The Zooarchaeology of the Late Neolithic Strymon (Struma) river valley: the case of the Greek sector of Promachon-Topolnica

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in loving memory of

Konstantinos Kazantzis

(my father)

Abstract

Excavations on the border between Greece (sector Promachon) and Bulgaria (sector Topolnica) in the basin of the river Strymonas, Central Macedonia, have revealed a ‘flat-extended’ settlement dating to the Late Neolithic. In addition to the rich array of material culture evidence, the excavation yielded a substantial quantity of animal bones, thus offering an unparalleled opportunity to study the human-animal relationships.

The current thesis focuses on the study of the faunal assemblage from the Greek sector of Promachon, and examines the role and the contribution of domestic and wild animals to the economy of the site. Within Promachon, the study of the animal remains indicates an economy particularly tuned to the production of meat; however, a small-scale exploitation of milk could also be inferred. This information is valuable, considering the scarcity of faunal data from contemporary settlements across the basin of Strymonas. Of particular interest is the presence of a large ‘public’ structure, rich in material culture evidence and animal bones, which creates an interesting contrast to the rest of the household deposits. In addition, the faunal evidence is consistent with the suggestion of the excavators of the site that significant changes occurred during the third phase of occupation at Promachon.

On the other hand, the substantially better representation of cattle in Promachon than any other settlement in Greek Macedonia, along with the evidence from pottery decoration and structural features, suggests that - to some extent - Promachon was linked to Balkan Late and Final Neolithic communities. Biometric analysis also provided interesting insights into the diverse husbandry practices among Late Neolithic sites in Macedonia and Thessaly. This information is particularly important, in view of the fact that the comparison of the size of domestic ruminants and pigs between Late Neolithic Macedonian and Thessalian sites has not been attempted prior to this study. In this respect, the collection of a larger body of metrical data from Late Neolithic Macedonian and Thessalian settlements should represent a priority for future research, in order to provide clarification to some of the issues discussed in this thesis.

The current research presents new information on subsistence strategies in an underrepresented area of northern Greece during a time-period (fifth and fourth millennium BC), that is considered one of the most dynamic eras of the prehistory of southeastern Europe. It also clarifies both temporal and regional trends in animal management, placing Promachon in the broader spectrum of contemporary agro-pastoral communities and creating an integrated picture of human-animal relationships that encompasses both the basin of Strymonas and northern Greece.

Περίληψη

Οι ανασκαφές στα σύνορα ανάμεσα στην Ελλάδα (τομέας Προμαχώνας) και τη Βουλγαρία (τομέας Topolnica) στη λεκάνη του Στρυμόνα της Κεντρικής Μακεδονίας, αποκάλυψαν έναν επίπεδο οικισμό που χρονολογείται στην Ύστερη Νεολιθική εποχή. Εκτός από τη πλούσια ποικιλία στοιχείων υλικού πολιτισμού, η ανασκαφή απέδωσε μια μεγάλη ποσότητα οστών ζώων, προσφέροντας έτσι μια μοναδική ευκαιρία για τη μελέτη των σχέσεων ανθρώπων και ζώων.

Η παρούσα διατριβή επικεντρώνεται στη μελέτη της πανίδας από τον ελληνικό τομέα του Προμαχώνα, εξετάζοντας το ρόλο και τη συμβολή των οικόσιτων και των άγριων ζώων στην οικονομία του οικισμού. Από τη μελέτη των ζωικών καταλοίπων προκύπτει μια οικονομία προσανατολισμένη στην εκμετάλλευση κρέατος. Επιπλέον, τα δεδομένα καταδεικνύουν μιας μικρής κλίμακας εκμετάλλευση των αιγοπροβάτων για γάλα. Αυτή η πληροφορία είναι πολύτιμη, ιδιαίτερα άν λάβουμε υπόψη την έλλειψη δεδομένων από σύγχρονους του Προμαχώνα οικισμούς στη λεκάνη του Στρυμόνα. Ξεχωριστό ενδιαφέρον παρουσιάζει ο μεγάλος «κοινόχρηστος» χώρος του οικισμού, πλούσιος σε κατάλοιπα υλικού πολιτισμού και οστά ζώων, εν αντιθέσει με τους υπόλοιπους αποθέτες στους οποίους βρέθηκαν κατάλοιπα οικιακής προέλευσης.

Η παρουσία βοοειδών στο Προμαχώνα, τα οποία παρουσιάζονται με μεγαλύτερη συχνότητα από οποιαδήποτε άλλη Ύστερη Νεολιθική θέση στην Μακεδονία, σε συνδυασμό με τα δεδομένα της κεραμικής και των αρχιτεκτονικών καταλοίπων, υποδηλώνει ότι ο οικισμός του Προμαχώνα συνδέεται με Ύστερες Νεολιθικές κοινότητες των Βαλκανίων. Επίσης, η βιομετρική ανάλυση των οστών των οικόσιτων ζώων παρουσίασε ενδιαφέροντα αποτελέσματα που αφορούν τις διαφορετικές πρακτικές εκτροφής μεταξύ Ύστερων Νεολιθικών οικισμών της Μακεδονίας και της Θεσσαλίας. Αυτή η πληροφορία είναι ιδιαίτερα σημαντική, αν λάβουμε υπ' όψιν το γεγονός ότι η σύγκριση του μεγέθους των οικόσιτων ζώων μεταξύ

Ύστερων Νεολιθικών οικισμών της Μακεδονίας και της Θεσσαλίας δεν είχε επιχειρηθεί πριν από την παρούσα μελέτη. Γίνεται σαφές βέβαια, ότι η συλλογή ενός μεγαλύτερου όγκου βιομετρικών δεδομένων θα πρέπει να αποτελέσει προτεραιότητα για μελλοντική έρευνα προκειμένου να παράσχει διευκρινίσεις για ορισμένα από τα ζητήματα που τίθενται στη παρούσα διατριβή.

Η παρούσα έρευνα παρέχει νέες πληροφορίες σχετικά με τις στρατηγικές διαχείρισης ζώων σε μια περιοχή της βόρειας Ελλάδας για την οποία δέν έχουμε πολλές πληροφορίες, κατά τη διάρκεια μιας χρονικής περιόδου (πέμπτη και τέταρτη χιλιετία π.Χ.) η οποία θεωρείται μία από τις πιο δυναμικές της προϊστορίας της νοτιοανατολικής Ευρώπης. Διευκρινίζει επίσης, τόσο τις διαχρονικές, όσο και τις περιφερειακές τάσεις στη διαχείριση των ζώων, τοποθετώντας τον οικισμό του Προμαχώνα στο ευρύτερο φάσμα των σύγχρονων του γεωργοκτηνοτροφικών κοινοτήτων, και δημιουργεί μια ολοκληρωμένη εικόνα των σχέσεων ανθρώπων και ζώων κατά την Ύστερη Νεολιθική, που περιλαμβάνει τόσο τη λεκάνη του Στρυμόνα όσο και τη βόρεια Ελλάδα.

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Prologue

Before expressing my gratitude to a number of individuals and Institutions that contributed to this research, I would like to refer to the people to whom I owe my involvement in the study of animal bones. My first contact with zooarchaeology was made while working as an undergraduate student at the excavation of Dr. Andreas Darlas (director of the Ephoria of Paleoanthropology and Speleology of northern Greece), in the Paleolithic cave of Kalamakia, in Mani, Peloponnese. The zooarchaeologist of the site, Dr. Eleni Psathi, whom I consider a true inspiration, introduced me to the study of faunal remains. The zooarchaeologist of the Ephoria of Paleoanthropology and Speleology of southern Greece, Katerina Trantalidou, trained me in the study of animal bones during 2006-2007, before I decided to pursue a Masters degree at the University of Sheffield during the academic year 2008-2009.

My involvement in the study of the faunal material from Promachon was made in circumstances, which I have totally forgotten. However, it is only fair to acknowledge the archaeologist of the site of Promachon, Dr. Chaido Koukouli-Chrysanthaki, who entrusted the study of the animal bone material to me. I would like to warmly thank her for believing in me, and for providing the opportunity to study an interesting - in all aspects - faunal material.

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Ioannis Aslanis (National Hellenic Research Foundation) provided useful comments on aspects of stratigraphy, structural features and phasing of Promachon: I would like to thank him for putting up with a lot of questions and emails during the writing of the second chapter of my thesis. Ivan (Ivo) Vajsov (National Institute of Archaeology, Bulgarian Academy of Sciences) has also provided useful information with regard to the phasing of the site and pottery typology. Thanks also go to Nikolai Spassov (Museum of Natural History of Sofia), who provided valuable information with regard to the faunal assemblage from the Bulgarian sector of Topolnica. Rosalia Christidou (CNRS) has provided valuable information on the bone industry from Promachon, while David Orton (University of Cambridge) provided comparative data from faunal assemblages of the Balkans: I would like to warmly thank both of them. Pascal Darcque (CNRS), Zoi Tsirtsoni (CNRS) and Dimitra Malamidou (18th Ephoria of Prehistoric and Classical Antiquities of Kavala) have provided useful information on aspects of habitation and stratigraphy from the nearby to Promachon site of Dikili Tash: I would like to warmly thank them for their permission to work in their research environment. I would also like to thank the archaeologists of the 28th Ephoria of Prehistoric and Classical Antiquities of Serres, Maria Stampouloglou and Nikoleta Pilarinou, as well as the conservator of the Amphipolis Museum, Maria Kyranoudi, for their enormous help in various aspects of this research.

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The structure of this thesis is fairly conventional. ***Chapter 1*** sets the scene in terms of the Neolithic in northern Greece and in Macedonia in particular and presents the history of the archaeological research undertaken in the area.

Chapter 2 introduces the site of Promachon-Topolnica, the history of the research on-site and the deposits from which the faunal material derives; this chapter brings together all available published sources with regard to the site (stratigraphy and habitation levels, material culture evidence) and presents the latest absolute dating evidence.

Chapter 3 presents the history of the faunal research undertaken in the region of Macedonia and briefly introduces the faunal assemblage of Promachon before moving to the statement of the aims of the current project.

Chapter 4 outlines the methodology and the analytical procedures followed in the faunal study.

The study proper begins in ***Chapter 5***; here, the results of the faunal material from Promachon sector are presented (*i.e.* taphonomic analysis, taxonomic, body part and contextual distribution, ageing and metrical analyses of the main domesticated species).

The main results from Promachon are then compared to the results obtained from a number of northern Greek and Balkan contemporary sites in ***Chapter 6***; the idea is to incorporate Promachon in the wider context of Late Neolithic communities of northern Greece and the Balkan Peninsula.

Chapter 7 discusses the case study, pointing to a number of key issues that arose from the previous chapters.

Finally, the conclusions of the faunal study are summarized in ***Chapter 8***.

Chapter 1. – Introduction

1.1 – The Neolithic: a brief introduction

John Lubbock coined the term 'Neolithic' [*Greek Etymology: Νέος (New) + Λιθικός (Stone) = New Stone Age*) in 1865 in order to distinguish that archaeological period in which polished stone axes and other stone tools were ground into shape, from the Old Stone Age [Paleolithic; *Greek Etymology: Παλαιός (Old) + Λιθικός (Stone)]*, in which flints were shaped by flaking (Runnels and Murray 2001). Lubbock's differentiation was based solely on changes in the technology of lithic tools, but later prehistorians further differentiated the two time-periods on the basis of economic practices.

During the first half of the 20th century, the science of archeology - and the study of the Neolithic in particular - were significantly influenced by the dialectical materialism and the Marxist theory, which were encountered in the work of the leading British archaeologist Gordon Childe. Childe's (1936) work, which was inevitably linked to his Marxist theoretical leanings, highlighted the regulatory role of the means of production and the material culture to the evolution of human society and had an immediate impact on archaeological science. Childe introduce to archaeology the well-established biological concept of 'monogenesis' (*i.e.* a novelty is only invented once, and then transferred from region to region); plant and animal domestication, writing, irrigation, pottery and tillage are commonly considered as such contrivances today. The transfer of a number of novelties that took place during the Neolithic, is commonly referred today as 'diffusion' and it might have occurred in two ways:

- Directly, by ***moving populations***.
- Indirectly, by ***contact, exchange*** and ***trade***.

A frequently mentioned concept with regard to the Neolithic is the so-called 'Neolithic package'; the concept itself has been attributed to Chris Chippindale while an undergraduate at the Cambridge University in the 1970's (Sherratt 2005). By that time also, the concept of 'New Archaeology', which affected the study of the Neolithic in a profound way, was already taking the lead in archaeological science[1]. Its proponents argued that the study of archaeological data should by no means be influenced by the various historical and social conditions, but only by the accuracy of the method used to explain the archaeological record (Clarke 1973)[2].

The 'Neolithic package' was first used to refer to the material culture of the period of the Neolithic as a whole, since Neolithic assemblages from Southwest Asia, Anatolia and Southeast Europe yielded similar types of finds, and these tended to occur together repeatedly in this vast geographical region (Çilingiroglu 2005; Özdogan 2001). Today, however, there is a general recognition that the term 'Neolithic package' implies something more than technological developments (*i.e.* the use of polished stone axes and querns, stone and adobe brick architecture, the use of pottery and woolen textiles and decorative arts in many materials). The 'Neolithic package' is closely related also to the appearance of domesticated plants (wheat, barley, beans and lentils) and animals (cattle, sheep, goat and pigs), sedentism, and the adoption of food production as the basis upon which, both social changes and technological innovations were founded (*cf.* Hodder 1990; Pluccienik 1998; Thomas 1991; Tringham 2000; Whittle 1996; Zvelebil 1998).

All in all, the term 'Neolithic package' is generally accepted to encompass the technological, economic, social and ideological aspects of the Neolithic period as a whole. Unquestionably, the beginning of the Neolithic is marked by fundamental changes in the economic mode of life and a dazzling burst of innovations in the sphere of material culture. In addition, the appearance of

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[1] Named shortly thereafter 'Processual Archaeology'.

[2] The main objective of the 'New Archaeology' (or Processual Archaeology) was to establish a number of scientific methods of analyzing the archaeological material in order to record patterns of human behavior.

permanently inhabited farming villages was indeed an important step in human history and brought into existence a way of life that has remained the basis of the human society to the present day (Runnels and Murray 2001).

1.2 – The Neolithic of Macedonia

One cannot refer to the research of the Neolithic of Macedonia, without first mentioning the research that was conducted in the Neolithic of Thessaly, which has a longer history. The pioneering work of Christos Tsountas in the first decade of the 20th century at the Neolithic sites of Sesklo and Dimini shaped much subsequent research into the Neolithic of Greece (Halstead 2006; Theocharis 1973; 1993). Long before any systematic chronological framework was established in other parts of Greece, the archaeological research in Thessaly presented an elaborate chronological system suitable for describing the cultural history of the area (Andreou *et al.* 1996). To some extent, this privileged position of the Thessalian Neolithic is still held today and some of the central issues of the Greek Neolithic in general, such as the beginning of a farming economy and the emergence of social complexity, revolve around research in Thessaly - although questions of cultural history and chronology are still discussed (*cf.* Andreou *et al.* 1996; Kotsakis 2002; Perlès 2001).

1.2.1 – A brief history of the research

Already at the beginning of the 20th century, the prehistoric period of Macedonia became the subject of research by European archaeologists. The area of Macedonia was considered a key province for the understanding of European prehistory. The widespread view on the significance of Macedonia for the Neolithic in Europe followed the model of Gordon Childe (1936). According to this model, Macedonia was a natural channel for the expansion of the Neolithic into Europe, through the Axios, Morava and Danube rivers. However, a number of scholars recognized also a general tendency of the area of Macedonia to isolation (Andreou *et al.* 1996). The evidence, on which the latter view rested, was rooted in the underdevelopment of the research in the area of Macedonia, and thus, the general scarcity of archaeological information (Fotiadis 2001; Fotiadis *et al.* 2000). This led archaeologists to place and discuss Macedonia in the context of a Thessalian, rather than a local Macedonian Neolithic; it also led to the assumption that the Neolithic cultures of Macedonia were largely derivative from, and marginal to, those of Thessaly (Andreou *et al.* 1996; Perlès 2001). Inevitably, archaeologists studying the prehistory of Macedonia were considering it to be the 'province' of Thessaly during the Neolithic (Andreou *et al.* 1996)[3].

This view of Macedonia changed with time, since the considerable number of Neolithic sites that were excavated as early as the early 1960's and 1970's gave important information with regard to the Neolithic of the area. The excavation of the site of Nea Nikomidia, which originally commenced in 1961 (Wardle 1996) in the prefecture of Veria in western Macedonia, yielded the earliest radiocarbon dating (6.220 ± 150 BC) and the site represented - at that time - the oldest dated Neolithic community in Europe. Regardless of the fact that the excavation project of Nea Nikomidia was abruptly terminated[4], it marked the beginning of a significant archaeological research in the area of Macedonia and it was followed by the excavation project of another important site, which remains until today a point of reference for the Neolithic of the area: Sitagroi (Renfrew *et al.* 1986).

By the mid 1990's and the early 00's the number of excavated Neolithic sites in Macedonia had increased considerably (***Figure 1.1***); sites such as Drosia (Kotsos 1992), Yiannitsa (Chrysostomou 1991), Dispilio (Hourmouziadis 1996), Makriyalos (Pappa and Bessios 1995; 1998; 1999; Pappa *et al.* 1998; 2003), Promachon (Koukouli-Chrysanthaki *et al.* 1997), Dikili Tash (Treuil 1992), Stavroupoli (Grammenos 2002a; 2004), Megalo Nisi (Fotiadis *et al.* 2000), Limenaria (Malamidou 1996; 2006; Malamidou and Papadopoulos 1993), Aggitis cave (Trantalidou *et al.* 2006), Arkadikos (Peristeri 2002; 2004), Vasilika and Dimitra (Grammenos 1991), Servia (Ridley *et al.* 2000), Kryoneri (Malamidou 2007), Mandalo (Papanthimou-Papasteriou 1993), Toumba Kremastis Koiladas (Hondrogianni-Metoki 2001) and Avgi (Stratouli

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[3] Heurtley (1939) argued in his book *Prehistoric Macedonia: an archaeological reconnaissance of Greek Macedonia (west of Struma) in the Neolithic, Bronze and early Iron Ages* that his purpose was to remove the impression that 'Macedonia goes with the north' (*i.e.* northern European hinterland).

[4] The results of the archaeological project of Nea Nikomidia remained unpublished until 1996. For an overview of the significance of the project see also Fotiadis (2001).

2004) have provided important information with regard to the Neolithic of the area. A significant number of these excavations were staffed with scholars with different specialisms (*i.e.* anthropologists, zooarchaeologists, palynologists, geoarchaeologists), who had been trained in various European Universities and were introduced to archaeological research in Greece. This according to Andreou *et al.* (1996) had brought:

"…*a radically different set of questions and ethos of practice, a scientific humanism that had developed outside the area of the Aegean prehistory"* (Andreou *et al.* 1996, 561-562).

The results of the archaeological research of the Neolithic (and Bronze Age) sites in the culturally and geographically distinct region of Macedonia were summarized about 20 years ago (Andreou *et al.* 1996). Their chronological framework, which was established for the Neolithic of Macedonia and northern Greece in general, is systematically used until today and it is presented in ***Table 1.1***; this also includes the division of the Late Neolithic into two stages of development, following Gallis (1996) and Demoule and Perlès (1993).

Table 1.1: Archaeological phases and chronology for northern Greece: Neolithic.

Neolithic	***Periods***	***Cal. BC***
	Final Neolithic	*4.700/4.500-3.300-3.100*
	Late Neolithic II	*4.800 - 4.700/4.500*
	Late Neolithic I	*5.400/5.300 - 4.800*
	Middle Neolithic	*5.800/5.600 - 5.400/5.300*
	Early Neolithic	*6.700/6.500 - 5.800/5.600*

Figure 1.1: Map of Macedonian and Thessalian Neolithic sites mentioned in the text.

1.2.2 – Promachon in context: the Late Neolithic of Macedonia

In contrast to the preceding Early and Middle Neolithic periods, the Late Neolithic period of Macedonia is characterized by a considerable expansion of the number of settlements; these settlements occupied either areas that were previously uninhabited, or areas in which the environmental conditions did not permit risk-free agricultural production (*i.e.* swampy areas) (Hourmouziadis 1996). Examples of such Late Neolithic communities are represented by the site of Dispilio (Hourmouziadis 2002) near the lake of Kastoria and the site of Dikili Tash (Treuil 1992) in the plain of Kavala. On the other hand, a number of settlements, such as Vasilika (Grammenos 1991; Pappa 1993), Stavroupoli (Grammenos 2002a; 2004) and Thermi (Grammenos *et al.* 1989; Pappa *et al.* 2000) covered large areas, which in some cases exceeded 20 hectares each (Pappa 1999; 2008). Despite the fact that the excavations in these settlements have uncovered a considerable number of structural features, it seems likely that the number of population in each settlement did not exceed 100-200 people (Andreou *et al.* 2001; Pappa 2008).

As in the Early and the Middle Neolithic periods, there were two types of settlements during the Late Neolithic in Macedonia: tells [also known as toumbes (in the area of Macedonia) and magoules (in the area of Thessaly)] and open-air (also known as flat-extended) settlements (Perlès 2001; Souvatzi 2008).

Prehistoric tells in Macedonia - often confused with ‘Macedonian tells’, which are funerary monuments of the Hellenistic period - were formed by the accumulation of building materials, since the construction of any new building was based on the foundations of an older (Andreou *et al.* 1996; 2001). This practice ultimately resulted in the rapid elevation of the settlements and in some cases tells approached - or even exceeded - 20m in height. The persistence of the inhabitants to build their new structures on top of the foundations of the older ones, might have been associated either with the declaration of the origins and the ‘antiquity’ of the group residing in the building, or with the close ties that this group shared with their ancestors who were perceived to support the longevity and the success of the household (*cf.* Andreou *et al.* 1996; 2001; Bailey 2000; Perlès 2001). In any case, practical considerations such as the availability of space or the easier construction of a new building might have also played a role (Bailey 2000).

In the case of the open-air (or flat-extended) settlements, the new structures were not constructed on the foundations of the previous ones; on the contrary, these were relocated within the framework of a wider area of the settlement, the limits of which, in most cases were defined by a circular trench (as in the case of Makriyalos) (Andreou *et al.* 1996; Kotsakis 1999; Pappa 2008). These buildings were not carefully constructed and they generally give the impression of more ephemeral structures, since they were often nothing more than pits dug into the natural soil (Souvatzi 2008). Like Thessaly, the density of the Late Neolithic buildings in Macedonian sites is extremely low, as there were extensive voids in-between structures - a practice, which is believed to reflect the establishment of the *private space* during the Late Neolithic (Pappa 2008). However, the large structural features (*Megaron*), which are present in Thessalian sites of this time-period (*i.e* Dimini) - possibly indicating a society with an enhanced hierarchical organization - are conspicuously absent from contemporary Macedonian sites (Pappa 2008). On the other hand, a considerable number of large circular or semi-circular structures, which were dug into the natural subsoil and are considered to represent communal structures with public functions are present at a number of Macedonian sites (*i.e.* Stavroupoli, Makriyalos, Promachon).

In contrast to the faunal evidence from the preceding (Early and Middle Neolithic) and the subsequent (Early Bronze) periods, the faunal evidence from the Late Neolithic period of Macedonia suggests that wild species had a limited use. The economy during this time-period is mainly based on the breeding and keeping of domesticated animals (cattle, caprines and pigs). Mortality curves suggest a considerable potential for the production of meat, while a small-scale exploitation for secondary products (milk, wool and labour) is also considered to have taken place (*cf.* Becker 1991; Halstead 1989a; 1996; Papathanasopoulos 1996; Theocharis 1973; 1993; Valamoti 2004). Widespread agricultural products are represented by wheat, barley, oats, lentils, vetch, beans and peas, while there is also evidence that Late Neolithic people were collecting wild figs, apples, pears, cranberries, grapes, almonds and acorns (Valamoti 2004). Charred seeds and skins that were found in the Late Neolithic deposits of Dikili Tash provide the first indication for the cultivation of the vine (Valamoti *et al.* 2007). Large storage pits and storage jars that were found either inside or outside the structures of almost all settlements from this time-period, have been considered to point to the existence of *surpluses* of products, as suggested by Halstead (1989b).

The evidence of technical expertise is also attested during the Late Neolithic in the area of Macedonia through a number of objects such as obsidian tools, high-quality pottery and marble vessels. The latter are present in a number of sites such as Limenaria in the island of Thassos (Papadopoulos and Malamidou 2012), Servia (Heurtley 1939), Dikili Tash (Treuil 1992) and Promachon (Koukouli-Chrysanthaki *et al.* 2007). Their manufacturing technology and their purpose of use are not yet fully understood, although the evidence from Limenaria suggests that these might have been used as colour containers (Papadopoulos and Malamidou 2012).

The considerable expansion of the number of Late Neolithic sites in Macedonia suggests a dense system of interacting communities that had proceeded from habitation sites to being villages in the functional sense. For instance, the impressive production of high-quality vessels with black paint on red background (also known as black-on-red or simply black-top; Fotiadis 2001; Grammenos and Kotsos 2001; Koukouli-Chrysanthaki *et al.* 2007) - typical of Eastern Macedonia - have also been found in contemporary settlements from Thrace (Makri) and Thessaly (Pevkakia). In addition, the evidence indicates that a number of Late Neolithic Macedonian sites shared contacts with the wide area of the Balkan Peninsula. For instance, the Late

Neolithic settlement of Mandalo in Yiannitsa (Chrysostomou 1991) yielded a considerable number of obsidian tools from the Carpathians (Grammenos and Kotsos 2001) and the well-known Aegean marine shell S*pondylus gaederopus* has been found in sites from Central and Northern Europe (Andreou *et al.* 2001).

Archaeological research has indicated that, in the beginning of the fourth millennium BC, settlements in Macedonia *(i.e.* Mandalo, Thermi, Stavroupoli, Promachon), which had been inhabited for several centuries, were ultimately abandoned (Andreou *et al.* 2001; Grammenos and Kotsos 2004). This constitutes a significant problem for the research of the prehistory of the area, as this means that the number of settlements which span the crucial transitional period between the Late/Final Neolithic and the Bronze Age are scarce (Megalo Nisi and Dikili Tash are two of the very few settlements that are continuously inhabited from the Neolithic to the Bronze Age).

Among recently excavated Late Neolithic sites in Greek Macedonia, the settlement of Promachon-Topolnica - with its rich array of material culture evidence - yielded a large assemblage of animal bones, which constitutes the focal point of the current research.

The site of Promachon-Topolnica is introduced in the next chapter (***Chapter 2***).

Chapter 2. – Archaeological background

2.1 – Location of Promachon-Topolnica

The Promachon-Topolnica settlement is situated exactly on the border between Greece and Bulgaria. The site is located 1 km to the west of the Strymon river, 2 km to the south of the Bulgarian village of Topolnica and almost 3.5 km northwest of the Greek border village of Promachon (Latitude: 41^{o} 23.220`; Longitude 23$^{o}$ 19.725`; h: 80.50 m.; Koukouli-Chrysanthaki *et al.* 2007; ***Figure 2.1***). This location was strategic and the site controlled the north-south traffic through the Promachon pass, which also provided an important link between the Neolithic cultures of Northern Greece and Southwestern Bulgaria. The locale itself also benefited from the river's fertile alluvial grounds, which are still today used for agriculture and pastoral activities (Fotiadis 1995).

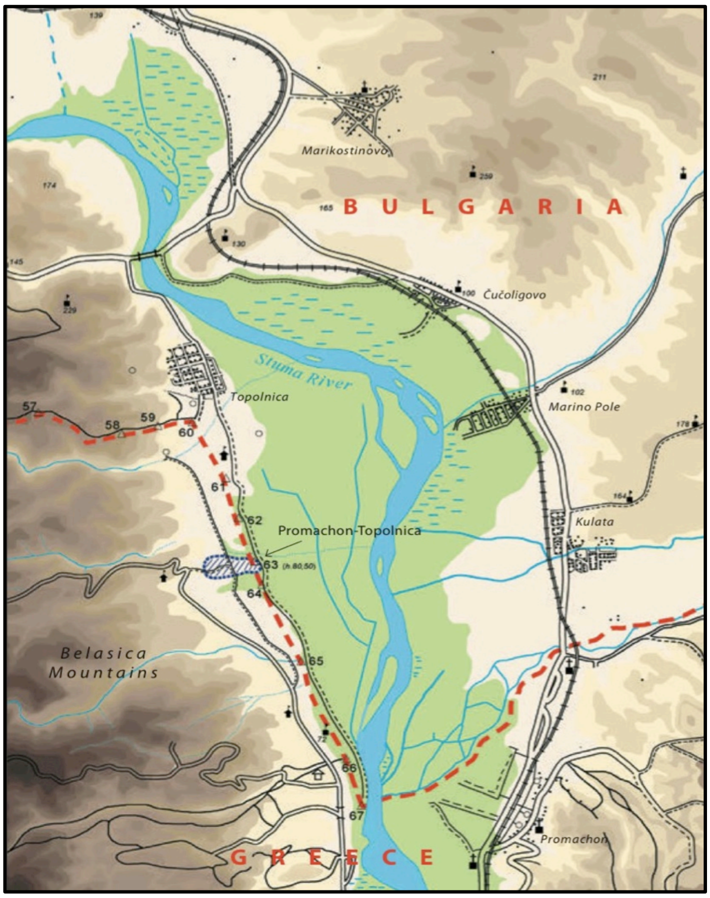

Figure 2.1: Geographical map of the lower course of the Middle Strymon (Struma) river valley and location of the Late Neolithic settlement of Promachon-Topolnica. After Koukouli-Chrysanthaki *et al.* (2007).

2.2 – History of research

The results of the thorough excavations carried out at the prehistoric settlement of Promachon-Topolnica are of special importance for our understanding of Southern European prehistory. Before 1981, when the investigations began on the Bulgarian part of the site (Topolnica sector), very little was known concerning prehistoric life in the Middle Strymon (Struma in Bulgarian) river valley (Vajsov 2007). At the same time, published research from some of the relevant excavated sites in Central Macedonia, Northern Greece, was scanty. In 1980 the results of the excavations at Sitagroi (Evans 1986; Keighley 1986; Renfrew *et al.* 1986) had not yet been fully published. Excavation results from the nearby Dimitra and Vasilika tell were published early in the 1990's (Grammenos 1991), while the Dikili Tash (Seferiadis 1983) publication provided only some preliminary results of the excavations and an outline of the chronological sequence. Overall, research concerning the Late Neolithic in the Middle and Lower Strymon river valley was still in its infancy (Vajsov 2007).

Sector Topolnica was discovered in 1978 but it was not until 1981 that it was originally registered as a site of archaeological interest. Until the mid-1990's the site was referred to in the published literature as “Kremenica” (Bailey 2000). The excavation on the Bulgarian side of Kremenica (or Topolnica), which was directed by H. Todorova from the Archaeological Institute of Sofia commenced in 1981 and lasted for 10 years. During the first few years, the excavation on the Bulgarian side constituted mainly of test soundings extending up to the border with Greece; these were aimed at establishing the stratigraphy and chronology of the site (***Figure 2.2***).

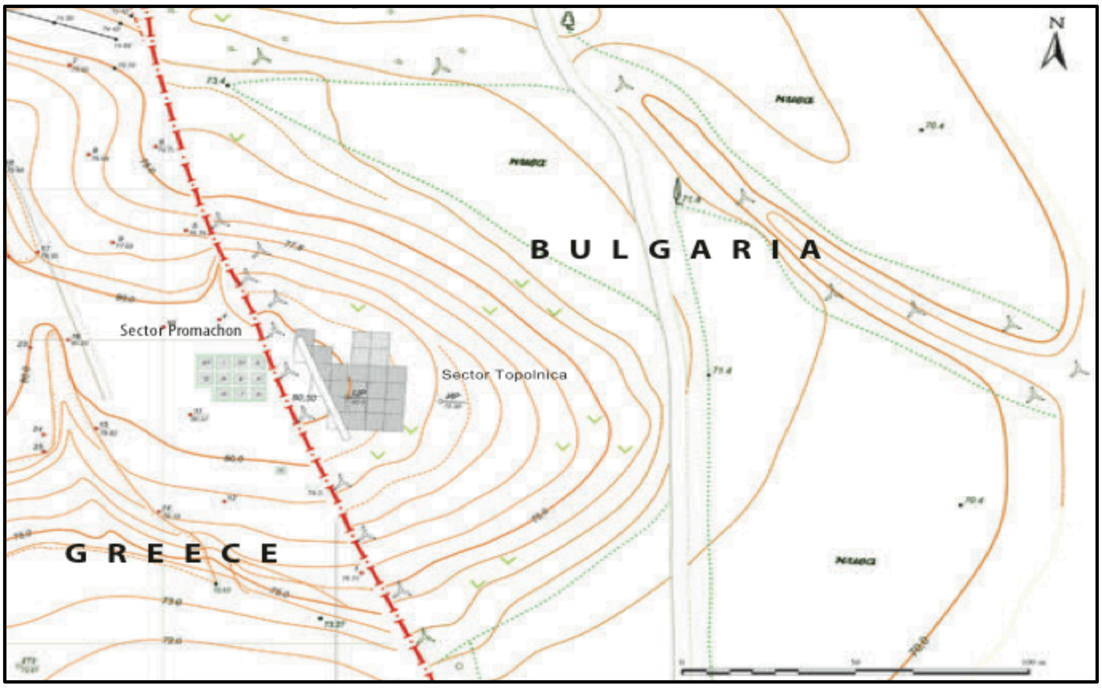

Figure 2.2: Topographic map of Promachon-Topolnica Late Neolithic site. After Koukouli-Chrysanthaki *et al.* (2007).

Due to the existence of many different features, this proved to be a difficult task, leading to future excavations extending to the East and thus encompassing a large part of the settlement on the Bulgarian side (Koukouli-Chrysanthaki *et al.* 2007; Vajsov 2007). In 1993, a joint Greek and Bulgarian excavation research program began on the sector of the site located in Greek territory (sector Promachon). It was carried out under the auspices of the Greek 18th Ephorate of Prehistoric and Classical Antiquities (KH Ε.Π.Κ.Α.) of Eastern Macedonia (prefecture of Kavala) and the direction of the archaeologist Chaido Koukouli-Chrysanthaki in collaboration with Ioannis Aslanis of the National Hellenic Research Foundation. This further stage of excavation also lasted for 10 years (Koukouli-Chrysanthaki 2000; 2006; Koukouli-Chrysanthaki and Basiakos 2002; Koukouli-Chrysanthaki *et al.* 1992; 1993; 1995; 1996; 1997; 1998a; 1998b; 1999; 2000; 2001; 2003; 2007). The joint research program, which has combined excavations and surface investigation with archaeometric ground probe data (Koukouli-Chrysanthaki *et al.* 2007), has determined the existence of a Late Neolithic open settlement also known in the Greek literature as 'flat-extended'

(Andreou *et al.* 1996; Chapman 1989) that covered an area of about five hectares (***Figure 2.3***). Dispersion of ceramic fragments, however, indicates that the site covered an area as large as seven hectares. The elevation of the settlement ranges between 0.5-1.7 m. The results, after about 23 years of excavation on both sectors (Greek and Bulgarian), are of exceptional importance for the Late Neolithic of the Balkan Peninsula.

Figure 2.3: Aerophotography of the two excavated sectors. After Koukouli-Chrysanthaki *et al.* (forthcoming).

2.3 – Stratigraphy and habitation levels

Excavations on the Greek sector of Promachon originally commenced in 1993. The excavation methodology employed, broadly followed the system devised by Hänsel *et al.* (1989) for the Early Bronze Age site of Kastanas in Western Macedonia (Koukouli-Chryssanthaki *et al.* 1993). It was flexible enough to be continuously modified as the understanding of the sedimentology and the dynamics of the deposited features gradually became clearer. The excavated area consisted of 11 trenches with dimensions of 5x5m each (**Figure 2.4**).

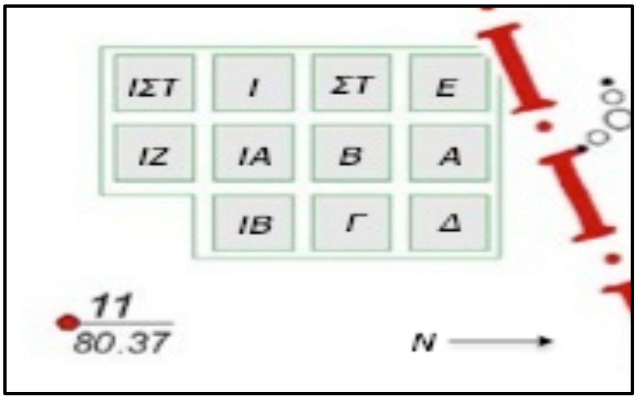

Figure 2.4: Topographic plan of the 11 excavated trenches in Promachon sector. After Koukouli-Chrysanthaki *et al.* (2007).

The excavation involved the removal of soil in horizontal spits, 8-10cm. in thickness; these were later combined by taking into consideration the natural pattern of the layers, occasional disturbances, the occurrence of pits and platforms as well as the storage areas and other features, which would lead to the recognition of the architectural and building phases (Aslanis pers. comm.; Koukouli-Chrysanthaki *et al.* 1993).

Material culture findings as well as animal bones deriving from various excavation contexts were given an ‘E.E.’ (Ενότητες Ευρημάτων: Finding Units) number, and were placed inside plastic bags labeled with information regarding the trench from which they were excavated, the stratigraphic context to which they belonged, their coordinates of the excavated area and the depth from which they were recovered (*i.e.* E.E. 1023 refers to the twenty third plastic bag of trench A). All trenches were fully excavated and the Neolithic deposits were dug down to the bedrock.

In the years 2003-2012 the analyses of the results from the Promachon sector have led to a good understanding of the stratigraphic sequence. Three phases of occupation (Phases I-III) have been identified on the basis of structural features and material culture. The latter evidence has also allowed subdividing the second phase into two stages of development (Phases IIa-IIb). The phasing, which is manifested most clearly in the horizontal plan but is also confirmed by the vertical stratigraphy, is based on the identification of eleven well-preserved layers (Layers 1-11). They all represent extremely rich deposits, which were either the result of levelling activities before a new house floor was built, or constituted habitation debris associated with everyday activities.

2.3.1 – Phase I (Layers 4-11)

Phase I (the oldest phase of habitation in the settlement), includes the deposits associated with layers 4-11. Layers 7-11 belong to a timber-framed structure (structure n. 4), which emerged in trenches IΣT and IZ. Structure n. 4 (***Figure 2.5***; Koukouli-Chrysanthaki *et al.* 2007) was found under a timber-framed wattle and daub structure, which is unrelated and belongs to Phase II (Koukouli-Chrysanthaki *et al.* 2007). Structure n. 4 was roughly circular, with a radius of nearly 11 m and a depth of nearly 7 m. Excavation undertaken underneath a hearth that was found near the eastern wall of structure n. 4, revealed another layer (Layer 8) with pottery vessels *in situ.* Whitish traces on the floor probably came from a wooden structure, while a large posthole may have supported a wooden floor

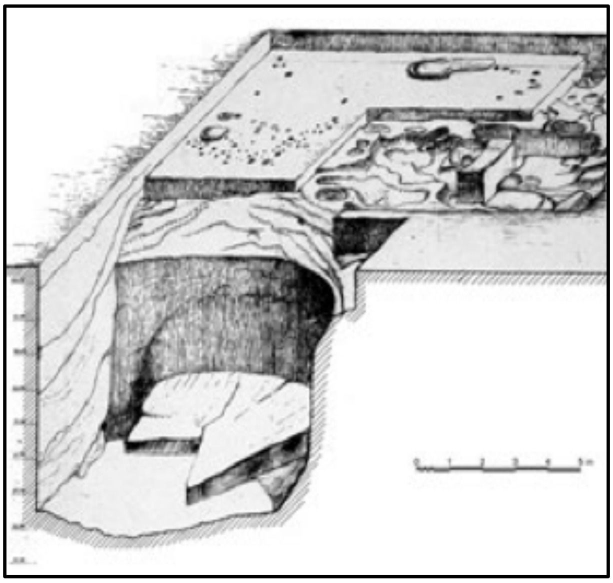

Figure 2.5: Structure n. 4. Promachon sector Phase I (LN1). After Koukouli-Chrysanthaki *et al.* (2007).

platform or simply the roof of the building (Koukouli-Chrysanthaki *et al.* 2001). Further excavations revealed the existence of a series of earlier layers (Layer 9-10 and 11) plastered with yellowish clay, rich in finds. Among the findings, there were pebbles and grinding stones, intact and fragmented high quality luxury vessels with incised, rippled and painted decorations, large quantities of animal bones, horncores and antlers, intact bucrania, as well as small objects including clay figurines, bone and stone tools, clay house models and jewelry, basket fragments and fragments of wooden barks with painted decorations (***Figure 2.6***) (Koukouli-Chrysanthaki *et al.* 2003; Koukouli-Chrysanthaki *et al.* 2007).

Figure 2.6: Layer 8, Structure n. 4. Promachon sector Phase I (LN1). After Koukouli-Chrysanthaki *et al.* (2007).

The next Layer (Layer 6) is represented by an almost 20 cm thick deposit, occurring in trenches Β, Γ, Δ, Ι, ΙΑ and ΙΒ. Here, the remains of three timber-framed structures (structures n. 1, n. 2 and n. 3) with internal pits along with mud bricks, hearths, plaster floors, pottery and animal bones were recovered. Structures n. 1, n. 2 and n. 3 along with structure n. 4, constitute the architectural remains of what is defined to be the first phase of habitation in the settlement (Phase I; ***Figure 2.7***)[5]. Timber-framed structures with internal pits (misleadingly defined in both Greek and Bulgarian publications as ‘*semi-subterranean structures*’ or ‘*subterranean structures’* : Koukouli-Chrysanthaki *et al.* 2007; Vajsov 2007) in some respects resemble - despite their geographical and chronological distance - the well-known Saxon ‘sunken

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[5] At least six timber-framed structures with internal pits have been unearthed from the Bulgarian sector of Topolnica (Koukouli-Chrysanthaki *et al.* 2007).

featured buildings' also known as 'sunken-houses' or 'Grubenhauser' (West 1985).

Figure 2.7: Promachon sector Phase I (LN1). Timber-framed structures with interior pits and structure n. 4. After Koukouli-Chrysanthaki *et al.* (2007).

The use of the timber-framed structures with internal pits - which are also referred in the bibliography as pit-houses, pit-dwellings, pit-huts (Bailey 2000; Halstead 2011; Pappa 2008) - is a much contentious issue for the prehistoric archaeology of Southeastern Balkans[6]. In general, pit-houses - similar to those found at Promachon-Topolnica - have been identified as early as the Early Neolithic at Nea Makri in Attica (Pantelidou-Gofa 1991) and the Middle Neolithic in the Northern Balkan Peninsula (Bailey 2000). In addition, they have been unearthed from Northern Greek sites contemporary to Promachon such as Makriyalos (Pappa and Bessios 1995; 1998; 1999), Thermi B (Grammenos *et al.* 1989; Pappa *et al.* 2000), Stavroupolis I-II (Grammenos and Kotsos 2002a; 2004), and Giannitsa B (Chrysostomou 1991). They all date to the early phase of the Late Neolithic (LN1) (Demoule *et al.* 1998).

There are currently two arguments with regard to the use of pit-houses; the

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[6] For the rest of this thesis, timber-framed structures with internal pits will be referred as pit-houses.

first supports the idea that pit-houses were proper households, where a number of everyday activities, including grouping of families and food preparation and consumption were taking place (Bailey 2000; Pappa 2008). Proponents of the second argument emphasize the fact that the size of the pits of the pit-houses is rather small for a nucleated family to sleep, let alone perform other activities (Bogdanović 1988; Flannery 1972).

At Promachon, each pit of the pit-houses (n. 1, n. 2 and n. 3) comprises an area of nearly 8-10 m^2, while the floor levels were found 60-70 cm below the surface of the natural subsoil from which they were cut. According to the archaeologists of the site, the size of the pits of the pit-houses is small for a nucleated family to group; in this sense, the archaeologists have suggested the presence of a raised upper structure, which would have been used as a living space, while the pits would have been used as storage facilities and workshop areas (Koukouli- Chrysanthaki *et al.* 2007; ***Figure 2.8***) It is worth noting, however, that the excavation on the lowest levels of the pit of the pit-house n. 1 from Promachon, revealed a hearth with distinctive traces of rebuilding and reuse (Koukouli-Chryssanthaki *et al.* 2007). It is therefore highly likely that pits of the pit-houses in Promachon might also have been used as actual living spaces. On the other hand, recent reconstructions of pit-houses based on two clay house models found in the Greek sector of Promachon (***Figure 2.9***), suggest the existence of pitched roofs.

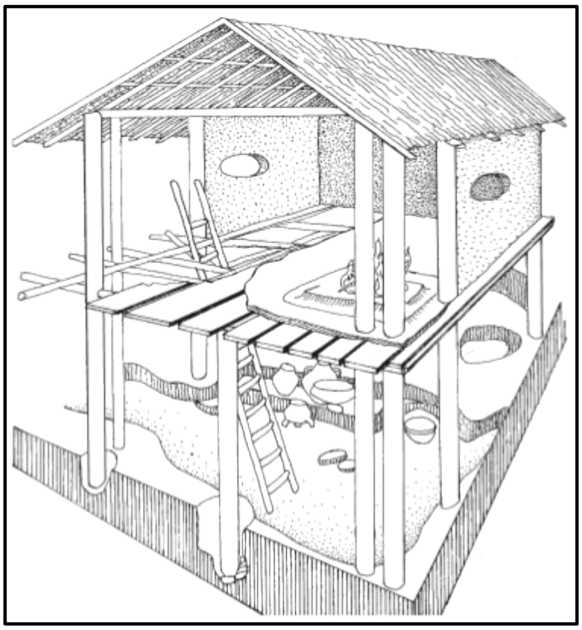


Figure 2.8: Reconstruction of a pit-house with a raised upper structure. After Koukouli-Chrysanthaki *et al.* (2007).

Figure 2.9: Clay house model with depicted bucrania on the 'wall'. Promachon sector Phase I. After Koukouli-Chrysanthaki *et al.* (2007).

Structure n. 4 significantly differs from the pit-houses n. 1, n. 2 and n. 3 in terms of size. In addition, the former structure can be differentiated from the other three in terms of functionality. The directors of the excavation of the site have proposed the use of structure n. 4 as a 'communal building' where activities of symbolic nature were taking place, involving the consumption of meat by a large number of participants (Koukouli-Chrysanthaki *et al.* 2007) as in the case of Makriyalos in Pieria, Northern Greece (Mainland and Halstead 2005; Pappa *et al.* 2003). Additionally, the presence of the bucrania often covered in red paint or clay - which has parallels from Dikili Tash, Macedonia (Darcque and Treuil 1997; Treuil and Darcque 1998) and the Vinča cultures of Eastern Serbia (Chapman 1981) - could have added an element of symbolism to those activities (Koukouli-Chrysanthaki *et al.* 2007).

Layer 6 is 'sealed' by a thick 20 cm deposit of white ash layer, marking a conflagration event that took place in the settlement. Evidence of the fire event is also documented on the Bulgarian sector of Topolnica in which, depending on the slope of the mound, the ash layer reaches almost 35-40 cm in thickness (Vajsov 2007). The next layer (Layer 5) was located above the successive layers of structure n. 4 and only in trench ΙΣΤ. Recent micromorphological evidence (Karkanas pers. comm.) suggests that this 15 cm layer might have been formed as a result of the collapsed wattle roof of structure 4 and the structure's ultimate subsidence after the conflagration event. Ultimately the debris covered that area.

Layer 4 represents a 25-30 cm thick destruction layer after the conflagration. It is found in trenches B, Γ, Δ, I, IA and IB. The deposits of this layer consist of a series of scattered debris of structures along with pebbles, a hearth, pottery sherds and animal bones, which may represent an incidence of leveling activity in order to form the floors of the structures in the next phase (Phase II). It is not yet clear whether there was a short phase of abandonment between Phase I and the subsequent Phase II (Koukouli-Chrysanthaki 2006), but evidence based on the continuity of the radiocarbon dates, suggest that this conflagration did not substantially interrupt the occupation of the settlement (Vajsov 2007). To date, the causes of the fire incident are unknown.

2.3.2 – Phase II (Layers 2-3)

Phase II includes the deposits belonging to layers 3 and 2. Layer 3 is found in all trenches of the excavation (trenches A, B, Γ, Δ, E, ΣT, I, IA, IB, IΣT, and IZ). This level's thickness varies from 20 to 25 cm and consists of traces of floor surfaces, scattered mudbricks, pottery and animal bones from two aboveground timber-framed structures with internal hearths (***Figure 2.10***).

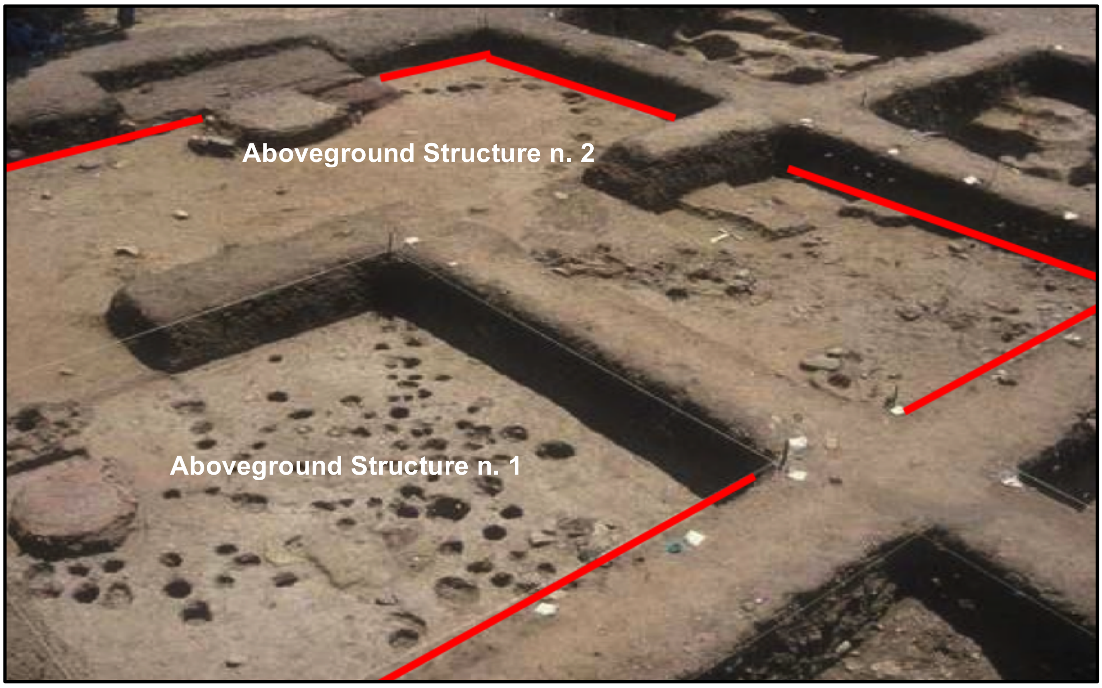


Figure 2.10: Promachon sector Phase II (LN1). Above ground timber-framed structures with internal hearths. After Koukouli-Chrysanthaki *et al.* (forthcoming).

In general, aboveground timber-framed structures are found in almost all Balkan Late Neolithic sites (Bailey 2000). In the case of Late Neolithic Macedonia, aboveground timber-framed structures replace the previous structural features (pit-houses), as the interior pits are being filled and the floors are placed above ground (Gallis 1990; Koukouli-Chrysanthaki *et al.* 1997). Typical examples, contemporary to Promachon-Topolnica, are represented by the aboveground timber-framed (wattle and daub) structures found at Limenaria on the island of Thassos (Malamidou 1996; 2006; Malamidou and Papadopoulos 1993; Papadopoulos and Malamidou 2012), at the Dikili Tash settlement in Kavala (Demoule 2004) and at the Arkadikos settlement in the plain of Drama (Peristeri 2002; 2004).

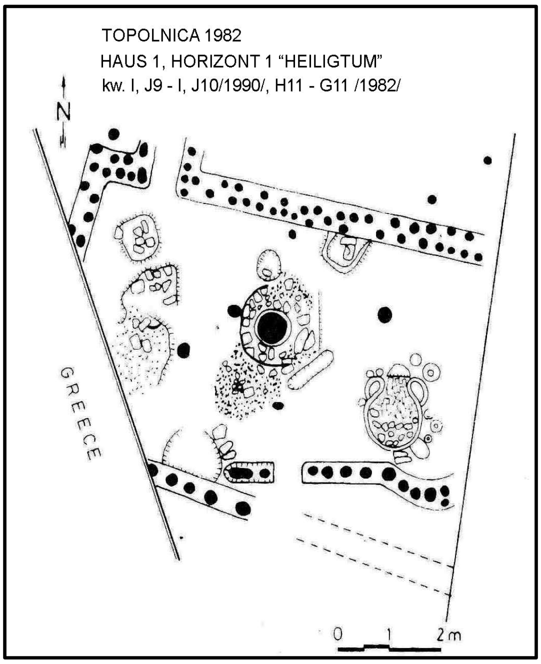


Figure 2.11: Plan of the aboveground timber-framed structure n. 1. Topolnica sector Phase II (LN1). After Koukouli-Chrysanthaki *et al.* (1996).

Excavation on both sectors of the settlement unearthed five such structures, three from the Bulgarian and two from the Greek sector. The largest of these structures was found in the Topolnica sector (structure n. 1). It was rectangular with dimensions of 8x5 m and aligned roughly along an east-west axis (***Figure 2.11***). A large posthole pit in the center may have been used to support the roof of the structure (Koukouli-Chrysanthaki *et al.* 1996; 2007; Vajsov 2007).

There is no certain interpretation on the function of structure n. 1 from the Bulgarian sector of Topolnica. Bulgarian archaeologists argue that the building was used as a ‘sanctuary’ (Vajsov 2007), since the conflagration that took place during the previous phase (Phase I) may have forced the inhabitants of the settlement to move the ‘communal’ building (structure n. 4) from the western plateau (Promachon sector) to the eastern one (Topolnica sector) by constructing a new aboveground structure (structure n. 1). The Bulgarian publications base their interpretations regarding the 'communal essence' of the structure on the four bas-relieved schematic female figures (Vajsov 2007), which were found on the destruction levels of this building and on the fact that the structure itself differs from the others in terms of size (Koukouli-Chrysanthaki *et al.* 1996).

Layer 2 was located only in trench ΙΣΤ. It consists of deposits made of a series of rocks, pebbles, pottery and animal bones, which accumulated in the negative features that formed as a consequence of the subsidence of structure n. 4 after the conflagration. Its thickness does not exceed 10 cm.

Radiocarbon analyses indicate that the site was abandoned by the end of the second phase of occupation (Koukouli-Chrysanthaki *et al.* forthcoming).

2.3.3 – Phase III (Layer 1)

After the period of abandonment, the site was re-inhabited and it was used for a short period of time during the third (and last) phase of occupation; this last phase is represented by the deposits of a single layer (Layer 1). Layer 1 is present in trenches Β, Γ, Δ, Ι, ΙΑ, ΙΒ, ΙΣΤ and ΙΖ. However, only a few pits and compacted debris of pottery sherds and pebbles appear in places where the structural remains of this last phase of habitation are present (***Figure 2.12***). These contexts probably came from the leveling of the ruins of the buildings from the preceding settlement levels, in order to form the floors of the houses of this last phase of habitation (Koukouli-Chrysanthaki *et al.* 1996; Koukouli-Chrysanthaki *et al.* 2007). Whatever the case, only tentative conclusions can be drawn, since pottery typology has indicated that this layer has been partly mixed with the preceding ones of Phase II, mainly due to intensive ploughing activity over the years (Koukouli-Chrysanthaki *et al.* 1996; Koukouli-Chrysanthaki *et al.* 2007).

Figure 2.12: Layer with pottery sherds and pebbles. Promachon sector Phase III (LN2). After Koukouli-Chrysanthaki *et al.* (forthcoming).

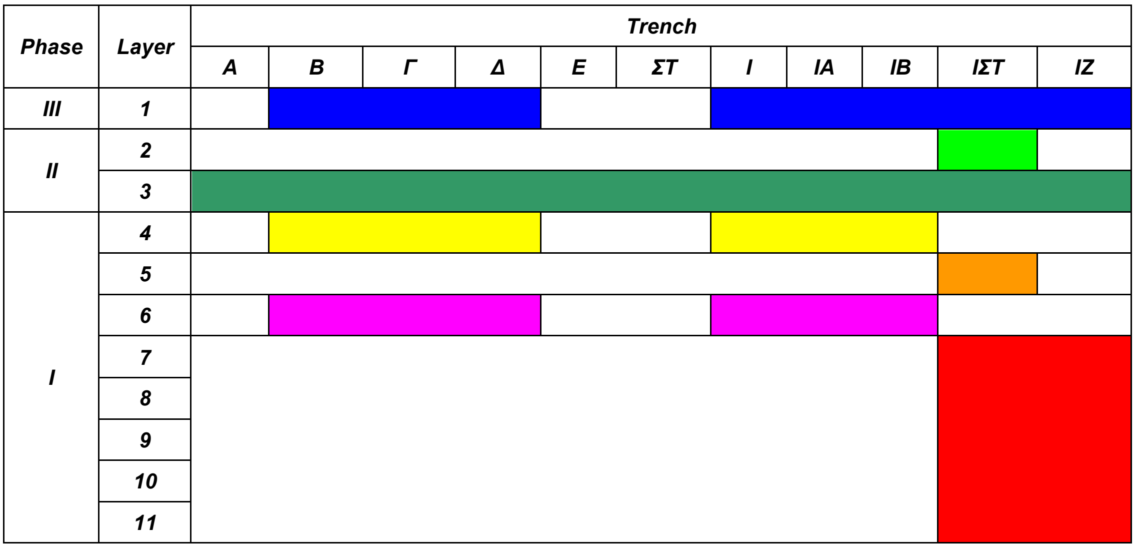
Evidence of copper smelting is of particular interest in Promachon sector and it is documented in the deposits of Phase III (Koukouli-Chrysanthaki *et al.* 2000; 2007; Koukouli-Chrysanthaki and Basiakos 2002). According to the excavators of the site and the Archaeometry Lab Decmocritos in Athens, a clay crucible that was found at the bottom of a small pit belonging to Phase III, contained traces of copper smelting with distinct also traces of heavy burning (Koukouli-Chrysanthaki *et al.* 2007); the archaeological investigation revealed also traces of copper on the floors of Phase III and a series of hollows with successive layers of burnt clay in their interiors, most likely associated with the extraction of copper.

In general, the southeastern Balkan region is considered one of the independent centers of the adoption of metallurgy during the late stages of the Neolithic period (Jovanović 1980; Renfrew 1969). Similar to Promachon cases from northern Greece and the Balkan regions constitute the site of Sitagroi [evidence of crucibles with copper slag during the third phase of occupation (Renfrew and Slater 2002)], Dikili Tash [hollows with burnt clay and evidence of copper extraction dating to the first phase of occupation

(Seferiadis 1983)], and also the sites of Rudna Glava (Jovanović 1980) and Ai bunar (Chernych 1978), with evidence of intensive copper extraction. The settlement of Promachon-Topolnica was eventually abandoned by the end of the third phase of occupation.

Table 2.1 provides information with regard to the phases, the layers and the excavated trenches in Promachon.

Table 2.1: Layers and habitation phases against excavation trenches.



Phase	***Layer***	***Trench***										
		A	***B***	***Γ***	***Δ***	***E***	***ΣΤ***	***I***	***IA***	***IB***	***IΣΤ***	***IZ***
III	***1***		🟦	🟦	🟦			🟦	🟦	🟦	🟦	🟦
II	***2***										🟩	
	3	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩	🟩
I	***4***		🟨	🟨	🟨			🟨	🟨	🟨		
	5										🟧	
	6		🟪	🟪	🟪			🟪	🟪	🟪		
	7										🟥	🟥
	8										🟥	🟥
	9										🟥	🟥
	10										🟥	🟥
	11										🟥	🟥

2.4 – Absolute dating

^{14}C analysis from 11 bone and charcoal samples from both sectors (Maniatis and Fakorellis 2000; Maniatis *et al.* 2004) has shown a clear clustering of the absolute dates for Phases I and II (***Table 2.2***).

Table 2.2: ^{14}C dates. After Koukouli-Chrysanthaki *et al.* (2007).

Lab N.	***Context***	***Material***	***^{14}C***	***δ ^{13}C***	***Cal. BC***
HD-20459	*Square ΣT (Phase II)*	*Bone*	*5999±47*	*-19.3*	*4939-4805 / 5017-4733*
HD-20462	*Square IA (Phase III) depth: 80.01 m*	*Bone*	*5530±48*	*-19*	*4448-4337 / 4459-4254*
DEM-1173	*Square IΣT (Phase II) depth: 79.30 m*	*Charcoal*	*5996±25*	*-25*	*4910-4810 / 4940-4870*
DEM-1185	*Square IΣT (Phase II) depth: 79.31 m*	*Charcoal*	*5895±33*	*-25*	*4800-4720 / 4850-4690*
Bln-3348	*Square M14 (Phase II) depth: 0.90 m*	*Charcoal*	*6000±80*		*4970-4780*
DEM-1250	*Square IΣT (Phase II) depth: 79.65 m*	*Charcoal*	*6068±40*	*-25*	*5030-4860 / 5190-4810*
DEM-1254	*Square IΣT (Phase II) depth: 78.99 m*	*Charcoal*	*6038±40*	*-25*	*4990-4820 / 5040-4800*
HD-20457	*Square Γ (Phase I) depth: 78.17 m*	*Charcoal*	*6188±38*	*-25.77*	*5227-5061 / 5287-5002*
Bln-3382	*Square 2c (Phase I) depth: 1.10 m*	*Charcoal*	*6100±60*		*5200-5180 / 5080-4930*
Bln-3349	*Square O12 (Phase I) depth: 1.20 m*	*Charcoal*	*6240±90*		*5270-5060*
Bln-3381	*Square J11 (Phase I) depth: 0.80 m*	*Charcoal*	*6270±60*		*5270-5200 / 5170-5080*

Following calibration (***Figure 2.13***), the general chronological sequence that can be established for the three phases in Promachon-Topolnica settlement is the following (***Table 2.3***):

Table 2.3: Phasing of Promachon-Topolnica. After Koukouli-Chrysanthaki *et al.* (2007).

Phases	***Cal. BC***	***Cultural Sequence***
III	*4.460-4.250*	*Late Neolithic 2*
II	*5.070-4.700*	*Late Neolithic 1*
I	*5.320-5.070*	

We must, however, consider that the dating of Phase III is only based on one ^{14}C date, which means that we must be cautious about its accurate chronological separation. As mentioned above the deposit from this phase is mixed with the one from the earlier Phase II. It is, however, worth paying attention to the fact that the single ^{14}C date from Phase III has produced the most recent date, which suggests that the finds from this phase are not entirely residual.

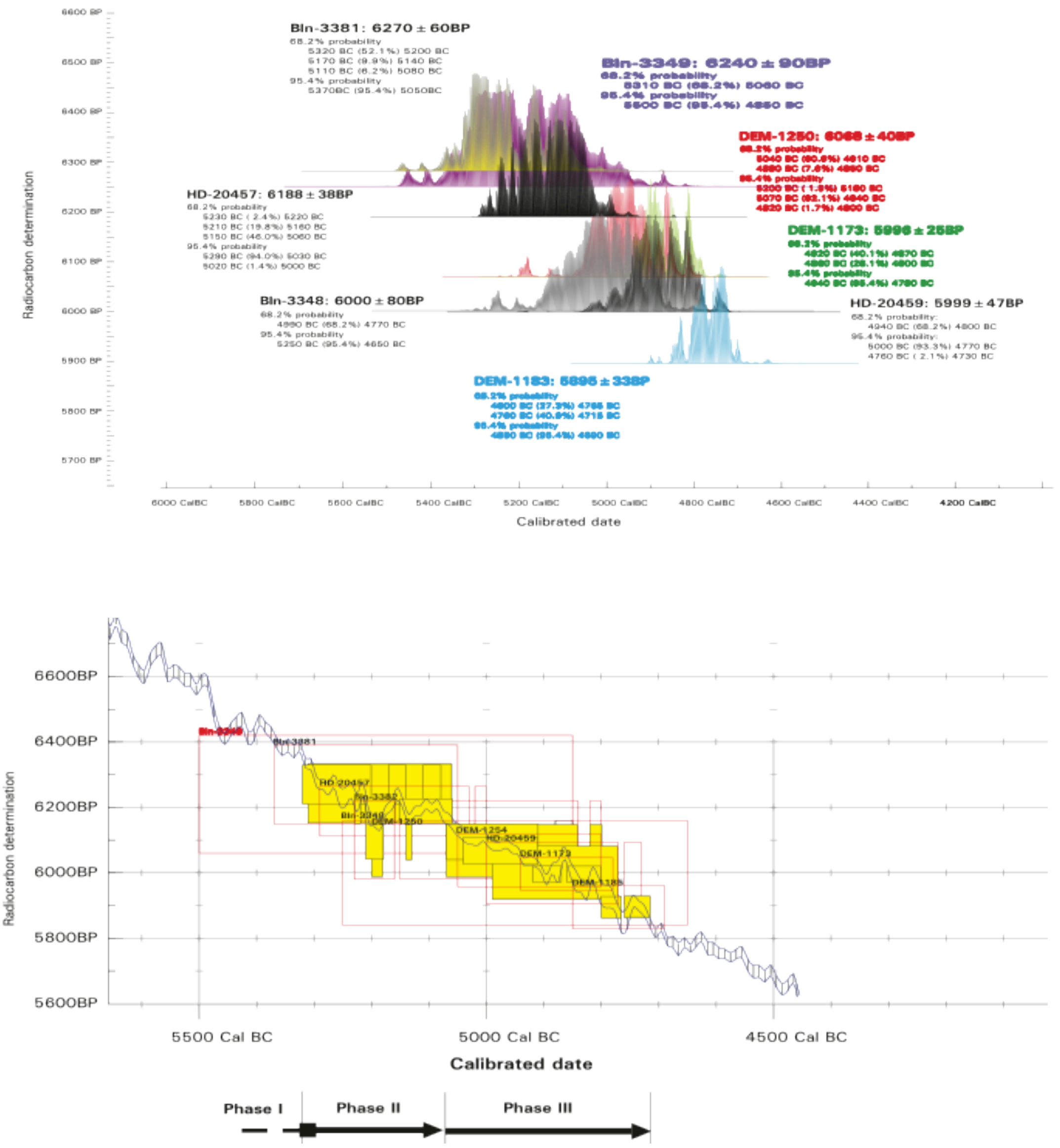


Figure 2.13: Calibrated ^{14}C dates from Promachon – Topolnica. After Vajsov (2007).

2.5 – Material culture evidence

The analysis of the material culture from both sectors indicates that Phases I-II belong to the early stage of the LN (LN1) (Demoule *et al.* 1998), which dates between the second half of the sixth and the beginning of the fifth millennium BC. Vessels painted in the 'Akropotamos type' of decoration (Mylonas 1941; Mylonas and Bakalakis 1938) (***Figure 2.14***) as well as vessels with 'black on top' decorative styles (Vajsov 2007) (***Figure 2.15***) and small clay lamps (Vajsov 2007) (***Figure 2.16***) are typical of Phase I in Promachon – Topolnica. Typical decoration styles from the following phase (Phase II) include pottery painted with wide bands of the 'Strumsko type' of decoration (Koukouli-Chrysanthaki *et al.* 1997) (***Figure 2.17***) and 'Dimitra type' repertoire (Grammenos 1991; Koukouli-Chrysanthaki *et al.* 1998a)

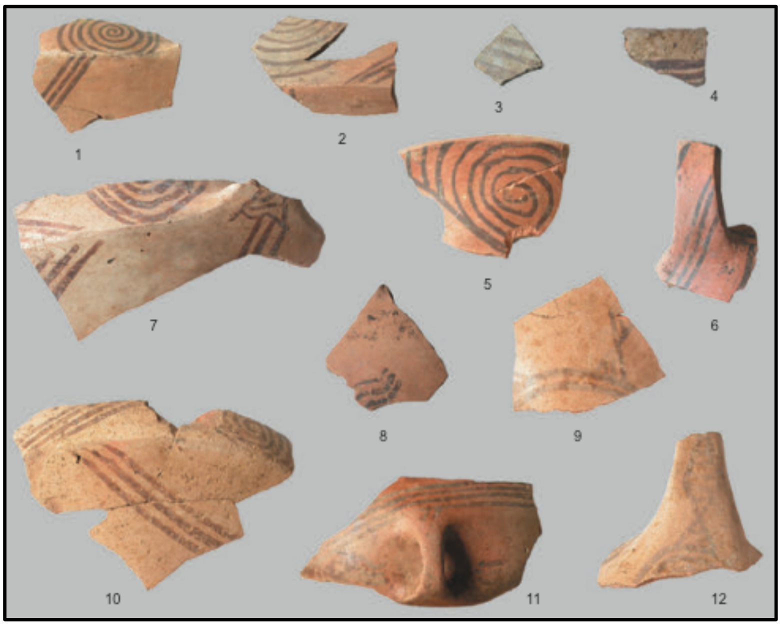


Figure 2.14: Fragments of painted 'brown on cream' (n. 1-4 and n. 7-12) and 'brown on red' (n. 5-6) fine ware with thin lines of the 'Akropotamos type' of decoration. Topolnica sector Phase I (LN1). After Vajsov (2007).

Figure 2.15: Single handed carinated bowl with 'black on top' style of decoration. Promachon sector Phase I (LN1). After Vajsov (2007).

Figure 2.16: Small clay lamp. Topolnica sector Phase I (LN1). After Vajsov (2007).

(***Figure 2.18***). This latter type can be subdivided into an earlier stage of development (typical of Phase IIa) and a later stage, which combines 'Strumsko and Akropotamos' types of decoration (Koukouli-Chrysanthaki *et al.* 2007; Vajsov 2007) (typical of Phase IIb) (***Figure 2.19***).

Figure 2.17: Wide bands of the 'Strumsko type' painted decoration. Promachon sector Phase IIa (LN1). After Koukouli-Chrysanthaki *et al.* (2007).

Figure 2.18: Bichrome painted 'Dimitra type' pottery sherds. Promachon sector Phase IIa (LN1). After Koukouli-Chrysanthaki *et al.* (2007).

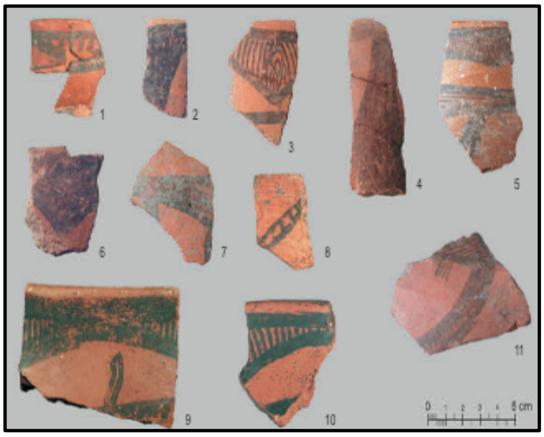


Figure 2.19: Combination of thick lined 'Strumsko type' and thin lined 'Akropotamos type' of decoration. Topolnica sector Phase IIb (LN1). After Vajsov (2007).

Pottery typology and decorative motives link Phases I and II with Makriyalos I (Pappa and Bessios 1998; 1999; Pappa *et al.* 1998), Sitagroi I-II (Keighley 1986; Renfrew *et al.* 1986), Dimitra I-II (Grammenos 1991) Dikili Tash I (Seferiadis 1983; Tsirtsoni 1991; 2000; 2001) and Vassilika I-II (Grammenos 1991) from Greek Macedonia, Paradimi II-III (Bakalakis and Sakellariou 1981) and Makri II from Thrace (Efstratiou *et al.* 1998) Arapi Magoula from Thessaly (Hauptmann and Milojcic 1969) Damjanitsa (Pernicheva 1995) and Balgarčevo (Pernicheva 2002) from the Bulgarian part of the Strymon river valley, and 'Vinča B culture' settlements (Chapman 1981) from Eastern Serbia.

The uppermost levels (Phase III) in the Promachon–Topolnica settlement can be dated to the late stage of the Late Neolithic (LN2) on the basis of pottery typology and decoration (Koukouli-Chrysanthaki *et al.* 1996; 1998a; 1998b; 2007). Typical examples of incised 'Gradesniča type' (Nikolov 1976) (***Figure 2.20***) and thin lined graphite painted (***Figure 2.21***) pottery sherds, link this later stage to Dikili Tash II (Seferiadis 1983; Treuil 1992), Sitagroi IIIA (Evans 1986), Dimitra III and Vassilika III-IV (Grammenos 1991), Makriyalos II (Pappa and Bessios 1998; 1999; Pappa *et al.* 1998), and Thermi B (Grammenos *et al.* 1989) from Greek Macedonia, 'classic' Dimini and Larissa (Demoule 2004; Demoule and Perles 1993; Demoule *et al.* 1998) from Thessaly, Paradimi IV (Bakalakis and Sakellariou 1981) from Thrace, Slatino I-V (Chochadziev 1986) from the Bulgarian part of the Strymon river valley, Gradesniča (Nikolov 1976) from Northwest Bulgaria, 'Mariča-Karanovo' phase (Hiller 1989) from Bulgarian Thrace, and 'Vinča C culture' settlements (Chapman 1981) from Eastern Serbia. The two following tables summarize the phasing of the site on the basis of the structural features and the material culture evidence (***Table 2.4***), and provide information on contemporary to Promachon sites from Greece and the Balkan regions (***Table 2.5***).

Figure 2.20: Sherds with incised 'Gradesniča type' decoration. Topolnica sector Phase III (LN2). After Vajsov (2007).

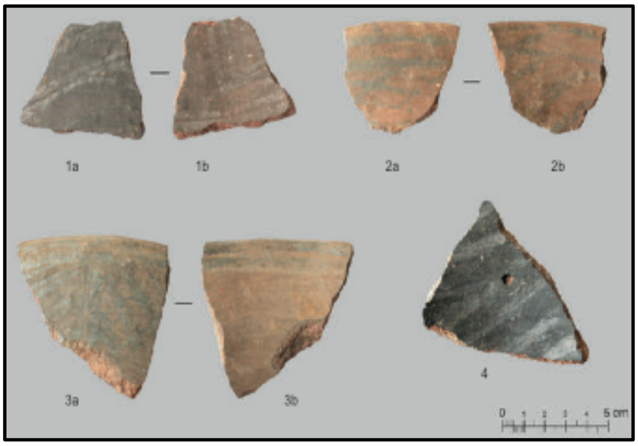


Figure 2.21: Sherds with graphite decoration. Topolnica sector Phase III (LN2). After Vajsov (2007).

Table 2.4: Summary of the phasing on the basis of structural features and material culture evidence, following: Andreou *et al.* 1996; Aslanis 1992; pers. comm.; Demoule 2004; Demoule and Perles 1993; Koukouli-Chrysanthaki *et al.* 2007; pers. comm.; Vajsov 2007.

Layers	***Structural features***	***Habitation phasing***	***Material culture phasing***	***Ceramic typology and repertoire***	***Cal. BC***	***Cultural Sequence***
1	*Non-defined.*	***III***	*III*	*· Gradesniča' type* *· Graphite type*	***4.46 – 4.25***	***Late Neolithic 2***
2	*Two timber-framed* ***aboveground*** *structures.*	***II***	*IIb*	*Combination of 'Strumsko' and 'Akropotamos' types*	***5.07 – 4.7***	***Late Neolithic 1***
3			*IIa*	*· 'Strumsko' type* *· 'Dimitra' type*		
4	***Pit-houses*** *n. 1, n. 2 and n. 3.*	***I***	*I*	*· 'Akropotamos' type* *· 'Black on top' type* *· Clay lamps*	***5.32 – 5.07***	
5						
6						
7	***Structure n. 4.***					
8						
9						
10						
11						

Table 2.5: Promachon in context: Late Neolithic sites from northern Greece and the Balkan regions, following: Andreou *et al.* 1996; Bakalakis and Sakellariou 1981; Chapman 1981; Chochadziev 1986; Demoule 2004; Demoule and Perles 1993; Efstratiou *et al.* 2001; Evans 1986; Grammenos 1991; Greenfield 2005; Hauptmann and Milojcic 1969; Hiller 1989; Keighley 1986; Nikolov 1976; Pappa and Bessios 1995; 1999; Pappa *et al.* 1998; Pernicheva 1995; 2002; Renfrew *et al.* 1986; Seferiadis 1983; Treuil 1992; Tsirtsoni 2000.

Balkan Phasing	***Un-Cal. BP***	***Cal. BC***	***Promachon Topolnica***	***Macedonia***	***Thessaly***	***Strymon river valley***	***Greek and Bulgarian Thrace***	***Eastern Serbia***	***Eastern European Chronology***	***Cal. BC***
Late Neolithic 2	***6.0***	***4.8***	***Phase III (4.46-4.25 Cal. BC)***	*Makriyalos II* *Sitagroi IIIA* *Dikili Tas II* *Vassilika III-IV* *Thermi B*	*'Classic'Dimini*	*Slatino I – V* *Dimitra III* *Kryoneri*	*Paradimi IV* *Karanovo V* *Gradesniča*	*Vinča C*	***Late Neolithic***	***4.5***
Late Neolithic 1	***6.5***	***5.3***	***Phase II (5.07-4.7 Cal. BC)*** ***Phase I (5.32-5.07 Cal. BC)***	*Makriyalos I* *Sitagroi I – II* *Dikili Tas I* *Vassilika I-II*	*Arapi*	*Damjanica* *Balgarcevo* *Dimitra I - II*	*Makri II* *Paradimi I – III* *Karanovo III – IV* *Anzabegovo IV*	*Vinča B*	***Middle Neolithic***	***5.1***

Chapter 3. – Zooarchaeological Background

3.1 – Introduction

The archaeology of classical Greece has been the main focus for research programs and excavations around the country for more than two centuries. The abundance of literary sources and the impressive archaeological discoveries from this period encouraged Greek archaeologists to focus strongly towards architectural and artistic features of the archaeological evidence, while social, economic and environmental aspects were largely neglected (Trantalidou 2001). Although there were a few cases of Greek archaeologists in the late 1920's and the early 1930's (Marinatos, Evans, Hatzidakis and Heurtley), who considered it necessary to have animal bones studied from their excavations (Trantalidou 2001), in most cases, excavation directors in Greece did not consider necessary to collect faunal material (Greenfield 1991; Reese 1994; Trantalidou 2001).

In the 1950's and in the 1960's, the proliferation of excavations at prehistoric sites - especially from the Neolithic period in Thessaly - prompted the sporadic collection of faunal materials (Trantalidou 2001). In the two following decades, the study of animal bone assemblages from excavations in Greece began with the occasional work of zooarchaeologists of non-Greek origin, such as Boessneck and von den Driesch (Germany), Bökönyi (Hungary), Payne and Higgs (UK) and Gejvall and Larje (Sweden), who are today considered as the pioneers of zooarchaeology in Greece. Naturally, whatever progress was made in the study of faunal materials from Greek sites was affected by the methods and the theoretical orientation of these researchers' country of origin.

Although the study of faunal remains from Greek sites increased rapidly during the 1980's and the early 1990's, the number of zooarchaeologists of Greek origin studying faunal assemblages from Greek sites was rather scarce. At the same time, two comprehensive surveys of zooarchaeological work in Greece were published. The first was compiled in the mid-1980's by Payne (1985a); in his paper, he included 100 titles, with a summary description of the basic data provided in each study (site, region, time-period, *NISP* and *MNI*). The second survey was compiled in the mid-1990's by Reese (1994); in his survey, he presented the zooarchaeological work conducted on Greek sites from 1985 to 1993, pointing out to the general scarcity of faunal reports dating to later than the Bronze Age, an issue which by and large still affects Greek zooarchaeology. In addition, Reese included a very useful table, in which he separated faunal materials deriving from settlements, sanctuaries and cemeteries from mainland Greece as well as the Greek islands.

In the mid-1990's and the early 00's, the potential of zooarchaeology was better understood by Greek archaeologists. By that time, scholars of Greek origins (who, due to the absence of a Greek zooarchaeology curriculum had been trained in European Universities) had already begun studying faunal assemblages from Greek sites (*e.g.* Grammenos 1997; Trantalidou 2001). The monograph *Zooarchaeology in Greece: recent advances*, which was published in 2006, contained a rich collection of articles; this monograph represents the first full survey entirely dedicated to Greek zooarchaeology (Kotjabopoulou *et al.* 2003) and includes many contributions by Greek zooarchaeologists.

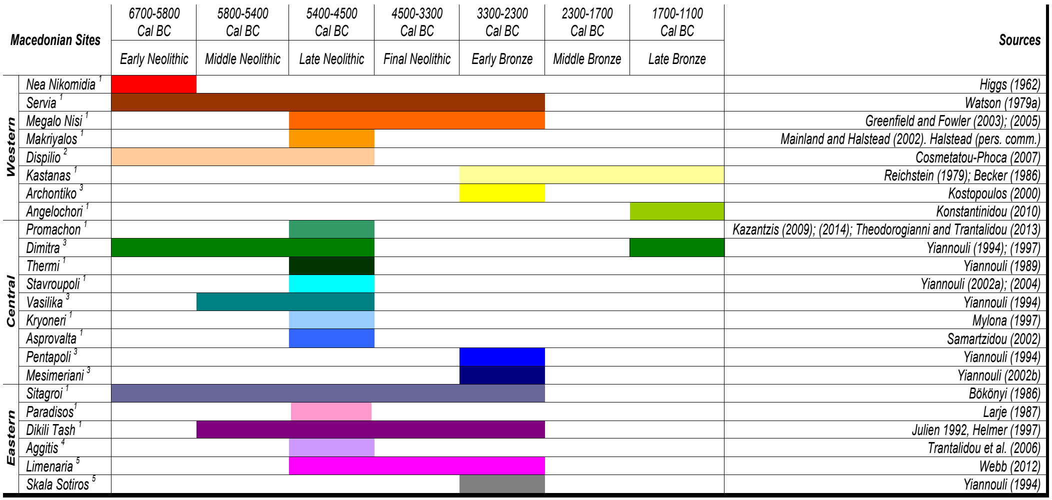
In recent years, papers on Greek faunal assemblages are regularly presented and published as parts of Annual Conference Proceedings such as *AEMTH* (*Archaeological Research in Macedonia and Thrace; ΑΕΜΘ*). However, a major drawback for zooarchaeology in Greece today is represented by the fact that there are no scientific journals dealing specifically with zooarchaeology - as there are for the more general field of archaeology (*i.e. Archaiologiki Efimeris*, *Praktika tis Archaiologikis Etairias*, *Archaiologikon Deltion*). However, and despite the availability of faunal remains from several recently excavated sites, there are still cases in which faunal assemblages are left unstudied, stored in the basements of various archaeological services and museums; the recent financial crisis in Greece has largely affected the entire discipline of archaeology and, with it, zooarchaeology.

There is however, another issue, which should also be considered. Even when faunal assemblages from Greek sites are studied and published, they tend to suffer from insufficient integration with other lines of archaeological evidence. There are cases however, in which the integration between archaeology and zooarchaeology has succeeded; this has given Greek archaeologists the opportunity to recognise the necessity of studying faunal studies as an important aid to the understanding of past human communities. It has also provided the opportunity to new researchers to move on from the classical tradition and explore new avenues of investigation. In addition, it has stimulated the understanding of patterns of past human behaviour, which were previously explained solely on the basis of ceramic typology and architecture.

3.2 – Previous research in prehistoric Macedonia

The bibliographic details that are provided in ***Table 3.1*** (***Figure 3.1***) reveal an uneven spread of faunal publications from prehistoric sites in Greek Macedonia as concerns space, time and the nationality of the zooarchaeologists involved.

Table 3.1: Faunal publications from prehistoric sites in Macedonia.



	Macedonian Sites	6700-5800 Cal BC	5800-5400 Cal BC	5400-4500 Cal BC	4500-3300 Cal BC	3300-2300 Cal BC	2300-1700 Cal BC	1700-1100 Cal BC	Sources
		Early Neolithic	Middle Neolithic	Late Neolithic	Final Neolithic	Early Bronze	Middle Bronze	Late Bronze	
Western	Nea Nikomidia ^{1}	■							Higgs (1962)
	Servia ^{1}	■	■	■	■	■			Watson (1979a)
	Megalo Nisi ^{1}			■	■	■			Greenfield and Fowler (2003); (2005)
	Makriyalos ^{1}			■					Mainland and Halstead (2002). Halstead (pers. comm.)
	Dispilio ^{2}	■	■	■					Cosmetatou-Phoca (2007)
	Kastanas ^{1}					■	■	■	Reichstein (1979); Becker (1986)
	Archontiko ^{3}					■			Kostopoulos (2000)
	Angelochori ^{1}							■	Konstantinidou (2010)
Central	Promachon ^{1}			■					Kazantzis (2009); (2014); Theodorogianni and Trantalidou (2013)
	Dimitra ^{3}	■	■	■				■	Yiannouli (1994); (1997)
	Thermi ^{1}			■					Yiannouli (1989)
	Stavroupoli ^{1}			■					Yiannouli (2002a); (2004)
	Vasilika ^{3}		■	■					Yiannouli (1994)
	Kryoneri ^{1}			■					Mylona (1997)
	Asprovalta ^{1}			■					Samartzidou (2002)
	Pentapoli ^{3}					■			Yiannouli (1994)
	Mesimeriani ^{3}					■			Yiannouli (2002b)
Eastern	Sitagroi ^{1}	■	■	■	■	■			Bökönyi (1986)
	Paradisos ^{1}			■					Larje (1987)
	Dikili Tash ^{1}		■	■	■	■			Julien 1992, Helmer (1997)
	Aggitis ^{4}			■					Trantalidou et al. (2006)
	Limenaria ^{5}			■	■	■			Webb (2012)
	Skala Sotiros ^{5}					■			Yiannouli (1994)

Key: 1 = Flat extended settlement; 2 = Lake settlement; 3 = Tell; 4 = Cave; 5 = Island.
Absolute dates for each cultural sequence follow Andreou et al. (1996). No fish and mollusk publications considered in this table.

The first published faunal report was undertaken by a non-Greek researcher and it dates back to as early as the early 1960's [*i.e.* Higgs' (1962) report for Nea Nikomidia]. In the following decades, zooarchaeologists of non-Greek origins continued to contribute to the study and publication of faunal remains from Macedonian prehistoric sites [*i.e.* Watson (1979a) for Neolithic Servia; Reichstein (1979) and Becker (1986) for Bronze Age Kastanas, *etc.*] (Cantuel *et al.* 2008; Reese 1994; Trantalidou 2001). Most of these reports were routinely relegated in appendices of archaeological publications (Trantalidou 2001); however, there are some cases of faunal studies being published together with other archaeological materials, while in the case of Kastanas, the faunal report was published in a separate volume (Becker 1986).

As previously noted, only from the mid-1990's and the early 00's Greek animal bone specialists started contributing regularly to zooarchaeological research (Grammenos 1997). However, the long tradition of non-Greeks doing faunal research in Macedonia continued to flourish, partly sponsored by the many archaeological schools and institutes established in Athens (Wiener Lab of the *ASCSA*; Fitch Lab of the *BSA etc.*). Yiannouli is considered one of the pioneers of Greek zooarchaeology in the area of Macedonia, since she started working on faunal assemblages from Neolithic (Thermi, Vasilika, Dimitra and Stavroupoli) and Bronze Age (Skala Sotiros, Pentapoli and Mesimeriani) sites, as early as the late 1980's (Yiannouli 1989; 1994; 1997; 2002a; 2002b; 2004). Trantalidou is another Greek zooarchaeologist who has provided an important contribution through her work on the faunal assemblage from the Late Neolithic cave on the East bank of the river Aggitis (Trantalidou *et al.* 2006), but also faunal assemblages from Southern Greece.

The coverage of faunal research in prehistoric Macedonia is inevitably linked with the intensity of archaeological research in the area. Most faunal analyses have been conducted on Late Neolithic and Early Bronze Age remains from Western and especially Central Macedonia. On the contrary, sites dating to the Paleolithic and the Iron Age as well as sites from Eastern Macedonia (and also Thrace), have received less archaeological attention (Reese 1994; Trantalidou 2001).

With regard to the Neolithic, the scarcity of faunal assemblages from Early and Middle Neolithic sites in all three regions can plausibly be attributed to the absence of these early levels due to 'gaps' in archaeological research (Andreou *et al.* 1996; Koukouli-Chrysanthaki 2006). Excavation of the earliest Neolithic phases are confined to sites such as Sitagroi, Nea Nikomidia, Servia and Dispilio while at Dikili Tash the excavation is still in progress, which means that early Neolithic horizons may still emerge.

The integration of such a diverse body of literature presents a number of challenges that should be articulated before making any comparisons. Taphonomy has important repercussions in the formation of the faunal assemblages, and naturally, it is a significant factor that we have to keep in mind; for instance, not all faunal reports from Late Neolithic sites from Macedonia contain information on patterns of butchery, and the effects of gnawing and burning on the faunal assemblages. The most important problem, however, is represented by the fact that the extent of recovery bias is not assessed in all cases. In addition, differences in the recording methodology (*i.e.* identifications, recording protocols) and the analytical techniques (methods for the assessment of the age-at-death, biometry, sexing) used by the faunal researchers in a number of sites, are additional issues to be considered when conducting inter-site analyses (Albarella 1995).

These issues will be further assessed for each site respectively, as we proceed with our comparisons, later in the current thesis. In addition, they will be taken into consideration when attempting to interpret the nature of human-animal relationships at a regional scale during the Late Neolithic.

