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**Les sociétés gravettiennes du Nord-Ouest européen :
nouveaux sites, nouvelles données, nouvelles lectures**

**Gravettian societies in North-western Europe:
new sites, new data, new readings**

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Hit the North! Review of Recent Archaeozoological Discoveries from Gravettian Sites in the North of France

Examples from Renancourt 1 and Les Bossats and Regional Perspective Integrating Central Belgium

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Résumé

Ces dix dernières années, la découverte dans le nord de la France de plusieurs occupations gravettiennes de plein air livrant des ossements d'animaux ouvrent des champs d'exploration inédits, en plus de fournir des jalons de chronologie absolue jusqu'alors mal appréhendée pour le début du Paléolithique supérieur de la région. Plusieurs travaux d'archéologie préventive, des projets collectifs de recherche, ainsi que le réexamen pluridisciplinaire de collections issues d'anciennes fouilles, ont grandement contribué à ce renouvellement. Des données archéozoologiques inédites documentent désormais les environnements qui se sont succédés, ainsi que les stratégies de chasse et d'exploitation des carcasses pendant cette longue phase du Paléolithique supérieur dénommée « Gravettien ». Nous exposons succinctement ici les conditions particulières de préservation de ces restes osseux en contexte de plein air, ainsi que leur potentiel informatif en présentant synthétiquement les résultats obtenus à partir de deux sites majeurs : Les Bossats (Seine-et-Marne) et Renancourt 1 (Somme). Une mise en perspective régionale intégrant les dernières découvertes et analyses est ensuite proposée.

Mots-clés : Bassin parisien, Nord de la France, Belgique, Gravettien, archéozoologie, taphonomie.

Abstract

Over the past ten years, discoveries of several open-air Gravettian occupations yielding animal bones in the North of France have opened up new fields of exploration, in particular in terms of absolute chronology, which had been poorly understood up until recently for the Upper Palaeolithic of this area. Several preventive archaeological operations, collective research projects, as well as the multidisciplinary reappraisal of material from former excavations have greatly contributed to this renewal in France and Belgium. Unpublished archaeozoological data provide information on the successive environments as well as on hunting and carcass exploitation strategies during this long phase of the Upper Palaeolithic called the 'Gravettian'. Here, we briefly describe the conditions of preservation of bone remains from open-air Gravettian contexts, as well as their informative potential by presenting a review of the results obtained from two major sites: Les Bossats (Seine-et-Marne) and Renancourt 1 (Picardy). A regional perspective incorporating the latest discoveries and analyses is then proposed.

Keywords: Paris Basin, North of France, Belgium, Gravettian, archaeozoology, taphonomy.

Introduction

With the notable exception of the caves of Arcy-sur-Cure (Yonne), our knowledge of the beginning of the Upper Palaeolithic in the south of the Paris Basin and the bordering areas is based on discoveries of open-air sites (Schmider, 1971), often in unfavourable contexts for the preservation of faunal remains. Only La Pente des Brosses, a Gravettian site formerly attributed to the Magdalenian, comprises several faunal remains attributed to reindeer (Schmider *et al.*, 1983; Schmider, 1986). Over the past decade, excavations

or collecting have been carried out at several open-air Gravettian sites: La Picardie (Klaric *et al.*, 2018), Mareuil-sur-Cher (Kildea and Lang, 2011), Mancy (Chehmana *et al.*, 2008). No bone remains were preserved in the two former sites, whereas several bovid remains were unearthed at Mancy (*ibid.*). At the beginning of the 2000s, a research project aiming to assess our knowledge of this period, showed an under-representation of sites with fauna.¹ In addition to the intrinsic interest of this category of material, faunal remains also offer the possibility to obtain absolute dates. In light of the necessity of chronological

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seriation for the Upper Palaeolithic of the Paris Basin, the members of the project decide to reconsider some of the material collected by amateurs. One of the most promising assemblages was collected by C. Pommier at Ormesson, curated at the Nemours Museum. It comprises a lithic assemblage including Gravette points, burins and knapping products (blades, bladelets, flakes and cores) documenting the use of a soft hammerstone, associated with burnt stones and well-preserved fragments of fauna, including bison and horse remains (Bodu *et al.*, 2011).

The region of Alsace is expected to be propitious to the preservation of prehistoric sites (presence of karstic cavities and siliceous raw material deposits), but the Upper Palaeolithic is still poorly documented there (Boès, 2017). Thematic prospections organized since 2011 and the revision of collections now offer interesting avenues of investigation (Koehler *et al.*, 2013). For the Gravettian period, the site of Achenheim comprises faunal remains (Junkmanns, 1995).

In the northern part of France, occupations from the beginning of the Upper Palaeolithic appear to be less common as they are less frequently preserved than older sites or more recent Upper Palaeolithic sites (Fagnart, 1988). However, excavations carried out at the beginning of the century by V. Commont after discoveries during 'brick earth' exploitation, as well as operations at the end of the 1960s (Hallines), revealed a number of occurrences. According to J.-P. Fagnart, assemblages from brickworks (in particular Devalois in Renancourt-lès-Amiens and Coquempot in Elnes) comprised industries attributable to the Upper Palaeolithic, which he compared to the material brought to light in the Gravettian sites of the Paris Basin (*ibid.*). It was not until 1996 that a first diagnosis was conducted on the outskirts of the Renancourt brickyard (dir. J.-P. Fagnart and P. Coudret). Reworked but characteristic material, composed of flint and bones, was gathered from the site and the first absolute dates confirmed a Gravettian attribution (Fagnart *et al.*, 2013). Recently, exceptional new discoveries during preventive archaeological operations (Amiens-Renancourt 1 and 2, dir. C. Paris; Havrincourt, dir. E. Goval; Languevoisin-Quiquery, dir. M. Soressi; Catigny, dir. J.-L. Loch; Chézy-sur-Marne, dir. C. Montoya) and a collective research project² have contributed to reveal the scientific interest of the region, including for the Early Upper Palaeolithic (fig. 1).

Early Upper Palaeolithic sites associated with fauna have been known to exist in Central Belgium from the 19th century (fig. 1). However, these sites, often in caves, were all discovered and excavated a long time ago. Goyet and Spy caves are two of the

most emblematic sites for the Gravettian period, but unfortunately the excavation methods used at the time limit interpretations of the material (Pesesse and Flas, 2013; Touzé *et al.*, 2016). In the same way, the open-air site l'Hermitage was episodically excavated from the second half of the nineteenth century to the beginning of the 1990s and contained several faunal remains associated with Gravettian material (Gautier, 2000). But the most innovative results come from the open-air site of Maisières 'Canal', discovered in the mid-1960s. It was excavated with modern methods and the remains were systematically collected (see Lacarrière *et al.*, this volume). In addition, the faunal remains are in an excellent state of conservation. This collection is currently undergoing complete revision as part of a Franco-Belgian project³ (*ibid.*).

Open-air sites with Gravettian industries from the northern half of France recently yielded corpuses of particularly reliable dates, opening unprecedented possibilities for chronological seriations. Archaeozoological analyses of these sites initiated over the past ten years (Lacarrière *et al.*, 2015; Lacarrière *in* Paris [dir.] 2015; Lacarrière and Bignon *in* Bodu [dir.] 2009) aim to define the settlement patterns of this territory between 33 and 26 ky cal. BP⁴, during a period of rapid climate change. First and foremost, the study of faunal spectrums is important for the reconstitution of the successive environments. These data also provide indicators of hunting strategies and the occupation seasons of these sites. Finally, the analysis of butchery methods leads to a better characterisation of economic strategies (degree of intensity of butchery processing, use of bones as fuel). This is essential to enhance our understanding of the settlement dynamics of these territories during this period preceding the desertification of the north of continental Europe before the Last Glacial Maximum (Tallavaara *et al.*, 2015).

