Supplementary Information A

Adaptive trade-offs towards the Last Glacial Maximum in North-Western Europe: a multidisciplinary view from Walou Cave

Luc Moreau[1,2]*, Christelle Draily[3], Jean-Marie Cordy[4], Katherine Boyle[1], Michael Buckley[5], Erik Gjesfjeld[1], Peter Filzmoser[6], Valentina Borgia[1], Sally A. Gibson[7], Jason Day[7], Robert Beyer[8], Andrea Manica[8], Marc Vander Linden[9], Marjorie de Grooth[10], Stéphane Pirson[3]

Affiliations:

[1] McDonald Institute for Archaeological Research, University of Cambridge, United Kingdom

[2] ArScan, UMR 7041, Ethnologie préhistorique, MAE - Maison René Ginouvès - Archéologie & Ethnologie, Nanterre, France

[3] Agence wallonne du Patrimoine, Service public de Wallonie, Belgium

[4] Independent researcher, Belgium

[5] Manchester Institute of Biotechnology, University of Manchester, United Kingdom

[6] Institute of Statistics and Mathematical Methods in Economics, Vienna University of Technology, Austria

[7] Department of Earth Sciences, University of Cambridge, United Kindgom

[8] Department of Zoology, University of Cambridge, United Kindgom

[9] Institute for the Modelling of Socio-Environmental Transitions, Department of Archaeology & Anthropology, Bournemouth University, United Kingdom

[10] Independent archaeologist, Bad Münstereifel, Germany

*corresponding author, *E-Mail address*: moreaul@hotmail.com (L. Moreau).

Table of Contents

SI Text

1 Aurignacian osseous industry: typological observations

The eight Aurignacian artefacts of Walou Cave can be described as follows, following the order of Figure 4 in the main text:

- The first point is characterised by a rounded extremity and a lateral longitudinal fracture in addition to a series of transversal *striae* (Fig. 4: 1). The point is well polished and shatter marks are visible on the lateral edges.

- The second point exhibits a tip (apex) damaged by a transversal fracture, compatible with an impact (Fig. 4: 2). The other end is slightly rounded. A series of chipping marks are visible on both ends and both faces of the tool (see detail). The position of the chipping marks resembles characteristic features of *retouchoirs*, which by definition typically show one of more clusters of localised short, shallow percussion marks used to retouch stone artifacts (Tartar et al., 2006). It is likely that the latter marks are linked to a secondary use of the point.

- The third almost complete projectile point (Fig. 4: 3) has respectively one fractured and one intact end. Previous scraping traces have been removed by an intense polishing. At least thirteen parallel notches are visible on the lateral edge (see detail). These notches were obtained by unidirectional incision, although they are clearly not equidistant and not lined-up. Some of them are deep, others only drafted.

- The fourth point is incomplete and consists of a distal point fragment (Fig. 4: 4). Despite the absence of diagnostic impact fractures (e.g. Pétillon, 2006), we have assigned this point to the 'projectile point' typological category based on a combination of criteria including its raw material, degree of shaping, symmetry, cross-section, and overall morphometric similarity with the other points of the assemblage (e.g. Tejero, 2016).

- The fifth tool made of antler presents a curved profile (Fig. 4: 5). The transversal striae visible on both faces are likely to correspond to traces of stuck scraping actions, showing a lack of accuracy in shaping/scraping the initial blank.

- The dimension and shape of the sixth tool made of antler (Fig. 4: 6) suggest it was part of the broader set of projectile points made of antler. However, the poor state of preservation hinders a detailed interpretation of its manufacture, use and maintenance.

- One lozenge-shaped point (Fig. 4: 7) exhibits a splintered extremity (see detail), suggesting its secondary re-use as chisel, possibly after breakage. Deep transversal striae are visible on both faces of the tool.

- One tool has been typologically assigned to an 'awl' based on a combination of criteria (Tejero, 2016), including its pointed shape and asymmetrical cross-section as well as transversal circular traces on the tip (Fig. 4: 8). Made of the metatarsal of a small ungulate, it has been worked summarily and does not exhibit any similarity with the antler points of the assemblage.

