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ACTES DE LA SÉANCE DE LA SOCIÉTÉ PRÉHISTORIQUE FRANÇAISE PARIS, 18-19 MARS 2015

Textes publiés sous la direction de
Jean-Denis Vigne, François Briois et Margareta Tengberg

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NEW DATA ON THE BEGINNINGS OF THE NEOLITHIC IN CYPRUS

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À la mémoire d'Edgar Peltenburg

To the memory of Edgar Peltenburg

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Illustration de couverture : Klimonas: sub-zenithal photo of the communal building (St 10) and its entrance device (upper left), taken at the end of the 2012 excavation season. *Klimonas : vue sub-zénithale du bâtiment communautaire (St 10) et de son dispositif d'entrée (en haut, à gauche), prise à la fin de la campagne de fouille 2012. La mire mesure 1 m. Le nord est situé vers la gauche* (© M. Azéma, Passé simple).

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A first glimpse into butchery practices in Pre-Pottery Neolithic Cyprus

Evidence on sheep and goat remains from six sites

Angelos Hadjikoumis, Paul Croft, Alan Simmons, Jean Guilaine,
Edgar Peltenburg †, Ian Todd, Alain Le Brun and Jean-Denis Vigne

Abstract: Butchery marks have not been considered very much in Cypriot zooarchaeology. This study aims to contribute towards filling this gap through a study of butchery marks on six Pre-Pottery Neolithic sheep and goat (caprine) assemblages in Cyprus. Taking into account the preservation condition of each assemblage, the analyses of the frequency and types of butchery marks, indicated some interesting trends. Most of these corroborate other lines of archaeological evidence indicating diversity in economic and social practices, which appear to vary both chronologically and geographically. Increased occurrence of butchery marks and differentiation in their types are compatible with a scenario of economic intensification in the 7th millennium cal. BC, at least at some sites. Moreover, the detection of butchery marks on caprine carcasses deposited in the vicinity of human remains in well 133 at Mylouthkia supports the interpretation of a deliberate deposition as part of Pre-Pottery Neolithic funerary practices in Cyprus.

Keywords: Cyprus, Pre-Pottery Neolithic, sheep, goat, butchery, cut mark, funerary practice.

Premier aperçu sur les pratiques de boucherie au Néolithique précéramique de Chypre : analyse des restes de mouton et de chèvre de six sites

Résumé: L'archéozoologie chypriote a accordé peu d'attention aux traces de boucherie. Cet article cherche à contribuer à combler cette lacune en proposant une étude des traces de découpe relevées sur six assemblages chypriotes d'ossements de mouton et de chèvre (caprinés) datant du Néolithique précéramique. En prenant en considération les conditions de conservation de chacune de ces faunes, l'analyse des fréquences et des types de traces de découpe révèle quelques tendances intéressantes. La plupart d'entre elles corroborent les autres informations archéozoologiques. Elles témoignent en effet d'une importante diversité chronologique et géographique dans les pratiques économiques et sociales. L'occurrence croissante des traces et leur diversification typologique sont compatibles avec le scénario d'une intensification de l'exploitation des ressources animales durant le VII^{e} millénaire avant notre ère, au moins sur certains sites. De plus, l'étude des traces de boucherie sur les ossements de caprinés déposés à proximité des restes humains du puits 133 de Mylouthkia confirme l'hypothèse d'un dépôt intentionnel s'inscrivant dans le cadre des pratiques funéraires du Néolithique précéramique de Chypre.

Mots-clés : Chypre, Néolithique précréamique, mouton, chèvre, boucherie, traces de découpe, pratiques funéraires.

The recording of butchery, like other modifications of bone surface, has formed an integral part of the study of faunal assemblages for more than 150 years (for a recent review of some of the literature see James and Thompson, 2015, p. 93–95). Butchery marks are used both in palaeontological (e.g. Shipman and Rose, 1983; Shipman, 1986; Binford, 1988) and zooarchaeological (e.g. Binford, 1978 and 1984; Vigne, 1987 and 1988; Reitz and Wing, 2008, p. 126–30) research to gain insights into hominid and human behaviour in the past. This study concerns human behaviour from a purely zooarchaeological perspective. The analysis of butchery marks can provide insights into many aspects of human behaviour in the past, such as how the carcasses of different

animal species and age cohorts were processed (e.g. Vigne, 2006; Halstead, 2011, p. 771–79), culinary preferences and taboos (e.g. Davis et al., 2008, p. 218–21) and cultural affinities (e.g. Yellen, 1991).

In Cyprus, however, butchery marks on animal remains have not been routinely recorded and studied for several reasons. The most important is the poor preservation of faunal materials in Cyprus. Many Neolithic assemblages are enveloped in varying amounts of carbonate crust (fig. 1). In most cases, bone surfaces under the carbonate crust are preserved well enough for most butchery marks to be visible, but carefully removing the crust mechanically (e.g. tungsten drill) is a non-viable endeavour in terms of time and finances, at least in the current technological and financial context. Many Neolithic assemblages are largely free of carbonate crust; in others most of the crust is loose enough to fall off by gently washing in tap water with a soft brush. Unfortunately, the lack of crust in such assemblages renders them more vulnerable to varying amounts of erosion (fig. 2). Fortunately, there are few assemblages where visibility on bone surfaces has been affected to a lesser degree by carbonate crust and erosion. Overall, the highly variable preservation condition between assemblages renders difficult the reliable quantification of butchery marks.

Fig. 1 – Example of extensive carbonate crust on an 8th millennium cal. BC random faunal sample from Shillourokambos (photo A. Hadjikoumis).
Fig. 1 – Exemple d'incrustations carbonatées sur un échantillon d'ossements du VIII^e millénaire cal. BC de Shillourokambos (cliché A. Hadjikoumis).

Fig. 2 – Example of the effect of erosion on faunal remains from a random sample of caprine remains from 8th millennium cal. BC Ais Yiorkis (photo A. Hadjikoumis).
Fig. 2 – Exemple de l'effet de l'érosion sur les ossements, pris sur un échantillon de restes de caprinés du VIII^e millénaire cal. BC à Ais Yiorkis (cliché A. Hadjikoumis).

In the few cases that butchery marks have been recorded and analysed, their potential to contribute to our knowledge on human behaviour in the past has been confirmed. For example, Vigne's (2011a) analysis of anatomical distributions on animal remains from sector 1 of Pre-Pottery Neolithic (PPN) Shillourokambos has shown differential treatment of pigs as opposed to ruminants as well as changes in the treatment of the same species through the different periods of the site. Moreover, the analysis of butchery marks has shown extensive use of percussion and has shed light on the culinary practices, the technological level and degree of specialisation in butchery practices (Vigne, 2011a; Vigne et al., 2015).

The reality of poor preservation of bone surfaces in Neolithic assemblages in Cyprus has been so far the main obstacle in attempting comparisons between sites, in terms of absolute numbers of remains bearing butchery marks as well as the extent of each type. Nevertheless, until a better solution becomes available in the future, this should not be a prohibiting factor in the identification of broad patterns in the frequency of butchery marks and their types. In order to restrict the bias caused by differential preservation, the condition (primarily the visibility on bone surfaces) of the material from different sites is taken into account in this study. Consequently, comparability between sites is further enhanced, as it focuses exclusively on sheep and goat remains from the largest and, chronologically, most reliable Neolithic assemblages available in Cyprus. Moreover, the fact that Pre-Pottery Neolithic (PPN) faunal assemblages show only scarce evidence of carnivore attrition (Vigne, 2011a) removes a complicating factor in interpreting anatomical distributions.

This study forms part of a larger project that focused on sheep and goat management in prehistoric Cyprus. It constitutes a first attempt to shed light upon aspects of human behaviour in Neolithic Cyprus based on butchery marks left on sheep and goat remains. Its main aim is to provide insights into how sheep and goat carcasses were processed at different sites and whether any variation (chronological, geographic or other) can be observed throughout the Neolithic period. This study also aims to probe the potential of studying butchery marks on Cypriot faunal material.