Here, we describe two currently excavated key sites to illustrate the potential of these open-air sites: Amiens-Renancourt 1 (Hauts-de-France) and Ormesson (Ile-de-France). They are both located in slope contexts in small valleys, and both present 'strategic' topographic characteristics from a hunting perspective (observation of game, redirecting/driving). Both sites yielded diversified archaeological material showing that multiple activities were carried out on site: flint knapping, manufacture of ornamental objects and portable art, culinary and technical activities linked to the animal resources found in and around fireplaces. Furthermore, in both cases, the spatial distribution of the remains indicates distinct activity zones (Bodu *et al.*, 2019; Lejay *et al.*, this volume; Peschaux, this volume; Paris *et al.*, 2019).

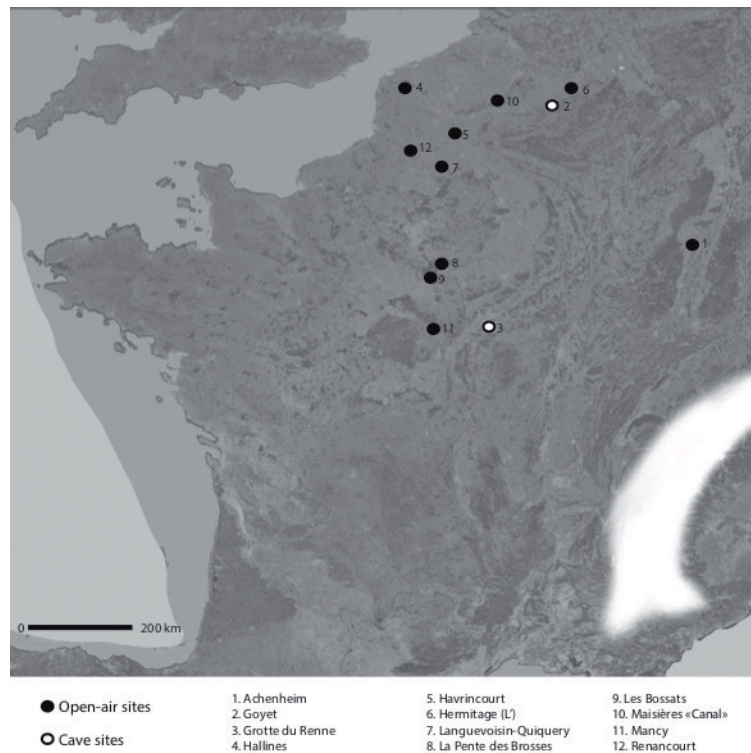


Fig. 1 – Map of the sites mentioned in the text corresponding to the main Gravettian sites with fauna in the Paris Basin and Belgium.

A few words on the regional context: geology and preserved archaeological sites

The Paris Basin corresponds to the vast sedimentary basin of the Hercynian chain delimited by ancient massifs (Ardennes, Vosges, Morvan, Massif Central and Massif Armoricain). It corresponds to the northern half of France and extends to the western part of Belgium, Luxemburg and part of southwestern Germany, forming a basin opening towards the Atlantic and the Channel (Cholley, 1939). From the north to the south, landscapes of varied plains (calcareous, clayey, sandy-clayey) and low-lying plateaux are prevalent (*ibid.*).

Gravettian occupations are occasionally situated in karstic zones, as is the case for the sites of Arcy-sur-Cure (Bourgogne, France) and Goyet (Province of Namur, Belgium see fig. 1). However, most of the known Gravettian sites are in open-air contexts. Maisières ‘Canal’ (Province of Hainaut, Belgium) is one of the most important of these sites in terms of the preservation and the nature of the archaeological assemblage, and also because it is a reference site characterized by a long and well documented sedimentary sequence (Haesaerts and de Heinzelin, 1979; Lacarrière *et al.*, this volume). In France, Havrincourt and Amiens-Renancourt (Hauts-de-France) were unearthed in similar open-air contexts. They are located about 65km away from each other and correspond to slope sites. Renancourt 1 is located

200 metres from Renancourt 2, an earlier Gravettian occupation with smaller quantities of faunal material, excavated a short time before the former site (Paris *et al.*, 2019).

Nearly 200 kilometres further south, the Gâtinais is a geographic sector rich in open-air Gravettian occupations (Klaric, 2013; Schmider, 1971), but where organic remains are rarely preserved. Since the 1960s, sites such as La Pente des Brosses yielded several reindeer remains (*Rangifer tarandus*). The discovery of Ormesson – Les Bossats represents a significant progress in terms of the future detection of sites ‘with fauna’, as its geographic situation was conducive to the conservation of calcareous silts, which are themselves propitious to the preservation of faunal remains (unlike sand, with is more acidic and very frequent in the region). These deposits are presumed to be of aeolian origin (Naton *in* Bodu [dir.], 2018) as Les Bossats is situated on the southeast margin of the main northwest European loessic deposits (Sima *et al.*, 2009).

All the open-air sites mentioned here present huge paleoenvironmental potential, in particular through studies of the components of the calcareous silts. From a geomorphological and malacological viewpoint, these data can be correlated with climatic events which open future possibilities of correlations between these Western European stratigraphic sequences and those of Central Europe (Antoine *et al.*, 2016; Paris *et al.*, 2017).

