at Labeko Koba, as at most sites with retouchers, both Aurignacian and Mousterian (e.g., Giacobini and Malerba, 1996; Mallye et al., 2012; Schwab, 2002; Vincent, 1993), there does not

Table 3
Labeko Koba level VI (Early Aurignacian). Length/width index of the bone fragments.
Tableau 3
Niveau VI de Labeko Koba (Aurignacien ancien). Index des longueurs/largeurs des fragments d'os.

Level VI	NR	L/W average	L/W min.	L/W max.
Bovidae	16	2.71	1.11	4.56
Equus ferus	1	1.52	–	–
Not determinable	12	2.21	1.18	3.44
Overall	39	2.14	1.14	4.00

Table 2
Labeko Koba level VII (Proto-Aurignacian). Length/width index of the bone fragments.
Tableau 2
Niveau VII de Labeko Koba (Proto-Aurignacien). Index des longueurs/largeurs des fragments d'os.

Level VII	NR	L/W average	L/W min.	L/W max.
Bovidae	20	2.75	0.97	4.04
Cervus elaphus	11	3.05	1.29	4.46
Equus ferus	5	2.26	1.59	3.84
Rupicapra pyrenaica	1	4.88	–	–
Not determinable	11	2.01	1.04	4.02
Overall	48	2.99	1.22	4.09

Table 4
Labeko Koba level V (Early Aurignacian). Length/width index of the bone fragments.
Tableau 4
Niveau V de Labeko Koba (Aurignacien ancien). Index des longueurs/largeurs des fragments d'os.

Level V	NR	L/W average	L/W min.	L/W max.
Bovidae	30	2.48	0.81	6.24
Cervus elaphus	10	2.94	1.85	4.37
Equus ferus	7	2.57	1.49	5.20
Rupicapra pyrenaica	1	3.74	–	–
Not determinable	25	2.42	1.18	7.44
Overall	73	2.83	1.33	5.81

Table 5
Labeko Koba level IV (Early Aurignacian). Length/width index of the bone fragments.
Tableau 5
Niveau IV de Labeko Koba (Aurignacien ancien). Index des longueurs/largeurs des fragments d'os.

Level IV	NR	L/W average	L/W min.	L/W max.
Bovidae	37	2.35	0.45	4.43
Cervus elaphus	6	1.95	1.93	3.5
Equus ferus	8	2.85	1.22	4.04
Rangifer tarandus	1	2.40	–	–
Not determinable	59	2.27	1.01	4.52
Overall	111	2.56	1.15	4.12

appear to be a specific fracturing of bones to make retouchers. Citations to a particular debitage of long bones to make objects of a certain size that were later used as retouchers have only been made for the Mousterian levels at the site of Axlor (Spain) and Scladina Cave (Belgium) (Abrams et al., 2014; Mozota, 2009).

The shape of selected bone fragments (see above) is elongated, however, elongation index reveals a high variation (since level IV, L/W = 0.45 to level V, L/W = 5.2). Considering the mean ratio of bovid bones (the largest group, 103 shaft fragments) elongation index decreases slightly, from a ratio of 2.75 in level VII to 2.35 in level IV. This change is thought to indicate a more intense use of the bone remains. A comparison between shaft and retouchers length (L/W index) in VII, VI and V levels, shows how shaft fragments are longer than the retouchers. Nevertheless, opposite pattern appears in level IV. This level yielded the largest number of retouchers (NR = 17) and limb bone diaphysis fragments (shafts) with anthropogenic modifications (NISP = 111), in this set of remains, implements (retouchers) are slightly more elongated than shafts (mean L/W = 2.69 and 2.56, respectively) (Fig. 8). This inversion in L/W index the length of the fragments and tools can be related to the techno-functional change in use of bone raw material at Labeko Koba (Fig. 8). In early Aurignacian chrono-cultural contexts (VI, V and IV), bones were used as fuel. As an example, only in the later stage of early Aurignacian (level IV) have been identified 1671 burnt fragments. Furthermore, the length of 1560 fragments is below 3 cm. This behaviour consisted of the selection of diaphysis and epiphysis fragments and systematic fragmentation to expose the highest quantity of bone tissue to fire (Villaluenga, 2013; Villaluenga et al., 2012; Yravedra et al., 2005) (Tables 6 and 7). This practice, also observed at other sites, both Mousterian and Upper Palaeolithic in age, and characterised experimentally (e.g., Costamagno et al., 2005; Théry-Parisot et al., 2004; Villa et al., 2002) at Labeko Koba might reflect technical behaviour related to an increasingly cold climate (Iriarte-Chiapuso, 2000). Otherwise, preservation of certain number of shafts to be, some of them, used as bone retouchers indicate a particular behaviour among EUP humans.