MATERIALS AND METHODS

This study includes six PPN caprine assemblages, which cover the 8th (mainly the second half), 7th and early 6th millennia cal. BC (table 1). Geographically, they cover the south and west of Cyprus (fig. 3). For reasons of economy, only the second part of each site's name will be used throughout this study (e.g. 'Shillourokambos' instead of 'Parekklisha-Shillourokambos', see table 1 for full site names). Prior to their study, all recorded specimens were washed with tap water and a soft brush to improve the visibility of butchery marks without causing further damage. Although some of the studied assemblages had been washed in the past, they were all invariably washed to eliminate yet another element of variability between assemblages. The bone samples from Shillourokambos were cleaned with diluted acetic acid (Vigne and Carrère, 2011, p. 543), which might have erased the faintest marks.

For reasons of economy of time and focus on the project's primary aims, body parts that are undiagnostic in terms of sheep/goat distinction and pose quantification problems such as the vertebrae, ribs and cranial elements (other than mandibles and horncore bases) were excluded from recording. Due to their irrelevance to butchery marks analysis, loose teeth have also been excluded. The anatomical units systematically recorded were: horncore

	Site	Millennium cal. BC	MinAU	MaxAU	Excavation reference	Zooarchaeological reference
1	Kritou Marottou-Ais Yiorkis	8th	729	934	Simmons, 2010 and 2012	Simmons, 2010, p. 22
2	Parekklisha-Shillourokambos (Recent phase, Sector 3)	8th (2nd half)	540	665	Guilaine et al., 2011	Vigne, 2011b
3	Kissonerga-Mylouthkia (Period 1B)	8th (2nd half)–early 7th	1047	1119	Peltenburg et al., 2003	Croft, 2003a
4	Kalavasos-Tenta (Periods 4–2)	late 8th	210	233	Todd, 2005	Croft, 2005
5	Khirokitia-Vouni (Levels D-J)	7th	1029	1183	Le Brun, 1989 and 2001	Davis, 1989 and 2003
6	Kholetria-Ortos	7th (2nd half)–early 6th	1062	1376	Simmons, 1996 and 1998	Croft, 2003b

Table 1 – Pre-Pottery Neolithic (PPN) sites included in the study in broad chronological order and sheep/goat sample sizes shown in MinAU and MaxAU. Bibliographical references are not exhaustive and only aim to provide general information about each site and the study of its faunal assemblage carried out so far.

Tabl. 1 – Sites du Néolithique précéramique pris en compte dans la présente étude, organisés par ordre chronologique. Les références bibliographiques mentionnées dans les colonnes de droite ne sont pas exhaustives ; elles n'ont d'autre ambition que de livrer des pistes pour chacun des sites.

Fig. 3 – Map of Cyprus showing the location of the six PPN sites included in this study (background map M. Sauvage, CNRS).
Fig. 3 – Carte de Chypre montrant la localisation des six sites précéramiques pris en compte dans la présente étude (fond de carte M. Sauvage, CNRS).

bases; mandibles and loose mandibular cheek teeth; atlas; axis; scapula; proximal and distal halves of humerus, radius, femur, tibia, metapodia; proximal half of ulna; pelvis; astragalus; calcaneum and phalanges 1–3. No attempt has been made to distinguish phalanges into fore- and hind-limb. These parts of the skeleton have been selected for their durability and identifiability.

Wherever possible, caprine postcranial remains were attributed to sheep or goat with the help of reference specimens (from the personal reference collections of A. Hadjikoumis and P. Croft, as well as the faunal collection of the annex of the French School of Athens at Agios Tychonas, Lemesos) and relevant publications by Boessneck et al. (1964), Kratochvil (1969), Prummel and Frisch (1986) and Zeder and Lapham (2010). The same was attempted for mandibular remains according to Payne (1985), Helmer (2000), Halstead et al. (2002), Balasse and Ambrose (2005) and Gillis et al. (2011). During recording, all specimens were inspected for butchery marks under × 10 hand lens and strong light source according to Blumenshine et al. (1996) and Vigne (2006 and 2011a). The quantification of butchered specimens as well as the frequency of the different types of butchery marks is based on the maximum number of anatomical units (MaxAU) according to Halstead (2011). MaxAU ensures that poorly preserved and heavily fragmented—but still identifiable—specimens are included, even if they could have belonged to more diagnostic specimens that contributed to the minimum number of anatomical units (MinAU, also according to Halstead, 2011).

Before presenting any results on the butchery of caprine carcasses at the six PPN sites, it was necessary to evaluate the anatomical representation of caprines. For this analysis, all caprine remains have been combined due to their uneven probability of being attributed specifically to either sheep or goat. The counts have been calculated in terms of MinAU. All statistical analyses were carried out using PAST V3.11 software (Hammer et al., 2001).

As stressed in the introduction, the first issue that should be addressed before proceeding to a study of butchery is that of the preservation of bone surfaces. In order to obtain some measure of bone surface preservation, the percentage of each specimen's surface obscured by concretions or eroded away was roughly estimated through visual inspection during recording. In this way, the degree of visibility can be taken into account, which enables a more reliable ranking of the six PPN assemblages according to their potential of yielding butchery marks.

Butchery marks were recorded as 'dismembering', 'filleting' or 'skinning' based on their location (Binford, 1981), with the addition of the categories 'chopping' and 'percussion'. For this study, chopping refers to specimens chopped with a sharp-edged heavy tool such as a stone axe or heavy stone blade, in the case of PPN Cyprus. Percussion refers to specimens partly or entirely broken by being hit with a heavy blunt object (e.g. unworked stone, hammer stone, axe, pestle or similar stone object). In order to retain

information concerning the tools used in the butchery of sheep and goat carcasses but also due to the greater degree of ambiguity concerning their exact purpose, chopping and percussion were kept as distinct categories instead of being assigned to dismembering, filleting or skinning (according to Vigne, 1988, p. 40, 2006 and 2011a). Taking into account the overall morphology and location of chopping and percussion marks in the assemblages included in this study, it is assumed that the vast majority were inflicted to either dismember or—more commonly in the case of percussion marks—to facilitate access to the marrow. Since all six assemblages are of Neolithic date, there is no doubt that all butchery was conducted with stone tools.

Before proceeding to the presentation and discussion of results, it is useful to keep in mind the problems of lack of universally accepted terminology and standardisation in the study of many aspects of bone surface modifications in general (cf. James and Thompson, 2015). Moreover, it has to be recognised that many of the terms employed in the recording of butchery marks in this study already include, to some extent, their interpretation (filleting, dismembering, etc.). For this reason, the location of each butchery mark has also been recorded, which will enable a more detailed study in the future, with the addition of better-preserved assemblages.