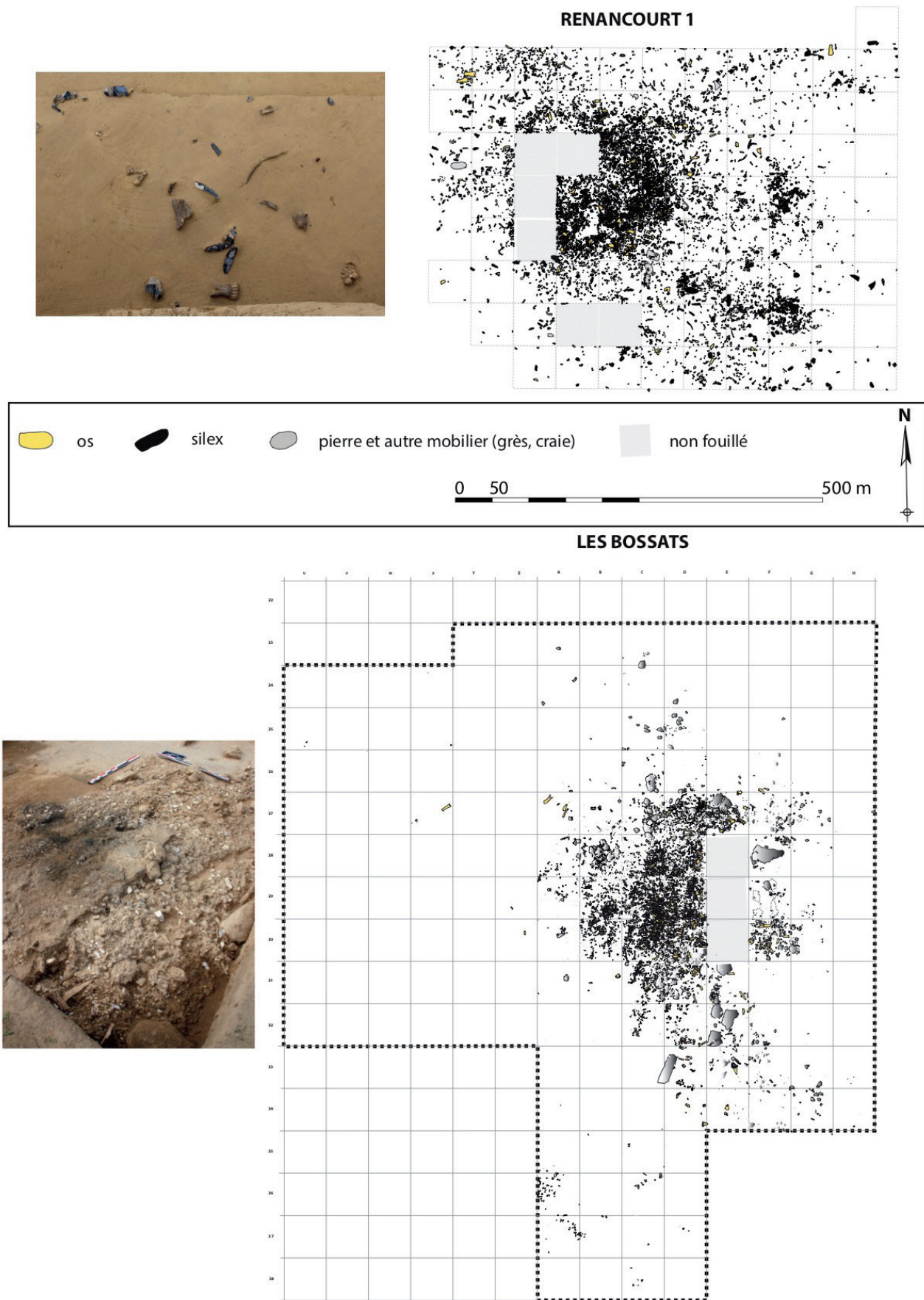


Fig. 2 – Plans presenting the distribution of remains after the 2018 excavation season. Top: Amiens-Renancourt 1 (Paris [dir.], 2018; picture: C. Paris; CAD: C. Font); bottom: Ormesson – Les Bossats, lithic and faunal remains (Bodu [dir.], 2018; picture: P. Bodu).

Species	Ormesson		Renancourt 1	
	NR	NMIf	NR	NMIf
<i>Bos/Bison priscus</i>	381	8	–	–
<i>Cervus elaphus</i>	–	–	1	1
<i>Rangifer tarandus</i>	31	2	–	–
<i>Elephantidae</i>	–	–	1	1
<i>Equus sp.</i>	23	2	202	6
<i>Lepus timidus</i>	–	–	1	–
<i>Coelodonta antiquitatis</i>	–	–	2	–
Total determined	435	12	207	8
Size IV/V (<i>Bos-Bis/Coelodontae</i>)	–	–	4	–
Size IV (<i>Equus/Bos-Bis</i>)	1141	–	236	–
Size III/IV	758	–	119	–
Size III (<i>Rangifer/Cervus</i>)	24	–	27	–
Size II/III (<i>Capreo/Rangifer/Cervus</i>)	8	–	25	–
Not attributed to a size class	745	–	651	–
Not recorded	308	–	341	–
Total non-identified/non-recorded	2984	–	1403	–
TOTAL	3419	–	1610	–

Tabl. 1 – Faunal spectrum of Ormesson – Les Bossats and Amiens-Renancourt 1.

Presentation of the sites

Ormesson – Les Bossats

At Ormesson, the lithic industry was mainly produced in Secondary flint of local origin (between 2.5 and 5km towards the east) and to a lesser extent, a Tertiary flint that could come from thirty to forty kilometres towards the north (Bodu [dir.], 2018; Touzé 2019; Touzé *et al.*, this volume). The lithic assemblage includes more than 16,000 pieces (excluding chips of less than 1,5cm), indicating the production of blades and bladelets with a soft hammerstone (Bodu *et al.*, 2011; Touzé, 2019; Touzé *et al.*, this volume). The retouched tools are numerous (around 700), but their proportion within the lithic assemblage is rather low. They predominantly include Gravette points and microgravettes (around 45% of the tools) and burins (44%). Only nine end-scrapers have been discovered up until now (Touzé *et al.*, this volume).

Discreet evidence of an osseous industry rely on about twenty rib fragments which show traces demonstrating a technical (but apparently limited) exploitation of animal resources at the site. A large segment of reindeer antler with probable technical marks was also discovered (Goutas *in* Bodu [dir.], 2018). In addition, abundant shells (perforated = 39; non-perforated = 92 and 34 indeterminate) were abandoned at the site (Peschaux, this volume).

The lithic industry and a consistent corpus of nine radiometric dates (Bodu *et al.*, 2019) situate the occupation between around 31.4 and 30.4 ky cal. BP and enable us to attribute the site to an early phase of the Gravettian in the Paris Basin.⁵ This interval of radiocarbon dates extends from the second half of the GS-5.2 to the first half of the GS-5.1, including the 5.1 interstadial (Rasmussen *et al.*, 2014).

Among the 219 preserved charcoal fragments, some were attributed to the *Pinus* genus but no further identification was possible due to the conservation status of the remains (Lejay *et al.*, this volume).

All of the Gravettian artefacts were ‘embedded in a layer of crusted gravels’ (Naton *in* Bodu [dir.], 2018). These gravels were probably brought to the site by the occupants from a short distance away in order to implant a ‘floor base’ during the occupation, as material was found below and above this layer (fig. 2). The Gravettian archaeological layer is recorded over a surface of about 80 m² and comprises two fireplace structures, but activities seem to have been concentrated around the central structure (Lejay *et al.*, this volume). A deciduous shed human tooth belonging to a child aged between 8 and 12 years old was also found on the edge of the main fireplace (Bodu *et al.*, 2019).

However, the Gravettian occupation is not completely preserved, since a thalweg caused the removal of part of the occupation (Bodu [dir.], 2018). In addi-

tion, part of the Gravettian material was brought up by ploughing, and then collected by amateurs, before archaeological work began in 2009. The consequences of this early collecting on the representativity of the archaeological material are impossible to estimate even if the impacted areas are well located.

This site is exceptional in terms of the quantity and quality of the preservation of faunal remains, in comparison with other sites in the region. Among the large mammals identified⁶, a total of 3,419 remains were recorded (excluding chips of less than 1cm representing about 9,000 remains). The dominant species is the bison⁷ (*Bison priscus*) with 381 remains, followed by the reindeer (*Rangifer tarandus*) which yielded 31 remains, and finally the horse (*Equus caballus gallicus* sp.) with 23 determined osseous remains (tabl. 1).

Amiens-Renancourt 1

At Renancourt 1, the lithic toolkit was made on a very good quality flint available on the outskirts of the site. The main production targets were large blades on one hand, and bladelets on the other, the latter being used as blanks for armatures. The lithic industry includes nearly 7,300 elements (excluding about 30,000 chips of less than 1cm). Among the tools, end-scrapers represent nearly a quarter of the assemblage, followed by projectile points in similar proportions (mainly backed bladelets, presence of micro-gravettes, gravettes and a gibbous point). Activities are diversified: cutting meat, working hide and hard animal and mineral matter. The osseous industry is poorly represented (one tool on a large ungulate rib and one on ivory, see Paris *et al.*, this volume). In addition to the abundant lithic industry, this site constitutes a major discovery as it also contains original ornament elements, including a perforated red deer vestigial canine (see Peschaux, this volume), and a significant assemblage of feminine statuettes and round elements in chalk (Paris *et al.*, 2017; this volume). The preservation of the occupation is characterized by numerous broken blades and waste from fireplaces, consisting of burnt and very fragmented material, including a lot of bones. The absence of associated structure and spatial organization is remarkable and evokes an area of intense activity and reject of domestic waste (Paris *et al.*, this volume). The data collected and the regional context make it possible to attribute the site to the Recent-final or Recent-evolved Gravettian (Paris *et al.*, this volume). This is corroborated by six radiocarbon dates which place the Gravettian occupation between 27.8 and

26 ky cal. BP (Paris *et al.*, 2017; Fagnart *et al.*, 2013). Furthermore, this occupation was found in a tundra gley formed during a climatic amelioration which could correspond to the GI.3 (Paris *et al.*, 2017). None of the charcoals gathered from the central 'ashy' zone have yet been identified.

