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Changes in faunal spectra in northern France during the Late Antiquity.

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Abstract: The period of transition between Late Antiquity and the beginning of the early Middle Ages is now better documented, primarily thanks to rescue archaeology. Although the zooarchaeological corpus for the north-east of France, which consists of only 35 contexts dating from the end of the 4th to the beginning of the 6th century AD, presents some limitations, initial synthesis of the work provided an inventory of current knowledge on this transitional phase. Changes in the proportions of the three main domestic mammals were observed, such as an increasing use of pork to the detriment of beef. But the most striking point was the small share taken by sheep and goats during this period. This raised the question of the causes of this phenomenon and resulted in several hypotheses being proposed: health,

socio-cultural, environmental, or economic. The present state of our knowledge suggests the latter is the most pertinent.

Key words: 5th century AD, zooarchaeology, husbandry, meat consumption, sheep, wool, northern Gaul

1. Introduction

Thanks to developments in rescue archaeology during the last twenty years, our knowledge concerning the Roman period in northern France has greatly increased. In the same way as buildings, ceramics, or metal artefacts, have benefitted from a large number of studies, faunal remains have been the basis for investigations into food habits and breeding choices in northern Roman Gaul (Lepetz 1996). At present, we still have a far better understanding of the Early Roman Empire than Late Antiquity, and it is twenty years since agro-pastoral practices of this latter period were the subject of preliminary studies (Leblay et al. 1997). However, new advances have recently been made; therefore, a new approach to this relatively unknown period is required, as is the expansion of the Late Antiquity corpus.

This initial work is based solely on the number of identified specimens (NISP) and aims to show the scarcity of sheep and goats. With this in mind, several interpretations are proposed which will have to be tested by the further exploitation of zooarchaeological data in the coming years.

2. Material and methods

2.1 Material

Despite numerous archaeological excavations, thanks primarily to the development of rescue archaeology, sites dating from the Late Antiquity in northern France are still scarce, and those

that have been the subject of a zooarchaeology study ~~scarcer~~ still **scarcer** still (Fig. 1). The initial corpus studied was supplied by the Myos database (<http://base-myos.fr> ; Lepetz and Barreau 2015), part of Project ERC-RurLand; based in the north-eastern quarter of France, it currently includes faunal data on Roman sites provided by thirty-five zooarchaeologists. However, although the accumulation of a large quantity of data is essential in developing a synthesis, its size can also cause numerous difficulties. Regarding this first synthesis for the end of Late Antiquity and the transition into the Early Middle Ages, various points must be raised.

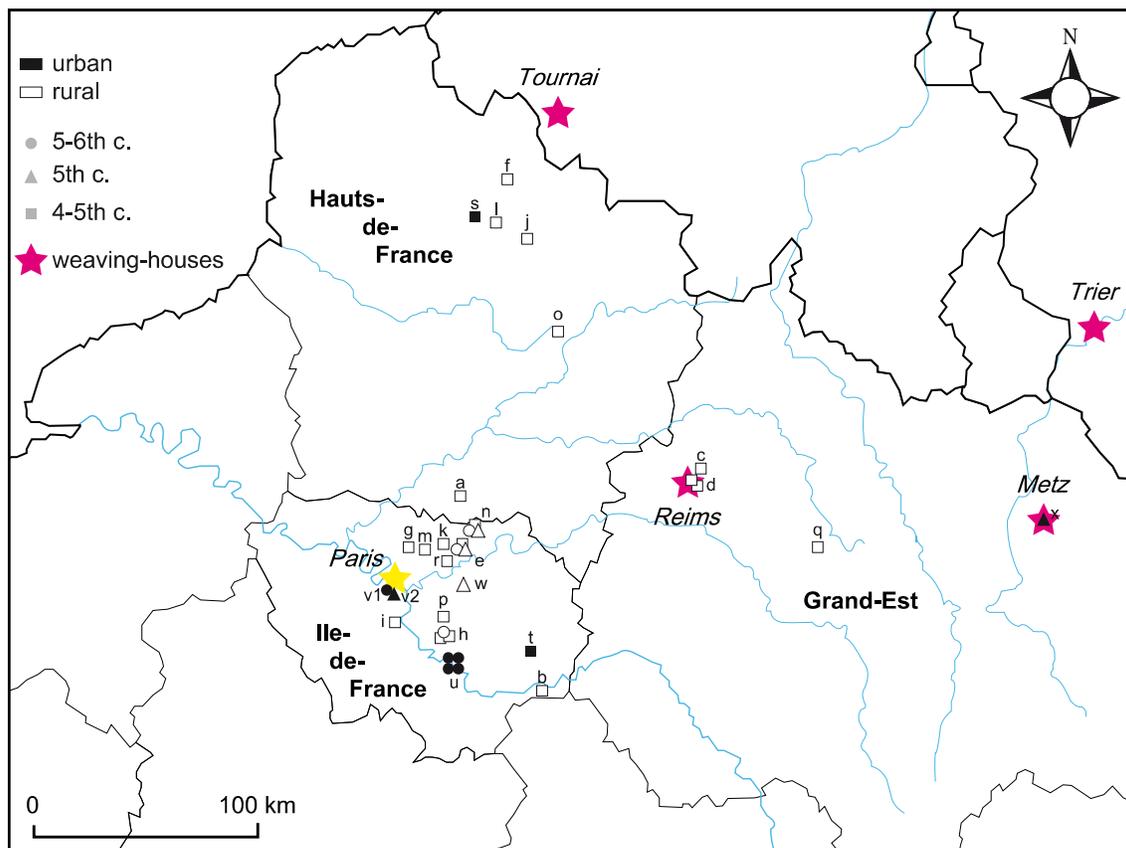


Fig. 1: Distribution map of the sites taken into account for this synthesis, north-eastern quarter of France. **(colour for this picture)**

The first concerns the allocation of chronological phases. Some studies relating to this region are old, when the knowledge of Late Antiquity ceramics was less precise than today, and for some sets a large chronological range should be considered; unfortunately, due to the absence of new studies on these ceramic assemblages, these dates could not be refined. Therefore, according to the chronological attribution of archaeologists, we have grouped the sites in three sets. The first relates to the transition between the 4th and the 5th century and provided twenty-two contexts. The second incorporates eight sites clearly dated to the 5th century. The third concerns the transition between the 5th and 6th centuries and numbers only five sites. As we can see, the number of sites in the different chronological phases is unequal.

The second point is the spatial heterogeneity of our data. The majority of contexts at our disposal were located in the Ile-de-France. The only exception was for the 4th-5th century phase in which a few sites in the (recently termed) regions of the Hauts-de-France and the Grand-Est were available. However, although the numbers of archaeological excavations were substantial, the data at our disposal for the end of Antiquity remained limited (Table 1 and appendices). Despite this, we were still able to outline a few major trends which will hopefully be clarified by the updating of new sites.

