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## Supplementary Materials for

### **New evidence of broader diets for archaic *Homo* populations in the northwestern Mediterranean**

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#### **The PDF file includes:**

Supplementary Materials and Methods

Fig. S1. Anatomical refits for various taxa at the site of l'Hortus and definition of the three ensembles used in this study.

References (48–113)

#### **Other Supplementary Material for this manuscript includes the following:**

(available at [advances.sciencemag.org/cgi/content/full/5/3/eaav9106/DC1](https://advances.sciencemag.org/cgi/content/full/5/3/eaav9106/DC1))

Data file S1 (Microsoft Excel format). Leporid data for the new assemblages and the comparative sample.

## Supplementary Materials and Methods

In the accompanying paper, new archaeological data on the exploitation of leporids by Middle and early Late Pleistocene hominins are compared with archaeological and actualistic data derived from the literature. The present document contains further information on the assemblages that we studied and the methods used to analyze them. Note that the entire dataset is provided in Data file S1. Highlighted sections in the data file indicate uncertainties about raw data values extracted from published sources and/or provide clarifications with respect to calculation methods. To increase reproducibility, the formula used to derive the data is typed directly into the cells when the raw frequencies were available.

### New archaeological assemblages

Our data file includes new faunal data collected from 21 assemblages derived from 8 sites in southern France. Here we provide information on the stratigraphy and archaeology of these sites. Note that the data for le Lazaret and les Ramandils comprise samples, as the taphonomic analysis is not fully completed for these sites. In the discussion below, sites are presented in order of location from West to East.

Les Canalettes is a mid-altitude (700m asl) rockshelter in the department of Aveyron (14, 48). The sequence from this site consists of three Middle Paleolithic layers (4, 3 and 2, from bottom to top) all associated with a centripetal type of Levallois debitage (49, 50). For this study, we analyzed the leporid sample from layer 2 of Meignen's 1980–1987 excavations (48). An averaged thermoluminescence date of  $73,500 \pm 6000$  ka suggests that this layer was deposited toward the end of MIS5a (51). The assemblage from layer 2 is dominated by red deer (*Cervus elaphus*) and horse (*Equus caballus*). In contrast, carnivores are very rare in the sample (52). Note that the rich leporid assemblage from layer 4 was shown by Cochard et al. (14, 40) to be anthropogenic, as indicated by the presence of cutmarks and a high frequency of long bone cylinders. With few exceptions, the leporid remains from les Canalettes were all attributed to *Oryctolagus cuniculus* (53, 54).

Les Ramandils (1.5m asl) is a cave site located in the Aude department at a short distance (1.4 km) from the current shoreline of the Mediterranean Sea (55). The cave contains five Middle Paleolithic levels (ensembles V–I, from bottom to top) with lithic artifacts dominated by small-sized Levallois products (56). The faunal accumulations suggest that the site was occupied toward the end of MIS5, and perhaps, MIS4. Red deer (*Cervus elaphus*), horse (*Equus caballus*) and aurochs (*Bos primigenius*) are the principal ungulates identified in the assemblages, whereas carnivores are poorly represented (57). The leporid sample from Les Ramandils is strongly dominated by *Oryctolagus cuniculus* (58, 59). The material that we examined was excavated by Boutié during the period from 1983–1994. A sample from excavation squares M21 and N21 was studied and formed the basis of the taxonomic analysis.

Located sixteen kilometers away from Les Ramandils, the site of La Crouzade (70m asl) consists of a cave in the Massif de la Clape conservation area near Narbonne. The sequence includes several occupations dating from the Middle (layers 8–6) and Upper (layers 5–4) Paleolithic to the Iron Age (layer 1). The Middle Paleolithic stone tool industries contain sidescrapers and a

substantial proportion of Levallois products (50). Dated to MIS3, the very well preserved fauna from these levels has mostly been attributed to *Equus caballus*, *Capra pyrenaica* and *Rangifer tarandus* (58, 60–62). With respect to the small game component of the assemblage, Gerber (58) and Percie du Sert (59) assigned all of the leporid specimens to *Oryctolagus cuniculus*, which is consistent with our observations. Carnivore remains occur in low numbers at la Crozade, with the exception of bear. For the Middle Paleolithic layers, bear is rare in layer 8, slightly more common in layer 7, and well represented in layer 6 (58, 61, 63). The leporid remains analyzed here derive mostly from layer 7 and were collected during the new excavations (2015–2017) directed by Thibaud Saos.