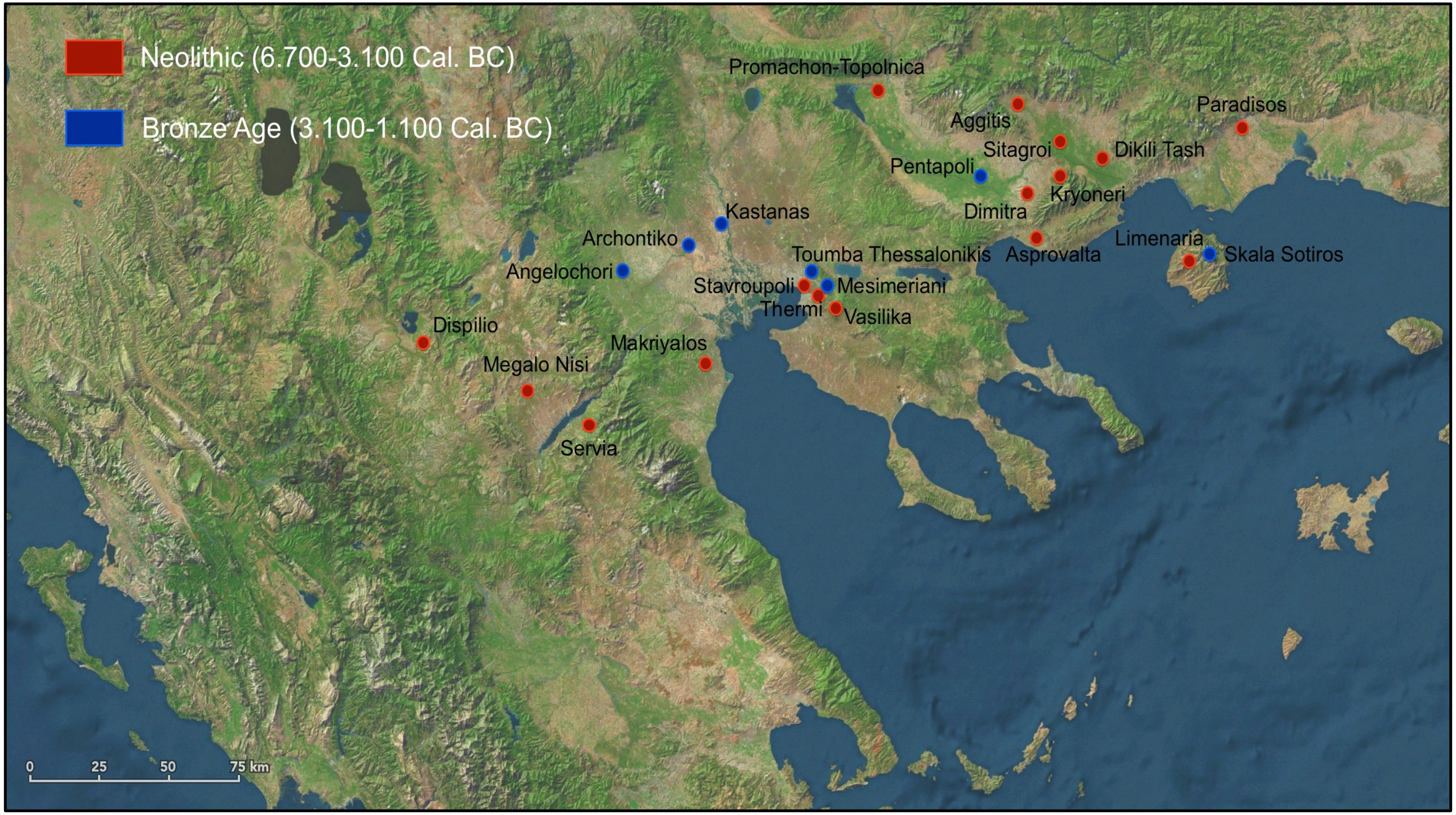


Figure 3.1: Map of Neolithic and Bronze Age sites in Macedonia, where faunal analyses were conducted and published.

3.3 – Pilot study and current research

The animal bone material from the Greek sector of Promachon derives from contexts of sufficiently accurate dating and stratigraphic integrity to warrant detailed study. The excavation yielded a volume of animal bone equivalent to 296 boxes with dimensions of 45 x 28 x 18 cm each. Of these, 150 boxes derive from the five successive layers of structure n. 4 (Layers 7-11; Phase I), while 146 derive from the rest of the layers (Layers 1-6; Phases I-II-III). The faunal material from the excavation was divided and stored separately: material deriving from layers 7-11 was stored in the basement of the Amphipolis Museum, in the town of Amphipolis, Serres, while the rest of the material (Layers 1-6) was stored at the Loutra Sanatorium in the village of Sidirokastro, Serres, Greece.

The current research is an extension of a previous study conducted as part of the dissertation associated with the MSc in Environmental Archaeology and Palaeoeconomy undertaken in the academic year 2008-09 at the University of Sheffield, UK (Kazantzis 2009; unpublished Masters dissertation). This previous study only dealt with a sample of the assemblage and can therefore be regarded as a pilot study to the current project: out of a total of 146 boxes of animal bone remains from the Greek sector of Promachon, the content of 16 boxes deriving from the floor levels of two structures belonging to the first and the second phase of the settlement's occupation [pit-house n. 2 (Phase I) and aboveground structure n. 1 (Phase II)] were washed and studied, and, in total, 1450 animal bone remains were recorded. Due to the relatively small size of the assemblage once it had been divided into the two phases of occupation (Phases I and II), the data (species, body parts and types of measurements) were merged and treated as a single sample (*cf.* Albarella 2002). Consequently, no comparison was attempted between the two phases and the two structures of the settlement. The study mainly focused on a general assessment of the subsistence economy and animal use at both the site and regional levels.

Therefore, the results from the Masters study derived from a small sample, with the inevitable limitations of the case. In order to tackle questions for which the initial sample was inadequate (Kazantzis 2009), the current PhD project involves the study of a much larger assemblage. This consists of faunal material from six layers (Layers 1, 2, 3, 4, 5 and 6; Phases I-II-III) belonging to trenches A, B, Γ, Δ, E, ΣT, I and IA. Unfortunately, the material from trench IB is not included in the current research, since at the time of the recording, the faunal material from this trench could not be located at the Loutra Sanatorium in the village of Sidirokastro, Serres. On the other hand, the animal bones from structure n. 4 (trenches IΣT and IZ) and thus, Layers 7, 8, 9, 10 and 11 (Phase I), are not considered in the current research, since they were studied by zooarchaeologist Ourania Theodorogianni as part of her PhD research at the University of Paris X.

Out of 130 boxes of animal bone remains used for this research, the content of 19 boxes derived from deposits placed between the topsoil and the first layer (Layer 1: Phase III). These were ultimately excluded from the analysis, since they could not be reliably dated. In overall therefore, the content of 111 boxes of animal bone remains were used for any analysis.

The bulk of the faunal material for the current PhD research was unwashed, which made the cleaning of the bones a paramount necessity. Washing took place from March 2010 to September 2011 in the lab of the 'Bezesteni' Archaeological Museum of Serres, Greece. In September 2011, the washed faunal material was transferred from the 'Bezesteni' Archaeological Museum to the basements of the 28th Ephoria of Prehistoric and Classical Antiquities (28th Ε.Π.Κ.Α.) of Serres, where it was recorded. After the recording, the content of 111 boxes of animal bone remains was transferred back to the Loutra Sanatorium in the village of Sidirokastro, Serres, in the beginning of October 2012.

3.4 – Statement of aims

The main purpose of this thesis is to investigate human *versus* animal relationships in the Late Neolithic Strymon river valley, using the animal bone assemblage from Promachon as the main source of evidence. First, the general aims are presented. These are followed by a summary of the more specific aims be interpreted in the context of the broader questions highlighted before.

3.4.1 – General aims

- To contribute to the understanding of the nature of the site in its different phases of occupation, as well as the use of different areas and contexts.

Comparison of different phases, contexts types and areas will be undertaken, as this will provide valuable information for the interpretation of the site. An element of particular comparative interest is represented by the interpretation of structure n. 4 as having been used for ‘public’ functions (Koukouli-Chrysanthaki *et al.* 2007). As previously noted (see also ***3.3 – Pilot study and current research***), the faunal material from structure n. 4 (Layers 7-11; Phase I) has been studied by zooarchaeologist Ourania Theodorogianni as part of her PhD research in the University of Paris X; the results from this study were published in a form of a preliminary report early in 2013 (Theodorogianni and Trantalidou 2013). It is therefore anticipated that the faunal evidence from this particular structure would make for an interesting comparison with the more likely household origin of some of the other deposits (Layers 4-6; Phase I).

In addition, the animal bone material from the Bulgarian sector of Topolnica has recently been published (Iliev and Spassov 2007). Unfortunately, the publication is in Bulgarian, which limits the opportunity for the results to reach a broad readership. In this thesis, however, the results from the Bulgarian sector will be considered and, whenever possible, integrated with the writer’s work on the Greek sector. This will provide valuable information for the interpretation of the site as a whole, since the two sectors (Promachon and Topolnica) belong to the same settlement, merely divided by modern political borders.

- To document regional and chronological trends in the importance of domesticated and wild species at the site and beyond, incorporating the settlement in the broader complex of contemporary agro-pastoral communities in the Strymon basin and adjacent areas.

This case study will present new information on subsistence strategies in an underrepresented area of northern Greece during a time-period (fifth and fourth millennium BC), that is considered one of the most dynamic eras of the prehistory of southeastern Europe. The comparison between Promachon and other contemporary Macedonian, Thracian and Thessalian assemblages has the potential of shedding light on prehistoric life at both local (Strymon river valley) and regional (Macedonia) levels. In addition, Promachon will be compared to a number of Balkan sites (Bulgarian and Serbian) in order to clarify temporal and regional trends in animal management and to create an integrated picture of human-animal relationships that encompasses both northern Greece and the Balkan regions.

- To understand the nature, scale and importance of pastoral activities at prehistoric Promachon.

The study will focus on husbandry strategies at the Greek sector of Promachon, and will examine the role of the domestic livestock and their contribution to the economy of the site. The integration of the faunal data with other lines of archaeological evidence will contribute to our understanding of the inhabitants' economic and social activities assessing also the significance and the relative contribution of livestock to subsistence. Ultimately the results from this local study will contribute to our understanding of prehistoric life as a whole and will also highlight the potential of zooarchaeology in the investigation of past human communities.

3.4.2 – Specific research aims

- To explore the effect of taphonomic modifications (fragmentation, burning, gnawing and recovery bias) in the formation of the faunal assemblage.
- To explore the frequencies (in terms of *NISP* and *MNI*) of the domesticated *versus* wild species, as well as the relative frequencies of three main domesticated species.
- To explore patterns of butchery on the bones of the three main domesticated species.
- To explore the body part distribution of domesticated and wild species.
- To reconstruct the age-at-death profiles of the three main domesticated species.
- To explore the size and shape of the three main domesticated species.
- To compare the relative frequencies of the domesticated and wild species, as well as of three main domesticated species, between structure n. 4 and the rest of the deposits of Phase I.
- To compare the age-at-death profiles of the three main domesticated species between structure n. 4 and the rest of the deposits of Phase I.
- To compare the frequencies of the domesticated *versus* wild species as well as the frequencies of three main domesticated species between Promachon sector and Topolnica sector.
- To compare the relative frequencies of the domesticated and wild species as well as the three main domesticated species between Promachon and other contemporary Macedonian, Thracian, Thessalian and Balkan sites.

- To compare the age-at-death profiles of the three main domesticated species between Promachon and other contemporary Macedonian sites.
- To compare the size and shape of the three main domesticated species between Promachon and other contemporary Macedonian and Thessalian sites.

The methodology developed to address all of these aims is set out in the next chapter (***Chapter 4 – Methods***).

Chapter 4. – Methods

4.1 – Introduction

Animal bone studies have developed in many ways during the past decade, while methodological approaches and analytical techniques have been the subject of numerous debates (Grayson 1984; Lyman 1994). Variations in faunal samples and the realization that factors such as taphonomy and the level of preservation may influence the very nature of an animal bone assemblage, has led to a reappraisal of methodological techniques (Reitz and Wing 2008). It is the task of the zooarchaeologist to evaluate these factors, and, according to the research questions, to create a methodological protocol suitable to assess bias and enhance interpretation.

The methods used in this project were chosen due to their ability of commenting directly on animal exploitation in Promachon; species frequency, body part distribution, sex ratios, age-at-death data and animal size and shape are focal points in assessing the economic importance and the cultural significance of both domestic and wild taxa on-site. In conjunction with these academic concerns, practical issues also influenced the selection of method; to be more specific, particular attention was given to the timescale of the project and also to the accuracy of the collected data.

4.2 – Identification

Promachon's faunal material is in an overall very good state of preservation (see also ***5.2 – Agents affecting the faunal assemblage***), thus enhancing our chances of correct anatomical and taxonomical identification. A small modern reference collection created by the author and consisting of whole skeletons of sheep, goat, dog, cattle, pig and red deer, as well as a few roe deer elements, was used for identification. This was complemented by the use of a number of identification atlases (Gromova 1950; 1960; Hillson 1986; 1992; Pales and Lambert 1971; Schmid 1972). A small number of specimens that could not be identified *in situ* were eventually attributed to taxa with the help of the reference collection from the University of Sheffield's zooarchaeology lab.

Identification challenges in temperate Europe Neolithic faunal material include distinction between similarly sized cervids and bovids, as well as wild and domestic forms of pigs, cattle and canids (Orton 2008). With regard to the latter, no wolves were positively identified at the time of the recording; however, metrical analysis has indicated the presence of the wild progenitor of dog in Promachon sector (see also ***5.10.4 – Canis familiaris size***). On the other hand, discrimination between domestic dog (*Canis familiaris*) and red fox (*Vulpes vulpes*) presented a certain level of difficulty, since both species are present at the settlement with roughly the same size. In the Bulgarian site of Topolnica, domestic dog is represented by a small-sized breed (Iliev and Spassov 2007), which confuses the pattern even further. Consequently, some canid elements could not be attributed with absolute certainty to either *Canis* or *Vulpes* (these were eventually identified as *Canis/Vulpes*).

Two wild ancestors of domesticated species were expected to be present in Promachon sector [*Bos primigenius* (aurochs) and *Sus scrofa* (wild boar)]. Theodorogianni and Trantalidou (2013) and Iliev and Spassov (2007) argue for the presence of the two species in structure n. 4 (Promachon sector) and in the Bulgarian sector of Topolnica respectively. In addition, the two species are reported in a number of contemporary sites in Greek Macedonia [*e.g.* Sitagroi (Bökönyi 1986) and Stavroupoli (Yiannouli 2002a; 2004)]. Even though metrical criteria can be useful in discriminating between wild and domesticated populations, sexual dimorphism as well as residual individual variation may confuse matters (Payne and Bull 1988). This approach was, therefore, used cautiously with very few specimens recorded as either wild or domestic at the time of recording - these were those whose size was obviously either very large or very small.

The sheep (*Ovis aries*) and goat (*Capra hircus*) distinction generally follows Boessneck (1969), Kratochvíl (1969) and Prummel and Frisch (1986) and it was attempted on the following postcranial elements: distal Humerus, proximal Radius, distal Metacarpal, distal Metatarsal, distal Tibia, Calcaneum and Astragalus. As for teeth, distinction between sheep and goat follows Payne (1985b) for deciduous teeth, and Halstead *et al.* (2002) for permanent teeth. However, the vast majority of *Caprinae* remains could not be identified to such a fine taxonomical level and were consequently identified as *Ovis*/*Capra* (sheep/goat).

Separation between cervids and bovids - in this case *Cervus* versus *Bos* and *Capreolus* versus *Ovis*/*Capra* - can be problematic on the basis of certain elements. The main references employed were Helmer and Rocheteau (1994) for the smaller species and Prummel (1988) for the larger. While this allowed the bulk of relevant specimens to be identified to taxon, a few were assigned to the categories *Ovis*/*Capra*/*Capreolus* (*OCC*) and *Cervus*/*Bos* (*CB*). The distinction of different cervids (red deer, fallow deer and roe deer) was mainly based on the criteria suggested by Lister (1996) and von Bosold (1968).

4.3 – Recording protocol

The recording system adopted in this study falls broadly within the genealogy traced back to Watson's (1979b) 'diagnostic zones', but generally follows Davis (1992) with minor changes. The collected data were recorded using an MS Excel database for Macintosh. Only a number of bone zones of bones whose identity could be established with reasonable confidence was recorded (Albarella and Davis 1994; Davis 1992), using the recording criteria in Davis (1992) for mammals; the aim was to produce a maximum amount of useful information, while avoiding recording low grade and redundant information. ***Table 4.1*** presents the recording protocol used in the study of the faunal assemblage from Promachon.

Table 4.1: The recording protocol used.

Anatomical elements	***Articulation Criteria***		***Other Criteria***	
	Proximal	***Distal***		
Antlers / Horn cores			*Complete transverse section*	
Teeth			*Occlusal surface*	
Cranium			*Zygomaticus*	
Atlas			>½	
Axis			>½	
Scapula			*Glenoid cavity*	*Articular end*
Humerus	✓	✓		
Radius	✓	✓		
Ulna	✓			
Carpal (2) + 3			>½	
Metacarpal		✓		
Pelvis			*Acetabulum*	*Ischial part*
Femur	✓	✓		
Tibia	✓	✓		
Astragalus			*Lateral half*	
Calcaneum			*Sustentaculum*	
Scafocuboid			>½	
Metatarsal		✓		
Phalanges	✓			

The recording system is based on three main database structures:

- Bones (B).
- Teeth (T).
- Vertebrae & Ribs (Verribs).

With regard to the 'Bones section', as well as species, element and side, fields were created for state of preservation, gnawing, burning, fusion status and pathology, with additional fields for measurements. The 'Teeth section' generally follows the same pattern as the 'Bones section'. However, additional fields were created to state whether a tooth was loose or within a jaw; the mandibular or maxillary status for each tooth was also recorded. No attempts were made, however, to separate first and second molars when isolated; these were recorded either as $M^{1/2}$ (maxillary) or as $M_{1/2}$ (mandibular). Presence was stated for vertebrae and ribs also, as these were recorded in a separate table into size groups (large, medium and small).

Measurements were taken on teeth and on fused, fusing and unfused specimens and generally follow von den Driesch (1976), with some additional measurements by Davis (1992), Albarella and Payne (2005), Albarella *et al.* (2005) and Payne and Bull (1988). Neonatal and juvenile specimens were measured following Prummel (1987) and flagged as such in an associated field.

In this thesis, raw measurements are plotted on individual dimensions in order to find if size differences between domestic species occur. However, whenever the sample sizes are too small for any metrical comparisons to be conducted, we use two different methods: firstly, the metrical data from domestic species deriving from a number of sites contemporary to Promachon are superimposed in order to increase the sample size. Secondly, we use the log ratio technique.

Log ratios are calculated to allow different measurements to be combined, maximizing the information potential of the data. The log ratio technique, first introduced in zooarchaeology by Simpson *et al.* (1960), is probably the most commonly used of the scaling techniques (Albarella 2002). The data from different measurements may be combined by transforming them into log-ratio scores relative to a standard animal; for each measurement on an archaeological specimen the natural logarithm is taken, and that of the equivalent measurement on the standard animal is subtracted to produce a measure of size difference between the archaeological specimen and the standard, allowing for comparability between elements (Orton 2008). For instance, if the distance between the mean of each measurement and the 'standard' tends to be constant, we can assume that the animals of the archaeological population under analysis are similar in size to the standard (Albarella 2002; Payne and Bull 1988).

The Cabeço da Arruda aurochs (Portugal; Wright 2013) is used as a standard for *Bos* in Promachon, along with specimens of Shetland ewes (UK; Davis 1996) for *Ovis aries*, and specimens of wild boar from Kizilcahaman (Turkey; Payne and Bull 1988) for *Sus*.

The two following tables show which measurements were taken on various postcranial (***Table 4.2***) and teeth (***Table 4.3***) elements:

Table 4.2: Postcranial measurements.

Postcranial elements	***Measurements taken***				
	Bovinae	***Caprinae***	***Suidae***	***Cervidae***	***Canidae***
Horn cores	*L W_{min} W_{max}*	*L W_{min} W_{max}*	-	-	-
Atlas	*H*	*H*	*BFcr*	*H*	*H*
Scapula	*SLC*	*SLC*	*SLC*	*SLC*	*SLC*
Humerus	*GLC BT HTC SD*	*GLC BT HTC SD*	*GLC Bd HTC SD*	*GLC, BT, HTC, SD*	*GLC Bd HTC SD*
Radius	*GL SD*	*GL SD*	*GL SD*	*GL SD*	*GL SD*
Metacarpal	*GL SD BatF Bd a b 3 6*	*GL SD Bd a b 1 2 3 4 5 6*	*GL*	*GL SD Bd 3*	*GL*
Pelvis	*LAR*	*LAR*	*LAR*	*LAR*	*LAR*
Femur	*GL SD DC*	*GL SD DC*	*GL SD DC*	*GL SD DC*	*GL SD DC*
Tibia	*GL Bd Dd SD*	*GL Bd Dd SD*	*GL Bd Dd SD*	*GL Bd Dd SD*	*GL Bd Dd SD*
Astragalus	*GLl GLm Bd Dl*	*GLl GLm Bd Dl*	*GLl GLm*	*GLl GLm Bd Dl*	*GL*
Calcaneum	*GL GD*	*GL GD*	*GL GD*	*GL GD*	*GL GD*
Metatarsal	*GL SD BatF Bd a b 3 6*	*GL SD Bd a b 1 2 3 4 5 6*	*GL*	*GL SD Bd a b 1 2 3 4 5 6*	*GL*
Phalanx 1 and 2	*GL Bd*	*GL Bd*	*GL Bd*	*GL Bd*	*GL Bd*

Measurements	***Description***	***Sources***
W_{min}	*Minimum basal diameter of the horn core*	*Driesch, von den (1976)*
W_{max}	*Maximum basal diameter of the horn core*	*Driesch, von den (1976)*
H	*Height*	*Albarella and Payne (2005)*
BFcr	*Width of cranial articular surface*	*Driesch, von den (1976)*
SLC	*Width of collum*	*Driesch, von den (1976)*
GLC	*Greatest length from caput*	*Driesch, von den (1976)*
BT	*Width of trochlea*	*Payne and Bull (1988)*
HTC	*Minimum diameter of trochlea*	*Payne and Bull (1988)*
SD	*Smallest breadth of diaphysis*	*Driesch, von den (1976)*
GL	*Greatest length*	*Driesch, von den (1976)*
BatF	*Greatest width of distal end*	*Davis (1992)*
Bd	*Width of distal end*	*Driesch, von den (1976)*
a	*Width of left distal condyle*	*Davis (1992)*
b	*Width of right distal condyle*	*Davis (1992)*
1	*Depth of left distal condyle*	*Davis (1992)*
2	*Diameter of the verticilus of the medial condyle*	*Davis (1992)*
3	*Diameter of the internal trochlea of the medial condyle*	*Davis (1992)*
4	*Depth of right distal condyle*	*Davis (1992)*
5	*Diameter of the verticilus of the lateral condyle*	*Davis (1992)*
6	*Diameter of the internal trochlea of the lateral condyle*	*Davis (1992)*
LA	*Length of acetabulum including the lip*	*Driesch, von den (1976)*
LAR (pigs only)	*Diameter of acetabulum*	*Payne and Bull (1988)*
DC	*Depth of the caput femoris*	*Payne and Bull (1988)*
Dd	*Depth of the distal end*	*Driesch, von den (1976)*
GLl	*Greatest length of the lateral half*	*Driesch, von den (1976)*
GLm	*Greatest length of the medial half*	*Driesch, von den (1976)*
Dl	*Depth of lateral side*	*Driesch, von den (1976)*
GD	*Greatest depth of the calcaneum excluding the sustentanculum*	*Albarella and Payne (2005)*

Table 4.3: Tooth measurements.

Teeth		***Measurements taken***				
		Bovinae	***Caprinae***	***Suidae***	***Cervidae***	***Canidae***
Maxillary	***dP***^{4}	W				
	M^{1}	W		L WA WP		
	M^{2}	W		L WA WP		
	M$^{1/2}$	W		L WA WP		
	M^{3}	W		L WA WC		
Mandibular	***dP***$_{4}$	W	W	L WP	W	
	P$_{4}$			L W		L W
	M$_{1}$	W	W	L WA WP	W	L W
	M$_{2}$	W	W	L WA WP	W	
	M$_{1/2}$	W	W	L WA WP	W	
	M$_{3}$	L W	L W	L WA	L W	
	P$_{1}$ ***– M***$_{3}$					L
	P$_{2}$ ***– M***$_{3}$					L
	P$_{1}$ ***– P***$_{4}$					L
	P$_{2}$***– P***$_{4}$					L
	M$_{1}$ ***– M***$_{3}$					L

Measurements	***Description***	***Sources***
L	*Crown length*	*Driesch, von den (1976), Payne and Bull (1988)*
W	*Crown width*	*Driesch, von den (1976)*
WA	*Width of anterior cusp*	*Payne and Bull (1988)*
WC	*Width of central cusp*	*Albarella et al. (2005)*
WP	*Width of posterior cusp*	*Payne and Bull (1988), Albarella et al. (2005)*

4.4 – Quantification

Methods of quantification have all been subjected to vigorous debates since the beginnings of the discipline (*e.g.* Grayson 1984; Lyman 1996). Regardless of the benefits and the drawbacks that each system presents, a consensus has been reached by a vast number of zooarchaeologists in using fragment count, or simply *NISP* (Number of Identified Specimens), as the basic measure of taxonomic abundance.

NISP suffers from a great deal of biases; it ignores some aspects that are related to animal anatomical representation (Ringrose 1993), while it is susceptible to differential bone fragmentation (Klein and Cruz-Uribe 1984; see also ***5.2.3 – Fragmentation***). The system of ‘Diagnostic Zones’ proposed by Watson (1979b) and used here - with substantial modifications - partly circumvents *inter-taxon* anatomical differences by counting only certain key parts of the skeleton, and potentially reduces fragmentation bias since zones are counted only if more than half is present (>½). Consequently, this prevents any single zone from being counted twice. *NISP* greatly suffers from recovery biases as well (Payne 1972a; 1972b; 1975); much of the observed variation in anatomical representation between large animals, such as cattle, and small animals, such as sheep/goat and pig, can plausibly be attributed to retrieval biases. Indeed, *NISP* in Promachon might be biased against small animals, young age groups and small body parts since the bulk of the material was hand collected during excavation (see also ***5.2.2 – Retrieval biases***).

For this study, all recorded elements are used for quantitative analysis except for the proximal ends of the metapodials (metacarpals and metatarsals), the horn cores and the antlers, as well as the elements or parts of elements, which are not included in the list of the recording protocol, but were worth recording (*e.g.* anomalous size bones, bones with interesting butchery marks and bones with pathological conditions and/or abnormalities). All these ‘non-countable’ elements were recorded as ‘OTH’ (others).

Similarly, the proximal ends of the four main long bones were recorded as OTHU (head of humerus), OTHRA (at least >½ proximal end), OTHFE (head of femur) and OTHTI (at least >½ proximal end).

Since a considerable amount of studied faunal assemblages in northern Greece and the Balkan Peninsula have used *NISP* as the basic measure of taxonomic abundance, we will also use it in this study as a mean of comparison. However, we have to keep in mind that since the vast majority of these reports do not assess the extent of recovery bias on-site, we will have to be extremely careful with our interpretations.

Minimum Number of Individuals (*MNI*) is a method for estimating relative taxonomic abundance. It simply uses the most frequent anatomical element for each taxon as a predictor of this taxon's frequency (Lyman 1994). The relevance of the *MNI* in relation to the archaeological issues posed is generally questioned. One of the main problems of the method is that it assumes that each individual in an assemblage was fully consumed in relation to that assemblage. However, in the current research, *MNI* is used as a predictor of taxonomic frequency rather than a predictor of the number of animals that were kept in the settlement, which is by and large not a primary goal in zooarchaeology. In this study, the calculation of the *MNI* was conducted simply by dividing the total number of a single anatomical element of one species to the number of the same elements that the identified species has in its skeleton.

4.5 – Ageing and sexing

In this study, age estimation is based primarily on dental development and attrition as mandibles and teeth represent the most useful elements to extract age information (Grant 1982; Greenfield 2005; Hillson 1986; Payne 1973; Zeder 2006). It is important to bear in mind that the teeth of animals in different conditions/time periods may have different rates of tooth eruption. Tooth eruption was recorded following Ewbank *et al.* (1964) (***Table 4.4***).

Table 4.4: Tooth eruption stages following Ewbank *et al.* (1964).

Abbreviations	***Eruption stages***
C	*Crypt*
V	*Visible*
E	*Erupting*
H	*Half-erupted*
U	*Fully-erupted, yet unworn*

Tooth wear stages were recorded following Grant's (1982) method for cattle and pigs, and Payne's (1973; 1987) method for sheep and goats. Tooth wear stages from a single mandible were then combined into age stages, using only mandibles with at least two teeth with recordable wear in the dP_4 / P_4 - M_3 row. For this study, O' Connor's (1988) age stages have been used for cattle and pigs (***Table 4.5***).

Table 4.5: Mandible wear stages for cattle and pigs following O'Connor (1988).

Age stage	***Tooth wear stages* sensu *Grant (1982)***
Neonate	*dP_4 not yet in wear.*
Juvenile	*M_1 not yet in wear.*
Immature	*M_1 in wear, M_2 not yet in wear.*
Sub adult	*M_2 in wear, M_3 not yet in wear.*
Adult	*M_3 in wear, not yet heavily worn.*
Elderly	*M_3 heavily worn [stage j or beyond sensu Grant (1982)].*

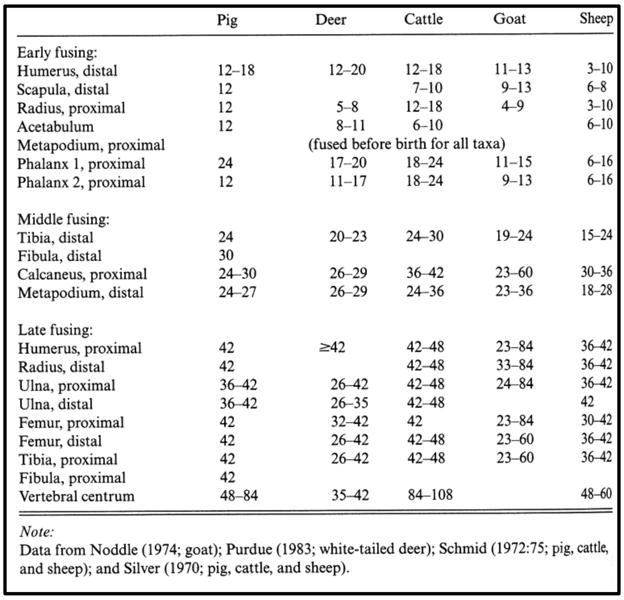
We also use Payne's (1973; 1987) age stages for sheep and goats (**Table 4.6**).

Table 4.6: Mandible wear stages for caprines following Payne (1973).

Age stage	***Tooth wear stages* sensu *Payne (1973)***	*Estimated age*
A	*dP_4 not yet in wear.*	*0-2 months*
B	*dP_4 in wear, M_1 not yet in wear.*	*2-6 months*
C	*M_1 in wear, M_2 not yet in wear.*	*6-12 months*
D	*M_2 in wear, M_3 not yet in wear.*	*1-2 years*
E	*M_3 in wear, posterior cusp still unworn (stages 1-8).*	*2-3 years*
F	*posterior cusp of M_3 in wear (stages 9-10).*	*3-4 years*
G	*M_3 stage 11, M_2 stage 9.*	*4-6 years*
H	*M_3 stage 11, M_2 stage post-9.*	*6-8 years*
I	*M_3 stage post-11.*	*8-10 years*

Despite epiphyseal fusion is susceptible to differential bone preservation, it is here used as a secondary source of ageing information in order to avoid the danger of relying only on a single indicator. Bone specimens were recorded as 'unfused', 'fusing', 'fusing/fused' and 'fused'. The approximate age of epiphyseal fusion for different skeletal elements of the common domesticates, follows the data of Silver (1969) for modern breeds (***Figure 4.1***).

Figure 4.1: Age of epiphyseal fusion of postcranial bones following Silver (1969).



	Pig	Deer	Cattle	Goat	Sheep
Early fusing:					
Humerus, distal	12–18	12–20	12–18	11–13	3–10
Scapula, distal	12		7–10	9–13	6–8
Radius, proximal	12	5–8	12–18	4–9	3–10
Acetabulum	12	8–11	6–10		6–10
Metapodium, proximal		(fused before birth for all taxa)			
Phalanx 1, proximal	24	17–20	18–24	11–15	6–16
Phalanx 2, proximal	12	11–17	18–24	9–13	6–16
Middle fusing:					
Tibia, distal	24	20–23	24–30	19–24	15–24
Fibula, distal	30				
Calcaneus, proximal	24–30	26–29	36–42	23–60	30–36
Metapodium, distal	24–27	26–29	24–36	23–36	18–28
Late fusing:					
Humerus, proximal	42	≥42	42–48	23–84	36–42
Radius, distal	42		42–48	33–84	36–42
Ulna, proximal	36–42	26–42	42–48	24–84	36–42
Ulna, distal	36–42	26–35	42–48		42
Femur, proximal	42	32–42	42	23–84	30–42
Femur, distal	42	26–42	42–48	23–60	36–42
Tibia, proximal	42	26–42	42–48	23–60	36–42
Fibula, proximal	42				
Vertebral centrum	48–84	35–42	84–108		48–60

Note:
Data from Noddle (1974; goat); Purdue (1983; white-tailed deer); Schmid (1972:75; pig, cattle, and sheep); and Silver (1970; pig, cattle, and sheep).

Sex determination was attempted only on cervid antlers (all antler specimens can be assumed to be males) and pig canines. Dimorphism in adult pig canine teeth provides the most reliable basis for sex discrimination, as male canines are considerably larger than their female counterparts and also morphologically different; alveolar cavities were also attributed to sex. On the other hand, cattle horn cores were measured in order to define sex ratios. Measurements that were taken on cattle horn cores include minimum (W_{min}) and maximum (W_{max}) basal diameter, but no length measurements were taken due to absence of intact specimens.

For other taxa, any attempts to detect the sexual composition of the assemblage had to rely on metrical analysis (see also ***5.10 – Metrical analysis***).

4.6 – Pathology, gnawing, burning and butchery

The identification of pathologies may provide important information on the treatment and management of animals but this is neither the only, nor the most reliable measure of the health of an animal population. Many diseases do not alter extensively the skeleton of the animals and we should also keep in mind that ailing animals might have been disposed of differently from the domestic debris. Animal pathological conditions were recorded - whenever visible - following details provided by Baker and Brothwell (1980) and notes were made in the 'comments' section of the database. The presence of linear enamel hypoplasia (LEH) on teeth was also recorded as one (P) or multiple (PP) lines, as this could provide useful information with regard to possible malnutrition and other forms of environmental stress (Kierdorf *et al.* 2006).

Gnawing provides information on peri-depositional damage, implying the exposure of an element to certain conditions before its ultimate burial into the archaeological record (Lyman 1994). Recognizing gnawing incidents in neonatal specimens can be extremely problematic due to these latter's relatively soft and porous surface. Therefore, in this study identification of gnawing incident is restricted to post-neonatal material. Human and pig gnawing is difficult to identify, let alone discriminate from other forms of gnawing (Greenfield 1988). Thus, it was not attempted in this study. On the other hand, carnivore (C) (Lyman 1994, 207-9) and rodent (R) (Lyman 1994, 196) gnawing was relatively easy to identify and was therefore recorded when visible. Partial digestion (D) of bones was also recorded (Lyman 1994, 211; Payne and Munson 1985).

Duration of exposure to a heat source, as well as its temperature and typology (*cf.* Nicholson 1993; Outram 2002; Shipman *et al.* 1984) can have different effects on the surface of the bones. In addition, the recognition of burned bones in the archaeological record may sometimes not be straightforward, since a black colour may be indicative of burning, but could also be due to staining by manganese and / or iron oxides (Shahack-Gross *et al.* 1997). Discriminating burnt and oxidized bones in the Promachon's faunal assemblage was difficult in some cases. Burning traces were therefore recorded only on specimens in which, the cause could unambiguously be identified. Consequently, it is possible that the rate of burning in the present study might be slightly underestimated. Three fields were created to record burning:

- Singed (S) referred to cases in which bones were only partially affected by heat.
- Burned (B) referred to cases were the incidence of burning covered the whole surface of the bones.
- Calcined (C) referred to cases in which bones presented white color on their surfaces.

The main reason for this separation is to try to identify the nature of the burning incidence on the bones from Promachon. For instance, burning traces (mostly bones which were recorded as singed) may well be the result of cooking activities. However, there are also cases of burned bones, in which burning traces are too severe to suggest only food preparation [*i.e.* calcined bones may be the result of the conflagration event at the end of the first phase of occupation; see also ***2.3.1 – Phase I (Layers 4-11)***].

Butchery is noticeable in Promachon sector, since the faunal material represents mostly consumption residues. Cutmarks (T) and chopping marks (P) were all recorded in the database and notes were made in the 'comments' section regarding their location on the surface of the bones. Cut marks referred to thin lines, which were inflicted by small tools and objects (mainly stone tools) for the dismemberment of the articulations and the joints. Chopping marks referred to traces inflicted by heavy tools and objects in order to divide the animal carcass into a great number of portions for processing. Attempts have also been made to attribute, where possible, butchery marks to dismembering, skinning and filleting, following Binford (1981). These notes were also stated in the 'comments' section.

An electronic database containing the raw data is provided on the enclosed

CD (see inside back cover). ***Appendix A*** includes the database fields and codes.

Chapter 5. – Results

5.1 – Breakdown of the faunal material

The faunal material from Promachon sector consists of 11527 recorded specimens. Of these, 4470 (39%) were recorded as bones, 3110 (27%) were recorded as teeth, 3871 (34%) were recorded as vertebrae and ribs and 76 (1%) were recorded as bone tools (***Table 5.1***). Out of the total 11527 recorded specimens, 10159 (88%) derive from undisturbed deposits (***Table 5.2***), while the rest of the material, which accounts for 1368 (12%) recorded specimens, derives from mixed deposits (***Table 5.3***).

Out of 10159 recorded specimens deriving from undisturbed deposits, a total of 6525 (64%) represented 'countable' elements (***Table 5.4***). Of these, 4332 (66%) were identified to species level, 2075 (32%) were identified to subfamily level (*Caprinae*) and 118 (2%) were identified as two or three most likely species: Red deer/Cattle (*Cervus/Bos*)*;* Red deer/Fallow deer (*Cervus/Dama*)*;* Sheep/Goat/Roe deer (*Ovis/Capra/Capreolus*); Dog/Fox (*Canis/Vulpes*). The rest of the 'uncountable' material, which accounts for 3634 (36%) recorded specimens consists of: 3379 (93%) vertebrae and ribs, 63 (2%) bone tools and 192 (5%) specimens, which fell into the 'non-countable' categories as specified in the recording protocol (169 'others', 20 horn-cores and 3 antlers).

Out of 1368 recorded specimens deriving form mixed deposits, a total of 836 (61%) represented 'countable' elements (***Table 5.5***). Of these, 564 (67%) were identified down to the level of species, 257 (31%) to subfamily level (*Caprinae*), and 15 (2%) were identified as two or three most likely species: Red deer/Cattle (*Cervus/Bos*)*;* Red deer/Fallow deer (*Cervus/Dama*)*;* Sheep/Goat/Roe deer (*Ovis/Capra/Capreolus*); Dog/Fox (*Canis/Vulpes*). The rest of the 'uncountable' material, which accounts for 532 (39%) recorded specimens consists of: 496 (93%) vertebrae and ribs, 13 (2%) bone tools and

23 (5%) specimens, which fell into the ‘non-countable’ categories as specified in the recording protocol (20 ‘others’ and 3 horn-cores).

Table 5.6 provides the Latin names of the families, subfamilies and species that are mentioned in this thesis in addition to their common English and Greek names. The last column on the right provides information on the species conservation status today, according to the *Red book of threatened animals of Greece* (Legakis and Marangou 2009).

Table 5.1: Breakdown of the faunal material. *NISP* counts.

Breakdown of the faunal material	*NISP*	*%*
Bones	*4470*	*39%*
Teeth	*3110*	*27%*
Ver-ribs	*3871*	*34%*
Tools	*76*	*1%*
TOTAL	***11527***	***100%***

Table 5.2: Faunal material from undisturbed deposits; breakdown to phases. *NISP* counts.

Breakdown of the faunal material	*Undisturbed Deposits*						*TOTAL*	
	Phase I *(Layers 6, 5, 4)*		***Phase II*** *(Layers 3, 2)*		***Phase III*** *(Layer 1)*			
	NISP	*%*	*NISP*	*%*	*NISP*	*%*	*NISP*	*%*
Bones	*1449*	*40%*	*1623*	*39%*	*900*	*37%*	*3972*	*39%*
Teeth	*902*	*25%*	*1063*	*26%*	*780*	*32%*	*2745*	*27%*
Ver-ribs	*1231*	*34%*	*1401*	*34%*	*747*	*30%*	*3379*	*33%*
Tools	*25*	*1%*	*17*	*1%*	*21*	*1%*	*63*	*1%*
TOTAL	***3607***	***100%***	***4104***	***100%***	***2448***	***100%***	***10159***	***100%***

Table 5.3: Faunal material from mixed deposits; breakdown to phases. *NISP* counts.

Breakdown of the faunal material	*Undisturbed Deposits*						*TOTAL*	
	Phases I-II		*Phases II-III*		*Phases I-II-III*			
	NISP	*%*	*NISP*	*%*	*NISP*	*%*	*NISP*	*%*
Bones	*169*	*40%*	*317*	*34%*	*8*	*35%*	*494*	*36%*
Teeth	*94*	*22%*	*262*	*28%*	*9*	*40%*	*365*	*27%*
Ver-ribs	*155*	*37%*	*335*	*36%*	*6*	*25%*	*496*	*36%*
Tools	*3*	*1%*	*10*	*2%*		*0%*	*13*	*1%*
TOTAL	***421***	***100%***	***924***	***100%***	***23***	***100%***	***1368***	***100%***

Table 5.4: 'Countable' material from undisturbed deposits; breakdown to phases. *NISP* counts.

Breakdown of the faunal material	***Undisturbed Deposits***						***TOTAL***	
	Phase I *(Layers 6, 5, 4)*		***Phase II*** *(Layers 3, 2)*		***Phase III*** *(Layer 1)*			
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Bones	*1386*	*60%*	*1538*	*59%*	*856*	*52%*	*3780*	*58%*
Teeth	*902*	*40%*	*1063*	*41%*	*780*	*48%*	*2745*	*42%*
TOTAL	***2288***	***100%***	***2601***	***100%***	***1636***	***100%***	***6525***	***100%***

Table 5.5: 'Countable' material from mixed deposits; breakdown to phases. *NISP* counts.

Breakdown of the faunal material	***MIxed Deposits***						***TOTAL***	
	Phases I-II		***Phases II-III***		***Phases I-II-III***			
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Bones	*166*	*64%*	*297*	*53%*	*8*	*47%*	*471*	*56%*
Teeth	*94*	*36%*	*262*	*47%*	*9*	*53%*	*365*	*44%*
TOTAL	***260***	***100%***	***559***	***100%***	***17***	***100%***	***836***	***100%***

Table 5.6: Names of families, subfamilies and species that are mentioned in this thesis.

Latin name	*Classification*	*Common name (English)*	*Common name (Greek)*	*Conservation status in Macedonia*
Bos taurus	*Species*	*Cattle*	*Αγελάδα*	*Domesticated*
Caprinae	*Subfamily*	*Caprines*	*Αιγοπρόβατα*	-
Ovis aries	*Species*	*Sheep*	*Πρόβατο*	*Domesticated*
Capra hircus	*Species*	*Goat*	*Αίγα*	*Domesticated*
Sus domesticus	*Species*	*Pig*	*Χοίρος*	*Domesticated*
Canis familiaris	*Species*	*Dog*	*Σκύλος*	*Domesticated*
Cervidae	*Family*	*Cervids*	*Ελαφίδες*	-
Cervus elaphus	*Species*	*Red deer*	*Κόκκινο ελάφι*	*Critical (≈ 30-50 individuals)*
Dama dama	*Species*	*Fallow deer*	*Πλατώνι*	*Critical*
Capreolus capreolus	*Species*	*Roe deer*	*Ζαρκάδι*	*Vulnerable/Endangered*
Lepus europaeus	*Species*	*Hare*	*Λαγός*	*Non established status*
Vulpes vulpes	*Species*	*Red fox*	*Αλεπού*	*Non established status*
Rupicapra rupicapra	*Species*	*Chamois*	*Αγριόγιδο*	*Vulnerable (remote populations)*
Sus scrofa	*Species*	*Wild Boar*	*Αγριόχοιρος*	*Least concern*
Lynx lynx	*Species*	*Eurasian lynx*	*Λύγκας*	*No data (Unconfirmed presence)*
Ursus arctos	*Species*	*Bear*	*Άρκτος*	*Endangered (≈ 190-260 individuals)*
Canis lupus	*Species*	*Wolf*	*Λύκος*	*Endangered*
Mustelidae	*Family*	*Mustelids*	*Ικτίδες*	-
Meles meles	*Species*	*European badger*	*Ασβός*	*Non established status*
Mustela putorius	*Species*	*Polecat*	*Βρωμοκούναβο*	*Non established status*
Mustela erminea	*Species*	*Stoat*	*Ερμίνη*	*Non established status*
Martes foina	*Species*	*Beech marten*	*Πετροκούναβο*	*Non established status*
Buteo lagopus	*Species*	*Rough-legged buzzard*	*Αρκτικοβαρβακίνα*	*Non established status*
Anser anser	*Species*	*Greylag goose*	*Σταχτόχηνα*	*Critical (Declining nr. of individuals)*
Grus grus	*Species*	*Common crane*	*Γερανός*	*Non established status*
Corvus corax	*Species*	*Raven*	*Κοράκι*	*Least concern*
Aves	*Class*	*Birds (indeterminate)*	*Πτηνά (αδιευκρίνιστα)*	-
Testudinidae	*Family*	*Tortoises*	*Χελωνίδες*	-
Siluris glanis	*Species*	*Sheatfish*	*Γατόψαρο*	*Least concern*
Cyprinidae	*Family*	*Minnows*	*Κυπρινίδες*	-
Murex trunculus	*Species*	*Banded dye-murex*	*Στρόμπος*	-
Homo sapiens	*Species*	*Modern human*	*Σύγχρονος άνθρωπος*	-

5.2 – Agents affecting the faunal assemblage

Issues of preservation, fragmentation and general taphonomy of bones are varied and have been extensively discussed (*e.g.* Binford 1981; Lyman 1994). The main factors affecting the preservation of a faunal assemblage are butchery, disposal methods, scavenger activity, weathering, excavation methods, and sampling regimes. When any number of these processes are combined, their individual effects can be difficult to determine and the result not easy to interpret. However, as these processes can be very important in our interpretation and understanding of the site, at least some attempt has to be made to identify the major factors involved in the formation of the animal bone assemblage (Albarella *et al.* 1997).

5.2.1 – Preservation

The faunal material from Promachon sector is in a very good state of preservation, thus enhancing our attempts of correct anatomical and taxonomical identification. A substantial number of bones were stained along their whole surface, presenting a dark red color due to the waterlogged deposits; some bones present a light red to dark orange color, with dark stains due to the high concentration of charcoal in the soil. Cases of concretion along the surface of the bones are extremely low and they are present only in a part of the material from trenches I and IA near structure n. 4. Cases of weathering and root etching on bones have been recorded in the 'comments' section of the database; their number, however, is extremely low (2 and 3 bones respectively).

It is generally difficult to assess if the faunal material derives from contexts representing primary or secondary deposition; for example, a number of articulated bones in anatomical connection as well as a number of unfused diaphyses that were found together with their unfused epiphyses indicate the presence of at least some primary deposits (***Table 5.7***). However, the presence of gnawing marks indicates that some bones were re-deposited (*i.e.* bones were not found at the original place of discard) as a result of scavenger activity.

Gnawing was observed on the postcranial bones of cattle, caprines, pig, red deer and roe deer. Most of the gnawing traces observed were suggestive of gnawing by carnivores, dog being the species most likely to be responsible for most of the chewing. However, it is highly likely that pigs (Greenfield 1988) as well as humans (Brain 1981) might have contributed to the modification of bones. Traces of rodent gnawing are present in only two bone fragments (a proximal radius of a cattle and a caprine rib). No evidence of partial or complete digestion of bones was recorded whatsoever.

The gnawing incidence in Promachon is relatively low; gnawing marks occur only on 4% of all ‘countable’ postcranial fragments (***Table 5.8***), indicating that scavenger access to bone debris was often restricted. The frequency of gnawing at Promachon is close to that from other contemporary sites across Greek Macedonia; for example, in the Late Neolithic settlement of Kryoneri in central Macedonia, gnawing is recorded on less than 5% of the total postcranial bones (Mylona 1997), while in the Late Neolithic settlements of Dispilio in western Macedonia (Cosmetatou-Phoca 2006) and Stavroupoli in central Macedonia (Yiannouli 2002a; 2004) gnawing traces are found only on 1% of the faunal material.

Only slight variations in the incidence of gnawing marks between the three main domesticates occur (***Figure 5.1***; ***Table 5.9***), suggesting that carnivores did not have differential access to these species and that the latter were not disposed of in different ways. It should be noted, however, that the amount of gnawing on the bones of caprines and pigs could be underestimated due to the tendency for carnivores to completely destroy bones from small taxa.

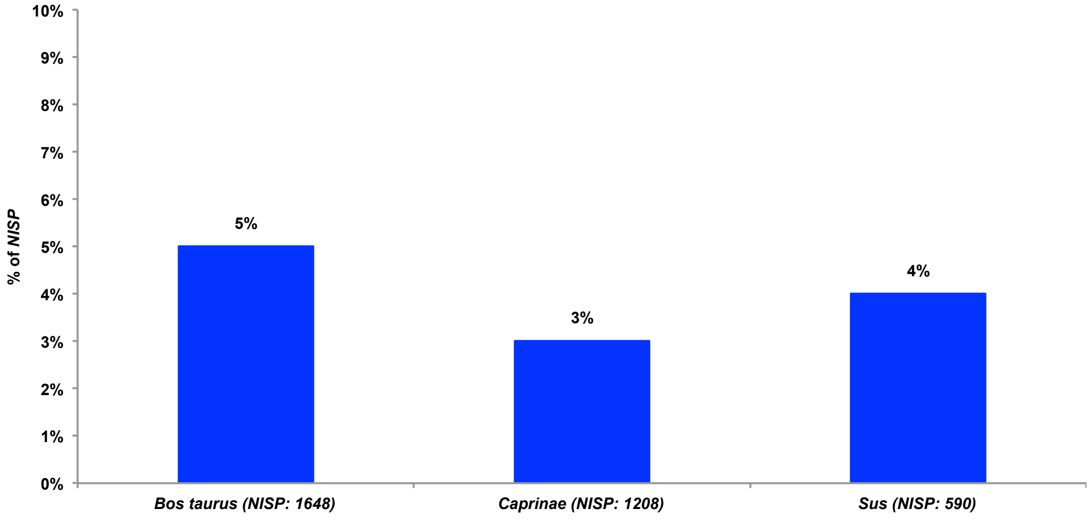


Figure 5.1: Incidence of gnawing among the postcranial bones of the three main domesticates. All phases are considered. The Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Only 'countable' elements are considered. Data in Table 5.9. *NISP* counts.

Tables 5.10-5.13 present the anatomical distribution of gnawing for the three main domesticates as well as for cervids. The incidence of gnawing does not vary significantly between the different body parts of the different species, though the low numbers of gnawed specimens may not be suitable to highlight such differences. Nonetheless, there is no evidence that scavengers had differential access to specific body parts of cattle, caprines, pigs and cervids, although it is highly likely that the amount of damage inflicted may have differed between bones of high and low density.

5.2.2 – Retrieval biases

As previously discussed (Chapter 3 – Archaeological background), most of the faunal material from Promachon was hand-picked, flotation and sieving having been carried out only for the material deriving from the deposits associated with Layers 11-7 (structure n. 4). The skewedness of the composition of a non-sieved faunal material is well known: young age categories, small anatomical parts and small animals are underrepresented when systematic sieving procedures are not employed (Payne 1972a; 1975).

Thus, before proceeding further with our analysis, we should assess the significance of the quality of recovery.

A comparison between the frequencies of the distal tibiae and the astragali is considered to be a good indicator of the quality of recovery (Payne 1972a; 1975). Given their anatomical proximity and similar bone density and treatment in carcass butchery, these two elements should be found in almost equal frequencies in cases of comprehensive recovery. ***Figure 5.2*** (***Table 5.14***) demonstrates that caprine and pig astragali are underrepresented when compared to the larger tibiae, clearly indicating recovery bias. On the other hand, cattle astragali are very well represented, in fact even more so than cattle tibiae; this is not strange, since due to their density and size cattle astragali are not generally overlooked during excavation.

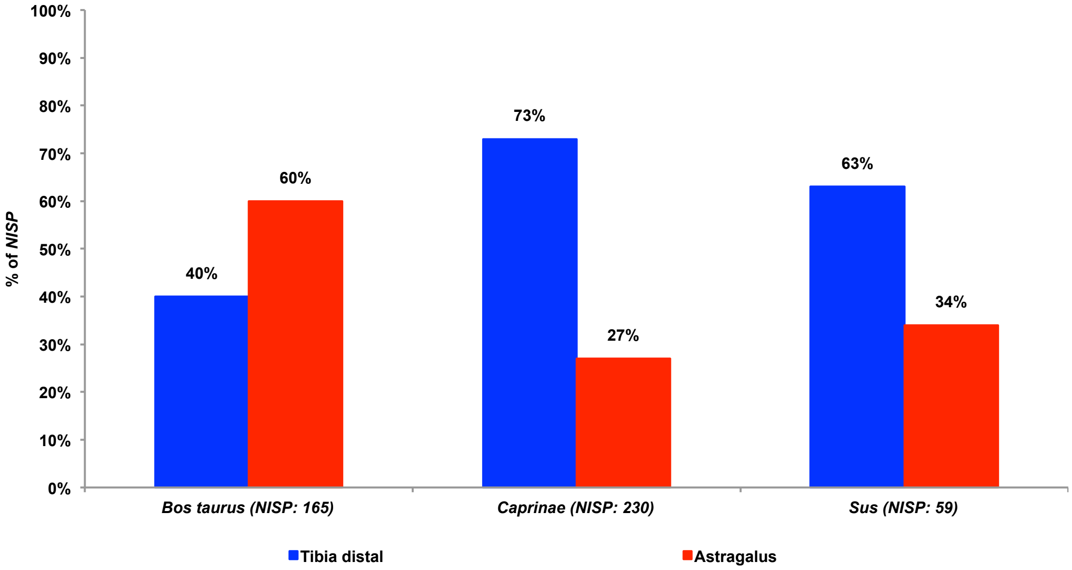


Figure 5.2: Retrieval biases; comparison between the astragalus and the distal tibia. All Phases are considered. The Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Distal tibia unfused epiphyses are not counted. Data in Table 5.14. *NISP* counts.

The ratio between the first and the second phalanges is considered to be an additional cogent test for assessing the quality of recovery in faunal assemblages (***Table 5.15***). ***Figure 5.3*** demonstrates that small anatomical parts such as caprine and pig second phalanges are seriously underrepresented when compared to the larger first phalanges. On the contrary, cattle second phalanges are better represented in comparison to the larger first phalanges, indicating that recovery bias does not entirely apply to large animals such as cattle.

Thus, in the following analysis, we should strongly consider the fact that recovery bias is likely to have played a significant role in the formation of the faunal assemblage; it is not possible, however, to give precise estimates as to which aspects of the wider assemblage might be more affected, though species frequency, young age profiles and body part distribution are of obvious concern.

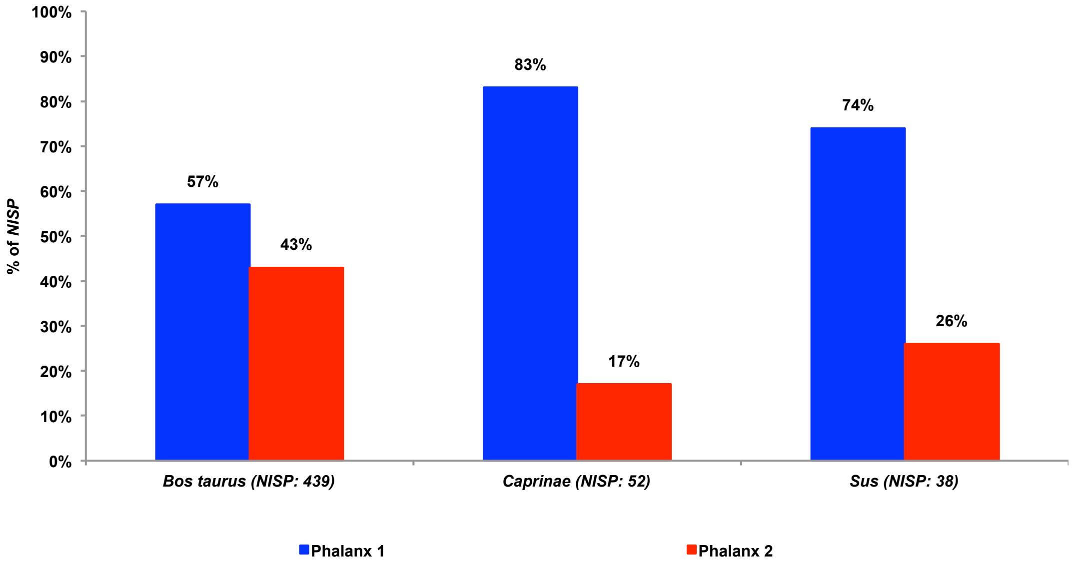


Figure 5.3: Retrieval biases; comparison between first and second phalanges. All Phases are considered. The Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Unfused proximal epiphyses are not counted. Data in Table 5.15. *NISP* counts.

5.2.3 – Fragmentation

In addition to the small number of articulated bones in anatomical connection, a number of complete bones untouched by fragmentation mechanisms were found. However, the majority of the material had been fragmented in antiquity. Old breaks may have occurred either before discard, most obviously in human extraction of marrow (Binford 1981), or after discard, *i.e.* in gnawing by dogs or trampling by humans. In this study, the level of fragmentation on the bones of the three main domesticates is assessed using two methods:

- The ratio between the number of mandibles and the number of isolated mandibular teeth (***Table 5.16***).
- The ratio between fragmented and complete long bones (humerus, radius, femur and tibia; ***Tables 5.17-5.19***).

– Ratio between mandibles and isolated mandibular teeth.

The level of fragmentation varies between the three commonest taxa (***Figure 5.4***). Cattle and caprine isolated teeth are represented with a higher frequency (87% for cattle and 71% for caprines) compared to mandibles. However, the frequency of caprine mandibles is higher than that of cattle (13% for cattle and 29% for caprines); on the other hand, pig mandibles are represented with a higher frequency (54%) than isolated teeth (46%).

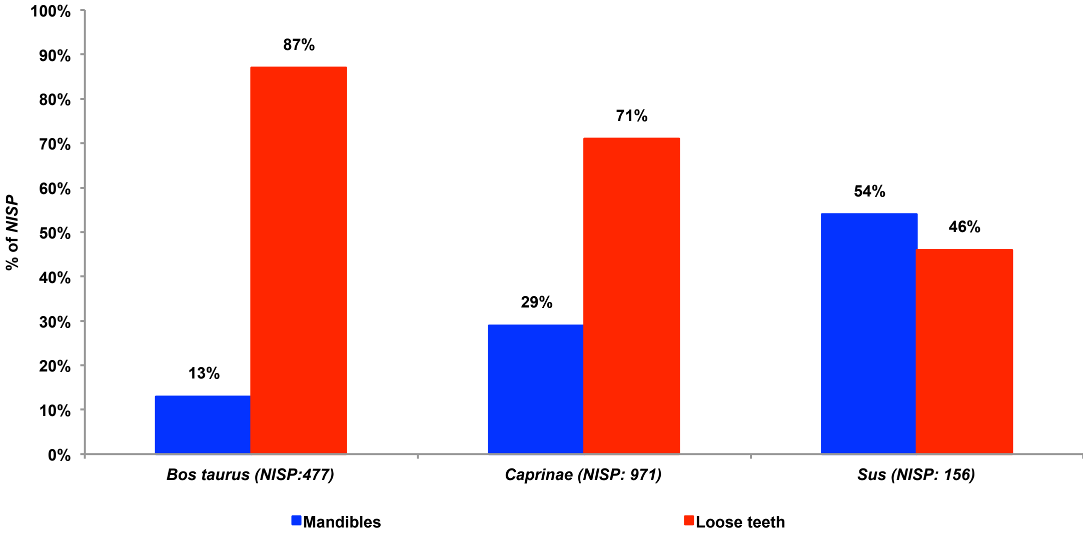


Figure 5.4: Ratio between mandibles and isolated mandibular teeth for the three main domesticates. All phases are considered. The Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Isolated mandibular teeth include all deciduous and permanent incisors, canines and premolars, and all permanent molars. Data in Table 5.16. *NISP* counts.

Although the evidence seems to suggest that cattle remains were much more affected by fragmentation than any of the other main domesticates, the higher proportion of cattle isolated teeth can probably be explained on the basis of retrieval biases; caprine and pig teeth are smaller than cattle teeth and they are frequently overlooked during excavation. On the other hand, the high proportion of pig mandibles is probably biased too; age-at-death information indicates a young age profile for pigs (see also ***5.7.3* Sus *age-at-death***). It is suggested, therefore, that retrieval bias is probably the reason for the underrepresentation of small deciduous isolated pig teeth.

– Ratio between fragmented and complete long bones.

The ratio between fragmented and complete long bones (humerus, radius, femur and tibia) provides a second method for the assessment of the level of fragmentation. In general, long bones have a better chance of survival than other anatomical elements (*i.e.* scapula, ulna, pelvis), which are particularly fragile and are rarely found complete. On the other hand, small compact bones such as the phalanges, the calcaneum and the astragalus, tend to be found complete; however, as we have already seen, small bones are subject to retrieval biases particularly in the case of small species such as caprines and pigs. Metacarpals and metatarsals are also excluded since their proximal ends, which in most taxa fuse before birth, were not recorded.

In Promachon sector, out of 1053 recorded long bones deriving from the three main domesticates, only 31 (3%) complete long bones were found. This proportion is slightly higher than that found in the Late Neolithic assemblage of Dimitra, where out of 323 recorded fragments of humerus, radius, femur and tibia, only 6 (< 2%) complete long bones were found (Yiannouli 1997). ***Figure 5.5*** shows that cattle long bones were more affected by fragmentation than the long bones of the other domesticates; out of 316 cattle long bones in total, only 4 (2%) were found complete. Fragmentation in caprine long bones is also high; out of 545 long bones, only 10 (3%) complete long bones were found. Pig is the species less affected by fragmentation; out of 192 pig long bones, a total of 17 (10%) complete long bones were recovered.

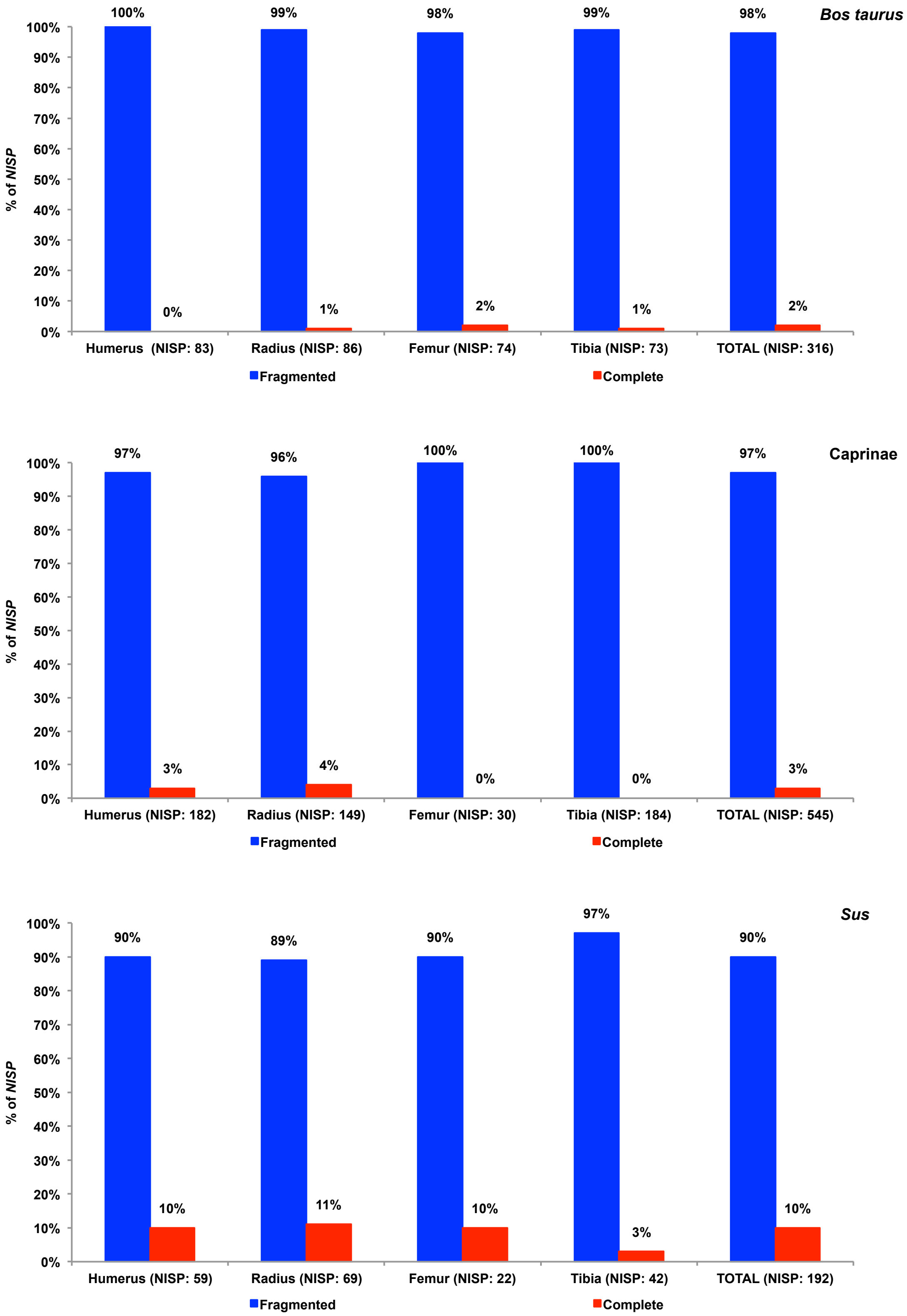


Figure 5.5: Ratio between fragmented and complete long bones of the three main domesticates. All phases are considered. The Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Proximal and distal ends include fusing/fused epiphyses and unfused diaphyses. Unfused epiphyses are not considered. Data in Tables 5.17-5.19. *NISP* counts.

Differences in bone fragmentation between the three main domesticates are most likely the result of the variation in the intensity of marrow extraction. It is suggested that humans preferentially fractured bones of large species such as cattle. The high fragmentation of cattle bones may be attributed to the species' large size: in order to obtain most of the marrow, cattle bones were subjected to intensive fracturing, thus resulting in a more fragmented material. In addition, the large cattle carcass needs to be separated out more; this leads to a greater amount of butchery-led fragmentation.

Fragmentation in caprine bones is also high; nevertheless, the proportion of intact caprine bones is higher than that of cattle. This is not strange, since caprine bones, being smaller than cattle bones, contain poor amount of marrow and offer relatively poor returns on processing labour (Binford 1978). On the other hand, the high proportion of unfused intact pig bones supports earlier arguments on the young age profile of the species. It is suggested, therefore, that unfused, immature pig bones were in some way 'protected' from intensive fragmentation since the content of marrow in young animals is considerably lower (Speth 1983).

Table 5.7: Number of articulated bones and number of unfused epiphyses and unfused diaphyses found together for the three commonest taxa. All phases are considered. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). *NISP* counts.

Prompt Burial	***Phases I-II-III** (Layers 6, 5, 4, 3, 2, 1)*	
	Articulated Bones	***Unfused diaphyses & epiphyses***
	NISP	***NISP***
Bos taurus ***(NISP: 1648)***	*5*	*4*
Caprinae ***(NISP: 1208)***	*4*	*1*
Sus ***(NISP: 590)***	*3*	*6*
TOTAL (NISP: 3446)	***12***	***11***

Table 5.8: Incidence of gnawing among the postcranial bones of all species identified in Promachon sector on a phase-by-phase level. Only 'countable' elements are considered. *NISP* counts.

Incidence of gnawing	***Postcranial elements***		
	NISP	***Gnawed***	***%***
***Phase I** (Layers 6, 5, 4)*	*1386*	*79*	*6%*
***Phase II** (Layers 3, 2)*	*1538*	*59*	*4%*
***Phase III** (Layer 1)*	*856*	*28*	*3%*
TOTAL	***3780***	***166***	***4%***

Table 5.9: Incidence of gnawing among the postcranial bones of the three main domesticates on a phase-by-phase level. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Only 'countable' elements are considered in this table. Data for Figure 5.1. *NISP* counts.

Main domesticates	***Gnawing Incidence***							
	Late Neolithic I				***Late Neolithic II***		***TOTALS***	
Bos taurus	***Phase I** (Layers 6, 5, 4)* ***NISP: 623***		***Phase II** (Layers 3, 2)* ***NISP: 671***		***Phase III** (Layer 1)* ***NISP: 354***		***TOTAL*** ***NISP: 1648***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
	23	*4%*	*44*	*7%*	*12*	*3%*	*79*	*5%*
Caprinae	***Phase I** (Layers 6, 5, 4)* ***NISP: 428***		***Phase II** (Layers 3, 2)* ***NISP: 487***		***Phase III** (Layer 1)* ***NISP: 293***		***TOTAL*** ***NISP: 1208***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
	13	*3%*	*19*	*4%*	*3*	*1%*	*35*	*3%*
Sus	***Phase I** (Layers 6, 5, 4)* ***NISP: 230***		***Phase II** (Layers 3, 2)* ***NISP: 226***		***Phase III** (Layer 1)* ***NISP: 134***		***TOTAL*** ***NISP: 590***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
	7	*3%*	*13*	*6%*	*4*	*3%*	*24*	*4%*
TOTAL	***Phase I** (Layers 6, 5, 4)* ***NISP: 1281***		***Phase II** (Layers 3, 2)* ***NISP: 1384***		***Phase III** (Layer 1)* ***NISP: 781***		***TOTAL*** ***NISP: 3446***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
	43	*3%*	*76*	*5%*	*19*	*2%*	*138*	*4%*

Table 5.10: *Bos taurus* (cattle); body part distribution of gnawing on a phase-by-phase level. Both 'countable' and 'uncountable' elements are considered in this table. *NISP* counts.

Bos taurus		*Gnawing Incidence*			
		Late Neolithic I		*Late Neolithic II*	*TOTAL (NISP: 1648)*
		Phase I (NISP: 623)	*Phase II (NISP: 671)*	*Phase III (NISP: 354)*	
		NISP	*NISP*	*NISP*	*NISP*
Postcranial elements	*Cranium (zygomaticus)*			1	**1**
	Atlas		1		**1**
	Axis				
	Scapula	1	1		**2**
	Humerus proximal	1			**1**
	Humerus distal	2	3	1	**6**
	Radius proximal	2		1	**3**
	Radius distal		1		**1**
	Ulna proximal	1			**1**
	Carpal 2+3				
	Metacarpal distal				
	Pelvis				
	Femur proximal	1	5	3	**9**
	Femur distal	3	4		**7**
	Tibia proximal		1	1	**2**
	Tibia distal	1	1		**2**
	Scafocuboid		1	1	**2**
	Astragalus	1	4	1	**6**
	Calcaneum	5	9		**14**
	Metatarsal distal				
	Phalanx 1	4	10	2	**16**
	Phalanx 2	1	3		**4**
	Phalanx 3			1	**1**
	TOTAL Countable	**23**	**44**	**12**	**79**
	TOTAL Uncountable	**1**	**4**	**4**	**9**
TOTAL		**24**	**48**	**16**	**88**

Table 5.11: Caprinae (sheep and goat); body part distribution of gnawing on a phase-by-phase level. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Both 'countable' and 'uncountable' elements are considered in this table. *NISP* counts.

Caprinae		Gnawing Incidence			
		Late Neolithic I		Late Neolithic II	TOTAL (NISP: 1208)
		Phase I (NISP: 428)	Phase II (NISP: 487)	Phase III (NISP: 293)	
		NISP	NISP	NISP	NISP
Postcranial elements	Cranium (zygomaticus)	1			1
	Atlas				
	Axis				
	Scapula				
	Humerus proximal				
	Humerus distal	6	10	1	17
	Radius proximal	1	1	1	3
	Radius distal		2		2
	Ulna proximal	1			1
	Carpal 2+3				
	Metacarpal distal	2		1	3
	Pelvis	1	1		2
	Femur proximal		2		2
	Femur distal				
	Tibia proximal		1		1
	Tibia distal		1		1
	Scafocuboid				
	Astragalus				
	Calcaneum				
	Metatarsal distal	1	1		2
	Phalanx 1				
	Phalanx 2				
	Phalanx 3				
	TOTAL Countable	13	19	3	35
	TOTAL Uncountable	1			1
TOTAL		14	19	3	36

Table 5.12: *Sus* (pig); body part distribution of gnawing on a phase-by-phase level. Both 'countable' and 'uncountable' elements are considered in this table. *NISP* counts.

Sus		***Gnawing Incidence***			
		Late Neolithic I		***Late Neolithic II***	***TOTAL (NISP: 590)***
		Phase I (NISP: 230)	***Phase II (NISP: 226)***	***Phase III (NISP: 134)***	
		NISP	***NISP***	***NISP***	***NISP***
Postcranial elements	***Cranium (zygomaticus)***				
	Atlas				
	Axis				
	Scapula	*2*	*2*	*1*	***5***
	Humerus proximal				
	Humerus distal	*1*	*1*		***2***
	Radius proximal		*4*		***4***
	Radius distal	*1*		*1*	***2***
	Ulna proximal	*1*	*2*		***3***
	Carpal 2+3				
	Metacarpal 3 distal				
	Metacarpal 4 distal				
	Pelvis		*2*	*1*	***3***
	Femur proximal				
	Femur distal			*1*	***1***
	Tibia proximal	*1*			***1***
	Tibia distal				
	Scafocuboid				
	Astragalus		*1*		***1***
	Calcaneum		*1*		***1***
	Metatarsal 3 distal				
	Metatarsal 4 distal	*1*			***1***
	Phalanx 1				
	Phalanx 2				
	Phalanx 3				
	TOTAL Countable	***7***	***13***	***4***	***24***
	TOTAL Uncountable		***1***	***1***	***2***
TOTAL		***7***	***14***	***5***	***26***

Table 5.13: Cervidae (cervids); body part distribution of gnawing on a phase-by-phase level. Cervidae family includes *Cervus elaphus* (red deer) and *Capreolus capreolus* (roe deer). Both ‘countable’ and ‘uncountable’ elements are considered in this table. *NISP* counts.

Cervidae		***Gnawing Incidence***			
		Late Neolithic I		***Late Neolithic II***	***TOTAL (NISP: 100)***
		Phase I (NISP: 29)	***Phase II (NISP: 51)***	***Phase III (NISP: 20)***	
		NISP	***NISP***	***NISP***	***NISP***
Postcranial elements	***Cranium (zygomaticus)***				
	Atlas				
	Axis				
	Scapula				
	Humerus proximal				
	Humerus distal				
	Radius proximal				
	Radius distal				
	Ulna proximal		*2*		***2***
	Carpal 2+3				
	Metacarpal distal				
	Pelvis				
	Femur proximal				
	Femur distal				
	Tibia proximal				
	Tibia distal				
	Scafocuboid				
	Astragalus				
	Calcaneum	*1*			***1***
	Metatarsal distal	*1*			***1***
	Phalanx 1				
	Phalanx 2	*1*			***1***
	Phalanx 3				
	TOTAL Countable	***3***	***2***		***5***
	TOTAL Uncountable				
TOTAL		***3***	***2***	***0***	***5***

Table 5.14: Retrieval biases; comparison between the astragalus and the distal tibia. All phases are considered. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Distal tibiae unfused epiphyses are not counted. Data for Figure 5.2. *NISP* counts.

Elements	***Retrieval biases: astragalus vs. distal tibia***					
	Bos taurus		**Caprinae**		**Sus**	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***
Tibia distal	*66*	*40%*	*167*	*73%*	*37*	*63%*
Astragalus	*99*	*60%*	*63*	*27%*	*22*	*34%*
TOTAL	***165***	***100%***	***230***	***100%***	***59***	***100%***

Table 5.15: Retrieval biases; comparison between the first and the second phalanges. All Phases are considered. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Unfused proximal epiphyses are not counted. Data for Figure 5.3. *NISP* counts.

Elements	***Retrieval biases: first vs. second phalanges***					
	Bos taurus		**Caprinae**		**Sus**	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***
Phalanx 1	*255*	*57%*	*43*	*83%*	*28*	*74%*
Phalanx 2	*184*	*43%*	*9*	*17%*	*10*	*26%*
TOTAL	***439***	***100%***	***52***	***100%***	***38***	***100%***

Table 5.16: Ratio between mandibles and isolated mandibular teeth for the three main domesticates. All phases are considered. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Isolated mandibular teeth include all deciduous and permanent incisors, canines and premolars, and all permanent molars. Data for Figure 5.4. *NISP* counts.

Three main domesticates	***Rate of fragmentation: Mandibles vs. teeth***			
	Mandibles		***Isolated mandibular teeth***	
	NISP	***%***	***NISP***	***%***
Bos taurus (*NISP: 477)*	*60*	*13%*	*387*	*87%*
Caprinae *(NISP: 971)*	*285*	*29%*	*686*	*71%*
Sus *(NISP: 156)*	*84*	*54%*	*72*	*46%*

Table 5.17: Rate of fragmentation on the long bones of *Bos taurus* (cattle). All phases are considered. Proximal and distal ends include fusing/fused epiphyses and unfused diaphyses. Unfused epiphyses are not counted. Data for Figure 5.5. *NISP* counts.

Bos taurus	***Rate of fragmentation: Long Bones***													
	Fragmented Bones						***Complete Bones***							
	Proximal end only		***Distal end only***		***TOTAL***		***1.***		***2.***		***3.***		***TOTAL***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Humerus	*8*	*10%*	*75*	*90%*	***83***	***100%***		*0%*		*0%*		*0%*	***0***	***0%***
Radius	*55.5*	*64%*	*29.5*	*35%*	***85***	***99%***	*1*	*1%*		*0%*		*0%*	***1***	***1%***
Femur	*33*	*44%*	*39*	*53%*	***72***	***98%***	*1*	*> 1%*		*0%*	*1*	*> 1%*	***2***	***2%***
Tibia	*6.5*	*10%*	*65.5*	*89%*	***72***	***99%***		*0%*		*0%*	*1*	*1%*	***1***	***1%***
TOTAL	***103***	***32%***	***209***	***66%***	***312***	***98%***	***2***	***1%***	***0***	***0%***	***2***	***1%***	***4***	***2%***

1. Both epiphyses fusing / fused.
2. One epiphysis fusing / fused, the other unfused.
3. Both ends of diaphysis unfused.

Each proximal or distal end is considered half (0.5) a complete bone.

Table 5.18: Rate of fragmentation on the long bones of Caprinae (sheep/goat). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). All phases are considered. Proximal and distal ends include fusing/fused epiphyses and unfused diaphyses. Unfused epiphyses are not counted. Data for Figure 5.5. *NISP* counts.

Caprinae	***Rate of fragmentation: Long Bones***													
	Fragmented Bones						***Complete Bones***							
	Proximal end only		***Distal end only***		***TOTAL***		***1.***		***2.***		***3.***		***TOTAL***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Humerus	*9.5*	*7%*	*169.5*	*91%*	***179***	***97%***	*1*	*< 1%*	*1*	*<1%*	*1*	*< 1%*	***3***	***3%***
Radius	*115.5*	*75%*	*26.5*	*20%*	***142***	***96%***	*2*	*1%*	*2*	*1%*	*3*	*2%*	***7***	***4%***
Femur	*19*	*63%*	*11*	*37%*	***30***	***100%***		*0%*		*0%*		*0%*		***0%***
Tibia	*17*	*10%*	*167*	*90%*	***184***	***100%***		*0%*		*0%*		*0%*		***0%***
TOTAL	***161***	***29%***	***374***	***68%***	***535***	***97%***	***3***	***1%***	***3***	***1%***	***4***	***1%***	***10***	***3%***

1. Both epiphyses fusing / fused.
2. One epiphysis fusing / fused, the other unfused.
3. Both ends of diaphysis unfused.

Each proximal or distal end is considered half (0.5) a complete bone.

Table 5.19: Rate of fragmentation on the long bones of *Sus* (pig). All phases are considered. Proximal and distal ends include fusing/fused epiphyses and unfused diaphyses. Unfused epiphyses are not counted. Data for Figure 5.5. *NISP* counts.

Sus	***Rate of fragmentation: Long Bones***													
	Fragmented Bones						***Complete Bones***							
	Proximal end only		***Distal end only***		***TOTAL***		***1.***		***2.***		***3.***		***TOTAL***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Humerus	*5*	*12%*	*48*	*77%*	***53***	***90%***		*0%*	*4*	*7%*	*2*	*3%*	***6***	***10%***
Radius	*33*	*47%*	*28*	*41%*	***61***	***89%***	*2*	*3%*	*4*	*5%*	*2*	*3%*	***8***	***11%***
Femur	*2*	*12%*	*18*	*78%*	***20***	***90%***		*0%*	*1*	*5%*	*1*	*5%*	***2***	***10%***
Tibia	*4.5*	*11%*	*36.5*	*86%*	***41***	***97%***		*0%*		*0%*	*1*	*3%*	***1***	***3%***
TOTAL	***44.5***	***25%***	***130.5***	***65%***	***175***	***90%***	***2***	***2%***	***9***	***5%***	***6***	***3%***	***17***	***10%***

1. Both epiphyses fusing / fused.
2. One epiphysis fusing / fused, the other unfused.
3. Both ends of diaphysis unfused.

Each proximal or distal end is considered half (0.5) a complete bone.

5.3 – Species representation

The fauna of Promachon is typical of the Late Neolithic of Greece. Domesticated animals constitute the overwhelming majority (***Table 5.20***); a glance at ***Figure 5.6*** reveals that domesticates represent almost 97% of the total *NISP* of all species identified considering all three phases[7]. On a phase-by-phase level, no differences occur; domesticates are represented with 95% during Phase I, increasing by 1% during Phase II (96%) and another 2% during Phase III (98%). *Chi*^{2} tests were conducted to test whether the differences between phases in domestic and wild animal representation were statistically significant. These tests indicated that the domestic and wild animal representation is not significantly different between Phases I-II (p= .77) as well as between Phases II-III (p= .17).

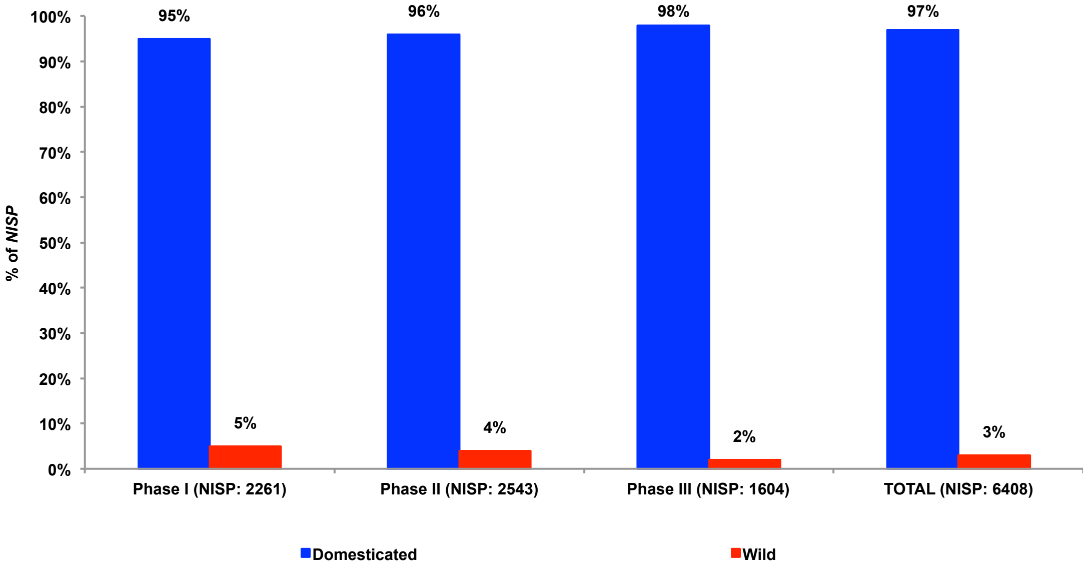


Figure 5.6: Domesticated vs. wild; comparison between phases. Data in Table 5.20. *NISP* counts.

The domesticated fauna is dominated by the four species (cattle, sheep, goat, and pig) that are present during this time-period in almost all settlements from Greek Macedonia (Halstead 1994; Yiannouli 2002a; 2004; ***Table 5.21***). No dramatic differences occur with time, but a gradual increase

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[7] Although we should note that the significance of the presence of the wild boar (*Sus scrofa*) has not yet been assessed [this will be done in the metrical analysis of the current chapter (see also ***5.10.3* – Sus *size***)].

in caprines, paralleled by an equivalent decrease in cattle, is noticeable (***Figure 5.7***). In Phase I the two taxa are present with roughly the same frequencies (43% for cattle and 42% for caprines), but there is a slight change of the situation in the next two phases: during Phase II, caprines form the most abundant species (46%), while cattle falls by almost 3% of its former percentage (40%). During Phase III caprine frequencies rise to 50% while cattle frequencies drop to 36%. It therefore seems that, with time, sheep and goat proportions increased while cattle proportions dropped. *Chi*^{2} tests were also conducted to test whether the differences between phases in cattle and caprine representation were statistically significant. The tests indicated that the two taxa representation is significantly different between Phases I-II (p= .015) and that it is highly different between Phases II-III (p= .003). Pigs are the least common of the three main domesticates. They are, however, consistently represented throughout the three main phases, with negligible differences between phases.

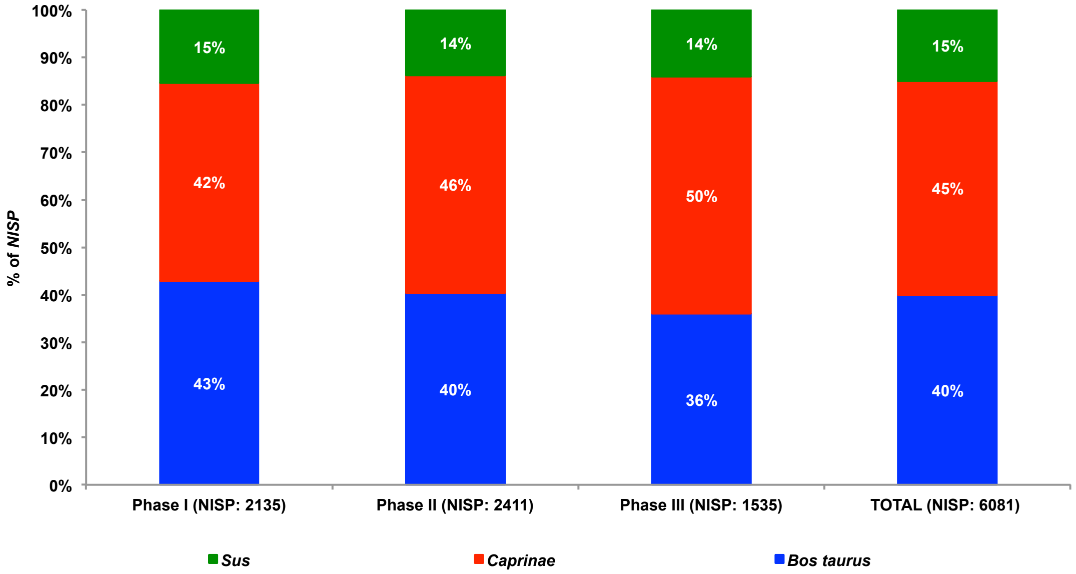

Figure 5.7: Three main domesticates; comparison between phases. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Table 5.21. *NISP* counts.

Attribution of specimens to either sheep or goat presented a certain level of difficulty. Regardless of the fact that the osteomorphological characteristics of a number of postcranial bones and teeth were used for the distinction of the two closely related species[8], the vast majority of caprine remains were not identified to the finest taxonomical level; these were recorded to the level of subfamily (sheep/goat). Of those fragments that were identified as either sheep or goat, the majority belonged to sheep considering all three phases (79% during Phase I, 82% during Phase II and 83% during Phase III; ***Table 5.22; Figure 5.8***). Once again, *Chi*^{2} tests were conducted in order to test whether the differences between phases in sheep and goat representation were statistically significant; these indicated that sheep and goat representation is not significantly different between Phases I-II (p= .47) as well as Phases II-III (p= .66). Further implications on the economic importance of these two closely related species will be assessed in other parts of the current analysis (see also ***5.7.2* – Caprinae *age-at-death***).

