The Châtelperronian Neandertals of Cova Foradada (Calafell, Spain) used Iberian imperial eagle phalanges for symbolic purposes

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Abstract

Evidence for the symbolic behavior of Neandertals in the use of personal ornaments is relatively scarce. Eagle talons, which were presumably used as pendants, stand out due to their abundance. This phenomenon seems to appear concentrated in a specific area of Southwestern Europe during a span of ca. 80 Ka. Here we present the analysis of one eagle pedal phalange recovered from the Châtelperronian layer of Foradada Cave (Spain). Our research broadens the known geographical and temporal range of this aspect of Neandertal symbolic behavior, by providing the first documentation of its use among Neandertals in Iberia, as well as of its oldest use in the peninsula. The recurrent appearance of large raptor talons throughout the Neandertal timeframe, including their presence among the last Neandertal populations, raises the question of the survival of some cultural elements of the Middle Paleolithic into the transitional Middle to Upper Paleolithic assemblages.

Introduction

Archeological personal ornaments such as beads and pendants have traditionally been recognized as a direct evidence of symbolic behavior. Their confection and use have been further related to the emergence of "behavioural modernity" (*1*). Analogously, the projection of the current ethnographic meaning has led specialists to interpret Paleolithic personal ornaments as conveyors of social identity (*2*). This current paradigm indicates a long-lasting and widespread bead working tradition of marine shells; having emerged in Africa and the Levant amongst anatomically modern humans (AMH) well before their arrival in Europe (100-75 ka) (*3*). Presumably in later times (50-37 ka) this expression appears among western European Neandertals independently or by a process of acculturation, being particularly relevant for Châtelperronian assemblages (CP) found in archeological layers from Le Grotte du Renne (Arcy-sur-Cure) and La Grande Roche de la Plématrie (Quinçay) (*4*). From this point of view, recent investigations in Cueva de los Aviones (Spain) have proposed the use of

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marine shells by Iberian Neandertals as beads and pigment containers as early as 115 ka, predating any expression of symbolism by AMH in Eurasia (*5*). These findings, together with new dates for some rock art motives in three Spanish caves anteceding the arrival of *Homo sapiens* in Europe (*6*), have generated a tremendous shake regarding the origin of symbolic behavior, cultural modernity and the appearance of art in Europe.

Focusing on Neandertal techno-cultural traditions, associated with the Middle Paleolithic (MP), Late Middle Paleolithic (LMP) and transitional techno-complexes, other more controversial evidence of symbolism such as abstract engravings, body-painting, use of feathers, funerary practices and grave goods, have been historically claimed as evidence for Neandertal symbolic complexity (*1, 7*). The debate, however, does not stop at this. By one hand, alternative explanations to these proofs of advanced symbolic thinking such as intervention of natural processes, purely functional character of symbolic items (e.g. pigments/ochre), stratigraphic mixtures and even the lack of Neandertal innate cognitive capacities has been proposed. On the other hand, the authorship of some of the European transitional complexes, in which some of the most striking manifestations of modern behavior are inserted, is still a subject of debate (*8*). Notwithstanding, in the case of the Châtelperronian, most of the studies show a clear cultural continuity of this transitional complex with the MP and where the CP is found with diagnostic fossils or biological trail, these are of Neandertals, not modern humans (*4, 9, 10*).

Asides from this, the use of raptor talons as bead-like objects seems to be one of the most widespread evidence of symbolism among Neandertal populations in Europe. At least 23 large raptor phalanges from 10 sites, dated between ~130 to 42 ka, present traces of anthropic manipulation in the form of cut marks (table 1).

The main arguments supporting the symbolic nature of these elements are; 1) the anatomical distribution of cut marks, positively contrasted by actualistic experiments, 2) the scarcity or complete lack of nutritional value of a bird’s lower extremities, 3) the rarity of large raptors in certain ecosystems (namely their selective hunting/gathering), 4) the established analogy with other cut-marked phalanges and talons from late Prehistoric contexts, and 5) their comparison with the ethnographic register (*11-22*).

The lacks of formal criticism of these interpretations indicate the plausibility of hypotheses regarding the anthropic modification of large raptor's pedal phalanges by Neandertals as their use for personal ornaments. Considering the large geographical distribution and temporal context of Neandertals across Eurasia, this phenomenon seems to be concentrated in a very specific area of Western Europe (Fig.1). Nevertheless, the relative novelty of these discoveries demands further investigation. Here we present a new case of large raptor pedal phalanges associated with a CP context, thus expanding the geographical and chronological limits of this kind of evidence and providing new insights into the symbolic practices in Neandertal populations.