	Commune	Site	Datation	NISP total	Conte xt	Zooarchaeologi st
a	Baron	Buisson-Saint-Cyr	4-5th c. AD	374	rural	S. Lepetz
b	Bazoches-lès-Bray	Les Demi-Arpents	4-5th c. AD	624	rural	S. Frère
c	Caurel	En Droit le Clocher	4-5th c. AD	28	rural	G. Auxiette
d 1	Cernay-lès-Reims	Les Bonnets marqués	4-5th c. AD	267	rural	G. Auxiette
d 2	Cernay-lès-Reims	Les Petits Didris	4-5th c. AD	745	rural	G. Auxiette
e 1	Compans	Ouest du Parc	4-5th c. AD	381	rural	J.-H. Yvinec
f	Dourges	Plateforme multimodale Delta 3	4-5th c. AD	120	rural	J.-H. Yvinec
g	Gonesse	ZAC Tulipes Sud	4-5th c. AD	261	rural	S. Frère
h	Lieusaint	Centre Commercial 2	4-5th c.	709	rural	C. Bemilli

1			AD			
h 2	Lieusaint	Parc du Levant	4-5th c. AD	63	rural	J.-H. Yvinec
i	Longjumeau	Champtier des Cerisiers	4-5th c. AD	376	rural	S. Frère
j	Marquion	Fouille 32 Secteur 8	4-5th c. AD	1050	rural	G. Jouanin
k	Mauregard	La Fossette	4-5th c. AD	59	rural	J.-H. Yvinec
l	Monchy-le-Preux		4-5th c. AD	1464	rural	S. Lepetz
m	Roissy-en-France	La Croix de Montmorency	4-5th c. AD	105	rural	S. Frère
n 1	Saint-Pathus	Les Petits Ormes	4-5th c. AD	1099	rural	J.-H. Yvinec
o	Saint-Quentin	La Voie de Francilly	4-5th c. AD	101	rural	G. Auxiette
p	Servon	L'Arpent Ferret	4-5th c. AD	73	rural	J.-H. Yvinec
q	Sivry-Ante	Les Sarthes	4-5th c. AD	208	rural	J.-H. Yvinec
r	Villeparisis	ZAC du Vieux Pays	4-5th c. AD	191	rural	C. Bemilli
s	Arras	Dépotoir militaire	4-5th c. AD	2887	urban	S. Lepetz
t	Châteaubleau		4-5th c. AD	3863	urban	J.-C. Leblay
	Total		4-5th c. AD	15048		
e 2	Compans	Ouest du Parc	5th c. AD	1149	rural	J.-H. Yvinec
h 3	Lieusaint	ZAC Pyramide	5th c. AD	91	rural	S. Frère
n 2	Saint-Pathus	Les Petits Ormes	5th c. AD	92	rural	J.-H. Yvinec
u 1	Melun	Médiathèque	5th c. AD	405	urban	J.-C. Leblay
u 2	Melun	ND 91	5th c. AD	218	urban	J.-C. Leblay
u 3	Melun	Prieuré Saint-Sauveur	5th c. AD	1029	urban	J.-C. Leblay
u 4	Melun	TND 2000	5th c. AD	239	urban	J.-C. Leblay
v 1	Vanves	Place de la République	5th c. AD	471	urban	S. Frère
	Total		5th c. AD	36945		
w	Bussy-Saint-Martin	Rentilly	5-6th c. AD	217	rural	J.-H. Yvinec
e 3	Compans	Ouest du Parc	5-6th c. AD	24	rural	J.-H. Yvinec
n 3	Saint-Pathus	Les Petits Ormes	5-6th c. AD	677	rural	J.-H. Yvinec
x	Metz	ZAC Amphithéâtre	5-6th c. AD	17264	urban	G. Jouanin
v 2	Vanves	Place de la République	5-6th c. AD	162	urban	S. Frère
	Total		5-6th c. AD	18344		

Table 1: List of sites taken into account for this synthesis.

The third point is the characterization of the sites themselves, which is primarily based on their geographical context. Three main categories, with the exception of the funerary context, are generally used: rural, urban, and *vicus*. The nuances that encompass these three classifications are often difficult to take into account; for example, it is difficult to compare the remains from dumps of the *pars urbana* of a large villa with those from the ditches of a more modest establishment. Yet, both are considered “rural”, as they are located in the countryside, and are therefore treated equally. Ideally, the comparison of two sites is only possible if the taphonomic characteristics, the origin of the studied material, the constitution of rejects (etc.) are identical. Similarly, grouping multiple sites into one category requires the same criteria. Unfortunately, this strict similarity is scarce, and each case could be considered unique. For this study, therefore, we have chosen to conform to the information as recorded in the database. The real confrontation, however, is between the rural and the urban world, without distinction of social levels; an opposition that may also be described as being between the sites producers (countryside) and the sites consumers (city). We should point out that the corpus of data used includes no site considered as a *vicus*. This is partly explained by a total or partial abandonment of many small towns in the 3rd and the 4th century (Van Ossel 1994; Ben Redjeb et al. 2005; Monteil and Tranoy 2008).

2.2 Methods

For this first stage of our reflection on Late Antiquity, we focused on the number of identified specimens (NISP) and relative proportions of the main domesticated mammals (cattle, pigs, and sheep/goats). The percentages were calculated from the sum of NISP of these main species (NR3) from each particular site-type and phase. The significance of observed differences was tested with Pearson’s chi-squared test.

Concerning sheep and goats, the distinction is rarely mentioned in the database or in most zooarchaeological studies. However, S. Lepetz notes only 6 % of bones attributable to goats among the distinguishable bones in his corpus of northern France (Lepetz 1996). Sheep are clearly the dominant material.

The place of equids, poultry and wild fauna were also considered. Cut marks on **the** bones from these three groups, including equids (Lepetz 1996, Arbogast et al. 2002), indicate that they were consumed. Their NISP relates to that of the three main species, which form the basis of a meat diet (for example, NISP of equids/NR3x100; Lepetz 1996, Clavel 2001, Oueslati 2006). The term poultry includes the chicken (*Gallus gallus*), the goose (*Anser anser*), the mallard duck (*Anas platyrhynchos*) and the rock pigeon (*Columba livia*); however, due to the difficulty of distinguishing the domestic or wild form of the last three, any taxa unable to be identified to the rank of species (*anatidae*, *anas sp.*, *colombidae*, etc..) were carefully integrated with the wild fauna.

Finally, we should specify that we did not have the ability to examine mortality profiles, due to scarcity of data and difficulty of analysis. Some sites provided few dental or epiphyseal series for sheep, but they were not enough to draw a general picture; however, this analysis was the only one able to define husbandry strategies.

3. Results

3.1 Taphonomic conditions

One element that did need to be taken into account, with the two considered categories of sites (rural and urban), was the difference between the average bone weights obtained (Fig. 2). The rural sets delivered a higher average weight than those of the urban assemblages, principally due to the structures where the bones were discovered and the nature of their fill. The faunal material for rural sites came primarily from slow filling structures (ditches) in

which bones were exposed to several destructive processes, a phenomenon which tends to preserve only the most voluminous and resistant bones. Conversely, in urban areas, the excavated structures (pits) filled much faster, which allowed for better preservation of even the most fragile elements. The differences in the dynamics of the filling may also have had an impact on the representation of species: cattle and horse were favoured in rural contexts, small livestock and birds in urban contexts.