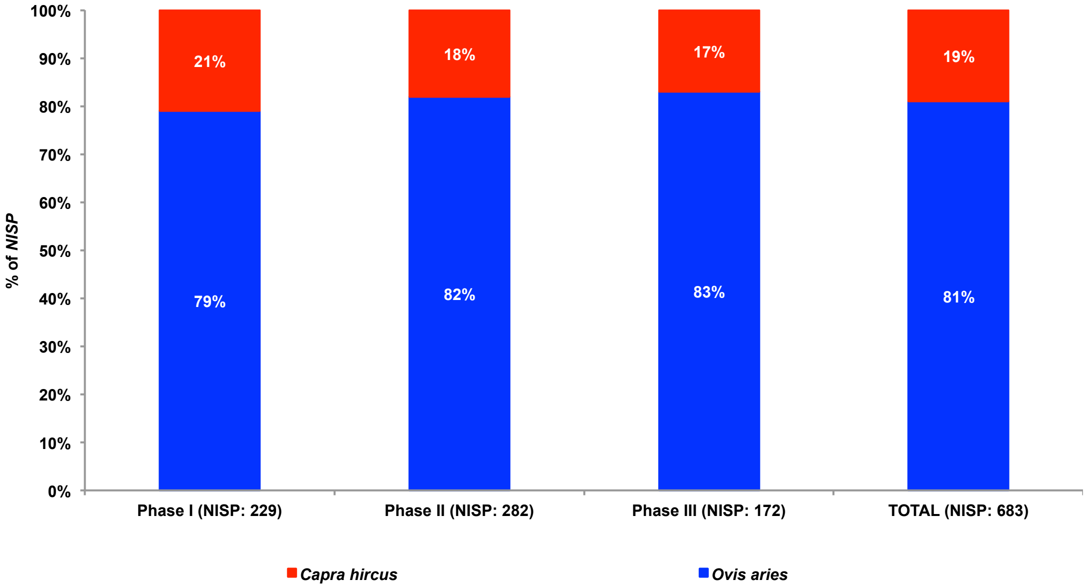

Figure 5.8: *Ovis aries* (sheep) vs. *Capra hircus* (goat); comparison between phases. Data in Table 5.22. *NISP* counts.

Dog remains tend to appear in low frequencies in Greek Neolithic contexts (Trantalidou 2006). This is also the case for Promachon, where dogs are represented with the same number of fragments during Phases I and II

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[8] For an overview of which caprine bones and teeth were regularly identified to species, see also ***4.2* – *Identification***.

(*NISP*: 48 respectively) and 28 fragments during Phase III. Their frequencies remain stable during all Phases (2% among domesticates, and 2% among all species identified).

Species frequencies for the three main domesticates calculated through *MNI* are not entirely consistent with those deriving from *NISP* (***Table 5.23***). The main difference is that caprines are substantially better represented when *MNI*s are considered (***Figure 5.9***). This difference between the two quantification systems represents a much-expected pattern due to the well-known effects of recovery bias. Anatomical elements deriving from smaller taxa such as sheep/goats (and pigs) are underrepresented in terms of *NISP* (a pattern already highlighted in ***Figures 5.2-5.3***), which leads to their under-representation (in comparison to cattle) in *NISP* counts. *MNI* counts are less affected by this bias as they only rely on the most common element.

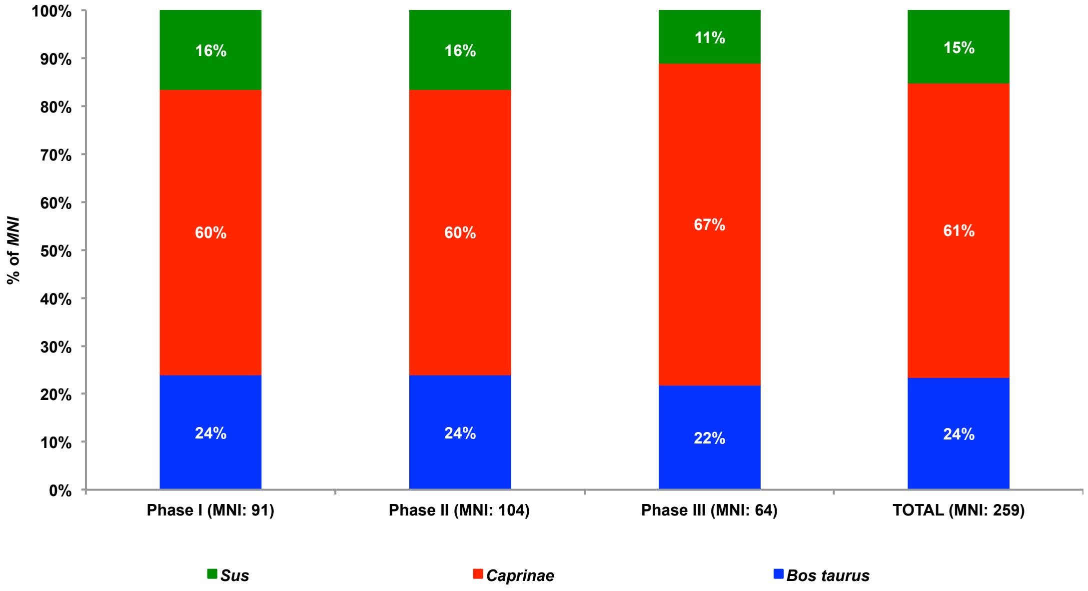

Figure 5.9: Three main domesticates; comparison between phases. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Table 5.23. *MNI* counts.

It is therefore argued that it would be wrong to assume that *NISP* provides an accurate estimate on the frequency of species since it is seriously affected by differential recovery, a major factor in the formation of the Promachon assemblage. When *MNI*, which is less affected by recovery bias is taken into account, cattle frequencies are severely reduced while sheep/goat frequencies increase. Although by no means perfect, the *MNI* probably provides a more accurate estimate of the frequency of species (Albarella 1999; Johnstone and Albarella 2002), at least in assemblages that are substantially affected by recovery bias. *MNI* frequencies are generally closer to frequencies of *NISP* from sieved assemblages than hand-collected ones (Albarella *et al.* 1997), such as the Promachon assemblage. This would also indicate that the *MNI* count reduces the effects of recovery bias created by *NISP*.

Since a substantial number of studied and published faunal assemblages from contemporary sites have used *NISP* (rather than *MNI*) as the main predictor of taxonomic frequency, we will also use it for comparative purposes later on in the current thesis.

In terms of diachronic trends, *MNI* counts are roughly consistent with the indications provided by *NISP*. The increase in caprine frequencies through time is confirmed, although, according to *MNI*, it does not emerge until Phase III, and this is not just at the expenses of cattle, but also pig. By combining the evidence of the two quantification systems therefore, the only safe conclusion to be drawn is the slight increase in the relative abundance of caprines through time.

Among wild taxa, cervids constitute the most common family and they are found in all habitation layers in Promachon sector (see also ***Table 5.20***). Red deer (***Plate 1***)[9] is represented with a total of 113 fragments (30 fragments during Phase I, 43 fragments during Phase II, 15 fragments during Phase III and 25 fragments deriving from mixed deposits). Roe deer, which is less frequent than red deer in almost all prehistoric sites in temperate Europe (Bökönyi 1986), is represented with a total of 39 fragments (10 fragments during Phase I, 15 fragments during Phase II, 9 fragments during Phase III and 5 fragments deriving from mixed deposits). The presence of the fallow deer in Promachon's faunal assemblage confirms previous claims of the

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[9] Plates are included in ***Appendix B***.

species reintroduction in the area of Greek Macedonia during the Late Neolithic, after its extinction due to hunting pressure by the end of the Lower Paleolithic (Bökönyi 1986; Curci and Tagliacozzo 2003; Yiannouli and Trantalidou 1999). Fallow deer remains are represented with a total of 11 fragments (2 fragments during Phase I, 6 fragments during Phase II, 1 fragment during Phase III and 2 fragments deriving from mixed deposits).

Less common than cervids, but frequently represented in Promachon, are the brown hare (***Plate 2***) and the red fox; both species are frequently encountered in Greek prehistoric sites. While the brown hare appears as early as the Early Paleolithic in Greece, the earliest remains of the red fox derive from the Pre-ceramic Neolithic (Bökönyi 1986; Yiannouli 2003); In Promachon, brown hare is represented with 23 fragments in total (8 fragments during Phase I, 7 fragments during Phase II, 6 fragments during Phase III and 2 fragments deriving from mixed deposits), whereas red fox is represented with a total of 32 fragments (16 fragments during Phase I, 8 fragments during Phase II, 7 fragments during Phase III and 1 fragment deriving from mixed deposits).

The deposits of Phase I have also yielded a right maxilla of a senile wild boar containing the tusk and the first, second, third and fourth premolars. The presence of the wild boar is reported from almost all contemporary to Promachon sites across Macedonia (*e.g.* Sitagroi: Bökönyi 1986; Stavroupoli: Yiannouli 2002a; 2004). In Promachon however, apart from the maxilla, no pig postcranial elements presented the dimensional characteristics necessary for their attribution to the wild form. Nevertheless, the significance of the species will be further assessed later in this thesis (see also ***5.10.3* – Sus *size***). Chamois, whose presence is extremely rare in Greek Neolithic sites since the species was pushed to high-altitude mountain areas as a result of hunting pressure by the end of the Lower Paleolithic (Bökönyi 1986), is represented in Phase I with a single specimen (first phalanx); the species' presence was also reported by Bökönyi (1986) in his study of the faunal material from the nearby site of Sitagroi.

Eurasian lynx remains are among the scarcest finds in Greek faunal assemblages (Yiannouli 2003): lynx pesence was reported from two sites contemporary to Promachon: Dikili Tash (Julien 1992; Helmer 1997) and Dimitra (Yiannouli 1994; 1997) in Eastern Macedonia. At Promachon, the Eurasian Lynx is represented in Phase I by a single fragment of a distal humerus.

Brown bear remains are frequently reported from sites in Northern Greece (Yiannouli 2003; 2013). Apart from Dikili Tash, brown bear remains have been reported from Sitagroi (Bökönyi 1986), Vasilika (Yiannouli 1994), Stavroupolis (Yiannouli 2002a), and Servia (Watson 1979a). Mountainous regions of the Balkans with dense forest surroundings, such as the area around Promachon provided an excellent habitat for the species. Brown bear is represented in Phase I by three fragments, a proximal radius, a third metacarpal (***Plate 3***) and a proximal ulna.

The family of Mustelids (*Mustelidae*) is represented with four species: European badger, polecat, stoat and beech marten. The badger is the most frequently occurring mustelid in Greek prehistoric faunal assemblages (Yiannouli 2003). The current distribution of the species covers an area from mainland Greece to the island of Crete. At Promachon, the badger is represented in Phases I and III by two ulnae (***Plate 4***). Although the presence of the polecat during historic times is well documented, only recently it has been reported in Macedonian Neolithic faunal assemblages (Dikili Tas: Helmer 1997). At Promachon, the polecat is present in Phase I with a single mandible containing the fourth premolar and first molar. The deposits of Phase III have also yielded a stoat mandible containing the fourth premolar and the first and second molars as well as a distal tibia of a beech marten. The latter species is also represented in the mixed deposits with a mandible containing the first and second molars.

Bird bones are extremely scarce. Only nine fragments were identified down to the level of species: the rough-legged buzzard and the common raven are represented during the second phase of occupation with two proximal ulnae respectively. In addition, a distal tarsometatarsus, a proximal scapula and a proximal ulna were attributed to the greylag goose, while a proximal scapula was attributed to a common crane. All four fragments belong to the first phase of occupation. The deposits of Phase II have also yielded a single distal carpometacarpus of a bird, which, due to its poor preservation, could not be identified to any taxonomic level.

Reptiles, fishes and molluscs are also present in the assemblage with ‘non-countable’ elements. Reptiles are represented in Phase II by a carapace fragment of a tortoise. Molluscs are also represented in Phases I and II by one shell of a snail respectively. The deposits of Phase II have also yielded four vertebrae and a spine of a catfish, and three vertebrae of a species belonging to the family of minnows.

Modern human is represented in Phase I with two specimens (a proximal scapula and a proximal radius) and in Phase II with one specimen (a proximal ulna); the mixed deposits have also yielded a proximal scapula (glenoid cavity). The presence of human remains in the faunal assemblage is rather interesting; there are a number of possible reasons that could potentially explain this presence, however, these will be further discussed later in this thesis (see also ***7.4.4 – Human remains***).

Table 5.24 presents the relative frequency of all species - in terms of the Minimum Number of Individuals (*MNI*) - on a phase-by-phase level.

Table 5.20: Species representation: undisturbed and mixed deposits. Each recorded bone, maxillae/mandibles and loose teeth are given a *NISP* value of one. *Caprinae* subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). *Testudinidae*, *Siluris glanis*, *Cyprinidae* and *Murex trunculus* are represented in the faunal material with 'non-countable' elements. Data for Figure 5.6. *NISP* counts.

SPECIES	***Undisturbed Deposits***														***Mixed Deposits***				***TOTAL***	***% TOTAL***
	Late Neolithic I								***Late Neolithic II***											
	***Phase I** (Layers 6, 5, 4)*				***Phase II** (Layers 3, 2)*				***Phase III** (Layer 1)*				***Total***	***%Total***						
	NISP		***Total***	***%Total***	***NISP***		***Total***	***%Total***	***NISP***		***Total***	***%Total***			***NISP***		***Total***	***%Total***		
	Bones	***Teeth***			***Bones***	***Teeth***			***Bones***	***Teeth***					***Bones***	***Teeth***				
Bos taurus	623	295	**918**	**40%**	671	304	**975**	**38%**	354	197	**551**	**34%**	**2444**	**38%**	194	100	**294**	**36%**	**2738**	**38%**
Caprinae	428	460	**888**	**39%**	487	616	**1103**	**43%**	293	474	**767**	**48%**	**2758**	**43%**	150	189	**339**	**41%**	**3097**	**43%**
(Ovis aries)	(108)	(73)	**(181)**		(151)	(79)	**(230)**		(90)	(53)	**(143)**		**(554)**		(41)	(23)	**(64)**		**(618)**	
(Capra hircus)	(20)	(28)	**(48)**		(30)	(22)	**(52)**		(14)	(15)	**(29)**		**(129)**		(10)	(8)	**(18)**		**(147)**	
Sus	230	99	**329**	**14%**	226	107	**333**	**13%**	134	83	**217**	**14%**	**879**	**14%**	82	57	**139**	**17%**	**1018**	**14%**
Canis familiaris	20	28	**48**	**2%**	34	14	**48**	**2%**	12	16	**28**	**2%**	**124**	**2%**	6	7	**13**	**1%**	**137**	**2%**
Total Domesticated	1301	882	**2183**	**95%**	1418	1041	**2459**	**96%**	793	770	**1563**	**98%**	**6205**	**97%**	432	353	**785**	**96%**	**6990**	**97%**
Cervus elaphus	19	11	**30**		33	10	**43**		11	4	**15**		**88**		17	8	**25**		**113**	
Dama dama	2		**2**		5	1	**6**		1		**1**		**9**		2		**2**		**11**	
Capreolus capreolus	8	2	**10**		13	2	**15**		8	1	**9**		**34**		5		**5**		**39**	
Lepus europaeus	8		**8**		6	1	**7**		6		**6**		**21**		2		**2**		**23**	
Vulpes vulpes	13	3	**16**		5	3	**8**		4	3	**7**		**31**			1	**1**		**32**	
Rupicapra rupicapra	1		**1**										**1**						**1**	
Sus scrofa		1	**1**										**1**						**1**	
Lynx lynx	1		**1**										**1**						**1**	
Ursus arctos	3		**3**										**3**						**3**	
Meles meles	1		**1**						1		**1**		**2**						**2**	
Mustela putorius		1	**1**										**1**						**1**	
Mustela erminea										1	**1**		**1**						**1**	
Martes foina									1		**1**		**1**			1	**1**		**2**	
Buteo lagopus					2		**2**						**2**						**2**	
Anser anser	3		**3**										**3**						**3**	
Grus grus	1		**1**										**1**						**1**	
Corvus corax					2		**2**						**2**						**2**	
Aves (indet.)					1		**1**						**1**						**1**	
Total Wild	60	18	**78**	**5%**	67	17	**84**	**4%**	32	9	**41**	**2%**	**203**	**3%**	26	10	**36**	**4%**	**239**	**3%**
Domesticated and Wild	1361	900	**2261**	**100%**	1485	1058	**2543**	**100%**	825	779	**1604**	**100%**	**6408**	**100 %**	458	363	**821**	**100%**	**7229**	**100%**
Cervus/Bos	12		**12**		27	2	**29**		9		**9**		**50**		6		**6**		**56**	
Cervus/Dama	1		**1**		6		**6**		2		**2**		**9**		1		**1**		**10**	
Ovis/Capra/Capreolus	8	1	**9**		14		**14**		18		**18**		**41**		6		**6**		**47**	
Canis/Vulpes	2	1	**3**		6	3	**9**		2		**2**		**14**			1	**1**		**15**	
Homo sapiens	2		**2**						1		**1**		**3**		1		**1**		**4**	
TOTAL	1386	902	**2288**		1538	1063	**2601**		856	780	**1636**		**6525**		471	365	**836**		**7361**	
PRESENCE STATED																				
Testudinidae					*Present (non-countable)*															
Siluris glanis					*Present (non-countable)*										*Present (non-countable)*					
Cyprinidae	*Present (non-countable)*				*Present (non-countable)*															
Murex trunculus	*Present (non-countable)*				*Present (non-countable)*															

Table 5.21: Three main domesticates; comparison between phases. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.7. *NISP* counts.

Three Main Domesticates	***Late Neolithic I***				***Late Neolithic II***		***TOTAL***	
	Phase I *(Layers 6, 5, 4)*		***Phase II*** *(Layers 3, 2)*		***Phase III*** *(Layer 1)*			
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Bos taurus	*918*	*43%*	*975*	*40%*	*551*	*36%*	*2444*	*40%*
Caprinae	*888*	*42%*	*1103*	*46%*	*767*	*50%*	*2758*	*45%*
Sus	*329*	*15%*	*333*	*14%*	*217*	*14%*	*879*	*14%*
TOTAL	***2135***	***100%***	***2411***	***100%***	***1535***	***100%***	***6081***	***100%***

Table 5.22: *Ovis aries* (sheep) vs. *Capra hircus* (goat); comparison between phases. Data for Figure 5.8. *NISP* counts.

Caprinae	***Late Neolithic I***				***Late Neolithic II***		***TOTAL***	
	Phase I *(Layers 6, 5, 4)*		***Phase II*** *(Layers 3, 2)*		***Phase III*** *(Layer 1)*			
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Ovis aries	*181*	*79%*	*230*	*82%*	*143*	*83%*	*554*	*81%*
Capra hircus	*48*	*21%*	*52*	*18%*	*29*	*17%*	*129*	*19%*
TOTAL	***229***	***100%***	***282***	***100%***	***172***	***100%***	***683***	***100%***

Table 5.23: Three main domesticates; comparison between phases. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.9. *MNI* counts.

Three Main Domesticates	***Late Neolithic I***				***Late Neolithic II***		***TOTAL***	
	Phase I *(Layers 6, 5, 4)*		***Phase II*** *(Layers 3, 2)*		***Phase III*** *(Layer 1)*			
	MNI	***%***	***MNI***	***%***	***MNI***	***%***	***MNI***	***%***
Bos taurus	*22*	*24%*	*25*	*24%*	*14*	*22%*	*61*	*24%*
Caprinae	*54*	*60%*	*62*	*60%*	*43*	*67%*	*159*	*61%*
Sus	*15*	*16%*	*17*	*16%*	*7*	*11%*	*39*	*15%*
TOTAL	***91***	***100%***	***104***	***100%***	***64***	***100%***	***259***	***100%***

Table 5.24: Species representation: only undisturbed deposits are considered. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). *MNI* counts.

Species	*Late Neolithic I*				*Late Neolithic II*		*TOTAL*	
	Phase I *(Layers 6, 5, 4)*		*Phase II* *(Layers 3, 2)*		*Phase III* *(Layer 1)*			
	MNI	*%*	*MNI*	*%*	*MNI*	*%*	*MNI*	*%*
Bos taurus	*22*	***20%***	*25*	***21%***	*14*	***18%***	***61***	***20%***
Caprinae	*54*	***49%***	*62*	***52%***	*43*	***56%***	***159***	***52%***
Sus	*15*	***14%***	*17*	***14%***	*9*	***12%***	***41***	***13%***
Canis familiaris	*4*	***4%***	*4*	***3%***	*3*	***4%***	***11***	***4%***
Total Domesticated	***95***	***87%***	***108***	***90%***	***69***	***90%***	***272***	***89%***
Cervus elaphus	*1*		*2*		*1*		***4***	
Capreolus capreolus	*2*		*2*		*1*		***5***	
Dama dama	*1*		*1*		*1*		***3***	
Lepus europaeus	*2*		*1*		*1*		***4***	
Vulpes vulpes	*2*		*2*		*1*		***5***	
Rupicapra rupicapra	*1*						***1***	
Sus scrofa	*1*						***1***	
Lynx lynx	*1*						***1***	
Ursus arctos	*1*						***1***	
Meles meles	*1*				*1*		***2***	
Mustela putorius	*1*						***1***	
Mustela erminea					*1*		***1***	
Martes foina					*1*		***1***	
Buteo lagopus			*1*				***1***	
Anser sp.	*1*						***1***	
Grus sp.	*1*						***1***	
Corvus corax			*1*				***1***	
Aves (indet.)			*1*				***1***	
Total Wild	***16***	***13%***	***11***	***10%***	***8***	***10%***	***35***	***11%***
Domesticated & Wild	***111***	***100%***	***119***	***100%***	***77***	***100%***	***307***	***100%***

5.4 – The human agent: butchery and burning

The preceding analysis, while recognizing that gnawing by carnivores (and pigs) played a significant role in the formation of the faunal assemblage, suggested that most of the bones represent material discarded by humans after some form of carcass processing for marrow extraction took place (see also ***5.2.3 – Fragmentation***). In the following analysis, carcass processing is explored using more direct types of evidence, such as the incidence of butchery (cut marks and chopping marks) and burning.

Because of the good preservation of the Promachon faunal material, butchery marks and burning could relatively easily be detected. ***Table 5.25*** presents the incidence of butchery marks and burning on the cranial elements (maxillae, mandibles and loose teeth) of the three main domesticates, dog and red deer. Chopping marks are present in a number of cattle, caprine and pig mandibles; more specifically, chopping marks were inflicted on the lower part of the mandible - beneath the tooth root line - suggesting marrow extraction (***Plate 5***). A number of chopped cattle, caprine and pig mandibles presented traces of burning, most likely to facilitate the extraction of marrow. Additionally, cut marks inflicted on the articular process (*ramus mandibulae*) of four dog mandibles are most likely suggestive of skinning (Binford 1981) (***Plate 6***).

Almost 5% of the total ‘countable’ postcranial fragments recorded, presented butchery marks (***Table 5.26***). The latter were observed on the postcranial bones of cattle, caprines, pig, dog, red deer and roe deer. Their absence from fallow deer is very likely to be the result of small sample size. This frequency is higher than that recorded in the Late Neolithic cave on the east bank of the river Aggitis, where less than 1% of the total postcranial bones presented any traces of butchery (Trantalidou *et al.* 2006). However, in the Late Neolithic settlement of Dimitra, butchery marks are present on 6% of the total postcranial bones (Yiannouli 1997).

Tables 5.27-5.30 present the incidence of cut marks and chopping marks on the postcranial bones of cattle, caprines, pig and dog on a phase-by-phase level; cut marks and chopping marks on the postcranial bones of red deer and roe deer were very few, and consequently, these two species are of necessity treated together (*Cervidae*; ***Table 5.31***). ***Figure 5.10*** provides details of the incidence of cut marks and chopping marks on the postcranial bones of the three main domesticates at a phase-by-phase level (***Plates 7-10***).

The overall frequency of butchery marks does not outstandingly differ between cattle, caprines and pigs. Butchery marks were recorded on about 6%, 4% and 5% of cattle, caprine and pig postcranial elements respectively. Chopping marks are represented with a higher frequency than cut marks in all three main domesticates during Phases I and II (and consequently for the whole cultural sequence of the Late Neolithic); this is rather unusual, as we would normally expect a greater difference in chopping between cattle and other species. The large size of the cattle body requires the use of heavy tools in order to divide it into a large number of portions for processing. On the other hand, we would normally expect cut marks to be more frequent than chopping marks on caprine and pig bones: in most prehistoric faunal assemblages, carcasses of small animals such as caprines and pigs were usually dismembered using flints and stone tools to cut through the tendons and joints. However, this is not the case at Promachon, since cut marks are much less common than chopping marks.

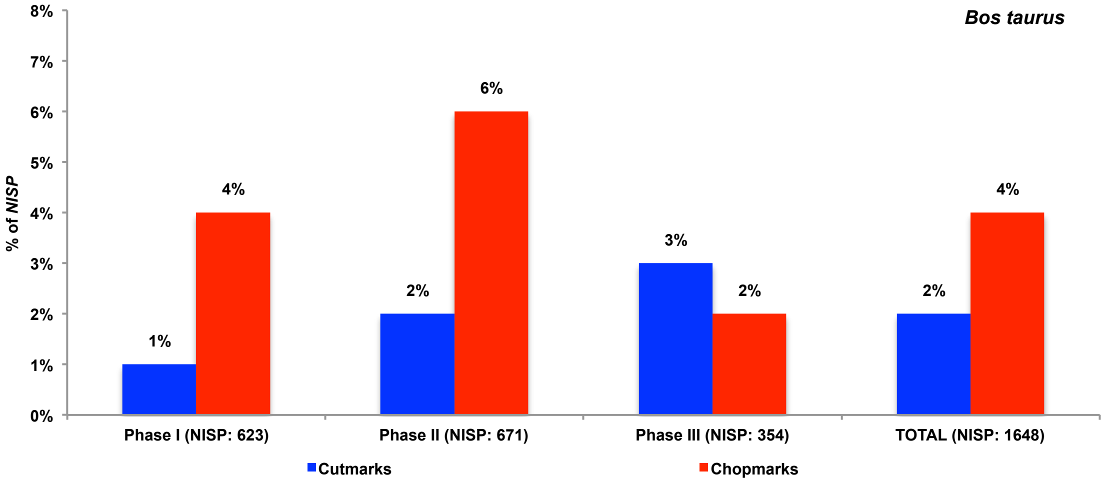
Carnivore gnawing could be a possible reason for the obliteration of cut marks from the postcranial bones of caprines and pigs during Phases I and II; cut marks resulting from dismembering tend to be concentrated around bone articulations, which are particularly vulnerable to carnivore attrition. However, as we have already seen, the frequency of gnawing at Promachon is relatively low (see also ***5.2.1 – Preservation***); gnawing, therefore, cannot be considered as the main reason for the low frequency of cut marks. It must also be considered that bone surface preservation is generally good at Promachon. It is therefore suggested that the small number of cut marks on the postcranial bones of the Promachon animals is most likely to be the result of the processing of animal carcasses in large chunks (or even whole) as a consequence of communal consumption.

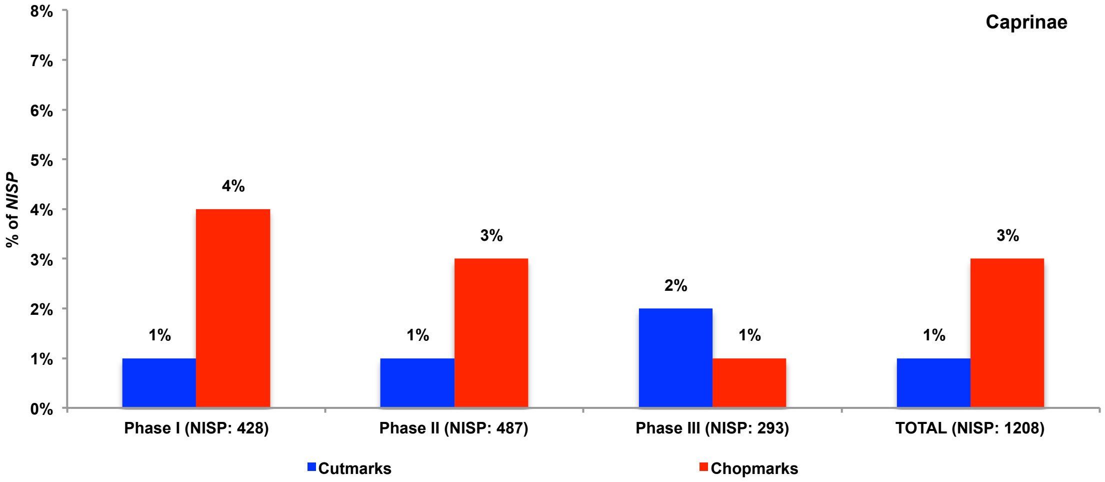
Another interesting pattern is that cut marks are represented with a higher frequency than chopping marks on the postcranial elements from the deposits associated with Phase III. This is observed on the postcranial bones of all three main domesticates, which supports the view that the pattern is genuine, and that during Phase III heavy tools and objects were not used as regularly.

This is rather unusual and requires some explanation. As previously noted [see also ***2.3.3 – Phase III (Layer 1)***], evidence of copper smelting is of particular interest in Promachon sector and it is documented in the deposits of Phase III (Koukouli-Chrysanthaki *et al.* 2000; 2007; Koukouli-Chrysanthaki and Basiakos 2002). In the light of this evidence, one would argue that during this time-period, metal tools and knives were most likely to have been implemented at Promachon; these new metal tools could have replaced heavy tools and objects that were used during the previous phases (Phases I and II), and could potentially explain the high frequency of cut marks rather than chopping marks on the postcranial bones of the three main domesticates during Phase III.

The origins of metallurgy, and thus, the use of metal tools have long intrigued archaeologists. However, still very little is known about their rate of adoption (Greenfield 1999). In general, monitoring the importance of metal tools has been restricted to inferential suppositions based on their absence. This is also the case for Promachon, where no metal tools were eventually recovered. The argument therefore for the possible use of metal tools and objects in Promachon is based solely on the presence of a clay crucible with traces of copper extraction [and also traces of slag (Koukouli-Chrysanthaki *et al.* 2007)] during Phase III. There are a number of arguments that could potentially explain the absence of metal tools from the deposits of Phase III: these could have been either recycled by their users, or deteriorated in their post-depositional contexts, or deliberately deposited somewhere. However, we should not exclude also the possibility that metal tools might have been very few in Promachon, and therefore it is just chance that they have not been found. If this is the case, then it is highly likely that metal tools might have been regarded as prestigious items and therefore not used for 'humble', mundane, everyday tasks. In addition, there is also the possibility that the high frequency of cut marks during Phase III is the result of the use of small stone tools and flints, rather than metal tools, which as previously noted were not found on site. In any case, it should be noted, that no attempt has been made to identify metal *vs.* stone cut marks. Tool manufacturing is currently being investigated by a tool specialist (Rozalia Christidou pers. comm.), who may test such hypothesis in the near future.

There is a further issue, which should also be considered. It is highly possible that the higher number of cut marks during Phase III might be related with the more intensive butchery of animal carcasses, possibly for household consumption. This leads to the assumption that there was an increase in household-based eating during the third phase of occupation in Promachon. In other words, it is possible that during Phases I and II animal carcasses were processed in large chunks possibly for consumption by large social groups, whereas in Phase III, animal carcasses were butchered more intensively, possibly for household consumption. This issue will be further discussed later in the current thesis (see also ***Chapter 7 – Synthesis***).





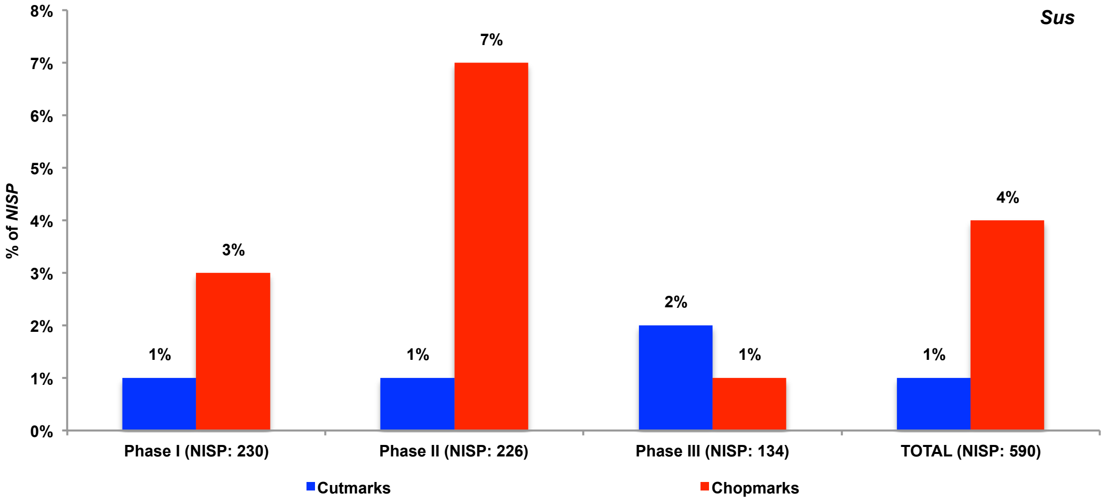


Figure 5.10: Incidence of butchery (cut marks and chopping marks) on the postcranial bones of the three main domesticates on a phase-by-phase level. The *Caprinae* subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Tables 5.27-5.29. *NISP* counts.

5.4.1 – The three main domesticates

Tables 5.32-5.35 present the anatomical distribution of butchery marks for the three main domesticates and cervids, while ***Figures 5.11-5.13*** present the percentage of cattle, caprine and pig anatomical elements displaying butchery marks.

Figure 5.11 shows that scapula, humerus, radius, tibia and the metapodials were the postcranial bones with the higher percentage of butchery in cattle. Of interest is the fact that patterns of butchery seem to be different between cattle forelimbs and hind limbs. The high frequency of butchery marks on cattle humeri suggests an emphasis on the upper limbs of the forelimbs; on the other hand, the high frequency of butchery marks on cattle metatarsals suggests an emphasis on the lower limbs of the hind limbs. The pattern is rather complicated and butchery in cattle postcranial bones seems to be a combination of both dismemberment and fracturing for marrow extraction. More specifically, most of the cut marks were inflicted on the articulations between scapula and humerus, most likely in order to severe the tendons.

Chopping marks on the other hand, were inflicted on almost all cattle postcranial bones. Transverse chopping marks, which may well have been inflicted in breaking the bone for marrow, were observed on the mid shafts of three humeri and two tibiae. Otherwise, characteristic examples of fracturing bones for marrow extraction were not observed, but such a diagnosis can only be attempted in extremely obvious cases. Analysis of the incidence of fragmentation, however, suggests that most cattle long bones were fractured during human extraction for marrow. Of particular interest is that no traces of cut marks were detected on cattle metapodials; this is rather strange, as evidence of skinning is implied by transverse knife marks on a single astragalus, four calcanei and eleven first phalanges.

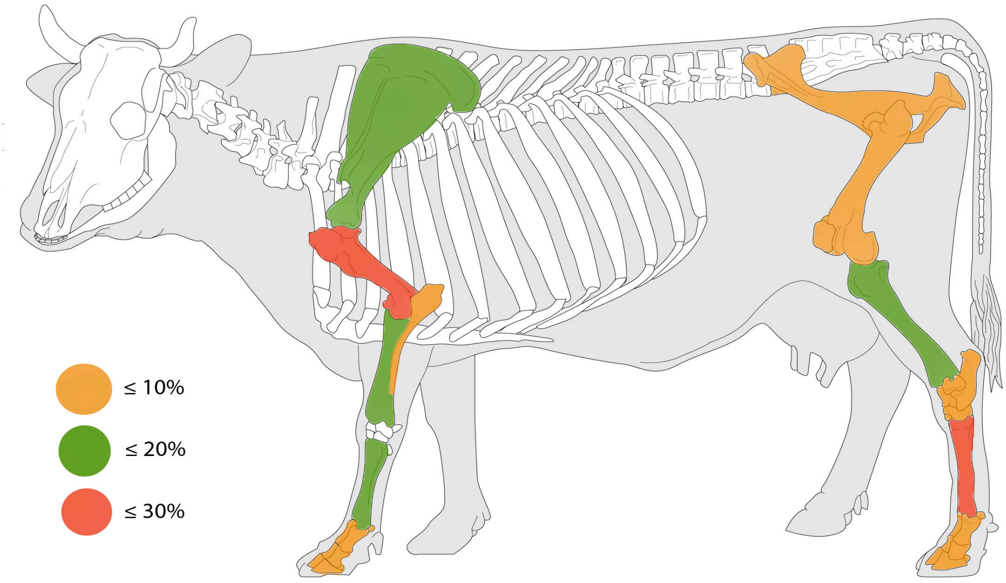


Figure 5.11: Percentage of *Bos taurus* (cattle) postcranial bones displaying butchery marks (chopping marks and cut marks). All phases are considered. Data in Table 5.32. *NISP* counts.

Since the overall frequency of butchery on the postcranial bones of caprines is considerably low, only tentative considerations can be made. The anatomical distribution of butchery marks indicates an emphasis on hind limbs (***Figure 5.12***), which may be related to greater amount of meat carried by the hind limb. The anatomical elements of the caprine skeleton with the higher percentage of butchered bones were the femur and the tibia. On the other hand, forelimb bones with the higher frequency of butchery marks were the distal humerus and the proximal radius; the cut marks inflicted on the latter anatomical elements possibly indicate the practice of the separation of the upper from the lower forelimb. Cut marks were also present on a single astragalus and a single calcaneum; these could possibly be associated with the practice of skinning. Last but not least, chopping marks on a single axis suggest the removal of the head.

Traces of butchery were not possible to be detected on other caprine postcranial bones, but this is most likely to be the result of both fragmentation and recovery bias.

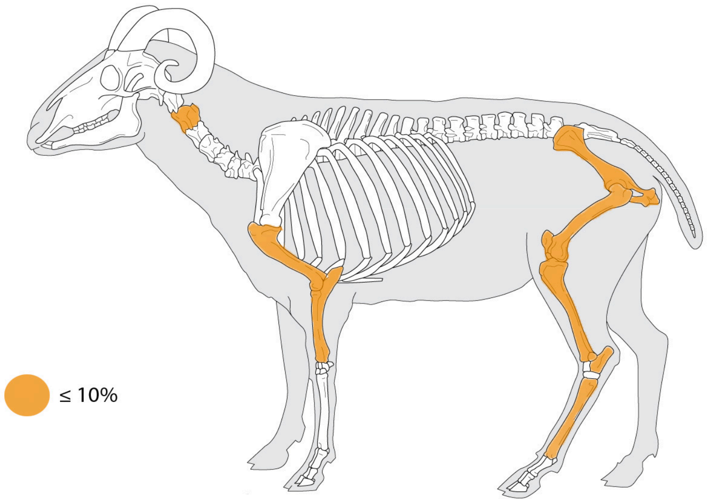


Figure 5.12: Percentage of Caprinae (sheep/goat) postcranial bones displaying butchery marks (chopping marks and cut marks). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). All phases are considered. Data in Table 5.33. *NISP* counts.

The young age profile of pig may be the reason for the low frequency of postcranial bones presenting any butchery marks (***Figure 5.13***). Unlike caprines, there is no reason to suggest a particular emphasis in either forelimbs or hindlimbs. Pig postcranial bones displaying the highest percentages of butchery marks were the humerus and the tibia. Chopping marks on a single atlas also suggest that the head was severed, as in the case of the caprine example.

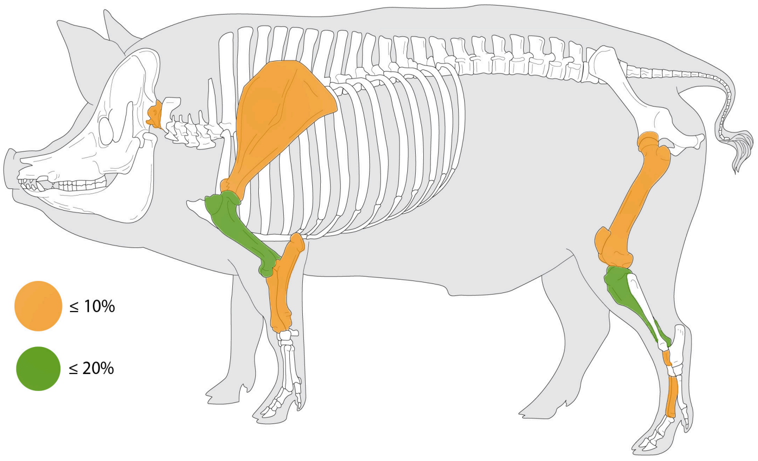


Figure 5.13: Percentage of *Sus* (pig) postcranial bones displaying butchery marks (chopping marks and cut marks). All phases are considered. Data in Table 5.34. *NISP* counts.

5.4.2 – Other mammals

In general, cynophagy (*i.e.* eating dog meat) is considered to have been a common practice during the whole of prehistory. Comparative data from northern Greece indicate that dogs were used as a source of protein as early as the Early Neolithic [*i.e.* Achilleion (Bökönyi 1989)]. However, zooarchaeological analyses of the age distribution of dogs indicate their secondary role as meat animals, since very few bones from juvenile and sub adult individuals were eventually recovered (Trantalidou 2006). Primarily, dogs seem to have been used in hunting, or as watchdogs (Bökönyi 1986; 1989).

At Promachon, cut marks on dog mandibles (*ramus mandibulae*) are scarce and as previously stated, these occur only in four cases. However, as Gejvall (1969) notes, knife marks on dog mandibles, most likely suggestive of skinning, do not fully support the argument that dog meat was eaten, unless traces of butchery also occur on other anatomical parts such as the humerus and the pelvis. At Promachon, butchery marks on dog postcranial elements were scarce, since only a single dog calcaneum bears traces of chopping marks. This however, does not disprove the idea that dogs could have been eaten, especially if we consider that dog carcasses were not disposed of away from the site, but were dismembered, and their bones were fragmented in the same way as those of the other domestic animals. In other words, the distribution and the fragmentation of dog anatomical elements - despite the lack of intensive butchery marks - supports the argument that these represent food refuse.

It is quite possible that dog meat occasionally supplemented the meat diet of the community, a fact that largely conforms to the evidence obtained thus far from other contemporary settlements in Greek Macedonia [*i.e.* Dimitra (Yiannouli 1997), Sitagroi (Bökönyi 1986) and Thermi (Yiannouli 1989)].

Evidence of butchery in cervids is rather scarce, due to the low frequency of bones of these animals in the faunal assemblage. Only two radii, an ulna and a metatarsal display evidence of chopping marks; on the other hand, a calcaneum and three phalanges display evidence of cut marks, most likely suggestive of skinning.

5.4.3 – Burning

Almost 7% of the total ‘countable’ postcranial bones bear traces of burning (***Table 5.36***). However, as previously noted (see also ***4.6 – Pathology, gnawing, burning and butchery***) the incidence of burning at Promachon could be underestimated since the discrimination between burned and oxidized material was difficult in some cases (due to staining on bones by manganese and/or iron oxides). Nevertheless, the frequency of burning at Promachon is higher than that from other contemporary sites in Macedonia. For instance, burning has been recorded only on 1% of the total postcranial elements from the Late Neolithic cave on the East bank of the river Aggitis (Trantalidou *et al.* 2006). In addition, burning at the Late Neolithic site of Stavroupoli (Yiannouli 2002a; 2004) was recorded on 2% of the total postcranial bones. However, the incidence of burning in the Late Neolithic settlement of Kryoneri (Mylona 1997) is significantly higher than that from Promachon, since it has been recorded on almost 17% of the total postcranial bones.

Burning traces were observed on the postcranial bones of cattle, caprines, pig, dog, red deer, roe deer and hare. The burnt bones were generally black and/or brown. Just 8% (105 postcranial fragments), 6% (90 postcranial fragments) and 8% (72 postcranial fragments) of the total postcranial bones presented traces of burning in Phases I, II and III respectively. In addition, the overall frequency of burning does not substantially differ between cattle (6%), caprines (9%) and pigs (8%) (***Tables 5.37-5.39***).

The incidence of burned bones is a much contentious issue in almost all archaeological sites; there are a number of reasons that could be associated with the burning of the bones at Promachon. Undoubtedly, we should have expected a higher frequency of burned bones in Phase I than later phases, since the archaeological evidence suggests that a conflagration event took place in Promachon at the end of Phase I [see also ***2.3.1 – Phase I (Layers 4-11)***]. It seems however, that the fire incident during this phase did not substantially affect the discarded bone material and the bones were ultimately protected from fire. It is possible therefore that some bones were either buried relatively soon after disposal (the latter argument is also corroborated by the low incidence of scavenger gnawing, see also ***5.2.1 – Preservation***), or that the fire during Phase I was not too long-lived to inflict substantial burning of the bones. In any case, the presence of a number of calcined bones [implying their exposure to very high temperatures, or to a source of heat for a prolonged period of time (Gilchrist and Mytum 1986)] is not limited only to Phase I (8%): calcined bones are present also in Phases II (6%) and III (9%). Therefore, even in Phase I, their presence should not necessarily be related to a fire that destroyed the settlement.

One could also argue that the burned bones were the result of cooking activities. Again, the presence of a number of calcined bones does not conform to this argument, simply because the meat would have become completely burned, and therefore inedible. However, we should by no means exclude the possibility that some of the burning traces - especially bones, which were recorded as singed - were inflicted during food preparation. In addition, as in the case of mandibles, a number of postcranial bones might have been intentionally heated on a fire, before eventually being broken up to extract the marrow (Binford 1981). Such practice can, however, only be directly demonstrated in three cases (two cattle humeri and a caprine tibia). It is likely that the bulk of the burned bones represent material that ended up in the fire accidentally, or were randomly thrown in a fire, suggesting unsystematic waste disposal practices.

Table 5.25: Evidence of butchery and burning on the cranial elements of *Bos taurus* (cattle), Caprinae (sheep/goat), *Sus* (pig), *Canis familiaris* (dog) and *Cervus elaphus* (red deer) on a phase-by-phase level. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). *NISP* counts.

Modification		***Cranial elements***										
		Maxilla				***Mandible***				***Loose teeth***		
		Cut	***Chopped***	***Burned***	***TOTAL***	***Cut***	***Chopped***	***Burned***	***TOTAL***	***Chopped***	***Burned***	***TOTAL***
Phase I *(Layers 6, 5, 4)*	**Bos taurus**						*4*	*3*	***7***	*1*	*2*	***3***
	Caprinae						*2*	*3*	***5***		*4*	***4***
	Sus			*2*	***2***		*1*	*3*	***4***		*3*	***3***
	Canis familiaris					*1*		*1*	***2***			
	Cervus elaphus										*2*	***2***
	TOTAL	***0***	***0***	***2***	***2***	***1***	***7***	***10***	***18***	***1***	***11***	***12***
Phase II *(Layers 3, 2)*	**Bos taurus**						*6*	*2*	***8***		*2*	***2***
	Caprinae						*1*	*2*	***3***		*8*	***8***
	Sus							*2*	***2***			
	Canis familiaris					*1*			***1***		*1*	***1***
	Cervus elaphus											
	TOTAL	***0***	***0***	***0***	***0***	***1***	***7***	***6***	***14***	***0***	***11***	***11***
Phase III *(Layer 1)*	**Bos taurus**						*2*	*6*	***8***			
	Caprinae							*6*	***6***			
	Sus										*2*	***2***
	Canis familiaris					*2*			***2***		*2*	***2***
	Cervus elaphus											
	TOTAL	***0***	***0***	***0***	***0***	***2***	***2***	***12***	***16***	***0***	***4***	***4***
TOTAL		***0***	***0***	***2***	***2***	***4***	***16***	***28***	***48***	***1***	***26***	***27***

Table 5.26: Incidence of butchery among the postcranial bones of all species identified in Promachon sector on a phase-by-phase level. Only ‘countable' elements are considered. Both cutmarks and chopmarks are considered. *NISP* counts.

Incidence of butchery	*Postcranial elements*		
	NISP	*Butchery*	*%*
***Phase I** (Layers 6, 5, 4)*	*1386*	*61*	*4%*
***Phase II** (Layers 3, 2)*	*1538*	*92*	*6%*
***Phase III** (Layer 1)*	*856*	*28*	*3%*
TOTAL	***3780***	***181***	***5%***

Table 5.27: Evidence of butchery marks on the postcranial bones of *Bos taurus* (cattle) on a phase-by-phase level. Only ‘countable' elements are considered. Data for Figure 5.10. *NISP* counts.

Bos taurus	*Modification: Postcranial elements*							
	Phase I (NISP: 623)		*Phase II (NISP: 671)*		*Phase III (NISP: 354)*		*TOTAL (NISP: 1648)*	
	NISP	*%*	*NISP*	*%*	*NISP*	*%*	*NISP*	*%*
Cutmarks	*5*	*1%*	*13*	*2%*	*10*	*3%*	*28*	*2%*
Chopmarks	*26*	*4%*	*41*	*6%*	*6*	*2%*	*73*	*4%*
TOTAL	***31***	***5%***	***54***	***8%***	***16***	***5%***	***101***	***6%***

Table 5.28: Evidence of butchery marks on the postcranial bones of Caprinae (sheep/goat) on a phase-by-phase level. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Only ‘countable' elements are considered. Data for Figure 5.10. *NISP* counts.

Caprinae	*Modification: Postcranial elements*							
	Phase I (NISP: 428)		*Phase II (NISP: 487)*		*Phase III (NISP: 293)*		*TOTAL (NISP: 1208)*	
	NISP	*%*	*NISP*	*%*	*NISP*	*%*	*NISP*	*%*
Cutmarks	*2*	***1%***	*1*	***1%***	*5*	***2%***	***8***	***1%***
Chopmarks	*17*	***4%***	*14*	***3%***	*1*	***1%***	***32***	***3%***
TOTAL	***19***	***5%***	***15***	***4%***	***6***	***3%***	***40***	***4%***

Table 5.29: Evidence of butchery marks on the postcranial bones of *Sus* (pig) on a phase-by-phase level. Only 'countable' elements are considered. Data for Figure 5.10. *NISP* counts.

Sus	***Modification: Postcranial elements***							
	Phase I* *(NISP: 230)		***Phase II* *(NISP: 226)***		***Phase III* *(NISP: 134)***		***TOTAL* *(NISP: 590)***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Cutmarks	*2*	***1%***	*1*	***1%***	*3*	***2%***	***6***	***1%***
Chopmarks	*7*	***3%***	*15*	***7%***	*2*	***1%***	***24***	***4%***
TOTAL	***9***	***4%***	***16***	***8%***	***5***	***3%***	***30***	***5%***

Table 5.30: Evidence of butchery marks on the postcranial bones of *Canis familiaris* (dog) on a phase-by-phase level. Only 'countable' elements are considered. *NISP* counts.

Canis familiaris	***Modification: Postcranial elements***							
	Phase I* *(NISP: 20)		***Phase II* *(NISP: 34)***		***TOTAL* *(NISP: 12)***		***TOTAL* *(NISP: 54)***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Cutmarks								
Chopmarks			*1*				*1*	
TOTAL			***1***				***1***	

Table 5.31: Evidence of butchery marks on the postcranial bones of *Cervidae* (cervids) on a phase-by-phase level. *Cervidae* family includes *Cervus elaphus* (red deer) and *Capreolus capreolus* (roe deer). Only 'countable' elements are considered. *NISP* counts.

Cervidae	***Modification: Postcranial elements***							
	Phase I* *(NISP: 29)		***Phase II* *(NISP: 51)***		***Phase III* *(NISP: 20)***		***TOTAL* *(NISP: 100)***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Cutmarks			*2*		*1*		*3*	
Chopmarks	*2*		*4*				*6*	
TOTAL	***2***		***6***		***1***		***9***	

Table 5.32: Body part distribution of butchery marks for *Bos taurus* (cattle) on a phase-by-phase level. Data for Figure 5.11. *NISP* counts.

Bos taurus		*Late Neolithic I*						*Late Neolithic II*			*Body part distribution of butchery marks*		
		***Phase I** (Layers 6, 5, 4)*			***Phase II** (Layers 3, 2)*			***Phase III** (Layer 1)*					
		Cut	*Chopped*	*TOTAL*	*Cut*	*Chopped*	*TOTAL*	*Cut*	*Chopped*	*TOTAL*	*Cut & Chopped*	*Total NISP*	*%*
Postcranial elements	***Cranium (zygomaticus)***												
	Atlas												
	Axis												
	Scapula				2	4	**6**	1		**1**	**7**	64	**11%**
	Humerus proximal								1	**1**	**22**	83	**26%**
	Humerus distal	1	7	**8**	3	7	**10**	2	1	**3**			
	Radius proximal		6	**6**		4	**4**				**11**	86	**13%**
	Radius distal					1	**1**						
	Ulna proximal		2	**2**							**2**	38	**5%**
	Carpal 2+3												
	Metacarpal distal		3	**3**		2	**2**				**5**	43	**11%**
	Pelvis		2	**2**		2	**2**	1	1	**2**	**6**	72	**8%**
	Femur proximal		1	**1**	1	1	**2**				**5**	74	**7%**
	Femur distal					2	**2**						
	Tibia proximal		1	**1**		1	**1**				**11**	73	**15%**
	Tibia distal		4	**4**		4	**4**		1	**1**			
	Scafocuboid				1		**1**				**1**	32	**3%**
	Astragalus				1		**1**				**1**	99	**1%**
	Calcaneum	1		**1**	2	2	**4**	1		**1**	**6**	73	**8%**
	Metatarsal distal					5	**5**		1	**1**	**6**	26	**23%**
	Phalanx 1	3		**3**	3	4	**7**	5	1	**6**	**18**	590	**3%**
	Phalanx 2					1	**1**						
	Phalanx 3					1	**1**						
	TOTAL Countable	**5**	**26**	**31**	**13**	**41**	**54**	**10**	**6**	**16**	**101**		
	TOTAL Uncountable	**1**	**1**	**2**	**2**	**5**	**7**	**1**		**1**	**10**		

Table 5.33: Body part distribution of butchery marks for *Caprinae* (sheep/goat) on a phase-by-phase level. *Caprinae* subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.12. *NISP* counts.

Caprinae		*Late Neolithic I*						*Late Neolithic II*			*Body part distribution of butchery marks*		
		***Phase I** (Layers 6, 5, 4)*			***Phase II** (Layers 3, 2)*			***Phase III** (Layer 1)*					
		Cut	*Chopped*	*TOTAL*	*Cut*	*Chopped*	*TOTAL*	*Cut*	*Chopped*	*TOTAL*	*Cut & Chopped*	*Total NISP*	*%*
Postcranial elements	Cranium (zygomaticus)												
	Atlas												
	Axis		1	1							1	31	3%
	Scapula												
	Humerus proximal		1	1							9	182	5%
	Humerus distal	1	2	3		2	2	2	1	3			
	Radius proximal		2	2	1	1	2				7	149	4%
	Radius distal		2	2		1	1						
	Ulna proximal		2	2							2	61	3%
	Carpal 2+3												
	Metacarpal distal												
	Pelvis					1	1				1	147	< 1%
	Femur proximal					1	1				3	30	10%
	Femur distal	1	1	2									
	Tibia proximal					1	1				14	184	8%
	Tibia distal		6	6		6	6	1		1			
	Scafocuboid												
	Astragalus							1		1	1	63	2%
	Calcaneum							1		1	1	51	2%
	Metatarsal distal					1	1				1	20	5%
	Phalanx 1												
	Phalanx 2												
	Phalanx 3												
	TOTAL Countable	**2**	**17**	**19**	**1**	**14**	**15**	**5**	**1**	**6**	**40**	* Includes 1 Ovis aries horn core bearing cut marks	
	TOTAL Uncountable	*** 2**	**2**	**4**	**5**	**1**	**6**	**1**		**1**	**11**		

Table 5.34: Body part distribution of butchery marks for *Sus* (pig) on a phase-by-phase level. Data for Figure 5.13. *NISP* counts.

Sus		Late Neolithic I						Late Neolithic II			Body part distribution of butchery marks		
		Phase I (Layers 6, 5, 4)			Phase II (Layers 3, 2)			Phase III (Layer 1)					
		Cut	Chopped	TOTAL	Cut	Chopped	TOTAL	Cut	Chopped	TOTAL	Cut & Chopped	Total NISP	%
Postcranial elements	Cranium (zygomaticus)												
	Atlas					1	1				1	14	7%
	Axis												
	Scapula				1	3	4	1		1	5	76	7%
	Humerus proximal					1	1				9	59	15%
	Humerus distal	1	3	4		2	2	2		2			
	Radius proximal					2	2				3	69	4%
	Radius distal					1	1						
	Ulna proximal					1	1				1	64	2%
	Carpal 2+3												
	Metacarpal 3 distal												
	Metacarpal 4 distal												
	Pelvis												
	Femur proximal										1	22	4%
	Femur distal								1	1			
	Tibia proximal		1	1							6	42	14%
	Tibia distal		3	3		2	2						
	Scafocuboid												
	Astragalus	1		1					1	1	2	22	9%
	Calcaneum												
	Metatarsal 3 distal										2	29	7%
	Metatarsal 4 distal					2	2						
	Phalanx 1												
	Phalanx 2												
	Phalanx 3												
	TOTAL Countable	**2**	**7**	**9**	**1**	**15**	**16**	**3**	**2**	**5**	**30**		
	TOTAL Uncountable		**1**	**1**	**1**		**1**				**2**		

Table 5.35: Body part distribution of butchery marks for *Cervidae* (cervids) on a phase-by-phase level. *Cervidae* family includes *Cervus elaphus* (red deer) and *Capreolus capreolus* (roe deer). *NISP* counts.

Cervidae		***Late Neolithic I***						***Late Neolithic II***		
		***Phase I** (Layers 6, 5, 4)*			***Phase II** (Layers 3, 2)*			***Phase III** (Layer 1)*		
		Cut	***Chopped***	***TOTAL***	***Cut***	***Chopped***	***TOTAL***	***Cut***	***Chopped***	***TOTAL***
Postcranial elements	***Cranium (zygomaticus)***									
	Atlas									
	Axis									
	Scapula									
	Humerus proximal									
	Humerus distal									
	Radius proximal		*1*	***1***		*1*	***1***			
	Radius distal									
	Ulna proximal		*1*	***1***						
	Carpal 2+3									
	Metacarpal distal									
	Pelvis									
	Femur proximal									
	Femur distal									
	Tibia proximal									
	Tibia distal					*1*	***1***			
	Scafocuboid									
	Astragalus									
	Calcaneum				*1*		***1***			
	Metatarsal distal					*1*	***1***			
	Phalanx 1				*1*		***1***	*1*		***1***
	Phalanx 2					*1*	***1***			
	Phalanx 3									
	TOTAL Countable		***2***	***2***	***2***	***4***	***6***	***1***		***1***
	TOTAL Uncountable		***1***	***1***						

Table 5.36: Incidence of burning among the postcranial bones of all species identified in Promachon sector on a phase-by-phase level. Only 'countable' elements are considered. *NISP* counts.

Burning	***Postcranial elements***		
	NISP	***Burning***	***%***
Phase I *(Layers 6, 5, 4)*	*1386*	*105*	*8%*
Phase II *(Layers 3, 2)*	*1538*	*90*	*6%*
Phase III *(Layer 1)*	*856*	*72*	*8%*
TOTAL	***3780***	***267***	***7%***

Table 5.37: Evidence of burning on the postcranial bones of *Bos taurus* (cattle) on a phase-by-phase level. Only 'countable' elements are considered. *NISP* counts.

Bos taurus	***Modification: Postcranial elements***							
	Phase I (NISP: 623)		***Phase II (NISP: 671)***		***Phase III (NISP: 354)***		***TOTAL (NISP: 1648)***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Burning	*36*	***6%***	*41*	***6%***	*23*	***6%***	***100***	***6%***

Table 5.38: Evidence of burning on the postcranial bones of Caprinae (sheep/goat) on a phase-by-phase level. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Only 'countable' elements are considered. *NISP* counts.

Caprinae	***Modification: Postcranial elements***							
	Phase I (NISP: 428)		***Phase II (NISP: 487)***		***Phase III (NISP: 293)***		***TOTAL (NISP: 1208)***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Burning	*41*	***10%***	*29*	***6%***	*35*	***12%***	***105***	***9%***

Table 5.39: Evidence of burning on the postcranial bones of *Sus* (pig) on a phase-by-phase level. Only 'countable' elements are considered. *NISP* counts.

Sus	***Modification: Postcranial elements***							
	Phase I (NISP: 230)		***Phase II (NISP: 226)***		***Phase III (NISP: 134)***		***TOTAL (NISP: 590)***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Burning	*26*	***11%***	*14*	***7%***	*9*	***7%***	***49***	***8%***

5.5 – Body part distribution

Body part distribution (*i.e.* the relative abundance of different skeletal parts) has been calculated using the *MNI* values rather than *NISP* in order to eliminate the bias from elements that occur more frequently in the body (Johnstone and Albarella 2002). Even though parts of the skeleton - rich in meat content - such as the vertebrae and the ribs are missing from the following body part analysis, this equally applies to all species.

In interpreting the skeletal distribution (for all species) in Promachon sector we will have to consider the following factors:

- ***Differential preservation****:* variation in body part representation may be attributed to selective attrition of less durable parts.
- ***Retrieval biases****:* this is likely to constitute a significant factor in the formation of Promachon’s faunal assemblage as already seen.
- ***Human agency*****:** skeletal parts may have been transported, deposited and processed differentially by the site inhabitants. Selectivity of elements brought on-site obviously applies primarily to hunted species, but also to domestic species killed off-site. The animal carcass may have also been subject to some sub-division within the site itself.
- ***Sample size***: small sample size renders body part analysis on both temporal and contextual levels highly unreliable. This applies particularly to the deer species, but to some extent to pigs too.

5.5.1 – Bos taurus *body part distribution*

Table 5.40 **and** ***Figure 5.14*** present the body part distribution for cattle. Cattle skeletal distribution in Phases I and III is similar; the highest *MNI* values are obtained from permanent first and second mandibular molars. The high representation of cattle teeth rather than cattle postcranial elements may be attributed to differential preservation between teeth and bones and it is expected.

On the other hand, there are no particular reasons to suggest that any cattle postcranial elements are missing because of pre-depositional factors. All postcranial bones are present, though less durable parts such as the cranium, the atlas and the femur are underrepresented. Scapula, humerus and pelvis are found in high frequencies, suggesting selection in body parts with high meat utility. Lower hind limbs (distal tibia and metapodials), as well as limb extremities (astragalus, calcaneum and phalanges) are quite common since they are better preserved due to their size and density.

The distribution of cattle body parts during the second phase of occupation provides a slightly different pattern. Unlike Phases I and III, the highest *MNI* value during Phase II derives from the astragali. The astragalus is a compact, durable bone, which would have survived well to taphonomic factors and in cattle is also large enough not to be easily overlooked. It is indeed the best represented postcranial bone in the other phases too. There are, however, no obvious taphonomic factors that could explain its better representation than teeth. We must therefore assume that this difference was in fact genuine at the time of the original formation of the cattle assemblage, and that, during Phase II, cattle heads were not as commonly introduced to the site with the rest of the carcass, or may have been processed in areas of the site not affected by the excavation.

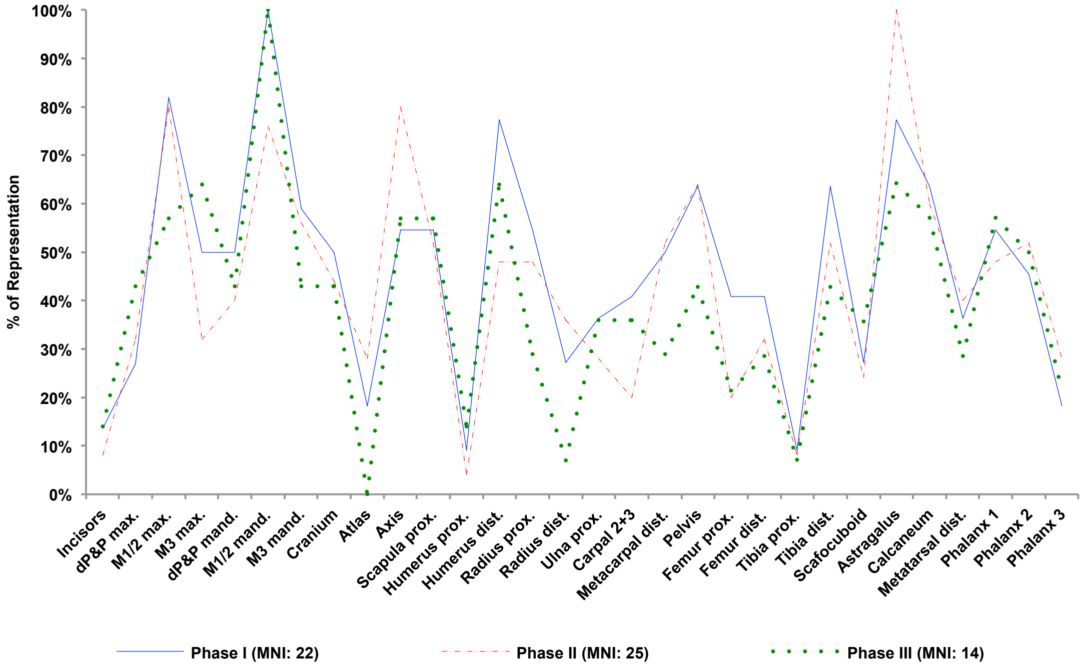


Figure 5.14: Body part profiles for *Bos taurus* (cattle) on a phase-by-phase level. Data in Table 5.40. *MNI* counts.

5.5.2 – Caprinae *body part distribution*

Identification of caprine bones to the level of species was attempted on a limited range of elements (***Table 5.41***). However, as already discussed, the bulk of the caprine material was identified to the level of sheep/goat; thus, in the following body part analysis these two species are of necessity treated together.

Body part distribution for caprines exhibits a clear and unambiguous consistency throughout all phases under study (***Table 5.42; Figure 5.15***). Teeth are the most common elements, a factor most likely to be a result of differential preservation between bones and teeth, as in the case of cattle. In all phases the highest *MNI* values derive from the first and second mandibular molars. The humerus and the pelvis are found in almost equal frequencies indicating preferences in body parts with high meat utility; it is therefore likely that whole caprine carcasses were introduced (or simply processed) on site. On the other hand, the overrepresentation of the radius and the tibia may be attributed to differential preservation. Elements that are poorly represented are those that do not easily survive in the archaeological record (i.e. cranium, atlas, axis, ulna, femur), or are less frequently recovered (i.e. carpals, tarsals and phalanges). Overall, the pattern for caprines appears to be mainly the result of preservation and recovery bias than of any specialized waste disposal practices. It is likely that all caprine body parts were equally represented on site before discard.

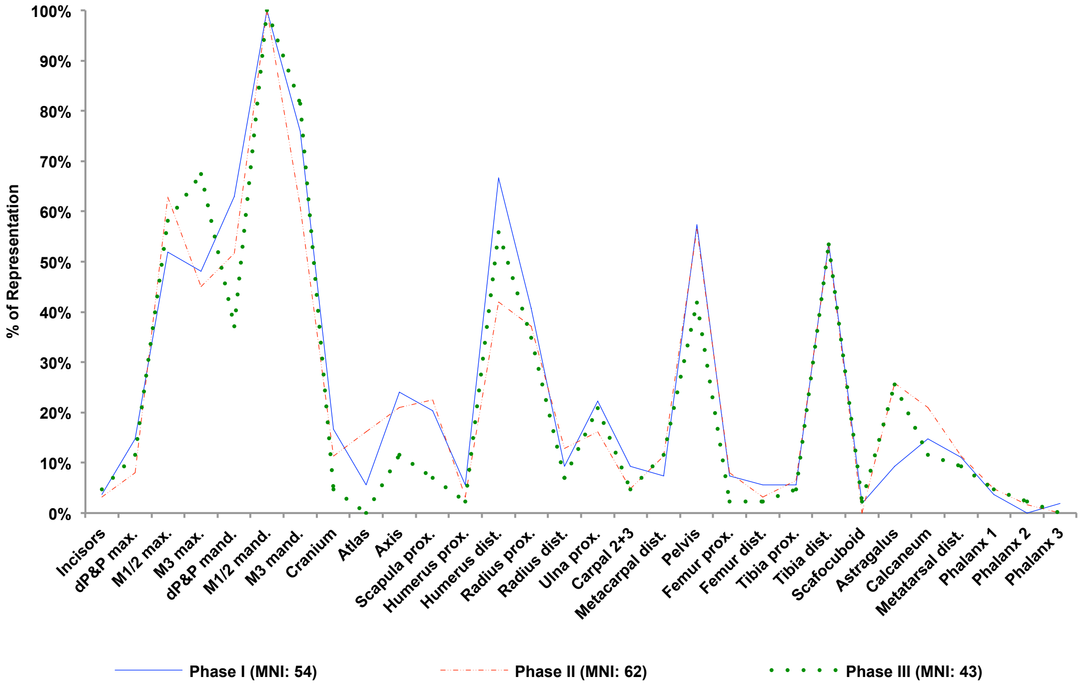


Figure 5.15: Body part profiles for Caprinae (caprines) on a phase-by-phase level. Caprinae subfamily includes *Ovis/Cpara* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Table 5.42. *MNI* counts.

5.5.3 – Sus *body part distribution*

Discussion of pig body part distribution is made rather difficult by the small sample size (***Table 5.43****;* ***Figure 5.16***). Nevertheless, a number of trends can still be detected:

- Teeth are underrepresented and the highest *MNI* values derive from postcranial bones (scapula and ulna during Phase I and scapula during Phase II). This possibly indicates, that some pig heads were disposed off-site.

- The high frequency of the upper forelimb bones (*i.e.* scapula, humerus) as well as the pelvis indicates preferences in body parts with high meat utility.

- One would argue that the scarcity of pig phalanges might be linked with the scarcity of the metapodials as well; this would lead to the hypothesis that limb extremities might have not been introduced to the site with the rest of the carcass and that the pig remains from the studied assemblage derive from dressed carcasses[10]. There is, however, one issue, which must be considered in connection to this; the bulk of the pig population from Promachon was killed young, making it more likely that pigs in Promachon would be moved around as complete carcasses. Therefore, it is highly likely that the underrepresentation of pig limb extremities is associated with recovery bias, rather than differential treatment of the pig carcass.

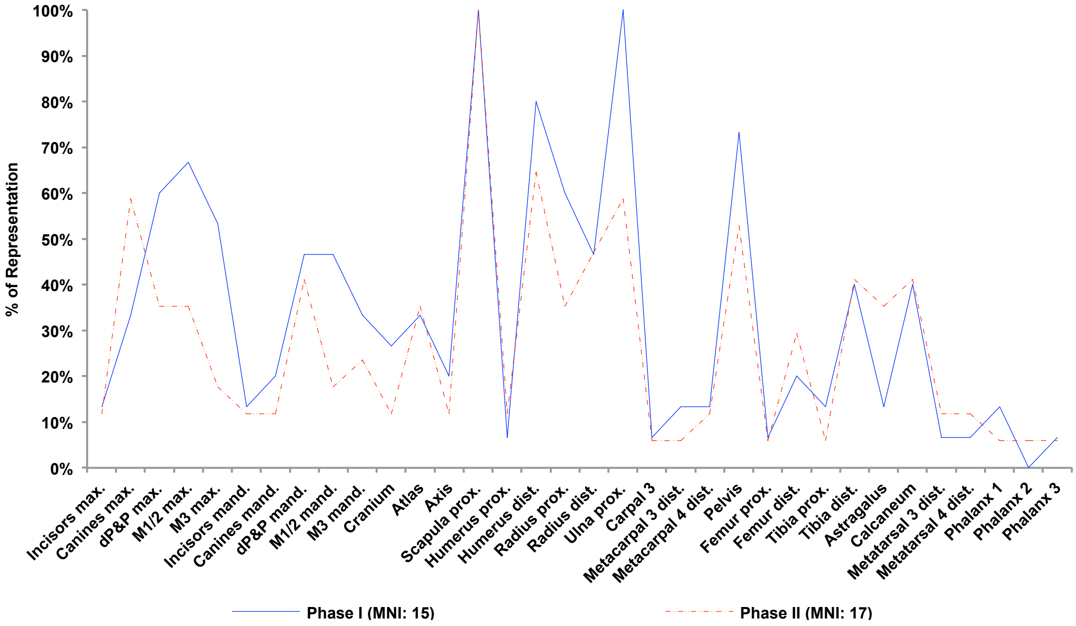


Figure 5.16: Body part profiles for *Sus* (pig) on a phase-by-phase level. Phase III (*MNI*: 8) is not considered due to small sample size. Data in Table 5.43. *MNI* counts.

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[10] See also: Albarella and Serjeantson (2002), on a similar case from Late Neolithic Durrington Walls.

5.5.4 – Cervidae *body part distribution*

Tables 5.44, 5.45 and ***5.46*** provide the body part distribution for red deer, roe deer and fallow deer respectively. However, their small sample sizes render any discussion on their skeletal representation highly problematic. In order to tackle this bias, the three species are of necessity treated together (***Table 5.47***). Though the bias is not entirely eliminated (***Figure 5.17***), we can still draw some basic conclusions.

The body part distribution of deer resembles more that of pigs than of any of the other domesticates; the highest *MNI* values are gained from postcranial elements (such as ulnae, astragali and first phalanges) rather than teeth. The scarcity of deer teeth can be linked to the scarcity of antlers as well; only four antler fragments with a complete transverse section were recorded, eventually representing 'non-countable' elements. Two were identified as red deer antlers and two as roe deer antlers. Although we cannot exclude the possibility that deer crania were disposed off-site due to their heavy weight and limited meat content, the pattern is most likely the result of the deer crania being kept elsewhere - at workshop areas - for the production of antler tools and objects. The latter hypothesis is further supported by two red deer tine antlers (lacking a complete transverse section and belonging to Phases I and III respectively), which also exhibit polished surfaces.

While the high frequency of deer astragali may be attributed to post-depositional differential preservation of less durable bones, the predominance of non-meat-bearing postcranial elements such as the ulna and the phalanges suggests that the species were exploited for a range of products besides meat. The high proportion of deer phalanges could be related to the presence or working of hides, although the small number of phalanges bearing butchery traits (only three) does not further support the latter hypothesis. Of more interest is the striking high frequency of deer ulnae, since it provides the highest *MNI* values. The abundance of bone tools with 'short active edges' made of deer ulnae (Christidou 2012) may provide an explanation as to the frequency of this specific body part. However, the study of bone tools falls into the task of the bone tools specialist currently working on the latter evidence (Christidou pers. comm.).

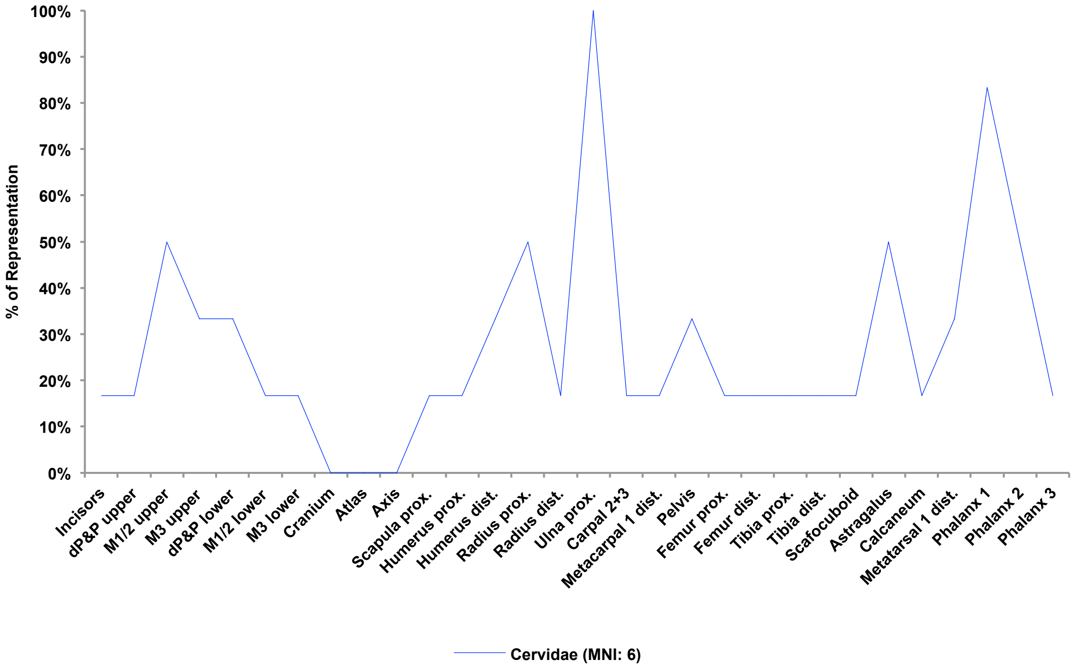

Figure 5.17: Body part profiles for Cervidae (cervids). All phases are considered. Cervidae family includes *Cervus elaphus* (red deer), *Capreolus capreolus* (roe deer) and *Dama dama* (fallow deer). Data in Tables 5.44, 5.45, 5.46 and 5.47. *MNI* counts.

5.5.5 – Body part distribution of the remaining fauna

Dog, an animal rather more conspicuous by its destructive influence upon the bones (Albarella and Davis 1994), is not as common as the rest of domesticates both in terms of *NISP* and *MNI* (***Table 5.48***). As previously suggested (see also ***5.4.2 – Other mammals***) dogs were eaten in Promachon: four mandibles and a calcaneum bear butchery marks. Nevertheless, no clear distribution of dog body parts could be found, a pattern most likely to be the result of small sample size.

Body part distribution of red fox is presented in ***Table 5.49***. Red fox elements are more likely to exhibit scavenger activity within the settlement, since there are no cases of reported use of red fox as a food resource. ***Table 5.50*** presents the body part distribution for hare. Hare bones may well represent hunted food resources, although no human-agent modifications (*i.e.*

cutmarks, burning) were eventually recorded. With regard to hare, the sample is too small to draw any firm conclusions, but various body elements are represented, including teeth. This is not surprising as the carcass of an animal of such relatively small size is unlikely to be subjected to successive stages of butchery process, which can be detected archaeologically.

Table 5.40: Parts of the *Bos taurus* (cattle) skeleton by number of fragments (*NISP*) and minimum number of individuals (*MNI*) for each phase under study. Data for Figure 5.14.

Bos taurus		***Late Neolithic I***						***Late Neolithic II***		
		Phase I *(Layers 6, 5, 4)*			***Phase II*** *(Layers 3, 2)*			***Phase III*** *(Layer 1)*		
		NISP	***MNI***	***%***	***NISP***	***MNI***	***%***	***NISP***	***MNI***	***%***
Teeth	***Incisors***	*19*	*3*	*14%*	*13*	*2*	*8%*	*16*	*2*	*14%*
	dP&P Maxillary	*35*	*6*	*27%*	*45*	*8*	*32%*	*33*	*6*	*43%*
	M1/2 Maxillary	*72*	*18*	*82%*	*80*	*20*	*80%*	*32*	*8*	*57%*
	M3 Maxillary	*21*	*11*	*50%*	*15*	*8*	*32%*	*17*	*9*	*64%*
	dP&P Mandibular	*66*	*11*	*50%*	*59*	*10*	*40%*	*34*	*6*	*43%*
	M1/2 Mandibular	*88*	*22*	*100%*	*76*	*19*	*76%*	*53*	*14*	*100%*
	M3 Mandibular	*26*	*13*	*59%*	*28*	*14*	*56%*	*11*	*6*	*43%*
Postcranial Bones	***Cranium***	*21*	*11*	*50%*	*21*	*11*	*44%*	*12*	*6*	*43%*
	Atlas	*4*	*4*	*18%*	*7*	*7*	*28%*	*0*	*0*	*0%*
	Axis	*12*	*12*	*55%*	*20*	*20*	*80%*	*8*	*8*	*57%*
	Scapula	*23*	*12*	*55%*	*25*	*13*	*52%*	*16*	*8*	*57%*
	Humerus proximal	*4*	*2*	*9%*	*1*	*1*	*4%*	*3*	*2*	*14%*
	Humerus distal	*34*	*17*	*77%*	*23*	*12*	*48%*	*18*	*9*	*64%*
	Radius proximal	*24*	*12*	*55%*	*24*	*12*	*48%*	*8*	*4*	*29%*
	Radius distal	*11*	*6*	*27%*	*18*	*9*	*36%*	*1*	*1*	*7%*
	Ulna proximal	*16*	*8*	*36%*	*13*	*7*	*28%*	*9*	*5*	*36%*
	Carpal 2+3	*18*	*9*	*41%*	*10*	*5*	*20%*	*10*	*5*	*36%*
	Metacarpal 1 distal	*16*	*11*	*50%*	*21*	*13*	*52%*	*6*	*4*	*29%*
	Metacarpal 1/2 distal	*4*			*2*			*2*		
	Pelvis	*28*	*14*	*64%*	*32*	*16*	*64%*	*12*	*6*	*43%*
	Femur proximal	*18*	*9*	*41%*	*10*	*5*	*20%*	*6*	*3*	*21%*
	Femur distal	*17*	*9*	*41%*	*16*	*8*	*32%*	*7*	*4*	*29%*
	Tibia proximal	*3*	*2*	*9%*	*3*	*2*	*8%*	*1*	*1*	*7%*
	Tibia distal	*28*	*14*	*64%*	*26*	*13*	*52%*	*12*	*6*	*43%*
	Scafocuboid	*11*	*6*	*27%*	*12*	*6*	*24%*	*9*	*5*	*36%*
	Astragalus	*33*	*17*	*77%*	*49*	*25*	*100%*	*17*	*9*	*64%*
	Calcaneum	*28*	*14*	*64%*	*30*	*15*	*60%*	*15*	*8*	*57%*
	Metatarsal 1 distal	*11*	*8*	*36%*	*13*	*10*	*40%*	*2*	*4*	*29%*
	Metatarsal 1/2 distal	*2*			*4*			*1*		
	Metapodium 1 distal	*2*			*0*			*1*		
	Metapodium 1/2 distal	*10*			*13*			*17*		
	Phalanx 1	*96*	*12*	*55%*	*95*	*12*	*48%*	*64*	*8*	*57%*
	Phalanx 2	*80*	*10*	*45%*	*97*	*13*	*52%*	*55*	*7*	*50%*
	Phalanx 3	*31*	*4*	*18%*	*49*	*7*	*28%*	*23*	*3*	*21%*
	TOTAL	***912***	***MNI: 22***		***950***	***MNI: 25***		***531***	***MNI: 14***	

Unfused proximal and distal epiphyses are not counted. Each tooth (loose or attached to maxilla/mandible) is considered. The *MNI* has been calculated as follows: Incisors and phalanges have been divided by 8, deciduous and permanent premolars (dP&P) have been divided by 6, first and second molars (M1/2) have been divided by 4 and all other elements -except for Metapodials- have been divided by 2. Metacarpals (Metacarpal 1 distal) and Metatarsals (Metatarsal 1 distal) have been calculated as follows:

Metacarpal = (Metacarpal 1 distal + Metacarpal 1/2 distal / 2 + Metapodium 1 distal / 2 + Metapodium 1/2 distal / 4) / 2.

Metatarsal = (Metatarsal 1 distal + Metatarsal 1/2 distal / 2 + Metapodium 1 distal / 2 + Metapodium 1/2 distal / 4) / 2.

Where Metapodium 1 distal: complete distal metapodial and Metapodium 1/2 distal: half distal metapodial.

%: Frequency of an element expressed in relation to the most common one (by *MNI*).

Table 5.41: Parts of the *Ovis aries* (sheep) and *Capra hircus* (goat) skeleton by number of fragments (*NISP*). Only body parts that were regularly identified to species are presented here. Unfused proximal and distal epiphyses are not counted. *NISP* counts.

Regularly identified to Species		***Late Neolithic I***				***Late Neolithic II***	
		Phase I *(Layers 6, 5, 4)*		***Phase II*** *(Layers 3, 2)*		***Phase III*** *(Layer 1)*	
		Ovis aries	**Capra hircus**	**Ovis aries**	**Capra hircus**	**Ovis aries**	**Capra hircus**
		NISP	***NISP***	***NISP***	***NISP***	***NISP***	***NISP***
Teeth and Postcranial Bones	***dP&P Mandibular***	*117*	*38*	*116*	*32*	*65*	*19*
	Humerus distal	*26*	*12*	*23*	*8*	*16*	*7*
	Radius proximal	*3*	*1*	*10*	*1*	*1*	
	Radius distal			*4*	*2*	*1*	
	Metacarpal 1 distal	*2*		*3*	*3*	*7*	
	Tibia distal	*45*	*2*	*47*	*6*	*35*	*3*
	Astragalus	*8*	*1*	*24*	*2*	*13*	
	Calcaneum	*5*	*5*	*13*	*4*	*6*	
	Metatarsal 1 distal	*4*		*6*		*2*	
	TOTAL	***210***	***59***	***246***	***58***	***146***	***29***

Table 5.42: Parts of the Caprinae (sheep and goat) skeleton by number of fragments (*NISP*) and minimum number of individuals (*MNI*) for each phase under study. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.15.

Caprinae		***Late Neolithic I***						***Late Neolithic II***		
		Phase I *(Layers 6, 5, 4)*			***Phase II*** *(Layers 3, 2)*			***Phase III*** *(Layer 1)*		
		NISP	***MNI***	***%***	***NISP***	***MNI***	***%***	***NISP***	***MNI***	***%***
Teeth	***Incisors***	*11*	*2*	*4%*	*11*	*2*	*3%*	*14*	*2*	*5%*
	dP&P Maxillary	*48*	*8*	*15%*	*27*	*5*	*8%*	*28*	*5*	*12%*
	M1/2 Maxillary	*112*	*28*	*52%*	*156*	*39*	*63%*	*100*	*25*	*58%*
	M3 Maxillary	*51*	*26*	*48%*	*55*	*28*	*45%*	*58*	*29*	*67%*
	dP&P Mandibular	*203*	*34*	*63%*	*192*	*32*	*52%*	*94*	*16*	*37%*
	M1/2 Mandibular	*216*	*54*	*100%*	*248*	*62*	*100%*	*169*	*43*	*100%*
	M3 Mandibular	*82*	*41*	*76%*	*76*	*38*	*61%*	*70*	*35*	*81%*
Postcranial Bones	***Cranium***	*18*	*9*	*17%*	*13*	*7*	*11%*	*3*	*2*	*5%*
	Atlas	*3*	*3*	*6%*	*10*	*10*	*16%*			*0%*
	Axis	*13*	*13*	*24%*	*13*	*13*	*21%*	*5*	*5*	*12%*
	Scapula	*21*	*11*	*20%*	*27*	*14*	*23%*	*6*	*3*	*7%*
	Humerus proximal	*6*	*3*	*6%*	*3*	*2*	*3%*	*2*	*1*	*2%*
	Humerus distal	*72*	*36*	*67%*	*52*	*26*	*42%*	*47*	*24*	*56%*
	Radius proximal	*43*	*22*	*41%*	*46*	*23*	*37%*	*30*	*15*	*35%*
	Radius distal	*9*	*5*	*9%*	*15*	*8*	*13%*	*6*	*3*	*7%*
	Ulna proximal	*23*	*12*	*22%*	*20*	*10*	*16%*	*18*	*9*	*21%*
	Carpal 2+3	*9*	*5*	*9%*	*5*	*3*	*5%*	*4*	*2*	*5%*
	Metacarpal 1 distal	*5*	*4*	*7%*	*10*	*7*	*11%*	*8*	*5*	*12%*
	Metacarpal 1/2 distal	*2*			*1*					
	Pelvis	*61*	*31*	*57%*	*70*	*35*	*56%*	*36*	*18*	*42%*
	Femur proximal	*8*	*4*	*7%*	*9*	*5*	*8%*	*2*	*1*	*2%*
	Femur distal	*5*	*3*	*6%*	*4*	*2*	*3%*	*2*	*1*	*2%*
	Tibia proximal	*6*	*3*	*6%*	*7*	*4*	*6%*	*4*	*2*	*5%*
	Tibia distal	*57*	*29*	*54%*	*65*	*33*	*53%*	*45*	*23*	*53%*
	Scafocuboid	*1*	*1*	*2%*			*0%*	*2*	*1*	*2%*
	Astragalus	*10*	*5*	*9%*	*31*	*16*	*26%*	*22*	*11*	*26%*
	Calcaneum	*15*	*8*	*15%*	*26*	*13*	*21%*	*10*	*5*	*12%*
	Metatarsal 1 distal	*7*	*6*	*11%*	*8*	*7*	*11%*	*5*	*4*	*9%*
	Metatarsal 1/2 distal	*4*			*4*			*3*		
	Metapodium 1 distal				*1*					
	Metapodium 1/2 distal	*6*			*10*			*3*		
	Phalanx 1	*10*	*2*	*4%*	*20*	*3*	*5%*	*13*	*2*	*5%*
	Phalanx 2			*0%*	*4*	*1*	*2%*	*5*	*1*	*2%*
	Phalanx 3	*2*	*1*	*2%*			*0%*			*0%*
	TOTAL	***1139***	***MNI: 54***		***1239***	***MNI: 62***		***814***	***MNI: 43***	

Unfused proximal and distal epiphyses are not counted. Each tooth (loose or attached to maxilla/mandible) is considered. The *MNI* has been calculated as follows: Incisors and phalanges have been divided by 8, deciduous and permanent premolars (dP&P) have been divided by 6, first and second molars (M1/2) have been divided by 4 and all other elements -except for Metapodials- have been divided by 2. Metacarpals (Metacarpal 1 distal) and Metatarsals (Metatarsal 1 distal) have been calculated as follows:

Metacarpal = (Metacarpal 1 distal + Metacarpal 1/2 distal / 2 + Metapodium 1 distal / 2 + Metapodium 1/2 distal / 4) / 2.

Metatarsal = (Metatarsal 1 distal + Metatarsal 1/2 distal / 2 + Metapodium 1 distal / 2 + Metapodium 1/2 distal / 4) / 2.

Where Metapodium 1 distal: complete distal metapodial and Metapodium 1/2 distal: half distal metapodial.

%: Frequency of an element expressed in relation to the most common one (by *MNI*).

Table 5.43: Parts of the *Sus* (pig) skeleton by number of fragments (*NISP*) and minimum number of individuals (*MNI*) for each phase under study. Data for Figure 5.16.