Results

Site stratigraphy, chronology and archeological record

Cova Foradada (Calafell, Catalonia, Spain; UTM (ETRS89) 381027.6 – 4562447.9) is a small karstic tunnel, 1.8 km far from the actual shoreline of the Mediterranean coastline of NE Spain (Fig. 1 and Fig. S1) (*21*). The morphology of the cave is defined by a circular entrance, yielding direct access to the "excavation hall" of *ca*. 14 m^2. Stratigraphically, the excavated area consists in a 2.5 m section presenting four major lithostratigraphic units and ten archaeo-paleontological layers, eight with evidence of human occupation/use of the cave from the mid-Holocene to the Upper Pleistocene (*21*) (Supplementary Materials). Units I & II correspond to the Holocene epoch. The middle part of the sequence corresponds to the litho-stratigraphic Unit III, formed by three different archeological layers. Layer IIIn has been associated to the Early Gravettian, followed by the almost sterile layer IIIg and layer IIIc, each corresponding to the Early Aurignacian. The basal part of the stratigraphic column corresponds to Unit IV; with layers IV, IV1 and IV2 being associated with the Châtelperronian occupation. Found underneath these layers is an almost archeologically sterile unit (Unit V). Unit V has been further documented to be in contact with a thick basal flowstone (Fig.).

Archeological patterns shared by layers IIIn, IIIc and Unit IV suggest that the cave was only occasionally occupied by human groups, leaving a very scarce archeological record; formed mainly by shell ornaments in Layer IIIn, and hunting-related tools in both layers IIIc and IV. Fortunately, the lithic remains recovered from layers IIIc and IV are typologically diagnostic and, asides from the chronological context, are useful indicators when attributing these occupations to their associated cultural technocomplexes (*21*).

Layer IV provided a small lithic assemblage highlighting the almost exclusive presence of Châtelperronian points (Fig. S3). This represents the southernmost expression of this particular tool class in Europe; exclusively related with the Châtelperronian culture, and supposedly associated with the Neandertals (*4, 10*).

The faunal assemblage of Unit IV is composed of 1289 remains (NSP); 1076 identified specimens (NISP) dominated by leporids (63.8% NISP), small bird remains (16.5 NISP) and Iberian lynx (9.4% NISP) (table S1). Twelve elements correspond to medium and large-sized raptors, mainly Iberian imperial eagle (cf. *Aquila adalberti*) (table 2). Bone surface modification (BSM) analysis indicate scarce anthropogenic intervention, with exception to 31 burned bones (2.4% of NSP), 19 long bone shaft cylinders of leporids (11% of the total humerus, femur and tibia NISP) and one fragment of leporid tibia showing cut marks (Fig. S5). The interpretation of the occupational dynamic in Unit IV suggests a very sporadic use of the cave by human groups; probably related to its' use as a hunting shelter where they could rest, repair and fine-tune certain hunting tools (*21*). Asides from this, Layer IV1 presents the remains of an Iberian imperial eagle with a cut-marked phalange. This find is

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horizontally and vertically associated with typical elements of the Châtelperronian culture. Radiocarbon evidence currently places the occupations of Unit IV >39 BP cal ^{14}C (*21*) (Fig. S4).

The specimen FO15/IV1/E6/1339

The specimen FO15/IV1/E6/1339 (Fig. 2 and Movie S1) corresponds to the phalanx I of the first digit (the thumb or *Hallux*) from the left foot of a large eagle. The general morphology of the phalanx is stylized and svelte, as in the genus *Aquila*, thus different from the more robust morphology of *Aegypiinae* (sub-family of vultures) and *Haliaeetus* (genus including white-tailed eagle). The palmar surface of the body is deeper than in vultures, presenting a well-marked attachment to fibrous sheaths of flexor tendons. The distal trochlea and the groove between them are well pronounced as in the genus *Aquila*. Studies regarding general morphology, dimensions, PCA results as well as the distribution of past, extant and Pleistocene large eagles in the Mediterranean Basin (*23*), all concur that *Aquila adalberti*, the Iberian imperial eagle, is the most plausible taxonomic match for the case of Foradada (Fig. 3).

The phalange presents 12 cut marks on the dorsal side of the diaphysis, appearing along approximately two-thirds of the phalanx's total length (Fig. 2). Most of the cuts (n = 11) are oriented obliquely to the principal axis of the bone, ranging from the proximal epiphysis to distal extremity of the bone. These striae are found orientated parallel amongst themselves. All these oblique cuts are deep and present both composed striae and associated shoulder effect as deep as the principal groove; similar to those produced by retouched stone tools (*24*). An additional incision can be observed, presented obliquely orientated with a longitudinal tendency. This last mark is more superficial than the previous marks and superimposes all other incisions. The 12 incisions observed present an average length of 3.678 mm and width of 0.234 mm. As can be seen in table S2, a general increase in the opening angle of each groove can be observed while a similar pattern is observed through a decrease in depth of each profile along the groove. This variation, however, is relatively subtle and gradual, most likely explained by the physical properties and pressure exerted when making an incision (*25*). The homogeneity of the groove's shape, however, is clearly represented by the cross-section morphology and its' development along the course of the incision. Procrustes analysis indicates that all these marks present an asymmetrical \/ shaped cross section (Fig. 4A and STL S2). This feature is one of the key characteristics described by multiple authors when diagnosing a taphonomic trace as a cut mark (*24*). Considering only the shape profile, these taphonomic traces are clearly comparable with cut mark samples studied by a great deal of taphonomists (e.g. *26*) as opposed to the morphology of other linear traces such as tooth scores (*27*). 3-Dimensional analysis (Fig. 4B, Supplementary Materials), indicates that depth and shape of the linear marks are clearly more pronounced than what would be expected of a trampling mark. Combined with a clear lack of a rounded base, as well as other features, this also rules out the possibility that these marks can be confused as a product of other natural agents, carnivores, humans or even herbivores (*28*). While these marks are associated to some other taphonomic alterations such as biochemical BSM, they do not prevent the morphological study of these traces to a degree where equifinality is overly present (*29*). Mark location and depth all agree with experimental works presented by Romandini et al. (*13*), associating these striae with the disarticulation of the claw and the entire digit from the tarsometatarsus. Other than FO15/IV1/E6/1339, no other specimen of eagle or raptor remains shows anthropic modifications. It should be noted, however, that all the remains of *A. adalberti* are from appendicular elements of which only one talon has been recovered. This unusual skeletal element representation can be further considered important when comparing with the case of other abundant small bird remains in this site (Tables S1 and S3, Fig. S6) (Supplementary Materials).