6.2. Retouchers and their relationship with the lithic assemblage

The site of Labeko Koba was excavated in the course of a salvage operation, but the most careful methodological procedures were observed, and all the sediment was sieved with water, which means the results obtained in the study of the lithic assemblage can be regarded as representative. The deposit contained a large number of remains of lithic reduction (over 22,000 pieces, of which nearly 1500 are tools) in its different levels. The levels with the largest number of objects are levels V and IV (Early Aurignacian) and VII (Proto-Aurignacian), in that order. However, the massive presence of Dufour backed bladelets in the latter level

Table 6
Taxonomical distribution of Labeko Koba, NISP and MNI.
Tableau 6
Distribution taxonomique de Labeko Koba, NISP et MNI.

Levels	Level VII		Level VI		Level V		Level IV		Level III		Overall	
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Bovini	111	7	175	6	161	5	290	7	4	1	741	26
Cervus elaphus	79	7	59	5	13	2	29	3			180	17
Equus ferus	183	9	36	4	53	4	61	1	12	1	345	19
Rangifer tarandus			1	1	1	1					2	2
Megaloceros giganteus	2	1			1	1					3	2
Capreolus capreolus	2	1			1	1					3	2
Mammuthus primigenius	6	1			5	1	6	1			17	3
Sus scrofa	1	1									1	1
Rupicapra pyrenaica	23	2	4	1	8	2	7	2			42	7
Sub-overall	405	29	275	17	238	17	393	14	16	2	1327	79
Canis lupus	2	1	2	1			1	1			5	3
Vulpes vulpes	22	3	67	5	16	1	6	1			111	10
Alopex lagopus	1	1									1	1
Crocuta crocuta	128	11	43	3	9	1	2	1	1	1	183	17
Felis silvestris	1	1					1	1			2	2
Ursus spelaeus	338	15	20	2			4	1			362	18
Sub-overall	492	32	132	11	25	2	14	5	1	1	664	51
Determinable	897	61	407	28	263	19	407	19	17	3	1991	130
Non-determinable non-burned fragments	81		47		213		611		10		962	
Non determinable burned fragments	298		113		1053		1671		136		3271	
Overall	1276		567		1529		2689		163		6224	130

Table 7
Labeko Koba taxonomical percentage distribution (%NISP and %MNI).
Tableau 7
Pourcentage de la distribution taxonomique de Labeko Koba (%NISP et %MNI).