Sus		***Late Neolithic I***						***Late Neolithic II***		
		Phase I (Layers 6, 5, 4)			***Phase II*** (Layers 3, 2)			***Phase III*** (Layer 1)		
		NISP	***MNI***	***%***	***NISP***	***MNI***	***%***	***NISP***	***MNI***	***%***
Teeth	***Incisors Maxillary***	7	2	13%	7	2	12%	3	1	14%
	Canines Maxillary	10	5	33%	19	10	59%	6	3	43%
	dP&P Maxillary	53	9	60%	35	6	35%	13	3	43%
	M1/2 Maxillary	39	10	67%	21	6	35%	11	3	43%
	M3 Maxillary	16	8	53%	5	3	18%	5	3	43%
	Incisors Mandibular	12	2	13%	11	2	12%	8	2	29%
	Canines Mandibular	5	3	20%	4	2	12%	3	2	29%
	dP&P Mandibular	37	7	47%	37	7	41%	24	4	57%
	M1/2 Mandibular	25	7	47%	16	3	18%	21	6	86%
	M3 Mandibular	9	5	33%	7	4	24%	5	3	43%
Postcranial Bones	***Cranium***	8	4	27%	3	2	12%	5	3	43%
	Atlas	5	5	33%	6	6	35%	3	3	43%
	Axis	3	3	20%	2	2	12%	1	1	14%
	Scapula	30	15	100%	34	17	100%	12	6	86%
	Humerus proximal	2	1	7%	3	2	12%	3	2	29%
	Humerus distal	23	12	80%	21	11	65%	7	4	57%
	Radius proximal	17	9	60%	12	6	35%	8	4	57%
	Radius distal	14	7	47%	15	8	47%	3	2	29%
	Ulna proximal	30	15	100%	20	10	59%	14	7	100%
	Carpal 3	1	1	7%	1	1	6%			0%
	Metacarpal 3 distal	5	2	13%	4	1	6%	1	1	14%
	Metacarpal 4 distal	7		2	13%		5	2		12%
	Pelvis	21	11	73%	18	9	53%	14	7	100%
	Femur proximal	1	1	7%	2	1	6%			0%
	Femur distal	5	3	20%	10	5	29%	4	2	29%
	Tibia proximal	3	2	13%	1	1	6%	1	1	14%
	Tibia distal	12	6	40%	14	7	41%	11	6	86%
	Astragalus	4	2	13%	12	6	35%	6	3	43%
	Calcaneum	11	6	40%	14	7	41%	8	4	57%
	Metatarsal 3 distal	3	2	13%	7	4	24%	2	1	14%
	Metatarsal 4 distal	4	2	13%	5	3	18%	3	2	29%
	Phalanx 1	11		2	13%		8	1		6%
	Phalanx 2			0%	3	1	6%	7	1	14%
	Phalanx 3	3	1	7%	6	1	6%	3	1	14%
	TOTAL	***436***	***MNI: 15***		***387***	***MNI: 17***		***231***	***MNI: 7***	

Unfused proximal and distal epiphyses are not counted. Each tooth (loose or attached to maxilla/mandible) is considered. The *MNI* has been calculated as follows: Phalanges have been divided by 8, deciduous and permanent premolars (dP&P) and incisors have been divided by 6, first and second molars (M1/2) have been divided by 4 and all other elements -except for Metapodials- have been divided by 2. Metacarpals (Metacarpal 3 or 4 distal) and Metatarsals (Metatarsal 3 or 4 distal) have been calculated as follows:
Metacarpal = Metacarpal 3 or 4 distal / 2. Metatarsal = Metatarsal 3 or 4 distal / 2.
%: Frequency of an element expressed in relation to the most common one (by *MNI*).

Table 5.44: Parts of the *Cervus elaphus* (red deer) skeleton by number of fragments (*NISP*) for each phase under study. Data for Figure 5.17.

Cervus elaphus		***Late Neolithic I***		***Late Neolithic II***
		Phase I *(Layers 6, 5, 4)*	***Phase II*** *(Layers 3, 2)*	***Phase III*** *(Layer 1)*
		NISP	***NISP***	***NISP***
Teeth	***Incisors***	*2*		*1*
	dP&P Maxillary		*1*	
	M1/2 Maxillary	*4*	*4*	*2*
	M3 Maxillary	*1*	*1*	*1*
	dP&P Mandibular	*3*	*4*	
	M1/2 Mandibular	*2*		
	M3 Mandibular	*1*	*1*	
Postcranial Bones	***Cranium***			
	Atlas			
	Axis			
	Scapula	*1*		
	Humerus proximal	*1*		
	Humerus distal	*1*	*1*	
	Radius proximal	*1*	*1*	*1*
	Radius distal	*1*		
	Ulna proximal	*1*	*4*	
	Carpal 2+3			
	Metacarpal 1 distal			
	Metacarpal 1/2 distal			
	Pelvis	*1*	*1*	*1*
	Femur proximal		*1*	
	Femur distal			*1*
	Tibia proximal	*1*		
	Tibia distal		*2*	
	Scafocuboid	*1*		
	Astragalus		*1*	*1*
	Calcaneum	*1*	*1*	
	Metatarsal 1 distal	*1*	*1*	
	Metatarsal 1/2 distal		*1*	
	Metapodium 1 distal			
	Metapodium 1/2 distal			
	Phalanx 1	*3*	*9*	*3*
	Phalanx 2	*4*	*10*	*2*
	Phalanx 3			*1*
	TOTAL	***31***	***44***	***14***

Table 5.45: Parts of the *Capreolus capreolus* (roe deer) skeleton by number of fragments (*NISP*) for each phase under study. Data for Figure 5.17.

Capreolus capreolus		*Late Neolithic I*		*Late Neolithic II*
		Phase I *(Layers 6, 5, 4)*	***Phase II*** *(Layers 3, 2)*	***Phase III*** *(Layer 1)*
		NISP	***NISP***	***NISP***
Teeth	***Incisors***			
	dP&P Maxillary		*2*	
	M1/2 Maxillary	*1*		
	M3 Maxillary	*1*		
	dP&P Mandibular	*1*		
	M1/2 Mandibular			
	M3 Mandibular			
Postcranial Bones	***Cranium***			
	Atlas			
	Axis			
	Scapula			
	Humerus proximal			
	Humerus distal			*1*
	Radius proximal	*1*	*1*	
	Radius distal			
	Ulna proximal	*3*	*3*	
	Carpal 2+3			
	Metacarpal 1 distal	*1*		
	Metacarpal 1/2 distal			
	Pelvis		*1*	
	Femur proximal			
	Femur distal			
	Tibia proximal			
	Tibia distal			
	Scafocuboid			
	Astragalus	*2*	*1*	
	Calcaneum			
	Metatarsal 1 distal		*1*	
	Metatarsal 1/2 distal			
	Metapodium 1 distal			
	Metapodium 1/2 distal			
	Phalanx 1	*1*	*5*	*7*
	Phalanx 2		*1*	
	Phalanx 3			
	TOTAL	***11***	***15***	***8***

Table 5.46: Parts of the *Dama dama* (fallow deer) skeleton by number of fragments (*NISP*) for each phase under study. Data for Figure 5.17.

Dama dama		***Late Neolithic I***		***Late Neolithic II***
		Phase I *(Layers 6, 5, 4)*	***Phase II*** *(Layers 3, 2)*	***Phase III*** *(Layer 1)*
		NISP	***NISP***	***NISP***
Teeth	***Incisors***			
	dP&P Maxillary			
	M1/2 Maxillary			
	M3 Maxillary			
	dP&P Mandibular		*1*	
	M1/2 Mandibular			
	M3 Mandibular			
Postcranial Bones	***Cranium***			
	Atlas			
	Axis			
	Scapula			
	Humerus proximal			
	Humerus distal			
	Radius proximal			*1*
	Radius distal			
	Ulna proximal			
	Carpal 2+3		*1*	
	Metacarpal 1 distal			
	Metacarpal 1/2 distal			
	Pelvis			
	Femur proximal			
	Femur distal			
	Tibia proximal		*1*	
	Tibia distal			
	Scafocuboid			
	Astragalus			
	Calcaneum			
	Metatarsal 1 distal			
	Metatarsal 1/2 distal			
	Metapodium 1 distal			
	Metapodium 1/2 distal			
	Phalanx 1	*2*	*3*	
	Phalanx 2			
	Phalanx 3			
	TOTAL	***2***	***6***	***1***

Table 5.47: Parts of the Cervidae (deer) skeleton by number of fragments (*NISP*) and minimum number of individuals (*MNI*). Cervidae family includes *Cervus elaphus* (red deer), *Capreolus capreolus* (roe deer) and *Dama dama* (fallow deer). All phases are considered into a Late Neolithic aggregate. Data for Figure 5.17.

Cervidae		*Late Neolithic I*		*Late Neolithic II*	*Total Late Neolithic*		
		Phase I (Layers 6, 5, 4)	*Phase II* (Layers (3, 2)	*Phase III* (Layer 1)			
		NISP	*NISP*	*NISP*	*NISP*	*MNI*	*%*
Teeth	*Incisors*	2		2	4	1	17%
	dP&P Maxillary		3		3	1	17%
	M1/2 Maxillary	5	4	2	11	3	50%
	M3 Maxillary	2	1	1	4	2	33%
	dP&P Mandibular	4	5		9	2	33%
	M1/2 Mandibular	2			2	1	17%
	M3 Mandibular	1	1		2	1	17%
Postcranial Bones	*Cranium*						0%
	Atlas						0%
	Axis						0%
	Scapula	1			1	1	17%
	Humerus proximal	1			1	1	17%
	Humerus distal	1	1	1	3	2	33%
	Radius proximal	2	2	2	6	3	50%
	Radius distal	1			1	1	17%
	Ulna proximal	4	7		11	6	100%
	Carpal 2+3		1		1	1	17%
	Metacarpal 1 distal	1			1	1	17%
	Metacarpal 1/2 distal						
	Pelvis	1	2	1	4	2	33%
	Femur proximal		1		1	1	17%
	Femur distal			1	1	1	17%
	Tibia proximal	1	1		2	1	17%
	Tibia distal		2		2	1	17%
	Scafocuboid	1			1	1	17%
	Astragalus	2	2	1	5	3	50%
	Calcaneum	1	1		2	1	17%
	Metatarsal 1 distal	1	2		3	2	33%
	Metatarsal 1/2 distal		1		1		
	Metapodium 1 distal						
	Metapodium 1/2 distal						
	Phalanx 1	6	17	10	33	5	83%
	Phalanx 2	4	11	2	17	3	50%
	Phalanx 3			1	1	1	17%
	TOTAL	***44***	***65***	***24***	***133***	***MNI: 6***	

Unfused proximal and distal epiphyses are not counted. Each tooth (loose or attached to maxilla/mandible) is considered. The *MNI* has been calculated as follows: Incisors and phalanges have been divided by 8, deciduous and permanent premolars (dP&P) have been divided by 6, first and second molars (M1/2) have been divided by 4 and all other elements -except for Metapodials- have been divided by 2. Metacarpals (Metacarpal 1 distal) and Metatarsals (Metatarsal 1 distal) have been calculated as follows:

Metacarpal = (Metacarpal 1 distal + Metacarpal 1/2 distal / 2 + Metapodium 1 distal / 2 + Metapodium 1/2 distal / 4) / 2.

Metatarsal = (Metatarsal 1 distal + Metatarsal 1/2 distal / 2 + Metapodium 1 distal / 2 + Metapodium 1/2 distal / 4) / 2.

Where Metapodium 1 distal: complete distal metapodial and Metapodium 1/2 distal: half distal metapodial.

%: Frequency of an element expressed in relation to the most common one (by *MNI*).

Table 5.48: Parts of the *Canis familiaris* (dog) skeleton by number of fragments (*NISP*) and minimum number of individuals (*MNI*) for each phase under study.

Canis familiaris		***Late Neolithic I***				***Late Neolithic II***	
		Phase I *(Layers 6, 5, 4)*		***Phase II*** *(Layers 3, 2)*		***Phase III*** *(Layer 1)*	
		NISP	***MNI***	***NISP***	***MNI***	***NISP***	***MNI***
Teeth	***Incisors Maxillary***						
	Canines Maxillary	*1*	*1*			*1*	*1*
	dP&P Maxillary			*1*	*1*		
	M1/2 Maxillary	*3*	*1*				
	M3 Maxillary	*1*	*1*				
	Incisors Mandibular					*2*	*1*
	Canines Mandibular	*6*	*3*	*2*	*1*	*4*	*2*
	dP&P Mandibular	*23*	*4*	*3*	*1*	*5*	*1*
	M1/2 Mandibular	*14*	*4*	*9*	*3*	*9*	*3*
	M3 Mandibular	*4*	*2*	*2*	*1*	*2*	*1*
Postcranial Bones	***Cranium***						
	Atlas	*1*	*1*	*1*	*1*	*1*	*1*
	Axis			*3*	*3*	*1*	*1*
	Scapula	*1*	*1*	*5*	*3*	*1*	*1*
	Humerus proximal	*2*	*1*	*1*	*1*	*1*	*1*
	Humerus distal	*2*	*1*	*7*	*4*		
	Radius proximal			*1*	*1*		
	Radius distal			*1*	*1*	*1*	*1*
	Ulna proximal	*6*	*3*	*3*	*2*	*2*	*1*
	Metacarpal 3 distal	*1*	*1*				
	Metacarpal 4 distal	*1*	*1*			*1*	*1*
	Pelvis			*2*	*1*		
	Femur proximal			*1*	*1*		
	Tibia proximal	*2*	*1*	*1*	*1*		
	Tibia distal	*1*	*1*	*4*	*2*	*1*	*1*
	Astragalus						
	Calcaneum			*2*	*1*		
	Metatarsal 3 distal	*1*	*1*			*2*	*1*
	Metatarsal 4 distal	*2*	*1*	*2*	*1*		
	Phalanx 1					*1*	*1*
	Phalanx 2						
	Phalanx 3						
	TOTAL	***72***	***MNI: 4***	***51***	***MNI: 4***	***35***	***MNI: 3***

Table 5.49: Parts of the *Vulpes vulpes* (red fox) skeleton by number of fragments (*NISP*) for each phase under study.

Vulpes vulpes		***Late Neolithic I***		***Late Neolithic II***
		Phase I *(Layers 6, 5, 4)*	***Phase II*** *(Layers 3, 2)*	***Phase III*** *(Layer 1)*
		NISP	***NISP***	***NISP***
Teeth	***M1/2 Maxillary***			*2*
	M3 Maxillary			*1*
	dP&P Mandibular	*3*	*7*	
	M1/2 Mandibular	*3*	*2*	*1*
	M3 Mandibular			*1*
Postcranial Bones	***Atlas***	*1*		*1*
	Axis	*1*		
	Humerus proximal	*1*	*1*	*1*
	Humerus distal	*1*	*1*	
	Ulna proximal	*1*	*2*	*2*
	Metacarpal 3 distal	*1*		
	Pelvis	*2*		
	Tibia distal	*3*	*1*	
	Calcaneum	*1*		
	Metatarsal 3 distal	*1*		
	TOTAL	***19***	***14***	***9***

Table 5.50: Parts of the *Lepus europaeus* (hare) skeleton by number of fragments (*NISP*) for each Phase under study.

Lepus europaeus		***Late Neolithic I***		***Late Neolithic II***
		Phase I *(Layers 6, 5, 4)*	***Phase II*** *(Layers 3, 2)*	***Phase III*** *(Layer 1)*
		NISP	***NISP***	***NISP***
Teeth and Bones	***dP&P Mandibular***		*3*	
	Scapula		*1*	
	Humerus distal	*3*		*1*
	Radius proximal	*1*		*1*
	Radius distal	*1*		
	Pelvis	*1*	*1*	*1*
	Femur proximal		*1*	
	Metatarsal 3 distal			*2*
	Metatarsal 4 distal	*1*		
	Phalanx 1	*1*	*2*	*1*
	Phalanx 2		*1*	
	TOTAL	***8***	***9***	***6***

5.6 – Contextual distribution

Species and body part distribution per context type is presented on a layer-by-layer level rather than broad chronological periods; it is believed that each layer represents a distinct and separate entity with different formation processes and discrete activity areas. The following analysis aims:

- To provide insights into the nature of different contexts.
- To reveal any patterns related to depositional practices.

Excavators of the site have identified more than 35 different contexts (Aslanis pers. comm.), resulting in the assemblage from each context being very small to be properly analysed. For heuristic purposes, therefore, it was decided that a number of contexts with roughly the same characteristics should be grouped together into 10 major categories. These are:

Contexts	***Description***
Pits	*Containing refuse material.* *The excavators use the term "ditches" as well.*
Pits of pit-houses	*Pits inside pit-houses n. 1, n. 2 and n. 3 (Layer 6/ Phase I). The floor levels were found 60-70cm below the surface of the natural subsoil from which they were cut [see also **2.3.1 – Phase I** (**Layers 4-11**)].*
Floors	*'Indoor' use surfaces, covered with clay.* *Scattered material culture objects and bones.*
Use surfaces	*'Outdoor' use surfaces.* *Scattered material culture objects and bones.*
Hearths	*Seven hearths in total. Layer 3 (Phase II): four hearths, two* in situ. *Layers 4, 5 and 6 (Phase I): one hearth respectively, all* in situ.
Building foundations	*Wattle walls daubed with clay.*
Postholes	*Supporting timber-framed wattle and daub walls and roofs.* *Some found in ditches.*
Ash layer	*Ash covering a part of Layer 6 after the conflagration event.*
Patios	*Paved area made with pebbles from the nearby river Strymon.* *Present in Layers 3 (Phase II) and 4 (Phase I).*
Cairns	*Mound of rough stones present in Layers 3 (Phase II) and 4 (Phase I). The excavators haven't suggested any particular reasons regarding their purpose.*
Mixed contexts	*Result of ploughing activities over the years.* *Mixed contexts include pebbles, rough stones, clay and pottery fragments.* *Present only in Layer 1 (Phase III).*

5.6.1 – Distribution of the faunal material per context type

Out of 6525 'countable' specimens, only 3628 (56%) were attributed to contexts. The rest of the faunal material (2897 specimens: 44%) derives from contexts of completely unknown origin (these should not be confused with the mixed contexts of Layer 1, which are described in the table above); the part of the faunal assemblage, which derives from contexts of completely unknown origin, was left out of the current analysis. ***Table 5.51*** and ***Figure 5.18*** present the distribution of the faunal material per context type on a layer-by-layer level. The analysis indicates that no particular context stands out for having being favoured regarding the disposal of butchered debris; on a gross scale, the examination reveals that use surfaces contain almost a quarter of the bone assemblage followed by pits, floors and hearths making up a further half of the assemblage. Other types of contexts produced more than 100 fragments each (*i.e.* postholes, ash layer, house pits), while building foundations, cairns and patios produced less than 100 fragments.

Mixed contexts (these should not be confused with the contexts of completely unknown origin; see also table above for more details), which are present in Layer 1 (Phase III) provided a high number of remains (59% of the faunal material from Layer 1), but unfortunately, their mingled nature (pebbles, stones, clay, pottery and bones) prevented any extensive analysis. Since the rest of the context types (pits, use surfaces, postholes) from Layer 1 produced very small quantities of animal bones, they will not be considered in the following analysis.

The contexts that produced the highest quantities of animal remains in Layer 6 (Phase I) were the pits of the pit-houses n. 1, n. 2 and n 3, the use surfaces and the ash layer. The high number of bones from the use surfaces was expected, since these were areas of everyday activities. On the other hand, the high number of bones recovered from the ash layer was also expected, as the sealing of parts of Layer 6 by a thick 20cm deposit of white ash [see also ***2.3.1 – Phase I (Layers 4-11)***] guaranteed bone preservation. Of interest is also the fact that the pits of the pit-houses produced a large quantity of bones. In order to investigate the nature of the deposition of the faunal remains in these pits, we looked at the depths from which these bones derive. These indicate that a considerable number of bones were found at the lowest levels of the pits of the pit-houses. As previously argued [see also ***2.3.1 – Phase I (Layers 4-11)***], the archaeological evidence at Promachon indicates that each pit of a pit-house covered an area as large as 8-10 m^2 (Aslanis pers. comm.), thus suggesting that it was large enough to accommodate a family; this evidence, combined with the presence of a hearth in the lower level of the pit of the pit-house n. 1 (square Δ; Koukouli-Chrysanthaki *et al.* 2007) and the presence of animal bones, suggests that pit-houses were used as living spaces, where a number of activities - involving also food consumption - were taking place[11].

In addition to the faunal material that was recovered from the lowest levels of the pits of the pit-houses, a smaller number of bones were found at various depths above the lowest levels of the pits. These bones, probably mixed with soil matrix, could potentially represent backfilling material that was used by the Neolithic inhabitants of Promachon in order to fill the pits - after the conflagration event - of the pit-houses for the construction of the aboveground houses that appear in the next phase (Phase II).

With regard to Layer 4 (Phase I), the highest numbers of bones derive from floors (31%), pits (24%) and use surfaces (17%). The high number of bones from the floors and use surfaces can - once more - be explained on the basis of the disposal of butchered debris on areas of everyday activities. In general, pits [*i.e.* external pits - not to be confused with pits of the pit-houses - are also referred as ‘ditches’ at Promachon (Aslanis pers. comm.)] have been considered to represent everyday deposition. This is also the case at Promachon. To be more specific, no particular preference on a single anatomical element or a specific age category was detected in any of the pits

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[11] Having said that, we should not exclude the possibility that pit-houses were also used as storage facilities and/or workshops. In connection to this, Koukouli-Chrysanthaki *et al.* (2007), propose the presence of raised upper structures (used as the main living spaces), which were separated from the lower levels (pits) with a raised (wooden?) platform [see also ***2.3.1 – Phase I (Layers 4-11)***].

from Layer 4; in addition, there was no particular reliance to a single, either domestic, or wild, species. It can be suggested that pits from Layer 4 were not reserved for any particular events, and they were more likely to be the recipients of deposits containing material from everyday activities.

The contexts that produced by far the highest quantities of bones in Layer 3 (Phase II) were the use surfaces, the hearths and the floors. The frequency of bones from pits in Layer 3 is lower than the preceding layer (Layer 4), which is probably a result of the general scarcity of pits as a context type from this Layer. In addition, the two structures present in this layer are aboveground, and therefore, the discarded bone debris was most likely to end up in the use surfaces and the floors; this could potentially explain the highest frequency of bones from the latter contexts.

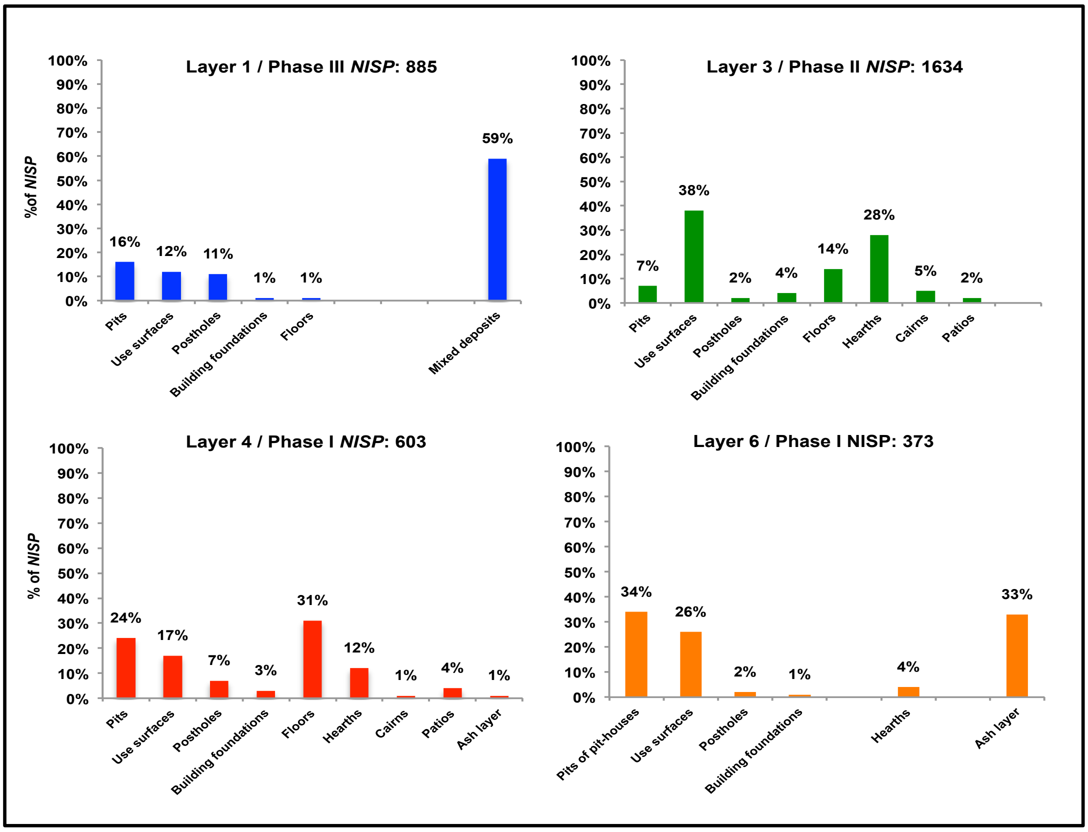

Figure 5.18: Distribution of the faunal material per context type on a layer-by-layer level. Layers 2 and 5 are excluded due to small sample sizes. Data in Table 5.51. *NISP* counts.

5.6.2 – Distribution of three main domesticates per context type

Only a number of contexts from each layer contained enough material to be properly examined; the threshold for this analytical purpose was set to 100 bone fragments (*NISP* ≥ 100) per single context type. Most of the faunal material from individual contexts belongs to domesticated species (cattle, caprines, pigs); it seems therefore that there isn't any particular reliance to wild species in any of the contexts analysed. Additionally, no particular preference in a single wild species was detected in any of the contexts.

Due to restrictions of small sample size, frequencies between species are explored only for the three commonest taxa (cattle, sheep/goat and pigs). The results are presented in ***Figure 5.19*** (***Tables 5.52a-5.64b***). Analysis of the distribution of the three main domesticates per context type shows that in most cases the observed pattern is similar to the distribution by phase; almost all contexts stand out for having a higher proportion of caprines than cattle, while pig is consistently the third most frequently recovered species in all context types and layers.

However, there is an issue that should also be considered; to be more specific, it is worth noting that the slight decline in cattle frequencies that had been identified through the analysis of the combined assemblage (see also ***5.3 – Species representation***) is inconsistently represented in pits and use surfaces (the only context types that we can compare across layers). In pits it is not evident at all, while in use surfaces is not apparent until Layer 1 (where caprines are represented with 75% and cattle with 20% in terms of *NISP*). This may suggest that the decline of cattle with time is not only a product of changes in husbandry strategies but also of the differential use of context types across layers.

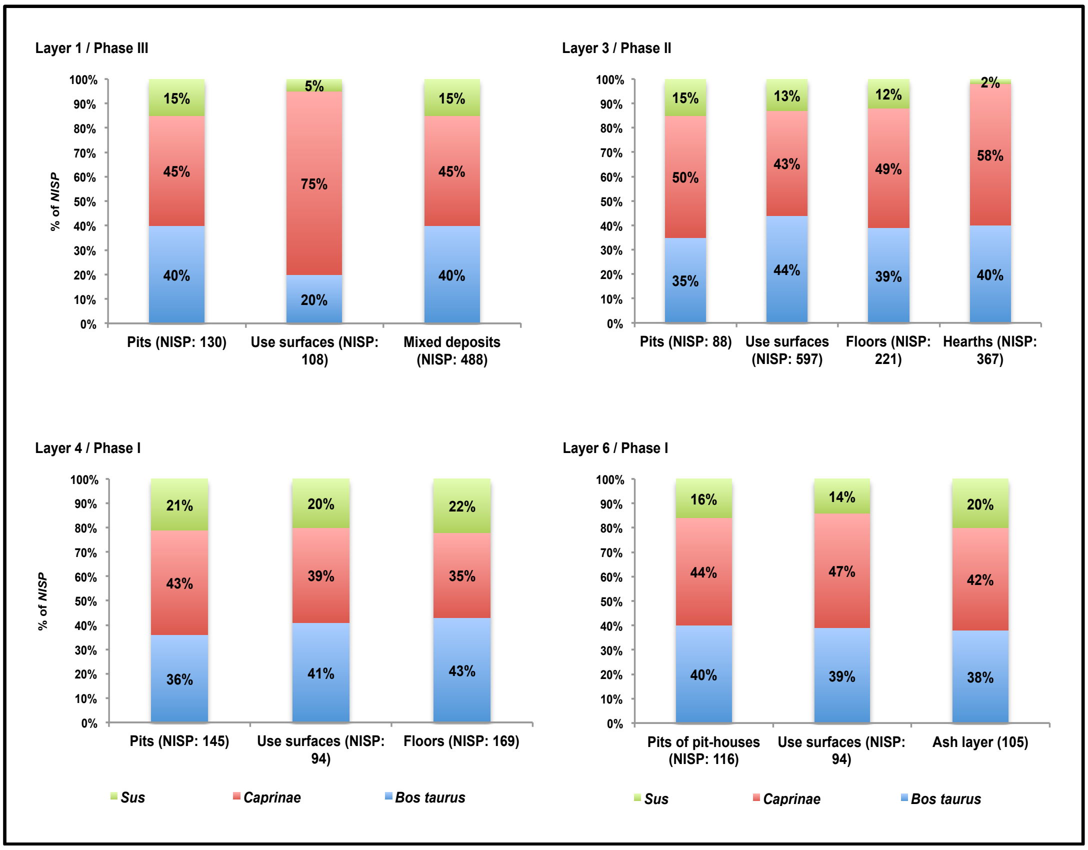

Figure 5.19: Distribution of the three main domesticates per context type on a layer-by-layer level. Layers 2 and 5 are excluded due to small sample sizes. The Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Tables 5.52a - 5.64b. *NISP* counts.

5.6.3 – Body part distribution of the three main domesticates per context type

Due to restrictions of small sample size, body part distribution is explored only for the commonest taxa (cattle, caprines and pigs) from the use surfaces of Layer 3 (Phase II) and only for broad anatomical groups (cranium, axial skeleton, upper limbs and lower limbs); the results are presented in ***Figures 5.20-5.22*** (***Tables 5.65-5.67***). The following table shows which bones were grouped together into broad anatomical groups:

Anatomical elements	***Groups***
Cranium (zygomaticus) and teeth (all)	***CRANIUM***
Atlas	***AXIAL SKELETON***
Axis	
Scapula	***UPPER LIMBS***
Humerus (proximal & distal)	
Pelvis	
Femur (proximal & distal)	
Radius (proximal & distal)	***LOWER LIMBS***
Ulna proximal	
Carpal 2+3	
Metapodials	
Tibia (proximal & distal)	
Scafocuboid	
Astragalus	
Calcaneum	
Phalanges (1, 2, 3)	

Analyses of the body part distribution of caprines and pigs from the use surfaces of Layer 3 (Phase II) show that the highest *MNI* values are gained from the cranium (caprines) and the upper limbs (pigs). This is consistent with the information that we have from the body part distribution of caprines and pigs from the combined assemblage for Phase II, where teeth (in the case of caprines) and the scapula (in the case of pigs) were represented with the highest *MNI* values.

On one hand, there are no particular reasons to suggest that any caprine postcranial elements are intentionally missing from the use surfaces of Layer 3; it is therefore safer to attribute the observed variations in the proportions of caprine postcranial elements to differential preservation and recovery bias rather than any specialized waste disposal practice. On the other hand, the low representation of pig crania from the use surfaces of Layer 3 is supporting earlier suggestions that these might have been disposed off-site during Phase II (see also ***5.5.3 – Sus body part distribution***).

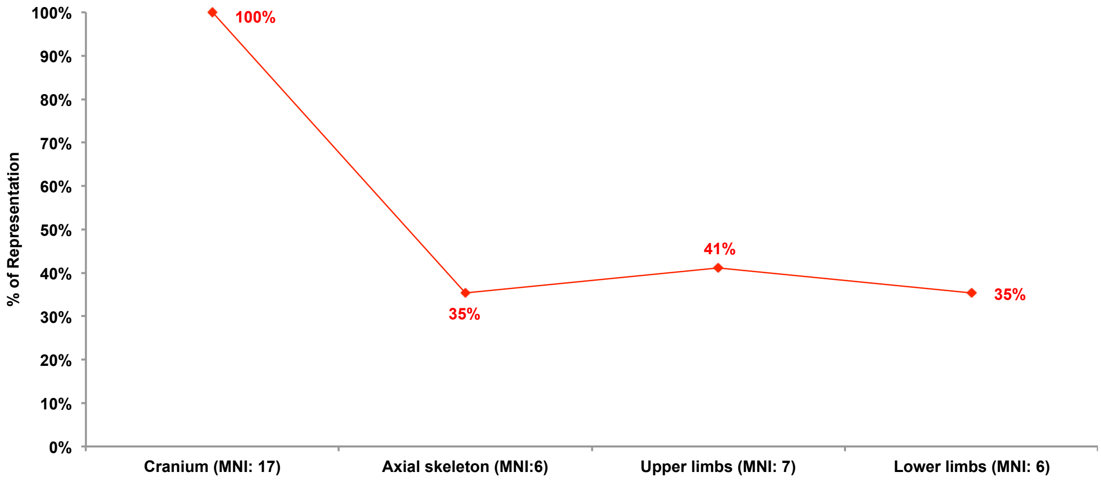

Figure 5.20: Body part distribution for Caprinae (caprines) from the use surfaces of Layer 3 (Phase II). *Caprinae* subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Table 5.65. *MNI* counts.

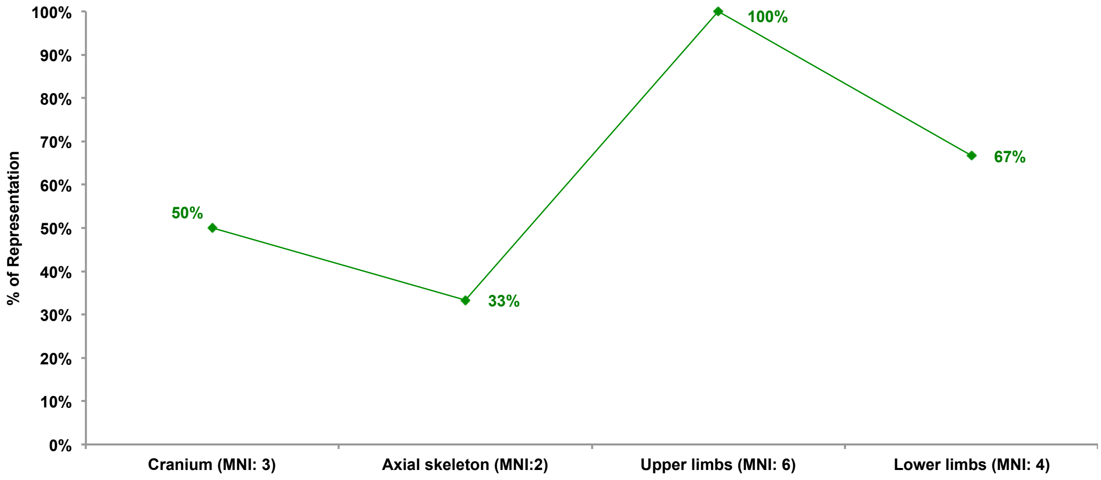

Figure 5.21: Body part distribution for *Sus* (pig) from the use surfaces of Layer 3 (Phase II). Data in Table 5.66. *MNI* counts.

Before moving to the body part distribution of cattle from the use surfaces of Layer 3 (Phase II), it is worth discussing what has been suggested for the body part distribution of this species from the combined assemblage for Phase II. The body part distribution of cattle for Phase II indicated that the highest *MNI* values were gained from cattle astragali rather than teeth; the pattern was considered peculiar, since there are not obvious taphonomic reasons, which could support the better representation of cattle astragalus in comparison to teeth. To be more specific, the astragalus is a very durable bone, however, teeth are dense and can easily survive in the archaeological record. It was therefore suggested that during Phase II, cattle heads were not as commonly introduced to the site with the rest of the carcass, or may have been processed in areas of the site not affected by the excavation (see also ***5.5.1* – Bos taurus *body part distribution***).

On the other hand, the body part distribution of cattle from the use surfaces of Layer 3 indicates that the cranium and the lower limbs are evenly distributed; however, the highest *MNI* values are gained from the axial skeleton (***Figure 5.22***). The bone contributing to the high representation of the axial skeleton is the axis, while the atlas, adjacent to it, is poorly represented. The atlas is placed between the head and the axis, both well represented, and since there do not seem to be obvious taphonomic factors that could explain its under-representation, and it seems unlikely that they would purposefully be removed by humans, this rather odd pattern can only be explained with the vagaries of small sample size (***Table 5.67***).

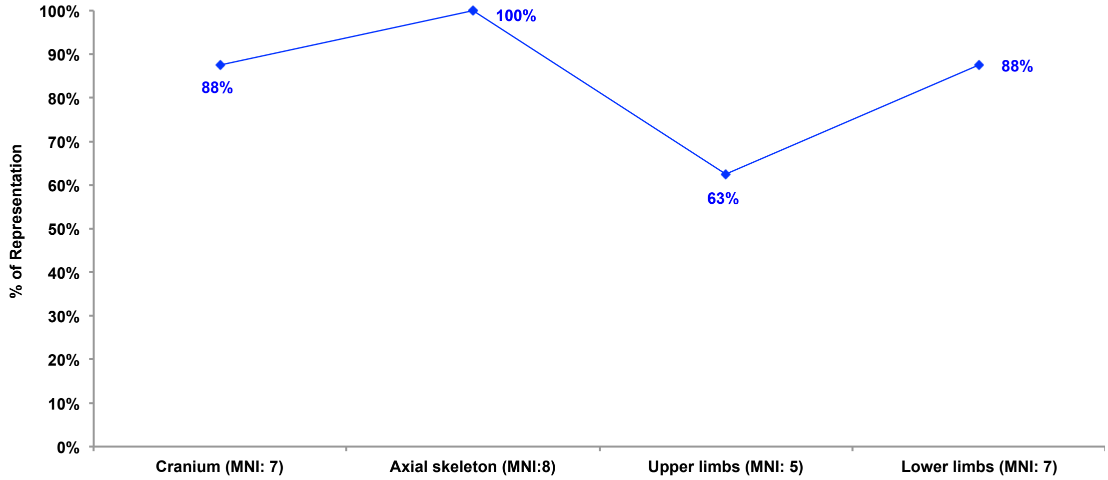

Figure 5.22: Body part distribution for *Bos taurus* (cattle) from the use surfaces of Layer 3 (Phase II). Data in Table 5.67. *MNI* counts.

5.6.4 – Distribution of taphonomic modifications per context type

Patterns of taphonomic modification and attrition may indicate differences in assemblage formation at a contextual level. ***Figure 5.23*** (***Table 5.68***) presents the incidence of gnawing, butchery and burning from a number of contexts where human modifications were most frequent: pits, use surfaces, floors and hearths. The context types are analysed by combining layers (and phases) in order to increase sample size, though at the expenses of a loss in chronological resolution.

To a considerable extent, the incidence of gnawing across different context types is consistent with the information from the combined assemblage (see also ***5.2.1 – Preservation***). To be more specific, there are no differences in the frequency of gnawing between individual contexts; scavenger gnawing is rather low in pits, use surfaces, floors (3% respectively) and hearths (4%), indicating that scavengers did not have differential access to areas of the site. This is consistent with the information from the combined assemblage, which suggested that scavenger access to bone debris was by and large restricted.

In addition, the frequency of butchery does not vary substantially across different contexts; butchery marks are represented with 4% on bones from pits and use surfaces and with 5% on bones from floors and hearths. There is no indication therefore from butchery marks that butchered debris from various stages of carcass processing was preferentially discarded in pits, use surfaces, floors or hearths.

As previously noted (see also ***5.4.3 – Burning***), the overall incidence of burning at Promachon is rather small (only 7% of the total 'countable' postcranial bones). There seems however, that burning is slightly higher in pits (8%) than any other analysed context (use surfaces, floors, hearths: 5% respectively). The difference in the burning incidence between pits and other contexts is rather small for any definite conclusions to be drawn, but we cannot exclude the possibility that burned material was preferentially discarded in pits rather than in use surfaces, floors and hearths.

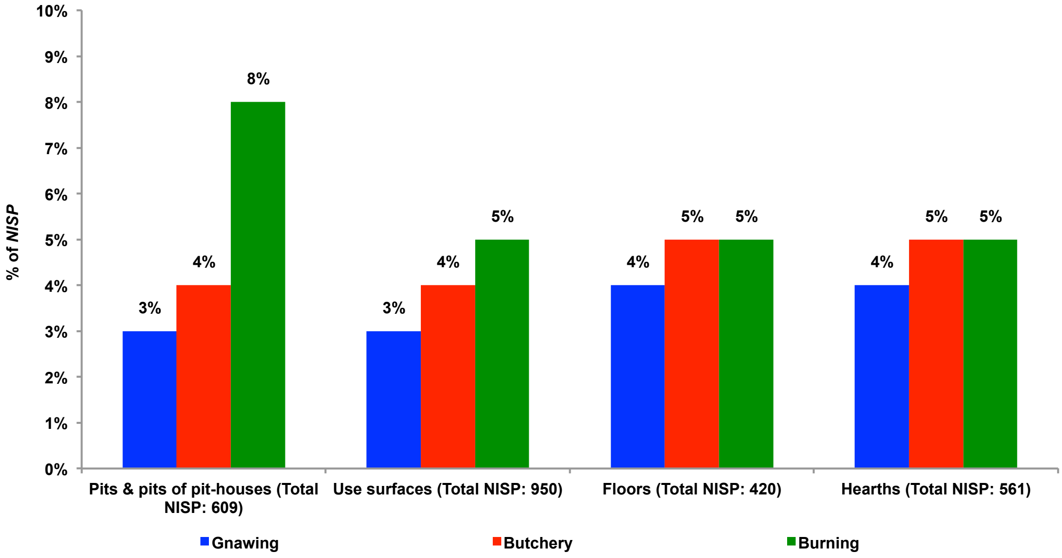

Figure 5.23: Frequency of gnawing, butchery marks and burning per context type. All layers are considered. Data in Table 5.68. *NISP* counts.

Table 5.51: Breakdown of the faunal material per context type. All layers are considered. Data for Figure 5.18. *NISP* counts.

Context types	Late Neolithic I										Late Neolithic II		TOTAL	
	Phase I						Phase II				Phase III			
	Layer 6		Layer 5		Layer 4		Layer 3		Layer 2		Layer 1			
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Pits	128	34%	71	64%	147	24%	103	7%	22	100%	138	16%	**609**	**17%**
Floors					184	31%	236	14%			8	1%	**428**	**12%**
Use surfaces	102	26%	9	8%	102	17%	627	38%			110	12%	**950**	**26%**
Hearths	15	4%	21	19%	72	12%	453	28%					**561**	**15%**
Building foundations	1	1%			18	3%	67	4%			6	1%	**92**	**3%**
Postholes	5	2%	10	9%	43	7%	34	2%			100	11%	**192**	**5%**
Ash Layer	122	33%			7	1%							**129**	**4%**
Patios					23	4%	39	2%					**62**	**2%**
Cairns					7	1%	75	5%					**82**	**2%**
Mixed contexts											523	59%	**523**	**14%**
TOTAL	**373**	**100%**	**111**	**100%**	**603**	**100%**	**1634**	**100%**	**22**	**100%**	**885**	**100%**	**3628**	**100%**

Table 5.52a: Species representation per context type: House pits, Layer 6 (Phase I). *NISP* counts.

Pits of pit-houses (Layer 6)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	*29*	*17*	*46*
Ovis/Capra	*17*	*15*	*32*
Ovis aries	*8*	*10*	*18*
Capra hircus	*1*		*1*
Sus	*12*	*7*	*19*
Canis familiaris	*2*	*2*	*4*
Cervus elaphus	*3*		*3*
Lepus europaeus	*2*		*2*
Ovis/Capra/Capreolus	*1*		*1*
Homo sapiens	*2*		*2*
TOTAL	***77***	***51***	***128***

Table 5.52b: Three main domesticates; representation per context type: House pits, Layer 6 (Phase I). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Pits of pit-houses (Layer 6)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*29*	*17*	*46*	***40%***
Caprinae	*26*	*25*	*51*	***44%***
Sus	*12*	*7*	*19*	***16%***
TOTAL	***67***	***49***	***116***	***100%***

Table 5.53a: Species representation per context type: Ash layer, Layer 6 (Phase I). *NISP* counts.

Ash layer (Layer 6)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	27	13	40
Ovis/Capra	12	23	35
Ovis aries	5	2	7
Capra hircus	1	1	2
Sus	13	8	21
Canis familiaris		3	3
Cervus elaphus	2	4	6
Capreolus capreolus	1	1	2
Lynx lynx	1		1
Mustella putorius		1	1
Cervus/Bos	3		3
Ovis/Capra/Capreolus	1		1
TOTAL	**66**	**56**	**122**

Table 5.53b: Three main domesticates; representation per context type: Ash layer, Layer 6 (Phase I). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Ash layer (Layer 6)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	27	13	40	**38%**
Caprinae	18	26	44	**42%**
Sus	13	8	21	**20%**
TOTAL	**58**	**47**	**105**	**100%**

Table 5.54a: Species representation per context type: Use surfaces, Layer 6 (Phase I). *NISP* counts.

Use surfaces (Layer 6)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	*30*	*7*	*37*
Ovis/Capra	*15*	*16*	*31*
Ovis aries	*8*	*5*	*13*
Capra hircus		*1*	*1*
Sus	*10*	*3*	*13*
Canis familiaris	*2*		*2*
Cervus elaphus		*2*	*2*
Dama dama	*1*		*1*
Ovis/Capra/Capreolus	*1*		*1*
Canis/Vulpes	*1*		*1*
TOTAL	***68***	***34***	***102***

Table 5.54b: Three main domesticates; representation per context type: Use surfaces, Layer 6 (Phase I). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Use surfaces (Layer 6)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*30*	*7*	*37*	***39%***
Caprinae	*23*	*21*	*45*	***47%***
Sus	*10*	*3*	*13*	***14%***
TOTAL	***63***	***31***	***94***	***100%***

Table 5.55a: Species representation per context type: Floors, Layer 4 (Phase I). *NISP* counts.

Floors (Layer 4)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	46	26	**72**
Ovis/Capra	17	20	**37**
Ovis aries	9	8	**17**
Capra hircus	3	3	**6**
Sus	21	16	**37**
Canis familiaris	4	5	**9**
Dama dama	1		**1**
Vulpes vulpes	3	1	**4**
Ursus arctos	1		**1**
TOTAL	***105***	***79***	***184***

Table 5.55b: Three main domesticates; representation per context type: Floors, Layer 4 (Phase I). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Floors (Layer 4)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*46*	*27*	*72*	***43%***
Caprinae	*29*	*31*	*60*	***35%***
Sus	*21*	*16*	*37*	***22%***
TOTAL	***96***	***74***	***169***	***100%***

Table 5.56a: Species representation per context type: Pits, Layer 4 (Phase I). *NISP* counts.

Pits (Layer 4)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	*33*	*16*	***49***
Ovis/Capra	*18*	*25*	***43***
Ovis aries	*7*	*6*	***13***
Capra hircus	*2*		***2***
Sus	*21*	*7*	***28***
Canis familiaris		*3*	***3***
Vulpes vulpes	*1*	*1*	***2***
Cervus elaphus	*2*		***2***
Cervus/Bos	*1*		***1***
Anser sp.	*2*		***2***
Grus sp.	*1*		***1***
Ovis/Capra/Capreolus	*1*		***1***
TOTAL	***89***	***58***	***147***

Table 5.56b: Three main domesticates; representation per context type: Pits, Layer 4 (Phase I). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Pits (Layer 4)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*33*	*16*	*49*	***36%***
Caprinae	*27*	*31*	*58*	***43%***
Sus	*21*	*7*	*28*	***21%***
TOTAL	***81***	***64***	***135***	***100%***

Table 5.57a: Species representation per context type: Use surfaces, Layer 4 (Phase I). *NISP* counts.

Use surfaces (Layer 4)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	*27*	*12*	***39***
Ovis/Capra	*12*	*15*	***27***
Ovis aries	*4*	*1*	***5***
Capra hircus	*3*	*2*	***5***
Sus	*16*	*2*	***18***
Canis familiaris	*1*	*1*	***2***
Sus scrofa		*1*	***1***
Lepus europaeus	*1*		***1***
Cervus/Bos	*3*		***3***
Canis/Vulpes	*1*		***1***
TOTAL	***68***	***34***	***102***

Table 5.57b: Three main domesticates; representation per context type: Use surfaces, Layer 4 (Phase I). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Use surfaces (Layer 4)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*27*	*12*	*39*	***41%***
Caprinae	*19*	*18*	*37*	***39%***
Sus	*16*	*2*	*18*	***20%***
TOTAL	***62***	***32***	***94***	***100%***

Table 5.58a: Species representation per context type: Use surfaces, Layer 3 (Phase II). *NISP* counts.

Use surfaces (Layer 3)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	*185*	*76*	*261*
Ovis/Capra	*66*	*134*	*200*
Ovis aries	*27*	*20*	*47*
Capra hircus	*4*	*5*	*9*
Sus	*55*	*25*	*80*
Canis familiaris	*8*	*6*	*14*
Cervus elaphus	*1*	*1*	*2*
Capreolus capreolus	*2*		*2*
Lepus europaeus		*1*	*1*
Vulpes vulpes	*2*	*1*	*3*
Corvus corax	*1*		*1*
Cervus/Bos	*1*		*1*
Cervus/Dama	*1*		*1*
Canis/Vulpes		*2*	*2*
Ovis/Capra/Capreolus	*3*		*3*
TOTAL	***356***	***271***	***627***

Table 5.58b: Three main domesticates; representation per context type: Use surfaces, Layer 3 (Phase II). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Use surfaces (Layer 3)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*185*	*76*	*261*	***44%***
Caprinae	*97*	*159*	*256*	***43%***
Sus	*55*	*25*	*80*	***13%***
TOTAL	***337***	***260***	***597***	***100%***

Table 5.59a: Species representation per context type: Hearths, Layer 3 (Phase II). *NISP* counts.

Hearths (Layer 3)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	98	48	146
Ovis/Capra	57	94	151
Ovis aries	42	10	52
Capra hircus	5	4	9
Sus	41	20	61
Canis familiaris	5	3	8
Cervus elaphus	4	4	8
Dama dama	1		1
Capreolus capreolus	6	2	8
Lepus europaeus	2		2
Cervus/Bos	1		1
Cervus/Dama	4		4
Canis/Vulpes	1		1
Ovis/Capra/Capreolus	1		1
TOTAL	**268**	**185**	**453**

Table 5.59b: Three main domesticates; representation per context type: Hearths, Layer 3 (Phase II). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Hearths (Layer 3)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	98	48	146	**40%**
Caprinae	104	108	212	**58%**
Sus	5	4	9	**2%**
TOTAL	**207**	**160**	**367**	**100%**

Table 5.60a: Species representation per context type: Floors, Layer 3 (Phase II). *NISP* counts.

Floors (Layer 3)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	58	28	86
Ovis/Capra	30	54	84
Ovis aries	11	9	20
Capra hircus	4	1	5
Sus	12	14	26
Cervus elaphus	4	1	5
Dama dama	1		1
Capreolus capreolus	1		1
Lepus europaeus	2		2
Aves	1		1
Cervus/Bos	3	1	4
Ovis/Capra/Capreolus	1		1
TOTAL	**128**	**108**	**236**

Table 5.60b: Three main domesticates; representation per context type: Floors, Layer 3 (Phase II). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Floors (Layer 3)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	58	28	86	**39%**
Caprinae	45	64	109	**49%**
Sus	12	14	26	**12%**
TOTAL	**115**	**106**	**221**	**100%**

Table 5.61a: Species representation per context type: Pits, Layer 3 (Phase II). *NISP* counts.

Pits (Layer 3)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	*23*	*9*	*32*
Ovis/Capra	*13*	*14*	*27*
Ovis aries	*7*	*2*	*9*
Capra hircus	*7*		*7*
Sus	*7*	*6*	*13*
Canis familiaris	*4*	*2*	*6*
Cervus elaphus	*2*	*1*	*3*
Capreolus capreolus	*1*		*1*
Vulpes vulpes	*1*		*1*
Cervus/Bos	*2*		*2*
Ovis/Capra/Capreolus	*2*		*2*
TOTAL	***69***	***34***	***103***

Table 5.61b: Three main domesticates; representation per context type: Pits, Layer 3 (Phase II). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Pits (Layer 3)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*23*	*9*	*32*	***35%***
Caprinae	*27*	*16*	*43*	***50%***
Sus	*7*	*6*	*13*	***15%***
TOTAL	***57***	***31***	***88***	***100%***

Table 5.62a: Species representation per context type: Mixed contexts, Layer 1 (Phase III). *NISP* counts.

Mixed contexts (Layer 1)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	*140*	*58*	*198*
Ovis/Capra	*51*	*110*	*161*
Ovis aries	*28*	*15*	*43*
Capra hircus	*5*	*6*	*11*
Sus	*53*	*22*	*75*
Canis familiaris	*6*	*4*	*10*
Cervus elaphus	*7*		*7*
Capreolus capreolus	*4*		*4*
Lepus europaeus	*2*		*2*
Vulpes vulpes	*1*	*1*	*2*
Homo sapiens		*1*	*1*
Cervus/Bos	*3*		*3*
Cervus/Dama	*1*		*1*
Ovis/Capra/Capreolus	*5*		*5*
TOTAL	***306***	***217***	***523***

Table 5.62b: Three main domesticates; representation per context type: Mixed contexts, Layer 1 (Phase III). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Mixed contexts (Layer 1)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*84*	*131*	*215*	***40%***
Caprinae	*140*	*58*	*198*	***45%***
Sus	*53*	*22*	*75*	***15%***
TOTAL	***277***	***211***	***488***	***100%***

Table 5.63a: Species representation per context type: Pits, Layer 1 (Phase III). *NISP* counts.

Pits (Layer 1)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	34	18	52
Ovis/Capra	19	26	45
Ovis aries	11	2	13
Capra hircus		1	1
Sus	9	10	19
Canis familiaris	1	2	3
Cervus elaphus		1	1
Capreolus capreolus			0
Vulpes vulpes		1	1
Meles meles	1		1
Cervus/Bos	1		1
Ovis/Capra/Capreolus	1		1
TOTAL	***77***	***61***	***138***

Table 5.63b: Three main domesticates; representation per context type: Pits, Layer 1 (Phase III). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Pits (Layer 1)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	30	29	59	***40%***
Caprinae	34	18	52	***45%***
Sus	9	10	19	***15%***
TOTAL	***73***	***57***	***130***	***100%***

Table 5.64a: Species representation per context type: Use surfaces, Layer 1 (Phase III). *NISP* counts.

Use surfaces (Layer 1)	*Bones*	*Teeth*	*TOTAL*
	NISP	*NISP*	
Bos taurus	*11*	*9*	*20*
Ovis/Capra	*17*	*39*	*56*
Ovis aries	*13*	*8*	*21*
Capra hircus	*1*	*3*	*4*
Sus	*3*	*4*	*7*
Canis familiaris	*2*		*2*
TOTAL	***47***	***63***	***110***

Table 5.64b: Three main domesticates; representation per context type: Use surfaces, Layer 1 (Phase III). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.19. *NISP* counts.

Use surfaces (L1)	*Bones*	*Teeth*	*TOTAL*	*% TOTAL*
	NISP	*NISP*		
Bos taurus	*11*	*9*	*20*	***20%***
Caprinae	*31*	*50*	*85*	***75%***
Sus	*3*	*4*	*7*	***5%***
TOTAL	***45***	***63***	***108***	***100%***

Figure 5.65: Body part distribution of Caprinae (caprines) on the use surfaces of Layer 3 (Phase II) using broad anatomical groups. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.20.

Caprinae	***NISP***	***MNI***	***HIGHEST MNI***	***% MNI***	***CATEGORIES***
Incisors	*7*	*1*	***17***	***100%***	***CRANIUM***
dP&P Maxillary	*14*	*3*			
M1/2 Maxillary	*38*	*10*			
M3 Maxillary	*18*	*9*			
dP&P Mandibular	*45*	*8*			
M1/2 Mandibular	*65*	*17*			
M3 Mandibular	*18*	*9*			
Cranium					
Atlas	*2*	*2*	***6***	***35%***	***AXIAL SKELETON***
Axis	*6*	*6*			
Scapula	*6*	*3*	***7***	***41%***	***UPPER LIMBS***
Humerus proximal		*0*			
Humerus distal	*9*	*5*			
Pelvis	*14*	*7*			
Femur proximal	*1*	*1*			
Femur distal	*1*	*1*			
Radius proximal	*10*	*5*	***6***	***35%***	***LOWER LIMBS***
Radius distal	*9*	*1*			
Ulna proximal	*3*	*2*			
Carpal 2+3	*2*	*1*			
Metacarpal distal	*3*	*2*			
Metacarpal ½ distal	*1*				
Tibia proximal	*2*	*1*			
Tibia distal	*11*	*6*			
Scafocuboid					
Astragalus	*7*	*4*			
Calcaneum	*8*	*4*			
Metatarsal distal	*2*	*2*			
Metatarsal ½ distal	*2*				
Metapodial distal					
Metapodial ½ distal					
Phalanx 1	*3*	*1*			
Phalanx 2	*1*	*1*			
Phalanx 3					
TOTAL	***301***	***MNI: 17***			

Figure 5.66: Body part distribution of *Sus* (pig) on the use surfaces of Layer 3 (Phase II) using broad anatomical groups. Data for Figure 5.21.

Sus	*NISP*	*MNI*	*HIGHEST MNI*	*% MNI*	*CATEGORIES*
Incisors Maxillary	*3*	*1*	**3**	**50%**	**CRANIUM**
Canines Maxillary	*4*	*2*			
dP&P Maxillary	*10*	*2*			
M1/2 Maxillary	*11*	*3*			
M3 Maxillary	*3*	*2*			
Incisors Mandibular	*4*	*1*			
Canines Mandibular	*1*	*1*			
dP&P Mandibular	*8*	*2*			
M1/2 Mandibular	*3*	*1*			
M3 Mandibular	*3*	*2*			
Cranium					
Atlas			**2**	***33%***	***AXIAL SKELETON***
Axis	*2*	*2*			
Scapula	*11*	*6*	**6**	***100%***	***UPPER LIMBS***
Humerus proximal	*2*	*1*			
Humerus distal	*4*	*2*			
Pelvis	*1*	*1*			
Femur proximal	*1*	*1*			
Femur distal	*1*	*1*			
Radius proximal	*2*	*1*	**4**	**67%**	**LOWER LIMBS**
Radius distal	*5*	*3*			
Ulna proximal	*8*	*4*			
Carpal 3					
Metacarpal 3 distal	*1*	*1*			
Metacarpal 4 distal	*1*	*1*			
Tibia proximal	*1*	*1*			
Tibia distal	*5*	*3*			
Scafocuboid					
Astragalus	*1*	*1*			
Calcaneum	*2*	*1*			
Metatarsal 3 distal					
Metatarsal 4 distal	*2*	*1*			
Phalanx 1	*2*	*1*			
Phalanx 2	*1*	*1*			
Phalanx 3	*2*	*1*			
TOTAL	***105***	***MNI: 6***			

Figure 5.67: Body part distribution of *Bos taurus* (cattle) on the use surfaces of Layer 3 (Phase II) using broad anatomical groups. Data for Figure 5.22.

Bos taurus	***NISP***	***MNI***	***HIGHEST MNI***	***% MNI***	***CATEGORIES***
Incisors	*3*	*1*	***7***	***88%***	***CRANIUM***
dP&P Maxillary	*11*	*2*			
M1/2 Maxillary	*17*	*5*			
M3 Maxillary	*3*	*2*			
dP&P Mandibular	*19*	*4*			
M1/2 Mandibular	*27*	*7*			
M3 Mandibular	*5*	*3*			
Cranium	*5*	*3*			
Atlas	*1*	*1*	***8***	***100%***	***AXIAL SKELETON***
Axis	*8*	*8*			
Scapula	*9*	*5*	***5***	***63%***	***UPPER LIMBS***
Humerus proximal	*1*	*1*			
Humerus distal	*5*	*3*			
Pelvis	*4*	*2*			
Femur proximal	*4*	*2*			
Femur distal	*4*	*2*			
Radius proximal	*6*	*3*	***7***	***88%***	***LOWER LIMBS***
Radius distal	*2*	*1*			
Ulna proximal	*3*	*2*			
Carpal 2+3	*3*	*2*			
Metacarpal distal	*6*	*4*			
Metacarpal ½ distal	*1*				
Tibia proximal	*2*	*1*			
Tibia distal	*8*	*4*			
Scafocuboid	*3*	*2*			
Astragalus	*13*	*7*			
Calcaneum	*9*	*5*			
Metatarsal distal	*5*	*3*			
Metatarsal ½ distal	*1*				
Metapodial distal					
Metapodial ½ distal	*1*				
Phalanx 1	*28*	*4*			
Phalanx 2	*28*	*4*			
Phalanx 3	*17*	*3*			
TOTAL	***262***	***MNI: 8***			

Table 5.68: Incidence of gnawing, butchery and burning from pits, use surfaces, floors and hearths. All layers are considered. Both 'countable' and 'uncountable' material is considered. 'Gnawing' includes gnawing marks attributed with safety to carnivores. 'Butchery' includes both cutmarks and chopmarks. 'Burning' includes burnt, singed and calcined material. Data for Figure 5.23. *NISP* counts.

Modification	***Pits & pits of pit-houses (NISP: 609)***		***Use surfaces (NISP: 950)***		***Floors (NISP: 428)***		***Hearths (NISP: 561)***	
	NISP	***%***	***NISP***	***%***	***NISP***	***%***	***NISP***	***%***
Gnawing	*16*	*3%*	*25*	*3%*	*15*	*4%*	*20*	*4%*
Butchery	*22*	*4%*	*36*	*4%*	*21*	*5%*	*26*	*5%*
Burning	*49*	*8%*	*50*	*5%*	*21*	*5%*	*29*	*5%*

5.7 – Age-at-death of the three main domesticates

Bone fusion and dental eruption and wear were recorded to assess kill-off patterns of cattle, caprine and pig populations from Promachon. In this section, these two main lines of evidence are presented independently. However, wherever possible, bone fusion and dental eruption and wear are integrated and evaluated.

5.7.1 – Bos taurus *age-at-death*

Examining the data concerning the epiphyseal fusion evidence first (***Table 5.69***), it seems that there is an inconsistency regarding the fusion of middle and late fusing bones. ***Figure 5.24*** shows that 67% of the middle fusing bones (2 - 3½ years) were fused; this indicates that 33% of the middle fusing bones were unfused and thus, a considerable part of the cattle population did not survive beyond the second and the first half of the third year. On the other hand, 89% of the bones in the late fusing stage (3½ - 4 years) were fused, indicating that the overwhelming majority of the cattle population in Promachon had reached skeletal maturity before death.

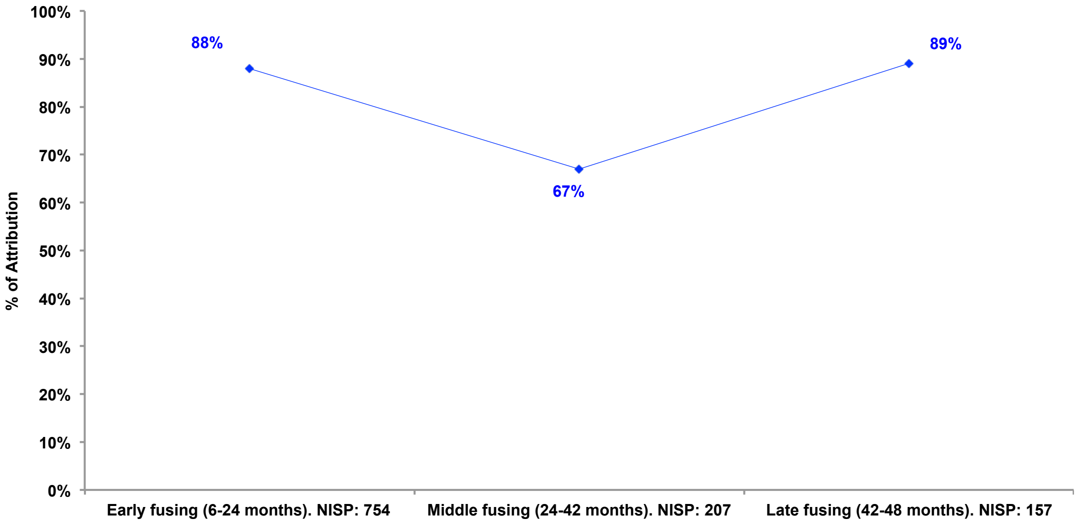

Figure 5.24: *Bos taurus* (cattle); percentage of fused/fusing bones in each of the three fusing categories (following Silver 1969). All phases are considered. Data in Table 5.69. *NISP* counts.

The pattern is rather confusing, as we would have expected a lower frequency of fused late fusing bones than fused middle fusing bones. This unusual pattern has also been observed at the Early Neolithic site of Runnymede bridge, UK (Viner 2010) and in the Late Jomon (equivalent to the Early Bronze Age) site of Tohoku region in Japan (Hongo *et al.* 2007). Due to the small sample size of cattle (in the first case) and pig (in the second case) postcranial elements, those two cases may be due to chance and do not necessarily require to be explained on the basis of a pattern of human behaviour.

The observed inconsistency at Promachon cannot be explained on the basis of taphonomy. If taphonomy was the reason, we would have expected the vulnerable late fusing bones (proximal and distal femur, proximal humerus, proximal ulna, proximal tibia and distal radius) to be more affected by attrition than the robust and dense middle fusing bones (metapodials, calcaneum and distal tibia). However, this is not the case at Promachon, since the fused late fusing bones are very well represented (89%), in fact slightly more so than the fused early fusing bones (88%).

The high frequency of fused late fusing bones may in fact have different origins: it is possible that some skeletally mature (older) individuals were killed off-site and that the inhabitants of Promachon transferred to the site only some parts of their carcasses. These partial skeletons of skeletally mature individuals might have been mixed with complete skeletons of skeletally immature (younger) individuals, thus significantly complicating the pattern. This might also explain the complete absence of mandibles belonging to ‘elderly’ individuals, further discussed in the following section. One would argue that it is highly unlikely that only the fused proximal humeri, distal radii, proximal ulnae, proximal and distal femora and distal tibiae were transferred into the site thus significantly inflating the frequency of fused late fusing bones, but this does not need to be the case. What the fusion evidence probably highlights is that, although all body parts are present, this does not necessarily indicate that all animals were introduced whole to the site. Perhaps specific meat cuts were also imported, deriving from animals of different ages, therefore confusing the fusion pattern.

In view of the fact that the fusion data is not entirely clear, mandible wear data (***Tables 5.70-5.71***) assumes a particular importance as a complementary source of evidence (***Plate 11***). However, the sample size of ageable cattle mandibles is small (*NISP*: 18), probably as a result of cattle crania being detached from the rest of the carcass and being deposited elsewhere (previously discussed in: ***5.5.1 –* Bos taurus *body part distribution***). In addition, the protocol decision of reconstructing the mortality profiles by using only the mandibles with at least two teeth with recordable wear in the dP_4 / P_4 - M_3 row, obviously affected the already small size of the sample. This is particularly true for the deposits of Phase III, from which, no cattle mandibles with more than one tooth with recordable wear were recovered. In order, therefore, to deal with the bias created by the small sample size, Phases I and II are of necessity treated together; although the integration of the two phases does not entirely eliminate the aforementioned bias, we can still draw some basic conclusions:

The age-at-death profile of cattle (***Figure 5.25***) exhibits three mortality peaks: the first and most prominent at 'sub adult' stage (39%), the second at 'immature' stage (28%) and the third at 'adult' stage (22%). About 11% of the mandibles were also attributed to the 'juvenile' stage.

Of interest is the complete absence of 'neonatal' mandibles; this contrasts with the occurrence of a small number (*NISP*: 7) of neonatal postcranial remains (suggesting that some animals at least were reared on-site). Preservation will bias the neonatal (as well as the very juvenile) individuals, as the teeth are more likely to fall out of the mandibles. For this reason, cattle isolated teeth were also examined in order to see if there was any evidence of the very young individuals being biased against in the mandible data. ***Table 5.72*** shows that a small number of unworn isolated mandibular first / second molars ($M_{1/2}$) are present, indicating that some mandibles of very young individuals were particularly affected by fragmentation factors.

The mortality profile of cattle indicates a considerable potential for the production of meat, with most animals being slaughtered when their maximum body weight had been reached. However, a diversified strategy for secondary products cannot be precluded, since the apparent frequency of juvenile and adult deaths is consistent with small-scale exploitation for milk (Halstead 1998; Payne 1973).

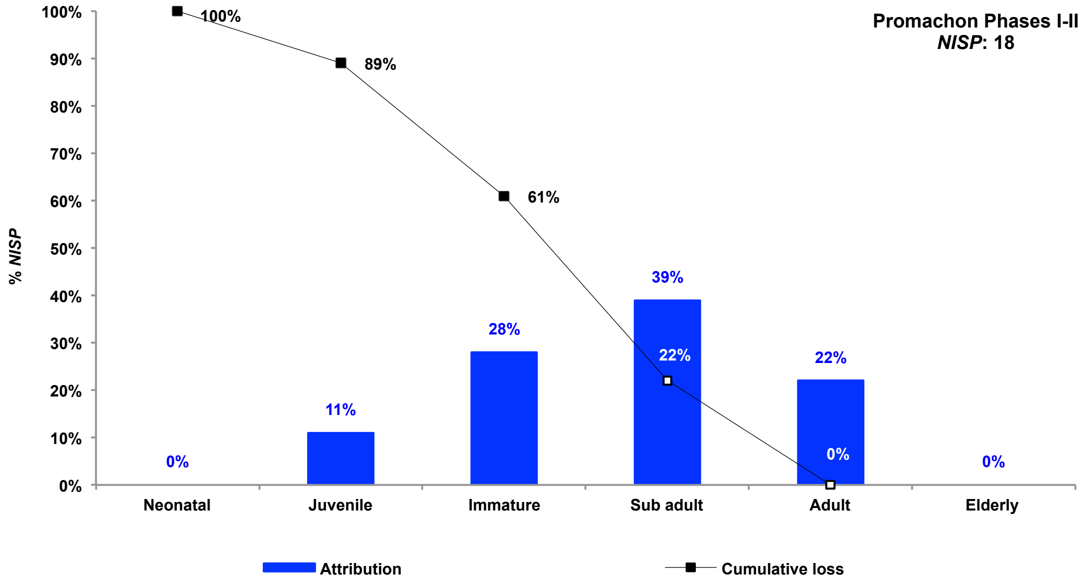

Figure 5.25: Promachon Phases I-II; *Bos taurus* (cattle) kill-off pattern from mandibular wear stages (following O'Connor 1989). Data in Table 5.71. *NISP* counts.

While the interpretation of Neolithic milk exploitation was initially challenged (*c.f.* Clutton-Brock 1981; Halstead 1998; McCormick 1992), it is now widely accepted due to mounting evidence for widespread dairy husbandry in this period (Evershed *et al.* 2008; Legge and Moore 2011). This form of combined meat and milk husbandry is rather difficult to be identified by means of the slaughter pattern alone, without independent corroboration[12]. However, mortality profiles approximating to the 'meat model' are compatible with the exploitation of a mixture of products; thus, the 'meat model' does not necessarily preclude the exploitation of cattle for milk, but rather implies that

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[12] The likelihood of cattle management for milking would be increased by the discovery of milk residues in ceramics, but such analyses have not as yet been carried out in Promachon-Topolnica.

any such use was most likely of low intensity and limited in scale (Halstead and Isaakidou 2013).

As in the case of prehistoric milking, the use of cattle for labour during the late stage of the Neolithic has been subjected to many speculations (Bartosiewicz *et al.* 1997; Halstead 1995; Johanssen 2005). Pathological conditions (*e.g.* exostosis, lipping, osteoarthritis) in cattle limb joints (*c.f.* Baker and Brothwell 1980; Bartosiewicz *et al.* 1993; 1997) are considered strong evidence of heavy stress, such as that involved in pulling an ard or a plough (Halstead 1998). However, we should also keep in mind that the osteological effects of the use of cattle for traction may be hard to disentangle from other factors such as, the nature of the terrain that cattle lived and, in particular, old age (Baker and Brothwell 1980; Halstead 1998; Johanssen 2005). In any case, no cattle bones with pathological conditions were recorded from Promachon (see also ***5.11 – Pathologies***).

Returning to the kill-off pattern highlighted in ***Figure 5.25***, of particular interest is the absence of mandibles belonging to ‘elderly’ individuals; this is consistent with previous suggestions that some of the skeletally mature (older) cattle might have been killed off-site, and that only some parts of their carcasses were introduced at the settlement. It is quite possible, therefore, that the absence of ‘elderly’ individuals in the observed kill-off pattern is the result of a selectivity of body parts brought on-site. Metrical examination on cattle horncores is too sparse to provide any information on the sexual composition of the cattle population at Promachon. However, we can assume that some of these ‘elderly’ individuals, which were killed off-site, were females used for breeding.

All in all, the evidence suggests that cattle in Promachon were used primarily for their meat. On the other hand, only tentative considerations can be made regarding the use of cattle for secondary products (milk and labour).

5.7.2 – Caprinae *age-at-death*

Compared to sheep postcranial bones (*NISP*: 349), the sample size of goat postcranial bones is very small (*NISP*: 64), and therefore insufficient for independent ageing analysis. To increase sample size, sheep and goat postcranial bones, as well as the three phases of occupation, have been combined for this analysis. ***Table 5.73*** presents the frequency of the fused early, middle and late fusing caprine postcranial bones, while ***Figure 5.26*** presents the results graphically. Epiphyseal fusion evidence for caprines shows that 79% of the early fusing bones (≤ 1½ years) were fused; the frequency of fused middle fusing bones (≈ 1½ - 3 years) drops to 77%, while in the late fusing stage (> 3 years), 68% of bones were fused. The fusion data indicates that a significant number of caprines survived to skeletal maturity, and that only a limited amount of slaughter occurred between the time the earliest and the latest fusing epiphyses fused. However, we need to look at the dental evidence too in order to draw a more accurate picture of the caprine kill-off pattern.

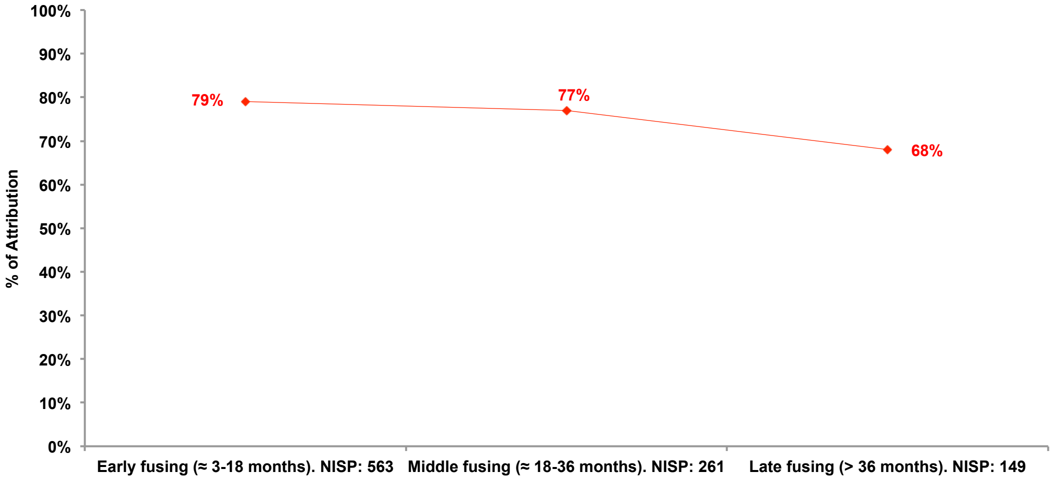

Figure 5.26: Caprinae (caprines); percentage of fused/fusing bones in each of the three fusing categories (following Silver 1969). The Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). All phases are considered. Data in Table 5.73. *NISP* counts.

Tooth wear stages (***Plate 12***) were analysed using the categories of Payne (1973; 1987) and the raw results are presented in ***Tables 5.74-5.76***. ***Figure 5.27*** and ***Table 5.77*** present the percentage of attribution of mandible wear stages for caprines (sheep/goat, sheep and goat), considering all three phases. One of the main issues of the ageing analysis is whether the fusion evidence could be combined with the data obtained from the mandible wear stages. In the case of cattle, we were unable to look into detail whether there is a real consistency between the two methods, since a rather unusual pattern was observed between the fused middle and late fusing bones (see also ***5.7.1* – Bos taurus *age-at-death***). Since such an unusual pattern does not apply for caprines, we can explore the issue of the compatibility of the two methods in the case of the caprine population. For instance, as previously noted, fusion data indicate that 68% of the late fusing caprine bones were fused, thus suggesting that the bulk of the caprine population survived beyond their third year; on the other hand, mandible wear data indicate that almost 61% of the caprine population survived beyond the third year [mandible wear stages F to I *sensu* Payne (1973); roughly equivalent to 3-10 years]; the fusion data is therefore consistent with the mandible wear data since the two methods present roughly the same frequencies with regard to the part of the caprine population that survived beyond the third year.

In more detail, the mandible wear data for caprines exhibit an almost even distribution of wear stages, though the greatest amount of slaughtering (almost 60% of the population) occurred between stages E and G (2-6 years). In overall therefore, the combined evidence of fusion and wear data is suggestive of the fact that caprines in Promachon were used for both primary (meat) and secondary (milk?) products. The culling of caprines between the age of six months and three years reflects an exploitation strategy particularly tuned towards the production of meat (Payne 1973). The mortality peak in stage E (2-3 years; 17%) indicates a decision of an increase in profitability of the meat (Helmer *et al.* 2007), since a number of caprines were slaughtered when they reached their maximum body sizes. However, part of the caprine population was slaughtered before they reached the optimum body size, as indicated by the 22% of animals represented in stages B to D. According to Helmer *et al.* (2007) and Vigne and Helmer

(2007) a mortality peak between the first and second year suggests that a number of caprines might had been culled when the *tender meat* was at maximum weight.

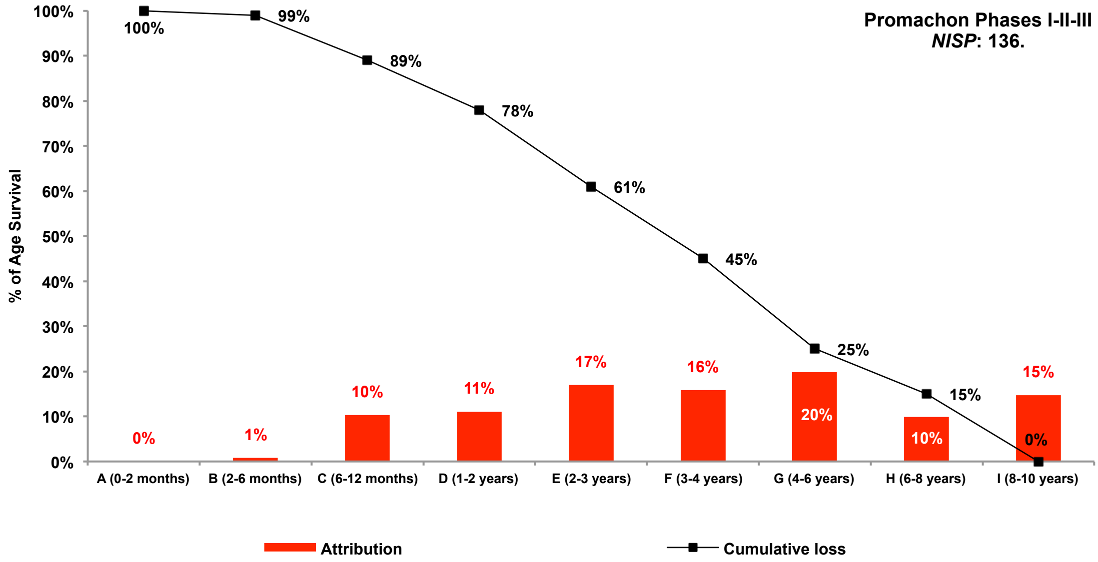

Figure 5.27: Promachon; Caprinae (caprines) kill-off pattern from mandibular wear stages (following Payne 1973). The Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). All phases are considered. Data in Table 5.77. *NISP* counts.

High infant mortality - characteristic of dairying exploitation (Payne 1973) - is likely to be obscured by taphonomic processes (Isaakidou 2006; Munson and Garniewisz 2003). As in the case of cattle, caprine loose teeth were examined to see if there was any evidence of very young individuals being biased against in the mandible data (***Table 5.78***). Since this did not appear to be the case, we can assume that the observed pattern indicates a ‘genuine’ dearth of very young individuals (wear stages A and B; 0-2 and 2-6 months respectively; 1% in total).

One would argue that the scarcity of very young caprines in Promachon does not conform to Payne’s (1973) idealized model of dairy husbandry. Halstead (1998), however, argues that the culling of lambs and kids (two to three months old or less) is characteristic of a *specialized economy* seeking a surplus production intended for trade and commerce; on the other hand, herders with a *mixed economy* and a small number of animals not seeking to maximise but to produce a consistent return, extend the culling age up to six months (*cf.* Rowley-Conwy 2000).

The latter model is more appropriate to Promachon, where during the Late Neolithic about 11% of the caprine population was slaughtered before the first year (wear stages A, B and C). It is therefore probable that the management of the caprine population at Promachon included - in addition to the exploitation of meat - a small-scale exploitation of milk. As in the case of cattle, the exploitation of caprines for dairy products should be corroborated by other lines of evidence such as traces of milk residues and lipids in ceramics. However, as previously noted, such analyses have not as yet been carried out at Promachon.

The apparent frequency of older individuals (wear stages G, H and I; 4-10 years; 45% in total) indicates that a number of (probably) female caprines were used for breeding, and also milk. One would argue however, that the high frequency of old individuals, combined with the presence of loom weights, clay spindle whorls and bone needles, which were found in the Late Neolithic deposits of Promachon (Koukouli-Chrysanthaki *et al.* 2007) [13], might indicate that other secondary products - besides milk - were used, the most likely of which would have been fleece[14]. However, spindle whorls, loom weights and bone needles do not necessarily indicate the use of animal fibres, as implied by Bailey (2000). Woven flax is well known to have been used in the Near East as early as the eighth millennium BC (Perlès 2001), while in the Balkan Peninsula the use of the same organic material has been reported in Late Neolithic deposits of the Vinča culture in Serbia (Borojević 2006). In any case, the appearance of fine hairs - characteristic of wool - result from a long-term process of selection for particular reproductive traits (Halstead 1998), which do not seem to have occurred until the Bronze Age (*cf.* Helmer *et al.* 2007; Perlès 2001; Ryder 1969; 1982; 1993).

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[13] The study of the clay spindle whorls from Promachon is currently in process (Theodorogianni and Trantalidou 2013).

[14] The term fleece is intended in its larger sense, whatever the nature of animal fibres.

The preceding analysis took into consideration the information provided by the wear data of all caprine (sheep, goat and sheep/goat) mandibles. However, in order to find whether the two closely related species were subject to different exploitation strategies, we have to look at the wear data from the mandibles of sheep/goat, sheep and goat respectively.

Figure 5.28 (***Table 5.79***), presents the percentage of attribution of wear stages only for the mandibles that were identified to the level of sheep/goat. The wear data for sheep/goat function as a control sample; we can see two mortality peaks: the first at stage E (2-3 years; 22%) and the second, more prominent, at stage I (8-10 years; 24%). About 16% of the mandibles were attributed to wear stages B and C (2-6 months and 6-12 months respectively) indicating that a number of individuals were killed before the first year. This confirms previous claims that both species were utilized for both primary (meat) and secondary products (milk).

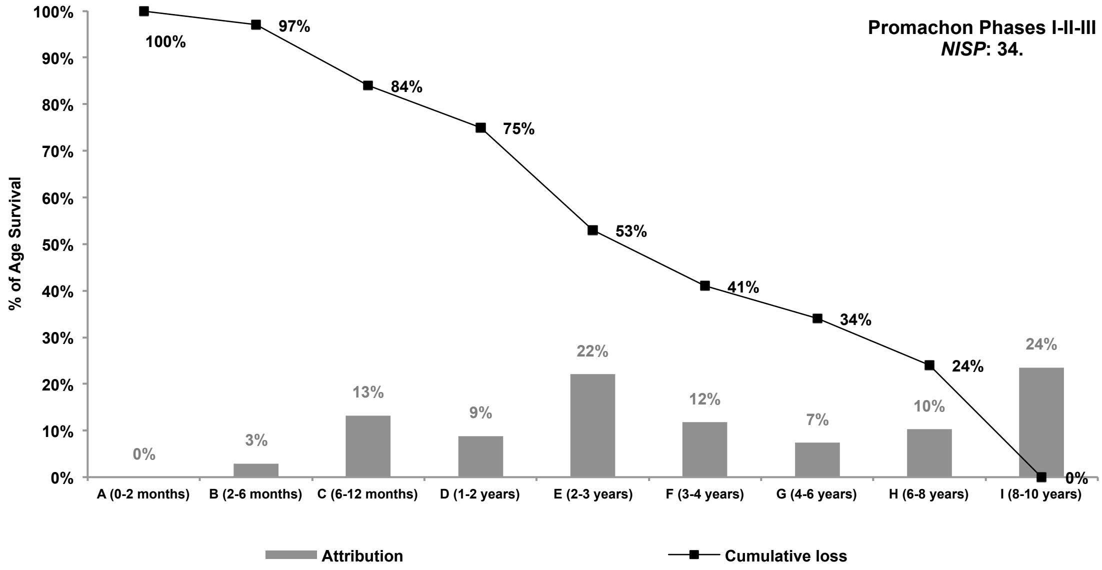

Figure 5.28: Promachon; kill-off pattern from mandibular wear stages (following Payne 1973) considering only the mandibles identified to the level of *Ovis/Capra* (sheep/goat). All phases are considered. Data in Table 5.79. *NISP* counts.

Figure 5.29 (***Table 5.80***) indicates that 41% of sheep were killed-off between the first and the fourth year (wear stages D, E, F). This suggests that these animals were slaughtered for meat. About 47% of the sheep population were killed-off between their fourth and tenth year (wear stages G, H, I); of these, about 24% were killed between the age of four and six (wear stage G). We can therefore assume that sheep - probably female individuals - were kept until they had lambed at least once, and hence produced milk and offspring.

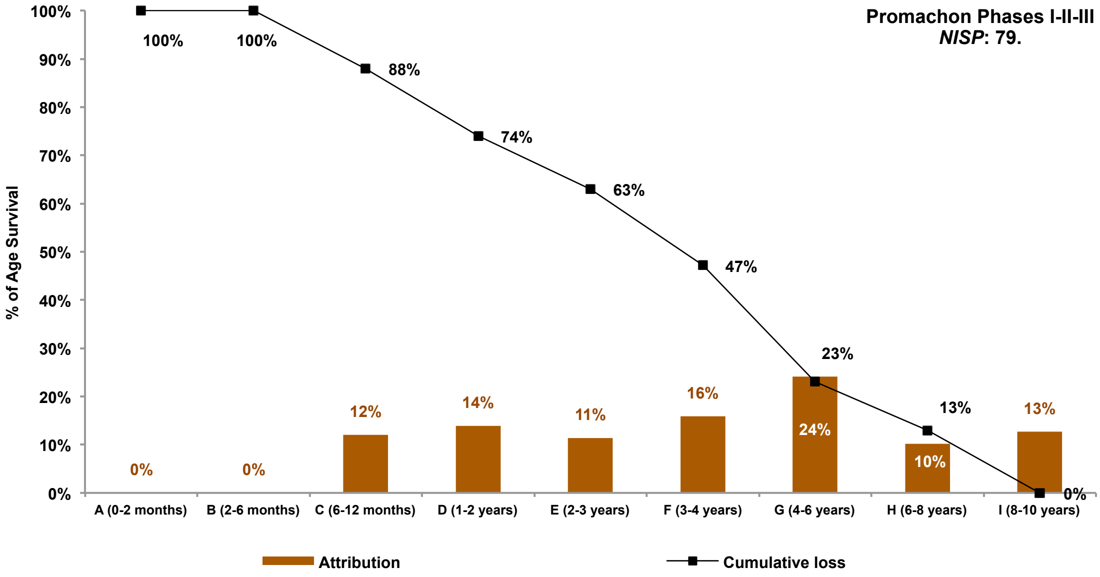

Figure 5.29: Promachon; kill-off pattern from mandibular wear stages (following Payne 1973) considering only the mandibles identified to the level of *Ovis aries* (sheep). All phases are considered. Data in Table 5.80. *NISP* counts.

Harvest profiles for goat (***Figure 5.30***; ***Table 5.81***) suggest that animals less than two years old (wear stages A to D), account for less than 4% of the mortality profile. The dearth of very young individuals (wear stages A, B and C; 0-2 months, 2-6 months and 6-12 months respectively) indicates that goats in Promachon were not particularly exploited for milk; this may be surprising considering that goats are known to be more prolific milk yielders than sheep (Halstead 1998; Ryder 1982). About 33% of the goat population were killed-off at stage E (2-3 years), while 45% were killed-off at stages F and G (3-4 years and 4-6 years respectively) suggesting that goats in Promachon were killed primarily for their meat. However, the apparent frequency of older individuals (wear stages H and I; 9% respectively) indicates that some goats might have been kept until the end of their lives for breeding.