Discussion

The exploitation of birds as an alimentary and non-alimentary resource has been proven through several zooarcheological investigations, suggesting that the trapping of birds formed a part of the behavioral variability of Neandertal populations (*7, 30, 31*). While not being a frequent practice, the consumption of raptors among hunter-gatherers has further been confirmed through ethnographic data (*32*), and supported by the archeological record, including other Neandertal sites (*33, 34*). Non-nutritional use of bird bones in Neandertal sites is almost exclusively related to symbolic purposes (*7*), while their use as a raw material for creating domestic tools is extremely scarce (*35*) (Supplementary Materials).

In the case of talons, their non-nutritional value has been exhibited to support the claim of their symbolic use by Neandertals; as opposed to their association with alimentary purposes (*11, 13*). Nevertheless, while the obvious consumption of talons can be considered a poor idea, according to current Spanish, Latin-American and oriental recipes, the edibility of the raptor's feet may just be a question of cooking and taste, in order to appreciate the skin and cartilaginous tissues present on these bones. Needless to say, cut marks are only indicators of anthropogenic manipulation. Their presence may simply indicate the butcher's removal of non-inedible areas.

The present study demonstrates how a combination of traditional and newly developed methodological approaches in cut mark analysis can be a powerful tool when classifying BSMs. Our results lean strongly towards the classification of the marks on FO15/IV1/E6/1339 as cut marks. Their presence is a fundamental and unique find when constructing the hypothesis and reasoning behind the manipulation of these elements by ancient humans. For this reason, the combination of old and new methods and tools for BSM analysis is essential when the presence of cut marks may lead to relevant evolutionary hypotheses. Furthermore, we strongly agree with the interpretation of these cut-marks as a product of talon extraction, or claw sheath removal, independently of the phalanx in which the traces are present (*11-22*).

This observation is especially supported by neo-taphonomical experimentation, thus aiding in the construction of our interpretation (*13*). The additional arguments leading us to discard the alimentary nature of these remains are: 1) the scarcity of raptor remains in the Foradada assemblage, namely the selection of the species for anthropogenic handling, 2) the high anatomical bias in favor of phalanges, thus presenting a selection of anatomical parts, and 3) the absence of other BSMs related to anthropogenic consumption. This includes human chewing, green breakage, burning and any traces of cooking BSMs on raptor bones or any other element in the majority of the faunal assemblage.