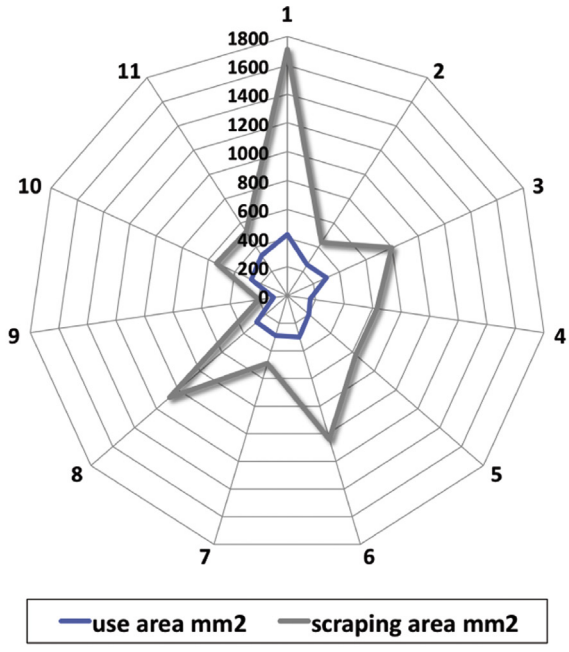
Layers	Level VII		Level VI		Level V		Level IV		Level III		Overall	
Percentage	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI
Bovini	12.37	11.47	42.99	21.42	61.21	26.31	71.25	36.84	23.52	33.33	11.18	20
Cervus elaphus	8.8	11.47	14.49	17.85	4.94	10.52	7.12	15.78			2.89	13.07
Equus ferus	20.4	14.75	8.84	14.28	20.15	21.05	14.98	5.26	70.58	33.33	5.54	14.61
Rangifer tarandus			0.24	3.57	0.38	5.26					0.03	1.53
Megaloceros giganteus	0.22	1.63			0.38	5.26					0.04	1.53
Capreolus capreolus	0.22	1.63			0.38	5.26					0.04	1.53
Mammuthus primigenius	0.66	1.63			1.9	5.26	1.47	5.26			0.27	2.3
Sus scrofa	0.11	1.63									0.01	0.76
Rupicapra pyrenaica	2.56	3.27	0.98	3.57	3.04	10.52	1.71	10.52			0.67	5.38
Overall	45.15	47.54	67.56	60.71	90.49	89.47	96.56	73.68	94.1	66.66	21.32	60.76
Canis lupus	0.22	1.63	0.49	3.57			0.24	5.26			0.08	2.3
Vulpes vulpes	2.45	4.91	16.46	1.22	6.08	5.26	1.47	5.26			1.78	7.69
Alopex lagopus	0.11	1.63									0.01	0.76
Crocuta crocuta	14.26	18.03	10.56	0.73	3.42	5.26	0.49	5.26	5.88	33,33	2.94	13.07
Felis silvestris	0.11	1.63					0.24	5.26			0.03	1.53
Ursus spelaeus	37.68	24.59	4.91	0.49			0.98	5.26			5.81	13.84
Sub-overall	54.84	52.45	32.43	39.28	9.5	10.52	3.43	26.3	5.88	33,33	10.66	39.23
Determinable	70.29		71.78		17.2		15.13		10.42		31.98	100
Non-determinable fragments	6.34		8.28		13.93		22.72		6.13		15.45	
Non-determinable burned fragments	23.35		19.92		68.86		62.14		83.43		52.55	
Overall	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.98	99.98	99.99	100	100

means that it is the one with the most tools. Flint is by far the most common raw material in all the levels, and its percentage only reduces slightly (85%) in the Chatelperronian layer (lower level IX). The main sources for the flint were in the Ebro valley (the Urbasa and Treviño Outcrops, both of them about 30 km far away from Labeko Koba), on the other side of the Atlantic/Mediterranean watershed from the site of Labeko Koba (Tarriño, 2000).

From its start, the Labeko Koba lithic assemblage is dominated by a high proportion of blades. Indeed, the percentage of blades decreases from the oldest levels (over 72% of the whole objects) to the most recent one (over 41%). Regarding fragments of blades and bladelets, the evolution is similar. Contradictory with this inverted leptolithisation process, linear and punctiform butts, which are associated with microblade lithic reduction, display an evolution in accordance with what might be expected and steadily become more common (Fig. 9). The levels in Labeko Koba contained very different numbers of lithic tools, and only three of them (VII, V and IV) have yielded enough for a statistically significant analysis. However, the evolution in modes of retouching is very consistent, at the site itself

Table 8
Summary of the retouchers features of Proto-Aurignacian (level VII) and Early Aurignacian (levels VI, V, IV) of Labeko Koba.
Tableau 8
Résumé des caractéristiques des retouchoirs du Proto-Aurignacien (niveau VII) et de l'Aurignacien ancien (niveaux IV, V, VI) de Labeko Koba.