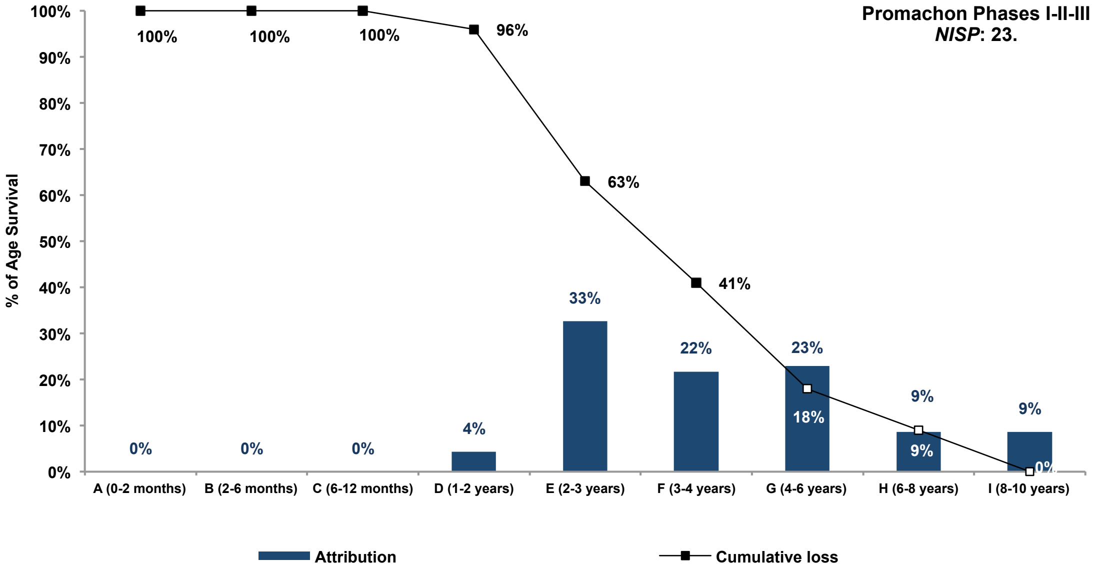

Figure 5.30: Promachon; kill-off pattern from mandibular wear stages (following Payne 1973) considering only the mandibles identified to the level of *Capra hircus* (goat). All phases are considered. Data in Table 5.81. *NISP* counts.

All in all, mortality profiles from Promachon indicate that caprines were used for meat; with regard to the presence of secondary products, it is more likely that the use of caprines included a small-scale exploitation for milk, rather than fleece. Sheep were subject to different exploitation strategies than goats; the evidence seems to suggest that sheep were used for meat and milk, while goats were used mainly for meat. In addition, a number of individuals from both species might have been kept until the end of their lives for breeding.

5.7.3 – Sus *age-at-death*

Epiphyseal fusion data (***Table 5.82***) indicate that pigs were slaughtered before they reached their skeletal maturity. ***Figure 5.31*** shows that 65% of the early fusing (1 - 2 years) postcranial bones were fused; the frequency of fused bones in the middle fusing category (2 - 2½ years) drops to 56%, while in the late fusing category (3 - 3½ years) only 21% of the postcranial bones were fused. The data indicate that a substantial number of pigs were killed during the first and second year and that the majority of the pig population did not survive their third year. The presence of a few neonatal postcranial bones (*NISP*: 5) shows that breeding of pigs may have taken place on-site, as these are most likely to be new born casualties.

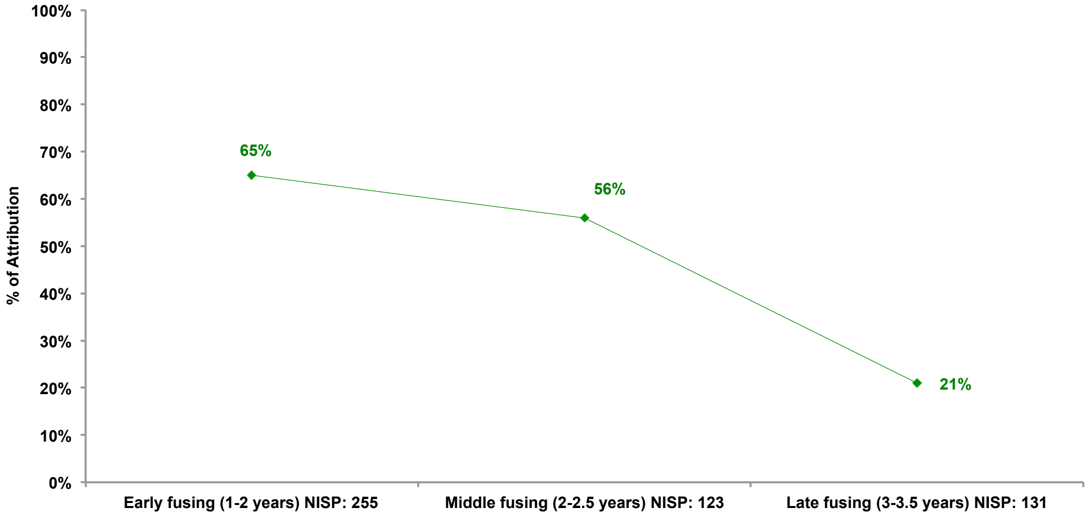

Figure 5.31: *Sus* (pig); percentage of fused/fusing bones in each of the three fusing categories (following Silver 1969). All phases are considered. Data in Table 5.82. *NISP* counts.

Estimates of age-at-death, based on tooth wear, are probably subject to greater bias in pigs than in the case of ruminants, since the degree to which the former dig for food (a major source of dental attrition) is highly variable (Halstead and Isaakidou 2013). However, the striking similarity in the data between epiphyseal fusion and tooth wear (***Tables 5.82-5.85***), suggests that the observed trend is probably valid. Dental eruption and wear data (***Plate 13***) for pigs reveal two mortality peaks (***Figure 5.32***): the first and most prominent at 'immature' stage (44%) and the second at 'sub adult' stage (41%). About 11% of individuals were killed at 'juvenile' stage, while only 4% of the individuals survived into the 'adult' stage.

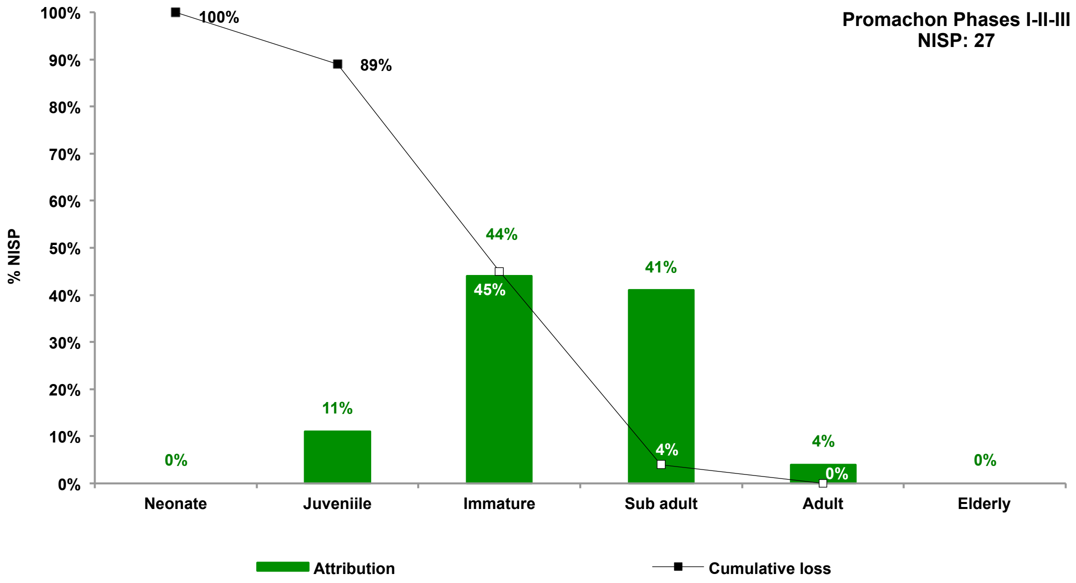

Figure 5.32: Promachon; *Sus* (pig) kill-off pattern from mandibular wear stages (following O' Connor 1989). All phases are considered. Data in Table 5.85. *NISP* counts.

All in all, mortality profiles for pigs in Promachon indicate that these animals were used for their meat. In addition, some of adult and sub adult individuals (females) might have been used for breeding; however, estimates on the sexual composition of the pig population in Promachon will be provided in the next part of this analysis (see also ***5.8 – Sexing***).

Table 5.69: *Bos taurus* (cattle) epiphyseal fusion evidence (categories after Silver 1969) on a phase-by-phase level. Fused (F) column includes fused, fusing and fusing/fused specimens. Unfused (UD) column includes unfused diaphyses. Unfused epiphyses are not counted. Data for Figure 5.24. *NISP* counts.

Bos taurus		***Late Neolithic I***										***Late Neolithic II***					***TOTAL***				
		***Phase I** (Layers 6, 5, 4)*					***Phase II** (Layers 3, 2)*					***Phase III** (Layer 1)*									
		NISP	***F***	***%***	***UD***	***%***	***NISP***	***F***	***%***	***UD***	***%***	***NISP***	***F***	***%***	***UD***	***%***	***NISP***	***F***	***%***	***UD***	***%***
Early Fusing	***Scapula***	***23***	*20*	*87%*	*3*	*13%*	***25***	*19*	*76%*	*6*	*24%*	***16***	*15*	*94%*	*1*	*6%*	***64***	*54*	*84%*	*10*	*16%*
	Humerus distal	***34***	*21*	*62%*	*13*	*38%*	***23***	*14*	*61%*	*9*	*39%*	***18***	*13*	*72%*	*5*	*28%*	***75***	*48*	*64%*	*27*	*36%*
	Radius proximal	***24***	*24*	*100%*		*0%*	***24***	*24*	*100%*		*0%*	***8***	*8*	*100%*		*0%*	***56***	*56*	*100%*		*0%*
	Pelvis acetabulum	***28***	*16*	*57%*	*12*	*43%*	***32***	*24*	*75%*	*8*	*25%*	***12***	*10*	*83%*	*2*	*17%*	***72***	*50*	*69%*	*22*	*31%*
	Phalanx 1	***96***	*89*	*93%*	*7*	*7%*	***95***	*88*	*93%*	*7*	*7%*	***64***	*60*	*94%*	*4*	*6%*	***255***	*237*	*93%*	*18*	*7%*
	Phalanx 2	***80***	*75*	*94%*	*5*	*6%*	***97***	*91*	*94%*	*6*	*6%*	***55***	*54*	*98%*	*1*	*2%*	***232***	*220*	*95%*	*12*	*5%*
	TOTAL	***285***	***245***	***86%***	***40***	***14%***	***296***	***260***	***88%***	***36***	***12%***	***173***	***160***	***92%***	***13***	***8%***	***754***	***665***	***88%***	***89***	***12%***
Middle Fusing	***Metacarpal distal***	***16***	*13*	*81%*	*3*	*11%*	***21***	*15*	*71%*	*6*	*29%*	***8***	*7*	*88%*	*1*	*12%*	***45***	*35*	*78%*	*10*	*22%*
	Tibia distal	***28***	*20*	*71%*	*8*	*29%*	***26***	*16*	*62%*	*10*	*38%*	***12***	*9*	*75%*	*3*	*25%*	***66***	*45*	*68%*	*21*	*32%*
	Calcaneum	***28***	*13*	*46%*	*15*	*54%*	***30***	*18*	*60%*	*12*	*40%*	***11***	*5*	*45%*	*6*	*55%*	***69***	*36*	*52%*	*33*	*48%*
	Metatarsal distal	***11***	*8*	*73%*	*3*	*27%*	***13***	*12*	*92%*	*1*	*8%*	***3***	*2*	*67%*	*1*	*33%*	***27***	*22*	*81%*	*5*	*19%*
	TOTAL	***83***	***54***	***65%***	***29***	***35%***	***90***	***61***	***68%***	***29***	***32%***	***34***	***23***	***68%***	***11***	***32%***	***207***	***138***	***67%***	***69***	***33%***
Late Fusing	***Humerus proximal***	***4***	*4*	*100%*		*0%*	***1***	*1*	*100%*		*0%*	***3***	*2*	*67%*	*1*	*33%*	***8***	*7*	*88%*	*1*	*12%*
	Radius distal	***11***	*10*	*91%*	*1*	*9%*	***18***	*18*	*100%*		*0%*	***1***	*1*	*100%*		*0%*	***30***	*29*	*97%*	*1*	*3%*
	Ulna proximal	***16***	*9*	*56%*	*7*	*44%*	***13***	*10*	*77%*	*3*	*23%*	***9***	*8*	*89%*	*1*	*11%*	***38***	*27*	*71%*	*11*	*29%*
	Femur proximal	***18***	*17*	*94%*	*1*	*6%*	***10***	*10*	*100%*		*0%*	***6***	*6*	*100%*		*0%*	***34***	*33*	*97%*	*1*	*3%*
	Femur distal	***17***	*16*	*94%*	*1*	*6%*	***16***	*14*	*88%*	*2*	*12%*	***7***	*7*	*100%*		*0%*	***40***	*37*	*93%*	*3*	*7%*
	Tibia proximal	***3***	*3*	*100%*		*0%*	***3***	*3*	*100%*		*0%*	***1***	*1*	*100%*		*0%*	***7***	*7*	*100%*		*0%*
	TOTAL	***69***	***59***	***86%***	***10***	***14%***	***61***	***56***	***92%***	***5***	***8%***	***27***	***25***	***93%***	***2***	***7%***	***157***	***140***	***89%***	***17***	***11%***
TOTAL		***437***	***358***	***82%***	***79***	***18%***	***447***	***377***	***84%***	***70***	***16%***	***234***	***208***	***89%***	***26***	***11%***	***1118***	***943***	***84%***	***175***	***16%***

Table 5.70: *Bos taurus* (cattle) mandibular wear stage data following O'Connor (1988). Only Phases I-II are considered.

Bos taurus	***MWS* sensu *O' Connor (1988)***					
	P4	***dP4***	***M1***	***M2***	***M3***	***MWS***
***Phase I** (Layers 6, 5, 4)*				*k*	*g*	***Adult***
			k	*j*	*e*	***Adult***
			m	*k*	*h*	***Adult***
		k	*f*	*H*		***Immature***
	P		*m*	*l*	*k*	***Adult***
		j	*H*			***Juvenile***
			o	*n*		***Sub adult***
	f		*k*	*k*		***Sub adult***
			d	*E*	*C*	***Sub adult***
	f		*k*			***Immature***
			j	*k*		***Sub adult***
		n	*g*	*g*	*H*	***Sub adult***
			m	*l*		***Sub adult***
***Phase II** (Layers 3, 2)*		*j*	*f*	*H*		***Immature***
	f		*n*			***Immature***
		f	*H*			***Juvenile***
			j	*g*		***Sub adult***
		k	*f*			***Immature***

Table 5.71: *Bos taurus* (cattle); percentage of attribution of mandibular wear stage data following O'Connor (1988). Only Phases I-II are considered. Data for Figure 5.25. *NISP* counts.

Bos taurus	***Phases I-II** (Layers 6, 5, 4, 3, 2)*		
	NISP	***% Attribution***	***% Cumulative loss***
Neonatal		*0%*	*100%*
Juvenile	*2*	*11%*	*89%*
Immature	*5*	*28%*	*61%*
Sub adult	*7*	*39%*	*22%*
Adult	*4*	*22%*	*0%*
Elderly		*0%*	*0%*
TOTAL	***18***	***100%***	

Table 5.72: *Bos taurus* (cattle) eruption stage and wear stage data from mandibular isolated teeth and teeth attached to mandibles on a phase-by-phase level. C= Crypt; V= Visible; E= Erupting; H= Half erupted; teeth recorded in wear stage “a” are considered fully erupted, yet still unworn (U). *NISP* counts.

Bos taurus		***Phases***	***Eruption stages** (sensu **Ewbank et al. 1964**) **and wear stages** (sensu **Grant 1982**).*																			
			C	***V***	***E***	***H***	***a***	***b***	***c***	***d***	***e***	***f***	***g***	***h***	***i***	***j***	***k***	***l***	***m***	***n***	***o***	***p***
Individual mandibular teeth (attached & loose)	**dP$_4$**	*Phase I*						*1*		*1*				*1*		*1*	*3*		*1*	*1*		
		Phase II										*3*		*3*		*1*	*1*		*1*			
		Phase III								*2*		*1*						*1*				
		TOTAL	***0***	***0***	***0***	***0***	***0***	***1***	***0***	***3***	***0***	***4***	***0***	***4***	***0***	***2***	***4***	***1***	***2***	***1***	***0***	***0***
	P$_4$	*Phase I*							*1*			*4*										
		Phase II			*1*	*1*				*1*		*1*		*1*								
		Phase III										*5*										
		TOTAL	***0***	***0***	***1***	***1***	***0***	***0***	***1***	***1***	***0***	***10***	***0***	***1***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
	M$_1$	*Phase I*				*3*				*1*		*2*	*1*			*1*	*4*		*3*		*1*	
		Phase II				*1*		*1*			*1*	*2*				*1*	*1*			*1*		
		Phase III			*2*									*1*			*1*					
		TOTAL	***0***	***0***	***2***	***4***	***0***	***1***	***0***	***1***	***1***	***4***	***1***	***1***	***0***	***2***	***6***	***0***	***3***	***1***	***1***	***0***
	M$_2$	*Phase I*			*1*	*2*							*2*			*1*	*5*	*2*		*1*		
		Phase II				*1*							*1*					*1*				
		Phase III																				
		TOTAL	***0***	***0***	***1***	***3***	***0***	***0***	***0***	***0***	***0***	***0***	***3***	***0***	***0***	***1***	***5***	***3***	***0***	***1***	***0***	***0***
	M$_{1/2}$	*Phase I*					*2*	*4*	*4*	*1*	*1*	*5*	*6*	*2*		*1*	*10*	*1*		*2*		
		Phase II					*1*	*3*	*2*	*4*	*1*	*3*	*11*	*2*		*3*	*10*	*2*	*1*		*2*	
		Phase III						*1*	*2*			*2*	*8*	*4*			*7*					
		TOTAL	***0***	***0***	***0***	***0***	***3***	***8***	***8***	***5***	***2***	***10***	***25***	***8***	***0***	***4***	***27***	***3***	***1***	***2***	***2***	***0***
	M$_3$	*Phase I*	*1*		*1*	*1*			*1*		*1*	*1*	*9*	*2*			*3*		*1*			
		Phase II	*1*				*1*		*1*	*2*		*2*	*5*	*2*		*1*	*3*	*3*				
		Phase III									*1*	*2*	*1*	*1*		*1*	*2*					
		TOTAL	***2***	***0***	***1***	***1***	***1***	***0***	***2***	***2***	***2***	***5***	***15***	***5***	***0***	***2***	***8***	***3***	***1***	***0***	***0***	***0***

Table 5.73: Caprinae (caprines) epiphyseal fusion evidence (categories after Silver 1969) on a phase-by-phase level. Fused (F) column includes fused, fusing and fusing/fused specimens. Unfused (UD) column includes unfused diaphyses. Unfused epiphyses are not counted. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.26. *NISP* counts.

Caprinae		***Late Neolithic I***										***Late Neolithic II***					***TOTAL***				
		***Phase I** (Layers 6, 5, 4)*					***Phase II** (Layers 3, 2)*					***Phase III** (Layer 1)*									
		NISP	***F***	***%***	***UD***	***%***	***NISP***	***F***	***%***	***UD***	***%***	***NISP***	***F***	***%***	***UD***	***%***	***NISP***	***F***	***%***	***UD***	***%***
Early Fusing	***Scapula***	*21*	*12*	*57%*	*9*	*43%*	*27*	*19*	*70%*	*8*	*30%*	*6*	*5*	*83%*	*1*	*17%*	*54*	*36*	*67%*	*18*	*33%*
	Humerus distal	*72*	*50*	*69%*	*22*	*31%*	*52*	*43*	*83%*	*9*	*17%*	*47*	*35*	*74%*	*12*	*26%*	*171*	*128*	*75%*	*43*	*25%*
	Radius proximal	*43*	*39*	*91%*	*4*	*9%*	*46*	*43*	*93%*	*3*	*7%*	*30*	*27*	*90%*	*3*	*10%*	*119*	*109*	*92%*	*10*	*8%*
	Pelvis acetabulum	*61*	*47*	*77%*	*14*	*23%*	*70*	*52*	*74%*	*18*	*26%*	*36*	*28*	*78%*	*8*	*22%*	*167*	*127*	*76%*	*40*	*24%*
	Phalanx 1	*10*	*9*	*90%*	*1*	*10%*	*20*	*17*	*85%*	*3*	*15%*	*13*	*12*	*92%*	*1*	*8%*	*43*	*38*	*88%*	*5*	*12%*
	Phalanx 2			*0%*		*0%*	*4*	*4*	*100%*		*0%*	*5*	*5*	*100%*		*0%*	*9*	*9*	*100%*	*0*	*0%*
	TOTAL	***207***	***157***	***76%***	***50***	***24%***	***219***	***178***	***81%***	***41***	***19%***	***137***	***112***	***82%***	***25***	***18%***	***563***	***447***	***79%***	***116***	***21%***
Middle Fusing	***Metacarpal distal***	*5*	*3*	*60%*	*2*	*40%*	*10*	*4*	*40%*	*6*	*60%*	*8*	*6*	*75%*	*2*	*25%*	*23*	*13*	*57%*	*10*	*43%*
	Tibia distal	*57*	*51*	*89%*	*6*	*11%*	*65*	*59*	*91%*	*6*	*9%*	*45*	*44*	*98%*	*1*	*2%*	*167*	*154*	*92%*	*13*	*8%*
	Calcaneum	*15*	*9*	*60%*	*6*	*40%*	*26*	*11*	*42%*	*15*	*58%*	*10*	*5*	*50%*	*5*	*50%*	*51*	*25*	*49%*	*26*	*51%*
	Metatarsal distal	*7*	*4*	*57%*	*3*	*43%*	*8*	*4*	*50%*	*4*	*50%*	*5*	*4*	*80%*	*1*	*20%*	*20*	*12*	*60%*	*8*	*40%*
	TOTAL	***84***	***67***	***80%***	***17***	***20%***	***109***	***78***	***72%***	***31***	***28%***	***68***	***59***	***87%***	***9***	***13%***	***261***	***204***	***77%***	***57***	***23%***
Late Fusing	***Humerus proximal***	*6*	*5*	*83%*	*1*	*17%*	*3*	*2*	*67%*	*1*	*33%*	*2*	*1*	*50%*	*1*	*50%*	*11*	*8*	*73%*	*3*	*27%*
	Radius distal	*9*	*8*	*89%*	*1*	*11%*	*15*	*12*	*80%*	*3*	*20%*	*6*	*4*	*67%*	*2*	*33%*	*30*	*24*	*80%*	*6*	*20%*
	Ulna proximal	*23*	*12*	*52%*	*11*	*48%*	*20*	*9*	*45%*	*11*	*55%*	*18*	*9*	*50%*	*9*	*50%*	*61*	*30*	*49%*	*31*	*51%*
	Femur proximal	*8*	*7*	*88%*	*1*	*12%*	*9*	*8*	*89%*	*1*	*11%*	*2*	*2*	*100%*		*0%*	*19*	*17*	*89%*	*2*	*11%*
	Femur distal	*5*	*5*	*100%*		*0%*	*4*	*4*	*100%*		*0%*	*2*	*2*	*100%*		*0%*	*11*	*11*	*100%*	*0*	*0%*
	Tibia proximal	*6*	*5*	*83%*	*1*	*17%*	*7*	*5*	*71%*	*2*	*29%*	*4*	*2*	*50%*	*2*	*50%*	*17*	*12*	*71%*	*5*	*29%*
	TOTAL	***57***	***42***	***74%***	***15***	***26%***	***58***	***40***	***69%***	***18***	***31%***	***34***	***20***	***59%***	***14***	***41%***	***149***	***102***	***68%***	***47***	***32%***
TOTAL		***348***	***266***	***76%***	***82***	***24%***	***386***	***296***	***77%***	***90***	***23%***	***239***	***191***	***80%***	***48***	***20%***	***973***	***753***	***77%***	***220***	***23%***

Table 5.74: Caprinae (caprines) mandibular wear stage data following Payne (1973) for Phase I.

Caprinae *mandible wear stages* sensu *Payne (1973)*						
Phase I (*Layers 6, 5, 4*)						
	P_4	dP_4	M_1	M_2	M_3	MWS
Ovis/Capra				15A	17G	I
	P		15A	15A	17G	I
		23L	9A	8A		D
			15A	10A	12G	I
			10A	9A	6G	E
			4A	5A		C
				5A	E	C
		16L	7A	C		C
	12S		10A	9A		F
	H		9A	7A		C
			14A	9A		F
	P		9A	9A	P	D-E
			12A	9A		F
	15A		15A			G-H
			15A	15A	14G	I
			15A	12A	11G	H
				9A	8G	E
				12A	12G	I
			9A	9A		D-E
			15A	15A		G-H
Ovis aries	H		9A	9A	V	D
			15A	11A	11G	H
	0		9A	8A		D
				13A	11G	H
	12S		14A	9A	11G	G
		16L	7A	7A		C
	15A		15A	14A	11G	H
	15A		15A	15A	13G	I
	9A		9A	9A		D-E
	15A			15A	12A	I
	15A		15A	15A	17G	I
	12S		15A	9A		F-G
		16L	7A			C
	15A		15A			G-H
	H		9A	6A		C-D
	12S		15A	9A		F-G
	12S		15A	9A	11G	G
	12S		15A	11A		F-G
	15A		15A	P		G-H
	0		14A	9A		F
	8A		9A	9A		E
		16L	7A			C
			15A	15A	12G	I
				10A	11G	H
	12S		12A	9A	11G	G
			11A	9A	7G	E
			15A	9A	9A	F
			9A	9A	6A	E
	15A		15A			G-H
	12S		15A	10A	11G	H
	15A		15A	11A		G-H
	12S		12A			F-G
		16L	H			C-D
	12S		10A			F-G
		16L	6A	C		C
	9A		9A	9A	9G	F
	H		9A	5A		C-D
			15A	15A	17G	I
Capra hircus	12S		12A	9A		F
	12S		15A	9A	11G	G
	12S		12A			F-G
	12S		12A	9A	8G	E
	15A		15A	9A		G
				10A	12G	I
	12S		15A		11G	G
	12S		10A	9A	5A	E
	12S		15A	10A	11G	H
	8A		9A	8A		D-E
	12S		12A	10A	11G	H
			9A	9A	8A	E
	12S		10A	9A	12G	I

Table 5.75: Caprinae (caprines) mandibular wear stage data following Payne (1973) for Phase II.

Caprinae *mandible wear stages* sensu *Payne (1973)*						
Phase II *(Layers 3, 2)*						
	P_4	dP_4	M_1	M_2	M_3	**MWS**
Ovis/Capra			15A	15A	12G	**I**
				11A	11G	**H**
				9A	10G	**F**
			15A	15A	16G	**I**
			12A	9A	6G	**E**
	H		9A	9A		**D-E**
			H	E		**B**
				9A	7G	**E**
			15A	15A	17G	**I**
	15A		15A	15A	P	**G-H**
Ovis aries	12S		11A			**F**
	P		9A	8A		**D**
	7A		9A	9A	7G	**E**
	12S		10A	9A	10G	**F**
	15A		15A			**G**
	4A		9A	9A	6G	**E**
		22L	8A			**D**
	12S		15A			**G**
	15A		15A			**G**
		20L	9A			**D**
	12S		12A	9A	5A	**E**
	12S		10A			**F-G**
		16L	5A	C		**C**
	15A		15A			**G**
		18L	8A			**D**
			9A	8A	C	**D**
	15A		15A	15A	12G	**I**
	12S		13A	9A		**E-F**
	H		10A	9A		**F**
		14L	C			**C**
	15A		15A		11G	**G**
	12S		11A	9A	11G	**G**
		23L	9A			**D**
	12S		9A	9A	10G	**F**
		20L	5A			**C**
	12S		15A			**G**
	15A		15A	13A		**F**
	15A		15A	13A	12G	**I**
	12S		15A	10A		**G**
		23L	9A	6A		**D**
Capra hircus	C		9A	6A		**D-E**
	9A			9A	5A	**E**
	12S		12A	9A	9G	**F**
	12S		10A	9A		**F**
	12S		P	P	4A	**E**

Table 5.76: Caprinae (caprines) mandibular wear stage data following Payne (1973) for Phase III.

Caprinae *mandible wear stages* sensu *Payne (1973)*						
Phase III *(Layer 1)*						
	P_4	***dP_4***	***M_1***	***M_2***	***M_3***	***MWS***
Ovis/ Capra			*8A*	*9A*	*5A*	***E***
				9A	*5A*	***E***
			10A	*8A*		***C-D***
	15A		*15A*			***G***
Ovis aries	*15A*		*15A*			***G***
	12S		*10A*	*9A*	*8G*	***E***
	12S		*15A*	*11A*	*11G*	***G***
			15A	*10A*	*12G*	***I***
		16L	*6A*			***C***
		23L	*9A*	*7A*		***E***
	12S		*14A*			***F***
	15A		*15A*	*15A*	*12G*	***I***
	12S		*14A*	*10A*	*11G*	***H***
	12S		*15A*	*10A*	*12G*	***I***
	15A		*15A*			***G***
Capra hircus	*9A*		*11A*	*9A*	*4A*	***E***
	12S		*10A*			***F-G***
	9A		*P*	*9A*		***E-F***
	12S			*10A*		***F-G***
	15A		*15A*			***G***

Table 5.77: Caprinae (caprines); percentage of attribution of mandibular wear stage data following Payne (1973). All Phases are considered. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.27. *NISP* counts.

Caprinae	***Promachon I-II-III*** *(Layers 6, 5, 4, 3, 2, 1)*		
	NISP	***% Attribution***	***% Cumulative loss***
A (0-2 months)	*0*	*0%*	*100%*
B (2-6 months)	*1*	*1%*	*99%*
C (6-12 months)	*14*	*10%*	*89%*
D (1-2 years)	*15*	*11%*	*78%*
E (2-3 years)	*24*	*17%*	*61%*
F (3-4 years)	*21.5*	*16%*	*45%*
G (4-6 years)	*27*	*20%*	*25%*
H (6-8 years)	*13.5*	*10%*	*15%*
I (8-10 years)	*20*	*15%*	*0%*
TOTAL	***136***	***100%***	

Table 5.78: Caprinae (caprines) eruption stage and wear stage data from mandibular isolated teeth and teeth attached to mandibles on a phase-by-phase level. *NISP* counts. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). C= Crypt; V= Visible; E= Erupting; H= Half erupted. *NISP* counts.

Caprinae		*Phases*	***Eruption stages*** (sensu ***Ewbank et al. 1964***) ***and wear stages*** (sensu ***Payne 1973***).																											
			C	V	E	H	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Individual mandibular teeth (attached & loose)	dP_4	*Phase I*																		1	2		9	4	3					
		Phase II																		1	7		6	3	2		2		1	3
		Phase III																		1	1		8	3						1
		TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	10	0	23	10	5	0	2	0	1	4
	P_4	*Phase I*			2	4	3		1					3	1	5			21			11								
		Phase II	1		2	2	5		1		1	1		2	1	6			28			15								
		Phase III			2				1		1	2				4			17			6								
		TOTAL	1	0	6	6	8	0	3	0	2	3	0	5	2	15	0	0	66	0	0	32	0	0	0	0	0	0	0	0
	M_1	*Phase I*			1	4							1	2	1	13	5	1	4		2	23								
		Phase II	1			1	1					2	1		2	12	4	2	3	1	1	14								
		Phase III											1		1	2	3	1			2	6								
		TOTAL	1	0	1	5	1	0	0	0	0	2	3	2	4	27	12	4	7	1	5	43	0	0	0	0	0	0	0	0
	M_2	*Phase I*	3									3	2	1	2	22	6	1	2	1	1	6								
		Phase II	1		1	2							2		2	17	2	2		2		5								
		Phase III												2	1	5	4	1				1								
		TOTAL	4	0	1	2	0	0	0	0	0	3	4	3	5	44	12	4	2	3	1	12	0	0	0	0	0	0	0	0
	$M_{1/2}$	*Phase I*									1	2	6	2	3	17	5	3	2			5								
		Phase II					2		2		2	5	7	15	10	62	12	3	5			4								
		Phase III					2		4		3	6	4	2	12	43	13	1			1	6	1							
		TOTAL	0	0	0	0	4	0	6	0	6	13	17	19	25	122	30	7	7	0	1	15	1	0	0	0	0	0	0	0
	M_3	*Phase I*			1						1	3	4	2	1	2	1	25	9	2	1		3	4						
		Phase II	1				5		5		1	4	3	3	2	3	4	22	6	2			1	1						
		Phase III					1		2		1	3	2		1	2	4	30	5		1		1	1						
		TOTAL	1	0	1	0	6	0	7	0	3	10	9	5	4	7	5	77	20	4	2	0	5	6	0	0	0	0	0	0

Table 5.79: *Ovis/Capra* (sheep/goat); percentage of attribution of mandibular wear stage data following Payne (1973). All Phases are considered. Data for Figure 5.28. *NISP* counts.

Ovis/Capra	***Promachon I-II-III*** *(Layers 6, 5, 4, 3, 2, 1)*		
	NISP	***% Attribution***	***% Cumulative loss***
A (0-2 months)		*0%*	*100%*
B (2-6 months)	*1*	*3%*	*97%*
C (6-12 months)	*4.5*	*13%*	*84%*
D (1-2 years)	*3*	*9%*	*75%*
E (2-3 years)	*7.5*	*22%*	*53%*
F (3-4 years)	*4*	*12%*	*41%*
G (4-6 years)	*2.5*	*7%*	*34%*
H (6-8 years)	*3.5*	*10%*	*24%*
I (8-10 years)	*8*	*24%*	*0%*
TOTAL	***34***	***100%***	

Table 5.80: *Ovis aries* (sheep); percentage of attribution of mandibular wear stage data following Payne (1973). All Phases are considered. Data for Figure 5.29. *NISP* counts.

Ovis aries	***Promachon I-II-III*** *(Layers 6, 5, 4, 3, 2, 1)*		
	NISP	***% Attribution***	***% Cumulative loss***
A (0-2 months)		*0%*	*100%*
B (2-6 months)		*0%*	*100%*
C (6-12 months)	*9.5*	*12%*	*88%*
D (1-2 years)	*11*	*14%*	*74%*
E (2-3 years)	*9*	*11%*	*63%*
F (3-4 years)	*12.5*	*16%*	*47%*
G (4-6 years)	*19*	*24%*	*23%*
H (6-8 years)	*8*	*10%*	*13%*
I (8-10 years)	*10*	*13%*	*0%*
TOTAL	***79***	***100%***	

Table 5.81: *Capra hircus* (goat); percentage of attribution of mandibular wear stage data following Payne (1973). All Phases are considered. Data for Figure 5.30. *NISP* counts.

Capra hircus	*Promachon I-II-III (Layers 6, 5, 4, 3, 2, 1)*		
	NISP	*% Attribution*	*% Cumulative loss*
A (0-2 months)		0%	100%
B (2-6 months)		0%	100%
C (6-12 months)		0%	100%
D (1-2 years)	1	4%	96%
E (2-3 years)	7.5	33%	63%
F (3-4 years)	5	22%	41%
G (4-6 years)	5.5	23%	18%
H (6-8 years)	2	9%	9%
I (8-10 years)	2	9%	0%
TOTAL	**23**	***100%***	

Table 5.82: *Sus* (pig) epiphyseal fusion evidence (categories after Silver 1969) on a phase-by-phase level. Fused column includes fused, fusing and fusing/fused specimens. Unfused column includes unfused diaphyses. Unfused epiphyses are not counted. Data for Figure 5.31. *NISP* counts.

Sus		Late Neolithic I										Late Neolithic II					TOTAL				
		Phase I (Layers 6, 5, 4)					**Phase II** (Layers 3, 2)					**Phase III** (Layer 1)									
		NISP	F	%	UD	%	NISP	F	%	UD	%	NISP	F	%	UD	%	NISP	F	%	UD	%
Early Fusing	**Scapula**	**30**		60%	12	40%	**34**	25	74%	9	26%	**12**	7	58%	5	42%	**76**	50	66%	26	34%
	Humerus distal	**23**	7	30%	16	70%	**21**	11	52%	10	48%	**7**	2	29%	5	71%	**51**	20	39%	31	61%
	Radius proximal	**17**	15	88%	2	12%	**12**	9	75%	3	25%	**8**	8	100%		0%	**37**	32	86%	5	14%
	Pelvis acetabulum	**21**	15	71%	6	29%	**18**	13	72%	5	28%	**14**	7	50%	7	50%	**53**	35	66%	18	34%
	Phalanx 1	**11**	9	82%	2	8%	**8**	6	75%	2	25%	**9**	6	67%	3	33%	**28**	21	75%	7	25%
	Phalanx 2			0%		0%	**3**	2	67%	1	33%	**7**	6	86%	1	14%	**10**	8	80%	2	20%
	TOTAL	**102**	**64**	**63%**	**38**	**37%**	**96**	**66**	**69%**	**30**	**31%**	**57**	**36**	**63%**	**21**	**37%**	**255**	166	**65%**	89	**35%**
Middle Fusing	**Metacarpal 3 distal**	**5**	2	40%	3	60%	**4**	4	100%		0%	**1**	1	100%		0%	**10**	7	70%	3	30%
	Metacarpal 4 distal	**7**	4	57%	3	43%	**5**	5	100%		0%	**7**	4	57%	3	43%	**19**	13	68%	6	32%
	Tibia distal	**12**	8	67%	4	33%	**14**	8	57%	6	43%	**11**	8	73%	3	27%	**37**	24	65%	13	35%
	Calcaneum	**11**	4	36%	7	64%	**14**	8	57%	6	43%	**8**		0%	8	100%	**33**	12	36%	21	64%
	Metatarsal 3 distal	**3**	2	67%	1	33%	**7**	5	71%	2	29%	**2**	2	100%		0%	**12**	9	75%	3	25%
	Metatarsal 4 distal	**4**	1	25%	3	75%	**5**	3	60%	2	40%	**3**		0%	3	100%	**12**	4	33%	8	67%
	TOTAL	**42**	**21**	**50%**	**21**	**50%**	**49**	**33**	**67%**	**16**	**33%**	**32**	**15**	**47%**	**17**	**53%**	**123**	69	**56%**	54	**44%**
Late Fusing	**Humerus proximal**	**2**		0%	2	100%	**3**		0%	3	100%	**3**		0%	3	100%	**8**	0	0%	8	100%
	Radius distal	**14**	1	7%	13	93%	**15**	6	40%	9	60%	**3**		0%	3	100%	**32**	7	22%	25	78%
	Ulna proximal	**30**	8	27%	22	73%	**20**	6	30%	14	70%	**14**	4	29%	10	81%	**64**	18	28%	46	72%
	Femur proximal	**1**		0%	1	100%	**2**	1	50%	1	50%			0%		0%	**3**	1	33%	2	67%
	Femur distal	**5**		0%	5	100%	**10**	2	20%	8	80%	**4**		0%	4	100%	**19**	2	11%	17	89%
	Tibia proximal	**3**		0%	3	100%	**1**		0%	1	100%	**1**		0%	1	100%	**5**	0	0%	5	100%
	TOTAL	**55**	**9**	**16%**	**46**	**84%**	**51**	**15**	**29%**	**36**	**71%**	**25**	**4**	**16%**	**21**	**84%**	**131**	28	**21%**	103	**79%**
TOTAL		**199**	**94**	**47%**	**105**	**53%**	**196**	**114**	**58%**	**82**	**42%**	**114**	**55**	**48%**	**59**	**52%**	**509**	**263**	**52%**	**246**	**48%**

Table 5.83: ***Sus*** **(pig) eruption stage and wear stage data from mandibular isolated teeth and teeth attached to mandibles on a phase-by-phase level. C= Crypt; V= Visible; E= Erupting; H= Half erupted; teeth recorded in wear stage "a" are considered fully erupted, yet still unworn (U).** ***NISP*** **counts.**

Sus		***Phases***	***Eruption stages (sensu Ewbank et al. 1964) and wear stages (sensu Grant 1982).***																			
			C	***V***	***E***	***H***	***a***	***b***	***c***	***d***	***e***	***f***	***g***	***h***	***i***	***j***	***k***	***l***	***m***	***n***	***o***	***p***
Individual mandibular teeth (attached & loose)	***dP₄***	*Phase I*					*1*	*1*			*1*	*1*	*1*	*1*			*1*		*1*			
		Phase II					*1*	*1*		*1*	*1*	*1*	*1*		*1*		*2*					
		Phase III									*2*											
		TOTAL	***0***	***0***	***0***	***0***	***2***	***2***	***0***	***1***	***4***	***2***	***2***	***1***	***1***	***0***	***3***	***0***	***1***	***0***	***0***	***0***
	P₄	*Phase I*					*1*	*1*														
		Phase II		*1*							*1*			*1*								
		Phase III								*2*												
		TOTAL	***0***	***1***	***0***	***0***	***1***	***1***	***0***	***2***	***1***	***0***	***0***	***1***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
	M₁	*Phase I*	*1*				*2*	*2*	*1*		*3*											
		Phase II	*1*		*1*			*3*	*3*	*2*	*2*					*1*						
		Phase III		*1*			*2*			*2*		*1*	*1*									
		TOTAL	***2***	***1***	***1***	***0***	***4***	***5***	***4***	***4***	***5***	***1***	***1***	***0***	***0***	***1***	***0***	***0***	***0***	***0***	***0***	***0***
	M₂	*Phase I*	*4*	*1*			*1*	*1*	*3*		*2*											
		Phase II	*2*		*2*		*1*	*1*	*2*	*1*	*1*							*1*				
		Phase III					*1*	*1*	*1*		*2*											
		TOTAL	***6***	***1***	***2***	***0***	***3***	***3***	***6***	***1***	***5***	***0***	***0***	***0***	***0***	***0***	***0***	***1***	***0***	***0***	***0***	***0***
	M_{1/2}	*Phase I*								*1*												
		Phase II					*4*		*1*													
		Phase III					*1*		*1*	*1*		*1*										
		TOTAL	***0***	***0***	***0***	***0***	***5***	***0***	***2***	***2***	***0***	***1***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
	M₃	*Phase I*	*2*	*1*	*2*	*1*			*2*													
		Phase II	*1*	*1*		*2*		*1*	*2*													
		Phase III	*1*				*2*	*1*	*1*								*1*					
		TOTAL	***4***	***2***	***2***	***3***	***2***	***2***	***5***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***1***	***0***	***0***	***0***	***0***	***0***

Table 5.84: *Sus* (pig) mandibular wear stage data following O' Connor (1989) on a phase-by-phase level. The mandibular wear stages were assigned to mandibles, only when two at least teeth in the dP_4 / P_4 – M3 row were present.

Sus	***MWS* sensu *O' Connor (1988)***					
	P_4	***dP_4***	***M_1***	***M_2***	***M_3***	***MWS***
***Phase I** (Layers 6, 5, 4)*		*k*	*b*	*C*		***Immature***
				a	*E*	***Immature***
		m	*b*	*V*		***Immature***
		m	*c*	*C*		***Immature***
		f	*a*	*C*		***Immature***
			e	*c*		***Sub adult***
		g	*a*	*C*		***Immature***
			e	*c*		***Subadult***
	b		*e*	*c*		***Subadult***
				e	*H*	***Subadult***
		k	*d*	*b*		***Subadult***
***Phase II** (Layers 3, 2)*		*k*	*c*			***Immature***
	V		*b*			***Immature***
				d	*b*	***Adult***
				c	*V*	***Subadult***
			e	*c*		***Subadult***
		b	*C*			***Juvenile***
		g	*E*	*C*		***Juvenile***
			c	*a*	*C*	***Subadult***
			j	*l*		***Subadult***
		e	*b*			***Immature***
			d	*E*		***Immature***
***Phase III** (Layer 1)*			*d*	*b*		***Subadult***
	d		*d*			***Immature***
		e	*a*			***Immature***
			f	*c*		***Subadult***
		e	*V*			***Juvenile***

Table 5.85: *Sus* (pig); percentage of attribution of mandibular wear stage data following O' Connor (1989). All Phases are considered. Data for Figure 5.32. *NISP* counts.

Sus	***Phases I-II** (Layers 6, 5, 4, 3, 2)*		
	NISP	***% Attribution***	***% Cumulative loss***
Neonatal		*0%*	*100%*
Juvenile	*3*	*11%*	*89%*
Immature	*12*	*44%*	*45%*
Sub adult	*11*	*41%*	*4%*
Adult	*1*	*4%*	*0%*
Elderly		*0%*	*0%*
TOTAL	***27***	***100%***	

5.8 – Sexing

It was only possible to separate the sexes using morphological characteristics in pigs. For other taxa, any attempts to detect the sexual composition of the assemblage had to rely on metrical analysis (see also ***5.10 – Metrical analysis***). Pig isolated canines, as well as those in jaws and their alveoli, were used for the analysis (***Table 5.86***).

Figure 5.33 presents the frequency of each sex category in the assemblage. When only isolated canines are considered, males and females are represented with similar frequencies, females being only slightly more frequent than males (45% for males and 55% for females); the ratio between male and female pigs being 1 : 1.3. However, since the smaller isolated female canines may be biased against due to differential retrieval, the frequency is also calculated for canines in jaws and their alveoli, as these should only be negligibly affected by a recovery bias. The pattern shows that females predominate with a much higher frequency, which is probably closer to reality: 73% of the sexed canines attached to jaws and their respective alveoli derive from females, while 27% derive from males. The ratio between male and female pigs in this case is 1 : 2.6.

The higher frequency of female pig canines probably reflects the practice of keeping more mature female pigs for breeding. If this is the case, then we must assume that a high number of pigs, which were culled at a young age for their meat - as previously suggested - were mainly males. It is also highly likely that the very young animals, which could not be sexed due to the non-diagnostic shape of the deciduous canine, were also predominately males. The occurrence of a substantial proportion of older females confirms the evidence of neonatal bones that at Promachon there was an emphasis on pork production and the pigs were not merely imported from elsewhere.

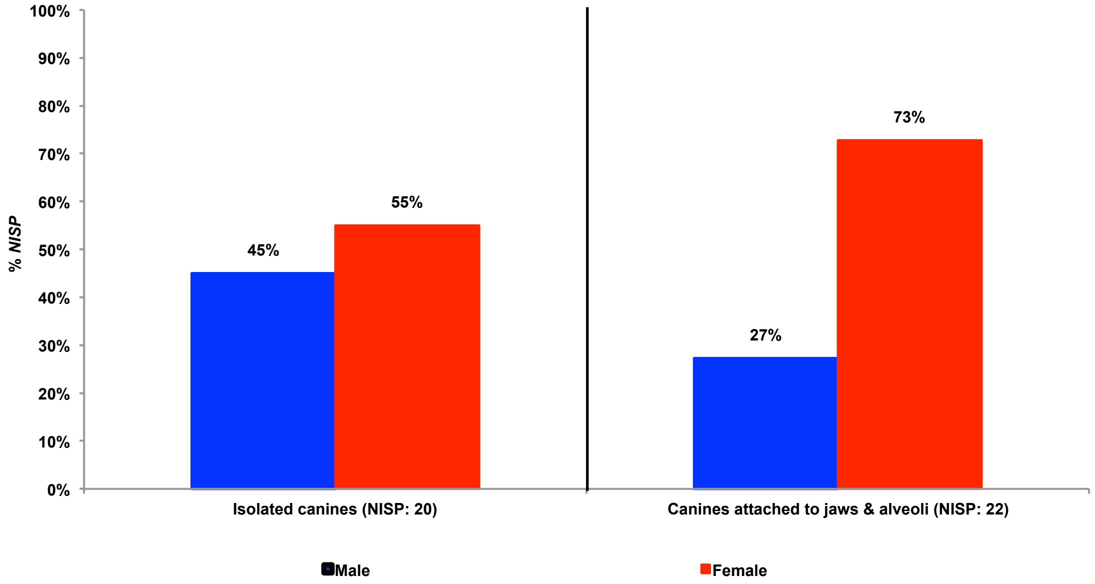

Figure 5.33: Frequency of male and female *Sus* (pig) isolated canines (left) and in jaws or alveoli (right). Both maxillary and mandibular canines and their alveoli are considered. All phases are combined. Data in Table 5.86. *NISP* counts.

Information on the sexual composition of pig populations from a number of contemporary settlements in Greek Macedonia is rather scarce, yet consistent with that from Promachon. For instance, in the Late Neolithic settlements of Kryoneri (Mylona 1997) and Stavroupoli (Yiannouli 2002a), the ratio between male and female pigs is 1 : 2 and 1 : 4 respectively. However, in order to sufficiently evaluate the sexual composition of the pig populations from the latter sites, we have to assess the significance of recovery bias for each site.

Table 5.86: Frequency of male and female *Sus* (pig) isolated and attached to jaw canines and alveoli. Both maxillary and mandibular canines and alveoli are considered. All phases are considered. Data for Figure 5.33. *NISP* counts.

Sus	***Canines: Maxillary and Mandibular Phases I-II-III** (Layers 6, 5, 4, 3, 2, 1)*			
	Isolated		***Attached to jaws and alveoli***	
	NISP	***%***	***NISP***	***%***
Male	*9*	*45%*	*6*	*27%*
Female	*11*	*55%*	*16*	*73%*
TOTAL	***20***	***100%***	***22***	***100%***

5.9 – Intra-site analysis

This section compares the Promachon faunal assemblage with that recovered through excavations of the Bulgarian sector (Topolnica) of the same site (Iliev and Spassov 2007). Unfortunately, no information about the excavation contexts and different phases from which the animal bone assemblage derives is provided for Topolnica. Consequently, the three phases had to be considered together under the broader cultural sequence of the Late Neolithic. A further complication concerns the fact that the report is written in Bulgarian, thus limiting the possibilities of understanding fully the adopted methodological approach, and therefore the nature of the evidence to be compared with Promachon.

In addition, the faunal material from the deposits associated with the first Phase of occupation in Promachon sector is compared to the faunal material from the deposits of structure n. 4 (which, as previously noted is used only during Phase I) of the same sector. The faunal material from the structure n. 4 was studied by O. Theodorogianni as part of her doctoral thesis at the University of Paris X and the results were published in the form of a preliminary report (Theodorogianni and Trantalidou 2013). The methodology employed by Theodorogianni regarding the recording and the quantification of the faunal material, as well as the assessment of the age-at-death of the main domesticated species, is inconsistent with the methodology employed by the author of the current thesis. This reflects the fact that both researchers adjusted their methodological protocols to their research questions, which were related to their specific area of study.

5.9.1 – Promachon sector vs. Topolnica sector

Due to the aforementioned limitations, the faunal material from the sector of Topolnica could be compared with that of Promachon only on the basis of species composition and frequency. In total, 2502 animal bones and teeth were recorded in the Bulgarian sector of Topolnica (Iliev and Spassov 2007). Of these, 2001 (79%) were identified to the level of species. Overall, 15 species were identified from Topolnica; this number is lower than that of Promachon, where almost 27 species (including human) were eventually identified, but this is likely to be the result of differences in sample sizes between the two sectors. ***Table 5.87*** presents the composition - in terms of *NISP* - of all the species identified from the Bulgarian sector of Topolnica, compares with those from Promachon.

Most of the species identified from Topolnica were also found at Promachon: cattle, sheep, goat, pig, dog, red deer, roe deer, red fox, hare and bear are present in both sectors. The absence of the fallow deer from Topolnica may be due to the lower chance to find such uncommon species in a much smaller sample size. There are however, some differences between the two sectors; Iliev and Spassov (2007) report the presence of wolf (*Canis lupus*; a single mandible and a single tibia), and wild horse (*Equus ferus*; a single calcaneum). As already noted (***4.2 – Identification***), all *Canis* remains from Promachon were identified as domestic dog (*Canis familiaris*), with no clear evidence of the occurrence of the wolf. Whether the absence of the wolf at Promachon is due to chance or is a consequence of different approaches to identification is difficult to say. The occurrence of the wild horse at Topolnica is noteworthy, especially if we consider that the species is not documented at other contemporary site in Greek Macedonia. To be confident regarding the actual chronology of this horse specimen we would, however, need more information regarding its context of origin.

Of additional interest is the identification of the aurochs (*Bos primigenius*; a single humerus and five phalanges) from Topolnica; no aurochs bones could be positively identified from Promachon. In addition, the number of wild boar specimens at Topolnica is relatively high (*NISP*: 140) while, as previously noted (***5.3 – Species representation***), only one wild boar specimen was identified at Promachon. The identification was based on the large size of a single mandible of a male individual containing the tusk and the first, second, third and fourth premolars, but in general the evaluation of wild forms of cattle and pig was based on biometrical analysis and is discussed later (see also ***5.10.1* – Bos taurus *size and shape***; ***5.10.3* – Sus *size***).

Figure 5.34 (***Table 5.88***) presents the frequencies of the three main domesticated species between the two sectors in terms of *NISP*. Pig representation is roughly the same in both sectors (12% in Topolnica and 15% in Promachon), but there are substantial differences in the frequencies of cattle and caprines. Cattle at Topolnica are substantially better represented than caprines (58% and 30% respectively), whereas the opposite is the case at Promachon (45% caprines and 40% cattle).

Differences in the *NISP* frequencies of cattle and caprines between the two sectors are most likely due to variation in the approaches to counting and quantification. Body part distributions for all species identified at Topolnica (Iliev and Spassov 2007; Table 2, 515), suggest that - unlike Promachon - all parts of the skeleton (including parts of the cranium as well as vertebrae and ribs) were recorded and eventually used for the calculation of *NISP*. However, as previously noted (see also ***5.2.2 – Retrieval biases***), recovery bias is likely to have played a significant role in the formation of the faunal assemblage, with large anatomical parts, and consequently, large taxa (such as cattle) being substantially better represented - in terms of *NISP* - than small anatomical parts deriving from small taxa (such as caprines and pigs).

We do not know whether the faunal material from Topolnica was hand-collected or sieved, yet, it is worth noticing that Iliev and Spassov (2007) do not assess the extent of recovery bias on site. In addition, the effect of fragmentation on large bones of large animals such as cattle, results in elements being counted more than once, thus inflating the total *NISP* for this species. Unlike Topolnica, the system of Diagnostic Zones employed in the study prevented any single zone from being counted twice: *inter-taxon* anatomical differences were partly circumvented by counting only certain key parts of the skeleton, and fragmentation bias was potentially reduced since zones were counted only if more than half was present.

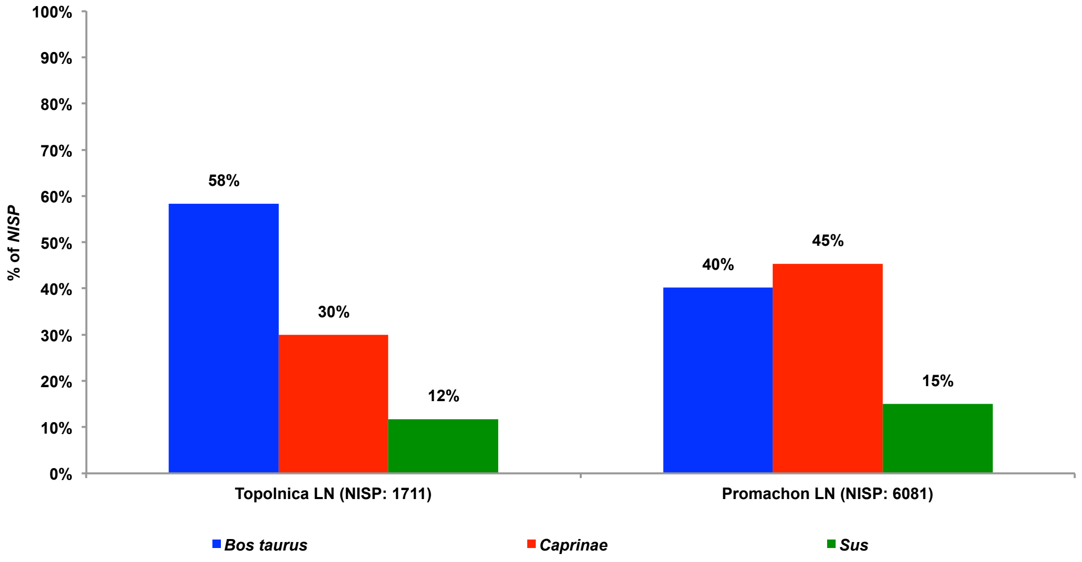

Figure 5.34: Topolnica sector vs. Promachon sector; three main domesticates. All Phases are considered for Promachon. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Table 5.88. *NISP* counts.

One possible way to tackle the biases created by the different methodological approaches in the two sectors, would be to compare the frequencies of the three main domesticated species using the *MNI* - rather than *NISP* - as the main predictor of taxonomic frequency. Regardless of the fact that we do not know the exact method with which, Iliev and Spassov (2007) calculated the *MNI* for the three main domesticates in Topolnica, we can see that caprines are represented with a higher frequency than cattle when *MNI*'s are considered (50% and 39% respectively) (Iliev and Spassov 2007). This is consistent with the frequency - in terms of *MNI* - of the three main domesticated species in Promachon, which also points to the predominance of caprines over cattle (61% and 24% respectively) (***Table 5.89***; ***Figure 5.35***). Therefore, the predominance of caprines in both sectors - in terms of *MNI* - possibly reflects the reality of the situation in Promachon-Topolnica; to be more specific, the results from both sectors indicate that caprines in Promachon-Topolnica are represented with higher frequencies than any other main domesticate during the Late Neolithic.

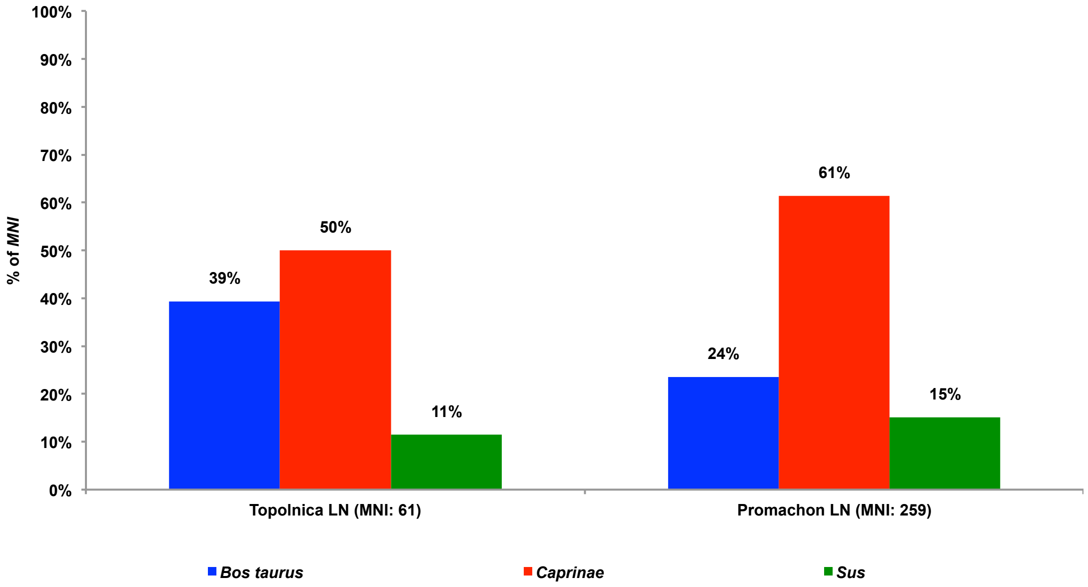

Figure 5.35: Topolnica sector vs. Promachon sector; three main domesticates. All Phases are considered for Promachon. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Table 5.89. *MNI* counts.

The information on the relative frequency of sheep and goat from Topolnica is approximately consistent with that of Promachon (***Figure 5.36***; ***Table 5.90***) as it indicates a predominance of sheep. Nevertheless, sheep are better represented at Promachon than Topolnica (81% and 64% respectively). We do not, however, know which anatomical elements were used at Topolnica for the identification of the two species and it is therefore difficult to evaluate the factors that may have cause the discrepancy.

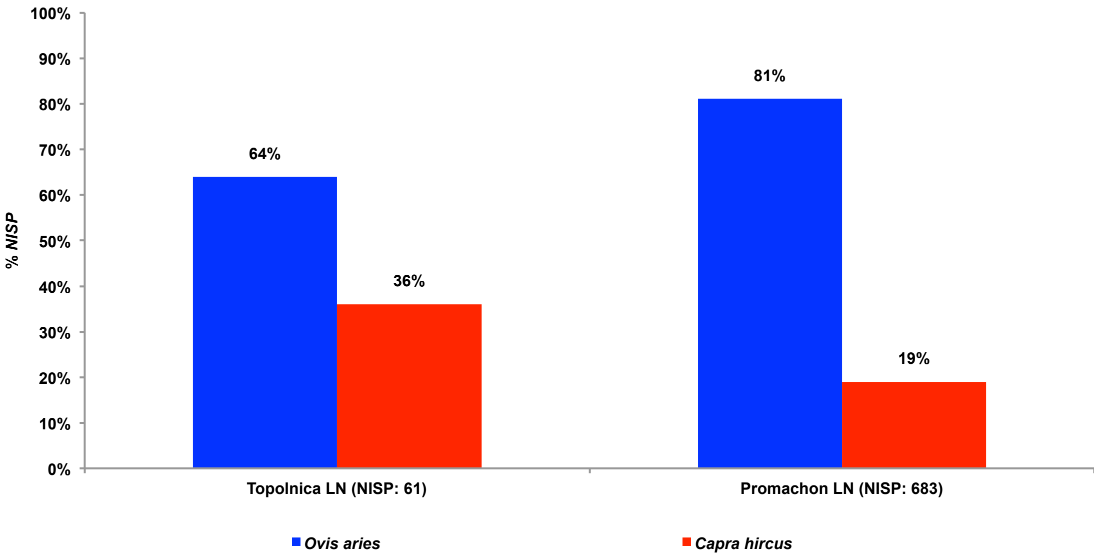

Figure 5.36: Topolnica sector vs. Promachon sector; sheep vs. goats. All Phases are considered for Promachon. Data in Table 5.90. *NISP* counts.

5.9.2 – Structure n. 4 vs. the rest of the deposits of Phase I

Despite differences in methodological protocols (which must be considered in the interpretation), it was possible to conduct comparisons between structure n. 4 and the rest of the deposits of Phase I on the basis of species composition and frequency, as well as ageing analysis.

Table 5.91 presents the composition - in terms of *NISP* - of all species identified in structure n. 4, and compares it with that from the rest of the deposits of Phase I. In total, 8842 animal bones and teeth from the deposits of structure n. 4 (Phase I) were recorded (Theodorogianni and Trantalidou 2013); this number is higher than that from the rest of the deposits of Phase I, from which, 2263 bones and teeth were recorded in total[15]. It must, however, be considered that the dataset from the rest of the site derives from a selective, diagnostic-zone approach, and is therefore not directly comparable in quantity to that from structure n.4. Out of 8842 bones and teeth from structure n. 4, 8839 (> 99%) were identified down to the level of species. The rest of the faunal material consists of one specimen belonging

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[15] Excluding specimens, which were only roughly attributed to taxa (*i.e.* cattle/red deer; red deer/fallow deer; sheep/goat/roe deer; dog/red fox) and non-countable specimens. See also ***Table 5.20*** for more details.

to the family of *Mustelidae* (mustelids) and two indeterminate fish bones. In total 12 species were identified in structure n. 4 (including human). This number is lower than the number of species identified from the rest of the deposits in Phase I (20 species, including human). Considering the much larger assemblage from structure n.4, this indicates a much lesser taxonomic variability in the assemblage from this context.

Cattle, sheep, goat, pig, dog, red deer, fallow deer, hare, wild boar and mustelids are present in both study areas. Roe deer, red fox and bird remains are, however, absent from structure n. 4 but were recorded in the rest of the deposits of Phase I. On the other hand, Theodorogianni and Trantalidou (2013) argue for the presence of aurochs and wild boar remains in structure n. 4 (*NISP*: 174 and 66 respectively); as previously noted, the significance of both the aurochs and the wild boar from the rest of the deposits will be assessed in a separate part of the current analysis (see also ***5.10.1* – Bos taurus *size and shape***; ***5.10.3* – Sus *size***).

Figure 5.37 (***Table 5.92***) presents the frequency - in terms of *NISP* - of domesticated and wild species between the two study areas. No difference can be seen between structure n. 4 and the rest the deposits of Phase I, since in both cases domesticates predominate with roughly the same frequencies (96% in structure n. 4 and 94% in the rest of the deposits of Phase I). A Chi^2 test was conducted to test whether the differences between the two research areas in domesticated and wild animal representation were statistically significant. The test indicated that the two taxa representation does not differ significantly between structure n. 4 and the rest of the deposits of Phase I (p= .67).

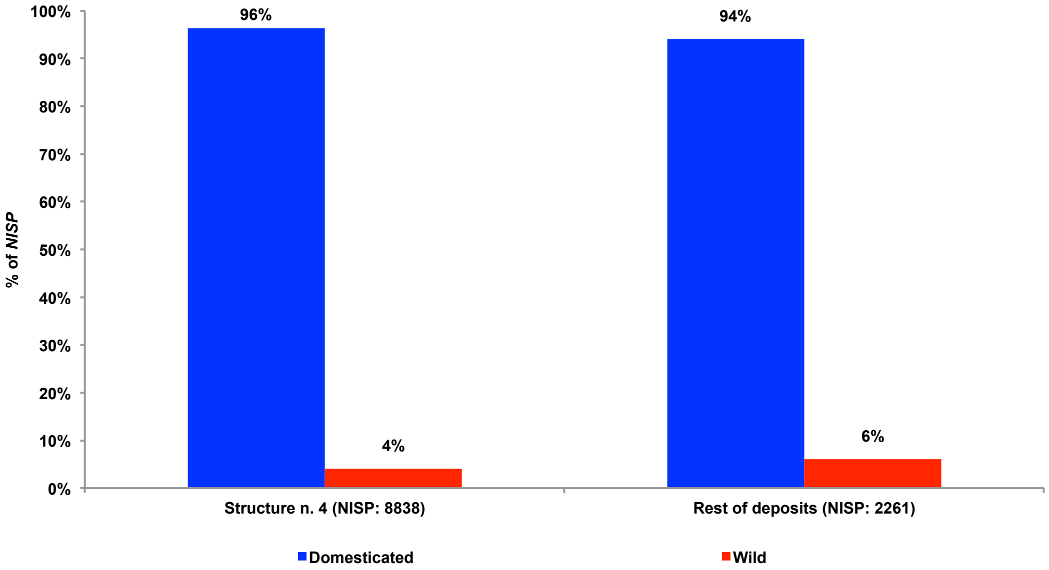

Figure 5.37: Structure n. 4 vs. the rest of the deposits of Phase I; domesticated vs. wild. Data in Table 5.92. *NISP* counts.

Figure 5.38 (***Table 5.93***) compares the frequency of the three main domesticated species between structure n. 4 and the rest of the deposits of Phase I in terms of *NISP*. Pigs are represented with lower frequencies than any other domesticate in both study areas (7% in structure n. 4 and 15% in the rest of the deposits). There is, however, a great difference in the frequencies between cattle and caprines; cattle are substantially better represented than caprines in structure n. 4 (83% and 9% respectively), while the two species are almost equally represented in the rest of the deposits of Phase I (43% for cattle and 42% for caprines). A *Chi*^{2} test was also conducted to test whether the differences between the two research areas in cattle and caprine representation were statistically significant. The test indicated that the two taxa representation is highly different between structure n. 4 and the rest of the deposits of Phase I (p= .0001).

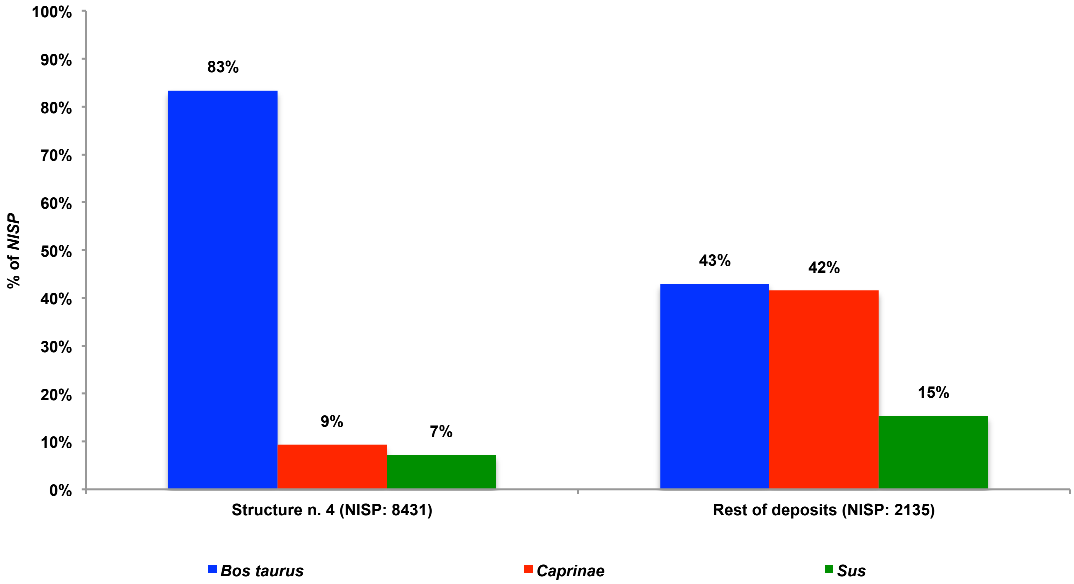

Figure 5.38: Structure n. 4 vs. the rest of the deposits of Phase I; three main domesticates. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data in Table 5.93. *NISP* counts.

It could be argued that the differences in the *NISP* frequencies of cattle and caprines between the two study areas (structure n. 4 and the rest of the deposits of Phase I) are due to methodological differences between the two studies, as in the case of the differences between Promachon and Topolnica (see also ***5.9.1 – Promachon sector vs. Topolnica sector***). Fragmentation of the bucrania, which were found in structure n. 4[16], enhances the possibility of cattle cranial elements (*i.e.* horn cores, maxillae, mandibles) being counted more than once; and, isolated cattle teeth would also be likely candidates for multiple recording of the same specimen, thus inflating the total *NISP* of the species. Nevertheless, a glance at the table providing the body part distribution for cattle from structure n. 4 (Theodorogianni and Trantalidou 2013; Table 4, 413), indicates that postcranial elements are very well represented as well; this suggests that the pattern is most likely genuine and that the fragmented bucrania cannot be the only reason for the overall high frequency of cattle in structure n. 4. The possibility that the high frequency of cattle postcranial elements in structure n. 4 is the result of a

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[16] In total, 35 bucrania were found in the successive floor levels of structure n. 4 during Phase I (Trantalidou 2010; Theodorogianni and Trantalidou 2013; Trantalidou and Gkioni 2008).

recovery bias should also be considered, but the deposits of structure n. 4 were sieved through a 1mm mesh (Koukouli-Chrysanthaki *et al.* 2007; Theodorogianni and Trantalidou 2013), thus ruling out the possibility that smaller animals such as caprines (and pigs) were biased against.

Methodological, taphonomic and recovery differences between the two study areas are unlikely to account for the substantially better representation of cattle in structure n. 4. There is another issue that must be considered; as in the case of the comparison between the Bulgarian sector of Topolnica and the Greek sector of Promachon (see also ***5.9.1 – Promachon sector vs. Topolnica sector***), one possible way to mitigate biases created by the different methodological protocols in the two study areas, would be to calculate the frequency of the three main domesticated species in terms of *MNI* rather than *NISP*. However, unlike the Bulgarian sector of Topolnica, Theodorogianni and Trantalidou (2013) do not provide the *MNI* for the caprine assemblage that was generically identified as sheep/goat.

In addition, there is no discussion of the method used for the calculation of the *MNI*'s from the deposits of structure n. 4. The authors, however, suggest that, in the deposits of structure n. 4, out of a total of 110 domesticated individuals (excluding dogs), cattle are represented with 54, sheep with 25, goats with 16, and pigs with 15 individuals respectively (Theodorogianni and Trantalidou 2013, Table 2, p. 410). Therefore, according to Theodorogianni and Trantalidou (2013) caprines from structure n. 4 are represented by 41 individuals, without counting the number of individuals identified to the generic level of sheep/goat. In terms of *MNI* percentages, therefore, caprines account for 37% (excluding sheep/goat), cattle for 49%, and pig account for 14% of the total *MNI* for the three main domesticates. Undoubtedly, had Theodorogianni and Trantalidou (2013) calculated also the *MNI* for the part of the caprine assemblage that was identified to the level of sheep/goat, we would have expected the frequency - in terms of *MNI* - of the whole caprine population (that is sheep, goat **and sheep/goat**) to be very close - if not higher - to the frequency of cattle.

In particular we must consider that in structure n. 4, sheep are represented with a *NISP* of 293, while sheep/goat are represented with a *NISP* of 322. Theodorogianni and Trantalidou (2013), argue that 293 remains of sheep (in terms of *NISP*), account for 25 sheep (in terms of *MNI*). Therefore, by using the 'rule of three'[17] we can roughly estimate what would probably be the *MNI* for sheep/goat:

Species	***NISP***	***MNI***
Ovis aries	*293*	*25*
Ovis/Capra	*322*	*MNI?*

'Rule of three'	*MNI= (322/293) * 25*
Ovis/Capra	*MNI=* ***27***

With rough estimates therefore, 322 sheep/goat remains (in terms of *NISP*), would account for 27 sheep/goats (in terms of *MNI*) in structure n. 4. This number, added to 25 sheep and 16 goats, would give a total *MNI* of 68 caprines (sheep, goat, sheep/goat). Therefore, the total *MNI* for the three main domesticates would reach 137 individuals (instead of 110) including cattle, sheep, goat, sheep/goat and pigs. Therefore, out of a total of 137 domesticated animals, cattle, which are represented with 54 individuals would account for 39% (instead of 49%), caprines (sheep, goat and sheep/goat), which would be represented with 68 individuals (instead of 41) would account for 49% (instead of 37%), and pigs, which are represented with 15 individuals would account for 12% (instead of 14%) of the total frequency for the three main domesticated species in terms of *MNI*.

The previous calculations indicate, that if the sheep/goat *MNI* was taken into consideration, caprines would - in overall - be represented with a higher frequency than cattle in the deposits of structure n. 4. More specifically, since *MNI* is less affected by recovery biases, it would be a much more reliable tool - than *NISP* - for the calculation of the frequency of the three main domesticates, and it would also demonstrate that the caprine population is

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[17] Mathematical rule asserting that, the value of an unknown quantity in a proportion is found by multiplying the denominator of each ratio by the numerator of the other.

represented with higher frequencies than any other domesticate in structure n. 4.

There is, however, one further issue that should also be considered. It is peculiar that 7031 cattle remains account for 54 individuals only, while 293 sheep remains give an *MNI* as high as 25. This high number of sheep in terms of *MNI* could potentially be explained if the calculation of the *MNI* in structure n. 4 was based on the most common element, and that element in turn, was represented with the highest proportions than any other element in the body part distribution. However, according to the body part distribution of sheep from the latter structural feature (Theodorogianni and Trantalidou 2013), this is not the case; all anatomical parts are very well represented. This indicates therefore, that cattle *MNI* was either calculated wrongly, or simply reported wrongly in the faunal report.

In any case, since the *MNI* for sheep/goat is not reported in the faunal report, only tentative considerations can be made with regard to the frequencies of the three main domesticates between the two study areas in terms of *MNI*. This obviously implies that the most useful predictor of taxonomic frequency for the three main domesticates between the two study areas, is *NISP*. It would have been more appropriate, however, to calculate the frequency of the three main domesticates between structure n. 4 and the rest of the deposits - except for *NISP* - also in terms of *MNI*.

As previously argued, the deposits of structure n. 4 were completely sieved, whereas the faunal material from the rest of the deposits was hand-collected. Since the faunal material from the deposits not associated with structure n. 4 was hand collected, caprines are likely to be seriously underrepresented in terms of *NISP* (an issue already discussed in ***5.2.2 – Retrieval biases***). On the other hand, since the deposits of structure n. 4 were completely sieved, it is likely that - in terms of *NISP* - caprines are not underrepresented and cattle remains dominate structure n. 4. It can be therefore concluded that in terms of *NISP*, the remains of cattle dominate structure n. 4, whereas no particular emphasis on a single species can be detected in the rest of the deposits (although there are hints that due to recovery biases, caprines are seriously underrepresented in comparison to cattle).

Although we do not know which anatomical elements Theodorogianni and Trantalidou (2013) used for the identification of the caprine population to the finest taxonomical level (sheep and goat), it seems that sheep are represented - in terms of *NISP* - with higher frequencies than goat in structure n. 4; this is consistent with the data from the rest of the deposits of Phase I (***Figure 5.39***; ***Table 5.94***). However, the frequency of sheep from structure n. 4 is higher than that in the rest of the deposits of Phase I. A Chi^2 test was also conducted to test whether the differences between the two research areas in sheep and goat representation were statistically significant. The test indicated that the two taxa representation is highly different between structure n. 4 and the rest of the deposits of Phase I (p= .00001).

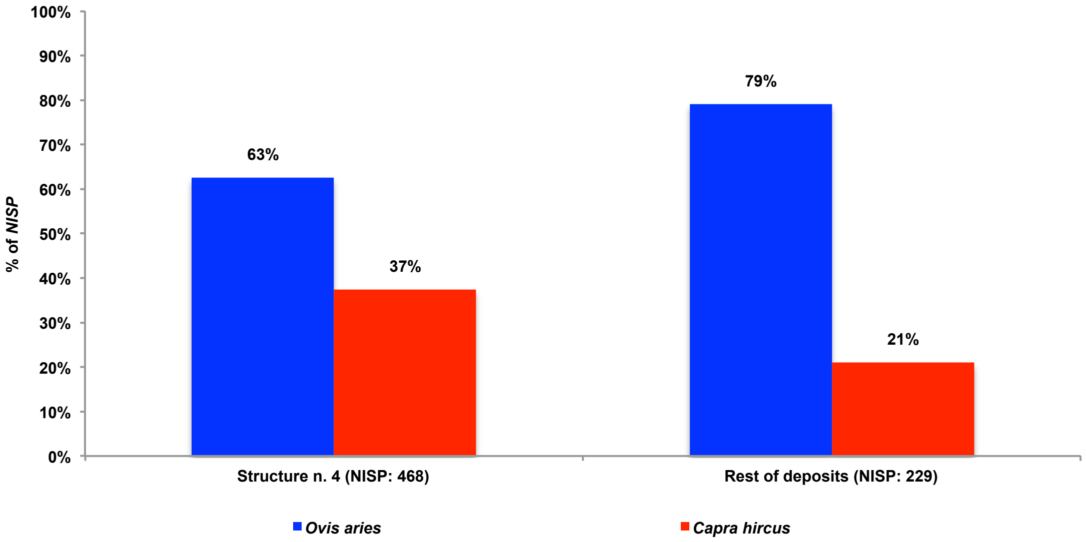

Figure 5.39: Structure n. 4 vs. the rest of the deposits in Phase I; sheep vs. goat. Data in Table 5.94. *NISP* counts.

As previously argued (see also ***4.5 – Ageing and sexing***) the assessment of the age-at-death for the main domesticates in Promachon was based on O' Connor's (1988) mandible wear stages for cattle and pigs, as well as Payne's (1973) mandible wear stages for caprines. On the other hand, Theodorogianni and Trantalidou (2013) do not provide information on the methodology that they have used for assessing the age-at-death of the same species from structure n. 4. In overall, they use six mandible wear stages for assessing the age-at-death for cattle and sheep (less than six months, six months, 6-18 months, 1½ - 2½ years, 2 ½ - 3 years and beyond three years), and five for assessing the age-at-death for goats (less than six months, 6-18 months, 1½ - 2 ½ years, 2 ½ - 3 years and beyond three years)[18]. Due therefore to the incompatibility of the methodology followed in the two study areas, we should be cautious with our interpretations.

Figure 5.40 (***Table 5.95***) presents the comparison of cattle age-at-death between structure n. 4 and the rest of the deposits from Phase I. As already noted (***5.7.1* – Bos taurus *age-at-death***), neonate and senile individuals were completely absent from the deposits of Phase I. On the other hand, senile individuals (> 3 years) are also absent from structure n. 4; of interest however, is the fact that neonate individuals (calves; < 6 months old) are represented in structure n. 4 with 18%.

It could be argued that the differences in the frequency of calves between the two study areas are the result of recovery biases: the deposits of structure n. 4 were sieved through 1mm mesh (Koukouli-Chrysanthaki *et al.* 2007; Theodorogianni and Trantalidou 2013), whereas the bulk of the faunal material from the rest of the deposits was hand-picked. Indeed, as previously noted (***5.7.1* – Bos taurus *age-at-death***), a small number of cattle unworn isolated mandibular first / second molars ($M_{1/2}$) from our area of study, indicates that a number of calf mandibles were particularly affected by fragmentation mechanisms and, ultimately, poor recovery procedures. However, the frequency of calves from structure n. 4 is considerably high (18%), and it cannot be explained only on the basis of differential recovery between structure n. 4 and the rest of the deposits. It is rather suggested that the overall pattern indicates a genuine difference, and that structure n. 4 was favoured regarding the disposal of the remains of calves.

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[18] Only the frequencies of cattle and sheep and goat mandible wear stages (%*NISP*) are provided. No information on pig wear stages is provided.

A possible explanation for this phenomenon is that this age group could represent young casualties, such as animals, which died immediately or relatively soon after birth, due to disease, weakness, difficult adaptation in the local environment *etc.* Given, however, the exceptional and distinctive function and nature of structure n. 4 (Koukouli-Chrysanthaki *et al.* 2007), it would be highly unlikely that ailing animals were killed and/or simply disposed of into the latter structural feature.

It is rather suggested that the preferential disposal of calves in structure n. 4 possibly reflects a purely *economic perspective*: calves were part of the cattle population that had to be slaughtered for the production of milk. Indeed, as previously noted, the frequency of calves is considerably high and therefore, largely conforms to Payne's (1973) idealized model of dairy husbandry. However, the *economic perspective* cannot be entirely disentangled from the *symbolic perspective*; in other words, the need for milk does not preclude the possibility that calves might have been considered as a species with a symbolic significance. To be more specific, the presence of luxurious material culture evidence (Koukouli-Chrysanthaki *et al.* 2007), packed with the presence of a characteristic age group, such as calves, is largely consistent with the distinctive and symbolic nature of structure n. 4.

Overall, the pattern indicates differential disposal of calves between structure n. 4 and the rest of the deposits in Phase I; in addition, older individuals, do not seem to have been disposed of in different ways.

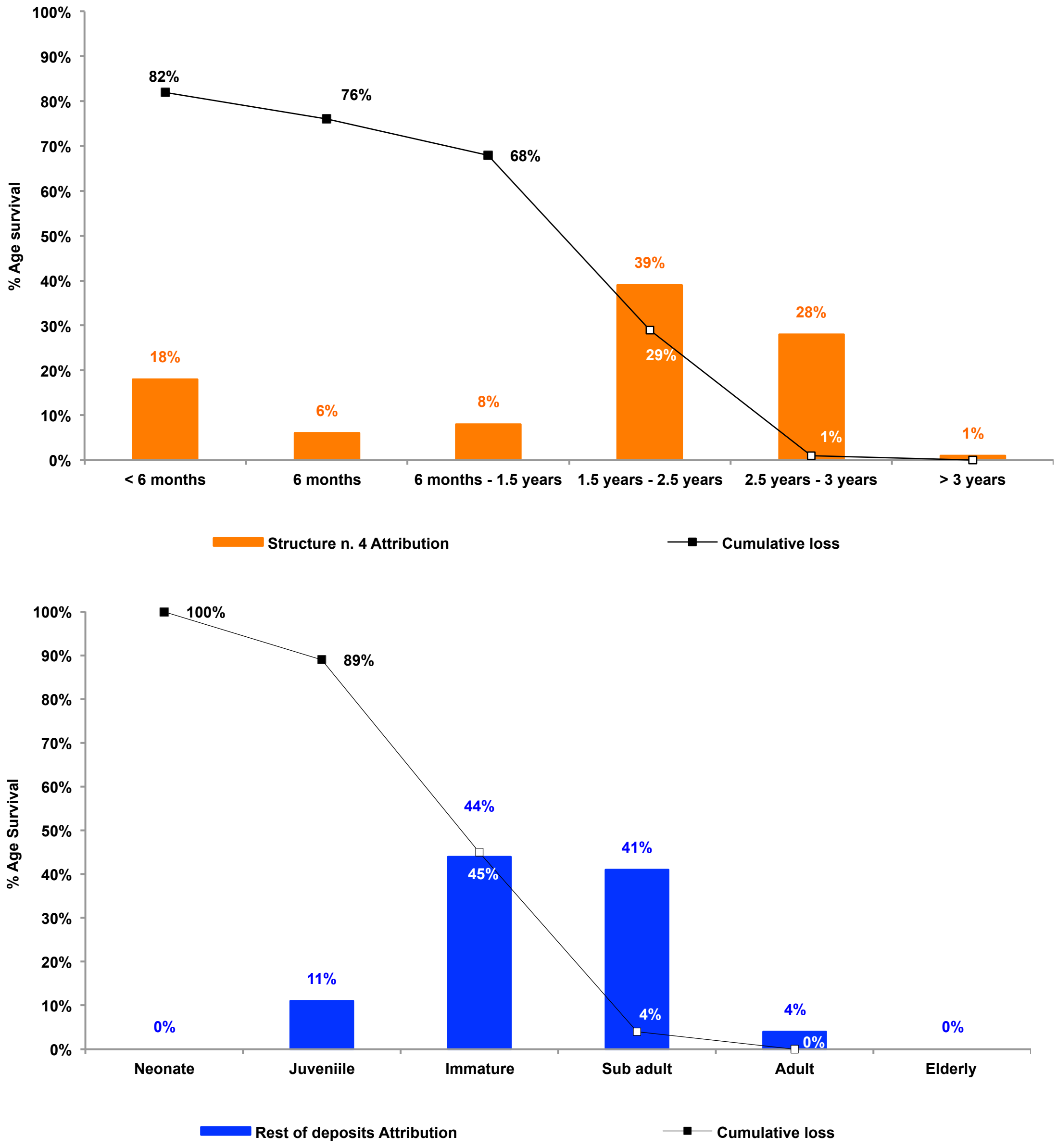

Figure 5.40: Structure n. 4 (Theodorogianni and Trantalidou 2013) vs. the rest of the deposits; *Bos taurus* (cattle) kill-off pattern from mandibular wear stages. Phases I-II (our area of study), are treated together, due to the small sample size of Phase I. Data for cattle from our area of study are drawn from Table 5.71. Data from structure n. 4 in Table 5.95. *NISP* counts.

Before proceeding to the comparison of the age-at-death of sheep and goat between structure n. 4 and the rest of the deposits of Phase I, it should be noted that, as in the case of postcranial elements, Theodorogianni and Trantalidou (2013) do not state which teeth they used for the identification of the caprine population to the finest taxonomical level (sheep and goats).

Figure 5.41 (***Table 5.96***) presents the age-at-death of sheep between structure n. 4 (Theodorogianni and Trantalidou 2013) and the rest of the deposits of Phase I. Lambs (0-6 months) are represented with 3% in structure n. 4, while they are completely absent from the rest of the deposits of Phase I [stages A and B *sensu* Payne (1973); 0-6 months]. Despite the fact that this trend is similar to the one identified for cattle, the proportion of sheep neonates is too small to give us any confidence in the occurrence of deliberate disposal pattern. Other factors, such as differential recovery bias, may play a role. However, a much larger discrepancy can be seen with regard to the rest of the sheep population. More specifically, structure n. 4, has a higher frequency of younger sheep (6 months and 3 years; 62% in overall), while older sheep predominate in the rest of the deposits of Phase I [stages F-G-H-I *sensu* Payne (1973); 66%]. In other words, it seems that sheep from structure n. 4 have a younger age profile than their counterparts from the rest of the deposits of Phase I. This appears to be a 'genuine' trend and, although it is difficult to pinpoint the reasons why such age differences occur, it does confirm the peculiarity of structure n.4 in comparison to the rest of the site.