Regarding species and anatomical selection, to date, cut marks are yet to be found on the pedal phalanges of other birds, with the exception of raptors, excluding the case of Baume Gigny and Fumane A9 (*12, 15*) . This can be further extended to the case of large carnivore claws, which would be more common if they were to be used as tools. This exceptional find reinforces their interpretation as symbolic elements; supporting and further suggesting that Neandertals transmitted similar symbolic connotations to large raptors as current traditional societies (*31*). The symbolic meaning of majestic eagles as large predators could thus be transmitted to some parts of their bodies as talons and feathers. While most archeological cases have presented this use in large eagle’s talons, other species, however, are also represented including vultures and eagle owls. Following the same logic, the talons of other species should convey other meanings too, considering both traditional and current societies associate vultures and eagles with opposing concepts. The same can be said for the swan of Baume Gigny; where it can be seen that the modest claw of a duck can hardly express the same symbolic message as a white-tailed eagle talon. Similarly, the talon of the black grouse form Fumane A9 presents another interesting case. These finds from Foradada increase the number of cases where large eagles have specifically been exploited for their talons. However, this case also sees an increase in the number of represented species too. Consequently, while some authors may have proposed a symbolic meaning behind the use of large eagle “ornamental talons” (*11*), as well as large diurnal raptors associated with scavenging habits (*18, 31*), the increase in the variety of taxa documented in these sites suggests a greater complexity in terms of the symbolic nature of these elements. Archeological parallels documented specifically among hunter-gatherers of the late Pleistocene and Holocene support the symbolic character of these types of elements (*34, 36-39*). Faced with the same type of zooarcheological and taphonomic evidence, the interpretation of specimens as fully symbolic in contexts associated with AMH leaves little space for speculation. This is enforced when the same elements and evidence are found within Neandertal sites, such as the case of Foradada. Peculiarly, manipulated talons are not very abundant among UP assemblages, at least until the end of the UP (17/12 ka) (22). Furthermore, the cases documented during the early UP appear to be extremely rare. Only two have been published, a talon of *Bubo scandiacus* from La Quina Aval (associated with early Aurignacian) (*37*) and a talon of probable *Gyp fulvus* from Üçağizli (associated with Ahmarian) *(36*). Again this can be applied to the case of Foradada, where no early or late UP layer have provided anthropogenically modified raptor phalanges. Seashell beads, on the other hand, are in abundance. Currently, UP sites in the Iberian Mediterranean region as well as the rest of the Iberian Peninsula also fail to present similar finds, except for the case of Santa Catalina, Biscay (Spain), where snowy owl (*Bubo scandiacus*) talons were recovered associated with Magdalenian archeological layers (*22*). In addition to archeological parallels, the ethnographic data proves that different cultural groups of all continents have used raptor claws/talon for the elaboration of a great variety of elements associated with rituals, dances, personal adornments, grave goods, etc. (*34,39*). Only the case of the National Eagle Repository (NER) in Colorado (USA) currently provides more than 600 eagle carcasses to American Nations every year for religious and cultural purposes. The most used elements are feathers and the limbs of these animals (with between 1200 and 1500 eagle limbs delivered on a yearly basis) (Dennis Wiist, NER, Personal Communication). In all cases, carcasses belong to two species; the Bald eagle (*Haliaeetus leucocephalus*) and the Golden Eagle (*Aquila chrysaetos*), since these species contain the highest symbolic meaning for most of Native American People.

Although researchers tend to agree on the symbolic nature of talons, their definition of these elements as personal ornaments have been explored with prudence. Most have advocated defining the talons as "supposed ornaments" while others have opted to refer to these finds directly as an example of Neandertal jewelry (*17*). In accepting the use of talons as personal ornaments, this can be considered a tradition that predates any other manifestation of symbolism among Neandertals or AMH; especially those in which seashells play a central role (*5*). If not, this manifestation also entails important implications for the emergence of symbolism and behavioral modernity; although further investigation is necessary to establish the functionality behind these objects. Regardless of whether the talons were hanging "beads", part of necklaces, earrings or any other elements for which there are no current parallels, the case of Foradada indicates the symbolic use of talons to be a well-rooted tradition among the Neandertals of Western Europe for more than 80 millennia. Furthermore, this suggests the presence of a common cultural territory in which the meaning conveyed by these large-raptor talons could probably be recognized by individuals from different groups. To date, the total absence of raptor talon exploitation in the African Paleolithic record (*31*), forces us to ask ourselves for the direction of cultural interactions between Neandertals and modern humans. The case presented in this paper is evidence for the last occurrence of the use of talons among Neandertals, immersed in a cultural movement in which other jewelry traditions, developed independently or not, are documented (*1, 5, 35*). This practice, which emerged in the early MP, appears from time to time but recurrently in the Neandertal world surviving on one of the last expressions of their material culture, the Châtelperronian and probably extinguishing with them forever.

Materials and Methods

Excavation methods

Cova Foradada was systematically excavated in extension according to an artificial subdivision of the site in 1x1m squares, following the natural inclination of the geological layers. Regarding faunal remains, all ≥ 2 cm and all identifiable specimens, regardless of size, were recovered and their coordinates documented on a 3D plot. Additionally, all the excavated sediment previously recovered by square, layer, and relative depth (5 cm ranges), were water-sieved using superimposed 1, 0.5- and 0.05-mm mesh screens. These finds were then bagged. Microfossils were then sorted and classified.