Materials and methods

2 Geochemical sourcing

A 100 µm diameter laser beam and a laser repetition rate of 10 Hz and laser power of 8J cm^{-1} was used for the entire study. For all analyses, NIST 612 was used for calibration of element sensitivity. The SiO_2 content of each sample was used for internal standard normalization of the trace element signals. Detection limit is typically 0.1 ppm for most elements. Calibration accuracy was checked by repeatedly analysing NIST 610, NIST 614, and BCR-2G as unknowns and comparing to GEOREM values. Standards were analysed at the beginning, end, and periodically within each laser session. To identify and minimize effects of heterogeneity in the natural flint material samples multielemental measurements were conducted at discrete locations across each lithic sample. The 29 chemical elements are as follows: Li7, B11, Mg25, Al27, Ca43, Ti49, V51, Cr53, Mn55, Fe57, Co59, Ni60, Cu65, Zn66, Ga71, Rb85, Sr88, Y89, Zr90, Nb93, Cs133, Ba137, La139, Ce140, Pr141, Nd143, Pb208, Th232, and U238. The internal standard for all analyses was Si29 which was used to normalise trace element concentrations in Glitter Software (GEMOC, Australia).

All spots measured on the lithic artefacts were chosen carefully to ensure laser sampling from the target mineral phase only, in addition the standardized discarding of the first 10 seconds of ablation signal. Multiplying the number of laser ablasion readings per sample aimed at achieving a higher confidence that the median value is representative of the underlying geochemical signature.

3 Zooarchaeology by Mass Spectrometry (ZooMS)

This involved the soaking of the tip of the four samples in 0.1 M hydrochloric acid (HCl) for only 1 hour, prior to ultrafiltration into 50 mM ABC and tryptic digestion as standard. Finally, the standard approach following van der Sluis et al. (2014) was also employed for the remaining specimens were destructive sampling was less of an issue due to the size and shape of the artefacts. This involved the removal of ~25 mg bone powder and then incubation in 1 mL 0.6 M HCl for 3 hours. All samples being ultrafiltered (in 10 kDa Molecular Weight Cut Off filters; Vivaspin, UK) and exchanged into 100 uL 50 mM ammonium bicarbonate (ABC) after two exchanges with 0.5 mL 50 mM ABC. Half of this (50 uL) was removed and digested with 1 uL of 1 ug/uL trypsin overnight at 37°C 1 uL spotted with 1 uL matrix (10 mg/mL alpha-cyano hydroxycinnamic acid in 50% acetonitrile/0.1% trifluoroacetic acid) onto a stainless steel Matrix Assisted Laser Desorption Ionization Time of Flight (MALDI-ToF) plate, allowed to dry and the analysed using a Bruker Ultraflex II MALDI-ToF mass spectrometer with up to 2000 laser acquisitions acquired per sample (Fig. S3).

Results

4 Subsistence activities

Differential representation of various parts of the skeleton may serve to indicate transport of selected body portions (Grayson, 1984). The MNE values for the Gravettian assemblages at Walou Cave (Tables S6-7) are derived from NISP counts rather than MNI calculations and therefore do not reflect the different quantities of particular elements within the skeleton.

Bearing in mind limited sample sizes, the appendicular skeleton is clearly better represented in the case of horse (*Equus caballus*) and reindeer (*Rangifer tarandus*) compared to the other species (Table S6). In fact, the anatomical composition of the preserved reindeer and horse remains of Gravettian layer B5 (A-D) suggests that front and hind limbs rich in meat and marrow were disarticulated and transported separately to Walou Cave. Cranial bones and elements of the axial skeleton are only poorly represented. However, since meat rich elements such as ribs and vertebrae are easily prone to differential destruction by humans due to relatively low bulk density (e.g., Lyman, 2008), their under-representation in the Gravettian assemblage is not particularly surprising and thus does not necessarily imply their original absence. These patterns indicate that prey were likely consumed on-site while the main butchering activities might have taken place at another location. Accordingly, it is likely that during the Gravettian period, Walou Cave served as an episodic residential location, as opposed to a specialised procurement site.

Season-of-death estimates are largely missing for Walou Cave. The Aurignacian faunal assemblage has been claimed to reflect human occupation within a time window spanning at least early winter to early summer (Simonet, 1993: 56). However, to draw far-reaching interpretations on these observations would be hazardous given that only a portion of the Aurignacian faunal assemblage has been analysed to date. Seasonality patterns for the Gravettian faunas have not been investigated at all. The shed antlers of reindeer and red deer present in both Aurignacian and Gravettian layers are only poor seasonality indicators, as shed antlers can be collected out of season. They might indicate a late autumn/early winter occupation if they derive from male reindeer which shed antlers after the rut, or alternatively a late winter/spring occupation if they derive from female reindeer or (male) red deer (e.g. Pike-Tay, 1991).