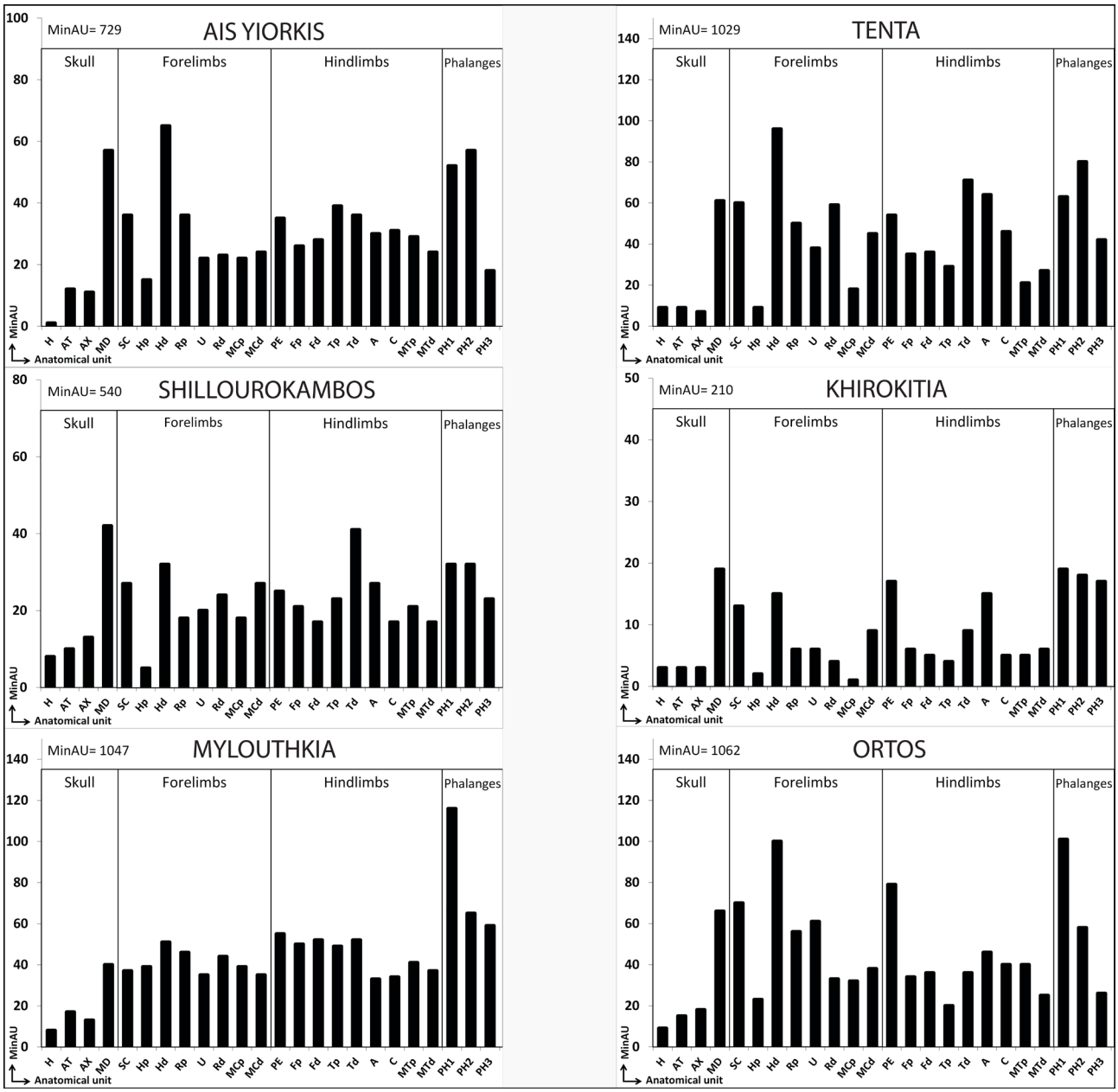

Fig. 4 – Anatomical representation of caprines at the six PPN sites in Cyprus. The sites are in broad chronological order from the upper left to the bottom right.

Fig. 4 – Représentation anatomique des caprinés dans les six sites du Néolithique précéramique chypriotes étudiés. Les sites sont organisés dans leur ordre chronologique, de haut en bas et de gauche à droite.

RESULTS

Anatomical representation

The quantification of anatomical representation (fig. 4) suggests that entire caprine carcasses were processed at all sites. Some discrepancies in the abundance of anatomical units (e.g. the consistently more abundant mandibular teeth and distal humeri) can be attributed mainly to the different preservation potential of each anatomical unit (Binford, 1981; Brain, 1981). The assemblage with the anatomical distribution closest to the expected one is that of Mylouthkia 1B, due to the fact that it mainly derives from well-protected contexts (i.e. in the fill of a well).

Butchery marks frequencies

Table 2 shows, for each taxon and for all caprines combined, the average degree of visibility on bone surfaces, the MaxAU, the corrected number of 'visible' bones (MaxAU visible = Visibility % × MaxAU) and the relative frequencies of butchery marks (Butchered % = MaxAU butchered/MaxAU visible %). Mylouthkia 1B clearly differs from the other five sites in yielding very low occurrence of butchery, despite the good visibility of bone surfaces (70%). This is probably due to the fact that it mainly derives from ritual/funerary contexts. The study of the Mylouthkia 1B caprine remains after they had been washed thoroughly has revealed that, contrary to what was expected (Croft, 2003a, p. 51), a small number of specimens from well 133 at Mylouthkia exhibited butchery marks (e.g., fig. 5).

If we exclude Mylouthkia 1B, which is almost free of butchery marks, we observe a significant straight linear correlation between the frequency of butchery marks and the estimated number of visible marks for sheep (Pearson $r = 0.96$, $p = 0.009$; fig. 6), and, to a lesser degree, for sheep/goat and for all caprines combined ($r = 0.95$, $p = 0.013$). This result indicates that the occurrence of butchery marks primarily depends on the number of 'visible' specimens and that their frequency is roughly the same for all five sites.

Nevertheless, Khirokitia plots well above the regression line, Shillourokambos slightly above it and the rest of the sites below it, in roughly the same distance (fig. 6). This pattern reflects small differences in the frequency of butchered caprine remains between sites. They can be estimated and ranked according to the shortest distance between the plot of each site and the regression line, that is their respective linear regression residuals (table 2), from lowest to the highest: Ortos (−18.7), Tenta (−16.4), Ais Yorkis (−14.3), Shillourokambos (+5.3; probably under-evaluated because of the effect of the soft acid wash) and Khirokitia (+44.0). These differences can be

Fig. 5 – Medial view of a right goat distal humerus from well 133 at Mylouthkia (period 1B) bearing butchery marks indicated by black arrows. On the right side of the figure the same specimen is shown in its unprocessed state, which drastically reduced the identifiability of butchery marks (photo A. Hadjikoumis).

Fig. 5 – Vue médiale d'une extrémité distale d'humérus droit de chèvre du puits 133 de Mylouthkia (période 1B) portant des traces de découpe (flèches). À droite, la même pièce est figurée avant nettoyage, ce qui réduit considérablement la visibilité des traces (cliché A. Hadjikoumis).

Site	Visibiliy%	Sheep				Goat			
		MaxAU	MaxAU visible	Butchered%	Residuals	MaxAU	MaxAU visible	Butchered%	Residuals
Ortos	80	515	412	23	−6.630	97	78	26	−6.082
Ais Yiorkis	60	108	65	19	−11.549	186	112	17	−10.899
Khirokitia (Levels B–J)	50	378	189	22	16.903	266	133	24	12.567
Shillourokambos (Recent)	20	232	46	15	8.438	135	27	6	−0.356
Tenta (Periods 4–2)	8	180	14	7	−7.162	84	7	6	4.771
Mylouthkia (1B)	70	302	211	1	NA	393	275	6	NA
Site	Visibiliy%	Sheep/Goat				Caprines (combined)			
		MaxAU	MaxAU visible	Butchered%	Residuals	MaxAU	MaxAU visible	Butchered%	Residuals
Ortos	80	615	492	13	−7.56	1,227	981.6	18%	−18.755
Ais Yiorkis	60	540	324	13	9.905	834	500.4	14%	−14.292
Khirokitia (Levels B–J)	50	520	260	10	2.368	1,164	582	17%	44.107
Shillourokambos (Recent)	20	206	41	7	0.172	573	114.6	10%	5.35
Tenta (Periods 4–2)	8	291	23	2	−4.885	555	44.4	4%	−16.41
Mylouthkia (1B)	70	386	270	1	NA	1,081	756.7	3%	NA

Table 2 – For the six sites taken into consideration and for the different taxonomic categories, average degree of visibility on bone surfaces (Visibility%), maximum number of anatomical units (MaxAU), number of 'visible' units (MaxAU visible = Visibility% × MaxAU), relative frequencies of butchery marks (Butchered% = MaxAU butchered/MaxAU visible%) and value of the straight linear regression residuals calculated without the very divergent data from Kissonerga-Mylouthkia.
Tabl. 2 – Pour les six sites pris en considération, et pour chacune des catégories taxinomiques, degré moyen d'« observabilité » des surfaces osseuses (Visibility %), nombre maximum de restes anatomiquement identifiés (MaxAU), nombre de restes « observables » (MaxAU visible = Visibility % × MaxAU), fréquence relative des traces de boucherie (Butchered % = MaxAU butchered/MaxAU visible %) et valeur des résidus de la régression linéaire calculée en excluant Kissonerga-Mylouthkia.