Techno-complex	Retouchers features
Early Aurignacian	
Raw material	Raw material procurement is linked to food activities
Debitage	Technical *débitage* is not documented. Bones were broken to access to bone marrow. Blanks were selected among the fragment of long bones
Taxonomical support	Correlation between taxa hunted and consumed (bovids, red deer, horse) and bones selected for use as retouchers
Anatomical support	Correlation between anatomical parts (limb bones with a preference for the humerus and femur) and anatomical parts used as retouchers
Use areas	Most of retouchers show a single use area with oval shape. Stigmata of use are mostly perpendicular to the long axis of the object. 15 of 35 use areas were prepared previously to their use by scraping the bone surface
Functionality	Likely used to pressure knapping of carinated endscraper-type core and retouch and/or reshape of lithic implements
Intensity of use	The retouchers were not use until they became exhausted. The cross-section of the bone is slightly modificated
Objects maintenance	Maintenance is not documented
Proto-Aurignacian	
Raw material	Raw material procurement is linked to food activities
Débitage	Technical *débitage* is not documented. Bones were broken to access to bone marrow. Blanks were selected among the fragment of long bones
Taxonomical support	Preference for bones of bovids for use as retouchers while horse is the most abundant species in the faunal assemblage
Anatomical support	Tibia and femur are the anatomical parts documented as support for retouchers
Use areas	Three of four retouchers have two use areas with oval shape. All use areas, with exception of one, display perpendicular scores. No previous preparation of use area has been documented
Functionality	Likely used to pressure knapping of prismatic cores and retouch and/or reshape of lithic implements
Intensity of use	The use intensity of retouchers is not exhaustive
Objects maintenance	Broken bone objects are rejected. Maintenance is not documented



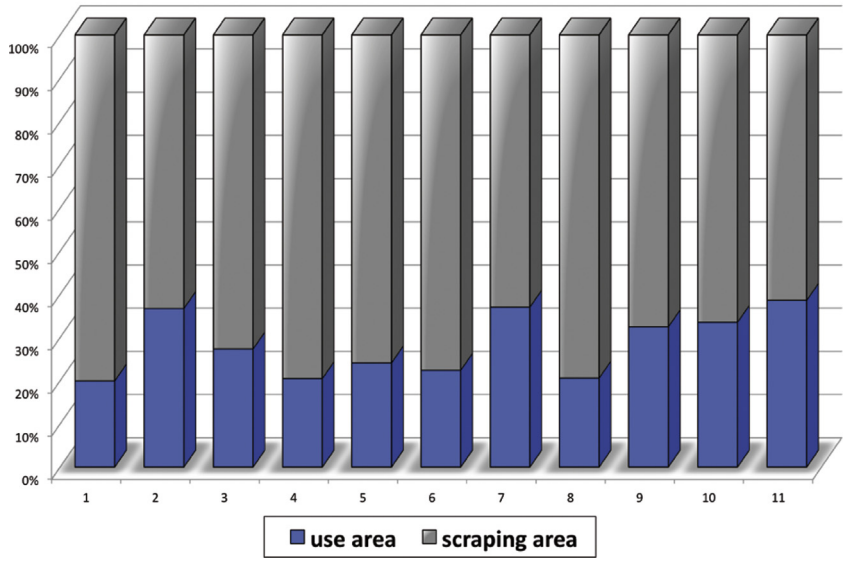


Fig. 7. Morphometric features of retouchers of Early Aurignacian levels (VI, V, IV). Ratio between use areas and scraping areas (on top, extension of both areas in mm^2).
Fig. 7. Caractéristiques morphométriques des retouchoirs de l'Aurignacien ancien (niveaux VI, V, IV). Proportion entre les zones d'usure et zone de raclage (en haut : dimensions des zones en mm^2).