Discussion

5 Climatic modelling and predicted residential mobility

Hamilton et al. (2016) proposed a relationship between hunter-gatherer residential mobility (i.e. average distance per move) and local climatic conditions. Here, we assess the variation in Aurignacian and Gravettian residential mobility in North-Western Europe based on Hamilton et al.'s model and climatic reconstructions from 36 to 20 kyr BP. Climate data are based on paleoclimate simulations from the HadCM3 general circulation model (Valdes et al., 2017). Outputs were downscaled from the original 2.5°×3.5° resolution to a 0.167° grid by means of the Delta Method (Maraun and Widmann, 2018) and high-resolution present-day climate data (New et al., 2002). Simulations are available at 2,000 year intervals, and were temporally interpolated using a shape-preserving piecewise cubic interpolation. Fig. S2 shows local climate reconstructions and the inferred residential mobility over time for Walou Cave.

We do not consider the modelled increase of average residential mobility by 6% between 32 and 22 kyr BP to be substantial, given the model's total range of 1-33 km, and the obvious uncertainty when applied to small-scale scenarios. We thus argue that the model provides no indication that changing climatic conditions had a strong impact on hunter-gatherer residential mobility between the Aurignacian and the Gravettian in North-Western Europe. We draw the same conclusion for the Paris Basin and the German Rhineland (Fig. S3).

References

De Wilde, B. (2011). Les macromammifères pleistocènes de la grotte Walou. In : Draily, Chr., Pirson, S., Toussaint, M. (Eds.) *La grotte Walou à Trooz (Belgique). Fouilles de 1996 à 2004*. Volume 2 : Les sciences de la vie et les datations. Études et Documents (Archéologie 21), Namur, pp. 14-35.

Gilot, E. (1993). Liste des datations 14C effectuées sur du matériel de la Grotte Walou à Trooz (Province de Liège, Belgique). In: Dewez, M. (Ed.) *Recherches à la grotte Walou à Trooz (Province de Liège, Belgique): Premier rapport de fouille*. Société Wallonne de Palethnologie (Mémoire 7), Liège, pp. 23.

Grayson, D. (1984). *Quantitative Zooarchaeology: Topics in the Analysis of Archaeological Faunas*. Orlando: Academic Press.

Hamilton, M.J., Lobo, J., Rupley, E., Youn, H., West, G.B. (2016). The Ecological and Evolutionary Energetics of Hunter-Gatherer Residential Mobility. *Evolutionary Anthropology* 25: 124-132.

Higham, T., Douka, K., Wood, R., Bronk Ramsey, Chr., Brock, F., Basell, L., Camps, M., Arrizabalaga, A., Baena, J., Barroso-Ruíz, C., Bergman, Chr., Boitard, C., Boscato, P., Caparros, M., Conard, N.J., Draily, Chr., Froment, A., Galván, B., Gambassini, P., Garcia-Moreno, A., Grimaldi, S., Haesaerts, P., Holt, B., Iriarte-Chiapusso, M.-J., Jelinek, A., Jorda Pardo, J.F., Maíllo-Fernández, J.-M., Marom, A., Maroto, J., Menéndez, M., Metz, L., Morin, E., Moroni, A., Negrino, F., Panagopoulou, E., Peresani, M., Pirson, S., de la Rasilla, M., Riel-Salvatore, J., Ronchitelli, A., Santamaria, A., Semal, P., Slimak, L., Soler, J., Soler, N., Villaluenga, A., Pinhasi, R., Jacobi, R. (2014). The timing and spatiotemporal patterning of Neanderthal disappearance. *Nature* 512: 306-309.

Lyman, R.L. (2008). *Quantitative Paleozoology*. Cambridge University Press, New York.

Maraun, D., Widmann, M. (2018). *Statistical downscaling and bias correction for climate research*. Cambridge University Press, Cambridge.

New, M., Lister, D., Hulme, M., and Makin, I. (2002). A high-resolution data set of surface climate over global land areas. *Climate Research* 21(1): 1-25.

Pétillon, J.-M. (2006). *Des Magdaléniens en armes. Technologie des armatures de projectile en bois de Cervidé du Magdalénien supérieur de la grotte d'Isturitz (Pyrénées-Atlantiques)*. Cedarc, Treignes.
Pike-Tay, A. (1991). *Red Deer Hunting in the Upper Paleolithic of Southwest France : A Seasonality Study*. BAR International Series 569, Oxford.