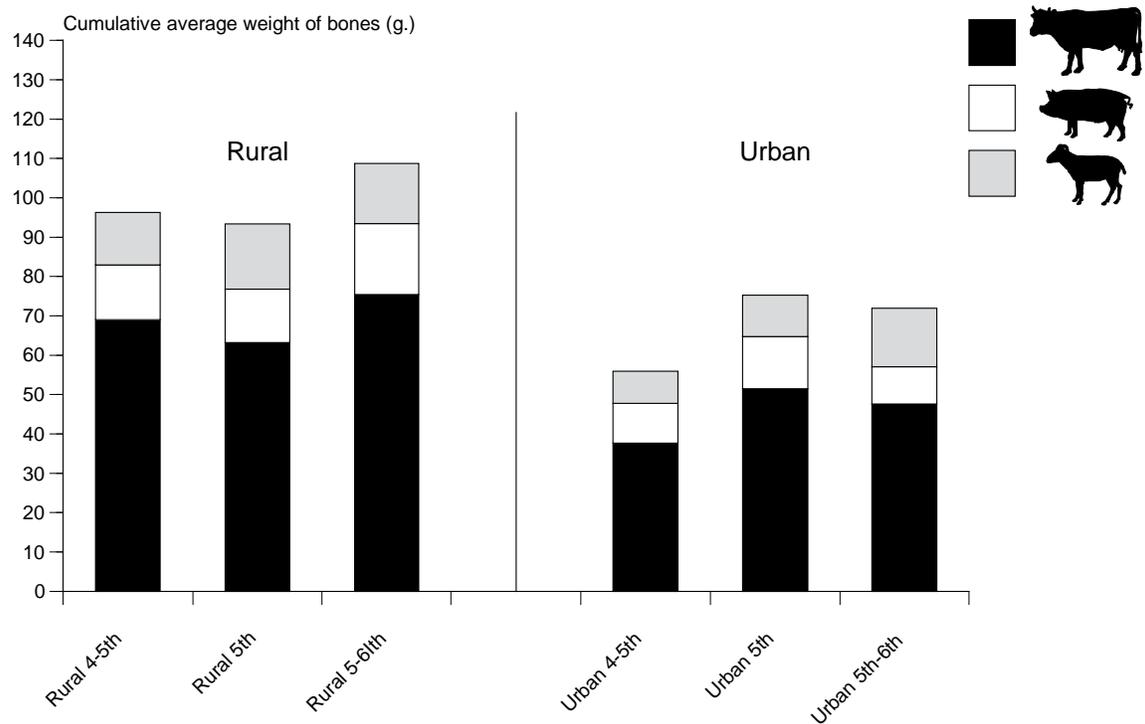


Fig. 2: Comparison and chronological evolution of the average bone weight of cattle, pigs, and caprines, depending on the context.

3.2. The three main domestic species

An examination of species frequency within the domestic triad highlights some interesting information. The rural sites are characterized by a high representation of cattle bones (Fig. 3); only the 5th century phase is distinguished by the domination of pig remains. This distinction is due to the strong influence of a single site – Compans "Ouest du Parc" – which concentrates the majority of bones from a rural context for this period. Therefore, the profile obtained is almost identical to that of this single site. Apart from this particular case, cattle dominate within rural contexts and pigs within urban ones, regardless of the phase considered.

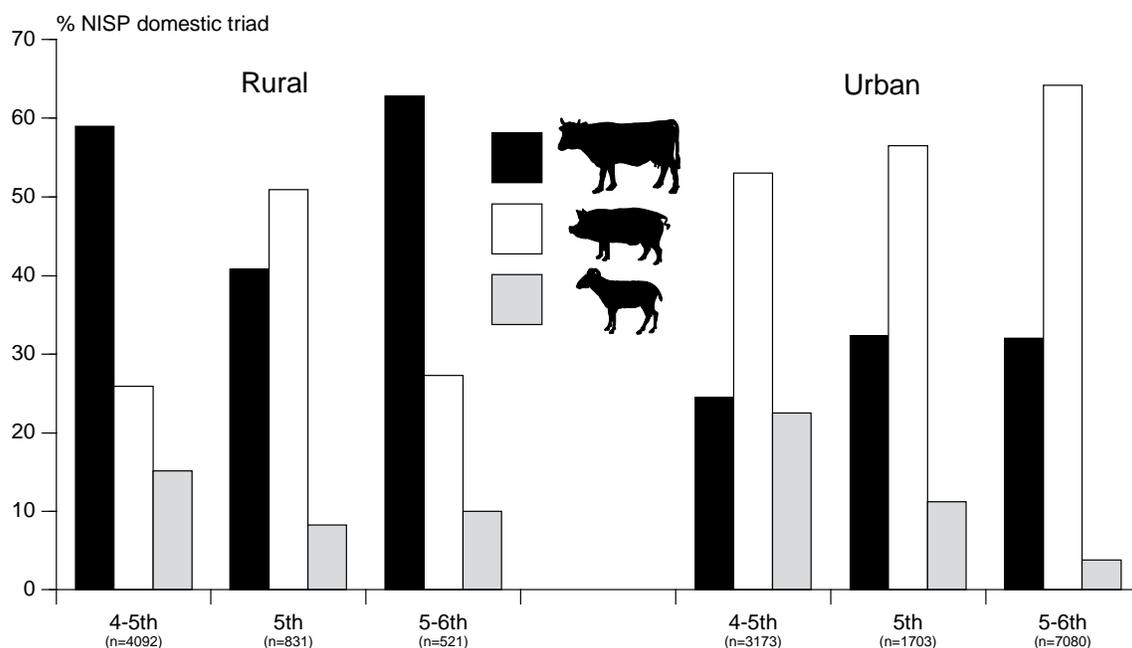


Fig. 3: Chronological evolution of the frequency, in terms of the number of remains, of the three main domestic species in both a rural and urban context.

It is interesting to note that the bones from Compans "Ouest du Parc" were mainly discovered in cellars or storerooms, located in *pars urbana*, and their accumulation seems to have originated directly from food consumption. The strong resemblance between the profile obtained from Compans and that from urban contexts attests to close consumption choices

between the city and the countryside, but only when we compare waste food from the *villa* owners. This point reinforces the idea of a distinction between the clearly termed profile of "consumer" and that, by default, of "producer".

3.3. Examples from three sites of long-term occupation

Within our corpus, the existence of a small number of diachronic sites is very interesting, as they have allowed us to follow the intra-site evolution of both food and agro-pastoral choices. This has helped us to avoid the general pitfall of trying to compare incomparable habitats where social levels or specific landscapes are significantly different. For these particular cases, we allowed ourselves to extend the chronological framework in order to keep the dynamics of each site. Nevertheless, even for these four sites, the 5th century remains the critical period.

3.3.1. Compans "Ouest du Parc" - Rural

For the rural habitat site of Compans "Ouest du Parc", 2847 bone remains were studied. A strong chronology could be defined per quarter of a century (a: first quarter, b: second quarter, c: third quarter, d: last quarter). If during the third quarter of the 4th century relative proportions of the three main species are relatively comparable, by the end of this century the rate of caprines quickly decreases (Fig. 4). This phenomenon continues throughout the 5th century.

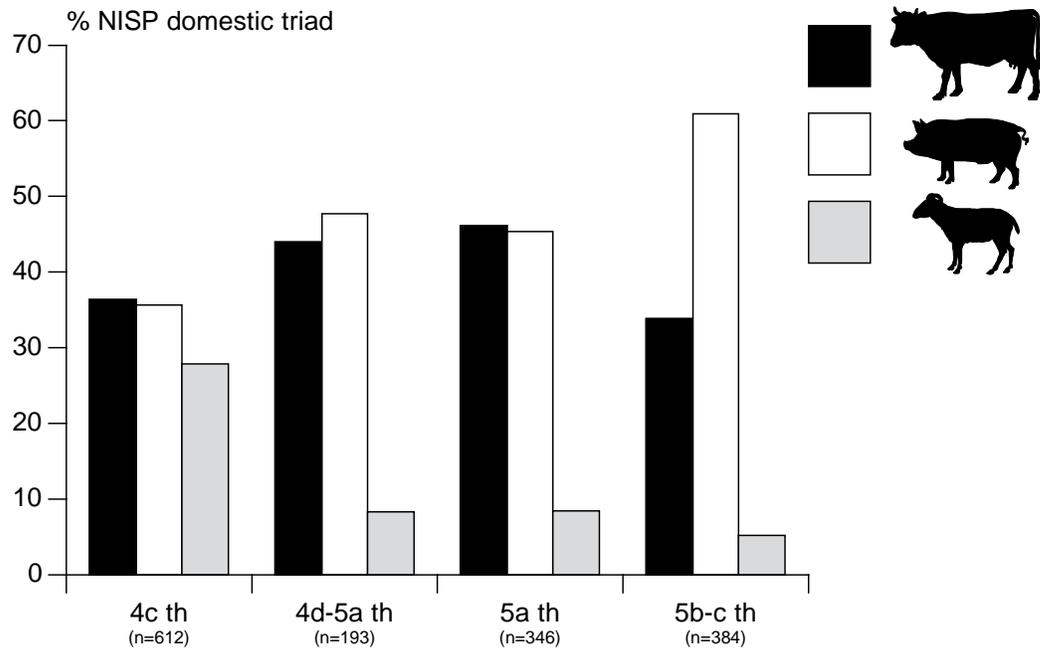


Fig. 4: Chronological evolution of the frequency, in terms of number of remains, of the three main domestic species from Compans "Ouest du Parc".