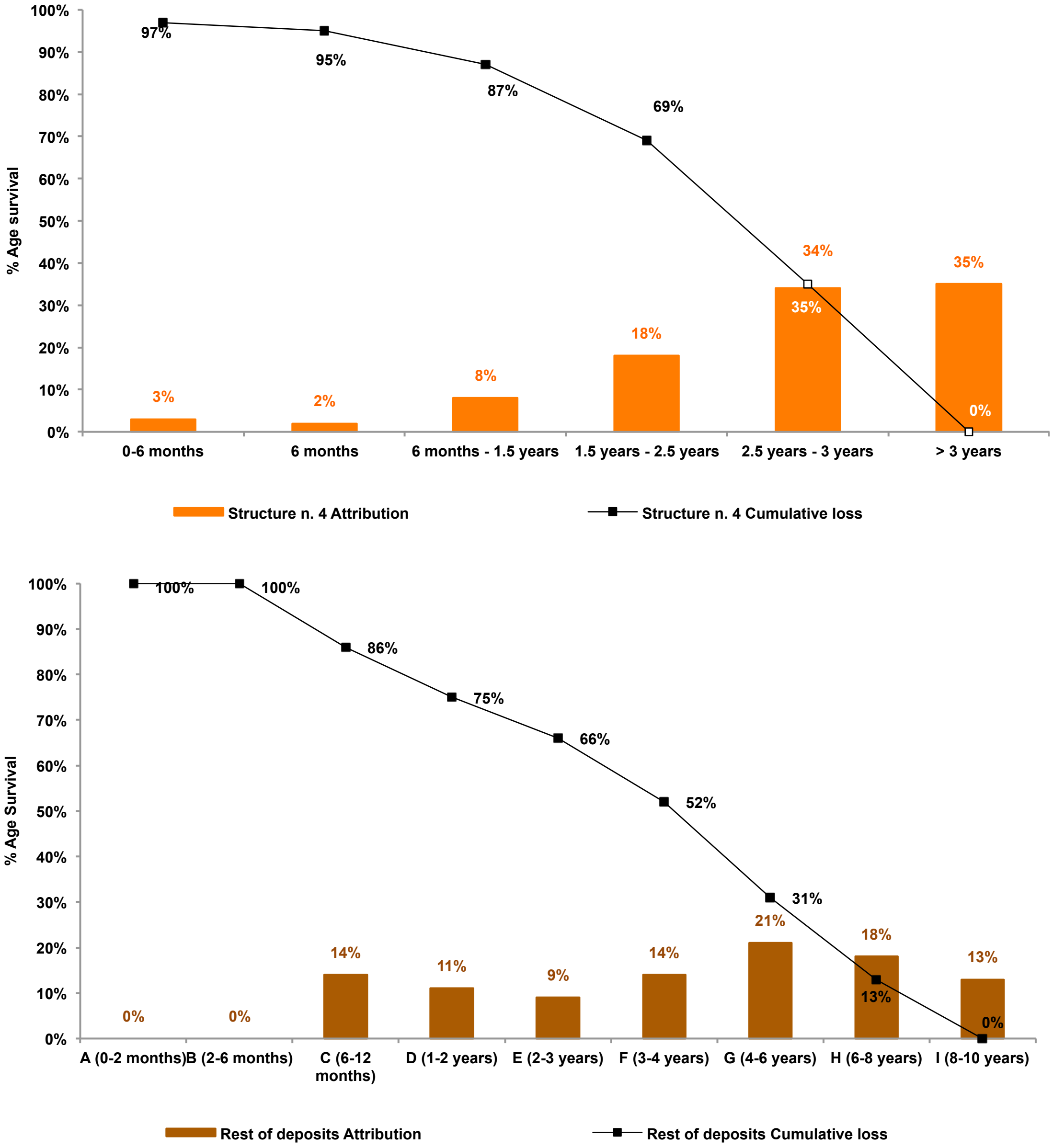

Figure 5.41: Structure n. 4 (Theodorogianni and Trantalidou 2013) vs. the rest of the deposits; *Ovis aries* (sheep) kill-off pattern from mandibular wear stages. Data for sheep from our area of study (Phase I) are drawn from Table 5.74. Data in Table 5.96. *NISP* counts.

Comparison of the age-at-death of goats between the two study areas is presented in ***Figure 5.42*** (***Table 5.97***). The pattern for goats is similar to that observed for sheep. Although, the small difference in the frequency of kids (0-6 months) between the two areas could be attributed to recovery bias or other taphonomic factor, structure n. 4 also has a high frequency of younger individuals (6 months to 3 years; 84%), while individuals being killed between

3 to 10 years [stages F-G-H-I *sensu* Payne (1973)] dominate in the rest of the deposits (69%). Therefore, the results indicate a younger profile of goats in structure n. 4 and an older profile of the same species from the rest of the area in Phase I. This should be interpreted cautiously due to the very small sample size for goats, but the similarity to the sheep pattern gives some confidence in the reliability of the results.

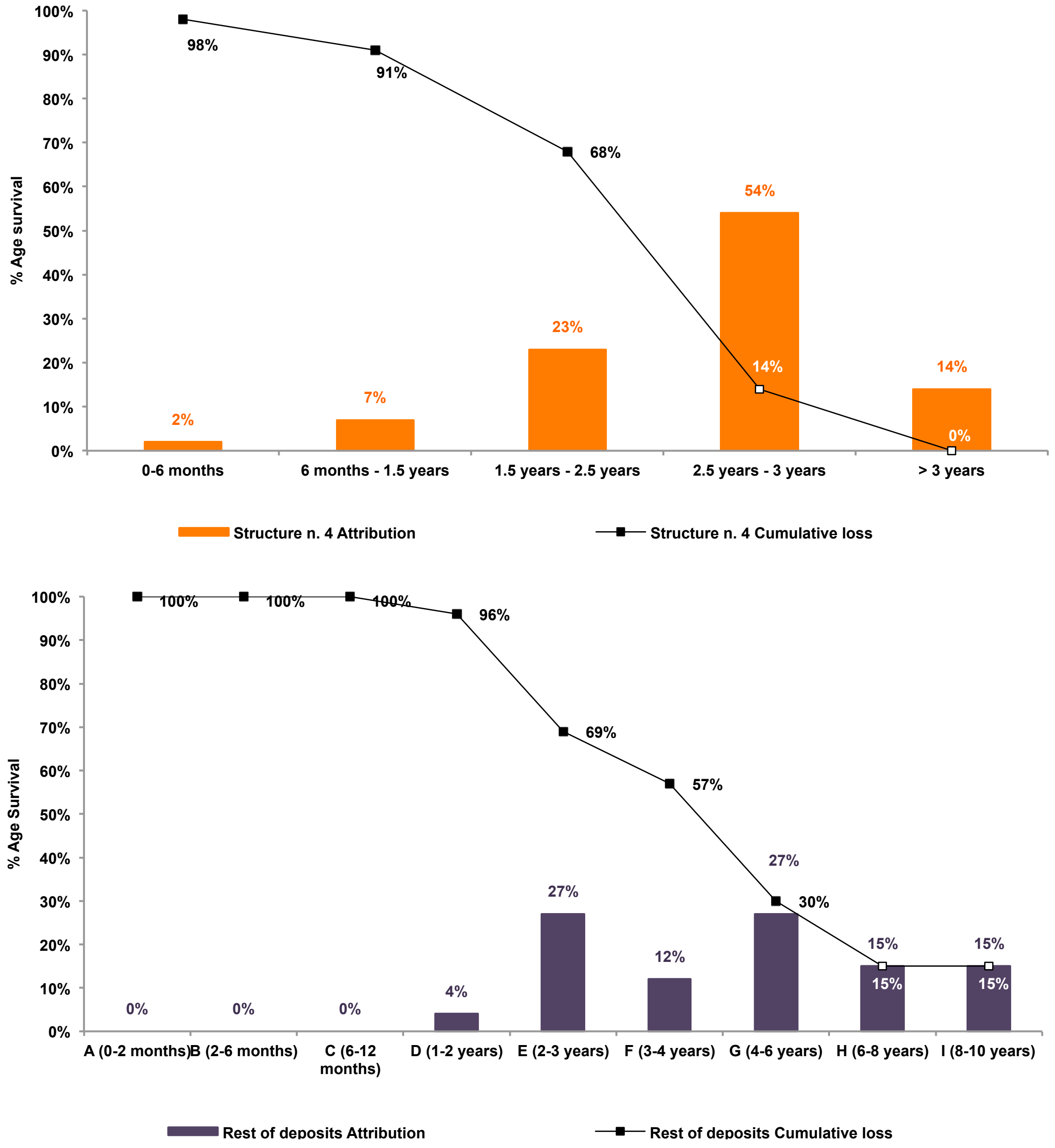

Figure 5.42: Structure n. 4 (Theodorogianni and Trantalidou 2013) vs. the rest of the deposits; *Capra hircus* (goat) kill-off pattern from mandibular wear stages. Data for goats from our area of study (Phase I) are drawn from Table 5.74. Data in Table 5.97. *NISP* counts.

Overall, there seems to be a differential disposal of caprines - on the basis of age - between structure n. 4 and the rest of deposits; the information thus, enhances previous suggestions regarding the different use of space, with the disposal of younger sheep and goats in structure n. 4 and the disposal of their older counterparts in the rest of the deposits of Phase I.

As previously noted, there is no published information on tooth age stages of pigs from structure n. 4. However, Theodorogianni and Trantalidou (2013) argue that pigs from this pit were slaughtered between their first and second year. This information is thus consistent with the evidence from our area of study, in which immature and sub adult individuals (1-2 years) predominate, with an overall 85% (***5.7.3* – Sus *age-at-death***).

Table 5.87: Composition of the domesticated and wild species identified in Promachon and Topolnica (Iliev and Spassov 2007). All phases are considered from Promachon. *NISP* counts.

Species	*Late Neolithic*	
	Topolnica LN Iliev and Spassov (2007)	*Promachon LN (Phases I-II-III); current thesis*
	NISP	*NISP*
Bos taurus	998	2444
Ovis/Capra	451	2075
Ovis aries	39	554
Capra hircus	22	129
Sus	201	879
Canis familiaris	14	124
Cervus elaphus	115	88
Dama dama	-	9
Capreolus capreolus	2	34
Bos primigenius	6	-
Equus ferus	1	-
Lepus europaeus	5	21
Vulpes vulpes	4	31
Rupicapra rupicapra	-	1
Canis lupus	2	-
Sus scrofa	140	1
Lynx lynx	-	1
Ursus arctos	1	3
Meles meles	-	2
Mustela putorius	-	1
Mustela erminea	-	1
Martes foina	-	1
Buteo lagopus	-	2
Anser anser	-	3
Grus grus	-	1
Corvus corax	-	2
Total	**2001**	**6407**
Aves	Indeterminate; 1	Indeterminate; 1
Testudinidae	2	Present; non-countable
Pisces	Indeterminate; 2	Siluris glanis; Cyprinidae; non-countable
Murex trunculus	-	Present; non-countable
Homo sapiens	-	3
TOTAL	**2006**	**6411**

Table 5.88: Topolnica sector vs. Promachon sector; three main domesticates. All phases are considered for Promachon. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.34. *NISP* counts.

Species	*Topolnica LN Iliev and Spassov (2007)*		*Promachon LN (Phases I-II-III); current thesis*	
	NISP	*%*	*NISP*	*%*
Bos taurus	*998*	*58%*	*2444*	*40%*
Caprinae	*512*	*30%*	*2758*	*45%*
Sus	*201*	*12%*	*879*	*15%*
TOTAL	***1711***	***100%***	***6081***	***100%***

Table 5.89: Topolnica sector vs. Promachon sector; three main domesticates. All phases are considered from Promachon. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.35. *MNI* counts.

Species	*Topolnica LN Iliev and Spassov (2007)*		*Promachon LN (Phases I-II-III); current thesis*	
	MNI	*%*	*MNI*	*%*
Bos taurus	*24*	*39%*	*61*	*24%*
Caprinae	*30*	*50%*	*159*	*61%*
Sus	*7*	*11%*	*39*	*15%*
TOTAL	***61***	***100%***	***259***	***100%***

Table 5.90: Topolnica sector vs. Promachon sector; sheep vs. goat. All phases are considered from Promachon. Data for Figure 5.36. *NISP* counts.

Species	*Topolnica LN Iliev and Spassov (2007)*		*Promachon LN (Phases I-II-III); current thesis*	
	NISP	*%*	*NISP*	*%*
Ovis aries	*39*	*64%*	*554*	*81%*
Capra hircus	*22*	*36%*	*129*	*19%*
TOTAL	***61***	***100%***	***683***	***100%***

Table 5.91: Composition of the domesticated and wild species between structure n. 4 (Theodorogianni and Trantalidou 2013) and the rest of the deposits from Phase I in Promachon sector. *NISP* counts.

Species	*Promachon sector*	
	Structure n. 4 (Phase I) Theodorogianni and Trantalidou (2013)	*Rest of deposits (Phase I) Current thesis*
	NISP	*NISP*
Bos taurus	7031	918
Ovis/Capra	322	659
Ovis aries	293	181
Capra hircus	175	48
Sus	610	329
Canis familiaris	86	48
Total domesticated	**8517**	**2183**
Cervus elaphus	73	30
Dama dama	1	2
Capreolus capreolus	-	10
Bos primigenius	174	-
Lepus europaeus	6	8
Vulpes vulpes	-	16
Rupicapra rupicapra	-	1
Sus scrofa	66	1
Lynx lynx	-	1
Ursus arctos	-	3
Meles meles	Mustelidae; 1	1
Mustela putorius		1
Anser anser	-	3
Grus grus	-	1
Total wild	**321**	**78**
Total domesticated and wild	**8838**	**2261**
Pisces	Indeterminate; 2	Cyprinidae; non countable
Murex trunculus	-	Present; non countable
Homo sapiens	2	2
TOTAL	**8842**	**2263**

Table 5.92: Structure n. 4 vs. the rest of the deposits in Phase I; domesticated vs. wild. Data for Figure 5.37. *NISP* counts.

Species	*Structure n. 4 (Phase I) Theodorogianni and Trantalidou (2013)*		*Rest of deposits (Phase I) Current thesis*	
	NISP	*%*	*NISP*	*%*
Domesticated	8517	96%	2183	94%
Wild	321	4%	78	6%
TOTAL	**8838**	**100%**	**2261**	**100%**

Table 5.93: Structure n. 4 vs. the rest of the deposits in Phase I; three main domesticates. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 5.38. *NISP* counts.

Species	*Structure n. 4 (Phase I) Theodorogianni and Trantalidou (2013)*		*Rest of deposits (Phase I) Current thesis*	
	NISP	*%*	*NISP*	*%*
Bos taurus	*7031*	*83%*	*918*	*43%*
Caprinae	*790*	*9%*	*888*	*42%*
Sus	*610*	*7%*	*329*	*15%*
TOTAL	***8431***	***100%***	***2135***	***100%***

Table 5.94: Structure n. 4 vs. the rest of the deposits in Phase I; sheep vs. goat. Data for Figure 5.39. *NISP* counts.

Species	*Structure n. 4 (Phase I) Theodorogianni and Trantalidou (2013)*		*Rest of deposits (Phase I) Current thesis*	
	NISP	*%*	*NISP*	*%*
Ovis aries	*293*	*63%*	*181*	*79%*
Capra hircus	*175*	*37%*	*48*	*21%*
TOTAL	***468***	***100%***	***229***	***100%***

Table 5.95: Structure n. 4 vs. the rest of the deposits; *Bos taurus* (cattle) kill-off pattern from mandibular wear stages. The methodology used for the assessment of cattle mandibular wear stages is not cited in the report on structure n. 4 (Theodorogianni and Trantalidou 2013); only the frequencies of the different mandible wear stages (%*NISP*) are provided. Phases I-II (our area of study), are treated together, due to the small sample size of Phase I. Data for cattle from our area of study are drawn from Table 5.71. Data for Figure 5.40. *NISP* counts.

Bos taurus *age-at-death*						
Structure n. 4; Theodorogianni and Trantalidou (2013); unknown NISP			***Rest of deposits (Phases I-II)***			
Stages (unknown)	***% Attribution***	***% Cumulative loss***	***Stages (O' Connor 1988)***	***Attribution***	***% Attribution***	***% Cumulative loss***
< 6 months	*18%*	*82%*	***Neonatal***		*0%*	*100%*
6 months	*6%*	*76%*	***Juvenile***	*2*	*11%*	*89%*
6 months - 1½ years	*8%*	*68%*	***Immature***	*5*	*28%*	*61%*
1½ years – 2½ years	*39%*	*29%*	***Sub adult***	*7*	*39%*	*22%*
2½ years - 3 years	*28%*	*1%*	***Adult***	*4*	*22%*	*0%*
> 3 years	*1%*	*0%*	***Senile***		*0%*	*0%*
TOTAL	***100%***		***TOTAL***	***18***	***100%***	

Table 5.96: Structure n. 4 vs. the rest of the deposits of Phase I; *Ovis aries* (sheep) kill-off pattern from mandibular wear stages. The methodology used for the assessment of sheep mandibular wear stages is not cited in the report on structure n. 4 (Theodorogianni and Trantalidou 2013); only the frequencies of the different mandible wear stages (%*NISP*) are provided. Data for sheep from our area of study (Phase I) are drawn from Table 5.74. Data for Figure 5.41. *NISP* counts.

Ovis aries *age-at-death*						
Structure n. 4; Theodorogianni and Trantalidou (2013); unknown NISP			***Rest of deposits (Phase I)***			
Stages (unknown)	***% Attribution***	***% Cumulative loss***	***Stages (Payne 1973)***	***Attribution***	***% Attribution***	***% Cumulative loss***
< 6 months	*3%*	*97%*	***A (0-2 months)***		*0%*	*100%*
6 months	*2%*	*95%*	***B (2-6 months)***		*0%*	*100%*
6 months - 1½ years	*8%*	*87%*	***C (6-12 months)***	*5.5*	*14%*	*86%*
1½ years – 2½ years	*18%*	*69%*	***D (1-2 years)***	*4*	*11%*	*75%*
2½ years - 3 years	*34%*	*35%*	***E (2-3 years)***	*3.5*	*9%*	*66%*
> 3 years	*35%*	*0%*	***F (3-4 years)***	*5.5*	*14%*	*52%*
			G (4-6 years)	*7.5*	*21%*	*31%*
			H (6-8 years)	*7*	*18%*	*13%*
			I (8-10 years)	*5*	*13%*	*0%*
TOTAL	***100%***		***TOTAL***	***38***	***100%***	

Table 5.97: Structure n. 4 vs. the rest of the deposits of Phase I; *Capra hircus* (goat) kill-off pattern from mandibular wear stages. The methodology used for the assessment of goat mandibular wear stages is not cited in the report on structure n. 4 (Theodorogianni and Trantalidou 2013); only the frequencies of the different mandible wear stages (%*NISP*) are provided. Data for goats from our area of study (Phase I) are drawn from Table 5.74. Data for Figure 5.42. *NISP* counts.

Capra hircus *age-at-death*						
Structure n. 4; Theodorogianni and Trantalidou (2013); unknown NISP			***Rest of deposits (Phase I)***			
Stages (unknown)	***% Attribution***	***% Cumulative loss***	***Stages (Payne 1973)***	***Attribution***	***% Attribution***	***% Cumulative loss***
< 6 months	*2%*	*98%*	***A (0-2 months)***		*0%*	*100%*
6 months			***B (2-6 months)***		*0%*	*100%*
6 months - 1½ years	*7%*	*91%*	***C (6-12 months)***		*0%*	*100%*
1½ years – 2½ years	*23%*	*68%*	***D (1-2 years)***	*0.5*	*4%*	*96%*
2½ years - 3 years	*54%*	*14%*	***E (2-3 years)***	*3.5*	*27%*	*69%*
> 3 years	*14%*	*0%*	***F (3-4 years)***	*1.5*	*12%*	*57%*
			G (4-6 years)	*3.5*	*27%*	*30%*
			H (6-8 years)	*2*	*15%*	*15%*
			I (8-10 years)	*2*	*15%*	*15%*
TOTAL	***100%***		***TOTAL***	***13***	***100%***	

5.10 – Metrical analysis

The purpose of this part of the analysis is:

- To find if there are differences in the size of the three main domesticated animals (cattle, caprines and pigs) between phases.
- To find if the wild progenitors of cattle (*Bos primigenius*: aurochs), pig (*Sus scrofa*: wild boar) and dog (*Canis lupus*: wolf) are present at Promachon during the Late Neolithic.

Summary statistics [ranges ($x_{(1)}$= minimum; $x_{(n)}$= maximum), means (μ), standard deviation (σ) and coefficient of variation (CV)] for cattle, caprine, pig and dog teeth and postcranial measurements with ten or more cases are given in ***Tables 5.98-5.130***, along with the results of the t-tests, which were also conducted for assessing the significance (p= probability) of the size differences between individual phases. Individual measurements were analyzed in order to study the relative sizes of teeth and bones between phases, before proceeding to more elaborate analysis (such as log ratios), and comparing the results with other contemporary Macedonian and Thessalian sites (see also ***6.4 – Metrical analysis***).

5.10.1 – **Bos taurus** *size and shape*

As a result of the volume of cattle bones recovered from Promachon, a large body of metrical data was collected. Summary statistics for cattle teeth and postcranial measurements with ten or more cases are given in ***Tables 5.98-5.108***. The most numerous cattle tooth measurements were the lengths and the widths of the third mandibular molar (M_3). In general, teeth tend to be more conservative than postcranial bones since they are less affected by environmental factors as well as sex and age (Albarella 2002; Payne and Bull 1988); they are therefore a useful tool for exploring if changes in the size of animals occur with time. In ***Figure 5.43*** we plot the length of the third mandibular molar (M_3L) against the width of the same tooth (M_3W). The diagram shows some variation in cattle M_3, but no obvious differences in size between individual phases seem to occur (the latter is also confirmed by a t-test; ***Table 5.99***).

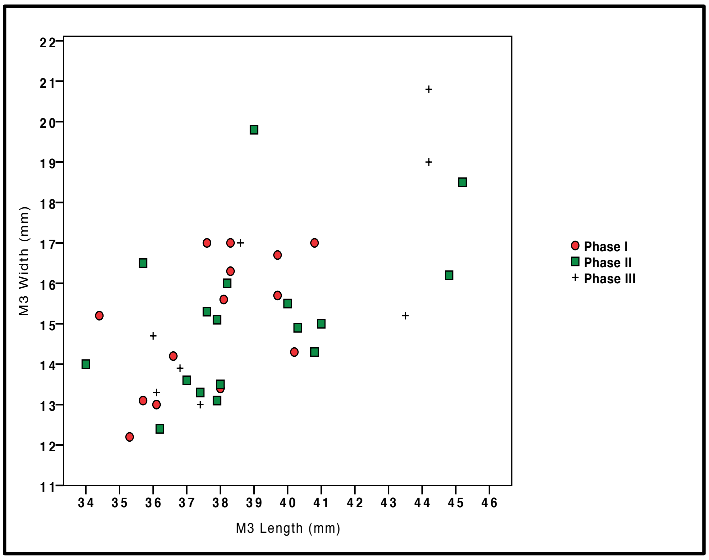

Figure 5.43: *Bos taurus* mandibular third molar (M_3); length (in mm) vs. width (in mm). Comparison between phases.

One of the main characteristics of teeth is that they respond considerably more slowly than postcranial elements to environmental pressures that may cause size change (Johnstone and Albarella 2002). Bearing in mind, that since the chronological gap between the three phases under study is relatively small (Phase I: 5,300-5,070 Cal. BC; Phase II: 5,070-4,700 Cal. BC; Phase III: 4,500-4,300 Cal. BC), the diachronic analysis will focus on those cattle postcranial bones that produced the most measurements (tibia, humerus and astragalus).

In ***Figure 5.44*** we plot the distal breadth (Bd) of cattle tibia against the distal depth (Dd). The scatterplot shows two or possible three apparent clusters. The smallest group is likely to be made of females, while the five largest specimens are likely to be from males. The intermediate group is closer to the ‘males’ but it is likely to be mixed in terms of sex distribution. The potential occurrence of castrates and cattle of different size types may of course contribute to confuse the pattern. To evaluate this better it is necessary to look at other postcranial bones.

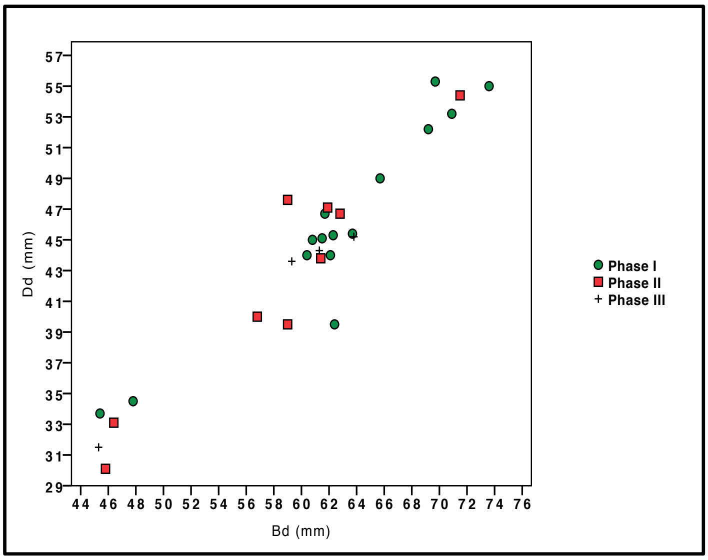

Figure 5.44: *Bos taurus* tibia; distal breadth (Bd in mm) vs. distal depth (Dd in mm). Comparison between phases.

Figure 5.45 presents the scatterplot of the measurements of the distal humerus; here we compare the width of the trochlea (BT) against the diameter of the trochlea (HTC). This diagram is not very useful for detecting differences in cattle size between individual phases due to the very small sample size of Phases II and III.

The scatterplot indicates that the two measurements are poorly correlated, which is not surprising as they are aligned on different axes (Davis 1996)[19]. As for tibia, there appears to be some clustering of measurements, though the sample is smaller and invites caution. This is most likely due to sex differences, bearing also in mind that in artiodactyls, fore limb bones appear to be particularly sex dimorphic (Payne and Bull 1988).

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[19] As Davis (1996) argues, there is better correlation between measurements taken on the same axis than between those on different axes.

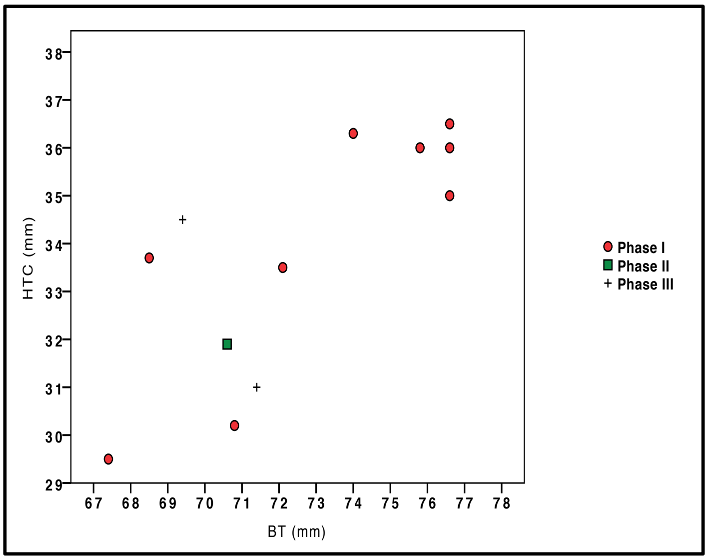

Figure 5.45: ***Bos taurus*** **humerus; width of the trochlea (BT in mm) vs. diameter of the barreled shaped articulation (HTC in mm).**

The astragalus rapidly reaches adult size and thereafter exhibits limited size change once is fully ossified, also because it is constrained in an articulation and has limited room for growth (Rowley-Conwy *et al.* 2012; Payne and Bull 1988; Albarella and Payne 2005). Nonetheless, some age-related variability obviously also affects this bone (and this must be considered for all size comparisons where astragalus measurements are involved), but it should represent a minor factor, once porous or unusually light (*i.e.* not fully ossified) astragali have been excluded from biometrical analysis.

The size of the astragalus is directly related to its weight-bearing role and it is therefore closely related to the overall size of the animal. Another great advantage for its use in biometric studies as a measure of the robustness of the individuals is the fact that - in most cases - it survives well, thus, permitting valuable metric data to be collected. In ***Figure 5.46*** we plot the greatest length of the lateral half of the astragalus (GLl) against the greatest length of the medial half of the astragalus (GLm). Unlike the previous elements there is high correlation between the two measurements, which make sense as they are both lengths. Consistently with the other measurements there are no differences in the size of cattle astragalus between individual phases, as also supported by the results of a t-test (***Table***

5.106). The clustering that had been identified in other bones is not apparent in the astragalus, which may be a consequence of the fact that this bone is less sexually dimorphic. If the separation in groups discussed above had been a consequence of the simultaneous occurrence at Promachon of different cattle morphotypes we would have expected this to show up in astragalus measurements too.

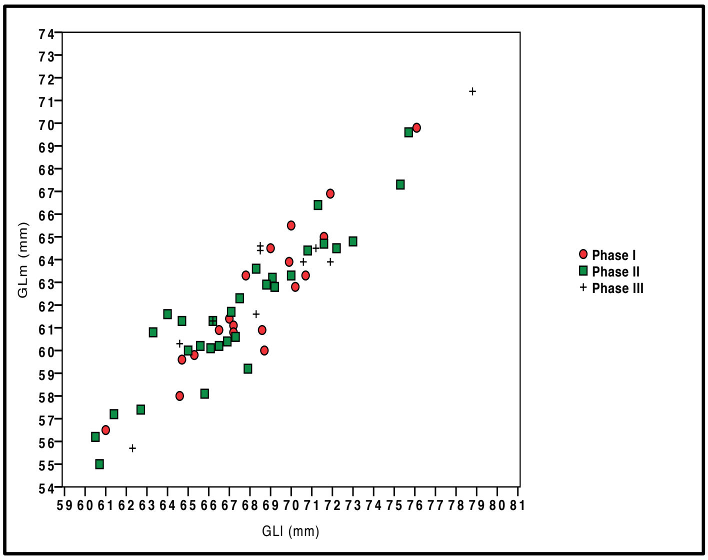

Figure 5.46: *Bos taurus* astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (GLm in mm). Comparison between phases.

A common method for detecting sexual dimorphism in cattle is the use of metapodial (metacarpal and metatarsal) measurements. This was not possible at Promachon since very few intact cattle metapodials were eventually recovered, and hence, very few length measurements could be taken.

Since shape analysis could not be conducted on metapodials, as insufficient measurements were available, shape indices were calculated on cattle astragali (*cf.* Albarella 2002). Diagrams based on metric ratios [*i.e.* Bd/GLl and Dl/GLl *sensu* von den Driesch (1976) for the astragalus] are relatively size-independent and are a useful tool to detect potential variations in sex, breeds or regional types (*c.f.* Albarella 1997; 2002), although some authorities have expressed doubts about using such ratio values in the evaluation of statistical differences (Atchley *et al.* 1976).

Figure 5.47 presents the shape indices for cattle astragali. As for size, there is no detectable change between individual phases. They also show that there is no linear relationship between the two indices, thus indicating quite a lot of variation in the shape of the cattle astragalus. There are however, no clear groupings, which would indicate that most cattle at Promachon - even in different phases - were of similar builds. This is rather interesting, as we would have expected that males, females and perhaps also castrates would be slightly different; however, it is possible that the differences are too slight to stand out visually.

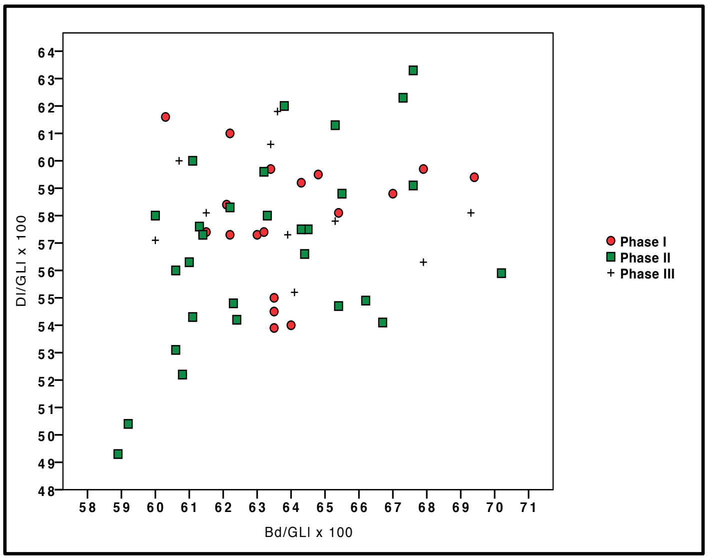

Figure 5.47: Scatterplot of shape indices for *Bos taurus* (cattle) astragalus on a phase-by-phase level in Promachon. Comparison between phases.

The presence of the wild progenitor of cattle (*Bos primigenius*; aurochs) has been reported at a number of Macedonian sites, contemporary to Promachon, such as Sitagroi (Bökönyi 1986), Stavroupoli (Yiannouli 2002a; 2004), Pigi athinas (Cantuel 2013) and Makriyalos (Halstead pers. comm.). The species' presence has also been reported in the Early Neolithic deposits of Achilleion (Bökönyi 1989) and in the Late Neolithic deposits of Argissa (Boessneck 1962); both sites are located in Thessaly.

The table below presents the metrical data of aurochs' astragali (GLl) from a number of sites in Macedonia and Thessaly[20]; the identification of the aurochs in these sites was based on the observation of the largest specimens (in this case, the astragali), which showed up as the largest outliers in each sample. The major drawback, however, is the extremely small sample size for each case. However, we can still see that the aurochs astragali from these sites are larger than the largest cattle astragalus from Promachon (GLl : 79.1 mm). If we combine this observation with the lack of obvious outliers in the Promachon distribution, we can argue against the presence of the aurochs in the case of Promachon.

Sites	**Bos primigenius** ***astragalus: greatest length of the lateral half (GLl in mm)***				
	Locale	***Cultural sequence***	***N.***	***Values (in mm)***	***Sources***
Achilleion IIb [1]	*Thessaly*	*Early Neolithic*	*1*	*82.0 mm*	*Bökönyi (1989)*
Pigi Athinas	*Macedonia*	*Late Neolithic*	*1*	*84.8 mm*	*Cantuel (2013)*
Sitagroi IV [2]	*Macedonia*	*Early Bronze Age*	*1*	*86.0 mm*	*Bökönyi (1986)*
Stavroupoli I-II	*Macedonia*	*Late Neolithic*	*2*	*82.3 mm & 87.8 mm*	*Yiannouli (2002a)*

[1, 2] Not entirely contemporary to Promachon, yet indicative of the length of aurochs astragalus.

As already noted, the presence of the aurochs has been reported in structure n. 4 at Promachon (Theodorogianni and Trantalidou 2013), where 174 remains of this species - consisting mainly of lower forelimbs and lower hindlimbs (mainly metapodials and phalanges)[21] - were identified. However, the authors in their original report of the faunal assemblage from structure n. 4 do not provide any metrical data.

In order to explore the possibility of the presence of the aurochs in the assemblage, we use the scale index technique (log ratio), which provides us with the advantage of observing how the distributions of different measurements compare with each other (see also ***4.3 – Recording protocol***). The length, the width and the depth measurements were kept separate, as there is better correlation between measurements taken on the same axis than between those on different axes (Albarella 2002; Davis

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[20] However, it is possible that aurochs might also be present in other sites - unknown to the author - contemporary to Promachon, but this is difficult to know, due to the dearth of available metrical data.

[21] In addition, two astragali from structure n. 4 have been positively identified to aurochs (Theodorogianni and Trantalidou 2013).

1996). Since there is no published Greek standard of aurochs to calculate the log ratios, we use the standard from a known sample of aurochs from the Mesolithic Cabeço da Arruda (Portugal; Wright 2013)[22]. When the data are plotted, the Cabeço da Arruda material will always be centered on zero (.00), giving an easy reference point to indicate whether the cattle material from Promachon is larger or smaller than Cabeço da Arruda.

Figure 5.48 shows the log ratio diagrams for the three dimensions (the lengths, the widths and the depths respectively); these show that the bulk of the material from Promachon plots on the left side of the standard, indicating that the overwhelming majority of *Bos* astragali are smaller than the average aurochs from Cabeço da Arruda. All distributions confirm the metrical analysis provided above, with no clear large outliers. There are only a length and a depth that pull away slightly on the right hand size of the distribution and also represent the only specimens that are larger than the standard. They are, however, still fairly close to the rest of the distribution and, although they could belong to the aurochs, the evidence is insufficient to be confident about it. Since the aurochs from Cabeço da Arruda is smaller than those from northwest Europe (*e.g.* Denmark, Britain and Germany), then the cattle material from Promachon - being even smaller than Cabeço da Arruda - is unlikely to belong to the aurochs.

Of interest is the fact that on average widths and depths appear to be relatively smaller than the standard in comparison to lengths. They also have a tail of small specimens that is absent in the lengths. This is a consequence of the greater robustness of the aurochs in comparison to domestic cattle as demonstrated by Wright (2013).

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[22] Unfortunatelly, metrical data of *Bos primigenius* from the Mediterranean (*e.g.* Italy) was extremely scarce. Regardless of the fact that the standard sample derives from a site distant from Promachon, we can still use the Cabeço da Arruda material since the geographical location of the site (Portugal) is similar to Greece in terms of latitude.

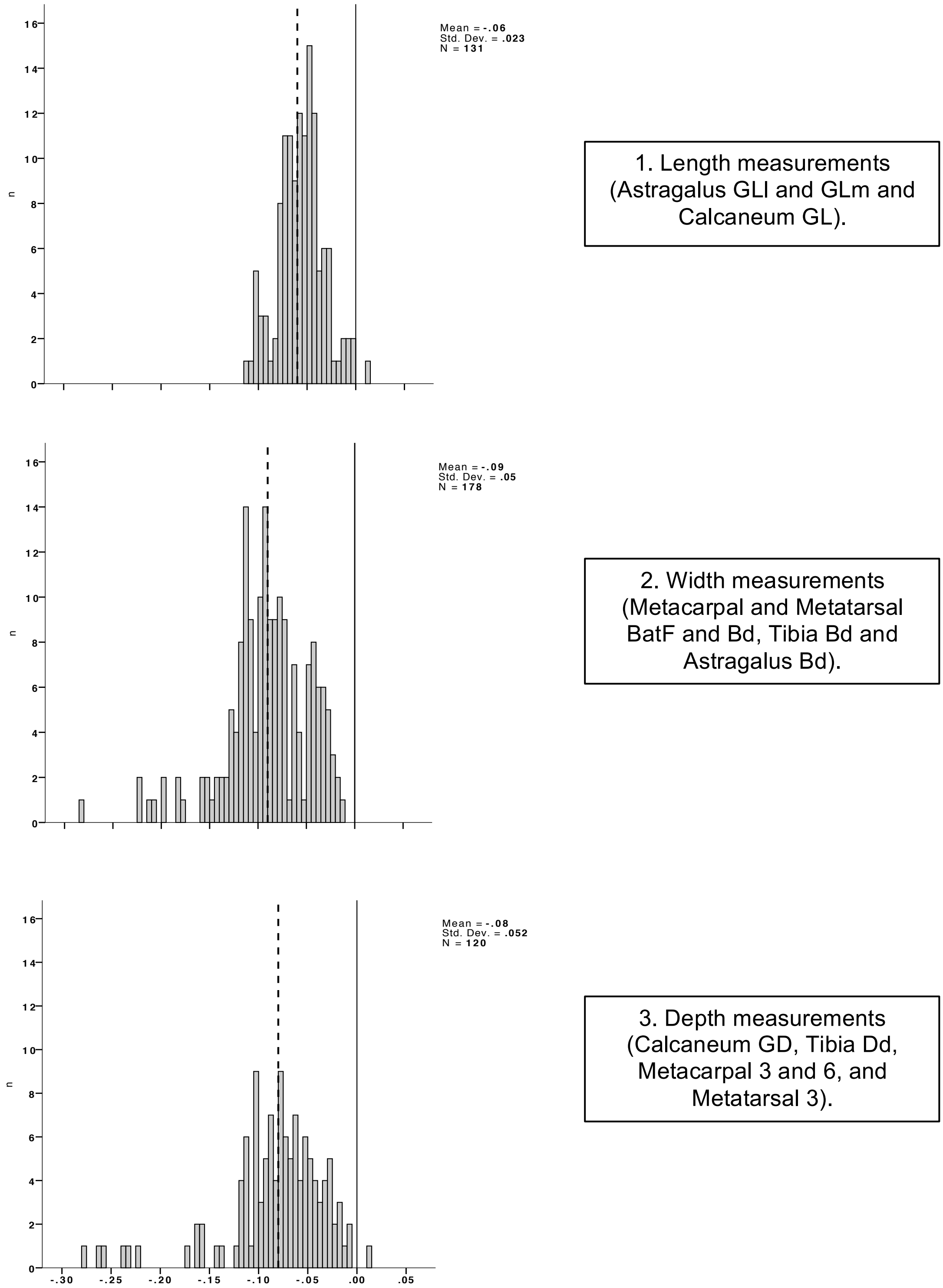


Figure 5.48: comparison of the *Bos* size from Promachon with a standard *Bos primigenius* sample from the Mesolithic site of Cabeço da Arruda in Portugal (Wright 2013) using the log ratio technique (Simpson *et al.* 1960). Only fully fused postcranial bones were considered. Only compatible measurements, were considered. The mean is marked by a black dashed vertical line, and the standard measurement by a black vertical line at .00. The scale of the vertical axis is fixed to emphasize differences in sample sizes.

All in all, we can say that the results of the biometry do not show any size differences in cattle between individual phases; perhaps the time difference between phases of occupation is too small for any changes to be obvious. In addition, the biometrical evidence does not provide any support to the suggestion for the occurrence of the aurochs.

5.10.2 – **Caprinae** *size and shape*

Caprine measurements are more numerous than those of cattle - as expected - due to their overall higher frequency in the assemblage (see also ***5.3 – Species representation***). ***Tables 5.109-5.115***, ***5.116-5.118*** and ***5.119-5.121*** give a summary of the bone and tooth measurements with more than ten cases, for sheep, goat and sheep/goat respectively. Tooth measurements are the most numerous, which is unsurprising given the high proportion of teeth in the assemblage (see also ***5.5.2*** **– Caprinae** ***body part distribution***). In ***Figure 5.49*** we plot the length of the third mandibular molar (M_3L) against the width of the same tooth (M_3W) for sheep, goat and sheep/goat on a phase-by-phase level. The sample size of goat teeth (especially in Phases II and III) is too small for any conclusions to be drawn; however, a comparison of the sheep and the sheep/goat M_3's shows that no obvious differences in the size of the caprines between individual phases occur; this result is also confirmed by a t-test (***Table 5.109*** *and* ***Table 5.119***).

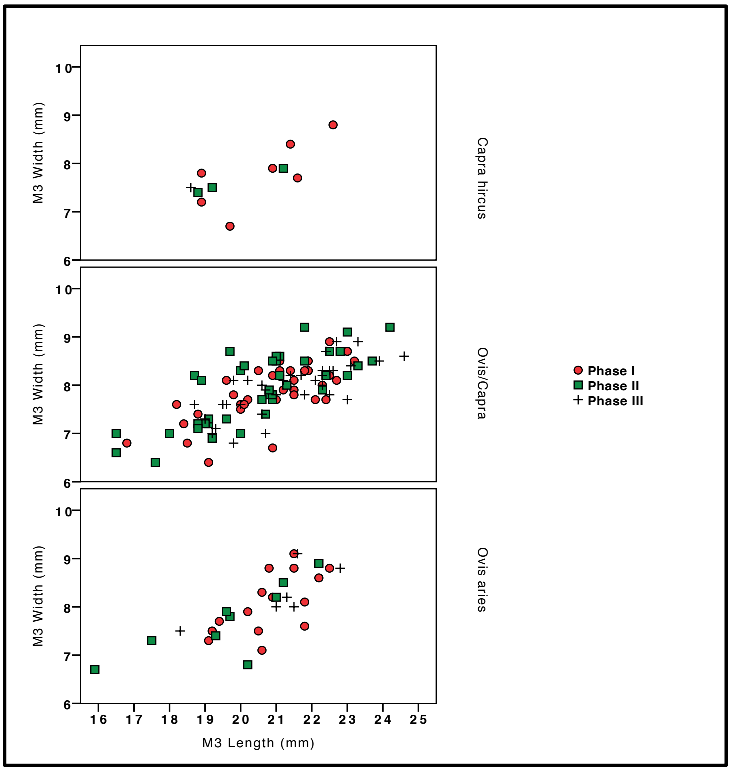


Figure 5.49: Caprinae mandibular third molar (M_3); length (in mm) vs. width (in mm). Comparison between phases.

Humerus, tibia, astragalus, metapodials and calcaneum were the postcranial elements that were regularly used for the distinction of sheep and goats (see also ***4.2 – Identification***). However, the most numerous postcranial measurements derive from the humerus, the tibia and the astragalus. In ***Figure 5.50*** we plot the width (BT) against the smallest diameter (HTC) of the trochlea of the distal humerus, for sheep, goat and sheep/goat on a phase-by-phase level. There is tantalizing evidence of a size decrease in goats (perhaps sex-related?) between Phases I and II but sample sizes are rather small for any definite conclusions to be drawn. No such difference was observed in the sheep humerus, but a single specimen from Phase III plots in the upper right corner of the diagram, probably indicating a particularly large male individual.

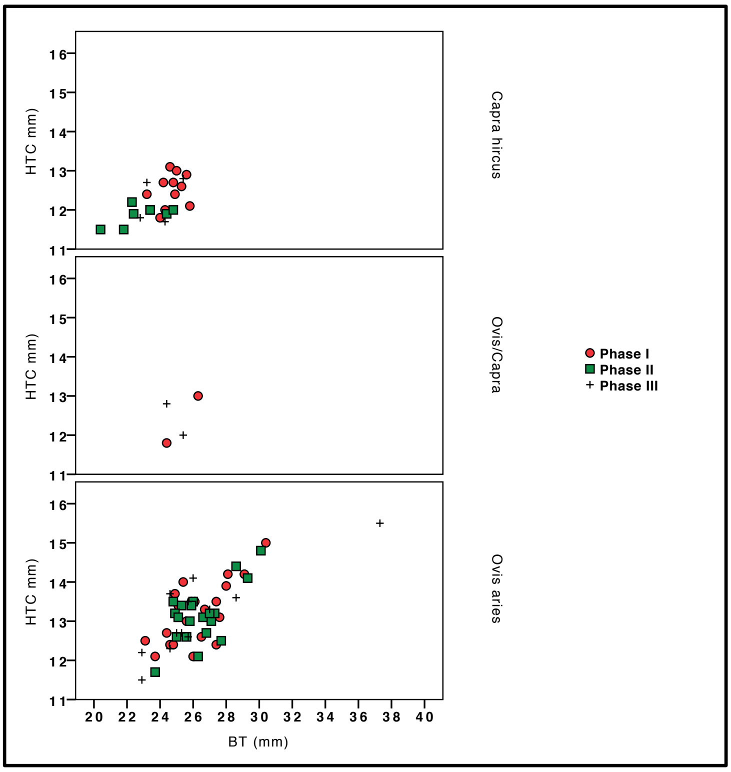


Figure 5.50: Caprinae humerus; width of the trochlea (BT in mm) vs. diameter of the barreled shaped articulation (HTC in mm). Comparison between phases.

In ***Figure 5.51*** we plot the distal breadth (Bd) against the distal depth (Dd) of the tibia. No differences in the size of goats between phases can be inferred from the diagram, but the sample is very small. The sheep sample is much more substantial but also did not produce any clear differences between phases.

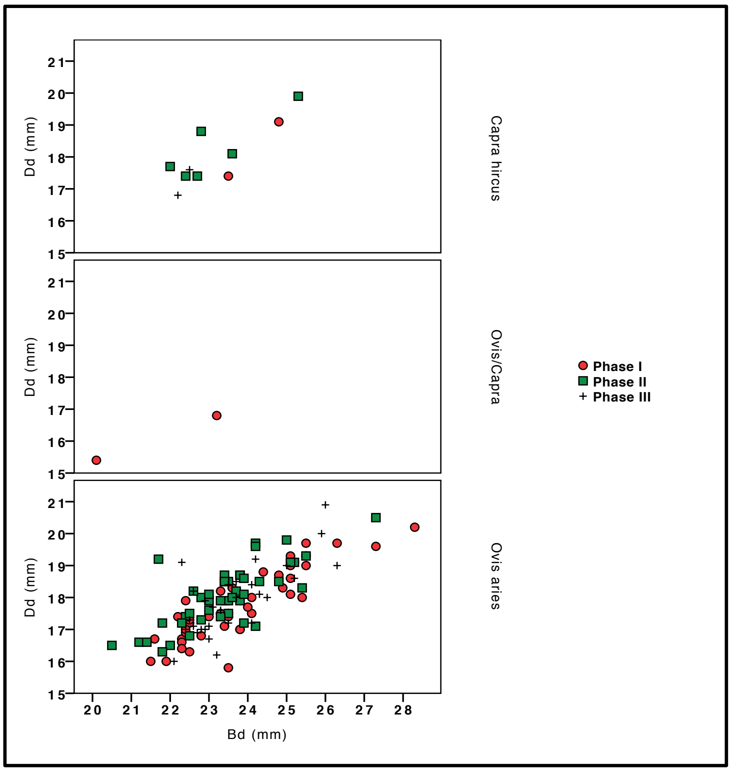


Figure 5.51: Caprinae tibia; distal breadth (Bd in mm) vs. distal depth (Dd in mm). Comparison between phases.

In ***Figure 5.52*** we plot the greatest length of the lateral half (GLl) against the greatest length of the medial half (GLm) of the astragalus, for sheep, goat and sheep/goat. Once again, the sample size of goat astragali is too small to allow any reliable conclusion. In sheep, it is possible to identify a large concentration of smaller specimens and a smaller group of larger-sized animals (four or six according to where one decides to draw the line). It is possible that the group of smaller astragali represents females (ewes), while the smaller group of larger astragali is made of males (rams and/or wethers). The larger proportion of smaller animals is consistent with the argument that, in most sites, females predominate, as only a few males need to be kept for reproduction (Albarella 1997).

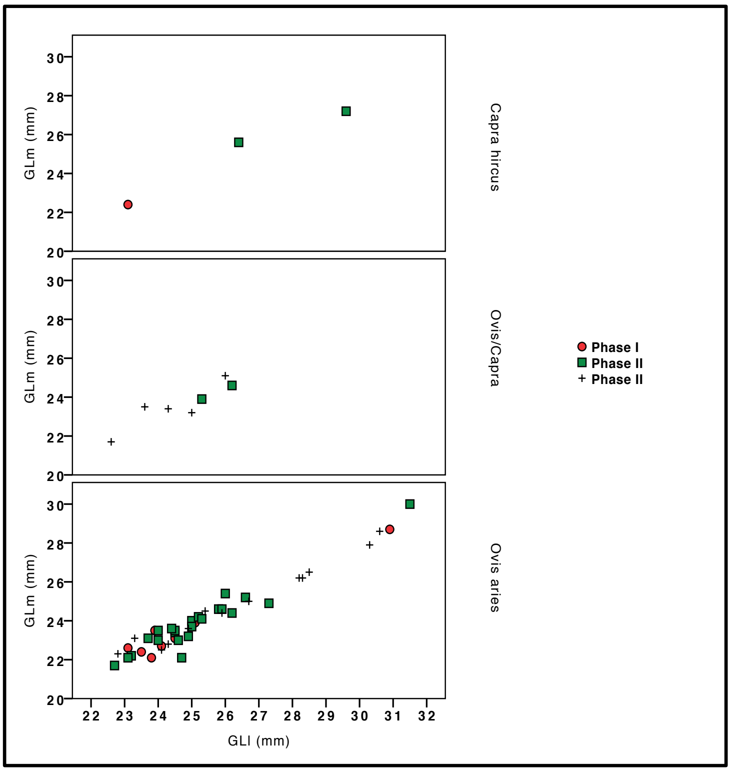


Figure 5.52: Caprinae astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (Dd in mm). Comparison between phases.

Whatever is the sex distribution of the sheep population and the main purpose of sheep breeding at Promachon, there is no evidence of any change in the size of the sheep during the period of occupation, and in goat only a very tentative suggestion can be made for a size decrease, which may, in fact, be due to a chance higher proportion of females in the later phase.

As for cattle, it was possible to calculate shape indices only for the astragalus, due to the small sample of available metapodial measurements. The analysis was limited to sheep as there were not enough goat astragali. As can be seen in ***Figure 5.53***, the two indices are poorly correlated (note the cloud-like, rather than linear, distribution), which means that any greater robustness according to the width does not necessarily correspond to an equivalent enhanced robustness according to the depth. We can see that there are no changes in the shape of sheep astragali between Phases I and II, which indicates that sheep during these two phases were of similar builds.

However, the ratio between the distal width and the greatest length of the lateral half of the astragalus (Bd/GLl) tends to be higher for sheep belonging to Phase III than those belonging to Phases I and II. In other words, it seems that sheep astragali from Phase III are tentatively more robust than those from previous phases; this suggests the presence of slightly more robust sheep in Phase III.

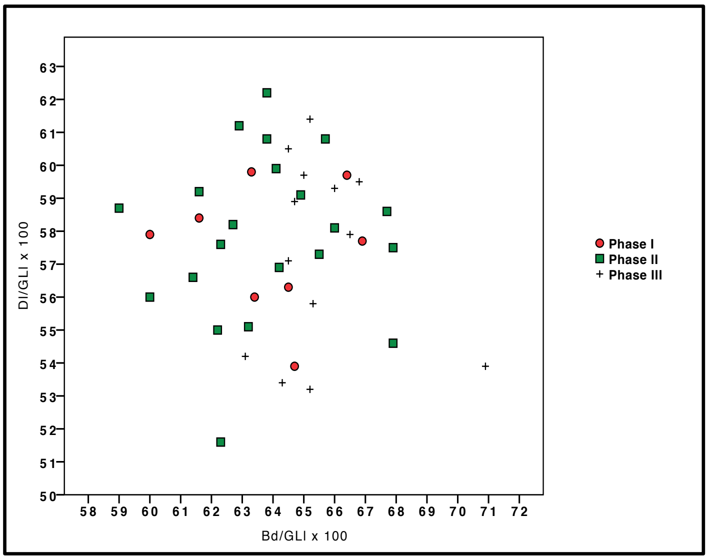


Figure 5.53: Scatterplot of shape indices for *Ovis aries* (sheep) astragalus. Comparison between phases.

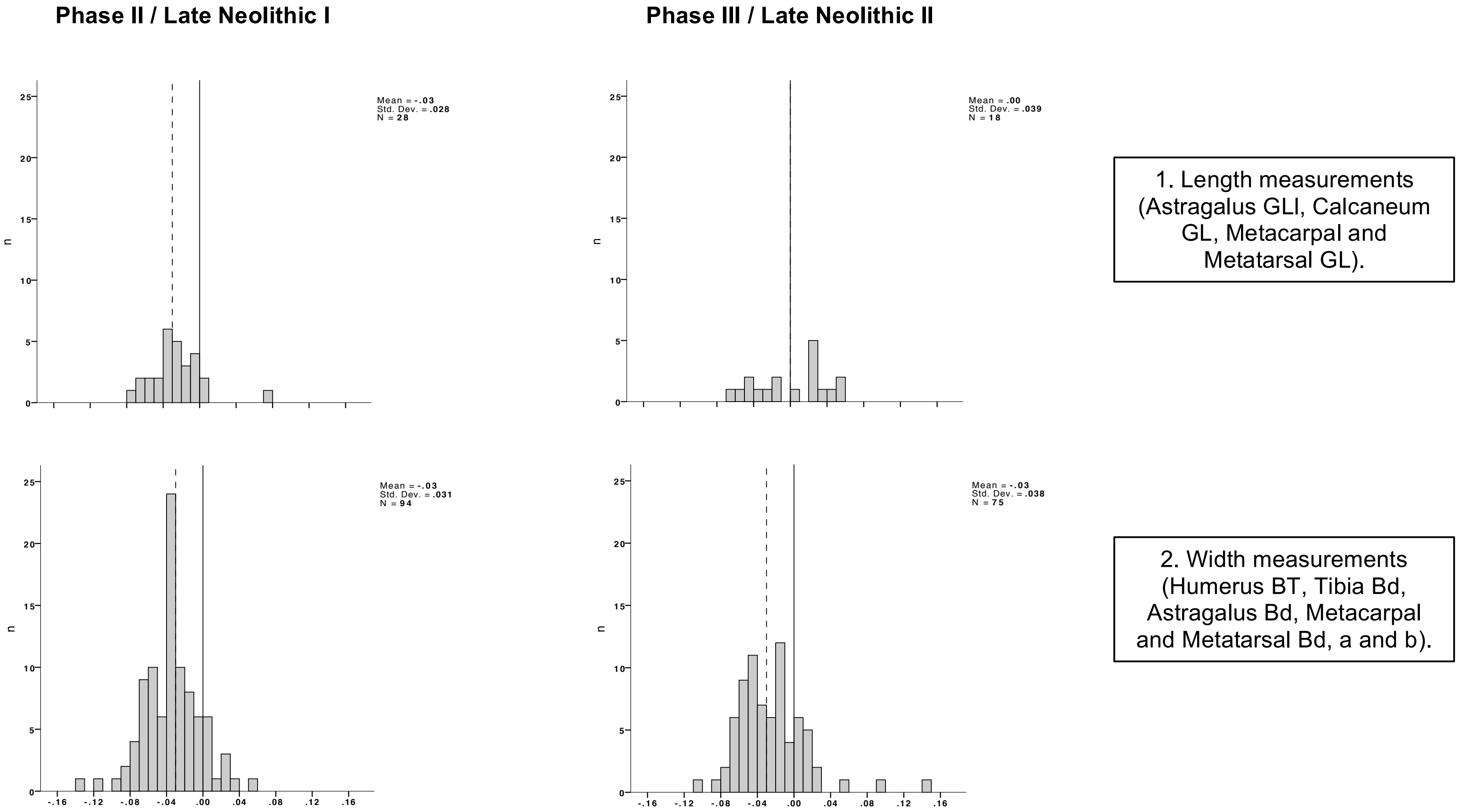
In order to statistically test the significance of the differences in the shape indices of sheep astragalus between phases, an *ANOVA* test was conducted, although as previously noted (***5.10.1* – Bos taurus *size and shape***), there are expressed doubts regarding the use of such ratios in the evaluation of statistical differences (Atchley *et al.* 1976). This took into account only the astragali of Phases II and III, since those of Phase I were too few to be tested. The test indicates that there is no significant difference in the ratio between the lateral depth and the greatest length of the lateral half of the astragalus (Dl/GLl) between the two phases (p= .553: more than 5% that the difference is due to chance). However, a significant difference in the ratio between the distal width and the greatest length of the lateral half of the astragalus (Bd/GLl) between Phases II and III was found (p= .035: less than 5% that the difference is due to chance), with sheep from Phase III having a significantly higher Bd/GLl ratio (μ= 65.5 mm) than their counterparts from Phase II (μ= 63.7 mm). This confirms the previous suggestion of a slightly more robust sheep in Phase III than Phase II.

To extend the comparison between Phases II and III, it is useful to have larger samples of measurements, which can be obtained through the use of log ratios. Since a potential difference in the ratio between length and width has been highlighted by the analysis of the astragalus, measurements placed along these two axes were selected for the scaling index analysis. The standard used for the log ratio calculations is represented by the mean of a group of Shetland (UK) ewes (Davis 1996). By taking the Shetland ewes as a reference point, we can plot the length and the width measurements of sheep for Phases II and III respectively, in order to find if there are any differences in the distribution of measurements between the two phases. In other words, when the data are plotted, the Shetland material will always be centered on zero (.00), thus giving an easy reference point for comparison. The main aim is, however, to compare phases with each other, rather than with the standard.

The results (***Figure 5.54***) show that during Phase II, there is a roughly unimodal distribution of length and width measurements from Promachon, with only one length measurement plotting as an outlier, indicating a particularly large individual, probably a male (ram). We can also notice that the means of both length and width measurements from Promachon plot on the left side of the standard, indicating that they are smaller than the standard. Length and width measurements are very similar in comparison to the standard, both plotting around a mean of -.04.

In Phase III, the mean of the length measurements is exactly the same as the standard, indicating that the length measurements of this phase are larger than the length measurements from Phase II. On the other hand, the mean of the width measurements plots on the left side of the standard, indicating that it is smaller than the standard and consistent with the values obtained for Phase II. There are, however, a few large outliers (right hand side of the histogram), which may, again, represent rams. The results of the log ratio diagrams are therefore indicating that the length measurements of Phase III are larger than those of Phase II, while the width measurements of Phase III remain roughly the same to those of Phase II. In other words, during Phase III the length measurements increase disproportionally to the width measurements; thus, the results of the log ratio diagrams do not confirm previous suggestions regarding the more robust size of sheep during Phase III.

All in all, we can say that although the shape indices for sheep astragalus exhibit a more robust size of sheep in Phase III than earlier phases, the log ratio diagrams do not seem to support such hypothesis (at least in comparison to Phase II, since the small sample size of sheep measurements for Phase I did not permit the calculation of log ratios). There are hints that different body parts were subject to various changes between Phases II and III, but these did not all go in the same direction, which means that the sheep from phase III are slightly different from those from Phase II, but such difference cannot be exemplified by concepts such as size and robustness. It is difficult to evaluate whether such difference is due to a change in the sex ratio or in the actual build of the sheep (due to a change in husbandry regime or the introduction of new animals) and future work will need to generate larger metric samples, so that such subtle differences can be explored in greater detail and become more informative about patterns of human life on site (or the wider region).



1. Length measurements (Astragalus GLl, Calcaneum GL, Metacarpal and Metatarsal GL).

2. Width measurements (Humerus BT, Tibia Bd, Astragalus Bd, Metacarpal and Metatarsal Bd, a and b).

Figure 5.54: comparison of the *Ovis aries* (sheep) size from Phases II and III in Promachon with a standard sample of Shetland ewes (female sheep; Davis 1996) using the log ratio technique (Simpson *et al.* 1960). Only fully fused postcranial bones were considered. Only compatible measurements were considered. The mean is marked by a black dashed vertical line, and the standard measurement by a black vertical line at .00. The scale of the vertical axis is fixed to emphasize differences in sample sizes.

5.10.3 – **Sus** *size*

Measurements of pig teeth and postcranial bones were fewer than those of the other food domesticates, which reflects the overall lower frequency of pig bones compared to cattle and caprines (see also ***5.3 – Species representation***). Measurements of pig teeth were more numerous than those of postcranial bones. ***Tables 5.122-5.129*** give a summary of tooth and postcranial measurements for which more than ten cases were recorded.

The Pearson's coefficient of variation (CV) is very high for some teeth and postcranial measurements, probably as a consequence of the occurrence of some large outliers, here interpreted as likely to belong to wild boar (*Sus scrofa*). For this reason, the larger values of each measurement were excluded and the coefficients of variation were recalculated, as suggested by Albarella (2002).

Among teeth, the most numerous measurements were those of the third maxillary molar (M^3). In ***Figure 5.55*** we plot the length against the width of the anterior cusp of the M^3. The scatterplot indicates that most of the M^3's are clustered together in the lower left part of the diagram, and they probably represent a domestic population. There is, however, one outlier plotting in the upper right corner of the diagram; this is a very large individual, probably a wild boar. No obvious differences in the size of domestic pigs between phases can be detected from this diagram. Measurements of the third mandibular molar (M_3) are unfortunately too few to verify the results of the upper M^3.

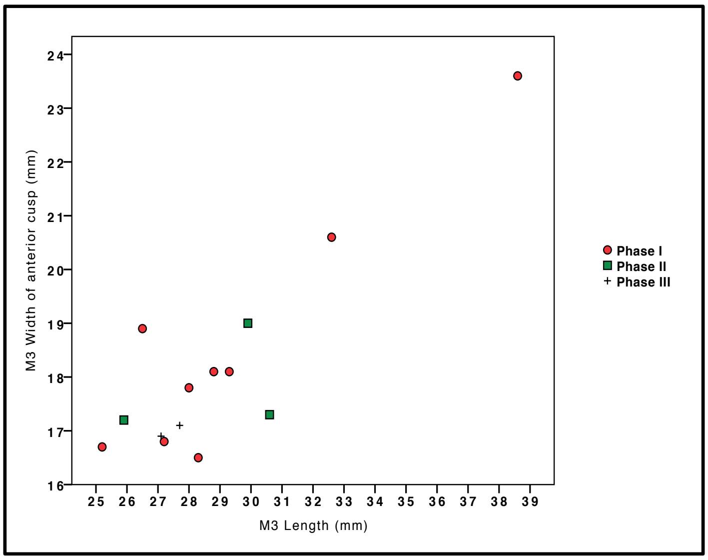


Figure 5.55: *Sus* maxillary third molar (M_3); length (in mm) vs. width of the anterior cusp (in mm). Comparison between phases.

Among pig postcranial elements, the most abundant measurements were provided by the humerus, tibia and astragalus. In ***Figure 5.56*** we plot the width (BT) against the smallest diameter (HTC) of the trochlea of the distal humerus. The diagram shows that most measurements plot at the smaller end of the distribution, but there are three large outliers, one of which plots away at the very top of the distribution.

Pig forelimb bones tend to be fairly age dependent as they are subject to greater post-fusion growth than hind limb bones (Albarella and Payne 2005; Albarella *et al.* 2006; Rowley-Conwy *et al.* 2012), but they are also much affected by sex variation (Payne and Bull 1988). Considering that BT and HTC are measurements that are much less affected by post-fusion growth than the commonly taken Bd (Payne and Bull 1988; Albarella and Payne 2005) the distribution is perhaps best explained as being characterized by a majority of domestic females, which would be consistent with the previous suggestion based on canine sexing that female pigs greatly outnumber males (see also ***5.8 – Sexing***). The two smaller outliers are likely to represent domestic males - but could also be wild females - while the largest specimen is almost certainly a (male?) wild boar. The sample is too small to detect any potential difference between phases.

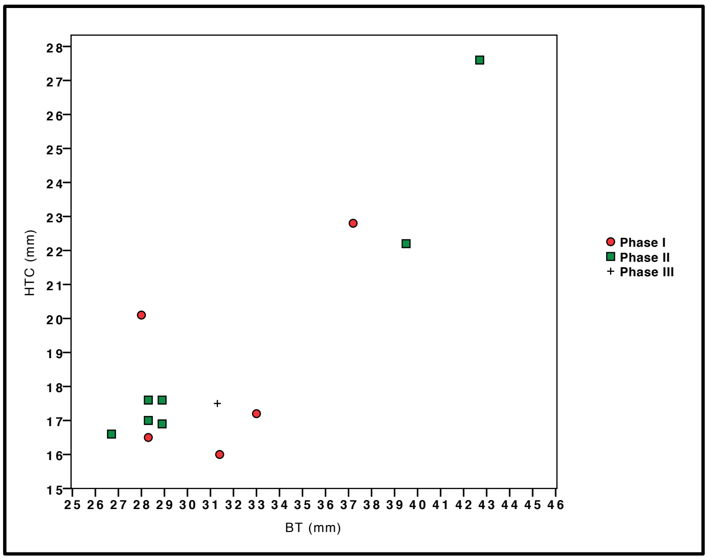


Figure 5.56: *Sus* humerus; width of the trochlea (BT in mm) vs. diameter of the barreled shaped articulation (HTC in mm). Comparison between phases.

Distal tibia measurements can provide a good indication of differences between genetically distinct populations (as in the case of domestic and wild populations), as this bone is not particularly affected by sex variation or post-fusion growth (Albarella and Payne 2005; Albarella *et al.* 2009; Payne and Bull 1988; Rowley-Conwy *et al.* 2012). In ***Figure 5.57*** we plot the distal breadth against the distal depth of the pig tibia on a phase-by-phase level. The scatterplot shows two groups of tibiae. As in the case of humerus, there is no overlap between the two groups. It is likely the more numerous group of smaller measurements represents domestic pigs, while the two large outliers - both from Phase II - are wild boar.

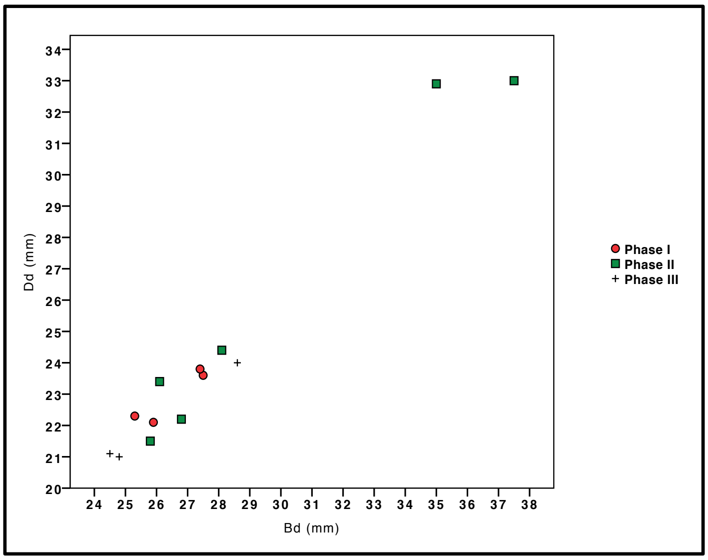


Figure 5.57: *Sus* tibia; distal breadth (Bd in mm) vs. distal depth (Dd in mm). Comparison between phases.

Figure 5.58 presents the comparison of the pig astragalus between individual phases, by plotting the greatest length of the lateral half (GLl) against the greater length of the medial half (GLm) of the astragalus. As in the case of tibia, we can see two groups of pig astragali that do not present any overlap. The first group plots on the lower left part of the diagram and probably indicates the presence of domesticated individuals. The second group, which plots on the upper right part of the diagram is probably represented by wild individuals. Unlike the humerus and the tibia scatterplots, wild individuals from all three phases of occupation are present in the astragalus scatterplot, and they are only slightly less abundant than the domestic specimens.

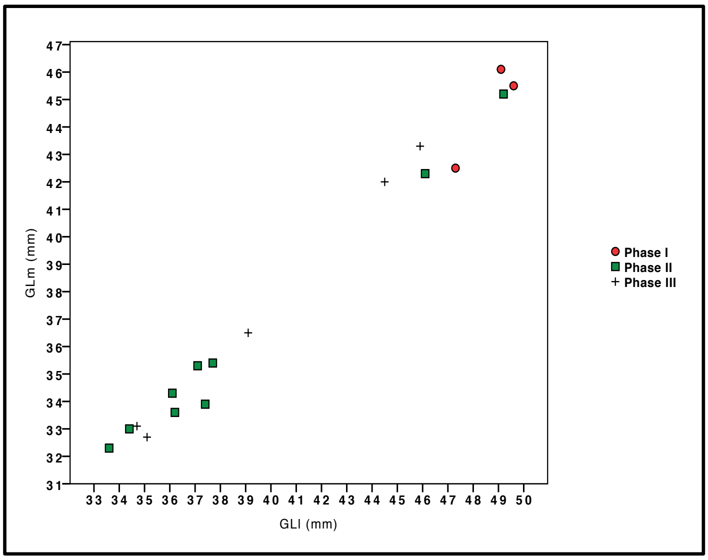


Figure 5.58: *Sus* astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (GLm in mm). Comparison between phases.

All in all, the comparison of the pig teeth and postcranial measurements suggests the presence of a substantial number of wild individuals at Promachon. No changes in the size of domesticated pigs were detected between individual phases, but this may due to the limitations of small sample size.

As for caprines and cattle the log ratio technique has been used to undertake an analysis based on a larger sample size. The standard that we use for the calculation of the log ratio is represented by the mean of a group of wild boar from Kizilcahaman (Turkey) (Payne and Bull 1988). Both postcranial bones and teeth are used, as they can provide different types of information. In particular, cheek teeth do not grow after eruption and are only slightly - if at all - sex dependent (Albarella and Payne 2005; Payne and Bull 1988; Rowley-Conwy *et al.* 2012). They can therefore be useful indicators of the occurrence of distinct populations (*e.g.* domestic vs. wild). Since the collum of the scapula is heavily subject to post-fusion growth (Rowley-Conwy *et al.* 2012), the scapula SLC is excluded from the calculation of the log ratios for postcranial measurements.

Figure 5.59 shows the log ratio diagrams for the tooth lengths, tooth widths and postcranial measurements respectively. By taking the Kizilcahaman wild pigs as a reference point, we can see how the tooth (length and width) as well as postcranial measurements of pigs from Promachon are compared to those of pigs from Kizilcahaman. In other words, when the data are plotted, the Kizilcahaman wild pig material will always be centered on zero (.00), thus giving an easy reference point to indicate whether the tooth and postcranial measurements of pigs from Promachon are larger or smaller than those of Kizilcahaman.

We can see that the log ratio diagrams for tooth lengths, tooth widths and postcranial measurements from Promachon have a broadly unimodal distribution (with a tail on the right hand side). The mean of each log ratio diagram from Promachon plots on the left side of the standard, thus indicating that teeth and postcranial measurements from Promachon are smaller than those from Kizilcahaman. This, in turn, indicates, that the bulk of the pig population at Promachon belongs to the domesticated form, a pattern that corroborates the results of the scatterplots. There are however, a number of outliers, which are plotted on the right side of the standard, thus confirming the presence of wild pigs in Promachon. Of interest, however, is the fact that postcranial bones plot bimodally far more than teeth, which may indicate that the wild boar is better represented by bones of the body than the head. So perhaps the pattern that we noticed earlier in this thesis (see also ***5.5.3* – Sus *body part distribution***) with regard to the higher representation of pig postcranial elements rather than teeth, applies in the case of wild boar rather than domestic pig. This would not be a surprising result as it has been reported elsewhere that wild boar heads may have in some cases been left at the kill-site rather than imported to the settlement (Albarella 1999).

Alternative explanation is that the approximate bimodality of the pig postcranial bones is due to the confusing effect of sex variation, with domestic, as well as wild, females and males all contributing to the distribution.

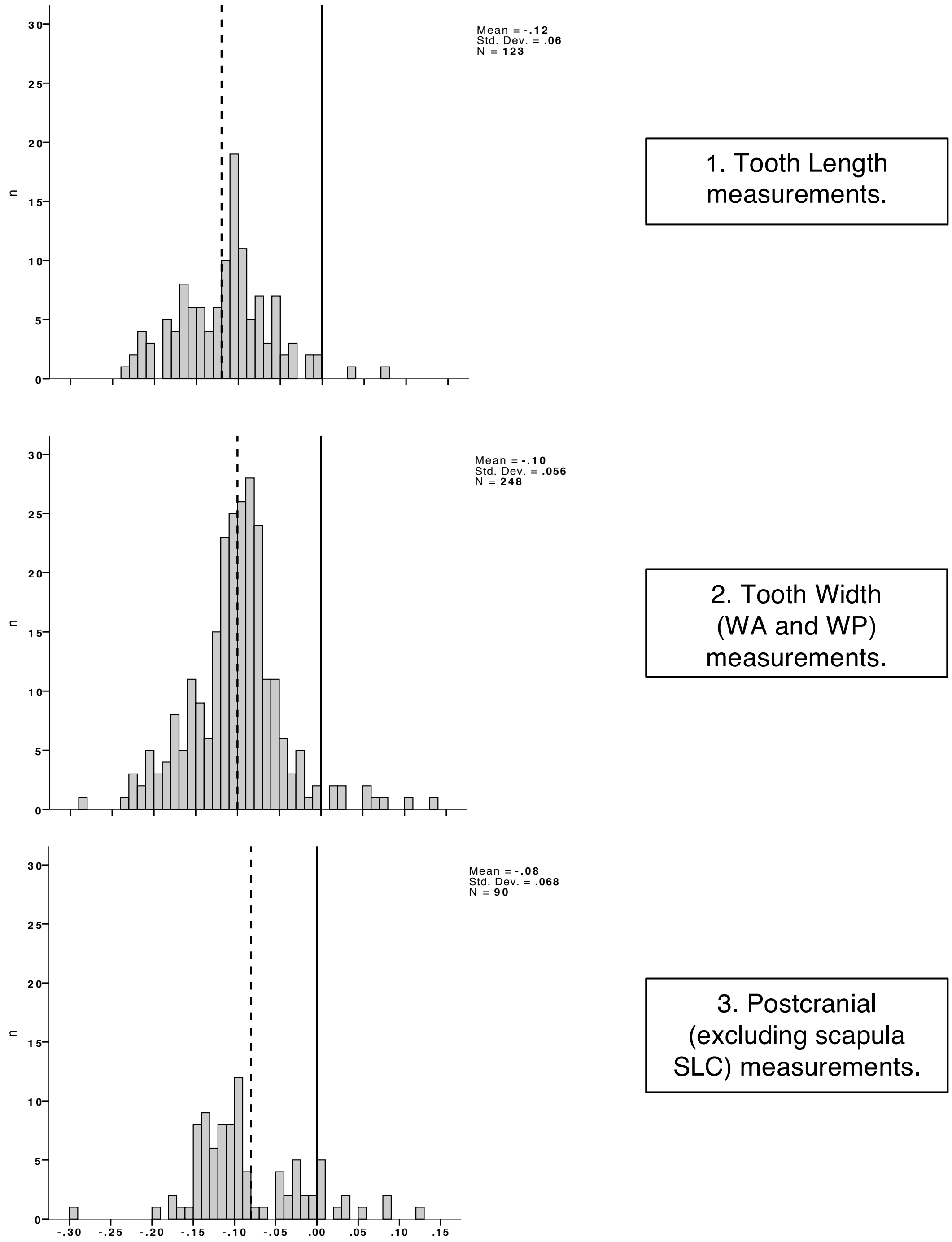


Figure 5.59: comparison of the *Sus* size from Promachon with a standard *Sus scrofa* sample from Kizilcahaman (Turkey; Payne and Bull 1988) using the log ratio technique (Simpson *et al.* 1960). Maxillary and mandibular teeth were combined. Only fully fused postcranial bones were considered. Only compatible measurements were considered. The mean is marked by a black dashed vertical line and the standard measurement by a black vertical line at .00. The scale of the vertical axis is fixed to emphasize differences in sample sizes.

5.10.4 – Canis familiaris *size*

No dog postcranial bones produced more than ten measurements within any phase or indeed within the entire Late Neolithic in Promachon. On the other hand, the only cranial elements that produced more than ten measurements within the entire Late Neolithic, were the first mandibular molar (length and width of M_1) and the mandible (height of the ramus mandibulae). A summary of these measurements is presented in ***Table 5.130***.

In ***Figure 5.60*** we plot the length against the width of the first mandibular molar. Most measurements plot in the lower left part of the diagram and are likely to belong to the domestic dog (*Canis familiaris*). A single outlier is much larger than any other tooth and is likely to have belonged to a wolf (*Canis lupus*). There are no available metrical data of either postcranial bones or teeth of wolf from other sites in Macedonia, except for Sitagroi (Bökönyi 1986). The length of the first mandibular molar of wolf from Sitagroi is even larger (M_1 Length: 28.5 mm) than the one from Promachon (M_1 Length: 24.3 mm), but the clear separation between the Promachon outlier and the rest of the dataset should represent sufficient evidence to suggest that this outlier derives from a wild animal.

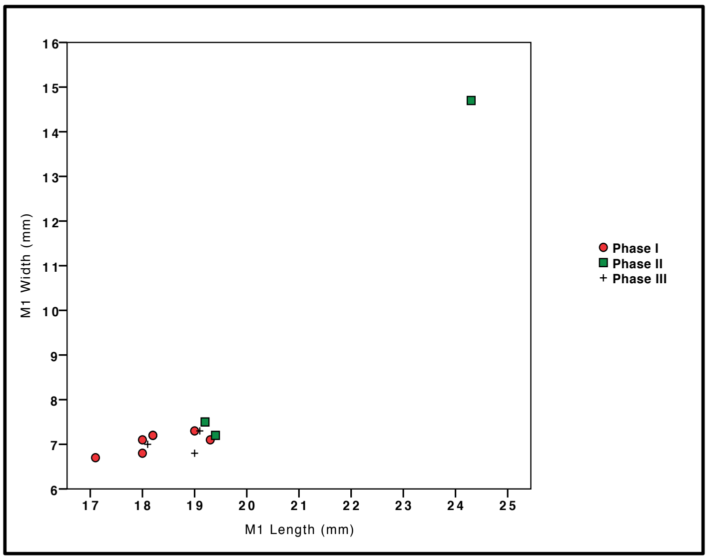


Figure 5.60: *Canis* mandibular first molar (M_1); length (in mm) vs. width (in mm). Comparison between phases.

Table 5.98: ***Bos taurus*** **(cattle) maxillary tooth measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm).**

Measurements	**Bos taurus *maxillary teeth***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n.***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
M¹ W	*LN*	*12*	*14.2*	*23.5*	*20.1*	*3*	*14.9*	-	-
M³ W	*Phase I*	*17*	*17.7*	*24*	*19.7*	*1.68*	*8.5*	-	-
	LN	*34*	*16.3*	*24.9*	*20.1*	*1.98*	*9.8*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.99: ***Bos taurus*** **(cattle) mandibular tooth measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm).**

Measurements	**Bos taurus *mandibular teeth***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Phases	***n.***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
dP_4 W	*LN*	*22*	*10.5*	*14.8*	*12.6*	*1.24*	*9.8*	-	-
M_1 W	*Phase I*	*13*	*11.7*	*16.9*	*14.9*	*1.57*	*10.5*	-	-
	LN	*21*	*11*	*16.9*	*14.4*	*1.79*	*12.4*		
M_2 W	*Phase I*	*11*	*12.7*	*17.2*	*15.7*	*1.33*	*8.4*	-	-
	LN	*13*	*12.4*	*18.9*	*15.7*	*1.80*	*11.4*		
M_3 L	*Phase I*	*14*	*34.4*	*40.8*	*37.7*	*1.94*	*5.1*	*.280*	-
	Phase II	*18*	*34*	*45.2*	*38.7*	*2.92*	*7.5*		
	LN	*40*	*34*	*45.2*	*38.5*	*2.81*	*7.3*		
M_3 W	*Phase I*	*19*	*12.2*	*17*	*15.1*	*1.5*	*9.9*	*.911*	-
	Phase II	*19*	*12.4*	*19.8*	*15.1*	*1.9*	*12.5*		
	LN	*47*	*12.2*	*20.8*	*15.2*	*1.92*	*12.6*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.100: *Bos taurus* (cattle) scapula measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Bos taurus *Scapula***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
SLC	LN	*12*	*38*	*58*	*50.9*	*5.19*	*10.2*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.101: *Bos taurus* (cattle) humerus measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Bos taurus *Humerus***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
BT	LN	*13*	*67.4*	*80.3*	*73*	*3.86*	*5.2*	-	-
HTC	Phase I	*13*	*29.5*	*36.5*	*33.6*	*2.28*	*6.8*	-	-
	LN	*23*	*23.0*	*37.9*	*32.9*	*3.77*	*11.4*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.102: *Bos taurus* (cattle) metacarpal measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comp2arison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Bos taurus *Metacarpal***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
Bd	Phase I	*12*	*54.5*	*68.1*	*60.9*	*5.21*	*8.5*	*.149*	-
	Phase II	*11*	*52.6*	*65.0*	*58.1*	*3.84*	*6.6*		
	LN	*29*	*52.6*	*71.2*	*60.3*	*5.28*	*8.7*		
BatF	Phase I	*11*	*50.6*	*61.5*	*55.9*	*4.27*	*7.6*	*.253*	-
	Phase II	*11*	*45.7*	*60.0*	*53.7*	*4.33*	*8*		
	LN	*28*	*45.7*	*63.5*	*55.3*	*4.60*	*8.3*		
a	Phase I	*13*	*25.3*	*31.1*	*28.4*	*2.05*	*7.2*	*.160*	-
	Phase II	*13*	*23.9*	*30.1*	*27.2*	*2.11*	*7.7*		
	LN	*33*	*23.9*	*34.5*	*28.3*	*2.61*	*9.2*		
b	Phase I	*14*	*24.5*	*33.0*	*29.3*	*2.52*	*8.6*	*.031*	-
	Phase II	*11*	*24.2*	*31.0*	*27.2*	*2.02*	*7.4*		
	LN	*31*	*24.2*	*33.6*	*28.6*	*2.60*	*9*		
3	Phase I	*14*	*26.4*	*33.1*	*30.6*	*2.16*	*7*	*.775*	-
	Phase II	*11*	*27.9*	*33.7*	*30.3*	*1.85*	*6*		
	LN	*31*	*26.4*	*34.0*	*30.5*	*2.05*	*6.7*		
6	Phase I	*14*	*25.3*	*33.1*	*30.4*	*2.31*	*7.6*	*.705*	-
	Phase II	*11*	*27.4*	*33.0*	*30*	*1.90*	*6.3*		
	LN	*31*	*25.3*	*34.1*	*30.4*	*2.14*	*7*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.103: *Bos taurus* (cattle) pelvis measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Bos taurus *Pelvis***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
LAR	LN	*10*	*50.5*	*71.5*	*64.7*	*6.75*	*10.4*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.104: *Bos taurus* (cattle) femur measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Bos taurus *Femur***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
DC	LN	*13*	*41.4*	*49.0*	*45.5*	*2.25*	*4.9*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.105: *Bos taurus* (cattle) tibia measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Bos taurus *Tibia***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
Bd	Phase I	*15*	*45.4*	*73.6*	*62.4*	*7.65*	*12.2*	-	-
	LN	*29*	*45.3*	*73.6*	*60.5*	*7.77*	*12.8*		
Dd	Phase I	*15*	*33.7*	*55.3*	*45.8*	*6.56*	*14.3*	*.288*	-
	Phase II	*10*	*30.1*	*54.4*	*42.7*	*7.23*	*16.9*		
	LN	*29*	*30.1*	*55.3*	*44.1*	*6.81*	*15.4*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.106: ***Bos taurus*** **(cattle) astragalus measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.**

Measurements	**Bos taurus *Astragalus***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
GLl	Phase I	*21*	*61*	*76*	*68.2*	*3.15*	*4.6*	*.715*	*.459*
	Phase II	*37*	*61*	*76*	*67.9*	*3.7*	*5.5*		
	Phase III	*10*	*62*	*79*	*69*	*4.53*	*6.5*		
	LN	*68*	*61*	*79*	*68.1*	*3.67*	*5.3*		
Glm	Phase I	*22*	*56.1*	*69.8*	*62.3*	*3.34*	*5.3*	*.494*	*.320*
	Phase II	*31*	*55*	*69.6*	*61.7*	*3.2*	*5.1*		
	Phase III	*10*	*55.7*	*71.4*	*63.1*	*4*	*6.3*		
	LN	*63*	*55.0*	*71.4*	*62.1*	*3.37*	*5.4*		
Bd	Phase I	*24*	*36.8*	*49.3*	*43.7*	*2.96*	*6.7*	*.095*	*.158*
	Phase II	*33*	*36.5*	*48.5*	*42.4*	*2.93*	*6.9*		
	Phase III	*10*	*39.7*	*48.9*	*44.1*	*3.3*	*7.4*		
	LN	*67*	*36.5*	*49.3*	*43.1*	*3.04*	*7*		
Dl	Phase I	*22*	*33.5*	*45.3*	*39.3*	*2.59*	*6.6*	*.338*	*.176*
	Phase II	*36*	*33.2*	*44.4*	*38.6*	*2.62*	*6.8*		
	Phase III	*10*	*36.0*	*47.3*	*40.2*	*3.29*	*8.1*		
	LN	*68*	*33.2*	*47.3*	*39*	*2.74*	*7*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.107: *Bos taurus* (cattle) calcaneum measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered

Measurements	**Bos taurus *Calcaneum***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
GD	LN	*12*	*34.4*	*56.2*	*51.14*	*5.6*	*10.9*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.108: *Bos taurus* (cattle) metatarsal measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Bos taurus *Metatarsal***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
Bd	Phase II	*12*	*41*	*62.5*	*52.5*	*7.47*	*14.2*	-	-
	LN	*17*	*41*	*62.5*	*53.4*	*6.57*	*12.2*		
BatF	Phase II	*10*	*37.6*	*57*	*46.7*	*5.98*	*12.8*	-	-
	LN	*15*	*37.6*	*57*	*47.9*	*5.45*	*11.3*		
a	Phase II	*11*	*17.9*	*28.8*	*23.7*	*3.44*	*14.5*	-	-
	LN	*17*	*17.9*	*28.8*	*24.5*	*3.14*	*12.8*		
b	Phase II	*13*	*17.8*	*30.5*	*24.9*	*4.37*	*17.5*	-	-
	LN	*21*	*17.8*	*30.5*	*25.1*	*3.75*	*14.9*		
3	Phase II	*12*	*22*	*33.9*	*28.4*	*3.51*	*12.3*	-	-
	LN	*17*	*22*	*33.9*	*28.7*	*3.16*	*10.9*		
6	Phase II	*15*	*22.8*	*32.8*	*28.6*	*2.81*	*9.8*	-	-
	LN	*23*	*22.8*	*32.8*	*29*	*2.54*	*8.7*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.109: ***Ovis aries*** **(sheep) mandibular tooth measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm).**

Measurements	**Ovis aries *mandibular teeth***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n.***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
dP_4 W	Phase I	*19*	*5.6*	*6.6*	*6.1*	*.3*	*4.9*	*.188*	*.186*
	Phase II	*25*	*5.7*	*7*	*6.2*	*.32*	*5.1*		
	Phase III	*14*	*5.7*	*6.6*	*6.1*	*.24*	*3.9*		
	LN	*58*	*5.6*	*7*	*6.1*	*.3*	*4.9*		
M_1 W	Phase I	*33*	*5.9*	*8.2*	*6.9*	*.55*	*7.9*	*.931*	*.322*
	Phase II	*28*	*6.3*	*8*	*6.9*	*.41*	*5.9*		
	Phase III	*10*	*6.3*	*7.6*	*7*	*.42*	*6*		
	LN	*71*	*5.9*	*8.2*	*6.9*	*.48*	*6.9*		
M_2 W	Phase I	*29*	*6.9*	*8.5*	*7.8*	*.42*	*5.3*	*.069*	-
	Phase II	*15*	*6.9*	*8.3*	*7.5*	*.4*	*5.3*		
	LN	*51*	*6.9*	*8.7*	*7.7*	*.46*	*5.9*		
M_3 L	Phase I	*16*	*19.1*	*22.5*	*20.8*	*1.02*	*4.9*	-	-
	LN	*31*	*15.9*	*22.8*	*20.5*	*1.5*	*7.3*		
M_3 W	Phase I	*17*	*7.1*	*9.1*	*8.1*	*.59*	*7.2*	-	-
	LN	*32*	*6.7*	*9.1*	*8*	*.64*	*8*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.110: *Ovis aries* (sheep) humerus measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Ovis aries *Humerus***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
BT	Phase I	21	23.1	30.4	26.2	1.81	6.9	.687	.937
	Phase II	20	23.7	30.1	26.4	1.6	6		
	Phase III	14	22.9	37.3	26.3	3.53	13.4		
	LN	55	22.9	37.3	26.3	2.26	8.6		
HTC	Phase I	24	12.1	15.7	13.3	.97	7.3	.562	.922
	Phase II	23	11.7	14.8	13.2	.72	5.4		
	Phase III	13	11.5	15.7	13.2	1.24	9.3		
	LN	60	11.5	15.7	13.2	.94	7		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.111: *Ovis aries* (sheep) metacarpal measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Ovis aries *Metacarpal***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
b	LN	*12*	*8.5*	*11.4*	*10.4*	*1*	*9*	-	-
4	LN	*12*	*8*	*11.4*	*9.8*	*1.1*	*9.7*	-	-
6	LN	*12*	10	13.7	12.3	1.1	7.9	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.112: *Ovis aries* (sheep) tibia measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Ovis aries *Tibia***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
Bd	Phase I	*43*	*21.0*	*27.8*	*23.3*	*1.52*	*6.5*	*.149*	*.542*
	Phase II	*45*	*20.0*	*26.8*	*22.9*	*1.27*	*5.5*		
	Phase III	*31*	*21.6*	*25.8*	*23*	*1.13*	*4.9*		
	LN	*119*	*20.0*	*27.8*	*23.1*	*1.34*	*5.8*		
Dd	Phase I	*43*	*15.8*	*20.2*	*17.7*	*1.12*	*6.3*	*.235*	*.265*
	Phase II	*45*	*16.3*	*20.5*	*18*	*.96*	*5.3*		
	Phase III	*31*	*14.9*	*20.9*	*17.7*	*1.22*	*6.9*		
	LN	*119*	*14.9*	*20.9*	*17.8*	*1.09*	*6.1*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.113: *Ovis aries* (sheep) astragalus measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Ovis aries *Astragalus***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
GLl	Phase II	*23*	*23*	*32*	*25.1*	*1.79*	*7.1*	-	*.132*
	Phase III	*13*	*23*	*31*	*26.4*	*2.58*	*9.7*		
	LN	*44*	*23*	*32*	*25.4*	*2.21*	*8.7*		
GLm	Phase II	*24*	*21.7*	*30.0*	*23.9*	*1.63*	*6.8*	-	*.149*
	Phase III	*13*	*22.3*	*28.6*	*24.8*	*2.05*	*8.2*		
	LN	*45*	*21.7*	*30.0*	*24.1*	*1.87*	*7.7*		
Bd	Phase II	*23*	*14.4*	*18.6*	*16*	*.99*	*6.1*	-	*.052*
	Phase III	*13*	*14.7*	*21.7*	*17.3*	*2.01*	*11.6*		
	LN	*44*	*14.1*	*21.7*	*16.4*	*1.56*	*9.5*		
Dl	Phase II	*21*	*13.1*	*18.5*	*14.5*	*1.15*	*7.9*	-	*.224*
	Phase III	*13*	*13.5*	*16.9*	*15*	*1.17*	*7.8*		
	LN	*42*	*13.0*	*18.5*	*14.6*	*1.21*	*8.2*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.114: *Ovis aries* (sheep) calcaneum measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Ovis aries *Calcaneum***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
GD	LN	*10*	*17.9*	*21.7*	*20.1*	*1.21*	*6*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.115: *Ovis aries* (sheep) metatarsal measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Ovis aries *Metatarsal***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
3	LN	*10*	*11.6*	*13.6*	*12.3*	*.61*	*4.9*	-	-
6	LN	*10*	*11.6*	*13.1*	*12.1*	*.49*	*4*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.116: *Capra hircus* (goat) mandibular tooth measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm).