Pirson, S., Damblon, F. Haesaerts, P., Draily, C., (2011a). Analyse des dates ^{14}C de la grotte Walou. In: Draily, C., Pirson, S., Toussaint, M. (Eds.) (2011). *La grotte Walou: fouilles 1996-2004*. vol. 2. Les sciences de la vie et les datations. Etudes et documents - Archéologie 21, Namur, pp. 198-211.

Simonet, P. (1993). La grande faune de la couche aurignacienne de la grotte Walou à Trooz (Province de Liège, Belgique): Étude préliminarie. In: Dewez, M. (Ed.) *Recherches à la grotte Walou à Trooz: Premier rapport de fouille*. Société Wallonne de Palethnologie (Mémoire 7), Liège, pp. 51-58.

Sluis van der, L.G., Hollund, H.I., Buckley, M., De Louw, P.G.B., Rijsdijk, K.F., Kars, H. (2014). Combining histology, stable isotope analysis and ZooMS collagen fingerprinting to investigate the taphonomic history and dietary behaviour of extinct giant tortoises from the Mare aux Songes deposit on Mauritius. *Palaeogeography, Palaeoclimatology, Palaeoecology* 416: 80-91.

Tartar, É., Teyssandier, N., Bon, F., Liolios, D. (2006). Équipement de chasse, équipement domestique: une distinction efficace? Réflexion sur la notion d'investissement technique dans les industries aurignaciennes. In: L. Astruc, F. Bon, V. Léa, P.-Y. Milcent and S. Philibert (eds.), *Normes techniques et pratiques sociales. De la simplicité des outillages pré- et protohistoriques*. XXXVIe rencontres internationales d'Archéologie et d'Histoire d'Antibes. Antibes, Éditions APDCA, pp. 107-117.

Tejero, J.-M. (2016). Spanish Aurignacian Projectile Points: An Example of the First European Paleolithic Hunting Weapons in Osseous Materials. In: Langley, M.C. (Ed.) *Osseous Projectile Weaponry Towards an Understanding of Pleistocene Cultural Variability*. Dordrecht, Springer (Vertebrate Paleobiology and Paleoanthropology Series), pp. 55-69.

Valdes, P. J., et al. "The BRIDGE HadCM3 family of climate models: HadCM3@ Bristol v1. 0." *Geoscientific Model Development* 10 (2017): 3715-3743.

SI Figures

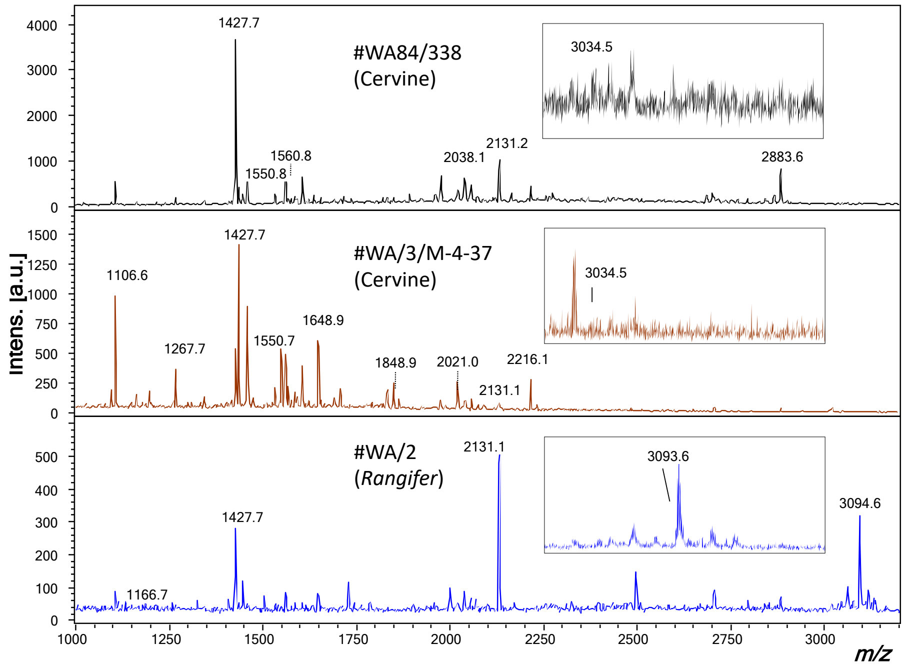

Fig. S1 MALDI-ToF-MS spectra for three osseous points from Walou Cave (ID's from top to bottom: WA84/338 (Cervine), WA/3 (Cervine) and WA/2 (*Rangifer*).