Le Salpêtre de Pompignan is a small, mid-altitude (380m asl) cave site near Montpellier in South-central France. The sequence (west wall profile) dates to the Middle Paleolithic (layers X–V) and Upper Paleolithic (layers IV–II) (58, 64). The faunal samples attributed to the Middle Paleolithic occupational phase are dominated by ibex (*Capra ibex*) and bear (*Ursus* spp.) remains (58). The presence of bear milk teeth suggests that the site also served as a den. Our analysis detected cutmarks, but cut specimens are rare in the assemblages of ungulate remains and there is little evidence of long bone processing. Concerning the leporids, Gerber (58) attributed the vast majority of the specimens to *Oryctolagus cuniculus*. For this study, we re-examined the material from the 1969–1970 excavations by Cours and Coularou (58) to collect taphonomic data and completed a full study of the leporid remains from the later Meignen and Coularou excavations (1978). Leporid data are presented here separately for layers IX through V. Layer X is excluded due to its very small sample size.

L'Hortus (120m asl) is part of a karstic system located only 10 km away from Salpêtre de Pompignan. Most of the archaeological specimens collected at this site derive from layers deposited in a 2m-wide vertical fault (“fossé”) situated near the cave’s entrance (30). The stratigraphy of l’Hortus is complex and includes occupations ranging from the Middle Paleolithic (layers 32–7, from bottom to top) through the Early Middle Age (A units 30). The analysis of the Middle Paleolithic faunas indicates that *Capra caucasica* dominates the fauna with bear (*Ursus* spp.) ranking next in abundance (63, 65–67). Paleontological trends indicate that these remains were mainly accumulated during MIS4, or more likely, MIS3 (60, 66). Specimens of carnivores, including bear, are increasingly common toward the end of the Middle Paleolithic sequence, although they remain less abundant than those of herbivores (66, 67). Pillard (68) identified only *Oryctolagus cuniculus* remains in the leporid sample. Because it has long been known that the sequence at l’Hortus is affected by problems of occupation mixing (69), we plotted anatomical refit data collected by de Lumley and collaborators (30) and Bergès (65) to assess the extent of this problem (fig. S1). These data point to substantial mixing in the uppermost Middle Paleolithic layers 20–9 (“upper ensemble” in fig. S1). For this reason, these layers are treated as a single unit in the present study. Additionally, we conservatively excluded layers 9–7 from our analysis to avoid potential contaminations from the historic occupations of the site. For the bottom layers of the sequence, we distinguished a “lower ensemble” (layers 30–27) from a “middle ensemble” (layers 26–21) based on the distribution of the refits.

The Baume des Peyrards is a cave (430m asl) at the bottom of a cliff near Buoux in the department of Vaucluse (70). The sequence of excavated layers at this site contains only Middle Paleolithic layers dated to MIS 5–3 (26, 71). The lithic industries represented at the site indicate

the prevalence of the Levallois method and contain high frequencies of sidescrapers, including many blanks with evidence of thinning (72). According to Daujeard (26, 71), ibex (*Capra ibex*) is the most common species in the faunal assemblages, followed by red deer (*Cervus elaphus*) and horse (*Equus caballus*). Carnivores are infrequent. The leporid specimens we examined were rarely assigned to specific layers, which means that chronological resolution is very coarse for these remains. Unlike the other leporid specimens we studied, those from Peyrards frequently showed signs of root etching. Consequently, percentages of human and nonhuman marks are probably depressed at this site relative to other assemblages in our dataset. Lastly, it is unclear at this point whether all faunal remains, including those from leporids, were kept during the excavations (26).