3.3.2. Saint-Pathus "Les Petits Ormes" - Rural

Located in the north of Seine-et-Marne, bordered by the Oise, the site of Saint-Pathus "Les Petits Ormes" appears to evidence a continuous period of occupation from the 3rd to the 8th century AD. During the Roman period a villa was constructed, chiefly in the northern half of the site, followed by various types of wooden buildings which moved the occupation of the site further south. Several phases of occupations were well presented, and there appears to be no gap in the site's occupation (Fig. 5).

Compared to the previous example, cattle remained dominant throughout this long sequence. The decline in the proportion of caprine remains appears earlier, during the 4th century, with the minimum being reached at the beginning of the 5th century.

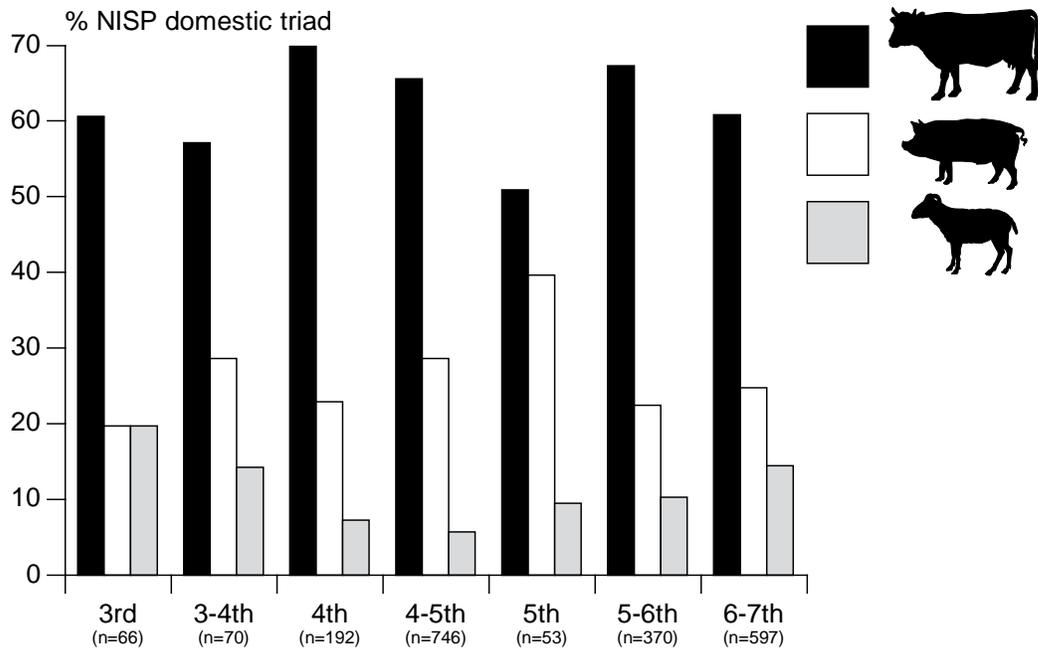


Fig. 5: Chronological evolution of the frequency, in terms of number of remains, of the three main domestic species from Saint-Pathus "Les Petits Ormes".

3.3.3. Baron "Buisson-Saint-Cyr" - Rural

This rural site, located on either side of the Nonette River, seems to have been occupied for a long period of time. There was an equal balance between the three main species from the 3rd century until the 4th-5th when cattle began to predominate (Fig. 6). Sheep and goats, which were slightly dominant with a rate of 37.2 %, declined to third position at a much reduced rate of 9.2 %. During this transition period, we observed a complete reversal in the dominance of cattle by pigs at the turn of the 5th century. The frequency of sheep and goats remains low, although it does increase slightly.

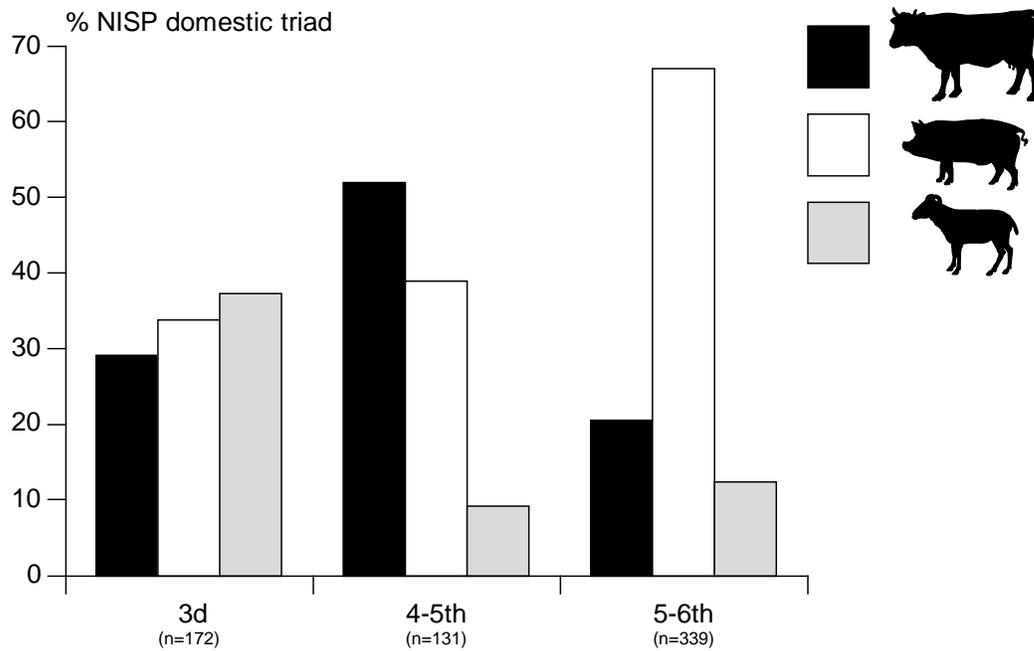


Fig. 6: Chronological evolution of the frequency, in terms of number of remains, of the three main domestic species from Baron "Buisson-Saint-Cyr".

The individual evolution of the three long-term occupation sites of Compans, Saint-Pathus, and Baron attests to the reality of the phenomenon highlighted at the scale of northern Gaul.

3.4 Equids, poultry, and wild fauna

Equids were an important component of the productive system with regards labour and transportation. Neither donkey nor mule remains were observed in our corpus. The frequency of horse bones observed in rural areas is important for both the first (4th-5th c., 8.6 % of NR3) and last phase (5th-6th c., 6.6 % of NR3; Fig. 7). The hiatus which occurred during the 5th century is difficult to take into account, for the reasons previously mentioned, and possibly reflects a difference in consumer choice rather than of chronological variation. This idea is reinforced by the similarity of numbers found in urban areas which are much lower,

around 2 %, except for 5th century phase for which the proportion is even lower; however, at present it is difficult to provide more than just an observation.