and on a more regional scale. Thus, the abrupt mode, basically on backed bladelets, is very common in Labeko Koba Proto-Aurignacian level (VII) at the expense of the simple mode. From level VI to the top of the sequence (all of them associated with Early Aurignacian), the simple mode increases whereas the abrupt mode is gradually replaced (by the burin mode in level VI, as well as by the simple mode) (Fig. 9). This evolution runs parallel to the classic characterisation of the Early Aurignacian, the abundance of endscrapers and blades or bladelets with simple retouching. In our opinion, the link between the most common elements in the osseous assemblage (retouchers on long bone shaft fragments) and lithic retouch is directly related to the typological characteristics of lithic assemblage.

6.3. *Regarding diachronic variability*

The comparison of the data obtained by this study will allow any differences and similarities between the Proto-Aurignacian and Early Aurignacian retouchers at Labeko Koba to be identified (Table 8). The first detail is the number of objects found in each of the periods

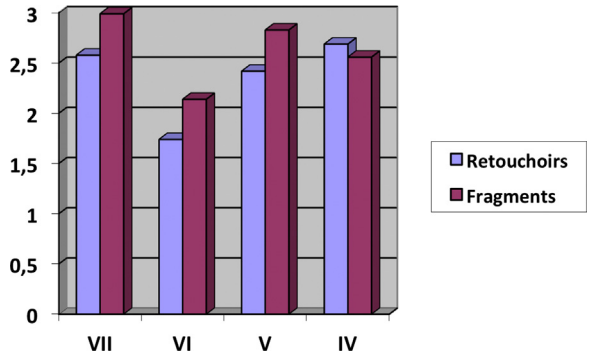


Fig. 8. Ratio between the retouchers of Early Aurignacian (levels VI, V, IV) and fragments of bone without anthropic modification.
Fig. 8. Proportion entre les retouchoirs de l'Aurignacien ancien (niveaux VI, V, IV) et les fragments d'os sans modification anthropique.

represented at the site. As described above, the study of the lithic and osseous assemblages reveals changes in the intensity of occupation through different phases, including a more intensive occupation in the Proto-Aurignacian than in the Early Aurignacian. This assumption is proportionally inverse to the number of retouchers in each level. Indeed, the number of retouchers in level VII (Proto-Aurignacian) is identical to its number in level VI, the horizon with lowest occupational intensity (level VI, NR = 4). This cannot be explained regarding a mere preference for the use of this kind of tool in the Early Aurignacian, as numerically large assemblages are known since Middle Palaeolithic. It seems more likely that the unequal proportions of retouchers at Labeko Koba in the different levels reflect certain variability in the modes of lithic technology. The varying retouch mode (the abrupt mode in the Proto-Aurignacian