The oldest site in our sample, Terra Amata (26m asl), is an open-air beach deposit site located within the city of Nice in southeastern France. At the time of occupation, the site would have been situated on the shoreline of the Mediterranean Sea (31, 73). Two major excavation units (C1a and C1b, from bottom to top) contain anthropogenic material at the site. Although finer stratigraphic subdivisions have been identified within these units, refits have raised issues about the homogeneity of several of these subdivisions (74, 75). For simplicity, only the major units (i.e., C1a and C1b) are retained here. The lithics uncovered are attributable to the late Acheulean period (73). In the anthropogenic levels, *Cervus elaphus*, *Palaeoloxodon antiquus* and suids are the most frequently represented ungulates, whereas carnivores are extremely rare (75). The leporids from the same units were all assigned to *Oryctolagus cuniculus* (19, 76). The current evidence suggests that these remains were deposited approximately 400,000 for C1a and approximately 380,000 years ago for C1b. Both sets of occupations are attributed to MIS11 (73).

Only 100m away from Terra Amata, le Lazaret is a low altitude (25m asl) cave located on the western slope of Mont Boron (35). At this site, the 8m thick sequence comprises at least 29 occupational levels dating from the Middle through the Late Pleistocene (35). Only the upper stratigraphic complex (C) comprises archaeological material, including faunal remains from Acheulean/Mousterian occupations. We studied the leporid samples recovered during the 2009–2014 excavation seasons for the archaeostratigraphic units UA29–27 (UA27 is the most recent of these occupations) in the CII complex. An absolute date (152±14 kilo-years BP) and paleontological data place these units within MIS6 (77). Faunal analyses revealed that the UA27–29 units are dominated by red deer (*Cervus elaphus*), ibex (*Capra ibex*) and *Bos/Bison* (71, 78, 79). Previous studies of leporids from the upper sequence at Lazaret indicated that the remains are mostly attributable to rabbits (*Oryctolagus cuniculus*) (19, 80). Although the earlier studies detected bone surface damage produced by carnivores and raptors in the assemblage, El Guennouni (76) also identified additional cutmarks as well as long bone shaft cylinders and burned specimens in the more recently excavated material from Lazaret.

#### Published archaeological assemblages

The archaeological assemblages studied by the authors were compared to 90 published leporid assemblages dating from the Middle Pleistocene (MIS9) through the Mesolithic (MIS1). Northwestern Mediterranean sites were the focus of our comparison due to the phylogeography of rabbits and their origins within Iberia and Southern France (81). These assemblages were selected because they show evidence of human intervention in the form of a minimum of one to as many as several hundred cutmarked leporid remains. However, we included two assemblages

that lack cutmarks (Les Agnells layer scb, 41, Anecrial layer 1, 82), because other lines of evidence (e.g., percentage of burning and/or bone tubes) from these sites are consistent with the assemblage being deposited by hominins. To avoid sampling error, assemblages with small numbers of leporid specimens (NISP<25) were also excluded from our analysis, as were those with insufficient taphonomic information. Our sample consists of 22 Middle Paleolithic (22/90 or 24.4%), 9 Early Upper Paleolithic (Aurignacian to early Solutrean, 9/90 or 10.0%) and 59 Late Upper Paleolithic/early Holocene (59/90 or 65.6%) assemblages. In terms of geography, the assemblages are mostly from Spain (52/90 or 57.8%) and France (30/90 or 33.3%). A full list of these assemblages and associated references are given in Data file S1. Note that the sites are presented in rough chronological order in the data file.