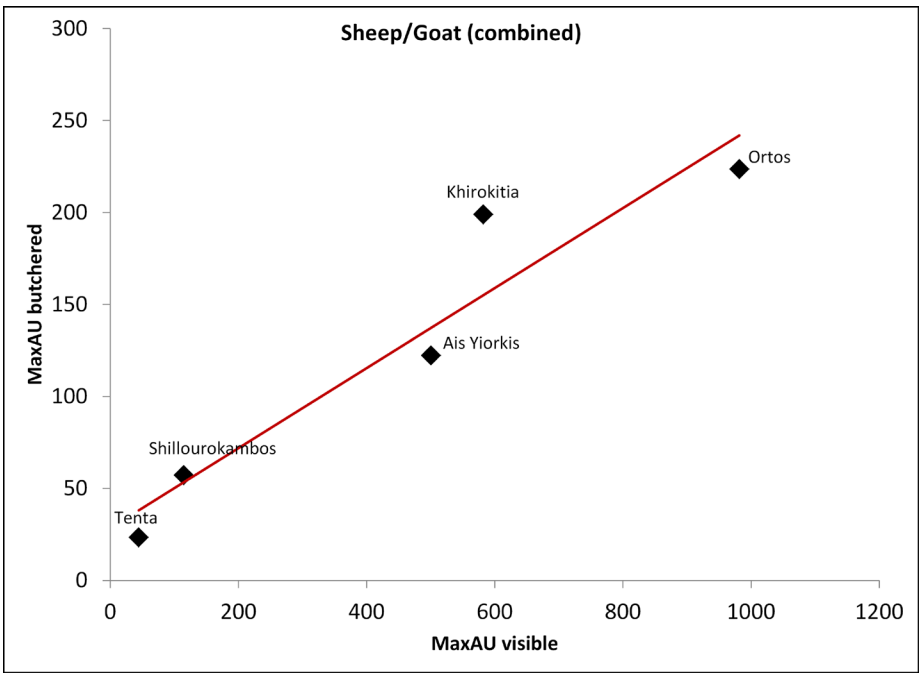

Fig. 6 – Biplots of the MaxAU visible against MaxAU with butchery marks, for caprines combined at the six sites different sites. The equation of the regression line is: y = 0.2144x + 30.138, and the Pearson r is 0.9514 (p = 0.0127).
Fig. 6 – Corrélation entre le nombre d'os observables et le nombre d'os portant au moins une trace de boucherie, pour la totalité des restes de caprinés. L'équation de la droite de régression est : y = 0,2144x + 30,138, et le coefficient de corrélation r de Pearson est de 0,9514 (p = 0,0127).

due to the state of preservation and/or different human behaviour at the different sites.

This pattern does not support a chronological basis of the differences in the occurrence of butchery. The two highest values derive from the two largest sites, Khirokitia and Shillourokambos. Beyond this pattern suggesting differences related to site size, a tentative geographical pattern in the intensity of butchery is also observed, if we exclude the smallest and worst preserved sample of Tenta. The rest of the south coast sites (i.e. Shillourokambos and Khirokitia) exhibit higher frequencies of butchery compared to sites in the uplands of Pafos district in the west (i.e. Ais Yiorkis and Ortos).

Furthermore, figure 7 compares the regression lines for sheep and goat samples. It suggests some differences between them, but they are not statistically significant (F = 1.41, p(same) = 0.28). This may also be due to the small size of goat samples. Differential treatment of sheep and goat should thus remain an open possibility to be pursued in the future with larger datasets.

Distribution of the different types of butchery marks

The frequency of each type of butchery mark per taxon is shown in table 3. Additional analyses have been carried out to compare sheep and goat. For the samples which are not too small for the application of a Fisher exact statistic test (Ais Yorkis, Shillourokambos, Khirokitia and Ortos), we found no significant difference in the distribution of the frequencies of the different types of marks for the two taxa ($0.98 > p > 0.71$). For Khirokitia only, there is a non-significant tendency for more dismembering for goat, and for more percussions for sheep ($\chi^2 = 7.9$, p Monte Carlo = 0.09).

The small sample sizes and non-significant differences between the two species make it possible to compare the larger samples of all caprines combined. The statistical pairwise comparison between the six PPN sites (Fisher exact test with Bonferroni correction; table 4) indicate significant difference between all pairs of sites, except Shillourokambos and Ais Yorkis, Shillourokambos and Ortos, Khirokitia and Tenta and Khirokitia and Mylouthkia. None of the sites differs from all the five other sites from this point of view.

That the pattern of butchery marks at Mylouthkia 1B, though somewhat similar to the one at Khirokitia, diverges from the rest of the dataset. While the broad pattern of all other five assemblages is once dominated by percussion and dismembering marks, Mylouthkia 1B exhibits lower percussion and higher dismembering and filleting percentages.

The rest of the assemblages can be divided in two categories: those with higher percussion and lower dismembering marks (Ais Yiorkis, Shillourokambos and Ortos), and those with the opposite pattern in the respective butchery types (Khirokitia and Tenta).

These results provide evidence for the existence of differences in butchery types at broadly contemporaneous sites such as Khirokitia and Ortos, with high dismembering and filleting percentages at the former and low at the latter site (fig. 8). This difference can be considered reliable, considering the significantly better preservation condition at Ortos, which would allow the identification of the finer filleting and dismembering marks. In addition, excluding Ortos, there is also evidence for differences between the 8th (i.e. Ais Yiorkis and Shillourokambos) and late 8th–7th millennium cal. BC (i.e. Khirokitia and Tenta), with percussion marks being the most common type at the former and dismembering marks at the latter. Preservation condition could not have played any major part in shaping this trend as the caprine remains of Ais Yiorkis are in better condition than those of Khirokitia and those of Shillourokambos in better condition than those of Tenta. Ortos and Mylouthkia, however, are in contrast with their chronological counterparts. The caprine remains of Mylouthkia derive from possible funerary/ritual contexts thus their treatment might have been different, although not significantly different (table 4) from 7th millennium Khirokitia. Nevertheless, the case of Mylouthkia is interesting as it exhibits the highest percentages of filleting and absence of skinning marks.

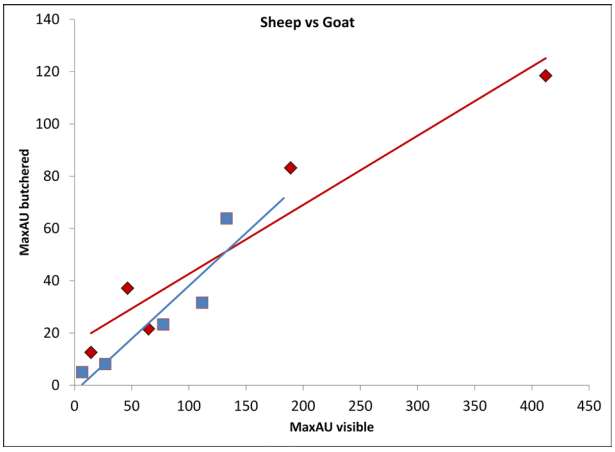

Fig. 7 – Biplots of the visibility of the bone surfaces (i.e. estimated number of visible bones) against the number of specimens with butchery marks, for sheep (red) against goat (blue) at the same sites. The slopes of the linear regression lines do not differ significantly (F = 1.41, p[same slope] = 0.28).