Zooarcheological and Taphonomical methods

Anatomical and taxonomic determination of mammalian and bird remains were carried out in the Zooarcheological and Taphonomical Laboratory of the Catalàn Institute of Human Paleoecology and Social Evolution (IPHES). Avian reference collections from the Nat-Museu de Ciències Naturals de Barcelona in Barcelona, Muséum National d´Histoire Naturelle in Paris, Laboratório de Arqueociências - LARC-DGPC in Lisbon and Estación Biológica de Doñana in Seville were used for comparative purposes. The osteological measurements were taken using a digital caliper with a precision of two decimal places in six specified anatomical points; proximodistal length (**L**), proximal mediolateral width (**BP**), mediolateral width at midshaft (**SD**), distal mediolateral width (**Bd1)**, distal mediolateral width at the beginning of the trochlea (**Bd2**), proximal dorsopalmar height (**Bapp**) and the distal dorsopalmar height at the beginning of the trochlea (**Badp**). The comparative data can be consulted in table S4. Bone surfaces of all faunal remains were inspected macroscopically and microscopically with a stereomicroscope OPTHEC 120 Hz model, using magnifications from 15x to 45x. Cut marks and their relationship with specific butchering activities were identified based on the criteria of Domínguez-Rodrigo et al. (*24*) and Romandini et al. (*13*). Additionally, each of the marks was digitalized using the HIROX KH-8700 3D Digital Microscope with a MXG-5000REZ triple objective revolving lens. Firstly, cross-sections of each mark were produced using the mid-range lens at a 600x magnification. A fixed high intensity LED light source was placed above each sample, combining the use of coaxial and ring illumination. 3D digital reconstructions were produced using a combination of quick auto focus and depth synthesis functions that are provided by the HIROX's system, generating a 3D display of each mark where measurements could be taken and cross-section profiles extracted. In order to construct each digital image, between 110 and 130 photos were taken for each profile. The capturing and assessment of the morphology of each mark's profile was carried out using a total of three cross sections, taken at 30, 50 and 70 percent of the total length of each mark. As described by Maté-González et al. (*26*), this particular range along the groove is suggested to be the most representative for cut mark morphological analysis.

These profiles were then exported to the free tpsDig2 (v.2.1.7) software where the allocation of seven homologous landmarks was carried out following the geometric morphometrics models described by Maté-González et al. (*26*). The resulting files produced through landmark allocation were then edited and imported into the free software R (www.rproject.org, *40*) where a full Procrustes fit was performed using the Geomorph library (*41*). This package can be used to prepare the sample for multivariate statistical analysis and is commonly referred to as a generalized Procrustes analysis (GPA). Through GPA each individual is standardized through a series of superimposition procedures involving the translation, rotation and scaling of each shape. Any differences in structure can thus be studied through patterns of variation and covariation which can then be statistically assessed (*42*). The library Shapes (*43*) is then used to calculate and plot the mean shape of each cross section. Additional measurements concerning the depth and opening angle of each of the profiles were later taken. In order to capture the entire shape of these incisions, a further digital reconstruction was carried out on the entire mark using the low-range lens at 100x or 150x magnification, depending on the necessities of the analyst with regards to resolution (*44*). In order to capture the entire length of each mark, the HIROX's tiling function was used to create a mosaic and complete digital reconstruction of each groove. 30 photos were taken for each tile while any number between 15 and 32 tiles were used to create the final image. With the use of a high pixel resolution as well as the consequential stacking of photos produced by the microscope, the entire shape of the taphonomic trace could be reproduced digitally. A 13 landmark model, as developed by Courtenay et al. (*44*), was then used to capture the entire shape of the groove. The position of each landmark was recorded through a series of measurements. This was done first using the 'XY-width' function to measure and plot the location of each landmark across a 2-Dimensional graph, followed by the measurement of depth using the 'point height' function in order to establish each landmarks position along the Z-axis of a 3-Dimensonal plot. Landmark coordinates were recorded and processed in the same manner as the 2D profiles.

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H2: Supplementary Materials

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in the Collections Room, Tarragona, Spain, with the permission of the Departament de Cultura of the Generalitat de Catalunya. The specimens are available to any researcher to be inspected. The microCT scan models are available on line (Supplementary Materials).

Figures and Tables

Fig. 1. Geographical range of Neandertal populations and sites with symbolic use of raptor talons. The line of white dots roughly marks the probable range of Neandertals in Eurasia, based on paleo-genetic data and fossil remains. The yellow dotted line suggests the common cultural territory for the use of raptor talons by Neandertals. The extended map indicates the location of all MP/CP sites with raptor phalanges interpreted as symbolic elements, including Cova Foradada. Baume Gigny is included for the sake of clarity.