After the 2018 excavation season, 82 square metres had been opened and about 60 of them yielded faunal remains, a dozen of which correspond to a very dense faunal distribution (fig. 2). Altogether, 1,610 osseous remains were recorded (excluding chips of less than 1cm representing about 5,000 remains), including 202 identified as horse remains (*Equus caballus gallicus* sp.). Two remains of young rhinoceros (*Coelodonta antiquitatis*), a fragment of mammoth ivory (*Mamuthus primigenius*) and a hare mandible (*Lepus timidus*) were also identified (tabl. 1).

Contrasting bone preservation... for unprecedented results on hunting strategies and carcass processing: archaeozoological analysis

Taphonomy

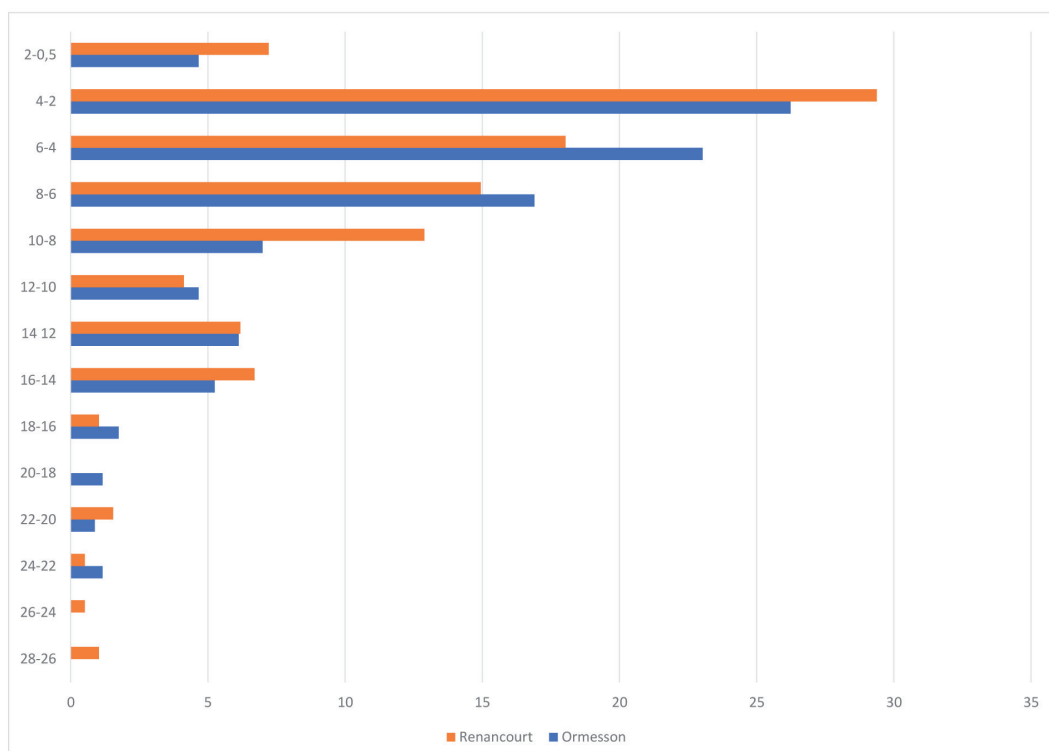
The analysis of the differential conservation of the osseous remains is based on the link between the osseous density of each element and their frequency of conservation (Lam *et al.*, 1999; Kreutzer, 1992). If fragile elements are less represented than denser elements, we can infer the differential conservation of these parts, potentially due to a number of reasons (intense fragmentation, sediment acidity, carnivore intervention, destructive anthropogenic activities). In order to conduct such analyses, the minimum number of anatomic elements per skeletal portion brought to the site must be established (MNE *sensu* Binford, 1984). The initial spatial distribution of the remains is preserved in each of the sites presented here and it is thus pertinent to proceed with these analyses once the excavations and the recording of the remains have been completed, in order to analyse as complete a sample as possible. This approach has not yet been applied due to the fact that excavation work and analyses are still ongoing, but a first estimation for the site of Les Bossats reveals relatively limited taphonomic destruction, linked to anthropogenic activities (Lacarrière, 2015; Lacarrière *et al.*, 2015). At Renancourt 1, the presence of hyoid bones (5 out of 861 recorded bones, or 0.6% of the NRT), of several foetal remains in the dense zone of faunal remains (4 remains, or 0.4% of the NRT, see fig. 3, no. 2) and of young horse decidual teeth spread over the whole occupation surface (20 dental remains, including

very young individuals just several weeks old, or 2.3% of the NRT) could indicate the relatively good conservation of osseous remains, as these elements are less dense, less mineralized and consequently more exposed to differential conservation (Klein and Cruz-Urbe, 1984; Lam *et al.*, 2010).

Each of these contexts yielded very fragmented assemblages; 55% of the determined material measures less than 6cm in both sites (tabl. 2). Roots, the formation of concretions and weathering, which produce cracking and splitting (fig. 3, nos. 1, 3 and 4), contributed to widespread fragmentation and to the obliteration of a lot of the surfaces of the bones from Ormesson and Amiens-Renancourt 1 (respectively 5.5 and 13% of the number of remains observed conserve one or several areas of their original cortical surface). Traces of carnivores are rare or absent at these open-air Gravettian sites, in keeping with observations for later periods in the same region, *i.e.* the Magdalenian (Bignon, 2009). Only few difficult to interpret marks (traces of roots), looking like pits (*sensu* Binford, 1981), have been recorded at Renancourt 1 on two humerus shafts and two horse ribs. None are formally identified at Ormesson.

Some differences between these two sites are noteworthy. Traces of roots are clearly more frequent at Ormesson. Colouration is relatively rare at Ormesson, but affects half of the remains at Renancourt. This can be explained by the natural presence of iron oxides in

the sediment (tabl. 3). Fragmentation is very intense in both cases, but seems to have affected bones differently. All of them, apart from sesamoids, a phalange and an incisor, are fragmentary at Ormesson, whereas at Amiens-Renancourt 1, three whole scapulae and numerous dental series were discovered (fig. 3, nos. 1-3). At Ormesson, about three-quarters of the original size of several metapodia are conserved, but these bones are among the most resistant of the skeleton (Kreutzer, 1992). The impact of weathering (of which bone splitting and disintegration are the most advanced stages, see Behrensmeyer, 1978) is difficult to compare. In any case, we observe the division of bones at Les Bossats (lengthways splitting of long bones, see fig. 3, no. 4) which is detrimental for the identification of long bones. This process has not been identified at Renancourt 1. Into the bone refuse, there are very few dental remains at Ormesson, whereas abundant fragments of enamel, dentine and cement were found at Amiens-Renancourt 1 among the bone chips (around 300 of the 5,000 chips of less than 1cm studied). Dental material is particularly exposed to the effects of freeze/thaw action, which could have contributed to this fragmentation. The black colour of some of the dental material could also indicate that it was exposed to heat⁸, but colouration due to oxides in the sediment is frequent at Renancourt (as mentioned above), which renders differentiation difficult.



Tabl. 2 – Distribution of the determined fragments by size classes.



Fig. 3 – State of the bone surfaces. Amiens-Renancourt 1 (top), 1: near-complete scapula; 2: tibia of a horse foetus; 3: Horse diastema. Ormesson – Les Bossats (bottom), 4: bovine radius shaft; 5: bovine tibia shaft

presenting fissures; 6: split phalanges 1, 2 and 3 found in loose connection in square C30 (combustion zone).