Fig. 7 – Corrélation entre le nombre d'os observables et le nombre d'os portant au moins une trace de boucherie, pour le mouton (rouge) et la chèvre (bleu). Les pentes des droites de régression ne diffèrent pas significativement l'une de l'autre (F= 1,41, p[same slope] = 0,28).

DISCUSSION

The results of the analyses on butchery marks have yielded interesting patterns, which offer opportunities for new insights into previously poorly known aspects

Ais Yiorkis							
Butchery Type	Sheep		Goat		Sheep/Goat		Total
	MaxAU	MaxAU%	MaxAU	MaxAU%	MaxAU	MaxAU%	
Chopping	2	8.7%	2	6.1%	3	3.9%	7
Dismembering	6	26.1%	7	21.2%	11	14.5%	24
Filleting	2	8.7%	4	12.1%	21	27.6%	27
Percussion	12	52.2%	18	54.5%	41	53.9%	71
Skinning	1	4.3%	2	6.1%	0	0.0%	3
Total	23	100.0%	33	100.0%	76	100.0%	132
Shillourokambos (Recent phase)							
Butchery Type	Sheep		Goat		Sheep/Goat		Total
	MaxAU	MaxAU%	MaxAU	MaxAU%	MaxAU	MaxAU%	
Chopping	0	0.0%	0	0.0%	0	0.0%	0
Dismembering	6	17.1%	2	22.2%	13	22.0%	21
Filleting	4	11.4%	2	22.2%	7	11.9%	13
Percussion	24	68.6%	5	55.6%	37	62.7%	66
Skinning	1	2.9%	0	0.0%	2	3.4%	3
Total	35	100.0%	9	100.0%	59	100.0%	103
Mylouthkia (1B)							
Butchery Type	Sheep		Goat		Sheep/Goat		Total
	MaxAU	MaxAU%	MaxAU	MaxAU%	MaxAU	MaxAU%	
Chopping	0	0.0%	0	0.0%	0	0.0%	0
Dismembering	3	100.0%	17	73.9%	1	16.7%	21
Filleting	0	0.0%	5	21.7%	4	66.7%	9
Percussion	0	0.0%	1	4.3%	1	16.7%	2
Skinning	0	0.0%	0	0.0%	0	0.0%	0
Total	3	100.0%	23	100.0%	6	100.0%	32
Khirokitia (Levels B-J)							
Butchery Type	Sheep		Goat		Sheep/Goat		Total
	MaxAU	MaxAU%	MaxAU	MaxAU%	MaxAU	MaxAU%	
Chopping	0	0.0%	4	4.8%	2	3.6%	6
Dismembering	47	46.5%	45	53.6%	25	45.5%	117
Filleting	14	13.9%	10	11.9%	10	18.2%	34
Percussion	35	34.7%	24	28.6%	17	30.9%	76
Skinning	5	5.0%	1	1.2%	1	1.8%	7
Total	101	100.0%	84	100.0%	55	100.0%	240
Tenta (periods 4-2)							
Butchery Type	Sheep		Goat		Sheep/Goat		Total
	MaxAU	MaxAU%	MaxAU	MaxAU%	MaxAU	MaxAU%	
Chopping	0	0.0%	0	0.0%	0	0.0%	0
Dismembering	6	50.0%	4	80.0%	5	71.4%	15
Filleting	0	0.0%	0	0.0%	0	0.0%	0
Percussion	5	41.7%	1	20.0%	2	28.6%	8
Skinning	1	8.3%	0	0.0%	0	0.0%	1
Total	12	100.0%	5	100.0%	7	100.0%	24

Table 3 – Absolute and relative frequencies of the different types of butchery marks for the different taxonomic categories at the six sites.

Tabl. 3 – Fréquences absolues et relatives des différents types de traces de boucherie pour les différents sites étudiés et pour les différentes catégories de taxons.

Ortos							
Butchery Type	Sheep		Goat		Sheep/Goat		Total
	MaxAU	MaxAU%	MaxAU	MaxAU%	MaxAU	MaxAU%	
Chopping	7	5.9%	0	0.0%	7	9.1%	14
Dismembering	23	19.5%	6	24.0%	8	10.4%	37
Filleting	5	4.2%	1	4.0%	8	10.4%	14
Percussion	82	69.5%	18	72.0%	51	66.2%	151
Skinning	1	0.8%	0	0.0%	3	3.9%	4
Total	118	100.0%	25	100.0%	77	100.0%	220

Table 3 (end) – Absolute and relative frequencies of the different types of butchery marks for the different taxonomic categories at the six sites.
Tabl. 3 (suite et fin) – Fréquences absolues et relatives des différents types de traces de boucherie pour les différents sites étudiés et pour les différentes catégories de taxons.

Sites	Ais Yorkis	Mylouthkia	Shillourokambos	Khirokitia	Tental	Ortos
Ais Yorkis		<0.0001	0.0505	<0.0001	<0.0001	0.0016
Mylouthkia	+++		<0.0001	0.0440	0.0024	<0.0001
Shillourokambos	NS	+++		<0.0001	0.0004	0.01187
Khirokitia	+++	NS	+++		0.2130	<0.0001
Tenta	+++	+	+	NS		<0.0001

Table 4 – Results of the statistical pairwise comparison between the distribution of the different types of butchery marks for the six sites, based on the Fisher exact test (p values in the upper right part of the matrix). After an application of the Bonferroni correction, as processed according to W. R. Rice (1989), some of the pairwise comparisons are non significant (NS) or significant (+).
Tabl. 4 – Résultats des comparaisons statistiques deux à deux des distributions de fréquence des différents types de traces de boucherie des six sites étudiés, fondées sur le test exact de Fisher (les valeurs de p sont portées dans la moitié supérieure droite de la matrice). Après application de la correction de Bonferroni, réalisée selon W. R. Rice (1989), certaines de ces comparisons apparaissent non significatives (NS), tandis que d'autres le sont (+).

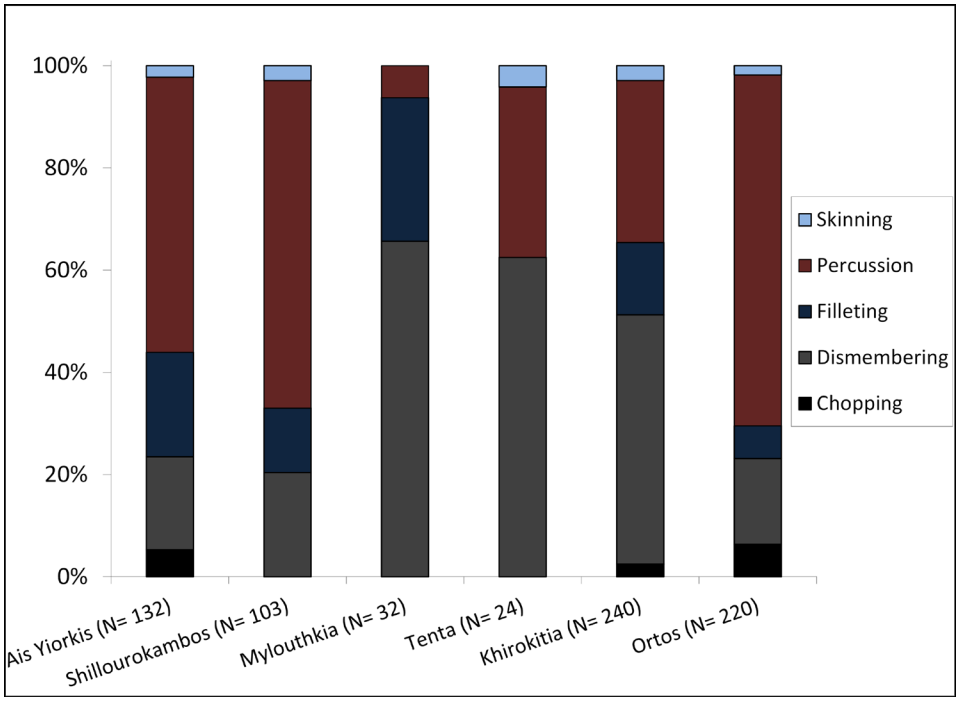

Fig. 8 – Frequencies of different types of butchery marks on caprine remains from the six PPN sites, in broad chronological order.
Fig. 8 – Fréquences des différents types de traces de boucherie observées sur les os de caprinés des six sites précéramiques étudiés, rangés par ordre chronologique croissant.