#### Estimation of the frequency of sites with strong indication of rabbit exploitation

We evaluated the prevalence of the pattern of rabbit exploitation by hominins we uncovered in the region based on the percentage of sites that strongly reflect this behavior in the Northwestern Mediterranean prior to the Upper Paleolithic. Our pre-Upper Paleolithic sample consists of 17 sites (see Data file S1) where taphonomic studies have included leporid remains. We added nine sites for which a taphonomic analysis of leporids was available to this sample (none of these sites include cutmarked rabbit remains, and as such they are not listed in the Data file S1). These new sites are: l'Adaouste (Meier and Morin, unpublished data), Boquete de Zafarraya (19, 83), les Cèdres (Meier and Morin, unpublished data), Cova 120 (84), Cueva Antón (85), El Salt (86), Galeria Pesada (87), Navalmaíllo rockshelter (88) and Orgnac 3 (19, 89). Note that the new sites exclude instances where both the leporid and large animal remains mainly result from natural accumulation, as is the case, for instance, for Gruta da Cadeirão (90) and l'Arbreda (91). Because it is not always clear in the literature whether rabbit specimens were counted and analyzed for cutmarks and other forms of bone surface damage, the proportion that we calculated is likely a crude measure of the frequency of rabbit exploitation in the study region.

#### The control assemblages

As an aid to estimate whether hominins were the primary accumulators of leporid remains at each site, we compared our assemblages with 21 modern ("control") leporid assemblages from the Northwestern Mediterranean. These modern assemblages were accumulated by a wide range of natural agents, including fox (*Vulpes vulpes*) (54, 92, 93), Iberian lynx (*Lynx pardinus*) (94, 95), wildcat (*Felis silvestris*) (28, 96), eagle owl (*Bubo bubo*) (54, 97–99), Bonelli's eagle (*Aquila fasciata*) (98), Spanish imperial eagle (*Aquila adalberti*) (98, 100), golden eagle (*Aquila chrysaetos*) (28) and Egyptian vulture (*Neophron percnopterus*) (28, 92). The sample also includes new data for two previously unpublished or only partially published assemblages accumulated by eagle owl (*Bubo bubo* sites "Hautes-Alpes" (19) and "Archiduc"). Moreover, our data were compared with results derived from an actualistic study of a modern rabbit warren (22). The data for these assemblages are listed in the Data file S1. Note that the identification of fox as the accumulator of modern leporid remains at les Rochers de Villeneuve is based on deduction (54), which means that the patterns for this assemblage must be considered with caution.

#### Methods of leporid analysis

With few exceptions, all of the data presented in the accompanying paper follow the calculation methods described below. To maximize comparability among the samples, we used calculation methods that are commonly employed in the published literature of studies focused on sites in

the Western Mediterranean. In some instances, the information presented here varies slightly from the summarized percentages and totals reported by the original authors, generally as a result of minor differences in calculation methods.

NISP values (Number of Identified SPecimens *101*) of leporids, ungulates, carnivores and birds were calculated for each faunal assemblage. Counts of *Lepus* sp. or *Oryctolagus cuniculus* specimens were combined with remains identified to the family Leporidae. However, our leporid NISP counts only include remains identified to the element, which means that indeterminate fragments, such as long bone shaft splinters, were ignored. With respect to ungulates, NISP counts include remains identified at least to the tribe (e.g., Caprinae), or more frequently, the genus or species (e.g., *Bos/Bison*, *Cervus elaphus*) level. Tentative attributions (e.g., “*Megaloceros?*”) and identifications limited to the order (e.g., indeterminate Carnivora) or family (e.g., indeterminate Cervidae) level were excluded, as were specimens only assigned to a body-size class (e.g., ungulate size class 2–3). Rhinocerotidae and Elephantidae represent exceptions to this last rule, as remains from these taxa can often only be identified to the family level, and therefore, are included in the ungulate lists. In very rare instances, Holocene species (e.g., pig) are mentioned in species lists. These were ignored here as they likely indicate contamination.