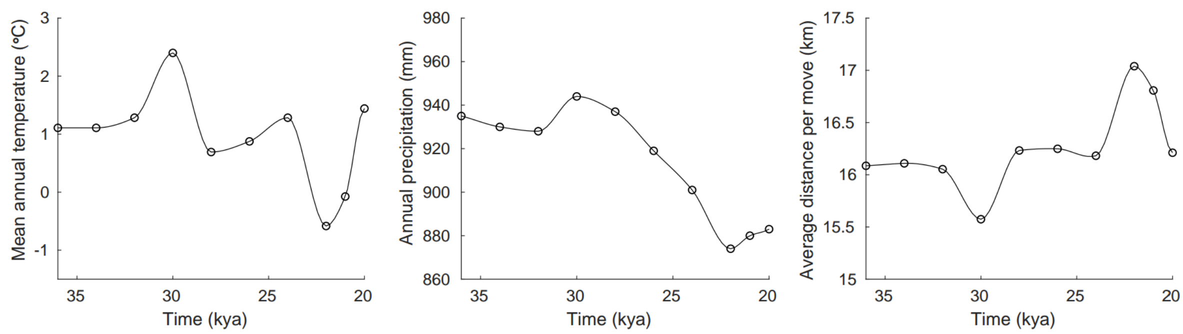

Fig. S2 Reconstructions of local temperature (left) and precipitation levels (middle) around Walou Cave, and estimated average hunter-gatherer mobility (right) between 20 and 36 kyr BP.

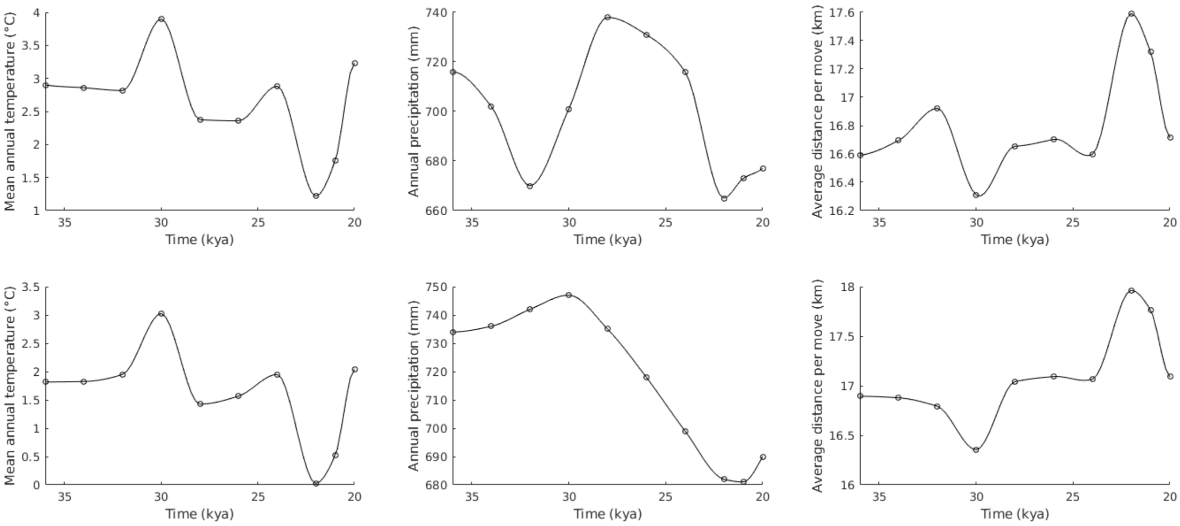

Fig. S3 Reconstructions of local temperature (left) and precipitation levels (right), and estimated average hunter-gatherer mobility (right) between 20 and 36 kyr BP at Amiens-Renancourt (Paris Basin, France) (top row) and Lommersum (German Rhineland) (bottom row).