Taphonomic modifications	Ormesson	Renancourt
Colouration	16,5	51,4
Traces of roots	76,3	51,1
Cracks and splitting	5,8	5,2
Concretions	14,30	14,9

Tabl. 3 – Frequencies of the main taphonomic modifications recorded on the material from Ormesson – Les Bossats and Amiens-Renancourt 1 in percentages of observed remains.

Skeletal elements	Les Bossats			Renancourt 1		
	Number of remains	% NISP	MNI	Number of remains	% NISP	MNI
Skull	6	1,6	1	14	6,9	3
Mandible	2	0,5	2	30	14,9	6
Dental remains	6	1,6	1	79	39,1	2
Vertebrae	12	3,1	1	1	0,5	1
Ribs	90	23,3	1	22	10,9	1
Scapula	13	3,4	4	5	2,5	4
Humerus	21	5,5	5	17	8,4	5
Radius	24	6,3	6	5	2,5	2
Ulna	9	2,4	3			
Metacarpal	17	4,5	5			
Coxal	1	0,3	1			
Femur	8	2,1	2	14	6,9	4
Tibia	27	7,1	8	15	7,4	3
Tarsals	5	1,3	1			
Metatarsal	16	4,2	4			
Sesamoids and meta. vest.	24	6,3	1			
Proximal	47	12,3	3			
Phalanges						
Mesial	26	6,8	2			
Distal	5	1,3	1			
Indeterminate metapodials	22	5,8	6			
TOTAL	381	100	8	202	100	6

Tabl. 4 – Skeletal representation of bovines for Ormesson – Les Bossats and of the horse for Amiens-Renancourt 1 in NR, % NISP and MNI.

Acquisition strategies of prey and carcass transport

Based on data pertaining to the structure of the slaughtered population of large herbivores, it is possible to infer the hunting strategies applied by humans (e.g. Bignon, 2006; Frison, 1978; Levine, 1983; Speth, 1983; Stiner, 1990).

Information from age profiles based mainly on teeth is very limited at Ormesson due to the rarity of these remains for the two secondary species, but also for bison as only six teeth and two mandible series belonging to this species were found.⁹ These mandibles, a left and a right, could belong to the same individual and observation of use-wear stages

indicates that it was aged between 8 and 10 years old (Lacarrière, 2015; Lacarrière *et al.*, 2015). The other age intervals were estimated in comparison to actualist references (Koch, 1935), based on the age of the epiphyseal fusion of long bones. An individual of three to four years old and another of about six years old were identified based on the still visible synostoses on these bones (distal tibia and radius). Up until now, eight bovines have been identified at Ormesson based on the minimum number of tibias and all are assumed to belong to adults more than three years old. At the current stage of excavations and analyses, no seasonality data are available. No decidual teeth have yielded information on tooth eruption/use and it is difficult to envisage a cementochronological analysis on so few dental remains (readability bias linked to taphonomic processes to be taken into

consideration). On the grounds of these sparse elements, several adult or sub-adult individuals appear to have been hunted at a still unknown period.

At Amiens-Renancourt 1, at this stage of the study, nine individuals have been counted. Unlike at Ormesson, there are many dental remains and series. The age structure has not yet been defined in detail but a preliminary examination of the incisors indicates that prime adults aged between 3 and 12 years old are predominant in the assemblage (following the criteria of Guadelli, 1998), accompanied by at least two distinct young individuals less than 18 months old. These decidual incisors were compared to the Philippe Morel reference collection (*in* Bignon, 2003). The Renancourt teeth appear to correspond to the 10-18-month interval, or more precisely to that of 12 to 16 months, as they show intermediary stages of wear in comparison to the reference collection. Considering that the mating period takes place between April and June (Groves, 1974), and that the gestation period lasts for about 11 months, these animals appear to have been slaughtered between April and September. The measurement of an almost-complete foetal bone (right tibia) indicates that a female was slaughtered between 170 and 190 days of gestation (Habermehl, 1975; Prummel, 1987), that is in autumn (September-October). These three markers converge towards an episode of hunting and site occupation between the beginning of spring and the end of summer. Therefore, at least one hunting episode targeted a harem, as shown by the presence of three foetal remains attesting to the slaughter of at least one gestating female.

Thus, in these two sites focusing on large herbivore hunting, the presence of most of the skeletal elements, and in particular long bones and ribs, supports the hypothesis of hunting near the sites¹⁰ (tabl. 4). From a hunting perspective, their respective geographic locations were probably strategic. Renancourt is situated on a rocky spur whereas Ormesson is located at the entrance of a narrowing valley. In both cases, local topography forms a bottleneck and it is easy to imagine that this characteristic would have facilitated hunting and driving strategies. After an examination of the respective skeletal representations of the two sites, the following observations emerge:

- At Ormesson, phalanges represent more than 20% of the number of identified bovine remains whereas horse limb extremities are totally absent at Renancourt.
- At Renancourt, dental remains represent 55% of the number of remains whereas at Ormesson, dental and mandible remains only account for 2%.

These first observations imply that these sites, or at least the preserved and excavated zones of these sites, did not have the same function. This is confirmed by the other archaeological data (industries, structures...). In both cases, rib fragments are rather frequent (23.3 and 10.9% of the number of remains, see tabl. 4), but the introduction of ribcage portions to the sites may correspond to non-alimentary imperatives (discovery of a discreet industry on ribs in each of these sites, see Goutas *in* Bodu [dir.], 2018; Lacarrière *et al.*, 2015; Paris *et al.*, this volume).

Carcass processing

As cortical surfaces are not well preserved (5.5% at Ormesson and 13% at Renancourt 1 of osseous remains presenting a partially observable surface), the possibilities of reconstruction of the butchery operational sequence are limited. However, several butchery cut marks (16 remains at Ormesson, 11 at Renancourt, see tabl. 5) and percussion impacts on long bones are visible (12.2% of the total at Ormesson and 10% at Renancourt 1). Some unprecedented information should be mentioned. First of all, it is important to point out a probable differential conservation of these anthropogenic marks linked to the taphonomic processes described above (dissolution, traces of roots, concretions). This preferential conservation seems to favour the deepest butchery marks. They correspond to stages during which the bone is accidentally in more insistent or invasive contact with the tools: skinning, disarticulation, tendon removal and breakage.

The interpretations proposed for these cut marks (the butchery stage to which a cut mark may correspond) are based on a recent publication taking into account red deer carcasses experimentally butchered (Soulier and Costamagno, 2017) and for which the exact position and orientation of cut marks left on bones were taken into consideration.

Most of the butchery traces observed at Ormesson are linked to disarticulation and the removal of tendons (tabl. 5). Two scapulae and two phalanges 2 bear traces linked to disarticulation. Tendon removal was brought to light on a metacarpal and on two phalanges 2. Undifferentiated traces representing one or the other of these two activities were identified on one phalange 1 and two phalanges 2. A fragment of a bovine femur and five rib fragments from a size IV herbivore bear traces compatible with a defleshing activity.

Conversely, and rather logically as limb extremities are completely absent at Renancourt, no identified remains bear traces of disarticulation or tendon removal. On material attributed to the horse or an animal of similar size, cut marks possibly related to skinning were identified on cranial and mandibular elements (NR = 5). Activities relative to defleshing are also represented on two rib fragments, three humeruses, a femur and a tibia.