of human behaviour in PPN Cyprus. Anatomical representation has, rather unsurprisingly, confirmed that entire caprine carcasses were processed at all sites included in this study (fig. 3) but also in a relevant study by Vigne (2011a) for the entire chronological sequence of Shillourokambos. This result is more compatible with domestic herds of sheep and goat exploited by the inhabitants of each site, at least predominantly, than hunted wild or feral populations. Had hunting been practised, at least at some distance from settlements, certain anatomical elements may have been discarded far from the site, which is not supported by the data. The opposite pattern has been recorded for some of the earlier phases at Shillourokambos, which has been interpreted as evidence for the hunting of fallow deer or of caprine feral populations, especially of goat (Vigne, 2011a and 2011b; Vigne et al., in press). A predominantly domestic status of sheep and goat in 8–7th millennium cal. BC Cyprus is also supported by other lines of evidence from the same sites (Vigne et al., 2011a and in press; Hadjikoumis et al., in prep.).

The analysis of the occurrence of butchery marks (table 2) has also produced interesting results that shed new light into human-animal interactions. Before discussing the results altogether, a new insight concerning Mylouthkia 1B deserves to be mentioned. The butchery-specific inspection of the caprine remains recovered from well 133, which were originally thought to be deposited unprocessed by humans (Croft, 2003a, p. 51), has revealed butchery marks (fig. 5). These occur on nineteen specimens (or thirty-two MaxAU) representing a broad range of anatomical elements. They consisted exclusively of dismembering and filleting marks, as the only two cases of percussion marks clearly represent food refuse discarded in the well and were not associated with the articulated carcasses. The dismembering and filleting marks on the articulated carcasses were mainly lightly inflicted, and were confined to the bones of adult and subadult individuals; butchery marks were not observed on the remains of lambs or kids that accounted for the majority of caprines in well 133, and these still seem likely to have been deposited intact and un-butchered as originally proposed. The great majority of butchery marks occurred on goat rather than sheep remains, but since goats outnumbered sheep in the assemblage, and sheep are represented almost exclusively by young lambs (Croft, 2003a, table 6.1), this is probably not significant. The presence of butchery marks suggests that a minority of the caprines were at least partially defleshed before they were deposited in the well. Most of the caprine remains recovered from Mylouthkia well 133 represented complete or nearly complete carcasses as suggested by their frequently articulated state, as well as their anatomical representation (Croft, 2003a, table 6.2), implying that the extent of any consumption of meat by humans would have been token rather than comprehensive. Additional pieces of caprine bone, as well as bones of fallow deer and pig, were scattered throughout well 133, along with the caprine carcasses, but these are comparatively very few in number and are considered to be food scraps of a more conventional nature (Croft, 2003a, p. 53). While this new evidence for butchery does not dramatically affect the initial interpretation of the well 133 animal bone assemblage, it adds a previously unknown aspect to it, presenting a more complex scenario than had formerly been envisaged. The presence of limited evidence for butchery combined with evidence that mainly entire animals were deposited in the well provide further support to Peltenburg's (2003) and Croft's (2003a) initial interpretation that the deposition of caprines may have formed part of funerary practices (as they were in the vicinity of human remains), rather than the disposal of everyday meals. A parallel can be established with the more or less contemporaneous period (mid 8th millennium cal. BC) collective burial at Shillourokambos, in the large pit St 23 (Le Mort et al., 2008; Vigne, 2011c; Vigne et al., 2011b). More or less disarticulated but complete bones of caprines with only a very small number of slight cut marks were the most abundant items among the animal bone deposited at the entrance of the burial, maybe as depositions connected with the abandonment of the burial.

Besides the special case of Mylouthkia 1B, the other caprine assemblages also yielded interesting results as shown by the differences observed in the intensity of butchery. Despite the variability in preservation condition, the analyses presented in this study have shown moderate but unquestionable differences between assemblages that cannot be explained solely by differential preservation. The most characteristic example is the much higher occurrence of butchery marks on the caprines of 7th millennium cal. BC Khirokitia than the 8th millennium cal. BC Ais Yiorkis (fig. 6). On the other hand, the chronologically latest site in the sample, that of late 7th–early 6th millennium Ortos, exhibits lower frequency of butchery marks than 8th millennium Shillourokambos, which could have in reality had even higher numbers of butchery marks erased by the soft acid treatment. This suggests either diversity in the approach to caprine carcass processing at different sites of the 7th millennium cal. BC or a chronological change towards less intensive butchery by the end of the 7th and beginning of the 6th millennium cal. BC in Cyprus. Alternatively, these results can also be interpreted in terms of site size, with the largest size of the 8th millennium (i.e. Shillourokambos) and the largest 7th millennium site (i.e. Khirokitia) plotting above the regression line. It is possible, then, that a more intensive exploitation of caprine (predominantly domestic) carcasses was an inherent characteristic of larger villages in PPN Cyprus. These scenarios are not mutually exclusive, but under the, by no means safe, assumption of an overall economic de-intensification (e.g. Wasse, 2007) and concurrent increase in the importance of hunting in Ceramic Neolithic and Chalcolithic Cyprus (6th–3rd millennia cal. BC), the pattern observed at Ortos can be viewed as a step towards that de-intensification. This trend is likely to have been established in the 6th millennium cal. BC, although the lack of faunal assemblages of that chronology in Cyprus does not allow an estimation of the speed and geographical expansion of the economic de-intensification.

According to this scenario, Khirokitia would represent the pinnacle of intensification in human-caprine relationship during the Neolithic and Chalcolithic periods in Cyprus, reflected in the significantly higher frequency of butchery marks and, among those, dismembering marks. The caprine assemblage from the nearby, but chronologically earlier site of Tenta is too small and badly preserved for reliable comparisons but it appears that, at least in butchery mark types, it provides further support to this interpretation through its similarity with Khirokitia (fig. 8). The intensification in carcass processing suggested by the characteristics of butchery practices at Khirokitia is further supported by the high importance of domestic animals (Davis, 1989 and 2003), and caprines among those, as well as other lines of archaeological evidence such as architecture and material culture (e.g. Le Brun, 1989). These characteristics of Khirokitia constitute indications of denser human population and consequent depletion of wild resources in the area, which would have increased the pressure to extract more energy from domestic animals through more intensive butchery, as it was the case for Shillourokambos in 8th millennium BC. Moreover, the high occurrence of dismembering marks suggests an effort to divide the carcass into smaller parcels whilst the carcass was fresh. Khirokitia, and Tenta to a lesser degree, also differ from earlier and later sites architecturally, in exhibiting increased segregation of household units and higher frequency of hearths within them (e.g. Le Brun, 1989). This can be viewed as increased social 'segregation', which in turn may have affected the practices revolving around the consumption of domestic animals. Increased segregation of residential units, more intensive butchery practices and possibly other converging lines of archaeological evidence are pointing towards consumption of smaller parcels of meat at the household or neighbourhood rather than a communal level (cf. Halstead, 2004, p. 153).