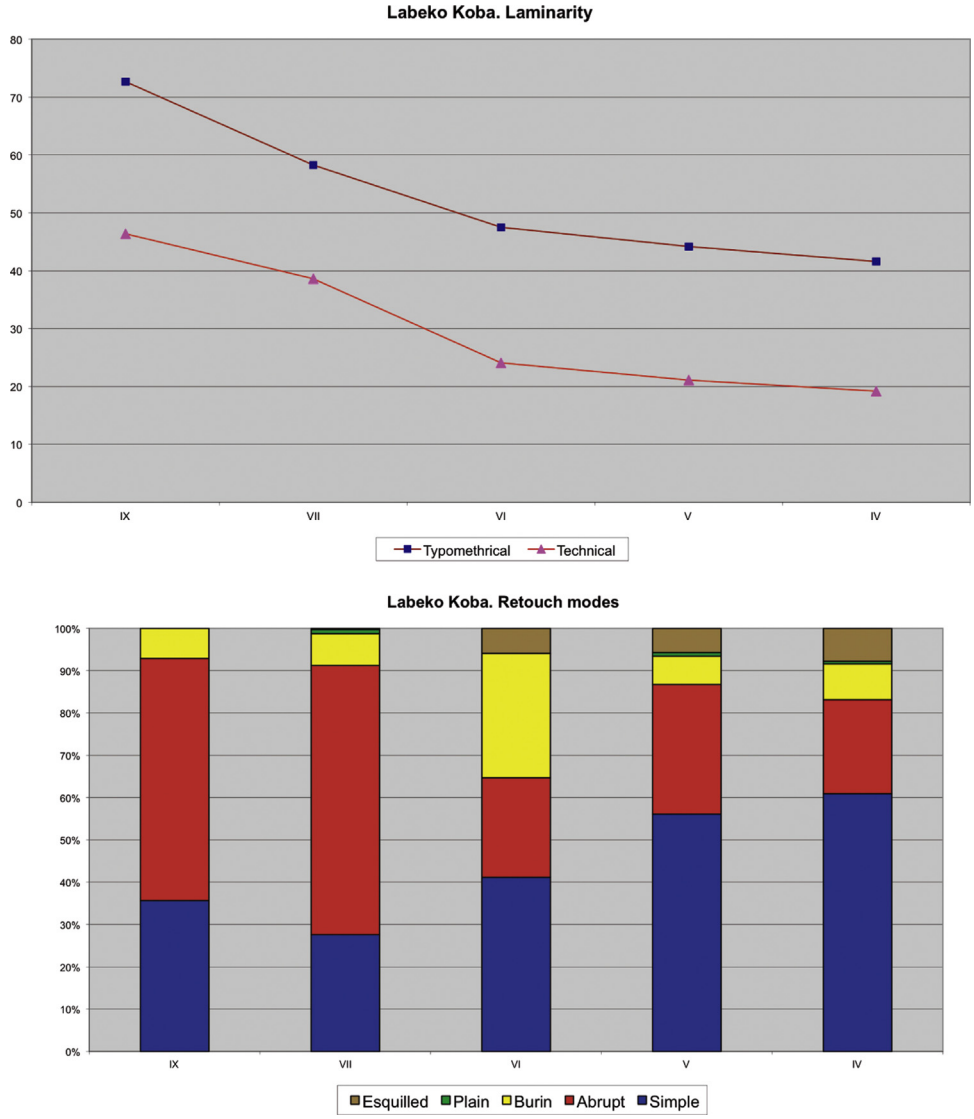


Fig. 9. General description of the lithic assemblage dynamics at Labeko Koba. On top: Evolution of Laminarity (Typological and technical). On bottom: retouching modes (simple, Abrupt, Burin, Plain, Esquilled).
Fig. 9. Description générale des dynamiques d'assemblage lithique de Labeko Koba. En haut : évolution de la laminarité (typologique et technique). En bas : modes de retouches (simple, abrupte, burin, plan, écaillé).

and the burin mode in Early Aurignacian) may, therefore, contribute to explain the different numbers of retouchers in each level. Taxonomical and anatomical choice of bones to be used as retouchers also varied significantly between the Proto-Aurignacian and Early Aurignacian levels. In the latter (levels VI, V and IV) a strict correlation exists between the species hunted and consumed (bovids, *C. elaphus* and *E. ferus*), middle size ungulates and selected anatomical elements (limb bones with a preference for the humerus and femur). In contrast, Proto-Aurignacian groups preferentially selected large size ungulate limb bone fragments, the horse is most abundant species in the faunal assemblage (Table 6). However, it should be borne in mind that the small number of objects and the possible taphonomic bias caused by the impact of carnivores in level VII might influence this view (see Section 6.1).