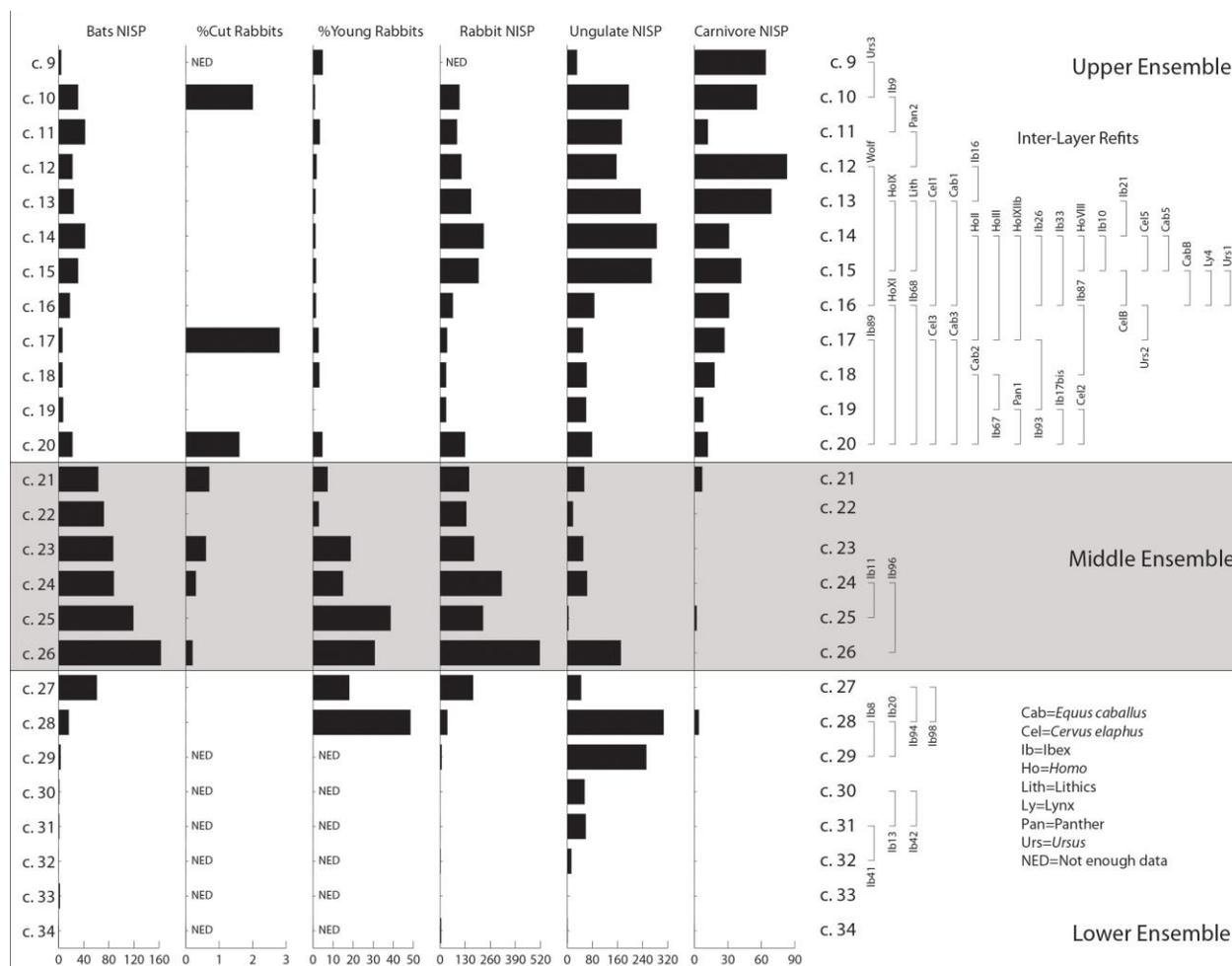
The abundance of leporids in the assemblages (%NISP) was calculated relative to that of ungulates to explore potential regional and temporal variation in hunting of small, fast game in relation to hunting of larger prey. These data are included in the Data file S1 to highlight potential taphonomic differences among the assemblages. Because very young rabbits can provide information about methods of capture (*14*, *18*), we recorded the number of “infants” (rabbits younger than two weeks old) following Pelletier et al. (*22*) in the assemblages. These specimens include unerupted teeth and porous and poorly ossified bones. Two approaches for estimating the proportion of adult leporids—one based on MNI (Minimum Number of Individuals), the other on MNE (Minimum Number of Elements)—were commonly encountered in the archaeological literature. MNI is the most common measure used for aging in the studies that comprised the published archaeological sample (*59/81* or *72.8%*). Generally, the authors adopted the following method of calculation in their estimation of the proportion of adults:  $MNI_{adults}/MNI_{total} \times 100$ . The total includes juveniles (2 weeks–3 months) and adults (>8 months). However, MNI is a less than ideal counting measure because it tends to inflate the representation of rare individuals (immature individuals in the present case), a problem that is particularly severe for small samples (*102*). More rarely (*22/81* or *27.2%*), researchers published age profiles in the form of NISP or MNE counts. In the latter approach, the proportion of adults was estimated using five elements that are generally fused by eight months of age (proximal humerus, femur and tibia, and distal radius and ulna (*103*, *104*), based on average rates of fusion of elements from modern leporid individuals as reported by Pelletier et al. (*22*). Some authors also reported data for fewer elements (e.g., *105*). When data were available for both approaches, we used the highest value in our calculation of the percentage of adults. Note that no attempts were made to derive sex-ratios for leporids as a recent study highlighted substantial problems with previous applications of sexing methods for this taxon (*106*).