On each of these sites, systematic percussion was applied to long bones but also to bones with small medullary cavities (phalanges 1 and 2 at Ormesson invariably present percussion traces, see the example of the loose connection found in the same square metre, fig. 3, no. 6). At Amiens-Renancourt 1, the

incisal parts of horse mandibles and maxilla seem to have been systematically processed in the same way, as three specimens broken in exactly the same place were discovered (an example is shown in fig. 3, no. 3). The presence of almost complete bones at Renancourt is noteworthy. Whereas, at Ormesson, intensive culinary processing activities seem to have taken place in the excavated part of the occupation (presence of fireplaces, breaking of limb extremities), at Renancourt, the assemblage appears to be, at least partially, a waste area, which accounts for the accumulation of less intensively fragmented skeletal portions (e.g. whole scapulae, numerous mandibles and sharp bones).

Skeletal elements	Les Bossats		Renancourt 1	
	Number of remains	Activity	Number of remains	Activity
Skull	—		2	Skinning?
Mandible	—		3	Skinning?
Rib	5	Defleshing	2	Defleshing
Scapula	2	Disarticulation	—	
(neck)			—	
Humerus	—		3	Defleshing
Metacarpal	1	Tendon removal	—	
(shaft)			—	
Femur	1	Defleshing	1	Defleshing
(shaft)				
Tibia	—		1	Defleshing
(shaft)	—			
Metatarsal	1	Tendon removal		
(proximal + shaft)				
Phalange 1	1	Disarticulation or tendon removal		
Phalange 2	2	Disarticulation		
Phalange 2	2	Tendon removal		
Phalange 3	1	Disarticulation or tendon removal		

Tabl. 5 – Cut marks observed on the skeletal parts of the main species and associated size classes (bovine and class IV at Ormesson – Les Bossats, horse and class III at Amiens-Renancourt 1) and interpretation of the butchery activities they represent in the operational sequence.

Discussion and perspectives: faunal remains from the time period between 33 to 26 ky cal. in the North of Europe

First of all, this discussion proposes a review of the faunal associations from the same time period in the region under consideration here. All of the sites with determinable bone remains associated with an archaeological level dating from this interval were taken into account. The other elements of the discussion focus on an archaeozoological approach of the following sites: Maisières 'Canal', Ormesson, Renancourt and Grotte du Renne.

Enhanced paleoenvironmental characterization

Over time, the network of newly discovered or newly studied sites (fig. 4) reveals changing hunting spectrums: in some cases several large herbivores were hunted, but in others the spectrum focuses on a single species.

- **33.4-31 ky cal. BP:** eponymous site of an original material culture and of a climatic interstadial (Haesaerts and Bastin, 1977), Maisières 'Canal' contains a large and very original hunting spectrum (NISP of mammals + birds = 993). The hare (*Lepus timidus*) is the best-represented hunted species in terms of number of identified specimen, followed by the reindeer, the polar fox (*Vulpes lagopus*), an *Anatinae* (*Anas sp.*), the horse and the bison (Lacarrière *et al.*, this volume for count details). The mammoth is also associated with the assemblage but may not be strictly contemporaneous with the human occupation (*ibid.*). The Maisières occupation occurred between 33.2 and 31.1 ky cal. BP (Jacobi *et al.*, 2010) during the GI-5.2 interstadial, with an 'arctic' association of small furry and feathered game, denoting a mosaic-type landscape in a 'steppe-tundra' type environment.¹¹ Also around 32 ky cal. BP (33.4-31 ky cal. BP), the Renancourt 2 occupation contained 118 determinable remains, including a majority of reindeer followed by the horse and two bison bone pieces (Paris *et al.*, 2019). Horizon N2 of Havrincourt yielded two radiocarbon dates with 32,5 to 30,8 ky BP interval (see Antoine *et al.*, 2014) and a small osseous assemblage (NISP = 47, see Goval *et al.*, 2018). We observe the more 'classical' horse-reindeer-bison association, but four fragments of rhinoceros bones and one of a marmot (*Marmotta primigenia*) are also present. Finally, at Languevoisin-Quiquery, an Early Upper Palaeolithic layer situated between 33 and

32 ky cal. BP (¹⁴C date made on an indeterminate bone) was found. This layer is characterised by the association of several lithic elements and five osseous fragments of mammoth, reindeer and bison (Auguste, 2012; Paris, 2020; Soressi *et al.*, 2009).

- Occupied between **31.4 and 30.4 ky cal. BP**, an interval containing the 5.1 interstadial, the site of Ormesson yields a steppe-type fauna that mainly includes bison, followed by reindeer and horse (NISP = 435 *cf.* above).

At the open-air site l'Hermitage in Belgium, reindeer, horse and mammoth remains were accumulated (Gautier, 2000) during an occupation which is attributed to the Early Gravettian based on chronostratigraphic data as well as on the typotechnological characteristics of the lithic industry, despite radiocarbon dates that are partially problematic (Touzé *et al.*, 2016; Touzé, 2019).

During the 31.4 – 30.4 ky cal. BP interval, there is a drop in the richness and diversity¹² of the hunting spectrum compared to the previous time-interval where smaller assemblages have delivered at least three species and Maisières 'Canal' a very diversified spectrum. The explanations can be multiple (*e.g.* palimpsests, site's function, duration of occupations, different economic strategies or repercussion of a climatic event on large fauna) and will be discussed in details in future work.

- A hiatus in the record is observed between **30.4 and 28 ky cal. BP** (Klaric, 2013). This period, which extends from the second part of the Heinrich Event 3 to the end of GS-4, includes an interstadial episode.
- **Between 27.8 and 26 ky cal. BP:** this time period begins with GI-3 and ends with a cooling episode that will culminate during the Heinrich Event 2. Two major sites are recorded in the Paris Basin: Grotte du Renne and Amiens-Renancourt 1. The level V of the Grotte du Renne (27.7 to 26.9 ky cal. BP) delivered a rich and diversified assemblage (NISP = 1962). It contains an arctic spectrum (reindeer is predominant and is associated with mammoth, horse and bovinæ) where the presence of concomitant mountain species could indicate a deterioration in climatic conditions (reduction in the habitat zones of the former species). This increase in the Pyrenean chamois (*Rupicapra rupicapra*) and ibex (*Capra ibex*) in the spectrums is observed in Recent Gravettian sites and especially in Final Gravettian sites in Auvergne and South-western France.¹³