Measurements	**Capra hircus *mandibular teeth***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n.***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	**p.**	**p.**
M_1 W	Phase I	*12*	*6.2*	*7.5*	*6.9*	*.4*	*5.8*	-	-
	LN	*18*	*6.2*	*7.6*	*7*	*.41*	*5.8*		
M_2 W	Phase I	*12*	*6.7*	*8.5*	*7.7*	*.63*	*8.1*	-	-
	LN	*19*	*6.7*	*8.5*	*7.8*	*.54*	*6.9*		
M_3 L	LN	*11*	*18.6*	*22.6*	*20.1*	*1.4*	*6.9*	-	-
M_3 W	LN	*12*	*6.7*	*8.8*	*7.7*	*.55*	*7.1*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.117: *Capra hircus* (goat) humerus measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Capra hircus *Humerus***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
BT	Phase I	*11*	*23.2*	*25.8*	*24.7*	*.75*	*3.03*	-	-
	LN	*25*	*20.4*	*25.8*	*23.8*	*1.3*	*5.46*		
HTC	Phase I	*11*	*11.8*	*13.1*	*12.5*	*.42*	*3.36*	-	-
	LN	*24*	*11.1*	*13.1*	*12.2*	*.52*	*4.26*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.118: *Capra hircus* (goat) tibia measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Capra hircus *Tibia***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
Bd	LN	*11*	*21.5*	*24.8*	*22.6*	*1.06*	*4.7*	-	-
Dd	LN	*11*	*14.7*	*19.9*	*17.7*	*1.35*	*7.6*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.119: *Ovis/Capra* (sheep/goat) mandibular tooth measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm).

Measurements	**Ovis/Capra *mandibular teeth***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n.***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
M$_1$ W	Phase I	*19*	*6*	*8.6*	*7.1*	*.67*	*9.4*	*.338*	-
	Phase II	*10*	*6.4*	*8.4*	*7.3*	*.62*	*8.5*		
	LN	*32*	*6*	*8.6*	*7.2*	*.65*	*9*		
M$_2$ W	Phase I	*20*	*6.2*	*9.4*	*7.5*	*.88*	*11.7*	*.917*	-
	Phase II	*13*	*7.2*	*9.7*	*8*	*.67*	*8.3*		
	LN	*37*	*6.2*	*9.7*	*7.7*	*.8*	*10.4*		
M$_3$ L	Phase I	*37*	*16.8*	*23.2*	*20.9*	*1.51*	*7.2*	*.316*	*.155*
	Phase II	*41*	*16.5*	*24.2*	*20.5*	*1.83*	*8.9*		
	Phase III	*31*	*15.1*	*24.6*	*21*	*1.85*	*8.8*		
	LN	*109*	*15.1*	*24.6*	*20.8*	*1.74*	*8.3*		
M$_3$ W	Phase I	*45*	*6.4*	*9*	*7.9*	*.59*	*7.4*	*.667*	*.975*
	Phase II	*48*	*6.4*	*9.2*	*7.9*	*.68*	*8.6*		
	Phase III	*44*	*6.5*	*8.9*	*7.9*	*.54*	*6.8*		
	LN	*137*	*6.4*	*9.2*	*7.9*	*.6*	*7.6*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.120: *Ovis/Capra* (sheep/goat) scapula measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Ovis/Capra *Scapula***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
SLC	LN	*14*	*15*	*22*	*17.4*	*1.78*	*10.2*	-	-

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.121: *Ovis/Capra* (sheep/goat) pelvis measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Ovis/Capra *Pelvis***							***Comparison (t-test)***	
								Phases I vs. II	***Phases II vs. III***
	Period	***n***	***x(1)***	***x(n)***	***μ***	***σ***	***CV***	***p.***	***p.***
LAR	Phase I	*28*	*19.0*	*25.4*	*22.2*	*1.44*	*6.4*	*.852*	*.821*
	Phase II	*25*	*19.4*	*26.4*	*22.3*	*2.33*	*10.4*		
	Phase III	*10*	*20.5*	*26.3*	*22.2*	*1.95*	*8.8*		
	LN	*63*	*19.0*	*26.4*	*22.3*	*1.89*	*8.4*		

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.122: *Sus* (pig) maxillary tooth measurements; sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm).

Measurements	Sus *maxillary teeth*											***Comparison (t-test)****	
												Phases I vs. II	***Phases II vs. III***
	Period	***n****	***x(1)****	***x(n)****	***μ****	***σ****	***CV****	***n*****	***μ *****	***σ*****	***CV*****	***p.***	***p.***
M^1 L	Phase I	18	12.1	18.6	15.6	2	12.7	-	-	-	-	-	-
	LN	31	11.9	19.8	15.4	2.02	13.1	30	15.3	1.8	11.7		
M^1 WA	Phase I	18	11.1	17.9	13.2	1.54	11.6	17	12.9	1	7.7	-	-
	LN	29	11	17.9	12.9	1.40	10.8	28	12.7	1	8.2		
M^1 WP	Phase I	17	10.5	17.1	13.2	1.69	12.8	16	13	1.4	10.7	.073	-
	Phase II	10	10.2	14.2	12	1.5	12.5	-	-	-	-		
	LN	31	10.2	17.1	12.8	1.64	12.8	30	12.6	1.4	11		
M^2 L	Phase I	17	15.7	27.4	20.2	2.81	13.8	16	19.7	2.18	11	-	-
	LN	27	15.2	27.4	19.7	2.65	13.4	26	19.4	2.2	11.3		
M^2 WA	Phase I	17	12.1	23.1	15.7	2.49	15.8	16	15.3	1.7	11	-	-
	LN	27	12.1	23.1	15.3	2.22	14.4	26	15	1.63	10.8		
M^2 WP	Phase I	18	12.8	22	15.4	2.13	13.8	17	15	1.4	9.3	-	-
	LN	28	12.8	22	15.2	1.82	11.9	27	14.9	1.27	8.5		
M^3 L	LN	14	25.2	38.6	28.9	3.4	11.7	13	28.2	2	7.1	-	-
M^3 WA	LN	14	16	23.1	17.6	1.92	10.9	13	17.2	1.17	6.8	-	-
M^3 WC	LN	14	13	19.3	14.5	1.69	11.6	13	14.1	1	7.2	-	-

* Including outliers (possibly wild individuals: wild boar). **Excluding outliers (possibly wild individuals: wild boar).
p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.123: *Sus* (pig) mandibular tooth measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (µ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm).

Measurements	**Sus *mandibular teeth***											***Comparison (t-test)****	
												Phases I vs. II	***Phases II vs. III***
	Period	***n****	***x(1)****	***x(n)****	***µ****	***σ****	***CV****	***n*****	***µ *****	***σ*****	***CV*****	***p.***	***p.***
dP_4 L	LN	*20*	*13.2*	*20.7*	*17.6*	*1.56*	*8.8*	-	-	-	-	-	-
dP_4 WP	LN	*19*	*7.7*	*9.9*	*8.4*	*.65*	*7.7*	-	-	-	-	-	-
M_1 L	Phase II	*10*	*14.5*	*24.1*	*16.8*	*2.85*	*16.9*	*9*	*16*	*1.35*	*8.4*	-	-
	LN	*22*	*14.5*	*24.1*	*16.8*	*2.21*	*13.1*	*21*	*16.5*	*1.56*	*9.4*		
M_1 WA	Phase II	*10*	*8.4*	*16.3*	*10.4*	*2.21*	*21.1*	*9*	*9.8*	*.89*	*9.1*	-	-
	LN	*21*	*8.4*	*16.3*	*10.4*	*1.61*	*15.5*	*20*	*10.1*	*.92*	*9.1*		
M_1 WP	Phase II	*11*	*9.5*	*16.6*	*11*	*1.97*	*17.9*	*10*	*10.5*	*.76*	*7.2*	-	-
	LN	*23*	*9.5*	*16.6*	*11*	*1.54*	*14*	*22*	*10.7*	*.96*	*8.9*		
M_2 L	LN	*19*	*15.1*	*22.4*	*19.1*	*1.94*	*10.1*	-	-	-	-	-	-
M_2 WA	LN	*19*	*10*	*13.7*	*12.2*	*.95*	*7.7*	-	-	-	-	-	-
M_2 WP	LN	*19*	*10.6*	*14.1*	*12.8*	*.94*	*7.3*	-	-	-	-	-	-

*Including outliers (possibly wild individuals: wild boar).
**Excluding outliers (possibly wild individuals: wild boar).
p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.124: *Sus* (pig) atlas measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Sus *Atlas***											***Comparison (t-test)****	
												Phases I vs. II	***Phases II vs. III***
	Period	***n****	***x(1)****	***x(n)****	***μ****	***σ****	***CV****	***n*****	***μ *****	***σ*****	***CV*****	***p.***	***p.***
BFcr	LN	*11*	*40.6*	*63.0*	*46.5*	*6.85*	*14.7*	*10*	*44.9*	*4.4*	*9.8*	-	-

*Including outliers (possibly wild individuals: wild boar).

**Excluding outliers (possibly wild individuals: wild boar).

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).

p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).

p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.125: *Sus* (pig) scapula measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Sus *Scapula***											***Comparison (t-test)****	
												Phases I vs. II	***Phases II vs. III***
	Period	***n****	***x(1)****	***x(n)****	***μ****	***σ****	***CV****	***n*****	***μ *****	***σ*****	***CV*****	***p.***	***p.***
SLC	Phase I	*13*	*16*	*33*	*21.1*	*4.62*	*21.89*	*12*	*20.2*	*3.26*	*16.1*	*.994*	-
	Phase II	*21*	*16*	*37*	*21.1*	*5.44*	*25.78*	*19*	*19.6*	*2.43*	*12.4*		
	LN	*37*	*16*	*37*	*21.1*	*4.86*	*23.03*	*34*	*20*	*2.66*	*13.3*		

*Including outliers (possibly wild individuals: wild boar).

**Excluding outliers (possibly wild individuals: wild boar).

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).

p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).

p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.126: *Sus* (pig) humerus measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Sus *Humerus***											***Comparison (t-test)****	
												Phases I vs. II	***Phases II vs. III***
	Period	***n****	***x(1)****	***x(n)****	***μ****	***σ****	***CV****	***n*****	***μ *****	***σ*****	***CV*****	***p.***	***p.***
BT	LN	*13*	*26.7*	*42.7*	*31.7*	*5.02*	*15.8*	*12*	*30.8*	*3.9*	*12.8*	-	-
HTC	LN	*14*	*16.0*	*27.6*	*18.7*	*3.29*	*17.59*	*13*	*18*	*2.18*	*12*	-	-

*Including outliers (possibly wild individuals: wild boar).

**Excluding outliers (possibly wild individuals: wild boar).

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).

p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).

p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.127: *Sus* (pig) pelvis measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Sus *Pelvis***											***Comparison (t-test)****	
												Phases I vs. II	***Phases II vs. III***
	Period	***n****	***x(1)****	***x(n)****	***μ****	***σ****	***CV****	***n*****	***μ *****	***σ*****	***CV*****	***p.***	***p.***
LAR	Phase I	*11*	*18.5*	*47.9*	*30.4*	*7.52*	*24.73*	*9*	*27.5*	*3.75*	*13.6*	*.842*	-
	Phase II	*11*	*23.3*	*34.1*	*29.9*	*3.30*	*11.03*	*11*	-	-	-		
	LN	*26*	*18.5*	*47.9*	*29.5*	*5.47*	*18.54*	*24*	*28.3*	*3.53*	*12.5*		

*Including outliers (possibly wild individuals: wild boar).
**Excluding outliers (possibly wild individuals: wild boar).
p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.128: *Sus* (pig) tibia measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Sus *Tibia***											***Comparison (t-test)****	
												Phases I vs. II	***Phases II vs. III***
	Period	***n****	***x(1)****	***x(n)****	***μ****	***σ****	***CV****	***n*****	***μ *****	***σ*****	***CV*****	***p.***	***p.***
Bd	LN	*14*	*24.5*	*37.5*	*27.7*	*3.83*	*13.82*	*12*	*26.3*	*1.32*	*5*	-	-
Dd	LN	*16*	*18.4*	*33.0*	*24.1*	*4.48*	*18.58*	*13*	*22.2*	*1.66*	*7.4*	-	-

*Including outliers (possibly wild individuals: wild boar).
**Excluding outliers (possibly wild individuals: wild boar).
p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.129: *Sus* (pig) astragalus measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in millimeters (mm). Only fully fused specimens are considered.

Measurements	**Sus *Astragalus***											***Comparison (t-test)****	
												Phases I vs. II	***Phases II vs. III***
	Period	***n****	***x(1)****	***x(n)****	***μ****	***σ****	***CV****	***n*****	***μ *****	***σ*****	***CV*****	***p.***	***p.***
GLl	LN	*17*	*34*	*50*	*40.7*	*5.97*	*14.6*	*14*	*38.9*	*4.84*	*12.4*	-	-
GLm	LN	*19*	*32.3*	*46.1*	*38.2*	*5.02*	*13.1*	*14*	*36.4*	*4.15*	*11.4*	-	-
Bd	LN	*11*	*20.5*	*31.2*	*26*	*3.98*	*15.3*	*8*	*24.6*	*3.74*	*15*	-	-
Dl	LN	*12*	*19.7*	*30.8*	*24.7*	*3.65*	*14.7*	*9*	*23.4*	*3*	*13*	-	-

*Including outliers (possibly wild individuals: wild boar).

**Excluding outliers (possibly wild individuals: wild boar).

p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).

p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).

p. = > .05: No significant difference (more than 5% probability that is due to chance).

Table 5.130: *Canis familiaris* (dog) mandibular tooth measurements. Sample sizes (n.), ranges [x(1)= minimum; x(n)= maximum], means (μ), standard deviations (σ), coefficients of variation (CV), and statistical comparison (using a t-test) for assessing the significance (p. = probability) of the size differences between individual phases. Only sample sizes with a minimum of ten cases are considered. All measurements are in tenths of millimeters (mm).

Measurements	**Canis familiaris *mandibular teeth***											***Comparison (t-test)****	
												p.	***p.***
	Period	***n****	***x(1)****	***x(n)****	***μ****	***σ****	***CV****	***n*****	***μ *****	***σ*****	***CV*****	***Phases I vs. II***	***Phases II vs. III***
M1 L	LN	*14*	*14.5*	*24.3*	*18.6*	*2.05*	*11.02*	*13*	*18.2*	*1.31*	*7.2*	-	-
M1 W	LN	*14*	*6.7*	*14.7*	*7.6*	*2.03*	*26.71*	*13*	*7.11*	*.23*	*3.3*	-	-
H	LN	*11*	*38.8*	*42.3*	*48.1*	*2.7*	*6.38*	-	-	-	-	-	-

* Including outliers (possibly wild individuals: wolf).
**Excluding outliers (possibly wild individuals: wolf).
p. = .001-.01: Difference is highly significant (less than 1% probability that is due to chance).
p. = .01-.05: Difference is significant (less than 5% probability that is due to chance).
p. = > .05: No significant difference (more than 5% probability that is due to chance).

5.11 – Pathologies

Only two pathological bones were observed. These were a broken and healed cattle rib and a caprine metatarsal that exhibited a slightly abnormal distal end. The fused distal end appeared to have extra bone growth around the condyles, while the whole bone appeared to be rather short and flattened. No other postcranial bones exhibited any abnormalities. Of interest is the fact that lower cattle limb bones (carpals, tarsals, metapodials, phalanges) did not exhibit any pathology, which support the hypothesis raised on the basis of the ageing evidence (see also ***5.7.1* – Bos taurus *age-at-death***) that there was no emphasis in the use of cattle for traction.

Oral pathologies were more common than the pathologies of the postcranial bones, but only affected caprines. The most common oral pathologies were coral-like outgrowths at the root apices (***Plate 14***), probably caused by alveolar infection (Siegel 1976; Baker and Brothwell 1980). Bearing in mind that a high proportion of caprines survived beyond their ninth-tenth year (see also ***5.7.2* – Caprinae *age-at-death***), these oral infections presumably gradually developed with age. The condition was present in nine (eight of sheep, one of goat) loose fourth mandibular premolars (P_4), four loose either first or second mandibular molars ($M_{1/2}$) and two loose third mandibular molars (M_3). Another common pathological condition was abscess development, which was present in ten cases (***Plate 15***). There were only two pathological cases with both root infection and abscess development.

Two types of non-metric traits were recorded at Promachon, both of which were only observed in caprines. The first was the absence of the second mandibular premolar (P_2); out of 27 caprine second mandibular premolars, two (7%) were missing. The second non-metric trait was the absence of the hypoconulid of the third mandibular molar (M_3). Out of 145 caprine third mandibular molars, only two (< 2%) had missing hypoconulids. The two recorded non-metric traits seem to bear no relation to each other in terms of their frequency. This is not surprising, as there is no reason why they should be related. No cases of non-metric traits on domesticated populations from Greek Macedonia have been reported. Generally, we still know very little about their variation; it is possible, however, that the pattern observed in Promachon might reflect the genetic character of the local caprine population.

All in all, the scarcity of pathological conditions suggests that the domestic population at Promachon was in a generally healthy state throughout the period of site occupation; having said that, it is possible that many conditions, which would have not affected the bones and teeth and therefore are invisible to zooarchaeological research, might have occurred. Despite these limitations the observed pathologies are still very few, possibly due to the relatively young age of the animals (cattle and pigs mainly), but probably also indicating that animal husbandry was not under severe stress.

Finally, no pathological conditions were detected on the postcranial bones and teeth of wild species, but the sample sizes are too few to draw firm conclusions about the meaning of this.

Chapter 6. – Contextualizing Promachon

6.1 – Introduction

The preceding chapter (***Chapter 5. – Results***) presented the results of the analysis of the faunal assemblage from the Greek sector of Promachon. This chapter compares these results to those obtained from a number of northern Greek (Macedonian, Thracian and Thessalian) and other Balkan (Bulgarian and Serbian) settlements, which are contemporary to Promachon. Its purpose is to contribute to our understanding of both temporal and regional trends in animal management, placing Promachon in the broader spectrum of contemporary agro-pastoral communities and creating an integrated picture of human-animal relationships that encompasses both northern Greece and the Balkan Peninsula. This will ultimately assist us in the understanding of the dynamics of animal management during a time-period that is considered one of the most vigorous eras of the prehistory of southeastern Europe. Adequate faunal data from a number of sites contemporary to Promachon from northern Greece and the Balkan Peninsula were mainly extracted from published sources. However, a number of colleagues kindly provided unpublished data in the early stages of the current research. Comparison between Promachon and other contemporary sites from northern Greece and the Balkan Peninsula (***Table 6.1***; ***Figure 6.1***) was possible to be conducted in terms of:

- Frequencies of domesticated and wild species as well as frequencies of cattle, caprines and pigs (only for assemblages that use *NISP* as the main system of taxonomic frequency).
- Age-at-death of cattle, sheep, goats and pigs (through mandibular wear stages).
- Size of the cattle, sheep and pigs (through metrical analysis).

Figure 6.1: Map of Late and Final Neolithic Balkan sites used for comparison with Promachon.

Table 6.1: Corpus of northern Greek and Balkan assemblages compared to Promachon.

Site		Comparisons between Promachon and sites from northern Greece and the Balkans			
		Frequency of species	Age-at-death	Measurements	Sources
Northern Greek sites (Macedonian, Thracian and Thessalian)	Sitagroi I-II-III	✓	✓	✓	Bökönyi (1986)
	Makriyalos I	✓		✓	Halstead (pers. comm.)
	Thermi B	✓	✓		Yiannouli (1989)
	Stavroupoli I-II	✓	✓		Yiannouli (2002a; 2004)
	Dimitra LN	✓	✓		Yiannouli (1994; 1997)
	Kryoneri LN	✓	✓		Mylona (1997)
	Aggitis east bank LN	✓			Trantalidou et al. (2006)
	Megalo Nisi LN	✓			Greenfield and Fowler (2005)
	Pigi athinas LN	✓			Cantuel (2013)
	Vasilika C	✓			Yiannouli (1994)
	Kastri LN	✓			Halstead (1996)
	Makri I-II	✓			Curci and Tagliacozzo (2003)
	Paradeisos LN	✓			Larje (1987)
	Ayia Sofia LN	✓		✓	Driesch and Enderle (1976)
	Argissa LN	✓		✓	Böessneck (1962)
	Pevkakia LN	✓		✓	Jordan (1975)
	Dimini LN	✓			Halstead (1992)
	Zarko LN	✓			Becker (1991)
Balkan sites (Bulgarian and Serbian)	Anza IV	✓			Bökönyi (1976)
	Azmaschka LN	✓			Kostov (2006)
	Divostin II	✓			Bökönyi (1988)
	Ezero LN-EBA	✓			Iliev and Spassov (2007)
	Goliamo Delchevo FN	✓			Iliev and Spassov (2007)
	Gomolava LN	✓			Orton (pers. comm.)
	Harmanli LN	✓			Bacvarov et al. (2010)
	Malo Pole LN	✓			Iliev and Spassov (2007)
	Opovo LN	✓			Orton (pers. comm.)
	Ovcharovo LN	✓			Iliev and Spassov (2007)
	Petnica LN	✓			Orton (pers. comm.)
	Sarnevo LN	✓			Gorczyk (2013)
	Vinitsa FN	✓			Iliev and Spassov (2007)
	Yasatepe LN	✓			Iliev and Spassov (2007)

6.2 – Species frequency

Comparisons between Promachon and northern Greek sites in terms of the frequencies of the domesticated and wild species, as well as the frequencies of the three main domesticates, were relatively straightforward since most faunal researchers use *NISP* as the main method to calculate taxonomic frequency. We must, however, consider that, while in the 'diagnostic zone' approach discussed here it is clear which fragments have been counted, in other cases this information is not so explicit, making comparisons more problematic. It should also be noted that the extent of recovery bias from a number of comparative sites has not been entirely assessed. There are also cases where a number of researchers use quantification systems other than *NISP* (*i.e. MNE*, *MinAU*, *MaxAU*), which are therefore more difficult to compare with our quantifications and, as a consequence, have not been used.

6.2.1 – Frequency of domesticated and wild species

Faunal evidence dating as early as the fifth millennium BC indicates that domestic ruminants and pigs assume a leading role in the Neolithic economies of Greece (Halstead 1994; Perlès 2001; Valamoti 2004; Yiannouli 1997). Consistently with this notion, faunal data from Promachon indicated that cattle, caprines and pigs are represented with higher frequencies than wild species (see also ***5.3 – Species representation***). There is, however, an additional issue, which needs considering.

As previously demonstrated (see also ***5.10.3* – Sus *size***), a sizeable proportion of wild boar from Promachon was identified through metrical analysis. It is extremely difficult, however, to 'isolate' and quantify (in terms of *NISP*) this part of the pig population. Therefore, any comparison of the frequencies of the wild and the domesticated species between Promachon and other contemporary sites would be problematic as wild boar represent, numerically, an entity that is not completely known.

A possible way to tackle this problem would be to compare the frequency of caprines and red deer. On one hand, red deer is definitely a wild species. On the other hand, caprines are definitely domestic and are preferred to cattle, as this latter may potentially include an aurochs element in the assemblage (though there is no real evidence of this at Promachon). This type of analysis may be crude but can be reasonably effective as caprines are common and widespread in all sites and red deer is often one of the most (if not the most) hunted species.

However, not all site reports from northern Greece provide the frequency of the red deer in terms of *NISP.* In some cases the presence of this species is masked under the generic level of the family (*Cervidae*), which may also include roe deer (*Capreolus capreolus*) and fallow deer (*Dama dama*). Secondly, there are cases, in which the authors of the faunal reports do not discuss which wild species were present on-site. Thirdly, there are cases, in which red deer is not particularly well represented among the wild fauna. Obviously, if we had taken into consideration these sites, they would have provided incorrect information on the significance of the wild species. Consequently they were excluded from the following analysis (***Figure 6.2; Table 6.2***).

Faunal data from contemporary to Promachon settlements such as Dimitra (Yiannouli 1994; 1997*)*, Megalo Nisi (Greenfield and Fowler 2005), Stavroupoli (Yiannouli 2002a; 2004), Sitagroi (Bökönyi 1986) and Paradisos (Larje 1987), suggest that caprines (and for the sake of this type of analysis, domesticated species) are of much higher economic importance than red deer (and thus, wild species). The Late Neolithic site of Promachon does not diverge from this pattern. Faunal data from sites such as Kryoneri (Mylona 1997) as well as the cave of Aggitis on the east bank of the river of Aggitis in the plain of Drama (Trantalidou *et al.* 2006) do, however, indicate that wild species are represented with higher percentages than any other settlement in Greek Macedonia, though domestic species still predominate.

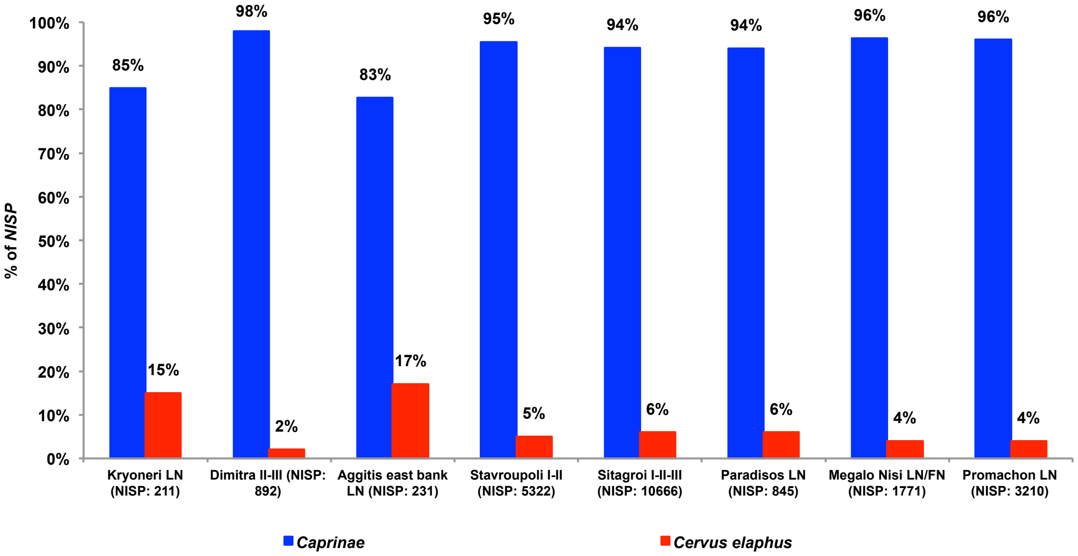


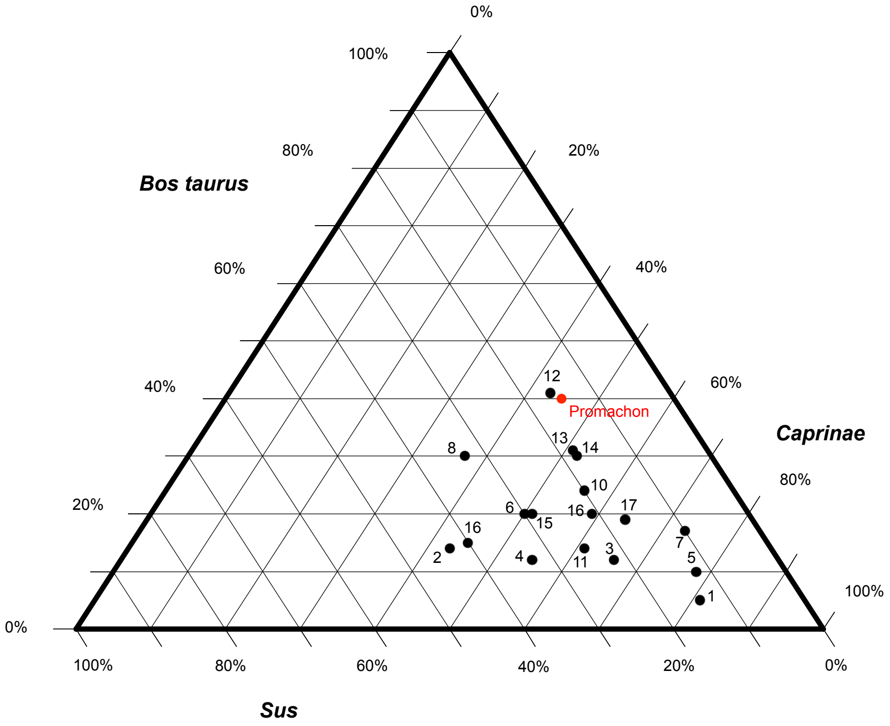
Figure 6.2: Frequency of Caprinae (caprine) vs. *Cervus elaphus* (red deer) from various Late Neolithic sites in Macedonia. Data in Table 6.2. *NISP* counts.

Different strategies in animal exploitation may be associated to a number of factors. For instance, Helmer *et al.* (2005) argue that the variation in the proportions of domesticated and wild animals could plausibly be attributed to site function - for instance a difference operating between open-air sites and caves. Helmer *et al.*'s argument could potentially explain the high frequency of wild animals in sites such as Aggitis, which is a cave-site. However, it cannot explain the high frequency of wild species in open-air sites such as Kryoneri. Therefore, the variations in the proportions between domesticated and wild species during the Late Neolithic should not be associated solely to the function of each site. To be more specific, the symbolic character that the wild animals might have had among Neolithic communities could have played a significant role in the decisions of Neolithic people regarding the more intensive exploitation of wild resources (*cf.* Becker 1991; 1999; Hamilakis 2003; Perlés 2001, Trantalidou *et al.* 2006; Valamoti 2004).

6.2.2 – Frequency of the three main domesticated species

In Greece, as elsewhere in temperate Europe, early famers relied on species of exotic origin: sheep and goats were non-native to Europe (Halstead and Isaakidou 2013). In addition, biometric evidence and ancient as well as modern DNA suggest that at least some the early domestic cattle and pigs were of southwest Asian descent (*cf.* Albarella *et al.* 2009; Larsson *et al.* 2007; Rowley-Conwy *et al.* 2012; Vigne 2011; Zeder 2005; Zeder *et al.* 2006). ***Figure 6.3*** (***Table 6.3***) presents a tripolar diagram with the frequencies of cattle, caprines and pigs from a number of sites in Macedonia, Thrace and Thessaly during the Late Neolithic. This shows that the bulk of these sites are clustered in the lower right corner of the triangle, suggesting that caprines are represented with the highest frequencies than any other species in almost all sites, a pattern that is typical for the time-period.

The results from Promachon are on the edge of the distribution of contemporary settlements from Macedonia, Thrace and Thessaly, but by and large consistent with it. The high frequency of caprines in Promachon implies that the site was linked in terms of economic subsistence with the bulk of the northern Greek Late Neolithic communities. In general, the predominance of caprines in Greece, has been subject to much discussion. To be more specific, this predominance has been attributed to the lack of expertise in the management of large species such as cattle (Cantuel *et al.* 2008), or as a failure of colonising farmers to adapt to alien environmental conditions due to ‘cultural conservatism’ (Whittle and Bartosiewicz 2007). Alternatively, it has been suggested that the high frequency of caprines could plausibly be attributed to the slow reproduction of large livestock such as cattle (Bökönyi 1973), or to a purposeful choice by the Neolithic people, since sheep were closely integrated with crop cultivation (Halstead and Isaakidou 2013).



N.	Site	Region	Locale	Status	NISP	Sources
1	Aggitis, east bank LN	Macedonia	Mainland	Cave	229	Trantalidou et al. (2006)
2	Ayia Sofia LN	Thessaly	Mainland	Open	3369	Driesch and Enderle (1976)
3	Dimini LN	Thessaly	Mainland	Open	1860	Halstead (1992)
4	Dimitra II-III	Macedonia	Mainland	Open	1450	Yiannouli (1994; 1997)
5	Kastri LN	Macedonia	Island	Open	n.a.	Frequencies cited in: Halstead (1996)
6	Kryoneri LN	Macedonia	Mainland	Open	349	Mylona (1997)
7	Makri I-II	Thrace	Mainland	Open	448	Curci and Tagliacozzo (2006)
8	Makriyalos LN	Macedonia	Mainland	Open	21752	Halstead (pers. comm.)
9	Megalo Nisi LN-FN	Macedonia	Mainland	Open	2672	Greenfield and Fowler (2005)
10	Paradeisos LN	Macedonia	Mainland	Open	1443	Larje (1987)
11	Pevkakia LN	Thessaly	Mainland	Open	500	Jordan (1975)
12	Pigi athinas LN	Macedonia	Mainland	Open	1428	Cantuel (2014)
13	Sitagroi I-II-III	Macedonia	Mainland	Open	19181	Bökönyi (1986)
14	Stavroupoli I-II	Macedonia	Mainland	Open	9477	Yiannouli (2002a; 2004)
15	Thermi B	Macedonia	Mainland	Open	1433	Yiannouli (1989)
16	Vasilika C	Macedonia	Mainland	Open	1650	Yiannouli (1994)
17	Zarko LN	Thessaly	Mainland	Open	1053	Becker (1991)

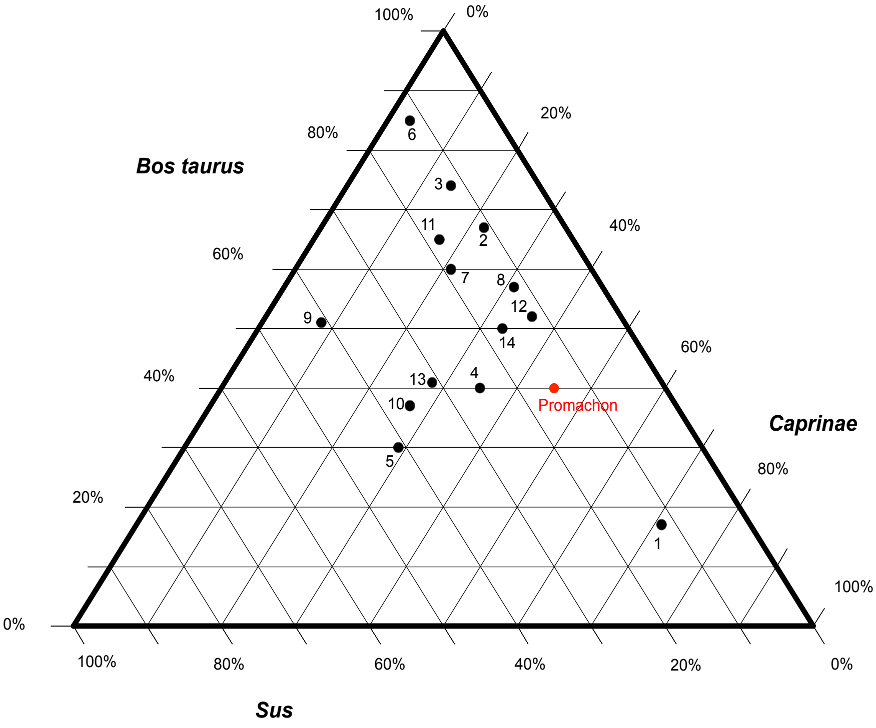
Figure 6.3: Corpus of Late Neolithic settlements from northern Greece. Data in Table 6.3.

Whatever the case, the evidence suggests that the keeping and breeding of caprines is characteristic of Neolithic farming, since it lasted for centuries. The climate and the environmental conditions in Greece might have played a decisive role in this choice. To be more specific, Greece has low winter precipitation, the climate is warm and therefore caprines adapted well to climatic conditions that are substantially not unlike those of their area of origin (Barker 1985; Bailey 2000; Halstead 1989a; 2000).

Figure 6.4 (***Table 6.4***) presents a tripolar diagram with the frequencies of cattle, caprines and pigs from a number of sites in Bulgaria and Serbia dating to the Late and Final Neolithic. In general, the frequency of these species radically changes as one moves from the southern Balkans (Greece) into the Balkans proper (that is into Bulgaria and Serbia) (Halstead 1989a; Lazić 1988). What is interesting therefore, is the fact that the bulk of the Bulgarian and Serbian sites are clustered on the upper triangle, indicating a predominance of cattle, which is in contrast with the information obtained from northern Greek sites.

Unlike the southern regions of the Balkans (Greece), which - as previously argued - has mainly winter precipitation, in the northern Balkans (Bulgaria and mainly Serbia) this is more evenly distributed year-round. This has important implications for cereal and pulse cultivations, which may have been disrupted by a shorter growing season, late frosts and potentially destructive wet summers (Halstead 1989a). In the case of domesticated animals, northern Balkan climate and vegetation would have better-suited cattle and pigs than sheep and goats (Bailey 2000; Barker 1985; Halstead 1989a). The faunal data from the northern Balkan regions indicate that cattle-dominated assemblages (in which red deer and pigs are also represented with high frequencies) ranged from southern Romania, to the western Balkans, and from south-central Bulgarian sites to the Gorges (Bailey 2000).

Other arguments - not connected to the climatic and environmnental conditions - have also been proposed to explain the high frequency of cattle in northern Balkan regions. For instance, Bökönyi (1990) suggested that the high frequency of cattle at Vinča (Serbia) might be explained with the demand for large quantities of meat due to rapid demographic increase. A similar argument was put forward by Bökönyi to explain the high frequency of cattle in sites located in the Great Hungarian plain (Bökönyi 1974). Bökönyi argued that the Neolithic people of these regions invested in the keeping and breeding of cattle (and pigs), which would have produced larger quantities of meat than caprines. This would have been required to meet the demands of an ever-growing population. If we accept Bökönyi's argument, then it would be normal to assume that meat in northern Balkan Late Neolithic communities was consumed on a more frequent basis than Greek Late Neolithic communities as implied by Halstead (*cf.* Halstead 2005; 2007; Halstead and Isaakidou 2013). This, ultimately, leads us to think that animals in northern Balkan regions (Bulgaria and mainly Serbia) were not subordinate to crops as it may have been the case in southern Balkan regions (Greece).



N.	Site	Country	Cultural sequence	NISP	Sources
1	Anza IV	F.Y.R.O.M.	Vinča B	2914	Bökönyi (1976)
2	Azmaschka LN	Bulgaria	Karanovo IV	1337	Kostov (2006)
3	Divostin II	Serbia	Vinča D	9080	Bökönyi (1988)
4	Ezero LN-EBA	Bulgaria	Karanovo V-VI	n.a.	Frequencies cited in: Iliev and Spassov (2007)
5	Goliamo Delchevo FN	Bulgaria	Karanovo V-VI	n.a.	Frequencies cited in: Iliev and Spassov (2007)
6	Gomolava LN	Serbia	Vinča	1714	Orton (pers. comm.)
7	Harmanli LN	Bulgaria	Karanovo IV	643	Bacvarov et al. (2010)
8	Malo Pole LN	Bulgaria	Karanovo III	n.a.	Frequencies cited in: Iliev and Spassov (2007)
9	Opovo LN	Serbia	Vinča	5756	Russel (1993)
10	Ovcharovo LN	Bulgaria	Karanovo II	n.a.	Frequencies cited in: Iliev and Spassov (2007)
11	Petnica LN	Serbia	Vinča	2027	Orton (pers. comm.)
12	Sarnevo LN	Bulgaria	Karanovo III	1902	Gorczyk (2013)
13	Vinitsa FN	Bulgaria	KaranovoV- VI	n.a.	Frequencies cited in: Iliev and Spassov (2007)
14	Yasatepe LN	Bulgaria	Karanovo II-III	n.a.	Frequencies cited in: Iliev and Spassov (2007)

Figure 6.4: Corpus of Late and Final Neolithic settlements from the Balkan regions. Data in Table 6.4.

What can be inferred from both tripolar diagrams is that Promachon seems to have characteristics that are intermediate between the Aegean and Balkan Late and Final Neolithic communities. It is likely that Promachon was equally linked to Balkan and Aegean traditions. Cattle at Promachon are represented with the highest frequency than any other settlement in Macedonia, Thessaly or Thrace - as illustrated in ***Figure 6.3*** - apart from Pigi Athinas, which has similar values (Cantuel 2014).

One could argue that the high frequency of cattle remains at Promachon could be the result of fragmentation bias, since the large cattle bones are likely to have been more fragmented than the bones of small animals such as caprines and pigs. However, as previously argued, the quantification system used for this research reduced the effects of fragmentation bias, since only certain, key-parts of the skeleton were recorded, thus preventing any bones from being counted twice. In any case, the frequency of fragmentation on cattle bones is close to that of caprines (98% for cattle and 97% for caprines).

It has been previously argued that the extent of recovery bias at Promachon might have significantly affected the formation of the faunal assemblage. It can be therefore suggested, that the high frequency of cattle bones might be due to a particularly poor level of recovery. However, recovery bias would have also affected most of the other assemblages, perhaps even more than at Promachon, where the use of a diagnostic zone approach to quantifications certainly reduced the effect of such bias. It can therefore not be the explanation for the high representation of cattle at Promachon. The environmental conditions in Promachon, the woodland environment, the strong vegetation cover, the slighter colder climatic conditions than other areas of Macedonia, could have significantly favoured the presence of a large number of cattle. The environmental conditions of the area probably played a significant role in the decision of the Neolithic people of Promachon to focus on cattle breeding.

The link of Promachon with the Balkan area is confirmed by evidence beyond that of animal economy and agriculture. Pottery decoration at Promachon (see also ***2.5 – Material culture evidence***) is typical for contemporary settlements from Bulgaria and Serbia. For instance, Gradešnica as well as Marica incised decoration (Perniceva 1995; Vajsov 2007), along with bitumen type of decoration[24], and channeling type decoration[25], are found in the deposits of all habitation levels at Promachon. On the other hand, pit-houses [see also ***2.3.1 – Phase I (Layers 7-11)***], which are present during the first phase of occupation at Promachon, are the typical structural features of northern Balkan (Bulgarian and Serbian) sites, in which, cattle plays a dominant role.

It can be argued therefore, that the high frequency of cattle remains, combined with the evidence from the ceramic repertoire as well as the evidence from the structural features, imply that the settlement of Promachon might had been culturally linked to Late and Final Neolithic communities from the northern regions of the Balkan Peninsula. This does not necessarily imply that Promachon was not culturally linked to northern Greek Late Neolithic communities as well. As far as the form of the chosen subsistence economy in Promachon is concerned, this was most likely to have been dictated by both environmental conditions and cultural ties that they shared with nearby Late Neolithic communities.

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[24] Not an actual decoration, rather a gluing agent, upon which decorative elements from wood (mainly birch bark) were glued, typical of the Vinča-Turdaş period (Vajsov 2007).

[25] Typical of the Late Neolithic cultures of Hotnica and Podgorica in northern Bulgaria, Karanovo IV-Kalojanovec in Bulgarian Thrace and Vinča B_2 in Serbia (Vajsov 2007)

Table 6.2: Frequency of Caprinae (caprine) vs. *Cervus elaphus* (red deer) from various Late Neolithic sites in Macedonia. Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 6.2. *NISP* counts.

Sites	Caprinae		Cervus elaphus		*TOTAL NISP*
	NISP	*%NISP*	*NISP*	*%NISP*	
Kryoneri LN	*179*	*85%*	*32*	*15%*	*211*
Dimitra II-III	*874*	*98%*	*18*	*2%*	*892*
Aggitis east bank LN	*191*	*83%*	*40*	*17%*	*231*
Stavroupoli I-II	*5082*	*95%*	*240*	*5%*	*5322*
Sitagroi I-II-III	*10043*	*94%*	*623*	*6%*	*10666*
Paradisos LN	*794*	*94%*	*51*	*6%*	*845*
Megalo Nisi LN/FN	*1706*	*96%*	*65*	*4%*	*1771*
Promachon LN	*3097*	*96%*	*113*	*4%*	*3210*

Table 6.3: Corpus of Late and Final Neolithic settlements from northern Greece (Macedonia, Thrace, Thessaly). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 6.3.

Site	**Bos taurus**		**Caprinae**		**Sus**		***TOTAL NISP***	***Sources***
	NISP	***%NISP***	***NISP***	***%NISP***	***NISP***	***%NISP***		
Aggitis, east bank LN	*9*	*4%*	*191*	*83%*	*29*	*13%*	229	*Trantalidou et al. (2006)*
Ayia Sofia LN	*463*	*14%*	*1436*	*43%*	*1470*	*43%*	3369	*Driesch and Enderle (1976)*
Dimini LN	*224*	*12%*	*1237*	*67%*	*399*	*21%*	1860	*Halstead (1992)*
Dimitra II-III	*169*	*12%*	*874*	*60%*	*407*	*28%*	1450	*Yiannouli (1994; 1997)*
Kastri LN	*-*	*10%*	*-*	*78%*	*-*	*12%*	-	*Only frequencies cited in Halstead (1996)*
Kryoneri LN	*64*	*20%*	*179*	*50%*	*106*	*30%*	349	*Mylona (1997)*
Makri I-II	*78*	*17%*	*329*	*73%*	*41*	*10%*	448	*Curci and Tagliacozzo (2006)*
Makriyalos I	*6508*	*30%*	*8054*	*37%*	*7190*	*33%*	21752	*Halstead (pers. comm.)*
Megalo Nisi LN-FN	*500*	*19%*	*1706*	*64%*	*466*	*17%*	2672	*Greenfield and Fowler (2005)*
Paradisos LN	*346*	*24%*	*803*	*56%*	*294*	*20%*	1443	*Larje (1987)*
Pevkakia LN	*69*	*14%*	*305*	*61%*	*126*	*25%*	500	*Jordan (1975)*
Pigi athinas LN	*590*	*41%*	*621*	*43%*	*217*	*16%*	1428	*Cantuel (2014)*
Sitagroi I-II-III	*5583*	*30%*	*10043*	*51%*	*3555*	*18%*	19181	*Bökönyi (1986)*
Stavroupoli I-II	*2788*	*29%*	*5082*	*54%*	*1607*	*17%*	9477	*Yiannouli (2002a; 2004)*
Thermi B	*276*	*20%*	*741*	*51%*	*416*	*29%*	1433	*Yiannouli (1989)*
Vasilika C	*235*	*15%*	*758*	*45%*	*657*	*40%*	1650	*Yiannouli (1994)*
Zarko LN	*198*	*19%*	*673*	*64%*	*182*	*17%*	1053	*Becker (1991)*

Table 6.4: Corpus of Late and Final Neolithic settlements from the Balkan regions (Bulgaria, Serbia and FYROM). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Figure 6.4.

Site	**Bos taurus**		**Caprinae**		**Sus**		***TOTAL NISP***	***Sources***
	NISP	***%NISP***	***NISP***	***%NISP***	***NISP***	***%NISP***		
Anza IV	*496*	*17%*	*2067*	*71%*	*351*	*12%*	*2914*	*Bökönyi 1976*
Azmaschka LN	*893*	*67%*	*295*	*22%*	*149*	*11%*	*1337*	*Kostov 2006*
Divostin II	*6763*	*74%*	*1089*	*14%*	*1228*	*12%*	*9080*	*Bökönyi 1988*
Ezero LN-EBA	-	*40%*	-	*35%*	-	*25%*	-	*Only frequencies cited in Iliev and Spassov (2007)*
Goliamo Delchevo FN	-	*30%*	-	*29%*	-	*41%*	-	*Only frequencies cited in Iliev and Spassov (2007)*
Gomolava LN	*1453*	*85%*	*55*	*3%*	*206*	*12%*	*1714*	*Orton pers. comm.*
Harmanli LN	*381*	*60%*	*138*	*21%*	*124*	*19%*	*643*	*Bacvarov et al 2010*
Malo Pole LN	-	*57%*	-	*31%*	-	*12%*	-	*Only frequencies cited in Iliev and Spassov (2007)*
Opovo LN	*2955*	*51%*	*432*	*8%*	*2369*	*41%*	*5756*	*Russel 1993*
Ovcharovo LN	-	*37%*	-	*27%*	-	*36%*	-	*Only frequencies cited in Iliev and Spassov (2007)*
Petnica LN	*1324*	*65%*	*332*	*17%*	*371*	*18%*	*2027*	*Orton pers. comm.*
Sarnevo LN	*991*	*52%*	*680*	*36%*	*231*	*12%*	*1902*	*Gorczyk 2013*
Vinitsa FN	-	*41%*	-	*28%*	-	*31%*	-	*Only frequencies cited in Iliev and Spassov (2007)*
Yasatepe LN	-	*50%*	-	*33%*	-	*17%*	-	*Only frequencies cited in Iliev and Spassov (2007)*

6.3 – Age-at-death

Age-at-death data for cattle, caprines and pigs from sites contemporary to Promachon Bulgarian are extremely scarce. On the other hand, available age-at-death data from Serbian sites could be obtained mainly through Greenfield's work (1986). However, these were not used for any comparisons with Promachon, mainly due to extremely small sample sizes.

This part of the analysis is therefore limited to comparisons of the age-at-death data for cattle, caprines and pigs between Promachon and other contemporary sites from Macedonia in Greece. However, these comparisons were not always straightforward. The main problem encountered, was the incompatibility with regard to the methodological protocols that were employed by various researchers for the assessment of the age-at-death of the main domesticates. However, there were a number of other problems as well as biases. These will be further assessed for each species separately, as we proceed with our analysis.

6.3.1 – **Bos taurus** *age-at-death*

The information on the age-at-death of cattle populations from a number of Late Neolithic sites in Macedonia is rather scarce. This is mainly due to the species' small sample size, since caprines and pigs significantly outnumber cattle in most Macedonian sites. As a result, zooarchaeologists working on Late Neolithic faunal assemblages from Macedonia provide a very crude and brief outline of cattle age-at-death, based solely on the fusion of postcranial bones. However, these results have limitations, since we can estimate the age of an animal before it is fully mature (following fusion data from Silver 1969), *i.e.* before the bones are fully fused; after the bones are fully fused, we can estimate the age only by tooth wear stages. Obviously, the estimation of the age-at-death by means of the fusion data alone poses additional limitations, since postcranial elements are subject to a number of post-depositional modifications (fragmentation, carnivore attrition, retrieval biases, *etc.*), which, have already been discussed. In some cases, however, the fusion data is corroborated by information regarding the presence (or the absence) of loose deciduous teeth.

With these *caveats* in mind, age-at-death data from a number of Macedonian sites contemporary to Promachon (*e.g.* Dimitra, Kryoneri, Sitagroi, Stavroupoli, Thermi) suggest a considerable variation regarding the exploitation of cattle. For instance, mortality profiles from the nearby sites of Dimitra (Yiannouli 1997) and Kryoneri (Mylona 1997) indicate an exploitation of cattle predominantly tuned to the production of meat. The ageing data suggest that the majority of the cattle population in Dimitra did not survive over the age of 3-3½ years, since most of the culling took place between the ages of two and three. In addition, Yiannouli (1997) reports that only one individual from Dimitra was less than 18 months old. The pattern, thus, is not consistent with the exploitation of cattle for milk. Likewise, age-at-death data from Kryoneri suggest that cattle - younger than the age of three - were completely absent in the faunal assemblage. The results, however, should be approached with extreme caution since they are based solely on the stage of fusion of postcranial bones: as already discussed, immature unfused bones are subject to severe fragmentation and/or obliteration by scavenger activity.

Unlike Dimitra and Kryoneri, cattle ageing data from Sitagroi (Bökönyi 1986), Stavroupoli (Yiannouli 2002a;) and Thermi (Yiannouli 1989) are interpreted to reflect for the use of secondary products. The Late Neolithic deposits of Sitagroi and Stavroupoli yielded large samples of cattle mandibles. However, only in the case of Sitagroi we have sufficient information on the frequencies of different age stages (***Figure 6.5***; ***Table 6.5***).

There is, however, one issue that should be considered in the case of the age-at-death data of cattle from Sitagroi. The age stages that Bökönyi (1986) uses (‘Neonate’, ‘Juvenile’, ‘Sub adult’, ‘Adult’, ‘Mature/Senile’) belong to a method that has been defined (and possibly used only) by him [this method was published in a 1963 paper (Bökönyi 1970), however this was difficult to be tracked down]. The same problem, in fact, applies to caprines and pigs. This obviously creates a problem of compatibility for any attempted comparisons of the age-at-death of the domestic species between the two sites, since Bökönyi does not state the level of eruption and wear of teeth for each of the age stages that he uses. Nevertheless, comparisons between the two assemblages (Promachon and Sitagroi) are attempted in this chapter, but it is important to consider that the age stages used for the two sites are only roughly comparable.

The bulk of the cattle population at Sitagroi was killed at the ‘Adult’ stage (57%), whereas at Promachon the frequency of adult individuals is 22%. This indicates that cattle from Sitagroi exhibit a slightly older age profile than those from Promachon. Of additional interest, is the fact that ‘Neonate’ and ‘Mature/Senile’ individuals are very scarce at Sitagroi, similarly to Promachon. According to Bökönyi (1986), cattle mortality profiles at Sitagroi suggest that the species was used mainly for meat. However, he also argues that a diversified strategy for milk (presence of ‘Juvenile’ and ‘Adult’ individuals) cannot be excluded. On the other hand, a zoomorphic clay figurine (probably cattle; Bailey 2000; Theocharis 1973) provides corroborating evidence for the use of cattle as pack animal at the Late Neolithic Sitagroi. Its presence, led Bökönyi to speculate that this was evidence for the use of cattle for traction as well. Nevertheless, pack animals are not the same as draught animals, and in any case, Bökönyi does not mention the presence of pathological conditions on cattle lower limbs, which may be associated with heavy stress, such as that involved in pulling an ard or a plough.

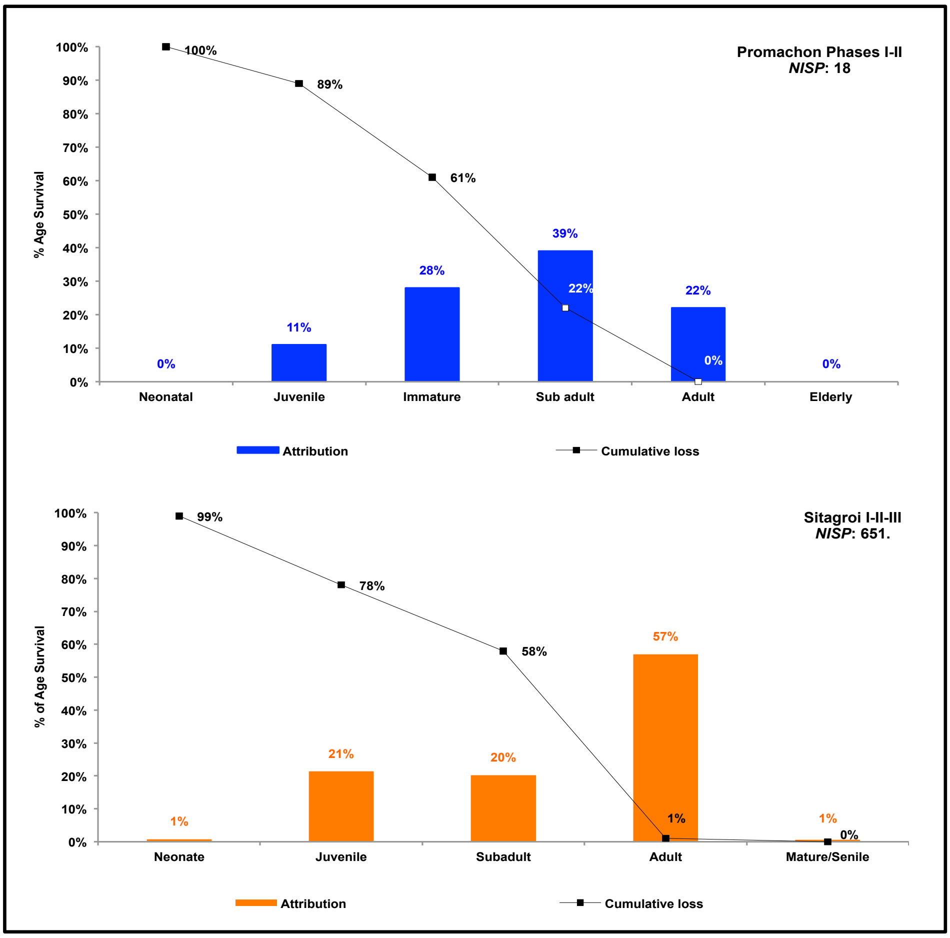

Figure 6.5: Promachon LN vs. Sitagroi LN (Bökönyi 1986). *Bos taurus* (cattle) kill-off patterns from mandibular wear stages. Data for Sitagroi in Table 6.5. *NISP* counts.

On the other hand, mandible wear data from Stavroupoli are consistent with those from Promachon, since almost half of the cattle population was slaughtered between 1-3 years, indicating exploitation for meat. In addition, almost 8% of the cattle population was slaughtered before the first year, indicating - according to Yiannouli (2002a) - exploitation for milk. Cattle mortality profiles are conspicuously absent from the original faunal report on Thermi (Yiannouli 1989); the author however, suggests an exploitation of cattle for meat and milk.

All in all, the evidence from Macedonia indicates little evidence for specialization in terms of products and uses. At several sites the emphasis seems to have been on meat production, but is also compatible with the additional exploitation of secondary products (milk).

6.3.2 – Caprinae *age-at-death*

Only in the case of Sitagroi (Bökönyi 1986) we have sufficient information regarding the age-at-death of sheep and goat respectively. On the other hand, the analyses of the caprine wear data from other Macedonian sites, contemporary to Promachon, such as Dimitra (Yiannouli 1997) and Thermi (Yiannouli 1989) combine the overall caprine assemblage (sheep, goat, sheep/goat), without exploring whether the two species were subject to different exploitation strategies.

Wear data of the caprine population from Promachon are more similar to those of Dimitra than Thermi (***Figure 6.6***; ***Tables 6.6-6.7***). As in the case of Promachon, an almost even distribution of wear stages can be detected at Dimitra. Almost 41% of the caprine population were killed-off between their first and fourth year (wear stages D, E, F) suggesting exploitation for meat. In addition, 32% of the individuals were killed between their fourth and tenth year (wear stages G, H, I). This according to Yiannouli (1997) indicates that - in addition to breeding - a number of caprines were also kept for milk and also fleece. Of interest is the fact that age-at-death data from Dimitra suggests a younger age profile than Promachon, since 9% of the caprine population was slaughtered between 2-6 months (wear stage B). In overall, almost 27% of caprines were killed before the first year (wear stages A, B and C) suggesting that caprines were also exploited for milk (Yiannouli 1997).

Unlike Promachon and Dimitra, caprine wear data from Thermi indicate two mortality peaks: one at stage D (1-2 years; 23%) and a more prominent one at stage G (4-6 years; 30%). Yiannouli (1989) suggests that caprines at Thermi were most probably exploited for meat and fleece; on the other hand, there seems to be an absence of very young individuals (wear stages A and B; 0-2 months and 2-6 months respectively; 0% in total) as in the case of Promachon. However, since the author does not assess the effect of recovery bias, we cannot be entirely confident whether the dearth of very young individuals represents a ‘genuine’ pattern. In any case, Yiannouli argues that a small-scale exploitation of caprines for milk is not entirely unlikely.

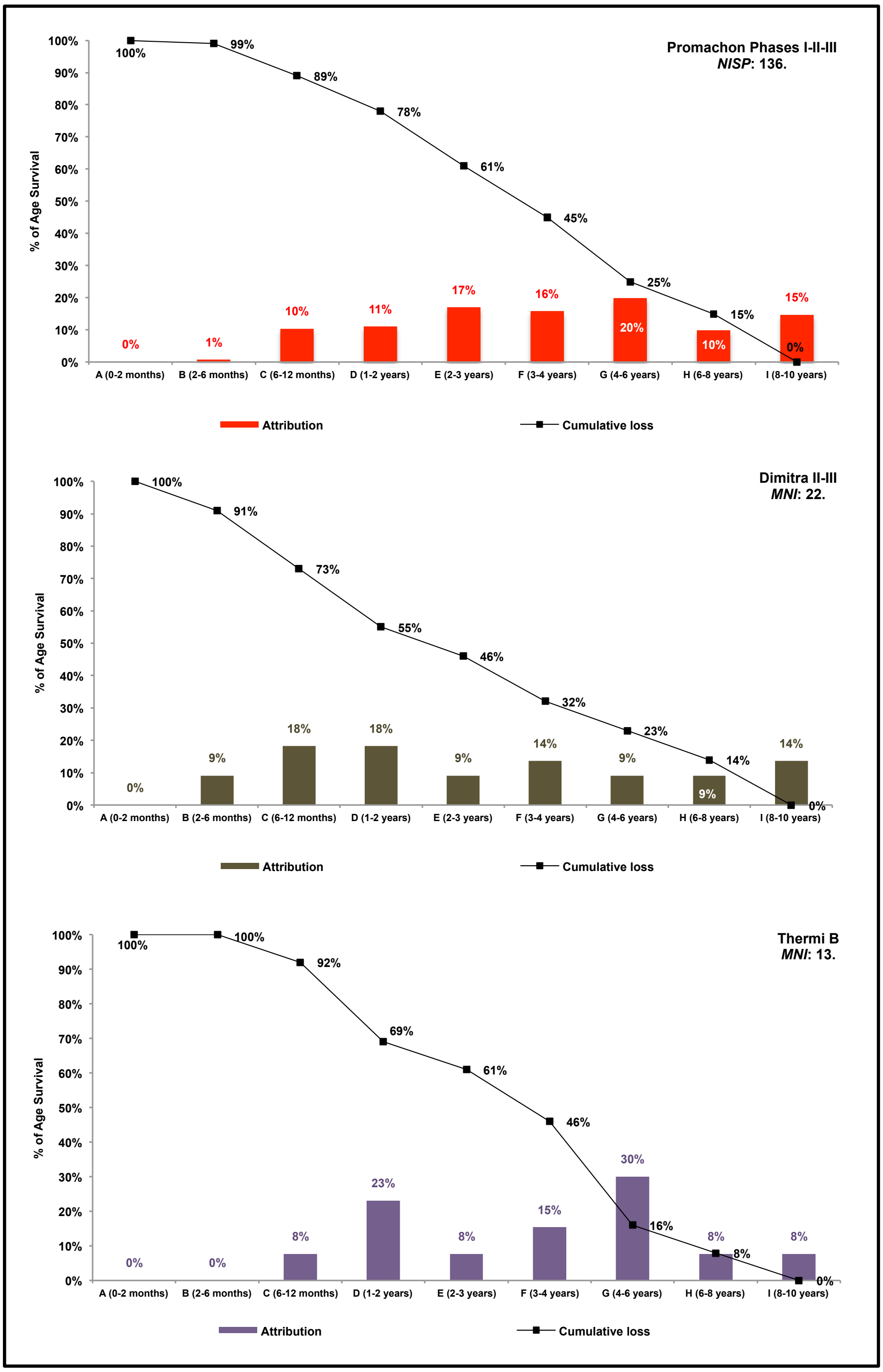

Figure 6.6: Promachon LN *vs.* Dimitra LN (Yiannouli 1997) and Thermi B (LN; Yiannouli 1989); Caprinae (caprines) kill-off patterns from mandibular wear stages, following Payne (1973). Caprinae subfamily includes *Ovis/Capra* (sheep/goat), *Ovis aries* (sheep) and *Capra hircus* (goat). Data for Dimitra and Thermi in Tables 6.6-6.7.

The age stages used by Bökönyi (1986) for the assessment of the age-at-death of sheep and goats from Sitagroi are the same as in the case of the cattle example (see also ***6.3.1* – Bos taurus *age-at-death***). An additional problem in the case of caprines, however, is represented by the fact that the age stages that we use in our caprine assemblage (following Payne 1973) are more numerous than those created by Bökönyi in his study of Sitagroi. Nevertheless, in the comparison of the mortality profiles for sheep and goats between the two sites, an attempt has been made to find equivalence between Payne's (1973) and Bökönyi's (1986) age stages.

The age-at-death data based on the sheep mandibles from Sitagroi (Bökönyi 1986; ***Figure 6.7***; ***Table 6.8***) indicate a much younger age profile compared to Promachon. In Sitagroi, the sheep population did not survive beyond Bökönyi's 'Adult stage'; on the contrary, almost 45% of individuals in Promachon survived beyond their fourth year [stages G-H-I (4-10 years) *sensu* Payne (1973)]. About 48% of the individuals at Sitagroi were killed at 'Juvenile-Sub adult stages' [roughly equivalent to stages C-D (6 months-2 years; 26% in Promachon) *sensu* Payne (1973)], which is consistent with the exploitation for milk and mainly meat. In addition, about 52% of the sheep population at Sitagroi was killed at 'Adult stage' [roughly equivalent to stage E-F (2-4 years; 27%) *sensu* Payne (1973)] which, according to Bökönyi (1986) indicates the exploitation of sheep for secondary products, such as milk and fleece. This interpretation is, however, questionable, as one should expect a greater proportion of adults, and at least some elderly individuals, if the emphasis were on secondary products. Overall, the caprine kill-off pattern from Sitagroi seems to be mainly consistent with an emphasis on meat production.

Of interest is the fact that neonate sheep are missing from Sitagroi; this is consistent also with the information from the sheep assemblage from Promachon [absence of individuals belonging to stage A (0-2 months *sensu* Payne 1973)]. One could argue that the absence of neonate sheep from Sitagroi could be the effect of recovery bias since unworn teeth are most likely to fall out off the young sheep mandibles, which are particularly affected by fragmentation. However, the presence of neonate goats does not support this hypothesis and we can therefore assume that the pattern for sheep is indicating a 'genuine' dearth of 'Neonatal' individuals.

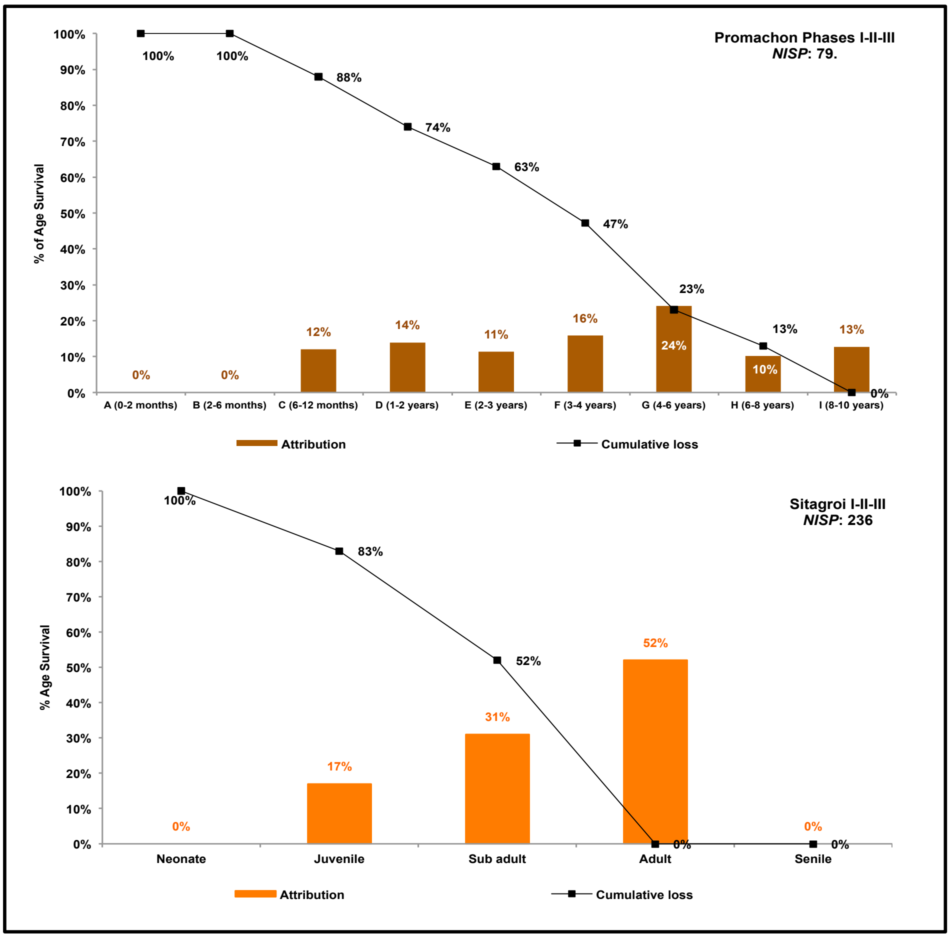

Figure 6.7: Promachon LN *vs.* Sitagroi LN (Bökönyi 1986); *Ovis aries* (sheep) kill-off patterns from mandibular wear stages. Data for Sitagroi in Table 6.8. *NISP* counts.

Figure 6.8 (***Table 6.9***) provides age data for goat mandibles from Sitagroi. As for sheep, goats at Sitagroi present a much younger age profile than those from Promachon. Almost 10% of the goats from Sitagroi were killed at the stage of 'Neonate' [roughly equivalent to stage A (0-2 months; 0% in Promachon) *sensu* Payne (1973)]. In addition, almost 45% of goats from Sitagroi were killed at the stage of 'Juvenile-Sub adult', [roughly equivalent to stages C-D (6 months-2 years; 4% in Promachon) *sensu* Payne (1973)], probably indicating the exploitation of these animals for meat (Bökönyi 1986).

About 45% of goats from Sitagroi were killed at the stage of ‘Adult’ [roughly equivalent to stages E-F (2-4 years; 55% in Promachon) *sensu* Payne (1973)]; this part of the population, combined with ‘Neonate’ individuals, may indicate the exploitation of goats for milk. Unlike sheep, Bökönyi argues against the use of ‘Adult’ goats for fleece, since the sample size of goat mandibles with recordable wear is small for any definite conclusions. ‘Senile’ goats [roughly equivalent to stages G-H-I (4-10 years) *sensu* Payne (1973)] are completely missing from Sitagroi (0%); they are however represented in Promachon with a high frequency (41%), which supports Bökönyi’s view that fleece production was not a major concern in goat breeding.

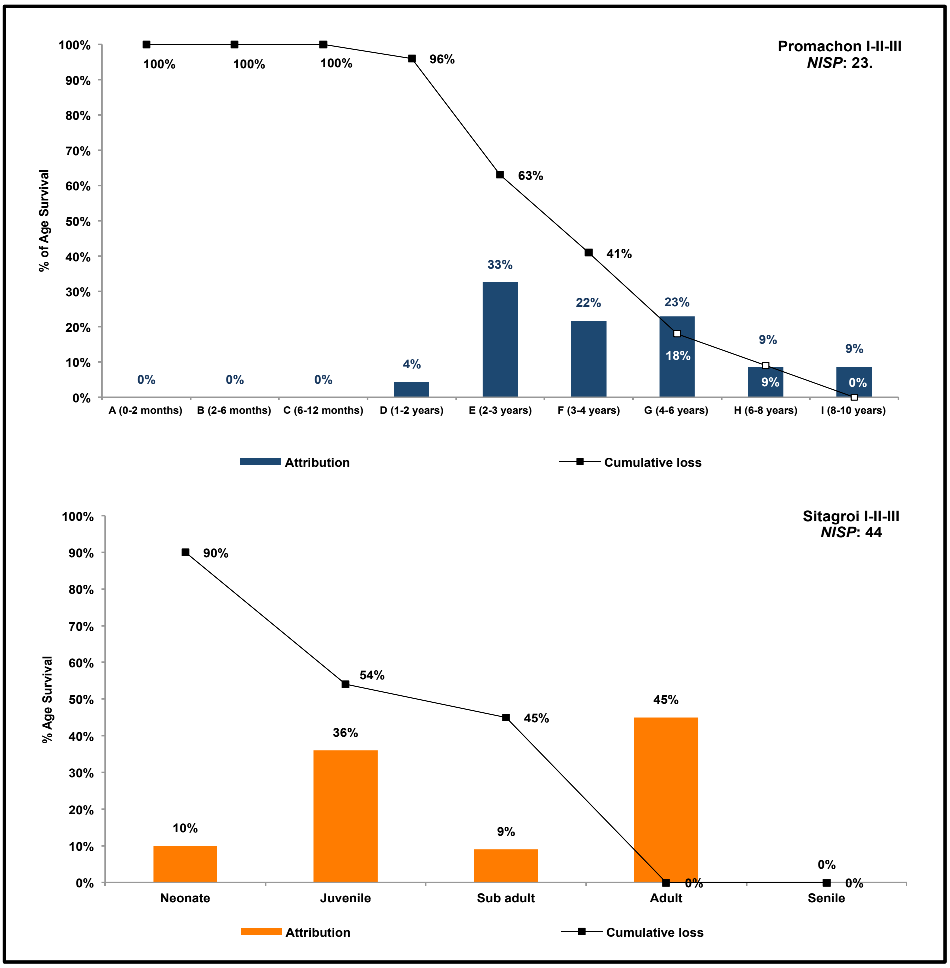

Figure 6.8: Promachon LN vs. Sitagroi LN (Bökönyi 1986); *Capra hircus* (goat) kill-off patterns from mandibular wear stages. Data for Sitagroi in Table 6.9. *NISP* counts.

As in the case of cattle, caprine ageing data from several sites in Macedonia indicate an emphasis on meat production. However, in almost all sites, caprine age-at-death data have also been interpreted to reflect for the use of secondary products, such as milk and fleece. In general, faunal researchers working in Late Neolithic faunal assemblages from northern Greece suggest the exploitation of caprines for secondary products: this is mainly due to the fact that milk and fleece have been considered by faunal researchers as the products with which, the Neolithic people would ‘balance’ the loss from the small quantities of caprine meat (in comparison to that of cattle and pigs) (Trantalidou 1990).

On one hand, the evidence for the use of milk in Greek Macedonia has been attested through residue analyses of ceramic vessels from Stavroupoli (Evershed *et al.* 2008). On the other hand, the arguments for the use of caprine fleece heavily rely on a combination of evidence, between the high mortality of ‘elderly’ individuals, and the presence of clay spindle whorls, loom weights and bone needles with eyes, which appear in high quantities in various sites from Greek Macedonia during the late stage of the Neolithic; however, the presence of ‘elderly’ individuals does not necessarily indicate that these animals were kept for their fleece (these individuals might have been used for breeding and milking), and certainly, the latter material culture objects do not necessarily indicate the use of animal fibres (see also ***5.7.2*** **Caprinae *age-at-death***).

6.3.3 – Sus *age-at-death*

The practice of killing off pigs at a young age has been observed at other sites from Greek Macedonia, contemporary to Promachon. This is not unusual, as pigs have been reared for meat since they were first domesticated and this kind of exploitation has never changed (Albarella *et al.* 1997). Age at death data for pigs from Sitagroi (Bökönyi 1986; ***Figure 6.9***; ***Table 6.10***), exhibits a striking similarity with that from Promachon and demonstrates that the overwhelming majority of pigs were killed before reaching the end of their second year in absolute age.

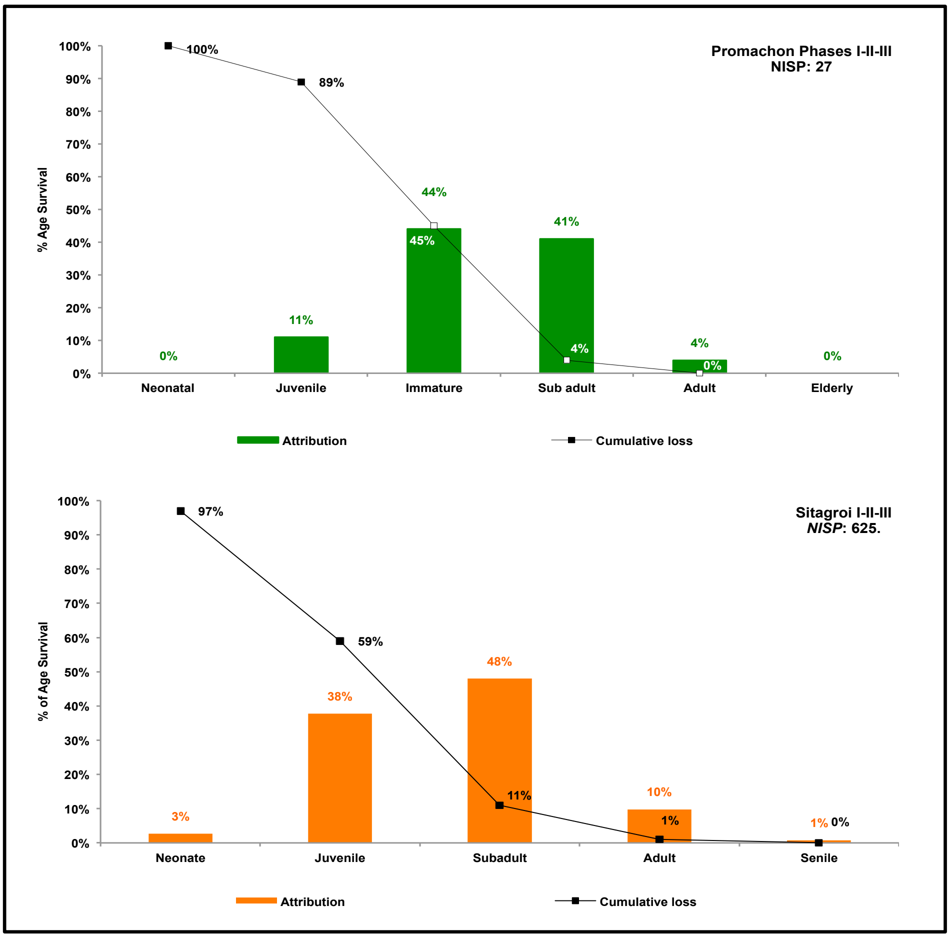

Figure 6.9: Promachon LN vs. Sitagroi LN (Bökönyi 1986); *Sus* (pig) kill-off patterns from mandibular wear stages. Data for Sitagroi in Table 6.10. *NISP* counts.

Yiannouli (1989; 1997) argues that the assessment of the age-at-death of the domestic pigs from Dimitra and Thermi was based on Bull and Payne's (1982) age stages for pigs. However, the age stages that she provides in her faunal reports from both sites are not the ones that Bull and Payne (1982) have defined. In view of this inconsistency, therefore, we have to be cautious with our interpretations. At Dimitra (Yiannouli 1997) and Thermi (Yiannouli 1989) (***Figure 6.10***; ***Tables 6.11-6.12***), almost all age stages are well represented; in Promachon however, the bulk of the pig population was killed at the stages of 'immature' and 'sub adult', which are roughly equivalent to the first and the second year. In addition, unlike Promachon, almost 6% of the pigs from Dimitra and 7% of the pigs from Thermi survived beyond the end of the third year, possibly reflecting the practice of keeping a number of elderly female pigs for breeding (Yiannouli 1989; 1997). On the other hand, the discussion with regard to the exploitation of very young pigs between Promachon, Thermi and Dimitra would be problematic. This is because Yiannouli does not mention the extent of recovery bias in these sites and also because we do not have information about the proportion of neonatal individuals from Thermi and Dimitra, since these might be possibly included in the '0-6 month' stage. All in all, Yiannouli argues that pigs in these sites were used for meat; in addition a number of older female pigs might have been possibly kept for breeding.

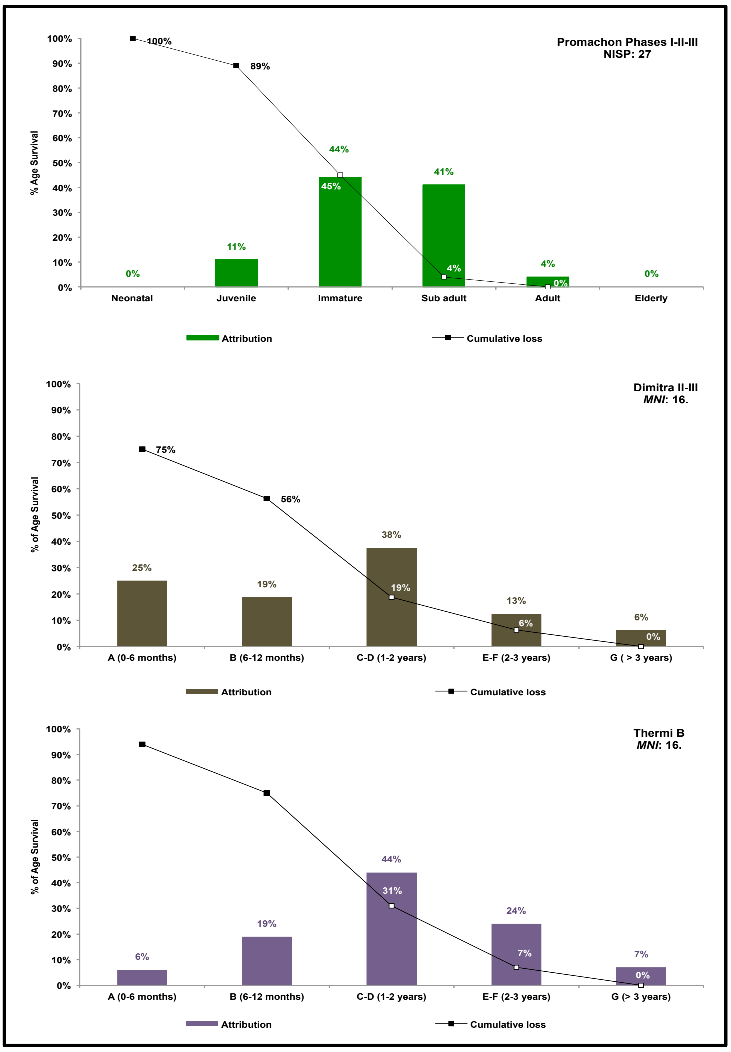

Figure 6.10: Promachon vs. Dimitra LN (Yiannouli 1997) and Thermi LN (Yiannouli 1989); *Sus* (pig) kill-off patterns from mandibular wear stages. Wear stages C and D as well as E and F were integrated for ease of comparison with O' Connor's (1982) wear data used in Promachon's pig assemblage. Data for Dimitra and Thermi in Tables 6.11-6.12.

Table 6.5: Sitagroi I-II-III (LN; Bökönyi 1986): percentage of attribution of mandibular wear stage data for *Bos taurus* (cattle). Data for Figure 6.5. *NISP* counts.

Bos taurus	*Sitagroi I-II-III (LN; Bökönyi 1986)*		
	NISP	*% Attribution*	*% Cumulative loss*
Neonatal	*5*	*1%*	*99%*
Juvenile	*139*	*21%*	*78%*
Sub adult	*132*	*20%*	*58%*
Adult	*371*	*57%*	*1%*
Elderly	*4*	*1%*	*0%*
TOTAL	***651***	*100%*	

Table 6.6: Dimitra II-III (LN; Yiannouli 1997): percentage of attribution of mandibular wear stage data for Caprinae (caprines). Data for Figure 6.6. *MNI* counts.

Caprinae	*Dimitra II-III (MN-FN; Yiannouli 1997)*		
	MNI	*% Attribution*	*% Cumulative loss*
A (0-2 months)	*0*	*0%*	*100%*
B (2-6 months)	*2*	*9%*	*91%*
C (6-12 months)	*4*	*18%*	*73%*
D (1-2 years)	*4*	*18%*	*55%*
E (2-3 years)	*2*	*9%*	*46%*
F (3-4 years)	*3*	*14%*	*32%*
G (4-6 years)	*2*	*9%*	*23%*
H (6-8 years)	*2*	*9%*	*14%*
I (8-10 years)	*3*	*14%*	*0%*
TOTAL	***22***	*100%*	

Table 6.7: Thermi B (LN; Yiannouli 1989): percentage of attribution of mandibular wear stage data for Caprinae (caprines). Data for Figure 6.6. *MNI* counts.

Caprinae	*Thermi B (LN; Yiannouli 1989)*		
	MNI	*% Attribution*	*% Cumulative loss*
A (0-2 months)		*0%*	*100%*
B (2-6 months)		*0%*	*100%*
C (6-12 months)	*1*	*8%*	*92%*
D (1-2 years)	*3*	*23%*	*69%*
E (2-3 years)	*1*	*8%*	*61%*
F (3-4 years)	*2*	*15%*	*46%*
G (4-6 years)	*4*	*30%*	*16%*
H (6-8 years)	*1*	*8%*	*8%*
I (8-10 years)	*1*	*8%*	*0%*
TOTAL	***13***	***100%***	

Table 6.8: Sitagroi I-II-III (LN; Bökönyi 1986): percentage of attribution of mandibular wear stage data for *Ovis aries* (sheep). Data for Figure 6.7. *NISP* counts.

Ovis aries	*Sitagroi I-II-III (LN; Bökönyi 1986)*		
	NISP	*% Attribution*	*% Cumulative loss*
Neonatal		*0%*	*100%*
Juvenile	*36*	*15%*	*85%*
Sub adult	*73*	*31%*	*54%*
Adult	*125*	*53%*	*1%*
Elderly	*2*	*1%*	*0%*
TOTAL	***236***	***100%***	

Table 6.9: Sitagroi I-II-III (LN; Bökönyi 1986): percentage of attribution of mandibular wear stage data for *Capra hircus* (goat). Data for Figure 6.8. *NISP* counts.

Capra hircus	*Sitagroi I-II-III (LN; Bökönyi 1986)*		
	NISP	*% Attribution*	*% Cumulative loss*
Neonatal	*1*	*2%*	*98%*
Juvenile	*7*	*16%*	*82%*
Sub adult	*12*	*27%*	*55%*
Adult	*24*	*55%*	*0%*
Elderly		*0%*	*0%*
TOTAL	***44***	***100%***	

Table 6.10: Sitagroi I-II-III (LN; Bökönyi 1986): percentage of attribution of mandibular wear stage data for *Sus* (pig). Data for Figure 6.9. *NISP* counts.

Sus	*Sitagroi I-II-III (LN; Bökönyi 1986)*		
	NISP	*% Attribution*	*% Cumulative loss*
Neonatal	*17*	*3%*	*97%*
Juvenile	*236*	*38%*	*59%*
Sub adult	*306*	*48%*	*11%*
Adult	*61*	*10%*	*1%*
Elderly	*5*	*1%*	*0%*
TOTAL	***625***	***100%***	

Table 6.11: Dimitra II-III (LN; Yiannouli 1997): percentage of attribution of mandibular wear stage data for *Sus domesticus* (pig). Data for Figure 6.10. *MNI* counts.

Sus	*Dimitra II-III (LN; Yiannouli 1997)*		
	NISP	*% Attribution*	*% Cumulative loss*
A (0-6 months)	*4*	*25%*	*75%*
B (6-12 months)	*3*	*19%*	*56%*
C-D (1-2 years)	*6*	*38%*	*19%*
E-F (2-3 years)	*2*	*13%*	*6%*
G (> 3 years)	*1*	*6%*	*0%*
TOTAL	***16***	***100%***	

Table 6.12: Thermi B (LN; Yiannouli 1989): percentage of attribution of mandibular wear stage data for *Sus domesticus* (pig). Data for Figure 6.10. *MNI* counts.

Sus	*Thermi B (LN; Yiannouli 1989)*		
	NISP	*% Attribution*	*% Cumulative loss*
A (0-6 months)	*1*	*6%*	*94%*
B (6-12 months)	*3*	*19%*	*75%*
C-D (1-2 years)	*7*	*44%*	*31%*
E-F (2-3 years)	*4*	*24%*	*7%*
G (> 3 years)	*1*	*7%*	*0%*
TOTAL	***16***	***100%***	

6.4 – Metrical analysis

The purpose of this part of the analysis is to compare the size of the main domesticated species between Promachon and other contemporary sites in Macedonia and Thessaly. In general, size comparisons are usually best interpreted by comparing data from various sites in order to investigate relative differences. Accordingly, measurements from Promachon are plotted on the same graphs with measurements from other sites. In cases in which, sample sizes are too small, we use the scaling index technique (through log ratios) in order to increase the effectiveness of size comparisons.