In addition to age profile data, we collected information on bone surface modifications, including cutmarks and burning (see Materials and Methods in the main paper). Human tooth marks (*27*,

107, 108) were recorded when present in the samples. These comprise conservative estimates given the difficulty of distinguishing human from nonhuman gnawing marks on the remains of small taxa (27). Note that our tooth marks for carnivores only include specimens specifically attributed to carnivores. We excluded non-descript tooth marks from the carnivore tooth mark counts as they may have been made by humans. Note that at l'Hortus, marks are likely underestimated as a consequence of the use of varnish applied for labeling.

Marrow processing of leporid long bones can result in the production of many fragments, including long bone shaft cylinders (or tubes), which are formed by removing both epiphyseal ends to facilitate marrow extraction (25, 109). For the present study, fragmentation analysis included calculation of the percentage of complete long bones out of all long bone fragments (ulna included, expressed in %) and estimation of the percentage of long bone cylinders calculated by dividing the total number of femur, tibia, humerus and radius cylinders by the total NISP for these elements  $\times 100$ . The maximum cylinder length (in mm) and type of breakage of the tubes was also considered when possible, as long cylinders seem to occur at greater relative frequencies in anthropogenic than natural assemblages (24, 25, 82). Moreover, the former assemblages tend to be associated with a greater proportion of green breaks, as a result of the opening of long bone shafts by hominins. The percentage of cylinders was calculated separately for all four long bones and for the tibia only, as this element yields comparatively high amounts of marrow (110). However, in a number of cases, the published data on long bone cylinders were only available for the femur, tibia, and humerus (e.g., 90, 111). We note that, in some instances, it is unclear whether the ulna was included in the tallies, a problem that also applies to the calculation of the percentage of complete long bones.

To more fully assess the issue of agency, we identified marks made by carnivores and raptors based on comparisons to published photos (e.g., 23, 112). The percentage of digested remains corresponds to the proportion of specimens showing evidence of gastric etching (e.g., 25, 54, 97), whereas the percentage of specimens with pits and/or gnaw marks most likely reflects carnivore and raptor damage made during feeding or masticatory exercise (e.g., 27). In both cases, percentages were calculated as the number of damaged specimens relative to the total leporid NISP or relative to the sample analyzed for taphonomic damage. All coded specimens in our samples were examined under a stereomicroscope at magnifications ranging from 10–45x.



Note: Each refit set is associated with a species and refit number. The acronyms for the species are listed in the lower right side of the figure. For ibex, refit data and numbers are from Bergès (65), and for all other species, from de Lumley (30). Bat NISP from Jullien (113).

**Fig. S1. Anatomical refits for various taxa at the site of l’Hortus and definition of the three ensembles used in this study.**