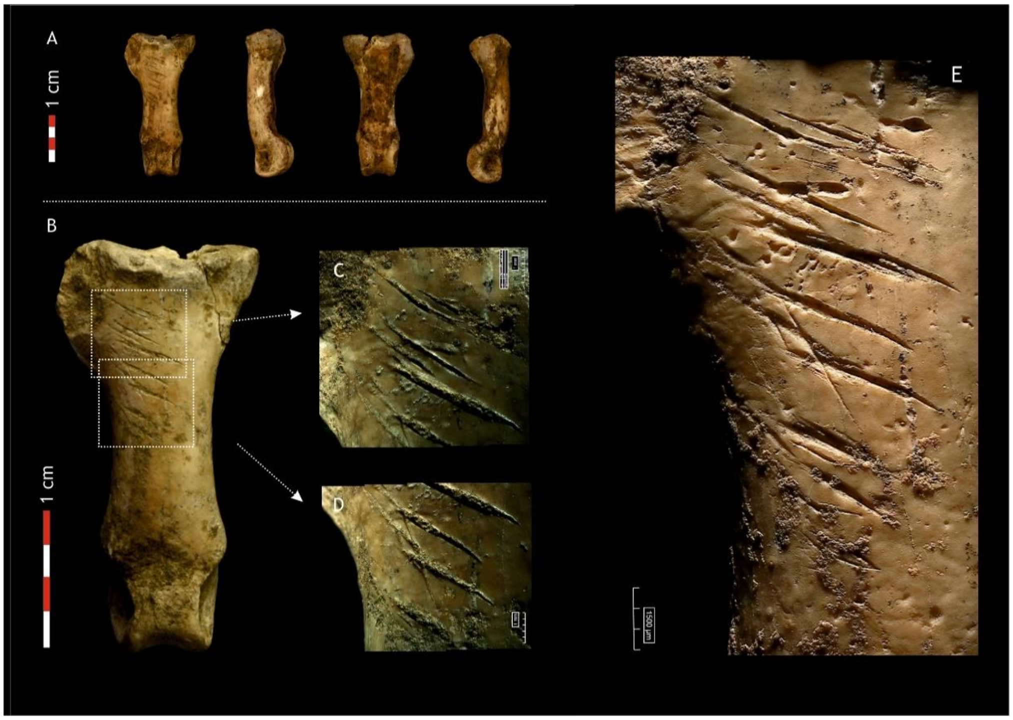

Fig. 2. FO15/IV1/E6/1339 specimen. (**A**) Dorsal, medial, plantar and lateral views of the phalange (from left to right, respectively). (**B**) Detail of the cut marks in the dorsal view and doted-line squares with the area amplified in photos (**C**) and (**D**). (**E**) Detailed photo of all the cut marks after cleaning and restauration.

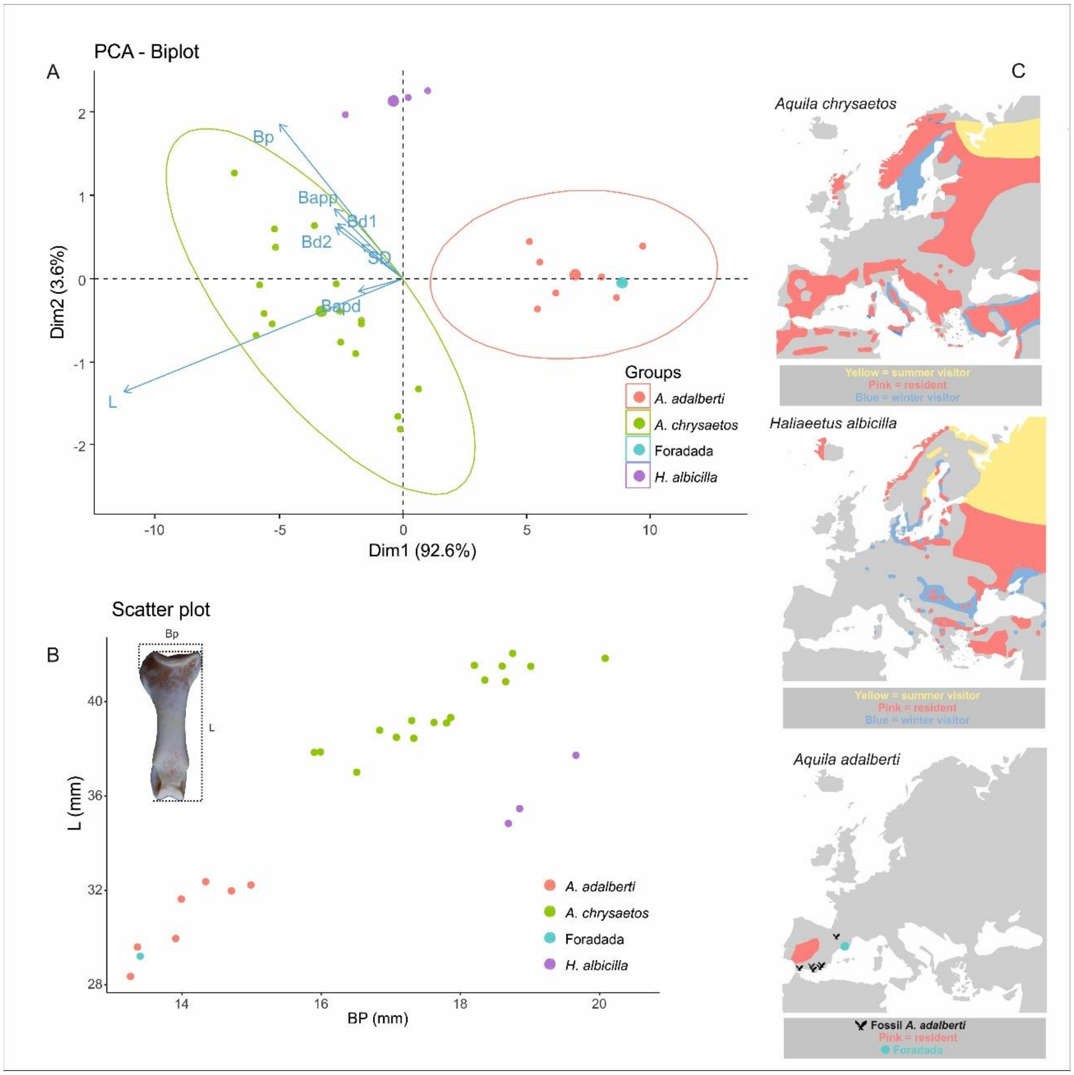

Fig. 3. Data supporting species identification. (**A**) PCA comparative analysis of six measurements of the Phalanx I of the first toe of different species of large eagles documented in the Iberian Pleistocene Fossil Record. (**B**) Diagram with comparative measurements of the total length (L) and proximal breath (Bp) of 1st phalanges of the toe I from different species of large eagles documented in the Iberian Pleistocene Fossil Record. (**C**) Current distribution of the three large eagles documented in the Iberian fossil record with special attention to *A. adalberti* fossil record (*23*).