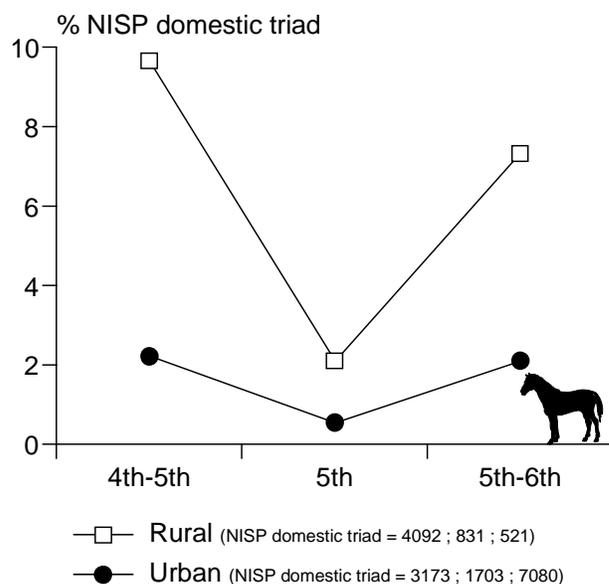


Fig. 7: Chronological evolution of the frequency of equids, reported number of remains of the domestic triad (NISP equids/NISP domestic triad x 100).

Poultry completes the meat supply contribution of the group cattle-pig-sheep. The consumption of domestic birds was lower in the countryside than the city, but the impact of taphonomy remains to be determined. On rural sites, with the exception of Compans "Ouest du Parc" with a percentage of 9% for the 5th c., poultry represents between 2 to 3 % of the domestic triad's NISP (Fig. 8). This figure rises to 7 % in an urban context. Again, the proportions observed at Compans "Ouest du Parc" are identical to those of the urban assemblages. For both contexts, chicken is the species with the largest majority. The goose, almost systematically present, oscillates between 2 and 10 % of the domestic bird remains. The frequency of the mallard duck and the rock pigeon remains anecdotal.

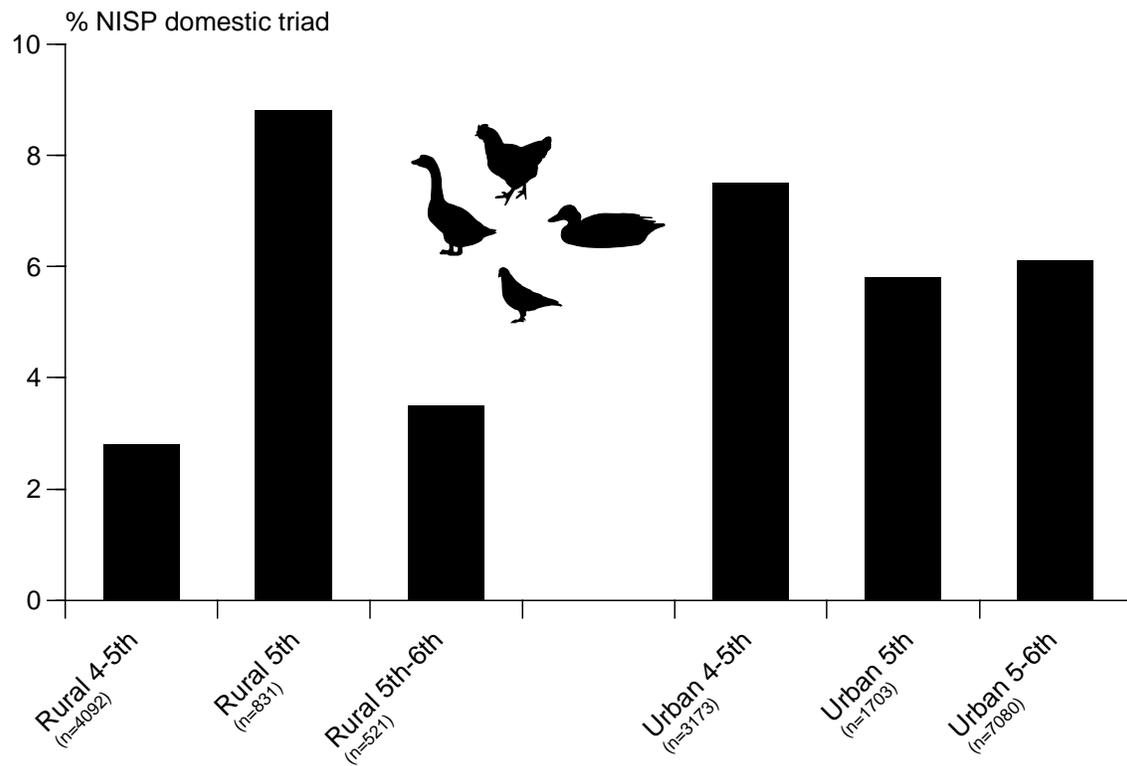


Fig. 8: Chronological evolution of the frequency, reported number of domestic triad remains (in brackets), of poultry ($\text{NISP poultry} / \text{NISP domestic triad} \times 100$).

Concerning wild fauna, which is overall quite small, a certain trend appears regarding the diversity of species encountered (mammals and birds). Indeed, we can observe an inversion in the number of species identified between the rural and urban context during this time (Fig. 9).

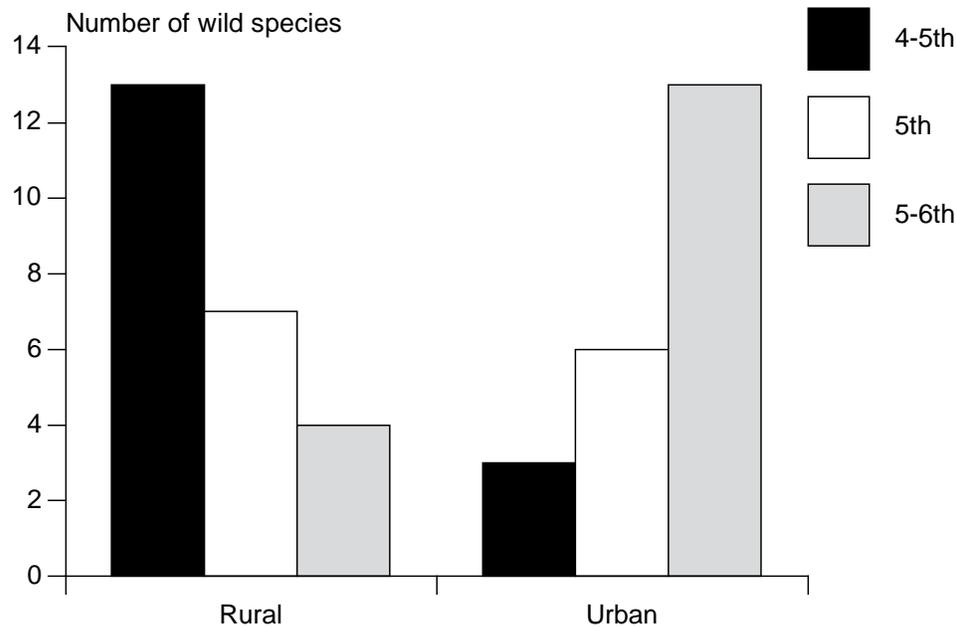


Fig. 9: Chronological evolution of the number of wild species in a rural and urban context.

While the 4th-5th century transition offers greater diversity on rural sites, during the 5th-6th century transition it is the urban and peri-urban sites which are the most species-rich. However, we must remain cautious in our observations as the data for this last phase were predominantly taken from a single site: Metz "ZAC Amphithéâtre". The evolution in the frequency of these wild species in relation to the cattle-pig-sheep group remains is largely the same between the rural and urban context (Fig. 10). In rural areas, the proportion of game decreased (again, with the exception of Compans "Ouest du Parc" during the 5th century), while it increased in urban and peri-urban areas. In mammals, deer and hare are the most frequent, both in the number of occurrences and the number of remains. Also evidenced were roe deer, wild boar, badger, fox, and, more exceptionally, wolf and bear. With regards birds, corvids and anatidae are the most frequent. Passerines and raptors appear regularly, and include the presence of the white-tailed eagle (*Haliaeetus albicilla*) at Metz "ZAC Amphithéâtre".