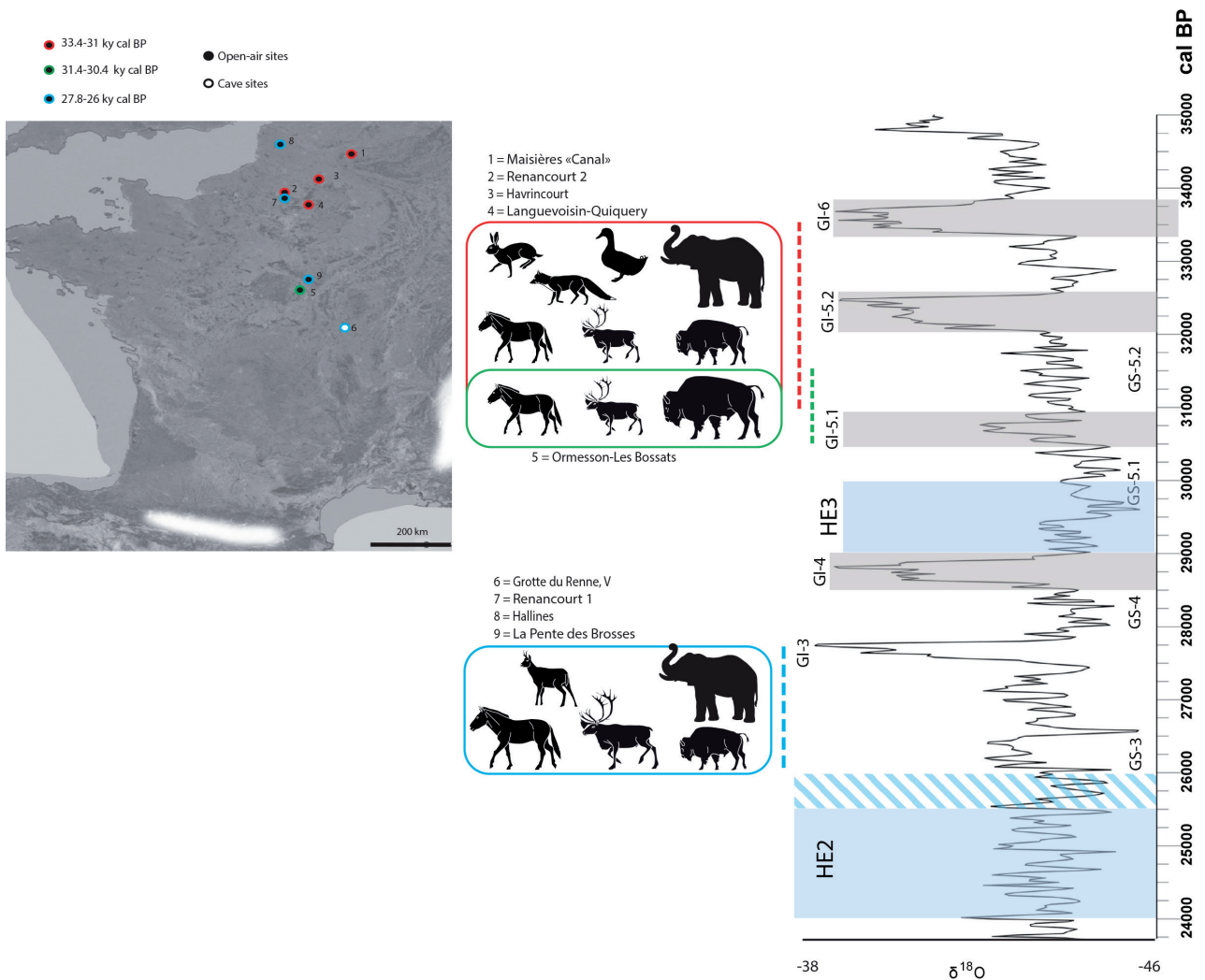


Fig. 4 – Evolution of hunted species in North-western Europe during the Gravettian time-period (paleo-climatic curve: Banks *et al.*, 2019). Size of mammals represented in this figure indicates their relative frequencies into spectrum of the various sites.

At Amiens-Renancourt 1 (27.8 to 26 ky cal. BP), the horse is the main species. It is associated with marginal species: hare, woolly rhinoceros, mammoth and red deer (*Cervus elaphus*). However, these species must be considered with caution as they are only few remains of it, and the red deer is only represented by ornamental elements (perforated vestigial canine, see Peschaux, this volume), which does not prove that they were slaughtered at the same time as the occupation of the site. The first three species corroborate a ‘mammoth steppe’ compatible with the other paleoenvironmental data, in contrast with the presence of the red deer vestigial canine, which is traditionally considered as an animal belonging to wooded environments. However, the presence of the red deer would not be inconsistent with a ‘mammoth steppe’ environment (see note 11).

Apart from those two major sites, the site of Hallines yielded a date of 28.1 to 27.6 ky cal. BP on a mammoth bone (Paris *et al.*, this volume). This

very significant date attests to the contemporaneity of the species with the Gravettian chrono-cultural interval. This is especially interesting considering that mammoth bones and ivory were collected in a fossil or subfossil state at the Gravettian sites of Arcy-sur-Cure and Maisières ‘Canal’ (Goutas and Lacarrière, 2018; Lacarrière *et al.*, this volume). La Pente des Brosses, an occupation situated near Les Bossats, contained an Upper Palaeolithic lithic industry which is attributed to the Recent or to the Recent-Final Gravettian based on radiocarbon dates that place the site around 27 ky cal. BP (Klaric, 2013). Among the hundred or so osseous remains, the reindeer is the sole taxon identified (Schmider *et al.*, 1983). Finally, Mancy, for which no coherent dates were obtained, but which is related to the evolved or final phase of the Gravettian (very poorly known and dated in the south of the Paris Basin, see Klaric, 2013), comprised several bison remains (Chehmana *et al.*, 2008).

Although they do not provide well defined and well dated Gravettian layers, two sites located in France are also worth mentioning. At Achenheim in Alsace (Junkmanns, 1995), two stratigraphic layers are attributed to the Gravettian time-period: layer 7 comprised proboscidean remains and layer 8 yielded reindeer and marmot remains. However, in the absence of absolute dates or a revision of the archaeostratigraphy, no further information is available for the time being. At Arcy-sur-Cure, the level III of Grotte du Trilobite yielded Gravettian tools in flint and bone. This industry is probably identical to that of level V of Grotte du Renne but was excavated at the beginning of the last century (Parat, 1902). Considering the date of the excavations and the difficulties involved in delimiting an archaeological level in cave contexts, the provenance of the bones associated with this level III is uncertain. However, it is important to note that the abundant proboscidean bones and teeth identified in this layer could have been collected rather than acquired by hunt (Goutas and Lacarrière, 2018). Some elements could have been retrieved from older habitat sites or from fossiliferous levels of the Cure valley, whereas others could have been acquired while still fresh (*ibid.*).

Diversified taphonomic contexts for archaeological records of variable quality

Maisières 'Canal' is an interesting site in terms of taphonomic conservation. In spite of high taxonomic diversity (marine fossils, lagomorphs, birds, medium-sized, large and very large mammals), which could have caused taphonomic disparities, we observe common denominators: good overall conservation with slight colouration and several traces of lateral roots. This demonstrates uniform burial conditions at this open-air site discovered in wetlands with complex excavation conditions (Lacarrière *et al.*, this volume).

In spite of analogies between the two site contexts presented here (Amiens-Renancourt 1 and Ormesson – Les Bossats), we observed marked contrasts in the respective conservation of the remains. The effects of weathering, traces of roots and concretions are very often observed and classically linked to open-air contexts, but their intensity varies on both sites. But the most interesting differences concern the fragmentation of remains and the preservation of butchery cut marks, which are both higher at Ormesson. According to skeletal representativeness data, the excavated zone at Ormesson appears to be in the heart of the habitat zone (fireplaces) and

less appreciated anatomic portions were left on the kill site or in a non-conserved or non-excavated zone. The bones discovered in the occupation were thus brought there to be processed. In contrast, at Renancourt, the excavated zone seems to represent a waste zone (waste that could result from emptying fireplaces), where less intensively processed portions could have been discarded. This could explain the lower frequency of butchery cut marks recorded at Renancourt in relation to Ormesson in spite of the better conservation of bone surfaces at the former site (respectively 10 and 12.2% of the observable remains, cf. above).

The closest Gravettian occupation to Ormesson with usable data is the one of Grotte du Renne. The context at this latter site was conducive to the conservation of cortical surfaces and butchery marks are more frequent (32.7% of the observable remains). The bones present very heterogeneous aspects, which could indicate significant local variation in taphonomic processes and/or different timing of bone deposition. Due to the absence of spatial coordinates, it is not possible to discuss the degree of palimpsest-type occupations (Lacarrière, 2015).

Diversified prey and hunting acquisition strategies

For the time being, Maisières is the Gravettian exception in North-western Europe as it provides information on an occupation where small game hunting or trapping seems to have been more widespread than large herbivore hunting (Lacarrière *et al.*, this volume).