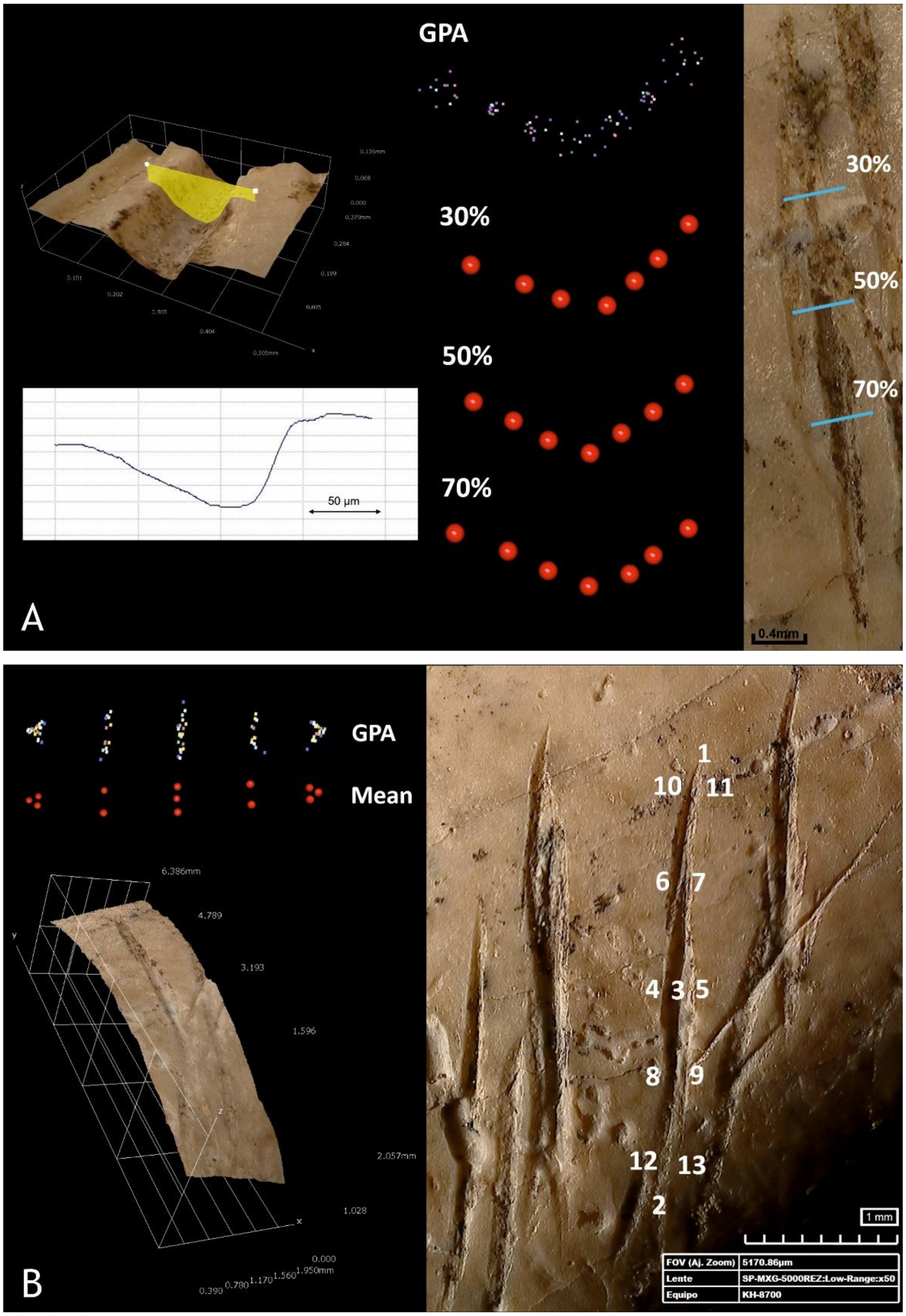

Fig. 4. Analysis of Cut Mark Morphology using the HIROX KH-8700 3D Digital Microscope. (**A**) 2D GPA and Mean Shape of cut mark cross-section profiles across 30%, 50% and 70% of each incision. (**B**) 3D GPA and Mean Shape of entire incision.