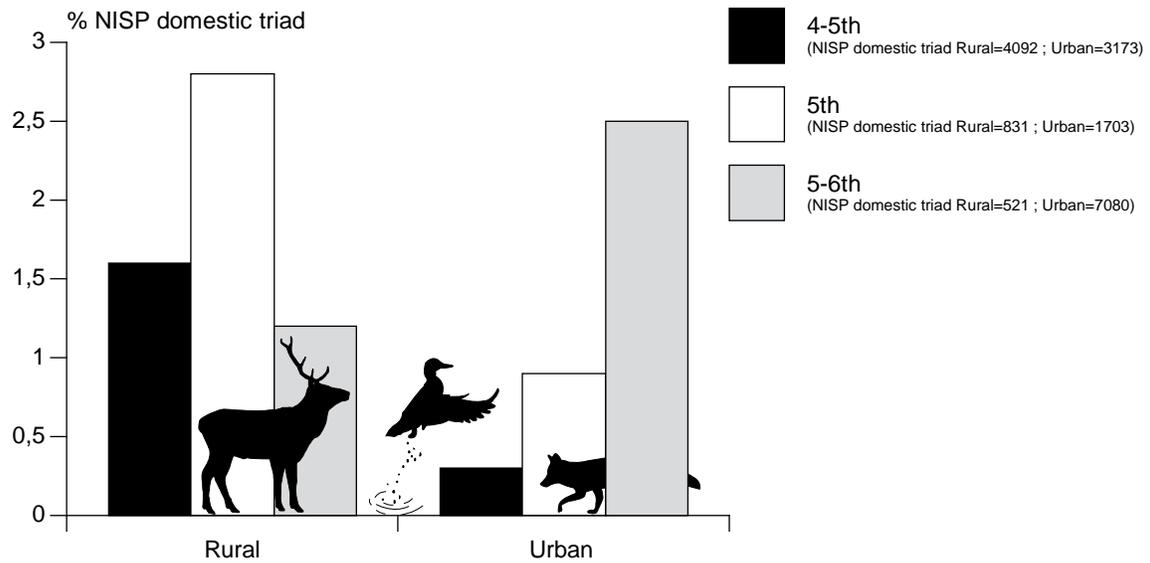


Fig. 10: Chronological evolution of the frequency of wild fauna, reported number of remains, of the domestic triad (NISP wild fauna/NISP domestic triad x 100).

4. Discussion

The figures obtained concerning the frequency of sheep and goat bones are very striking and are the subject of this discussion.

Between the end of 4th and the beginning of 6th century, the rate of caprines in the three main species was halved in rural contexts (15 to 8 %) and even further decreased in urban contexts (22.5 to 3.8 %). Pearson's chi-squared test, applied to the domestic triad, confirms the high significance of these differences (rural, $\chi^2=9.8$ $p=0.007$; urban, $\chi^2=884.1$ $p<0.001$). It also confirms that the NISP of caprines is the main differentiating factor (rural $\% \chi^2=85.4$; urban $\% \chi^2=90$).

The decrease in caprines has already been observed for the Ile-de-France and Hauts-de-France (Lepetz 2009); however, the data studied here shows that this phenomenon also concerns

urban contexts and the east of France, and even seems to be observed in Belgium (Pigière, in this issue).

Though this phenomenon seems centred on the 5th century, it does begin earlier on some sites (in mid 4th c.), especially in the Ile-de-France. In this region, 11 of the 20 sites considered have a caprine rate of less than 15 %, including 6 which have a rate below 10. However, we should mention that although this phenomenon appears as a common trend, there are some exceptions; some sites such as Vanves “Place de la République” or Melun “TND 2000” have a relatively high caprines rate (16 and 22 % respectively).

In order to try to understand this phenomenon for the disaffection of sheep and goats despite their economic value, we have examined various assumptions.

4.1. Health hypothesis

The factors that contributed to the economic success of the Roman Empire also created the conditions for the spread of epidemics and disease. Bacteria and viruses evolved quickly due to the close proximity of human and animal populations, and the accelerated movement of long-distance goods. Today, studies concerning infectious diseases such as Ebola, Zika or avian and swine flu are conducted both in the long historical context of man-animal relations and in the broad geographical scope of globalization (Morand 2016). A similar approach should, therefore, be implemented at the scale of the Roman Empire; we know that human epidemics occurred during the Roman period (about Antonine plague, see Duncan-Jones 1996, Scheidel 2002 and Bagnall 2002; about plague of Justinian, see Little 2006 ; in general Biraben 1976), consequently, it is possible that some epidemics also affected domestic animals, especially sheep.

Ideas about animal epizootics and the criteria for their identification are only just beginning, but some guidelines already exist (Binois 2013, 2017). Regarding caprines, two infections are

likely to cause mass mortality of herds over a large geographical area: parasitic fasciolosis due to liver fluke (*Fasciola hepatica*) and sheep pox. These two diseases are highly contagious and can lead to mass mortality, but their long-term retention is unlikely. Liver fluke is mainly due to an increase in snails, hosting parasites, caused by heavy rainfall. However, current knowledge suggests that only the beginning of the 5th century was very wet; the second half of this century appears relatively dry (McCormick et al. 2012). Concerning sheep pox, although it is highly contagious, the surviving animals develop a lasting immunity which limits the duration of the epidemic and the risk of its return. Furthermore, ewes are more prolific and have a shorter reproductive cycle than cows; therefore, theoretically, the herd can renew itself and return to its previous size quite quickly. Finally, as far as we know, there are no deposits of numerous carcasses to suspect or identify a catastrophic event involving sheep and goat flocks. Nor do historical sources mention a caprine epidemic, whereas Endelechius relates, in his poem *De mortibus boum* (4th c. AD), an epidemic affecting cattle which began in Pannonia, crossing Illyria, Belgium and Gaul (Jaillette 2003).

4.2. Environmental hypothesis

Climatic conditions can favour certain diseases, but they can also be mortal factors for herds; a very cold winter, a wet spring or a too dry summer can be as dangerous as an epidemic.

The synthetic analysis of various data (e.g. historical sources, tree growth, glaciological analysis, palynology) show that Late Antiquity was climatically more unstable than the Early Empire (McCormick et al. 2012). The first half of the 5th century seems cooler and wetter than the second, which was warmer and drier. However, the high level of decline in the frequency of sheep and goats and its duration cannot be explained by climate change alone. Firstly, sheep and goats are exceptionally adaptable, when one considers the climates and environments in which they are raised today. Secondly, the decrease began at some sites from

as early as the 4th century, during a more favourable climatic period. Finally, if climatic conditions have an influence on human and animal populations, the extent of this impact is still under discussion (Kuzucuoğlu and Tsirtsoni 2016).

4.3. Socio-cultural hypotheses

Work carried out over the last twenty years in the Ile-de-France, and northern Gaul in general, shows changes in rural settlement during Late Antiquity. A decrease in rural occupations number and a progressive move away from the *villa* model in favour of the development of other forms of habitat are the main characteristics of these changes (Van Ossel, Ouzoulias 2001 ; Ouzoulias, Van Ossel 2009). These origins probably find their roots at the end of the Early Empire and still require some research to be accurately understood. However, in view of these changes, the question of an evolution of agro-pastoral systems can be proposed (Camizuli et al 2016 ; Kasprzyk 2016); cultivating and breeding choices may have changed too, in response to new conditions or new preferences. Furthermore, Late Antiquity was a period of establishment of new human groups in northern Gaul coming from beyond the *limes*. The impact of these new inhabitants and of a greater military presence is unknown but should be taken into consideration (Van Ossel 1995; Ouzoulias, Van Ossel 2001). Nevertheless, there is no evidence that sheep and goat breeding was not practiced by newcomers (Lepetz 1996), and the decrease in the rates of caprines appears to be chronologically offset against changes in rural settlement.