SI Tables

Layer	Lab no.	Material	Date BP	Cult. attribution	Source
B-1	Lv-1556	Bone (multiple pieces)	9,990 ± 180	Creswellian	Gilot, 1993
B-4	Lv-1582	Bone (multiple pieces)	13,030 ± 140	Magdalenian	Gilot, 1993
B-4	Lv-1593	Bone (multiple pieces)	13,120 ± 190	Magdalenian	Gilot, 1993
B-5	LV-1581	*Ursus spelaeus* bones	21,230 ± 650	Gravettian	Gilot, 1993
B-5	LV-1651	Antler	22,800 ± 400	Gravettian	Gilot, 1993
B-5X	LV-1837	Bone (multiple pieces)	24,500 ± 580	Gravettian	Gilot, 1993
B-5X	LV-1867	Bone (multiple pieces)	25,860 ± 450	Gravettian	Gilot, 1993
C0-C5A	LV-1557	Horse scapula	30,460 ± 700	Undetermined	Gilot, 1993
CI-1	GrN-22769	Humic fraction	28,010 ± 340	Aurignacian	Pirson et al., 2011a
CI-1	GrN-22904	Humic fraction	27,760 ± 780/-710	Aurignacian	Pirson et al., 2011a
CI-1	LV-1587	Charcoal (multiple pieces)	29,800 ± 760	Aurignacian	Gilot, 1993
CI-1	LV-1592	Bone (multiple pieces)	29,470 ± 640	Aurignacian	Gilot, 1993
CI-3	LV-1641	*Ursus spelaeus* bones	33,830 ± 1790	Undetermined	Gilot, 1993
CI-2	OxA - 21618	*Ursus spelaeus* bone/tooth	35400 ± 650	Undetermined	Higham et al., 2014
CI-6	OxA - 21603	*Ursus spelaeus* bone/tooth	>42500	Mousterian	Higham et al., 2014
CI-6/7	Lv - 1642	*Ursus spelaeus* bones	35380 ± 1870	Mousterian	Gilot, 1993
CI-8	OxA - 21608	*Ursus spelaeus* bone/tooth	47900 ± 3500	Mousterian	Higham et al., 2014
CII-2	OxA - 21619	*Ursus spelaeus* bone/tooth	44200 ± 1900	Mousterian	Higham et al., 2014
CII-2	OxA – 21609	*Ursus spelaeus* bone/tooth	>48600	Mousterian	Higham et al., 2014

Table S1 Previously available radiocarbon dates from Walou Cave. ‘Lv’ denotes radiocarbon results from the no longer operational ‘Louvain-la-Neuve’ laboratory. Lv results have been obtained through an amalgamation of several different bones from the same context.

Archaeological Sample		SP	NO	OB	ZW
WA-1	Ablation 1	1	-	-	-
	Ablation 2	-	-	-	1
	Ablation 3	-	1	-	-
	Ablation 4	-	1	-	-
	Median	1	-	-	-
	Totals	**2**	**3**	**-**	**1**
WA-2	Ablation 1	-	1	-	-
	Ablation 2	-	1	-	-
	Ablation 3	1	-	-	-
	Ablation 4	1	-	-	-
	Median	1	-	-	-
	Totals	**3**	**2**	**-**	**-**
WA-3	Ablation 1	-	-	1	-
	Ablation 2	-	-	1	-
	Ablation 3	-	-	1	-
	Ablation 4	-	-	1	-
	Median	-	-	1	-
	Totals	**-**	**-**	**5**	**-**
WA-4	Ablation 1	-	-	1	-
	Ablation 2	-	-	1	-
	Ablation 3	-	-	1	-
	Ablation 4	-	-	1	-
	Median	-	-	1	-
	Totals	**-**	**-**	**5**	**-**

Table S2 Walou Cave. Summary of predicted group membership of archaeological samples (WA: Walou Cave). The columns correspond to the “control groups” (i.e. OB: Obourg; NO: Nouvelles; SP: Spiennes; ZW: Zeven Wegen) defined based on the training data, since their lithostratigraphic and geographic provenance is known. The classification rules of the LDA method derived from the training data (i.e., geological samples) have been applied to the test data (i.e., archaeological samples). Four ablation values and one median value for each archaeological sample were assigned to the most probable geological group using the LDA method. In some cases, observations for each individual ablation value or median value have been assigned to different training groups, likely caused by inhomogeneities in the analysed material.