Regarding the size and shape of the retouchers, variation is seen in their size, although in this case it is not diachronically linear. Thus, the size of shaft fragments is larger than the fragments selected for use as retouchers in levels VII, VI and V. However, in level IV, the retouchers are larger than the general shaft fragments. The inversion in the trend does not take place in the change from the Proto-Aurignacian to the Early Aurignacian occupations, but instead is identified in the upper part of the sequence. This apparent change in the pattern of choice of bones may be related to paleoenvironmental conditions. Palynological data confirm that level VII formed in more temperate conditions than the upper part of the sequence, gradual worsening in the climate (stadial taxa and the low proportion of arboreal species) (Iriarte-Chiapuso, 2000). As a consequence during late occupations (levels V and IV) bone remains were smashed to be used as fuel, with a single exception, shafts used as bone retouchers support (Villaluenga et al., 2012; Yravedra et al., 2005). The last difference between Proto-Aurignacian and Early Aurignacian retouchers in Labeko Koba is seen to be in the work surfaces conditioning. None of the use areas on the Proto-Aurignacian retouchers displays any traces of the preparation of the active area, may be explained by the size of the sample (NR: 4). In contrast, out of the 35 use areas on the Early Aurignacian retouchers, 15 were prepared by scraping (use marks are superimposed to scraping marks) (Fig. 7). It should be noted that these differences between the Proto-Aurignacian and Early Aurignacian retouchers at Labeko Koba do not correspond to increasing complexity in the form of this kind of object. From a strictly technological point of view, retouchers in each techno-complex display no conceptual differences, as neither do the Mousterian retouchers (Daujeard et al., 2014). In all cases, they are tools whose volume is not shaped specifically, except Mousterian levels at Axlor (Mozota, 2009) and Scladina Cave (Abrams et al., 2014). Tasks in which retouchers were used required minimal technical requirements (size, shape, weight...), moreover abundance of shafts produced during butchery process produced a great availability of appropriate supports, made an exclusively technical fragmentation unnecessary. Finally, morpho-technical characteristics manifest a correspondence between Proto-Aurignacian and Early Aurignacian objects. Traces characteristics and orientation, perpendicular or slightly oblique, to the long axis of the bone, show no significant differences in kinematics, intensity and duration of the activities (Fig. 9).

7. Conclusion

The study of the bone retouchers in the Proto-Aurignacian (VII) and Early Aurignacian (VI, V and IV) levels at Labeko Koba has provided data about the selection, technological aspects and functionality of these objects. The interaction between faunal, lithic and osseous studies has being proved efficient in the assessment and determination of technical, subsistence and behavioural traits of the EUP occupations at the site. It must be mentioned that no specific technical operative scheme to obtain the supports to be used as retouchers has been identified at Labeko Koba. Bone fragments were selected from amongst butchery process leftovers. The retouchers in both technocomplexes at Labeko Koba were used in response to an immediate need and then abandoned, without exhausting their potential. This behaviour of the occupants of the site is undoubtedly connected with the abundance of raw material. The selective use of limb shafts from consumed fauna can be integrated within a wider pattern of use, which culminated with the use of smashed bones as fuel (Yravedra et al., 2005). The functionality of the Labeko Koba retouchers appears to have been determined by the lithic retouch modes documented at the site.

Finally, exploitation of bone fragments in the EUP levels at Labeko Koba, cannot be regarded as complex (contra Abrams et al., 2014). Selection, occasional shaping (only seen in three retouchers at Labeko Koba) and surface preparation (scraping) of use areas, are not sufficient to consider this transformation as complex from a technical viewpoint. Late Mousterian and EUP archaeological record display continuity in the bone uses patterns. Conceptual break (exclusively technical use, complex and complete transformation of a block of raw material by a combination of diverse techniques and procedures) is documented from the Early Aurignacian onwards (Tejero, 2014; Tejero and Grimaldi, 2015). Only after, generalised and systematic use of the antler marked a turning point in the use of organic raw materials with an animal origin. However, this should not motivate a simplistic and unilinear view, as the use of osseous matter to make symbolic objects or personal adornments and complexity in the transformation of abiotic raw materials (stone) was clearly established at least by the Mousterian, with the Levallois reduction method.

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