CONCLUSIONS

This paper constituted an attempt to address archaeological questions pertinent to PPN Cyprus, through the analysis of butchery marks. Given the limitations of preservation condition and sizes of some of the samples, interpretations have remained consciously at a basic level. This attempt, however, shows that the potential of the study of butchery marks has been underestimated in Cypriot archaeology, with few exceptions. In this short study, several important issues of the Cypriot PPN have been addressed. This study has highlighted the diversity in butchery practices, both in terms of chronology and geography, and in terms of the size of the villages (i.e. the social complexity). The analysis of butchery marks is in accordance with other lines of archaeological evidence that suggest increased stress on domestic resources occurring, at least locally at some sites, in the course of the 8th and 7th millennia cal. BC. Moreover, there are indications that at the end of the chronological sequence covered by the six PPN assemblages (i.e. end of 7th–early 6th millennia cal. BC) the process of economic de-intensification had already started, at least in terms of caprine husbandry in some areas of Cyprus. The documented changes in butchery practices can also be viewed as a proxy of change in social practices. Differences in butchery practice between broadly contemporaneous sites located in different areas also suggest diversity in economic practice and adaptations to local environments and social circumstances.

This study has also shed new light upon well 133 at Mylouthkia by confirming the presence of butchery marks on some of the caprine carcasses deposited near human remains, similar to what has been observed in the same period at Shillourokambos. This discovery suggests that the animals had been at least partly consumed (but not heavily fragmented) before being deliberately deposited in the well. This very light degree of butchery possibly represents part of a funerary practice.

Beyond its contribution of new archaeological knowledge, this study highlights the potential of butchery marks in Cypriot faunal assemblages. Stemming from this project, more similar studies are in progress (e.g. comparison of Neolithic to Bronze Age butchery practices) but following the ones which have been recently conducted for the early phases at Shillourokambos, this study will hopefully also act as an invitation to others in exploring this evidently fruitful line of zooarchaeological evidence in Cyprus.

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BIBLIOGRAPHICAL REFERENCES

Balasse M., Ambrose S. H. (2005) – Distinguishing Sheep and Goats Using Dental Morphology and Stable Carbon Isotopes in C4 Grassland Environments, *Journal of Archaeological Science*, 32, p. 691–702.

Binford L. R. (1978) – *Nunamiut Ethnoarchaeology*, London, Academic Press, 509 p.

Binford L. R. (1981) – *Bones: Ancient Men and Modern Myths*, New York, Academic Press, 320 p.

Binford L R. (1984) – Butchering, Sharing, and the Archaeological Record, *Journal of Anthropological Archaeology*, 3, p. 235–57.

Binford L. R. (1988) – Fact and Fiction about the *Zinjanthropus* Floor, *Current Anthropology*, 29, p. 123–49.

Blumenschine R. J., Marean C. W., Capaldo S. D. (1996) – Blind Tests of Inter-Analyst Correspondence and Accuracy in the Identification of Cut Marks, Percussion Marks, and Carnivore Tooth Marks on bone surfaces, *Journal of Archaeological Science*, 23, p. 493–507.

Boessneck J., Müller H. H., Teichert M. (1964) – Osteologische unterscheidungsmerkmale zwischen Schaf (*Ovis aries* Linné) und Zeige (*Capra hircus* Linné), *Kühn-Archiv*, 78, p. 1–129.

Brain C. K. (1981) – *The Hunters or the Hunted? An Introduction to African Cave Taphonnomy*, Chicago, University of Chicago Press, 376 p.

Croft P. (2003a) – The Animal Bones, in E. Peltenburg, D. Bolger, S. Colledge and P. Croft (eds.), *Lemba Archaeological Project, Cyprus*, III.1. *The Colonisation and Settlement of Cyprus: Investigations at Kissonerga-Mylouthkia, 1976-1996*, Sävedalen, Paul Åströms (Studies in Mediterranean Archaeology, 70, 4), p. 49–56.

Croft P. (2003b) – Water-Holes and Cowboys-Animal Remains from the Paphian Neolithic, in J. Guilaine and A. Le Brun (eds.), *Le Néolithique de Chypre*, proceedings of the International Meeting organized by the Department of Antiquities of Cyprus and the École française d'Athènes (Nicosia, 2001), Athens, École francaise d'Athènes, p. 269–78.

Croft P. (2005) – Mammalian Fauna, in I. A. Todd (ed.), *Vasilikos Valley Project*, 7. *Excavations at Kalavasos-Tenta*, II, Sävedalen, Paul Åströms (Studies in Mediterranean Archaeology, 71:7), p. 342–67.

Davis S. J. M. (1989) – Some More Animal Remains from the Aceramic Neolithic of Cyprus, in A. Le Brun (ed.), *Fouilles récentes à Khirokitia (Chypre), 1983-1986*, Paris, ERC (Mémoire, 81), p. 189–222.

Davis S. J. M. (2003) – The Zooarchaeology of Khirokitia (Neolithic, Cyprus), Including a View from the Mainland, in J. Guilaine and A. Le Brun (eds.), *Le Néolithique de Chypre*, Proceedings of the International Meeting organized by the Department of Antiquities of Cyprus and the École française d'Athènes (Nicosia, 2001), Athens, École francaise d'Athènes, p. 253–68.

Davis S. J. M., Gonçalves M. J., Gabriel S. (2008) – Animal Remains from a Moslem Period (12th–13th Century AD) 'Lixeira' (Garbage Dump) in Silves, Algarve, Portugal, *Revista Portuguesa de Arqueologia*, 11, 1, p. 183–258.

Guilaine J., Briois F., Vigne J.-D., eds., (2011) – *Shillourokambos. Un établissement néolithique précéramique à Chypre. Les fouilles du secteur 1*, Paris, Errance and Athens, École française d'Athènes, 1247 p.

Gillis R., Chaix L., Vigne J.-D. (2011) – An Assessment of Morphological Criteria for Discriminating Sheep and Goat Mandibles on a Large Prehistoric Archaeological Assemblage (Kerma, Sudan), *Journal of Archaeological Science*, 38, p. 2324–39.

Halstead P. (2004) – Farming and Feasting in the Neolithic of Greece: The Ecological Context of Fighting with Food, *Documenta Praehistorica*, 31, p. 151–61.

Halstead P. (2011) – Faunal Remains from FN-EH Nemea Tsoungiza: Husbandry, Butchery, Consumption and Discard of Animals, in D. J. Pullen (ed.), *Nemea Valley Archaeological Project*, I. *The Early Bronze Age Village on Tsoungiza Hill*, Princeton, American School of Classical Studies at Athens, p. 741–800.

Halstead P., Collin, P., Isaakidou V. (2002) – Sorting the Sheep from the Goats: Morphological Distinctions between the Mandibles and Mandibular Teeth of Adult *Ovis* and *Capra*, *Journal of Archaeological Science*, 29, p. 545–53.

Hammer Ø., Harper D. A. T., Ryan P. D. (2001) – PAST: Paleontological Statistics Software Package for Education and Data Analysis, *Palaeontologia Electronica*, 4, 1, 9 p., http://palaeo-electronica.org/2001_1/past/issue1_01.htm [online]

Helmer D. (2000) – Discrimination des genres *Ovis* et *Capra* à l'aide des prémolaires inférieures 3 et 4, et interprétation des âges d'abattage : l'example de Dikili Tash (Grèce), *Ibex: Journal of Mountain Ecology*, 5; *Anthropozoologica*, 31, p. 29–38.

James E. C., Thompson J. C. (2015) – On bad terms: Problems and Solutions within Zooarchaeological Bone Surface Modification Studies, *Environmental Archaeology*, 20, 1, p. 89–103.

Kratochvil Z. (1969) – Species Criteria on the Distal Section of the Tibia in *Ovis ammon* f. aries L. and *Capra aegagrus* f. hircus L., *Acta Veterinaria*, 38, p. 483–90.