4.4 Economic hypothesis

Like cattle, sheep are advantageous in offering several products: milk, wool, dung and finally meat and skin. Milk, and its by-product cheese, is particularly economically fortuitous as it can be sold daily and, therefore, can provide a regular income. However, and even if the

analysis of age-at-death does not yet confirm this idea, it seems that the income provided by wool was the most important for Gallo-roman populations.

Indeed, ancient authors, especially agronomists, emphasize the importance of sheep breeding and the wool trade (Varro 1st c. BC, Columella 1st c. AD). Historians and geographers underline the quality of Gallic wool and textiles, especially among the Atrebates, Ambiani, Nervii or Treveri (Strabo 1st c. AD, Orose 5th c. AD). The *Notitia Dignitatum* (end of 4th c. AD) mentions six imperial weaving-houses (*gynaecia*) in Gaul. Four were located in northern Gaul: Tournai, Trier, Reims and Metz (moved to Autun; Fig. 1); the other two were in Lyon and Arles. The location of these weaving-houses is probably not random and almost certainly met a need in the wool supplying areas. The proximity of the weaving-house of Arles and the Crau sheep-folds is a clear example of this symbiotic relationship (Leguilloux 2003).

Zooarchaeological data confirms this interest in wool, at least during Early Empire. Indeed, in northern Gaul, as in Burgundy, the age-at-death indicates the majority of individuals were slaughtered after 3 years (Lepetz 1996 ; Cambou 2010). Breeding seems to be centred on wool and/or milk production. The low representation of very young lambs does not argue for this latter hypothesis (Payne 1973 ; Vigne, Helmer 2007).

If one agrees that during this period wool was an important object of trade and that Gaul was its key source, then it is logical to consider that the sheep had to be sustainably raised. If the economic tracks changed and/or demand fell the effects could have been devastating, leading to a drastic reduction in sheep.

And if, contrary to what was thought some years ago, the Gallic economy of Late Antiquity was not totally destroyed, the political and military context could have made regional administration and trade difficult. The removal of the Praetorian Prefecture of Gaul from Trier to Arles (395 or 407 AD) and the closure of imperial weaving-houses are probably proof of this. In the same way, the abandonment of the *limes* (c. 450 AD) is a striking event, as at that

period Gallia Belgica began to play a prominent part in supply to military camps (Reddé 2011). Finally, the trade routes changed with some products (e.g. oil, wine, terra sigillata) coming from new regions of the Roman Empire or from a narrower geographical diffusion (Ferdrière 2005 p. 357-360; Bonifay *et al* 2007).

All these factors – changes in supply sources, a more regional trade, the disappearance of the imperial capital market and the abandonment of the *limes* – may have led to a sharp decline in wool requirements. Although the economic and political contexts are totally different from those of Late Antiquity, some recent examples from Europe and Oceania show how economic conditions can lead to a fall in the number of animals in a sheep flock (Gerbaud 1995; collective 2014).

Finally, the issue of competition between animal and plant fibres should be raised. Archaeobotanical data, in particular carpological data, are not efficient enough in identifying the textile exploitation of certain plants; indeed, their seeds are generally edible (Zech-Matterne *et al* 2008). The analysis of mineralized textiles, mainly from burials, however, is more relevant. Between the 8th century BC and the end of Roman period, three phases were identified. From 8th century to 5th century BC, linen is the most frequently determined fibre among an important diversity. From the end of 5th century to the 2nd century BC, wool is the most common. Finally, from first century BC to the end of Roman period, plant fibres are once again the most present (Moulhérat quoted by Zech-Matterne *et al* 2008). Therefore, the stability of choices during this period does not suggest a sudden preference for plant fibres instead of animal fibres.

5. Conclusion

This first approach looking at the choice of livestock and meat consumption of Gallo-Roman populations at the end of Late Antiquity in French northern Gaul, provides both information

and various avenues of reflection. As with any corpus it has some flaws, but it has been sufficiently expanded to make our first observations credible. The difference between the remains from rural (favouring cattle) and urban (favouring pigs) areas stayed marked throughout the period considered; however, some rebalancing was noted. The urban areas also consumed greater amounts of poultry, though the conservation conditions of the faunal material probably affected species representation. The two most important points to emerge from this synthesis are the presence of sites with specific characteristics (preponderance for pigs, high proportion of rare wildlife species) and the exceptionally low frequency of sheep and goats. If interpretation of the first phenomenon is prevented by the limited number of cases, many avenues of research can already be put forward for the second.

Due to the current state of our analysis, we retain that the economic hypothesis most likely explains the sustainable collapse and general interest in caprines in northern France. However, we cannot exclude a conjunction of complex events – political, economic, socio-cultural, environmental – which could have led to this phenomenon. This is undoubtedly the case here, although a cultural hypothesis (new populations with other breeding practices) cannot be fully rejected.

The study of population genetics would be a very interesting path for future research. Indeed, it should be possible to either eliminate or confirm the origin of catastrophic mortality by observing the potential genetic restrictions relating to a bottleneck, by comparing the genetic profiles before and after the hiatus of the 5th century AD. Difficulties in precisely dating sites of this period, during previous decades, leads us to imagine that many sites would benefit from dating refinement. The enlargement of the archaeological and zooarchaeological corpus remains both a priority and a necessity for better documentation of this problematic; as currently the data are poorly distributed, the sites too few and the essential slaughtering patterns not yet drawn.

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References

Arbogast R.-M., Clavel B., Lepetz S., Méniel P. et Yvinec J.-H. 2002. *Archéologie du cheval*, collection des Hespérides, Errance.

Bagnall R. S.. 2002. The effects of plague : model and evidence. *Journal of Roman Archaeology*, 15, pp. 114-120.

Ben Redjeb T., Duvette L., Quérel P., 2005. L'Antiquité. In : La recherche archéologique en Picardie : Bilans & Perspectives. Journées d'études tenues à Amiens les 21 & 22 mars 2005, *Revue Archéologique de Picardie*, 3-4, pp. 177-222.

Bernigaud, N., Ouzoulias P., Lepetz S., Wiethold J., Zech-Matterne V., Séguier J.-M., Reddé M., 2016. Exploitations agricoles et pratiques agro-pastorales dans les campagnes du nord-est de la Gaule (IIe s. av. J.-C.-Ve s. ap. J.-C.) : l'apport des données de l'archéologie préventive d'Île-de-France et de Lorraine. In : Michel Reddé. Méthodes d'analyse des différents paysages ruraux dans le Nord-Est de la Gaule. France. 2016. <hal-01253470>

Binois A. 2013. Approche méthodologique des mortalités de masse ovines en archéologie. In : Auxiette G., Méniel P., Les dépôts d'ossements d'animaux en France, de la fouille à l'interprétation, Actes de la table ronde de Bibracte (15-17 octobre 2012), Editions Monique Mergoïl, *Archéologie des Plantes et des Animaux* 4, pp. 275-286.

Binois, A., 2017. L'archéologie des épizooties. Mise en évidence des mortalités de masse chez les animaux d'élevage en France et dans les régions limitrophes, du Néolithique au

XIX^{ème} siècle (provisional title). PhD thesis in archaeology, Université Paris I Panthéon-Sorbonne.

Biraben J.-N., 1976. *Les hommes et la peste en France et dans les pays européens et méditerranéens*, 2 tomes, Editions Mouton, Paris-La Haye.

Bonifay M., Raynaud C. Berthault F., Bien S., Boucharlat E., Foy D., Mukai T., Pellegrino E., Pelletier J.-P., Pieri D., Piton J., Rigoir Y., Silvino T., Trégliat J.-C. 2007. Echanges et consommation. *Gallia*, tome 64, pp. 93-161.