Site	**Layer**	**Age ka**	**Cultural attribution**	**Taxa CM**	**Common name**	**CM NISP**	**Bird NISP**	**Raptor NISP**	**Reference**
Baume de Gigny*	XV	50	MP	*Cygnus cygnus*	Whooper swan	1	N/A	N/A	(*11, 12*)
Combe Grenal	52	90	MP-CM	*Aquila chrysaetos*	Golden eagle	1	7	1	(*11*)
Fumane	A12	MIS3	MP-L	*Aquila chrysaetos*	Golden eagle	1	N/A	1	(*13, 14*)
Fumane*	A9	38-42	MP-D	*Tetrao tetrix*	Black grouse	1	N/A	N/A	(*15*)
Grotte de L'Hyene	N/A	MIS3	MP	*Aquila chrysaetos*	Golden eagle	1	N/A	N/A	(*11, 14*)
Grotte du Renne	IX-X	44-42	CP	*Haliaetus albicilla*	White-tailed eagle	1	N/A	N/A	(*16*)
Grotte du Renne	IX-X	44-42	CP	*Bubo bubo*	European eagle-owl	1	N/A	N/A	(*16*)
Krapina	N/A	100-130	MP-M	*Haliaetus albicilla*	White-tailed eagle	5	29	12	(*17*)
Les Fieux	I/J	60-40	MP-DM	*Haliaetus albicilla*	White-tailed eagle	1	81	3	(*11, 18*)
Les Fieux	Jbase	60-40	MP-MTA	*Haliaetus albicilla*	White-tailed eagle	1	42	4	(*11, 18*)
Les Fieux	Ks	MIS3	MP-MTA	*Haliaetus albicilla*	White-tailed eagle	2	97	8	(*11, 18*)
Les Fieux	Ks	MIS3	MP-MTA	*Aegypius monachus*	Cinereous vulture	1	97	8	(*11, 18*)
Les Fieux	Rec. clean	MIS3	MP-MTA	*Haliaetus albicilla*	White-tailed eagle	2	>2	2	(*11, 18*)
Mandrin	E	52-56	MP-N	*Aquila chrysaetos*	Golden eagle	1	11	1	(*13*)
Pech de l'Azé I	4	44-48	MP-MTA	*Aquila chrysaetos*	Golden eagle	2	92	5	(*12, 19*)
Pech de l'Azé IV	8	100	MP-M	*Medium-sized raptor*	N/A	1	1	1	(*20*)
Rio Secco	7	48-49	MP-M	*Aquila chrysaetos*	Golden eagle	1	15	1	(*13*)
Cova Foradada	IV1	>39	CP	cf. *Aquila adalberti*	Iberian Imperial Eagle	1	41	12	This Work, (*21*)

Table 1. Neandertal sites and layers with cut-marked raptor phalanges interpreted as symbolic elements. CP: Châtelperronian; CM: Classic Mousterian; L: Levallois; MP: Middle Paleolithic; M: Mousterian; MTA: Mousterian of Acheulean Tradition; N: Neronian; N/A: Not applicable/ Unknown. *The cases of Baume de Gigny and Fumane A9 corresponds to other birds than raptors.

ID	**Layer**	**Element**	**Side**	**Taxon**	**Common Name**	**BSM**
FO14/IV/F8/2848+3453	IV	Tarsometatarsus	R	cf. *Aquila adalberti*	Iberian imperial eagle	Broken-Dg
FO15/IV/G8/C1	IV	Phalange II Toe 2	L	cf. *Aquila adalberti*	Iberian imperial eagle	-
FO14/IV/F9/1971	IV	Talon	-	Accipitridae sp.	-	-
FO14/IV/F6/306+307	IV	Tibiotarsus	R	cf. *Aquila adalberti*	Iberian imperial eagle	Broken-Dg
FO15/IV/D7/C1	IV	Humerus	L	Accipitridae cf. *Milvus milvus*	cf. Red kite	Broken-Dg
FO14/IV/D8/1018	IV	Phalange II Toe 3	R	*Gyps fulvus*	Griffon vulture	-
FO15/IV/E6/C1	IV	Phalange	-	Accipitridae cf. *Accipiter* sp.	-	-
FO14/IV1/F8/2864	IV1	Phalange II Toe 2	R	cf. *Aquila adalberti*	Iberian imperial eagle	-
FO14/IV1/F8/2862	IV1	Phalange II Toe 2	L	cf. *Aquila adalberti*	Iberian imperial eagle	-
FO14/IV1/F8/3129	IV1	Phalange I Toe 1	-	Accipitridae cf. *Aquila* sp.	-	Broken-indet.
FO15/IV1/E6/1339	IV1	Phalange I Toe 1	L	cf. *Aquila adalberti*	Iberian imperial eagle	CM
FO15/IV2/D7/C1	IV2	Ulna	R	Accipitridae cf. *Milvus milvus*	cf. Red kite	Broken-indet.

Table 2. Raptor remains from the Unit IV of Cova Foradada. ID is the unique identification number of each specimen, bone surface modifications (BSMs). Cut marks (CM), diagenetic breakage (Dg).

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