Aurignacian C6/CI-1	**NISP** (excavation 1985-1986)	**%**	**MNI** (excavation 1985-1986)	**%**	**NISP** (excavation 1996-2004)
Herbivores					
Mammuthus primigenius	2	2.86	1	5	0
Coelodonta antiquitatis	1	1.43	1	5	0
Equus caballus	8	11.43	3	15	2
Bos primigenius	4	5.71	2	10	0
Capra ibex	0	-	0	-	0
Saiga tatarica	0	-	0	-	0
Alces/Megaloceros	0	-	0	-	0
Rangifer/Cervus	0	-	0	-	0
Cervus elaphus	17	24.29	2	10	0
Rangifer tarandus	37	52.86	10	50	0
Capreolus capreolus	1	1.43	1	5	0
Lepus sp.	0	-			0
Sub-total	**70**	**100.00**	**20**	**100.00**	**2**
Carnivores					
Ursus/Crocuta spelaea	0	-	0	-	1
Ursus spelaeus	100	94.34	9	75	3
Crocuta spelaea	1	0.94	1	8.33	0
Meles meles	0	-	0	-	0
Martes sp.	0	-	0	-	0
Mustela putorius	0	-	0	-	0
Canis lupus	1	0.94	1	8.33	0
Vulpes/Alopex	0	-	0	-	0
Vulpes vulpes	4	3.77	1	8.33	0
Alopex lagopus	0	-	0	-	0
Sub-total	**106**	**100.00**	**12**	**100.00**	**4**
Undetermined	**4**				32
Total	**180**		**32**		**7**

Table S3 Walou Cave. Summary of identified faunal remains from Aurignacian layer C6/CI-1 (after Simonet, 1993; De Wilde, 2011).

Gravettian B5 (A-D)	**Counts**	**%**	**Extrapolated Counts***	**Extrapolated %***
Herbivores				
Mammuthus primigenius	0	0.00	0	0.00
Perissodactyla	7	6.19		
Coelodonta antiquitatis	1	0.88	1	0.88
Equus caballus	17	15.04	24	21.24
Bovinae	4	3.54		
Bos primigenius	1	0.88	5	4.42
Capra ibex	5	4.42	5	4.42
Saiga tatarica	1	0.88	1	0.88
Cervidae	11	9.73		
Alces/Megaloceros	1	0.88	1	0.88
Rangifer/Cervus	1	0.88		
Cervus elaphus	4	3.54	5	4.42
Rangifer tarandus	52	46.02	63	55.75
Capreolus capreolus	1	0.88	1	0.88
Lepus sp.	7	6.19	7	6.19
Sub-total	**113**	**100.00**	**113**	**100.00**
Carnivores				
Ursidae	18	25.71		
Ursus spelaeus	35	50	53	75.71
Crocuta spelaea	0	0.00	0	0.00
Meles meles	1	1.43	1	1.43
Martes sp.	2	2.86	2	2.86
Mustela putorius	2	2.86	2	2.86
Vulpes/Alopex	9	12.86	9	12.86
Vulpes vulpes	2	2.86	2	2.86
Alopex lagopus	1	1.43	1	1.43
Sub-total	**70**	**100.00**	**70**	**100.00**
Undetermined	**336**			
Total	**519**			

Table S4 Walou Cave. Summary of identified faunal remains from Gravettian layer B5 (subunits A-D), inside the cave (data from Cordy, n.d.; De Wilde, 2011). *Extrapolated counts and percentages: 1) Given that horse clearly outnumbers rhino in B5, the 7 remains of undetermined *Perissodactyla* have been assigned to horse; 2) Given that the only determinable *Bovinae* remains found in B5 belong to bison, it is reasonable to attribute any undetermined *Bovinae* remains to bison; 3) Given the numerical importance of reindeer and deer in B5, it is reasonable to attribute any undetermined *Cervidae* remains to reindeer and *Rangifer/Cervus* remains to red deer, at the pro rata of their respective representation. 4) Since *Ursus arctos* is not represented among the identified faunal remains of B5, it is reasonable to assume all *Ursidae* remains belong to *Ursus spelaeus*.