Cambou, D., 2010. Principales caractéristiques de l'élevage et de l'alimentation carnée entre le II^e s. av. et le IV^e s. ap. J.-C. en Bourgogne. Sciences Humaines Combinées : Revue électronique des écoles doctorales ED LISIT et ED LETS <http://revueshs.u-bourgogne.fr/lisit491/document.php?id=693>.

Camizuli, E., Petit, C., Bernigaud, N., Reddé, M., 2016. Principes méthodologiques pour caractériser des agrosystèmes antiques: Exploitation des bases de données actuelles. *Les nouvelles de l'archéologie* 20–26. doi:10.4000/nda.3273

Clavel B. 2001. L'animal dans l'alimentation médiévale et moderne en France du Nord (XII^e-XVII^e siècles). *Revue Archéologique de Picardie*, n° spécial 19, Amiens.

Collective 2014. Productivité dans les élevages ovins allaitants. Comparaisons France, Union européenne, Océanie. *Les synthèses de FranceAgriMer*, n°19.

Duncan-Jones R. P. 1996. The impact of the Antonine plague. *Journal of Roman Archaeology*, 9, pp. 108-136.

Ferdière A. 2005. *Les Gaules. II^e s. av. J.-C. – Ve s. ap. J.-C.*, collection U-Histoire, Armand Colin.

Gerbaud F. 1995. L'élevage est-allemand face à la PAC. *Revue Géographique de l'Est*, tome 35, n°2, pp. 137-162.

Jaillette P. 2003. *Fert pecuaria... Gallus*. Le bétail en Gaule romaine tardives. Inventaire des données littéraires. In : Lepetz S., Matterné V. Cultivateurs, éleveurs et artisans dans les campagnes de Gaule romaine, Actes du VI^e colloque AGER de Compiègne (5-7 juin 2002), *Revue Archéologique de Picardie*, 1-2, pp. 249-261.

Kasprzyk, M., 2016. Établissements ruraux, occupation du sol et systèmes agraires de l'Antiquité tardive dans le nord de la Gaule : quelques remarques. In : Michel Reddé. Méthodes d'analyse des différents paysages ruraux dans le Nord-Est de la Gaule. France. 2016. <hal-01253470>

Kuzucuoğlu, C., Tsirtsoni, Z., 2016. Changements climatiques et comportements sociaux dans le passé : quelles corrélations ? *Les nouvelles de l'archéologie* 49–55. doi:10.4000/nda.3280

Leblay J.-Cl., Lepetz S., Yvinec J.-H., 1997. L'élevage dans l'Antiquité tardive en Île-de-France. In : Ouzoulias P., Van Ossel P., *Les campagnes de l'Île-de-France de Constantin à*

Clovis, colloque de Paris, mars 1996, Paris, *Dioecesis galliarum* (Document de travail n° 3), pp. 50-67.

Leguilloux M. 2003. Les bergeries de la Crau : production et commerce de la laine. In : Lepetz S., Matteredne V. Cultivateurs, éleveurs et artisans dans les campagnes de Gaule romaine, Actes du VI^e colloque AGER de Compiègne (5-7 juin 2002), *Revue Archéologique de Picardie*, 1-2, pp. 339-346.

Lepetz, S., 1996. L'animal dans la société gallo-romaine de la France du nord. *Revue archéologique de Picardie*, Amiens, France.

Lepetz S. 2009. Le statut de l'habitat rural en Gaule septentrionale. Les ossements animaux sont-ils de bons marqueurs ? In : Leveau Ph., Raynaud C., Sablayrolles R., Trément F., *Les formes de l'habitat rural gallo-romain. Terminologies et typologies à l'épreuve des réalités archéologiques*. Actes du Colloque AGER VIII, Toulouse 2017, Aquitania supplément, 17, pp. 13-21.

Lepetz S., Barreau J.-B., 2015. Banque de données MyOS – World Wide Web electronic publication. <http://base-mynos.fr>

Little L. K. (ed.), 2006. *Plague and the end of Antiquity. The pandemic of 541-750*, Cambridge.

McCormick, M., Büntgen, U., Cane, M.A., Cook, E.R., Harper, K., Huybers, P., Litt, T., Manning, S.W., Mayewski, P.A., More, A.F.M., Nicolussi, K., Tegel, W., 2012. Climate Change during and after the Roman Empire: Reconstructing the Past from Scientific and Historical Evidence. *Journal of Interdisciplinary History* 43, 169–220. doi:10.1162/JINH_a_00379

Morand, S., 2016. La prochaine peste : Une histoire globale des maladies infectieuses. Fayard.

Monteil M., Tranoy L., 2008. La France gallo-romaine. La Découverte, coll. Archéologies de la France.

Oueslati T. 2006. *Approche archéozoologique des modes d'acquisition, de transformation et de consommation des ressources animales dans le contexte gallo-romain de Lutèce (Paris, France)* (BAR S1479), British Archaeological Reports, Oxford.

Ouzoulias, P. & Van Ossel, P., 2009. Petites et grandes exploitations agricoles : le cas de la Plaine de France. In: Leveau, P., Raynaud, C., Sablayrolles, R., & Trément, F., *Les formes de l'habitat rural gallo-romain. Terminologie et typologie à l'épreuve des réalités archéologiques*. Actes du colloque AGER VIII : Les formes de l'habitat gallo-romain : Terminologies et typologies à l'épreuve des réalités archéologiques. *Aquitania*, Supplément, 17, Bordeaux : Éditions de la fédération Aquitania, pp. 111-121.

Payne S. 1973. Kill-off pattern in sheep and goats : the mandibles of Asvan kale. *Anatolian Studies*, 23, pp. 281-303.

Reddé, M., 2011. « Ut eo terrore commeatus Gallia adventantes » (Tacite, Hist., V, 23) La Gaule intérieure et le ravitaillement de l'armée du. *Revue des études anciennes* 113, pp. 489–509.

Reddé, M., 2016. Méthodes d'analyse des différents paysages ruraux dans le Nord-Est de la Gaule. France. 2016. <hal-01253470>

Van Ossel P. 1994. Déclin et continuité des agglomérations secondaires. In : Petit, J.-P., Mangin, M., *Les agglomérations secondaires. La Gaule Belgique, les Germanies et l'Occident romain*. Actes du colloque de Bliesbruck-Reinheim/Bitche (21-24 octobre 1992), Errance, pp. 254-261.

Scheidel W., 2002. A model of demographic and economic change in Roman Egypt after the Antonine plague. *Journal of Roman Archaeology*, 15, pp. 97-114.

Van Ossel P., 1995. Insécurité et militarisation en Gaule du Nord au Bas-Empire. L'exemple des campagnes. In : Insécurité et militarisation en Gaule du Nord au Bas-Empire, Actes de la 17^e journée d'étude du Centre de recherches archéologiques de l'université Charles-de-Gaule Lille III (3 décembre 1994), *Revue du Nord*, tome 77, n°313, pp. 27-36.

Van Ossel P., Ouzoulias P., 2001. La mutation des campagnes de la Gaule du Nord entre le milieu du III^e siècle et le milieu du Ve siècle. Où en est-on ?. In : Lodewijckx M. (ed.), *Belgian Archaeology in a European Setting II*, Acta Archaeologica Lovaniensia, Monographiae 13, pp. 231-245.

Vigne J.-D., Helmer D. 2007. Was a milk a « secondary product » in the Old World Neolithisation process? Its role in the domestication of cattle, sheep and goats, *Anthropozoologica*, 42 (2), pp. 9-40.

Zech-Matterne V., Derreumaux M., Preiss S. 2008. Production et utilisation des plantes « techniques », de l'âge du bronze à l'époque médiévale en France du Nord. In : Zech-Matterne V., Derreumaux M., Preiss S. *Archéologie des textiles et teintures végétales*, Acte de la table ronde Archéobotanique 2006, Compiègne (28-30 juin), *Les Nouvelles de l'archéologies*, 114, pp. 9-17.