In contrast, Ormesson shows the selective hunt of a big and dangerous ungulate, which consequently allows to think that specific and adapted hunting strategies, maybe involving the use of topography, may have been applied for this type of game. An experimental approach aims to link the morphologies of fractures on microgravettes with the mode of propulsion of hunting weapons, which will permit to continue the discussion on hunting strategies (Coppe, n.d.; Coppe and Rots, 2017). The analysis of the high number of horse dental remains from Amiens-Renancourt 1 should lead to a detailed interpretation of the mortality profile and the hunting strategy adopted by its occupants. Deciduous teeth and foetal fragments already indicate a seasonal occupation situated between the beginning of spring and the beginning of autumn when females are in good physical condition.

Based on deciduous reindeer teeth, the occupation of layer V of Grotte du Renne seems to have taken

place in winter. It is likely that the strategic position of this site in a meander of the Cure was also known to hunters as a refuge zone for herbivores during winter. At this season, the reindeer were probably attracted to the thermal characteristics of the region (Lacarrière, 2015; Goutas and Lacarrière, 2018), which made them undoubtedly easier to detect since they are usually dispersed in small groups during this period of the year.

Pending questions on site functions and human mobility dynamics

Three open-air sites presented in this discussion show some similarities. The occupation of Amiens-Renancourt 1 is more recent than those of Ormesson – Les Bossats and Maisières ‘Canal’ but they are nonetheless similar in terms of the type of occupation: base camps, probably located near the kill site of a part of the game, and where diversified activities were carried out.

It is interesting to underline that the two Gravettian occupations of Amiens-Renancourt show major differences. The oldest one (Amiens-Renancourt 2) shows a limited range of activities (knapping and butchery) and did not yield any projectile point or hearth structure (Paris *et al.*, 2019). Conversely, the most recent occupation (Amiens-Renancourt 1) corresponds to a camp that was used for several domestic activities (knapping and butchery, but also the use of fireplaces, perhaps linked to culinary preparation, production of female statuettes in chalk...) and hunting, the presence of numerous projectile points and remains of horses attesting the importance of this latter activity.

From a chronological perspective, when we compare the data presented here with the rest of the Gravettian faunal landscape in the north of France and Belgium, we observe a combination of changes and continuities. The example of Maisières ‘Canal’ and Les Bossats, which are two of the oldest sites for the Gravettian period in this region, is interesting in this regard. Indeed, even though both sites attest intense and multiple activities, the diversity of hunted species at Maisières ‘Canal’ contrasts with the specialized spectrum observed at Les Bossats. This difference in the diversity of prey must be questioned in the light of a refined palaeo-climatic framework in order to determine whether it results from different environments or if it reflects distinct economic strategies.

Those elements of interpretation are only the promising first stages of ongoing analyses of abundant material (Ormesson, Renancourt, Maisières

‘Canal’) or partially published material (Achenheim, Hallines). The in-depth analysis of certain economic aspects (use of bones for rendering grease for diverse utilisations, fuel or conservation for example, see Lejay *et al.*, this volume), as well as an enhanced understanding of seasonality data will allow us to refine our vision of the occupation modes of this ‘threshold’ region where rapid climatic changes marked this period of instability.

Conclusion: the perspective of new (re)discoveries

Over the past years, several Early Upper Palaeolithic sites have been discovered in the north of France. These discoveries rebalance the significant disparities in our knowledge with regard to the end of the Palaeolithic for which abundant data are already available, especially in the Paris Basin (Bayle *et al.*, 2018).

Open-air contexts limit the acquisition of certain data (reconstruction of the butchery operational sequence) but are, on the other hand, auspicious to a paleoethnographic interpretation of these occupations. In addition to the detailed analysis of carcass transport strategies, which enable us to discuss the function of each site in greater depth, taking into consideration the spatial distribution of remains is decisive for our overall understanding of these habitats.

Finally, recent discoveries in preventive archaeological contexts have opened multiple new perspectives. The latest of these discoveries, Montereau-sur-le-Jard¹⁴ (Blaser, pers. comm.) is situated near Ormesson. The implementation of research projects focusing on the beginning of the Upper Palaeolithic has also revealed unpublished or under-documented archaeological assemblages in Île-de-France (*e.g.* La Pente des Brosses), les Hauts-de-France (*e.g.* Hallines, Havrincourt, Languevoisin-Quiquery, see Goval [dir.], 2020; Auguste, 2012; Paris, 2020) and Alsace (Bachelierie *in* Wuscher *et al.*, 2017), and promises to disclose new results in the coming years.

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Endnotes

1. Collective Research Project directed by P. Bodu, F. Bon and L. Brou between 1999 and 2005 and entitled '*The Early Upper Palaeolithic in the centre and the south of the Paris Basin. From technical systems to behaviours*'.
2. Collective Research Project directed by E. Goval since 2019 and entitled '*Paléohauts enrichissement du cadre chronostratigraphique et archéologique des sites paléolithiques historiquement et récemment découverts en Hauts-de-France*'.
3. Economy and practices of Gravettian societies in North-western Europe (ECOPRAT, CDR FNRS) coordinated by O. Touzé, H. Salomon, N. Goutas and P. Noiret.
4. In this work, the radiocarbon dates used are calibrated in BP using Oxcal 4.3 with the Intcal 13 curve (Bronk Ramsey, 2009; Reimer *et al.*, 2013). The paleoclimatic and cultural chronology we refer to is based on the Greenland ice core climatic record from Rasmussen *et al.* 2014 and from the synthesis of Banks *et al.*, 2019.
5. On the other hand, this interval between 31 and 30 ky BP corresponds to the Middle Gravettian in the southwest of France, see Banks *et al.*, 2019.
6. Several souslik remains (*Spermophilus* sp.) were also determined and have a natural origin (Stoetzel in Bodu [dir.], 2014). The digging of their burrows disturbed very localized areas of the Gravettian occupation, after the occupation, during milder periods of the last glaciation.
7. This large bovine was determined on the basis of morphological criteria, in particular the glenoid cavity of the scapula, the humerus, the radius and the tibia (Brugal, 1983; Olsen, 1960; Lacarrière, 2015).
8. A spatial analysis of these fragments in relation to their proximity to waste from fireplaces, after further delimitation, will provide additional information. Their distribution will also be compared to that of the fragmentary chalk elements related to ornaments or feminine statuettes. Indeed, these objects may also have been exposed to gelifraction and this hypothesis should be tested (Paris *et al.*, 2019). A spatial approach comparing these two types of materials (dental remains and chalk) will be interesting for discussing the role of frost in the deterioration of remains at Renancourt.
9. Since 2018, eight dental remains of bovine were found into the thalweg. If it were shown that these remains come from

the Gravettian level as their surface state seems to suggest, it would mean that an additional mandible was introduced by the hunters into the site.

10. The presence of three foetal remains at Amiens-Renancourt 1 could suggest that the evisceration stages, which are often among the first stages in the butchery operational sequence, took place nearby. But deliberate transport over a certain distance cannot be ruled out. Large ungulate foetuses may have been particularly appreciated for the tenderness of their meat or the fineness of the skin (for ethnographic examples see Soulier, 2013, p. 90, 93).
11. Also called 'mammoth steppe' (Guthrie, 1982; 1990), this very abundant biome could potentially include several non-analogous species. This environmental mosaic would have been conducive to the coexistence of the mammoth, the bison, the horse, the reindeer, as well as other sympatric cervids.
12. Richness and diversity *sensu* Grayson, 1984; Grayson and Delpech, 1998.
13. At Blot (C23-35), Roc de Combe (layer 1), Laugerie-Haute Est (layer 36), Pataud (layer 2) and Peyrugues (layer 18), see Lacarrière, 2015. Radiocarbon dates published for the two latter sites indicate an interval ranging from 28 to 26 ky cal BP.
14. This site is located about 40km north of Les Bossats and yielded several equid dental remains which are currently being studied (Bayle and Lacarrière, work in progress).

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