Gravettian B5X	Counts	%	Extrapolated Counts*	Extrapolated %*
Herbivores				
Mammuthus primigenius	1	5.88	1	5.88
Coelodonta antiquitatis	0	-	0	-
Equus caballus	1	5.88	1	5.88
Bos primigenius	0	-	0	-
Capra ibex	0	-	0	-
Saiga tatarica	0	-	0	-
Alces/Megaloceros	0	-	0	-
Rangifer/Cervus	9	52.94	0	0.00
Cervus elaphus	0	-	0	-
Rangifer tarandus	5	29.41	14	82.35
Capreolus capreolus	1	5.88	1	5.88
Lepus sp.	0	-	0	-
Sub-total	**17**	**100.00**	**17**	**100.00**
Carnivores				
Ursidae	1	33.33		-
Ursus spelaeus	0	-	1	33.33
Crocuta spelaea	1	33.33	1	33.33
Meles meles	0	-		-
Martes sp.	0	-		-
Mustela putorius	0	-		-
Vulpes/Alopex	0	-		-
Vulpes vulpes	1	33.33	1	33.33
Alopex lagopus	0	-		-
Sub-total	**3**	**100.00**		**100.00**
Undetermined	**134**			
Total	**154**			

Table S5 Walou Cave. Summary of identified faunal remains from Gravettian layer B5 (subunit X) on the cave's terrasse. *Extrapolated counts and percentages: 1) Since *Cervus* is not represented among the determinable faunal remains, it is hypothetically legitimate to assign the 9 remains of *Cervidae* (i.e., *Rangifer/Cervus*) to reindeer; 2) Since *Ursus arctos* is not represented among the identified faunal remains of B5X, it is reasonable to assume all *Ursidae* remains belong to *Ursus spelaeus*.

B5 A-D		*Coleodonta antiquitatis*	*Equus caballus*	*Bos sp.*	*Capra ibex*	*Saiga tatarica*	*Cervidae*	*Alces/ Megaloceros sp.*	*Cervus elaphus*	*Rangifer tarandus*	*Capreolus capreolus*	*Lepus europaeus*	**Total**
Antler							11		3	41			**55**
Skull bone				1	1								**2**
Mandibulae				1						1			**2**
Tooth			2		1				1	1		1	**6**
Vertebrae													**0**
Rib			3							4			**7**
Forelimb	Scapula		1	1								1	**3**
	Humerus	1	1									1	**3**
	Radius-Ulna												**0**
	Metacarpal, carpal, phalange		2				1						**3**
Hindlimb	Os coxa									2			**2**
	Femur		2		2	1							**5**
	Tibia-fibula		2	2								1	**5**
	Metatarsal, tarsal, phalange		5							1		1	**7**
Limb unidentified	Long bone		4										**4**
	'Foot bones'		1					1		2	1	1	**6**
		1	**23**	**5**	**4**	**1**	**12**	**1**	**4**	**52**	**1**	**6**	**110**

Table S6 Walou Cave. Summary of skeletal element frequencies for all mammals from Layer B5 (subunits A-D), expressed as minimum number of elements (MNE).

B5 A-D		*Ursus sp.*	*Meles sp.*	*Martes sp.*	*Mustela sp.*	*Vulpes sp.*	*Vulpes vulpes*	*Alopex lagopus*	**Total**
Cranium		5	1						**6**
Manibulae		1				4			**5**
Tooth		24							**24**
Vertebrae								1	**1**
Rib		2							**2**
Forelimb	Scapula	2							**2**
	Humerus	2		1					**3**
	Radius-Ulna	3			1	1	1		**6**
	Metacarpal, carpal, phalange	1					1		**2**
Hindlimb	Os coxa								**0**
	Femur			1					**1**
	Tibia-fibula	6			1	3			**10**
	Metatarsal, tarsal, phalange	1				1			**2**
Limb unidentified	Long bone								**0**
	'Foot bones'	3							**3**
		50	**1**	**2**	**2**	**9**	**2**	**1**	**67**

Table S6 (continued). Walou Cave. Summary of skeletal element frequencies for all mammals from Layer B5 (subunits A-D), expressed as MNE.

B5X	*Mammuthus sp.*	*Equus caballus*	*Cervidae*	*Rangifer tarandus*	*Capreolus capreolus*	*Ursus sp.*	*Crocuta sp.*	*Vulpes sp.*	**Total**
Antler			9	3					**12**
Cranium									**0**
Tooth	1	1				1			**3**
Vertebrae									**0**
Rib									**0**
Bone front leg				1			1	1	**3**
Bone hind leg				1	1				**2**
	1	**1**	**9**	**5**	**1**	**1**	**1**	**1**	**20**

Table S7 Walou Cave. Summary of skeletal element frequencies for all mammals from Layer B5 (subunit X), expressed as MNE.