Le Brun A. (1989) – *Fouilles récentes à Khirokitia (Chypre), 1983-1986*, Paris, ERC (Mémoire, 81), 288 p.

Le Brun A. (2001) – At the Other End of the Sequence: the Cypriot Aceramic Neolithic as Seen from Khirokitia, in S. Swiny (ed.), *The Earliest Prehistory of Cyprus: from Colonization to Exploitation*, Boston, American Schools of Oriental Research, p. 109–18.

Le Mort F., Vigne J.-D., Davis S. J. M., Guilaine J., Le Brun A. (2008) – Man-Animal Relationships in the Pre-Pottery Burials at Shillourokambos and Khirokitia (Cyprus, 8th and 7th millennia cal. BC), in E. Vila,

L. Gourichon, A. Choyke and H. Buitenhuis (eds.), *Archaeozoology of the Near East VIII*, proceedings of the 8th ASWA International Symposium (Lyon, 2006), Lyon, Maison de l'Orient et de la Méditerranée (Travaux de la Maison de l'Orient et de la Méditerranée, 49), p. 219–41.

Payne S. (1985) – Morphological Distinctions between the Mandibular Teeth of Young Sheep, *Ovis*, and Goats, *Capra*, *Journal of Archaeological Science*, 12, p. 139–47.

Peltenburg E., Bolger D., Colledge S., Croft P., eds. (2003) – *Lemba Archaeological Project, Cyprus*, III.1. *The Colonisation and Settlement of Cyprus: Investigations at Kissonerga-Mylouthkia, 1976–1996*, Sävedalen, Åström Verlag (Studies in Mediterranean Archaeology, 70, 4), 320 p.

Prummel W., Frisch H. J. (1986) – A Guide for the Distinction of Species, Sex and Body Side in Bones of Sheep and Goat, *Journal of Archaeological Science*, 13, p. 567–77.

Reitz E. J., Wing E. S. (2008) – *Zooarchaeology*, 2nd ed., Cambridge, Cambridge University Press (Cambridge Manuals in Archaeology), 533 p.

Rice W. R. (1989) – Analyzing Tables of Statistical Tests, *Evolution*, 43, 1, p. 223–25.

Shipman P. (1986) – Scavenging or Hunting in Early Hominids: Theoretical Framework and Test, *American Anthropologist*, 88, p. 27–43.

Shipman P., Rose J. (1983) – Early Hominid Hunting, Butchering and Carcass Processing Behaviour: Approaches to the Fossil Record, *Journal of Anthropological Archaeology*, 2, p. 57–98.

Simmons A. (1996) – Preliminary Report on Multidisciplinary Investigations at Neolithic Kholetria-Ortos, Paphos Distict, *Report of the Department of Antiquities* (Cyprus), p. 29–44.

Simmons A. (1998) – Test Excavations at Two Aceramic Neolithic Sites in the Uplands of Western Cyprus, *Report of the Department of Antiquities* (Cyprus), p. 1–16.

Simmons A. (2010) – Ais Giorkis, an Upland Aceramic Neolithic Site in Western Cyprus: Progress Report of the 1997–2009 Investigations, *Report of the Department of Antiquities* (Cyprus), p. 1–25.

Simmons A. H. (2012) – Ais Giorkis: an Unusual Early Neolithic Settlement in Cyprus, *Journal of Field Archaeology*, 37, p. 86–103.

Todd I. A. (2005) – *Vasilikos Valley Project*, 7. *Excavations at Kalavasos-Tenta*, II, Sävedalen, Paul Åströms (Studies in Mediterranean Archaeology, 71, 7), 396 p.

Vigne J.-D., ed. (1987) – *La découpe et le partage du corps à travers le temps et l'espace*, proceedings of the RCP 117 Meeting (Paris, 1985), Paris, Hasri (*Anthropozoologica*, special issue 1), 135 p.

Vigne J.-D. (1988) – *Les mammifères post-glaciaires de Corse : étude archéozoologique*, Paris, éditions du CNRS (*Gallia Préhistoire*, suppl. 26), 337 p.

Vigne J.-D. (2006) – Découpe du cerf *(Cervus elaphus)* au Mésolithique moyen, à Noyen-sur-Seine (Seine-et-Marne) : analyses tracéologique et expérimentale, *Revue de paléobiologie*, sp. issue 10, p. 69–82.

Vigne J.-D. (2011a) – Découpe de boucherie et mode de consommation des petits et moyens ongulés, in J. Guilaine, F. Briois and J.-D. Vigne (eds.), *Shillourokambos. Un établissement néolithique précéramique à Chypre. Les fouilles du secteur 1*, Paris, Errance and Athens, École française d'Athènes, p. 871–918.

Vigne J.-D. (2011b) – Histoire de la gestion des chèvres et des moutons, in J. Guilaine, F. Briois and J.-D. Vigne (eds.), *Shillourokambos. Un établissement néolithique précéramique à Chypre. Les fouilles du secteur 1*, Paris, Errance and Athens, École française d'Athènes, p. 1039–58.

Vigne J.-D. (2011c) – Les dépôts animaux issus de la sépulture collective (St 23), in J. Guilaine, F. Briois and J.-D. Vigne (eds.), *Shillourokambos. Un établissement néolithique précéramique à Chypre. Les fouilles du secteur 1*, Paris, Errance and Athens, École française d'Athènes, p. 1119–34.

Vigne J.-D., Carrère I. (2011) – Les ossements de vertébrés : méthodologie, spectres de faune et périodisation, in J. Guilaine, F. Briois and J.-D. Vigne (eds.), *Shillourokambos. Un établissement néolithique précéramique à Chypre. Les fouilles du secteur 1*, Paris, Errance and Athens, École française d'Athènes, p. 539–78.

Vigne J.-D., Carrère I., Briois F., Guilaine J. (2011a) – The Early Process of the Mammal Domestication in the Near East: New Evidence from the Pre-Neolithic and Pre-Pottery Neolithic in Cyprus, *Current Anthropology*, S52, 4, p. S255–71.

Vigne J.-D., Giraud T., Briois F., Carrère I., Coularou J., Crubezy E., Duchesne S., Gérard P., Guilaine J., Manen C., Perrin T., Serrand N. (2011b) – La structure 23, in J. Guilaine, F. Briois and J.-D. Vigne (eds.), *Shillourokambos. Un établissement néolithique précéramique à Chypre. Les fouilles du secteur 1*, Paris, Errance and Athens, École française d'Athènes, p. 335–432.

Vigne J.-D., Daujat J., Monchot H. (2015) – First Introduction and Early Exploitation of the Persian Fallow Deer on Cyprus (8,000–6,000 cal. BC), *International Journal of Osteoarchaeology*, doi: 10.1002/oa.2488 [online].

Vigne J.-D., Carrère I., Guilaine J. (in press) – Instability and Co-Development of the Exploitation of Early Domestic Sheep and Goats: The Example of Shillourokambos (Cyprus, Pre-Pottery Neolithic, 10,400–9,000 cal. BP), in M. Mashkour and M. Beech (eds.), *Archaeozoology of the Near East IX*, proceedings of the 9th ASWA International Symposium (Al Ain, 2008), Oxford, Oxbow Books.

Wasse A. (2007) – Climate, Economy and Change: Cyprus and the Levant during the Late Pleistocene to Mid Holocene, in J. Clarke (ed.), *On the Margins of Southwest Asia: Cyprus in the 6th to 4th Millennia BC*, Oxford, Oxbow Books, p. 43–63.

Yellen J. E. (1991) – Small mammals: !Kung San Utilization and the Production of Faunal Assemblages, *Journal of Anthropological Archaeology*, 10, p. 1–26.

Zeder M. A., Lapham H. A. (2010) – Assessing the Reliability Criteria Used to Identify Postcranial Bones in Sheep, *Ovis*, and Goats, *Capra*, *Journal of Archaeological Science*, 37, p. 2887–905.

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