6.4.1 – **Bos taurus** *size in the wider Late Neolithic context*

Unfortunately, cattle metrical data from Greek Macedonia are scarce. This is mainly a consequence of cattle not being particularly well represented at sites of this time and area. In addition, even when cattle are more abundant, metric data are not commonly reported. Fortunately there is more available evidence from contemporary Thessalian sites, which can also be used for comparison. The problem with these sites is, however, that not always the measurements were comparable with those collected at Promachon.

With these *caveats* in mind, the only sites from Greek Macedonia and Thessaly where a sufficient number of measured cattle bones could be used were Sitagroi (Bökönyi 1986), Makriyalos (Halstead pers. comm.), Ayia Sofia (von den Driesch and Enderle 1976), Pevkakia (Jordan 1975) and Zarkos (Becker 1991; 1999). In all cases, the most numerous measurements that could be used for comparisons were those of the astragalus. In ***Figure 6.11*** we compare the size of cattle astragalus between Promachon and Sitagroi by plotting the greatest length of the lateral half of the astragalus (GLl) against the distal breadth of the astragalus (Bd)[26]. The diagram shows that cattle astragali at Promachon and Sitagroi have similar lengths, but those from Sitagroi have a relatively greater distal breadth (Bd). The distal breadth

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[26] Bökönyi (1986), in his study of the faunal material from Sitagroi, provides only these measurements for the cattle astragalus.

(Bd) is a measure of the width of the joint surface and it is therefore related to the weight-bearing ability of that particular joint. An increased Bd reflects the presence of more robust animals (Johnstone and Albarella 2002).

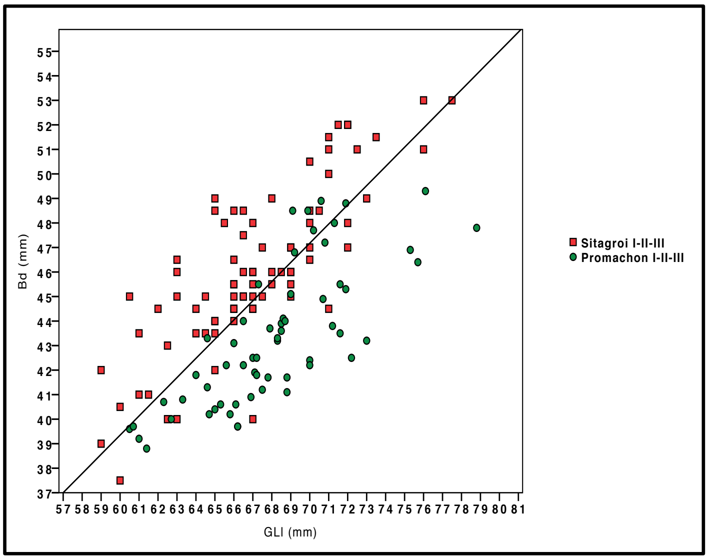

Figure 6.11: ***Bos taurus*** **astragalus; greatest length of the lateral half (GLl in mm) vs. distal breadth (Bd in mm). Comparison between Promachon and Sitagroi.**

In order to statistically test the significance of the difference in the size of the cattle astragalus between the two sites, an *ANOVA* test was also conducted. This indicates that there is no significant difference in the greatest length of the lateral half (GLl) of the astragalus between Promachon and Sitagroi (p= .129) but there is a highly significant difference in the distal breadth (Bd) between the two groups (p= .000). The Sitagroi astragali have a much greater distal breadth (μ= 46 mm) than the Promachon astragali (μ= 43.4 mm).

In order to obtain large enough samples to facilitate cattle size comparisons between Promachon and Sitagroi, log ratios were also calculated. ***Figure 6.12*** shows the log ratio diagrams for all three dimensions (lengths, widths and depths respectively) of cattle postcranial bones from Promachon (top diagrams) and Sitagroi (bottom diagrams) in order to see how different measurements are distributed according to the standard. The standard that we use for the calculation of the log ratio is the mean of the length, width and depth measurements of cattle postcranial bones from Promachon. In terms of absolute size, the log ratio diagrams indicate that cattle bones from Sitagroi were of similar length to cattle bones from Promachon, but they were larger both in the width and the depth measurements. In view of the fact that cattle metapodials are heavily sexually dimorphic [the metacarpals even more so than the metatarsals (Albarella 1997)], and that the log ratio diagrams for the widths and the depths might be affected by the presence of different sexes (males, females and possibly castrates), we recalculated the log ratio for the width and depth measurements, excluding Promachon's metapodial measurements; width measurements of cattle metapodials from Sitagroi were also excluded. The new log ratio diagrams for the width and the depth measurements (***Figure 6.13***) shows - once more - that cattle bones from Sitagroi have a greater width and depth than those from Promachon. It also indicates that the width of the metapodials slightly affected the results of the previous log ratio diagram, since - this time - fewer width measurements from Sitagroi plot on the left side of the standard, while the number of the width measurements plotted on the right side of the standard remains roughly the same. Altogether the log ratio analysis supports the results obtained from analysis of the astragalus, indicating that width and depth measurements at Sitagroi are relatively larger than lengths, in comparison to Promachon.

All in all, the results show that cattle from Sitagroi are more robust than cattle from Promachon. However, before moving to interpretations for the observed trend, we have to compare the size of the other domesticates (caprines and pigs) between the two sites in order to obtain a clearer picture. This will be further discussed in the next parts of this analysis.

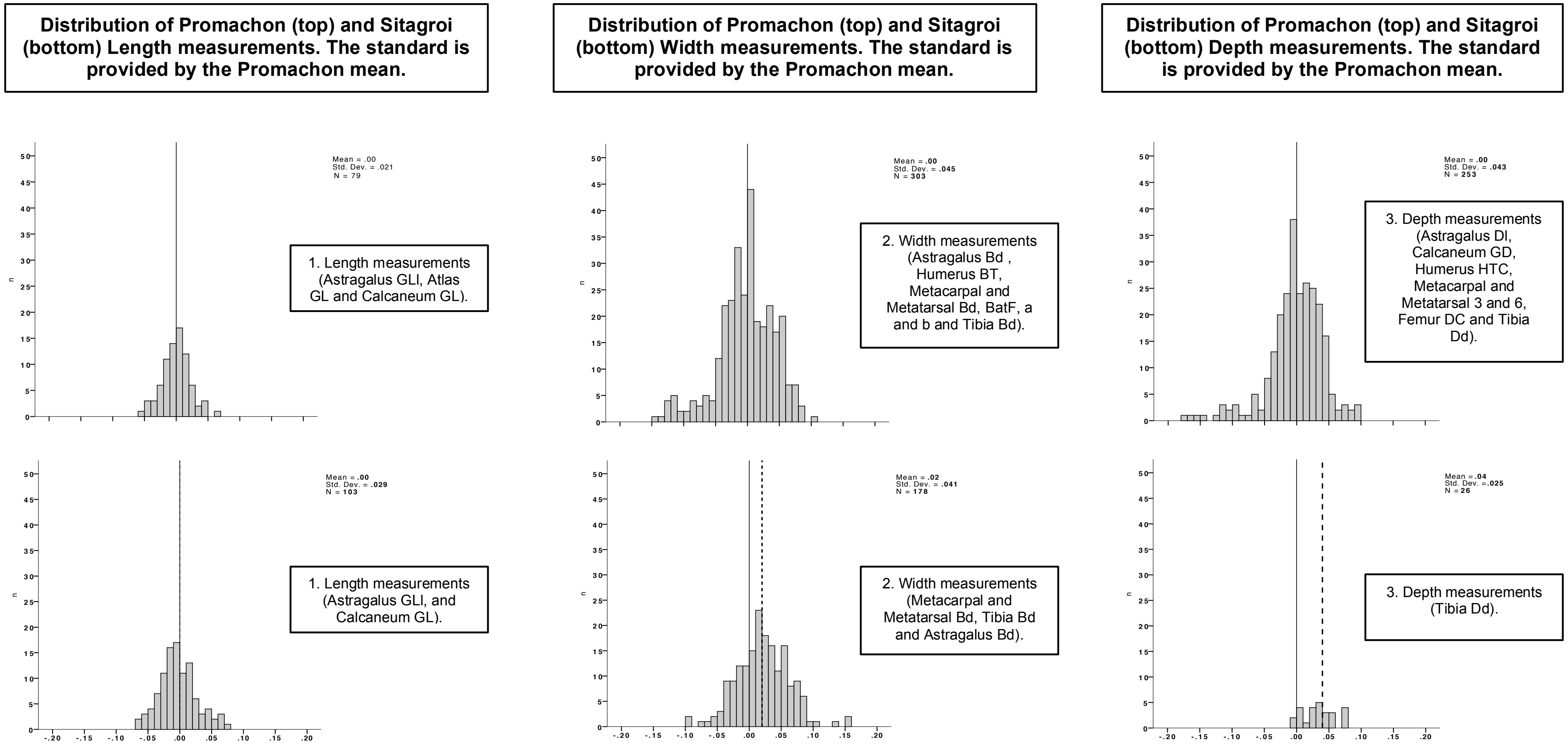

Figure 6.12: Distribution of Promachon (top diagrams) and Sitagroi (bottom diagrams) *Bos taurus* postcranial Length, Width and Depth measurements using the log ratio technique (Simpson *et al.* 1960). The standard is provided by the Promachon mean. Only fully fused postcranial bones from Promachon were considered. Only measurements from Sitagroi compatible to Promachon were considered. The mean of Sitagroi Length, Width and Depth measurements is marked by a black dashed vertical line, and the standard measurement by a black vertical line at .00. The scale of the vertical axis is fixed to emphasize differences in sample sizes. Only Phases I-II-III from Sitagroi are considered.

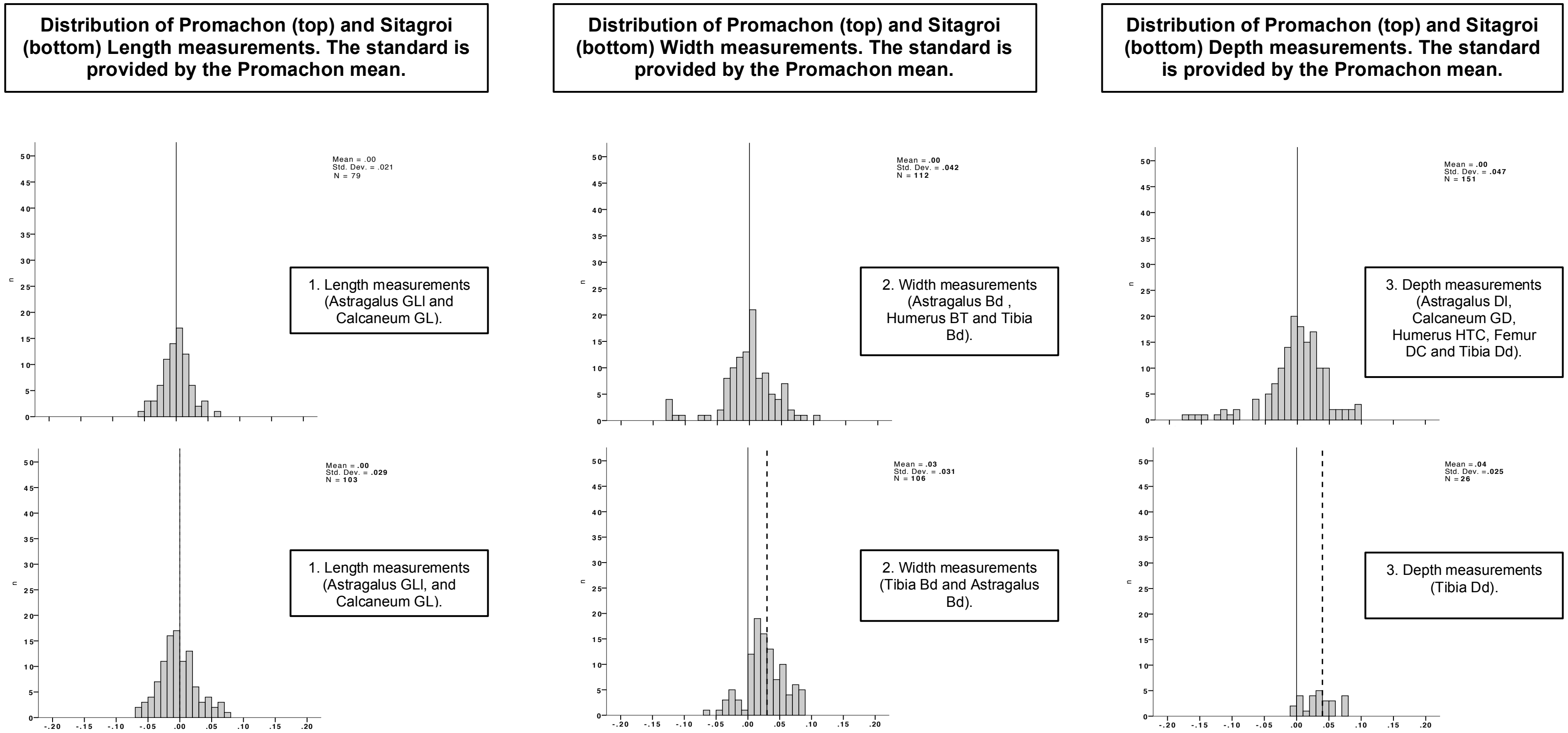

Figure 6.13: Distribution of Promachon (top diagrams) and Sitagroi (bottom diagrams) *Bos taurus* postcranial Length, Width and Depth measurements using the log ratio technique (Simpson *et al.* 1960). Metapodial measurements are excluded. The standard is provided by the Promachon mean. Only fully fused postcranial bones from Promachon were considered. Only measurements from Sitagroi compatible to Promachon were considered. The mean of Sitagroi Length, Width and Depth measurements is marked by a black dashed vertical line, and the standard measurement by a black vertical line at .00. The scale of the vertical axis is fixed to emphasize differences in sample sizes. Only Phases I-II-III from Sitagroi are considered.

In ***Figures 6.14-6.15*** we present the comparison of the size of cattle astragalus between Promachon and Makriyalos (Halstead pers. comm.). In the first diagram we plot the greatest length of the lateral half of the astragalus (GLl) against the distal breadth of the astragalus (Bd). It seems that on average, cattle astragali from Promachon are slightly larger than their counterparts from Makriyalos in terms of length. However, some of the large astragali from Promachon seem to be also more robust than those from Makriyalos.

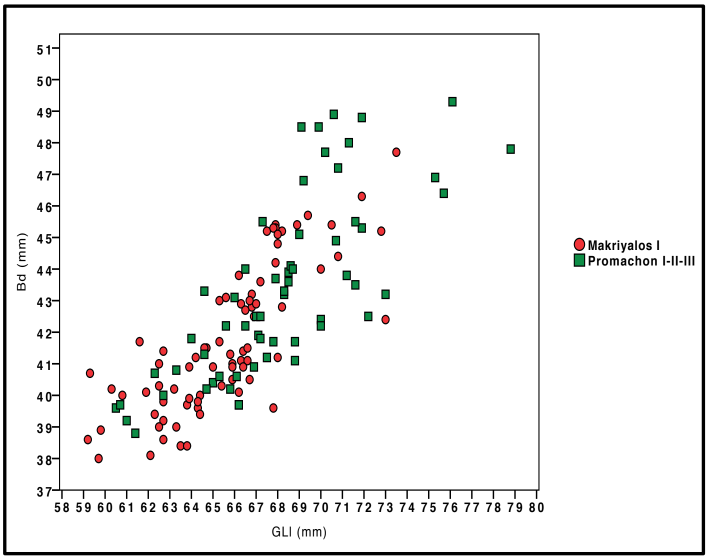

Figure 6.14: *Bos taurus* astragalus; greatest length of the lateral half (GLl in mm) vs. distal breadth (Bd in mm). Comparison between Promachon and Makriyalos.

In the second diagram we plot the greatest length of the lateral half of the astragalus (GLl) against the greatest length of the medial half of the astragalus (GLm); although there is very substantial overlap between Promachon and Makriyalos astragali, those from Promachon are, on average, larger than their counterparts from Makriyalos. The diagram confirms our previous interpretation regarding the slightly larger size (in terms of length) of cattle astragalus from Promachon.

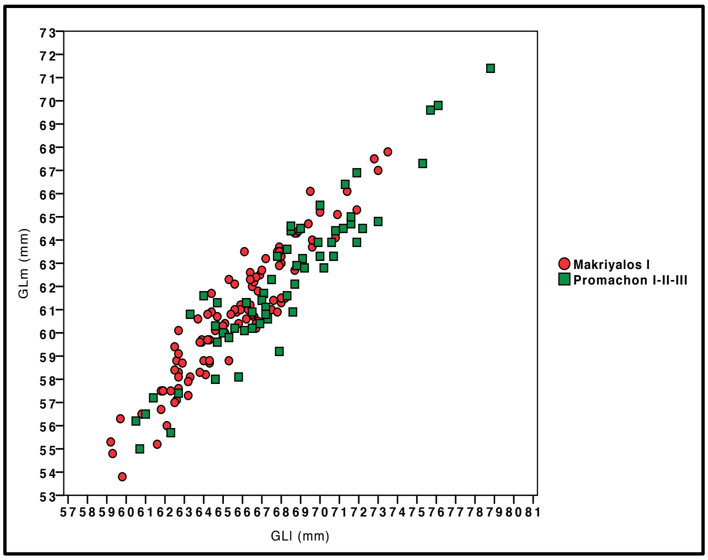

Figure 6.15: *Bos taurus* astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (GLm in mm). Comparison between Promachon and Makriyalos.

As in the case of the size differences of cattle between Promachon and Sitagroi, we need to compare the size of other domesticates (caprines and pigs) between Promachon and Makriyalos, in order to draw safe conclusions.

Figure 6.16 presents the comparison of the cattle astragalus between Promachon and other contemporary sites from Thessaly [Ayia Sofia (von den Driesch and Enderle 1976), Pevkakia (Jordan 1975) and Zarkos (Becker 1991; 1999)]. Unfortunately, cattle astragalus measurements from the latter sites do not include the distal breadth (Bd); therefore, only the greatest length of the lateral half of the astragalus (GLl) against the greatest length of the medial half of the astragalus (GLm) are plotted. Cattle from Promachon are slightly larger than their counterparts from Thessaly, but some of the sample sizes from Thessaly are rather small. Cattle astragali from Zarkos are, however, definitely much smaller.

As with previous cases, we need to look at size comparisons of other main domesticates between Promachon and Thessaly, in order to draw firm conclusions.

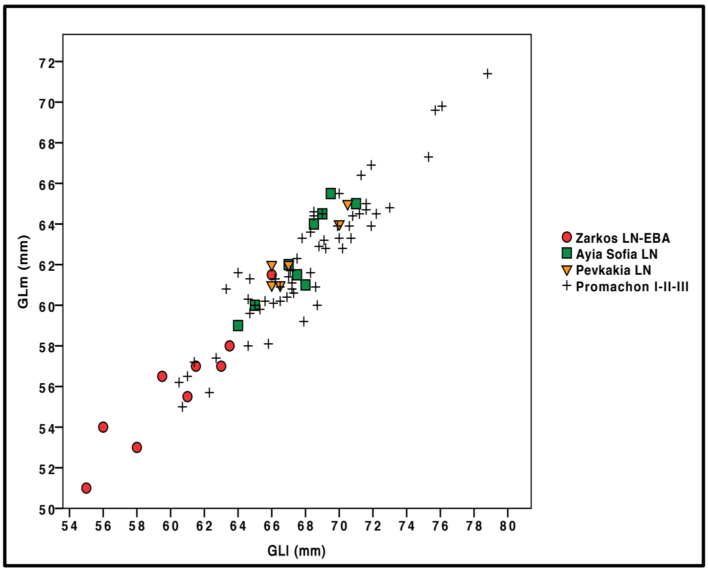

Figure 6.16: *Bos taurus* astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (GLm in mm). Comparison between Promachon and Thessalian sites (Zarkos, Ayia Sofia and Pevkakia).

6.4.2 – Ovis aries *size in the wider Late Neolithic context*

Comparing the size of goats between Promachon and contemporary Macedonian and Thessalian sites was not possible, since almost all sites produced too few goat measurements. On the other hand, enough biometric data for sheep were available from five sources for comparison; these are represented by the sites of Sitagroi (Bökönyi 1986) and Makriyalos (Halstead pers. comm.) from Macedonia and a number of Thessalian sites [Ayia Sofia (Driesch von den and Enderle 1976), Pevkakia (Jordan 1975) and Zarkos (Becker 1991; 1999)].

In all cases, the most numerous measurements that could be used for comparison were - once more - those of the astragalus. In ***Figure 6.17*** we compare the size of sheep astragalus between Promachon and Sitagroi (Bökönyi 1986). The scatterplot indicates the presence of two slightly overlapping groups as illustrated by the two superimposed oval shapes. The lower group includes the astragali from Promachon, while the upper group includes the astragali from Sitagroi. What is inferred from the diagram is that sheep astragali from Promachon are smaller than those from Sitagroi both in terms of length and width. There are, however, some astragali from

Promachon that are similar in size to those from Sitagroi, but they are a minority. These larger Promachon astragali are also different in shape from those from Sitagroi as their width is relatively smaller in comparison to the length, which makes them more slender in comparison.

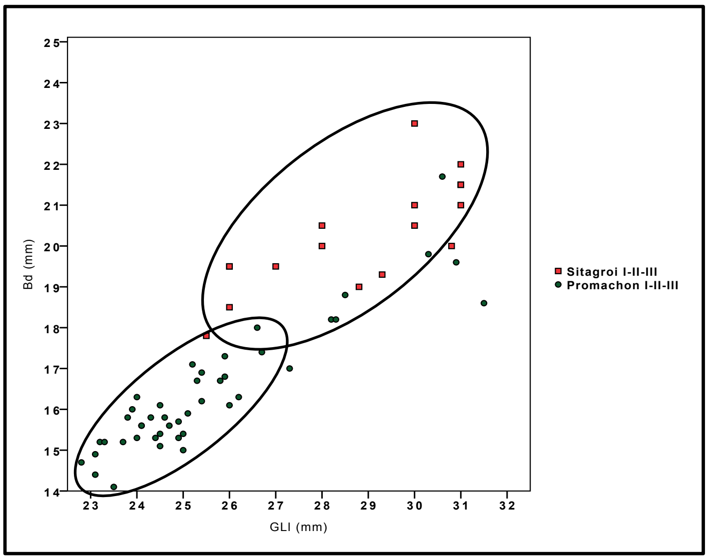

Figure 6.17: *Ovis aries* astragalus; greatest length of the lateral half (GLl in mm) vs. distal breadth (Bd in mm). Comparison between Promachon and Sitagroi.

An *ANOVA* test indicates that there is a highly significant difference in the greatest length of the lateral half (GLl) of the astragalus between Promachon and Sitagroi (p= .000), with Sitagroi astragali having a much greater length (μ= 28.7 mm) than Promachon astragali (μ= 25.5 mm), In addition, a highly significant difference in the distal breadth (Bd) between the two groups was also found (p= .000), with Sitagroi astragali having a much greater distal breadth (μ= 20.2 mm) than Promachon astragali (μ= 16.4 mm).

In order to obtain large enough samples of measurements to make further comparisons between Promachon and Sitagroi, we use the log ratio technique. In ***Figure 6.18*** we plot Promachon (top diagrams) and Sitagroi (bottom diagrams) length and width measurements in order to see how these are distributed according to the standard; the standard that we use for the calculation of the log ratio is - as in the case of cattle - the mean of the length and width measurements of sheep postcranial elements from Promachon.

Log ratios from depth measurements from both sides were not calculated, since Bökönyi (1986) does not measure the depth of sheep postcranial elements.

The log ratio diagrams show that the mean of both length and width measurements from Sitagroi plots on the right side of the standard (Promachon mean) indicating that, in terms of absolute size, Sitagroi sheep bones have a greater length and a greater width than those from Promachon. Therefore, the log ratio diagrams are consistent with the astragalus scatterplot and the statistical test, which indicated that sheep from Sitagroi are taller and wider than their counterparts from Promachon.

However, the log ratio analysis indicates that length measurements at Sitagroi are relatively larger than widths, in comparison to Promachon. This is not consistent with the evidence that we had from the larger group of Promachon astragali (***Figure 6.17***) and confirms a trend that had been seen in cattle - namely that differences in the shape of different anatomical elements are variable between the two sites. All in all, however, it has emerged that differences existed between both cattle and sheep kept at the two sites.

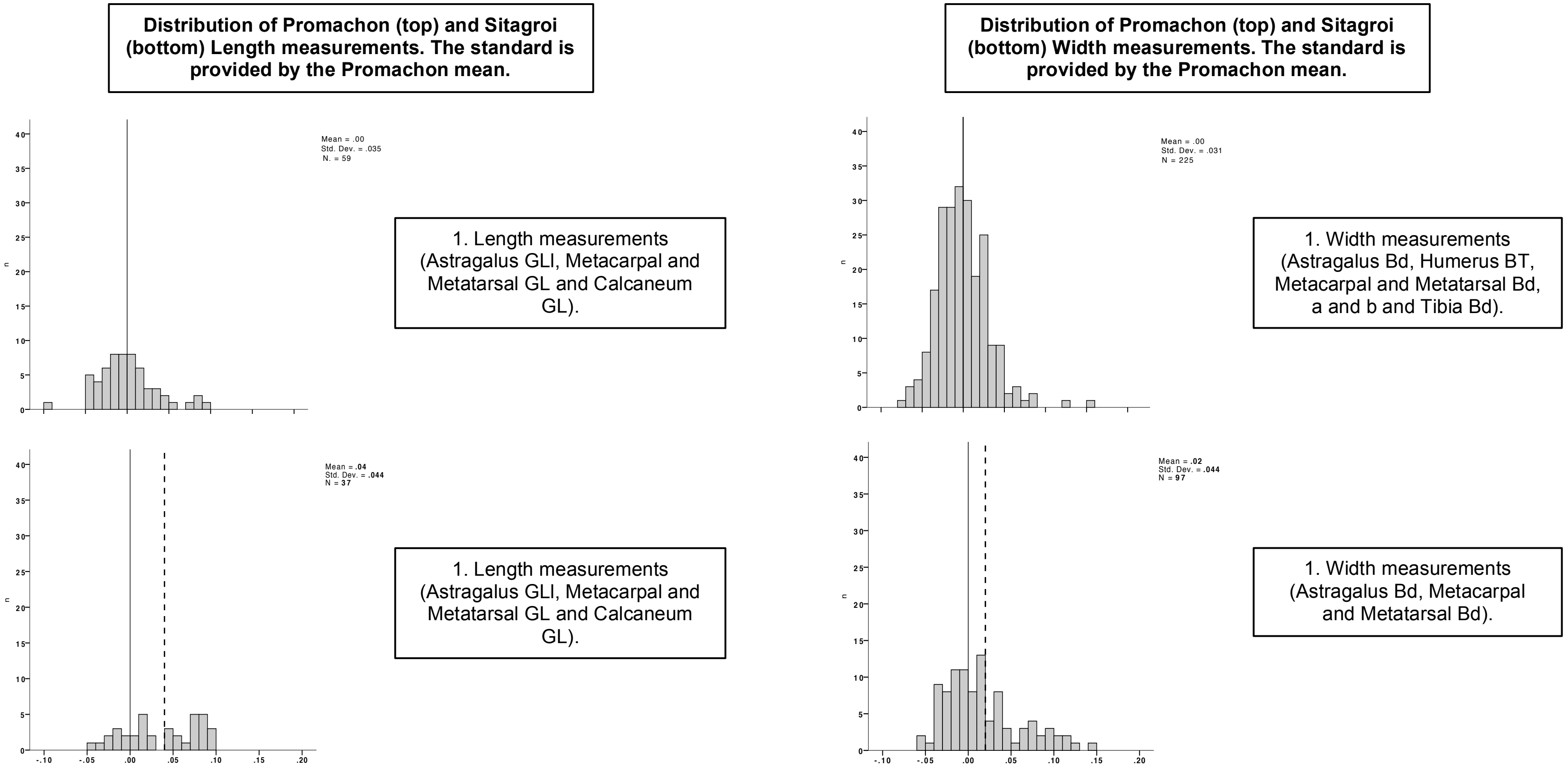

Figure 6.18: Distribution of Promachon (top diagrams) and Sitagroi (bottom diagrams) *Ovis aries* postcranial Length and Width measurements using the log ratio technique (Simpson *et al.* 1960). The standard is provided by the Promachon mean. Only fully fused postcranial bones from Promachon were considered. Only measurements from Sitagroi compatible to Promachon were considered. The mean of Sitagroi Length and Width measurements is marked by a black dashed vertical line, and the standard measurement by a black vertical line at .00. The scale of the vertical axis is fixed to emphasize differences in sample sizes. Only Phases I-II-III from Sitagroi are considered.

Figures 6.19-6.20 present the comparison of sheep astragali between Promachon and Makriyalos (Halstead pers. comm.). In the first diagram we plot the greatest length of the lateral half (GLl) against the distal breadth (Bd) and in the second we plot the greatest length of the lateral half (GLl) against the greatest length of the medial half (GLm).

Both scatterplots indicate that the size of the sheep astragali between these two sites is roughly the same. At Makriyalos, however, there is less variability, with the top and bottom ends of the distribution only occupied by Promachon specimens. This may indicate a higher number of males (or castrates) or a greater variability in terms of sheep types at Promachon.

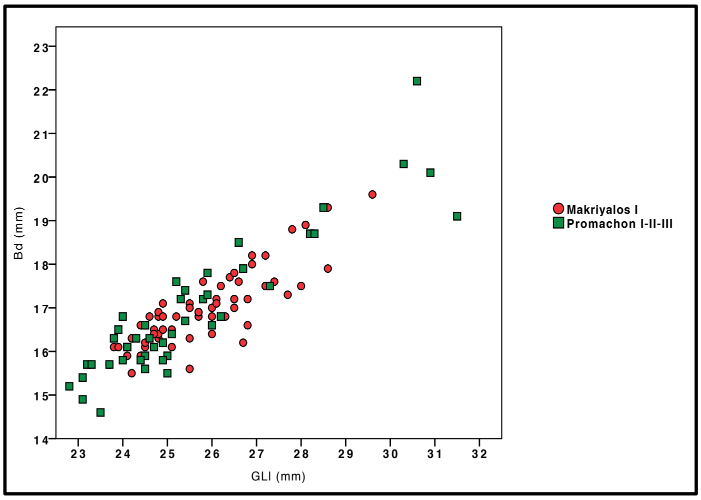

Figure 6.19: *Ovis aries* astragalus; greatest length of the lateral half (GLl in mm) vs. distal breadth (Bd in mm). Comparison between Promachon and Makriyalos.

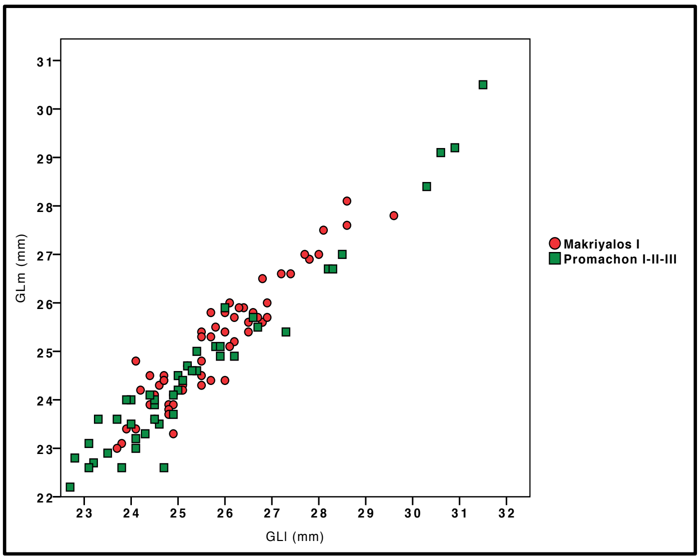

Figure 6.20: ***Ovis aries*** **astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (GLm in mm). Comparison between Promachon and Makriyalos.**

Figure 6.21 presents the comparison of sheep astragalus between Promachon and three Thessalian sites (Ayia Sofia, Pevkakia and Zarkos). In this diagram we plot the length of the lateral half (GLl) against the length of the medial half (GLm) of the astragalus, since - as in the case of cattle - sheep astragali measurements from Thessalian sites do not include the distal breadth (Bd).

Promachon sheep astragali seem to have the widest range of all sites, but most of them plot in the lower part of the diagram. Sheep astragali from Pevkakia, and especially Zarkos, are on average substantially larger than those from Promachon, while those from Ayia Sofia are similar but the sample is too small to be relied on. The large size of the sheep from Zarkos is noteworthy, particularly in view of the entirely opposite trend showed by cattle (***Figure 6.16***).

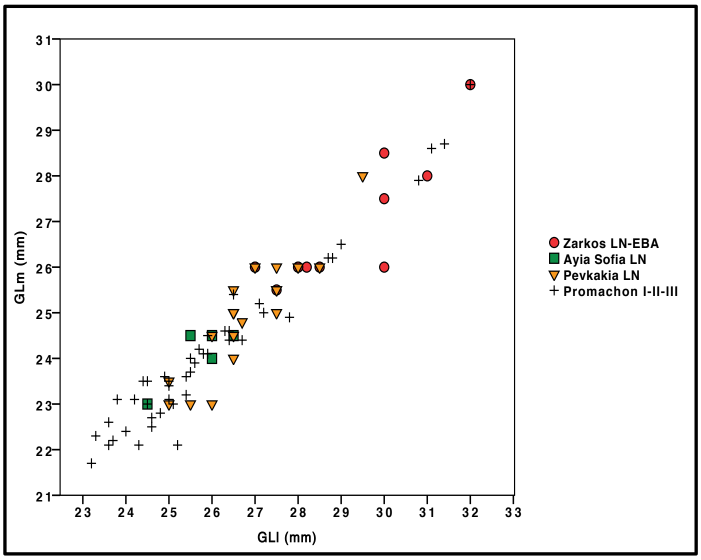

Figure 6.21: ***Ovis aries*** **astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (GLm in mm). Comparison between Promachon and Thessalian sites (Zarkos, Ayia Sofia and Pevkakia).**

6.4.3 – Sus *size in the wider Late Neolithic context*

An adequate number of comparative measurements for comparison could only be obtained from Sitagroi (Bökönyi 1986) and Makriyalos (Halstead pers. comm.) from Macedonia, and Ayia Sofia (von den Driesch and Enderle 1976), Pevkakia (Jordan 1975) and Zarkos (Becker 1991; 1999) from Thessaly. In the cases of Makriyalos, Ayia Sofia, Pevkakia and Zarkos, the most numerous measurements that could be used were those of the astragalus. In the case of Sitagroi, apart from the measurements of the astragalus, we were also able to use those of the tibia.

Figures 6.22-6.23 present the comparison of the pig astragalus and the pig tibia between Sitagroi and Promachon. We also include the astragali and the tibiae from Sitagroi, which were identified by Bökönyi (1986) as belonging to the wild form (*Sus scrofa*). At both sites, there are two distinct metric groups, presumably domestic and wild. Both domestic and wild populations appear to be metrically consistent at the two sites. The Sitagroi evidence supports the Promachon interpretation of the larger astragali and tibia specimens as belonging to the wild boar (***Figures 5.57-5.58***).

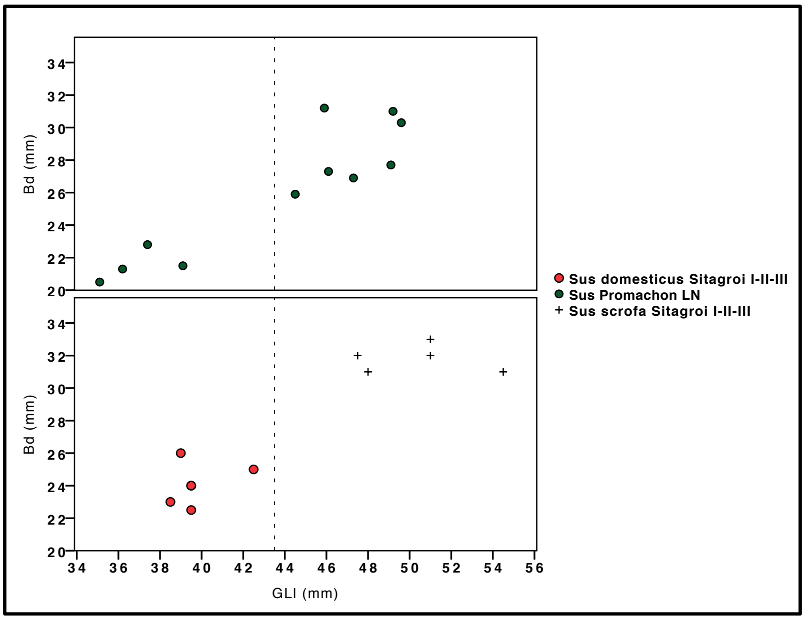

Figure 6.22: *Sus* astragalus; greatest length of the lateral half (GLl in mm) vs. distal breadth (Bd in mm). Comparison between Promachon and Sitagroi.

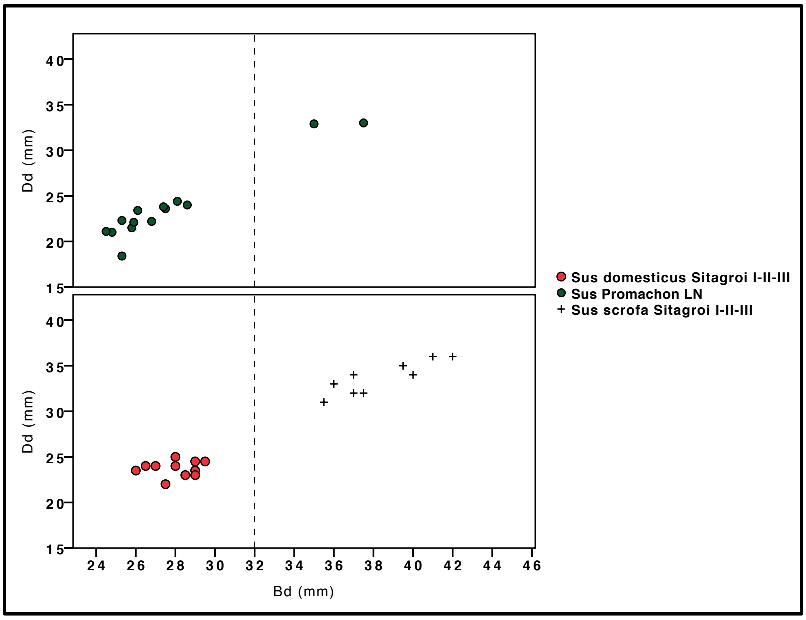

Figure 6.23: *Sus* tibia; distal breadth (Bd in mm) vs. distal depth (Dd in mm). Comparison between Promachon and Sitagroi.

In ***Figure 6.24*** we compare the size of the pig astragalus between Promachon and Makriyalos (Halstead pers. comm.). Unfortunately, metrical data of wild pigs from Makriyalos have not been provided; therefore the scatterplot includes only those astragali, which were identified as belonging to domesticated individuals. In addition, pig astragali measurements from

Makriyalos did not include the distal breadth (Bd). Therefore, in the following diagram we plot the greatest length of the lateral half of the astragalus (GLl) against the greatest length of the medial half (GLm). The domestic pig astragali from Promachon are, on average, slightly larger than those of Makriyalos, and also have a slightly different shape (see how the two groups align along different regression lines). As for cattle, the larger size of domestic pigs from Promachon may be the result of different feeding strategies between the two sites.

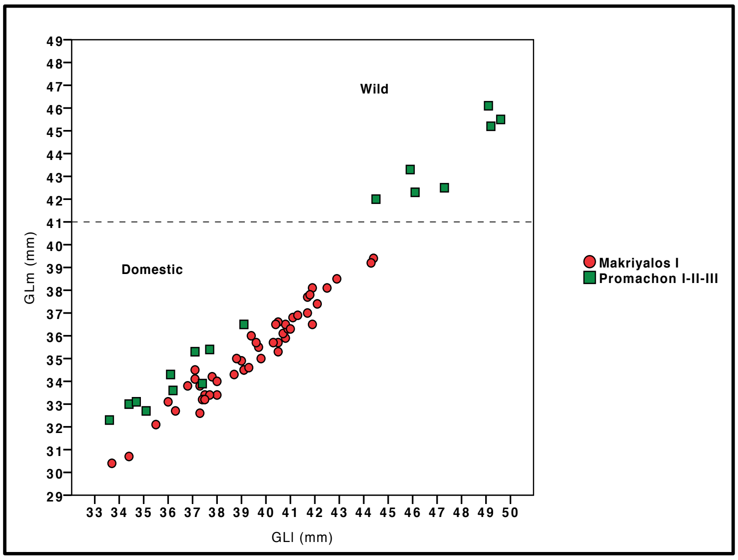

Figure 6.24: *Sus* astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (GLm in mm). Comparison between Promachon and Makriyalos.

Figure 6.25 presents the comparison of the pig astragali between Promachon and three Thessalian sites (Zarkos, Ayia Sofia and Pevkakia). As in the case of cattle and caprines, pig astragali measurements from Thessalian sites do not include the distal breadth (Bd). As in the case of Sitagroi, we include also the astragali that were originally identified as belonging to wild individuals, though there are only a few of them. The wild boar does not appear to have been hunted at these Thessalian sites as commonly as in the cases of Promachon and Sitagroi. Concerning the domesticated pigs, although the pattern shows that there is some overlap in terms of size between the four settlements, domestic pigs from Promachon are, in general, smaller than their counterparts from Thessaly. Domestic pigs from Ayia Sofia are particularly large, perhaps due to interbreeding with wild boar or the occurrence of some wild females within the 'domestic' group.

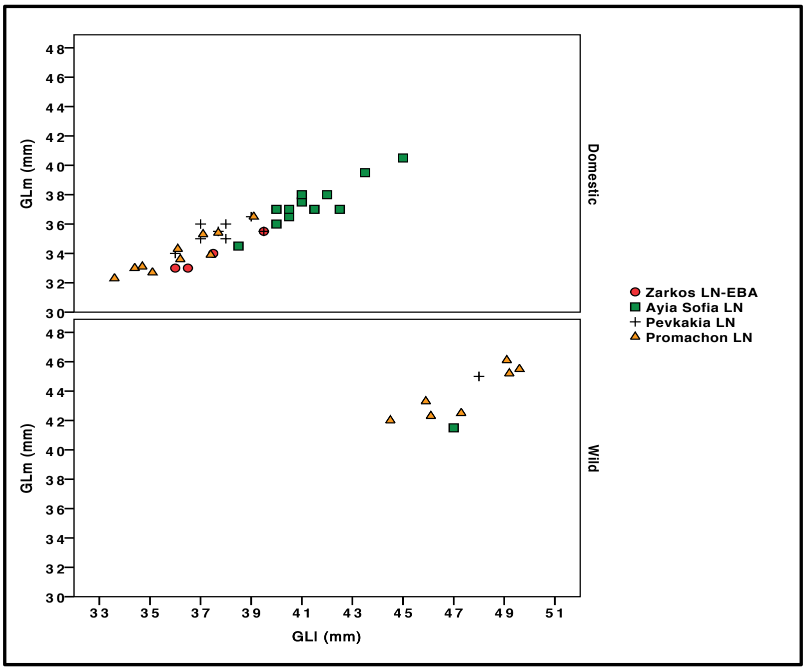

Figure 6.25: *Sus* astragalus; greatest length of the lateral half (GLl in mm) vs. greatest length of the medial half (GLm in mm). Comparison between Promachon and Thessalian sites (Zarkos, Ayia Sofia and Pevkakia).

6.4.4 – Contemplating the size of domestic ruminants and pigs during the Late Neolithic of Macedonia and Thessaly

The preceding analysis took into account the metrical data from Promachon and compared them with the metrical data from other contemporary Macedonian and Thessalian sites, in an attempt to find if size differences in domestic ruminants and pigs between Promachon and these sites occur.

A number of interesting issues were detected. Probably, most remarkable were the differences in the overall size of cattle and sheep between Promachon and Sitagroi. Cattle and sheep from Sitagroi seem to have been more robust than their counterparts from Promachon. In the next few pages, we will try to point out possible factors that might have affected the overall size of the domestic ruminants between the two sites. However, before proceeding with our interpretations, it is appropriate to present Bökönyi's

(1986) arguments with regard to the large size of cattle and sheep from Sitagroi.

Bökönyi (1986, 70) argues that the large size of cattle from Sitagroi is the result of the presence of a “transitional” form of cattle. According to Bökönyi, the “transitional” form of cattle is represented by the crossbreeding of aurochs and domesticated cattle, as well as by “newly domesticated cattle”. Bökönyi’s argument was based on the observation of a large group of intermediate-sized cattle metapodials (mainly belonging to Phases I-II-III from Sitagroi), which plotted between the smaller bones, assumed to have belonged to domestic cattle, and the larger bones, assumed to have belonged to aurochs (Bökönyi 1986; Figures 5.2-5.4).

The question of whether crossbreeding between aurochs and domestic cattle occurred in Europe has been the subject of much debate (Bollongino *et al.* 2008; Edwards *et al.* 2007; Götherström *et al.* 2005; Troy *et al.* 2001). Its proponents (among them, also Bökönyi) have argued that crossbreeding might have been unavoidable - or even encouraged - by Neolithic pastoralists, in order to improve the breeding stock and increase the numbers of their domestic livestock (Bollongino *et al.* 2008).

Studies of ancient cattle DNA resulted in the identification of repeated hybridization between domesticated cattle and aurochs (Götherström *et al.* 2005). However, more recent analyses based on the ancient DNA of 59 Neolithic skeletal samples from Central, Western, and South-Eastern Europe do not support the hypothesis of introgression (*i.e.* the transfer of genetic information from one species to another as a result of hybridization) between aurochs and domesticated cattle (Bollongino *et al.* 2008). Overall, the issue of crossbreeding of domestic cattle with aurochs still remains open, although by no means we should exclude the possibility of hybridization between wild and domestic types of cattle.

As previously noted, in addition to crossbreeding, Bökönyi also argued in favor of “newly domesticated” cattle. In general, Bökönyi has been a proponent of the domestication of cattle in Europe, as a feature of local contributions to the farming economy (Bradley and Magee 2006). Due to a considerable number of mature aurochs individuals from Sitagroi, Bökönyi suggested that:

"…*man tried to capture the immature wild cattle - since only these could be tamed and domesticated - and killed the adults that were attempting to protect their young*" (Bökönyi 1986, 72).

The argument of local domestication of cattle has also been suggested by Boessneck (1962) in his study of the faunal material from Argissa in Thessaly, as well as Becker in her study of the faunal material from Middle-Late Neolithic Zarko (1991; 1999). However, recent work in the Aegean area argues that domestication was introduced much earlier than previously thought, with the arrival of colonists, who, at *c.* 9,000 to 8,000 Cal. BP carried many components of the Neolithic package with them (Zeder 2008). In other words, according to such view, the late stage of the Neolithic cannot be considered as a time-period during which cattle was still in the process of domestication.

In addition, Bökönyi does not take into account the effects of sexual dimorphism (Rowley-Conwy 2003), which is highly pronounced in cattle metapodials (and in cattle metacarpals even so more than metatarsals; Albarella 1997; Bartosiewicz *et al.* 1993; 1997). Thus, it is possible that the intermediate-sized cattle metapodials, which Bökönyi had identified in his assemblage, could have been either female aurochsen or male domesticated cattle.

All in all, the evidence does not really support the argument of a local domestication at Sitagroi (and Argissa and Zarko), and the large size of cattle at Sitagroi can be explained on the basis of other factors, such as sex or regional variation.

As concerns sheep, Bökönyi (1986) does not mention the possibility of local domestication at Sitagroi, since the presence of the wild progenitor of sheep

(*Ovis orientalis*; mouflon) is not documented in the area. Bökönyi, however, does not elaborate on the large size of the domestic sheep during the Late Neolithic at Sitagroi, possibly due to the lack of available comparable metrical data from contemporary Macedonian sites. On the contrary, he argues for a size increase of the domestic sheep during the transition between the Final Neolithic and the Early Bronze Age (Phases IV-V at Sitagroi)[27].

According to Bökönyi, the increase in the size of sheep during this transitional period is most likely the result of a combination between the practice of penning, breeding and satisfactory feeding for the production of fleece[28]. What is interesting however, is the fact that - regardless of the time period (Late and Final Neolithic and Early Bronze Age) - sheep from Sitagroi seem to be larger than their counterparts from any other site in Macedonia (and also Thessaly).

Moving away from Bökönyi's arguments regarding the large size of cattle and sheep in Sitagroi, the observed differences in the overall size of domestic ruminants between the two sites may have other explanations. The practice of intensive rotation in grazing grounds is a key factor for the reduction of animal size (Hart *et al.* 1993), though, in the case of Promachon, the practice of transhumance (*i.e.* the action of moving livestock from one grazing ground to another in a seasonal cycle, typically to lowlands in winter and highlands in summer) is not supported by the archaeological evidence. However, by no means this should preclude the possibility of a considerable mobility of segments of the population of Promachon on a seasonal or other basis. For this reason, strontium analyses (^{87}Sr/^{86}Sr) for the assessment of the geological 'signature' of the enamel from the teeth of domesticates should be carried out in Promachon in the future[29].

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[27] Bökönyi (1986; Figures 5.7; 5.12-5.13).

[28] As previously noted (see also ***6.3.2* – Caprinae *age-at-death***), Bökönyi (1986) argues for the use of sheep fleece in the Late Neolithic of Sitagroi.

[29] Note that this would work only if the underlying geology of highland and lowland were different in terms of the age of the rocks.

The availability of pasture, and more specifically, the availability of food resources is another factor that could potentially explain the differences in the overall size of domestic ruminants between Promachon and Sitagroi. However, if we assume that there is a limitation in food resources in Promachon, which might have significantly affected the size of domestic ruminants, then, we might also assume that some kind of environmental degeneration might have taken place in the vicinity of the site sometime during the Late Neolithic. However, this assumption cannot be fully supported, since palynological analyses have not as yet been carried out in Promachon.

It is probable however, that the problem in the overall pattern is the unusually large size of cattle and sheep at Sitagroi, rather than the small size of the same species at Promachon. The reconstruction of the settlement pattern in the plain of Drama may provide some explanation; this suggests that during the Late Neolithic, there was a considerable expansion in the number of settlements in the plain of Drama (where the site of Sitagroi is located) with the utilization of a greater variety of locations. Overall, it seems that the expansion in the number of settlements in the plain of Drama might have resulted in a greater production of food resources, which in turn allowed population numbers to increase considerably (Blouet 1968). The evidence suggests higher yields and a far greater degree of control over cropping, with an agricultural system that attained a high degree of expertise. It is possible that the settlements in the plain of Drama progressed from habitation sites to being villages in the functional sense, and that they had moved to the point where they provided a number of services other than convenient places for families to group (Blouet 1968).

To be more specific, the evidence seems to suggest that Sitagroi was linked to a group of settlements in the plain of Drama, where opportunities of better responses to environmental constraints and/or food limitations (possibly through a system of exchange?) might have taken place. Of particular importance is the fact that one of the most dynamic settlements that thrived during this time-period in the plain of Drama - as indicated by the persistence and the density of occupation, the abundance of finds, the variety and quality of artifacts and a number of innovations in food-consuming procedures (such as wine-pressing; Valamoti *et al.* 2007) - was Dikili-Tash (Darcque *et al.* 2007; Koukouli-Chrysanthaki 2006). Promachon on the other hand, is not centralized in the plain of Serres; being located on the northernmost part of the plain of Serres, Promachon was most likely to have been isolated from the rest of the sites, thus having a slower response to environmental and/or economic constraints.

On the other hand, the size of domestic pigs between Promachon and Sitagroi is roughly the same; this similarity is in contrast with the greater size of both cattle and sheep at Sitagroi. If we accept the argument that the larger size of domestic ruminants at Sitagroi was the result of better-fed animals due to a more organized and centralized system of economy, it must follow that no equivalent attention was placed on pig husbandry. This may be consistent with the lower apparent importance of pig keeping for the economy of the site, as well as the partial reliance on wild boar.

The observed differences in the size of domestic ruminants and pigs between Promachon and Makriyalos as well as between Promachon and Thessalian sites could plausibly be attributed to diverse husbandry strategies. Especially in the case of Promachon and Thessalian sites, the metrical examination indicated that sheep and pigs from Promachon were slightly smaller than their counterparts from Ayia Sofia, Zarkos and Pevkakia, whereas the exact opposite pattern was detected in the case of cattle. These size differences might be related to the economic importance of cattle, sheep and pigs between Macedonian and Thessalian sites.

To be more specific, the relative proportions (in terms of *NISP*) of the three main domesticates from sites from Thessaly contemporary to Promachon, such as Dimini (Halstead 1992), Zarko (Becker 1991), Ayia Sofia (von den Driesch and Enderle 1976), Pevkakia (Jordan 1975) and Argissa (Boessneck 1962) suggest the predominance of sheep, followed in most cases by pigs

(Cantuel *et al.* 2008). The pattern can plausibly be attributed to the fact that the geomorphology, environment and vegetation in Thessaly are different from those in Macedonia, thus favoring the keeping and breeding of small ruminants and pigs, rather than cattle. This obviously indicates that the former animals were the backbone of the economic subsistence for the Neolithic economies in Thessaly, in contrast with Promachon (and Macedonia in general) in which - although caprines still predominate - cattle certainly played a more important role than Thessaly.

Therefore, the large size of small ruminants and pigs at sites such as Ayia Sofia, Zarkos and Pevkakia, might be the result of a particular emphasis in sheep and pig husbandry, possibly through the method of satisfactory feeding. In the case of pigs, however, we should by no means exclude the possibility of the interbreeding of domestic pigs with wild animals. In any case, the large size of domestic pigs from Ayia Sofia, Zarkos and Pevkakia indicates the general importance of pig keeping for Thessalian Late Neolithic economies.

Unlike Thessalian sites, pig metrical data from Macedonian sites, such as Promachon and Sitagroi, indicate that the Neolithic people from these sites commonly hunted wild pigs. In addition, the smaller size of domestic pigs from Promachon and Sitagroi in comparison to their counterparts from Thessaly, possibly suggests that there was not a particular emphasis on pig keeping in Macedonian sites and that no particular attention was placed on pig husbandry (through either interbreeding with wild boar, or satisfactory feeding).

Another interesting pattern that was observed in the metrical analysis were the differences in the size of domestic ruminants between Thessalian sites. More specifically, sheep from Zarkos seem to be larger than their counterparts from Pevkakia and Ayia Sofia, whereas the exact opposite pattern was detected in the case of cattle. We would probably be going too far to suggest that the pattern indicates different breeds of cattle and sheep in Zarkos than the rest of the settlements in Thessaly, but at least we can suggest the presence of different regional types. If this is the case, then it seems that these sites were fairly independent from each other and maintained their own types of livestock.

All in all, it can be suggested that the size of domestic ruminants and pigs varied between settlements located in different geographic areas (Macedonia and Thessaly), as well as between settlements, even when they were in relatively close proximity (*e.g.* Promachon and Sitagroi; Zarkos, Ayia Sofia and Pevkakia). It seems that the size of these animals may have been dependent on food availability and on the adequacy of Neolithic communities to respond to risk and uncertainty (*i.e.* environmental and/or economic constraints). It can also be argued that the economic importance of certain animals within each settlement might have played a significant role in the decisions of Neolithic people regarding the investment in their keeping.

A larger body of metrical data from Late Neolithic Macedonian and Thessalian settlements should allow further clarification of some of these issues, and should represent a priority for future research.

Chapter 7 – Synthesis

7.1 – Introduction

The preceding chapters presented the results of the analysis of the animal bone assemblage from Promachon and compared them to the results obtained from a number of contemporary settlements from northern Greece and the wider Balkan regions. The investigation has focused on how animals were managed at both local (Promachon and Strymon river valley) and regional (northern Greece and Balkan regions) levels. This chapter will move away from strict zooarchaeological narratives by taking into consideration other lines of archaeological evidence. This by no means implies that zooarchaeology will not be taken into account, but rather that zooarchaeology and other lines of archaeological evidence will be integrated in order to address broader archaeological questions regarding past patterns of human behavior at Promachon and in the wider region.

Three broad themes are discussed in this chapter. Each theme incorporates a number of key-points that are ultimately essential in our understanding of animal use and site function. *Economic considerations* will focus on the scale and the nature of animal husbandry at Promachon, assessing also the relative contribution of domestic and wild animals to subsistence. *Social and symbolic considerations* touch upon the issue of consumption[30], which has arguably received small attention in Greek zooarchaeology, before moving to the symbolic significance of domestic and wild species in Promachon. Finally, the attention turns to the *function of the settlement*, and the discussion moves to the understanding of the wide range of activities attested on-site.

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[30] The issue of consumption could also be discussed in the *economic considerations* of the current chapter; however, it will be discussed in the *social and symbolic considerations* since the archaeological and the faunal evidence indicate that the consumption of animal carcasses at Promachon was of high social and symbolic significance. In any case, it should be noted that consumption is largely affected by economic as well as social factors.

7.2 – Economic considerations

The economic aspects dealt with by the current research can be divided into three main subjects. These are:

- Scale and nature of animal husbandry.
- The economic importance of cattle.
- The economic importance of wild resources.

7.2.1 – Scale and nature of animal husbandry

One of the key aims of the current research was to understand the scale of animal husbandry at Promachon. In general, this is a contentious issue in Greek zooarchaeology (Halstead 2000). The debate is often polarized around two models, which are particularly relevant to the late stage of the Neolithic and the Early Bronze Age. In addition, both models heavily rely on circumstantial evidence, mainly due to the complexities of bone fragmentation and recovery (Halstead 1996; 2000; 2002).

Proponents of the first model argue that the Late Neolithic (and Early Bronze Age) pastoral economies of Greece were small-scale and relatively sedentary. In addition, these economies were based on a small number of animals, which were subordinate to crops (Halstead 2000; 2002). Due to the absence of a market economy, Late Neolithic communities were not able to invest in product specialization (Halstead 1989b). All in all, small-scale pastoralists - since they were not seeking to maximize the production, but to produce a consistent return - are characterized by a mixed composition of animals (Halstead 1996), and no heavy specialization in secondary products (*i.e.* milk, wool, traction).

Proponents of the second model argue in favor of extensive, large-scale herding. The argument of large-scale herding is based on the fact that certain regions and site locations in Greece were unsuitable for arable farming

(Cavanagh 1999)[31]. Consequently, these areas offered more potential for grazing than cultivation (Johnson 1996). It has also been argued that large-scale herders might have been relatively mobile[32]. These economies are also characterized by their reliance on a single species and specialization in secondary products.

At Promachon, the faunal evidence exhibits a number of characteristics that are consistent with small-scale mixed economy, rather than extensive and specialized herding. First of all, the economy at Promachon is based on the exploitation of a highly mixed composition of livestock (cattle, caprines and pigs), rather than a strong focus on the exploitation of a single domestic species. The latter strategy is the norm among contemporary pastoralists, such as the ethnic group of the Sarakatsani (Halstead 1990), who are specialized in the exploitation of a number of caprine products (*i.e.* milk, cheese and wool).

The ageing evidence also supports the argument of small-scale herding at Promachon. The age-at-death data for the three main domesticated species do not indicate the pastoral specialism proposed by the secondary products revolution (SPR) model (Arnold and Greenfield 2006; Greenfield 2005); the use of cattle for traction, which constitutes a major capital intensification of arable farming (Gilman 1981), as well as the exploitation of caprines for their fleece seem rather unlikely, except for the very small scale. All in all, the ageing evidence from Promachon indicates that animals were bred and kept primarily for their meat.

Having said that, small-scale exploitation of milk is not impossible, even though the age-at-death data (at least for caprines, since the sample size of cattle mandibles is too small to provide any definite conclusions) does not conform to Payne's (1973) milk model. However, as previously argued, the

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[31] It is interesting to note however, that areas unsuitable for farming activities are mainly located in southern Greece (for instance, Peloponnese). On the contrary, areas in Macedonia, where Promachon is located, are known to be more cultivable.

[32] However, this argument is based on ethnographic studies of contemporary ethnic groups residing in Greece, such as the Sarakatsani and the Vlachs (Halstead 1990).

evidence from the nearby site of Stavroupoli attested to the exploitation of milk (traces of milk residues and lipids in ceramics) in the area of Macedonia during the late stage of the Neolithic (Evershed *et al.* 2008). It is therefore possible that settlements that were contemporary and close to Stavroupoli - including Promachon - were aware of the utilization of milk.

Of particular interest is also the fact that the management of sheep is different from that of goats. The age-at-death data from Promachon indicate that both sheep and goats were bred primarily for their meat. However, while goat remains provided a kill-off pattern that is highly typical of a focus on meat exploitation, this is less so for sheep, which may therefore have, to some extent, also been used for secondary products. This is the first time that a distinction in the management of sheep and goats has been attempted at kill-off pattern level in the valley of the river Strymon. It is possible that sheep milk would have constituted a “welcome and nutritionally valuable variety” (Halstead 1989a; 30) into the crop and meat diet of the Neolithic people of Promachon.

Despite the lack of evidence for penned structures at Promachon, recent micromorphological analyses (Karkanas pers. comm.) indicate the presence of dung in almost all areas of the settlement. In general, herbivores can produce large quantities of dung. Modern sheep breeds can produce around 1.5 kg per day, which amounts to between 500 and 900 kg per year per animal; goats are even more productive (Mlekuz 2009). Cattle on the other hand, can produce up to 10 t of dung per year per animal (Mlekuz 2009).

Dung might have been used by the Neolithic people of Promachon as fuel for cooking and heating fires (Valamoti 2007), or as a very durable material in flooring. Whatever the case, the dung evidence is important as it suggests that animals were kept on-site - or at least - in areas close to it. This does not necessarily suggest that transhumance was not practiced at Promachon. This practice does not imply that all animals will be moved away from the site. In addition, even the section of the animal population that is seasonally moved will spend part of the year locally. Thus, as previously argued, the possibility of the movement of segments of the animal population of Promachon on a seasonal or other basis should not be excluded. In any case, the dung evidence at Promachon is interesting in pointing out that animals were actually present in the habitation area. This means that domestic livestock were likely to have played an important large part in people’s everyday lives, thus representing a “more constant domestic sociality” in the sense that Whittle (2003; 94) implies.

7.2.2 – The economic importance of cattle

The analysis of the faunal assemblage from Promachon indicates that caprines are represented with higher frequencies (both in terms of *NISP* and *MNI*) than any other domesticated species on-site. However, the abundance of a species in terms of the number of fragments (and/or the estimated number of individuals) does not necessarily indicate that this species had the highest economic importance. Although caprines at Promachon are represented with a higher frequency than cattle (both on a phase-by-phase level and also for the whole cultural sequence of the Late Neolithic), from an economic and symbolic point of view, cattle could have been more important than caprines.

Cattle are much larger than caprines and pigs, and therefore, they would have undoubtedly provided the largest quantity of meat than any other domesticated animal on-site. Hence, in terms of meat provision, cattle would have been far more important than caprines (and pigs). The economic importance of cattle was also attested through inter-site analyses. To be more specific, the comparison of the frequencies of the three main domesticates on a regional level, indicated that cattle in Promachon are represented with a higher frequency than most contemporary sites from Macedonia[33]. Although - as previously argued - the abundance of a species should not be confused with its importance, the higher frequency of cattle at Promachon (in comparison to other contemporary Macedonian sites)

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[33] The only exception is represented by Pigi Athinas (Cantuel 2014), where the frequencies of the three main domesticated species present a striking similarity with those of Promachon.

provides an indication that cattle would have played a particularly significant role for the inhabitants of Promachon.

There is however, another issue, which should also be considered. We should bear in mind that the extent of recovery bias at a number of sites that have been compared to Promachon has not been entirely assessed, and therefore, some of our interpretations should be approached with caution. In this sense, it would have been more appropriate to compare the frequencies of the three main domesticated species (on a regional level) in terms of *MNI* rather than *NISP*, as the former is less affected by recovery bias. However, as previously argued, a large number of faunal researchers do not use *MNIs,* therefore, making a regional comparison based on *MNIs* was impossible.

Of additional interest were the results of biometry, which indicated that cattle from Promachon were larger than their counterparts from Macedonia (with the exception of Sitagroi) and Thessaly. It is possible that the Neolithic people of Promachon placed particular attention on cattle husbandry, and provided them with ample and/or better-quality fodder in order to increase their size. A high quality-feeding regime could plausibly be attributed to the high economic importance that this species had for the Neolithic people of the site.

All in all, although the faunal evidence from Promachon indicates that caprines are represented with a higher frequency than cattle, the latter seems to have been the species with the highest economic importance.

7.2.3 – The economic importance of wild resources

The economic importance of hunting in Neolithic economies of Macedonia has primarily been inferred by the presence of deer, which - in most cases - are represented with the highest frequencies among wild taxa. On the other hand, the importance of the aurochs and the importance of wild pig in the same region have not been adequately investigated. In most cases, aurochsen and wild pigs have been identified only through a visual assessment of shape and size. At most sites, cattle and pig bones are, by default, attributed to domesticated individuals, while the identification of their wild counterparts is limited to cases of particularly large specimens. This obviously represents a potential problem, since the significance of both species in Neolithic sites from Macedonia has not been properly evaluated.

Concerning Promachon, biometrical analysis has provided no evidence of the presence of the aurochs, although Theodorogianni and Trantalidou (2013) and Iliev and Spassov (2007) argue for its presence in the successive layers of structure n. 4 and the Bulgarian sector of Topolnica respectively. Conversely, biometrical analysis has confirmed the presence of a substantial number of wild pig remains. This mirrors Bökönyi's (1986) assessment of the situation at Sitagroi[34]. Therefore, metrical analyses have indicated the general importance of wild pigs for the Neolithic people of Promachon and Sitagroi during the Late Neolithic. This does not necessarily mean that the Neolithic people of Promachon and Sitagroi hunted wild pigs more regularly than the inhabitants of other sites. There could be many reasons why at different sites wild pig hunting may have been practiced more or less extensively (*i.e.* regional differences in the environmental conditions and vegetation cover). The lack of in-depth biometrical analysis at other sites means, however, that the possibility of a similar level of hunting at other sites cannot be ruled out.

It is therefore possible that the hunting of wild boar were the norm among a considerable number of Late Neolithic communities in Macedonia. Perhaps, reliance on substantial wild pig hunting also meant that not particular attention was paid to intensify pig husbandry[35]. Conversely, the low frequency of wild pigs in Thessaly could plausibly be attributed to the higher attention that was paid to pig husbandry. In the absence of clear evidence from other sites it cannot be ruled out that wild pigs in the whole Macedonia were equally important to other wild species (mainly deer), and that Neolithic

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[34] See also ***Figures 6.22-6.23***.

[35] The argument of the low attention on pig husbandry is also based on the observation that pigs are represented with the lower frequency among the main domesticates in almost all sites from Neolithic Macedonia.

people in the region hunted them more regularly than previously thought. The evidence from Sitagroi and Promachon is, in this respect, tantalising.

A useful example, which demonstrates the importance of biometrical work for the understanding of past patterns of human behavior, was presented earlier in the current thesis. More specifically, pig body part distribution indicated that during Phases I-II[36] the highest *MNI* values were gained from pig postcranial elements rather than teeth. It was therefore suggested that pig heads might have been disposed off-site. However, log ratios indicated that pig postcranial bones plotted bimodally far more than teeth, suggesting that wild pigs were better-represented by bones of the body than the head[37]. Therefore, it is likely that the disposal of pig heads off-site was practiced in the case of wild pigs rather than their domestic counterparts.

It has been repeatedly argued that recovery bias is the main reason for the underrepresentation of small animals, small anatomical parts and young age categories. One would argue that the scarcity of fish remains from Layers 1-6 in Promachon[38] could plausibly be attributed to poor recovery procedures, since the faunal assemblage was hand-collected. However, it is interesting to note that a very small number of fish remains [24 fish remains out of a total *NISP* of 31377 (< 1%) (Theodorogianni and Trantalidou 2013)], was also recovered from structure n. 4, whose deposits were sieved. A general scarcity of fish remains was also detected in other sites where sieving and flotation took place. For instance, at the LN sites of Aggitis and Dimitra the frequency of fish remains is less than 1% of the total *NISP*. More specifically, at Aggitis, out of a total *NISP* of 869, only one fish fragment was recovered, while in Dimitra, out of a total *NISP* of 2457, only 12 fish fragments were

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[36] See also ***Figure 5.16***. The sample size of Phase III was too small to be considered for analysis.

[37] See also ***Figure 5.59***.

[38] As previously noted (see also ***Table 5.20***), only four fish remains were recovered from the deposits of Layers 1-6 (Phases I-II-III).

retrieved[39]. In both cases, fish remains were not identified at any taxonomical level.

Therefore, the scarcity of fish remains at a number of sites from Greek Macedonia, which were located near water sources, cannot be entirely attributed to retrieval biases. It is probable that this scarcity is the result of a genuine pattern, which indicates a general reliance on terrestrial rather than fresh water resources. This should be viewed in the context of the vicinity of Promachon to the river Strymon, and Aggitis and Dimitra from the river Aggitis in the plain of Drama. Lack of fishing was therefore not due to a lack of opportunity to access appropriate environments.

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[39] See also Mylona (2003) for a gazetteer of multi-period Greek sites where fish remains were recovered.

7.3 – Social and symbolic considerations

The social and symbolic considerations of the current research can be divided into three subjects as well. These are:

- The social significance of meat consumption.
- The symbolic significance of cattle.
- The social and symbolic significance of wild resources.

7.3.1 – "Consuming passions and patterns of consumption"[40]: contemplating the social significance of meat consumption in Promachon

Zooarchaeological studies in prehistoric sites from Greece have arguably neglected the issue of consumption and focused mainly on the process of production (Hamilakis 1999; 2003). The discussion has primarily been focused on how animals were managed (bred, raised and killed), rather than on the context and the possible special circumstances under which meat was consumed.

Concerning Promachon, the main question to be asked is in which cases, and under which particular circumstances, meat was consumed. It has been suggested that the consumption of meat in Neolithic Greece was linked to particular social events. This model contrasts with what has been proposed for the northern Balkan Neolithic economies (Bulgaria and Serbia), in which the high frequencies of cattle and pigs (in comparison to caprines) have been regarded as an indication that meat was consumed more frequently than in the southern Balkans (*e.g.* Greece), due to a rapid demographic increase (Bökönyi 1974; 1990).

At Promachon, the large assemblage of animal bones, the evidence for unselective deposition of anatomical parts of domestic animals and the large number of standardized cooking and serving vessels suggest that the entire

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[40] A title partly owing to one of the most creative of sources: *Consuming passions and patterns of consumption* (Miracle and Milner 2002).

chaîne opératoire, from slaughter to consumption, took place mainly on-site. With regard to the consumption of meat in the Neolithic (and Early Bronze Age) Greece, two hypotheses have been made (Halstead 2007). The first is that, the consumption of meat may have taken place by individual households over an extended period of time. A problem that we need to consider in connection with this hypothesis concerns meat preservation. It is well known that meat spoils too quickly to be consumed over an extended period of time by individual households, if not preserved properly. Ethnographic evidence suggests that the preservation of meat with pre-modern technological implements could be achieved in a number of ways, the most common of which is salting (McGee 1988). However, the amount of salt needed for the preservation of large carcasses, is considerably high. Therefore, unless and until evidence for salt collection on a significant scale is found in prehistoric Greece, the hypothesis of the preservation of animal carcasses by salting should be approached with caution (Halstead 2007).

The second hypothesis is that the consumption of meat may have taken place collectively, at large-scale social events (Halstead 2007). It is likely that cattle played a significant role in large-scale social events. Strong evidence for the collective consumption of cattle carcasses is provided by the incidence of butchery on cattle postcranial bones, which is relatively low (6%), implying that cattle were butchered into large parcels, perhaps for consumption by large social groups[41]. Conversely, caprines and pigs may have been small enough to have been consumed primarily at the level of the household. However, as already seen, the frequency of butchery marks on the postcranial bones of caprines and pigs from Promachon is roughly similar to that of cattle (4% for caprines and 5% for pigs). Although not as much as for cattle, pig and caprine carcasses would also be expected to be butchered fairly intensively for household consumption. It is therefore possible that, like beef, mutton and pork were consumed communally in Promachon.

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[41] See also ***Figure 5.10***.

A potential problem that must be considered is that the incidence of butchery marks on the bones of the three main domesticates from Promachon could be masked by taphonomic phenomena. As already argued however, the faunal material from Promachon is in a very good state of preservation; in addition, the incidence of carnivore gnawing at Promachon's faunal material is low, thus making it less likely that carnivore attrition resulted in the obliteration of butchery marks[42].

Therefore, the low frequency of butchery marks on the bones of the three main domesticates from Promachon is certainly genuine. This indicates that animal carcasses were not intensively butchered, in order to be consumed communally. It is likely that structure n. 4 was the main recipient of consumption residues, following large-scale feasting. The significance of this particular structure, however, will be assessed later in the current chapter. Possible reasons for the consumption of animal carcasses at large-scale social events could be related to a number of different possibilities: visitors from neighboring settlements, sealing of alliances or exchanges, responses to difficult environmental conditions (Orton 2008), and generally village-based feasts in order to celebrate all kind of possible events.

The consumption of animal carcasses at large-scale events does not entirely preclude the possibility of meat consumption at the level of household. The contextual analysis indicated that the areas of everyday activities, such as use surfaces, floors and hearths were the recipients of high proportions of bone refuse. Thus, although the evidence indicates that the consumption of animal carcasses in Promachon took place mainly at a large social scale, it is also highly likely that some meat was consumed at a domestic level. It would be unrealistic to suggest that, if the opportunity arose, the Neolithic people of Promachon would not consume some meat as part of their everyday life.

There is however, a further issue, which should also be considered. The evidence from Phase III suggests an increase in the frequency of cut marks on the postcranial bones of the three main domesticates; this indicates that

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[42] See also ***5.2.1 – Preservation***.

during Phase III animal carcasses were more intensively butchered, possibly for household consumption. If this was the case, then it can be assumed that there was an increase in household-based consumption during Phase III in Promachon. This issue will be further discussed later in the current chapter.

7.3.2 – The symbolic significance of cattle

The economic significance of cattle at Promachon has been discussed earlier in this chapter. Cattle, however, like all other animals, but perhaps particularly so, has a symbolic significance as well. The universal idea that cattle is a beast of great strength and at the same time, the incarnation of nature's rebirth, may have been reflected in the ideology of many Neolithic groups (Cauvin 2004). The symbolic significance of cattle is cross-cultural and characterizes many periods in human history. For instance, cattle are considered to have been of particular symbolic significance in Minoan art (***Figure 7.1***), while in Hinduism, cattle is a symbol of wealth, strength, abundance, selfless giving, and a full earthly life (Shaffer and Lichtenstein 1995).

Figure 7.1: Bull leaping. Fresco. Palace of Knossos, Court of the stone spout. Late Minoan II: 1500-1450 *Cal.* BC, following Hood (1993), equivalent to Late Bronze Age in mainland (northern) Greece. Museum of Iraklion, Crete. The practice of bull leaping - unlike the bullfight - did not require the killing of bulls. The aim was to highlight the courage and flexibility of athletes.

With regard to the Neolithic, the large number of cattle zoomorphic figurines from a number of sites such as Knossos, Itea, Sitagroi, Zarko (Toufexis 2003), indicates that cattle, was probably the most prized animal (Halstead and Isaakidou 2013). Due to its large size, Ingold (1980; 225) has also suggested that cattle are the only species to meet the requirements to act as a "store of wealth". According to Orton (2008) however, the word 'wealth' should not imply commodification, and should not be used in its strict materialistic sense. Rather, cattle might have been regarded and also used as exchangeable goods (Ray and Thomas 2003), for the creation and maintenance of social ties (Halstead 2007; Halstead and Isaakidou 2013; Orton 2008).

Figure 7.2: Layer of pottery sherds, grinding stones and bucrania from structure n. 4. Phase I. After Koukouli-Chrysanthaki *et al.* (2007).

In view of the absence of cattle zoomorphic figurines at Promachon, the presence of almost 35 bucrania (Trantalidou and Gkioni 2008) from the deposits of structure n. 4 (***Figure 7.2***) constitutes probably the most reliable source of evidence for highlighting the symbolic importance of cattle at Promachon. According to a number of scholars, bulls reflected a male entity in fertility rites, and the sacredness of the animal was expressed with the presence of horns (Gimbutas 1991).

In general, bucrania are powerful symbols and they can be found in sites from the Near East dating as early as the 10th millennium BC, as well as the Balkan (Vinča and Tisza cultures) regions. However, their use is not always clear and the archaeologists hold conflicting opinions. For instance, bucrania might be linked with the religious perception for the sacredness of cattle, manifested through the use of horncores (Trantalidou and Gioni 2008), but they could also been used as decorative objects (Trantalidou ad Gkioni 2008). The bucrania that have been found at Hallan Çemi in Turkey (Rosenberg 1999) and Kormadin in Croatia (Koukouli-Chrysanthaki *et al.* 2007) have been interpreted as such. A single bucranium, which was found in the deposits of a Phase I structure from Dikili Tash (***Figure 7.3***) in eastern Macedonia, has been interpreted as a decorative object as well; archaeologists of the site argue that the bucranium, which was covered in clay, could have been suspended on posts around the periphery of the structure (Darque and Treuil 1997; Treuil and Darque 1998). The probable use of bucrania as decorative objects does not necessarily imply that these did not have a symbolic value as well (Trantalidou and Gkioni 2008). The use of the bucrania inside structures, under floors, or on walls, may - in the minds of the Neolithic people - have strengthened the power and the longevity of the building (Treuil and Darque 1998).

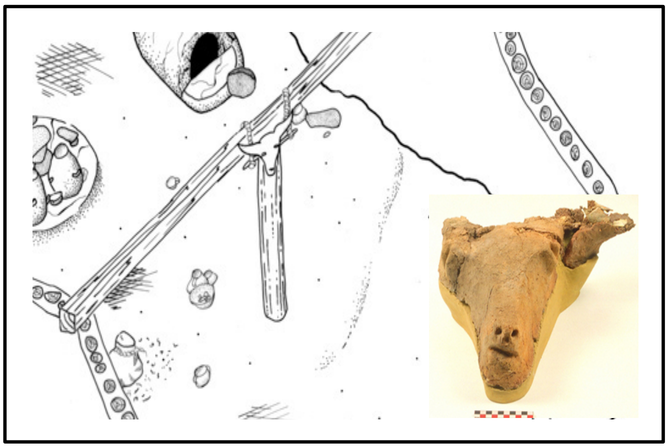

Figure 7.3: Bucranium plastered with clay. Dikili Tash I. After Koukouli-Chrysanthaki *et al.* (2007).

In this sense, it is possible that the inhabitants of Promachon suspended bucrania on posts or in visible parts of structure n. 4, in order to reassure the structure's durability against physical phenomena and potential environmental disasters. Corroborating evidence for the latter hypothesis is represented by a clay house model, which was found in the deposits of structure n. 4, with the decoration of plastered bucrania on its walls[43].

The occurrence of bucrania tends to increase at times when the economic importance of cattle is high (Orton 2008), as is also the case at Promachon. The bucrania at Promachon were found in the deposits of structure n. 4,

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[43] See also ***Figure 2.9***.

which belongs to the first phase of occupation, when cattle are represented with the highest frequencies. It can be suggested therefore, that there is a link between the economic and the symbolic significance of cattle, and that the two variables should not be entirely disentangled. For instance, as suggested, the large size of cattle at Promachon (in comparison to other sites from Macedonia and Thessaly) could be the result of the economic importance of the species for the Neolithic people of Promachon[44]. However, it may also be the result of the symbolic significance of the species. If we accept the argument that cattle carcasses were consumed in large-scale social events, then it is highly likely that cattle were subject to special treatment by the Neolithic people at Promachon, possibly being fed in a privileged way in comparison to other livestock.

7.3.3 – The social and symbolic significance of hunting

Arguably, the issue of hunting in farming societies has received small attention in European zooarchaeology (Hamilakis 2003). Zvelebil (1992) notes that this is mainly the result of the evolutionary thought in archaeology, which perceived hunting as a remnant of a backward and outdated stage in human evolution. The information from single, as well as multi-period, sites from mainland Greece indicates a marked increase in the percentage of wild animals during the late stages of the Neolithic and the Early Bronze Age (Halstead 1992; 1999; Hamilakis 2003). One of the main questions in Greek zooarchaeology therefore, is why people during these time-periods hunted and consumed wild animals given that fact that they had plenty of access to meat that could be produced by domesticated animals (Hamilakis 2003).

In the case of the Greek Neolithic, a number of hypotheses regarding the importance of hunting in farming economies have been suggested. For instance, Halstead and O'Shea (1989) argue that hunting constituted a risk-buffering choice by the Neolithic people in cases of crop failures and livestock diseases. Conversely, Hamilakis (2003) suggests that hunting in

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[44] See also ***6.4.4 – Contemplating the size of domestic ruminants and pigs during the Late Neolithic of Macedonia and Thessaly***.

farming societies was linked with the development of an institutionalized authority and that wild animals may have been regarded as 'trophies' by an emerging elite group of people. The argument for the presence of elite groups during the Late Neolithic of Greece is based on archaeological evidence, such as the presence of large structures and monumental buildings in Thessaly (*i.e. Megaron* in Late Neolithic Dimini), which denote delineation and separation from the rest of the structures.

The presence of monumental buildings also applies in the case of Promachon. For instance, structure n. 4 is a particularly large structure in Promachon, and in this respect, it is a distinct feature from the rest of the structures of Phase I (pit-houses). However, structure n. 4 should not be taken as an indication for the presence of a hierarchical and socially stratified society at Promachon. It is possible that it was not used to strengthen the authority of an elite group of people, but rather as a public building, where activities of symbolic nature took place. These probably involved the consumption of meat (and perhaps other stimulants) aimed to strengthen bonds and social relations in the community.

Returning to the issue of Neolithic hunting, the relatively high frequency of wild animals at a number of sites in Greek Macedonia could be linked to the symbolic significance that these animals had among Neolithic communities. Like the meat of the domestic animals, the meat of the wild animals could have been consumed primarily communally. Unfortunately, this cannot be firmly demonstrated at Promachon due to the complexity of bone fragmentation and recovery, as well as sample size. In any case, it is highly possible that the consumption of the meat of wild animals might have had particular symbolic and social implications, which possibly outweighed its nutritional value as a source of protein.

We should not forget also that the bones of wild animals represented a valuable source of raw materials, as the presence of a number of worked deer ulnae demonstrates. In general, the bones of wild animals constitute better working material than the bones of domestic animals, since they tend to be denser and more resilient. The absence of deer cranial elements from Promachon might be an indication for the disposal of deer crania in workshop areas for the production of antler tools and objects; this is also corroborated by the presence of two tine antlers with polished surfaces in Promachon[45]. The use of antlers as a source of raw materials is attested elsewhere as well: for instance, antlers are known to have been used as picks and digging implements in various Neolithic sites of Europe (Clutton-Brock 1984). However, the use of bone as raw material is likely to have represented just a useful by-product of hunting.

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[45] However, we should not also exclude the possibility that, as in the case of wild pig, deer heads might have been disposed off-site due to their heavy weight and limited meat content.

7.4 – Use of space and chronological development

This part of the discussion will combine zooarchaeological and archaeological information in order to discuss settlement patterns at Promachon. It will also discuss the most interesting patterns that emerged from the comparison of Promachon with other Macedonian, Thessalian and Balkan settlements.

7.4.1 – Phase I and structure n. 4

The comparison of the faunal material between structure n. 4 (Theodorogianni and Trantalidou 2013) and the rest of the deposits of Phase I provided some interesting insights regarding the use of space during the first phase of occupation at Promachon (***Table 7.1***). We should note, however that, due to the differences in the methods of study of the faunal material between the two areas, the results of this comparison should be approached with caution.

The comparison of the frequencies of the three main domesticates (in terms of *NISP*) between the two areas indicated that the remains of cattle dominate the deposits of structure n. 4, whereas no particular emphasis on a single species could be detected in the rest of the deposits of Phase I. In addition, in structure n. 4 there is an emphasis on the disposal of calves, whereas the same age group is completely absent from the rest of the deposits. Of particular interest is also the fact that there is a higher proportion of younger caprines in structure n. 4, whereas the opposite pattern could be detected in the rest of the deposits of Phase I.

Table 7.1: Structure n. 4 (Theodorogianni and Trantalidou 2013) vs. rest of the deposits of Phase I. Faunal and archaeological evidence.

Spatial differentiation in Phase I		
Evidence	***Structure n. 4 (Layers 7-11)***	***Rest of the deposits (Layers 4-6)***
Faunal	*Emphasis on cattle (in terms of* NISP*)*	*No particular emphasis on a single species (in terms of* NISP*)*
	Presence of calves	*Absence of calves*
	Younger caprines	*Older caprines*
	35 bucrania	*No bucrania*
Archaeological	*'Extravagant' material culture objects*	*Everyday material culture objects*
	Large structure (12 m diameter, 7 m in depth)	*Pit-houses (each 8-10 m^2)*

The comparison of the faunal material between structure n. 4 and the rest of the deposits of Phase I supports the arguments of the excavation team regarding spatial differentiation during the first phase of occupation in Promachon.

As previously noted, the low frequency of butchery marks on the bones of the three main domesticates indicates that animal carcasses were not intensively butchered, probably as a consequence of their communal consumption[46]. It has also been argued that some meat was probably also consumed at the level of household. The contextual analysis from Phase I indicates that neither the pits of the pit-houses, nor the floors and the hearths of Phase I indicate the preferential disposal of the remains of a particular species. The higher frequency of older caprines from the deposits of Phase I (in comparison to the higher frequency of younger caprines from structure n. 4) suggests that these animals were not bred exclusively for meat, but secondary products were also used, though they may have been less important. It is possible that communal consumption of animal carcasses in the deposits of Phase I did not have a particular symbolic (and/or ritual) significance and that it did not involve large gatherings of people. There is nothing in the overall archaeological context that suggests social exclusivity;

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[46] See also ***Figure 5.10***.

therefore the consumers are unlikely to have been particularly chosen people, but merely extended family groups or similar social gatherings.

Unlike the majority of the deposits of Phase I, where the consumption of animal carcasses is likely to have been practiced both communally and to the household level, the deposits of structure n. 4 were the recipients of consumption residues associated exclusively with large-scale feasting. The mass disposal of this material in structure n. 4 could be interpreted "as a symbolic reinforcement of the importance of a series of major consumption events" as Halstead (2007; 39) implies in the case of Late Neolithic Makriyalos, Pieria, Greece. The high frequency of cattle remains from the deposits of structure n. 4 may be explained on the basis of the particular symbolic significance of this animal for the Neolithic people at Promachon. In addition, the presence of a characteristic age group such as calves, the presence of the bucrania and antlers, as well as other luxurious material culture objects, is consistent with the particular symbolic nature of structure n. 4[47]. The significance of the presence of younger caprines in the deposits of structure n. 4 is difficult to understand yet it is tempting to assume that this part of the caprine population was reserved particularly for large-scale feasting.

All in all, it can be suggested that there are differences in the use of space during the first phase of occupation in Promachon. The pit-houses, the use surfaces, the floors and the hearths were areas of everyday activities, where consumption took place primarily communally; however, we cannot also exclude the possibility of household consumption. On the other hand, structure n. 4 was exclusively used for large-scale consumption events. It is highly likely that the communal consumption of animal carcasses between the two areas of the settlement during Phase I did not have the same

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[47] However, as previously noted (see also ***5.9.2 – Structure n. 4 vs. the rest of the deposits of Phase I***), we should not entirely disentangle the symbolic significance of cattle from its economic value. In this sense, there is a possibility that calves, as a characteristic age group, might have had a particular symbolic value for the people of Promachon. However, calves might also have been the part of the cattle population that had to be slaughtered to favour the production of milk for human consumption.

significance. Probably, the large-scale consumption events that took place in structure n. 4 were of higher symbolic (and/or ritual) significance than those from the rest of the settlement during Phase I.

7.4.2 – Phase II

One may expect that the changes in the structural features (the replacement of the pit-houses of Phase I by the aboveground structures of Phase II) were also related to changes in the economy of the site and the husbandry regime. However, the study of the faunal material from Phase II does not indicate any substantial changes in the proportions of the three main domesticates in comparison to Phase I. In addition, metrical analyses do not indicate changes in the size of the animals between the two phases. The contextual analysis suggests that the use surfaces, the floors and the hearths were the recipients of the highest proportion of bone refuse during Phase II. Thus, it can be argued that the bones represent discarded material after some form of collective consumption took place. However, as in the case of Phase I, we cannot also exclude the possibility that domestic consumption took place.

On the other hand, it is highly likely that the large structure (structure n. 1), which was found at the Bulgarian sector of Topolnica during the second phase of occupation[48], was used as a public structure with a symbolic significance similar to that of structure n. 4 (Phase I) in the Greek sector of Promachon. It is therefore possible that in the second phase of occupation, large-scale social events took place in the Bulgarian sector of the site (Topolnica). It would have been interesting to find out whether the higher frequency of cattle postcranial elements during the second phase of occupation at Promachon[49] were the result of the disposal of bucrania in structure n. 1 at Topolnica, as it had been the case for structure n. 4 from Promachon. Unfortunately, however, the absence of contextual detail from

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[48] As already noted [see also ***2.3.2 – Phase II (Layers 2-3)***], the conflagration event that took place in Phase I, may have forced the inhabitants of the settlement to move the 'public' building (structure n. 4) from the western plateau (Promachon sector) to the eastern plateau (Topolnica sector), by constructing a new aboveground structure (structure n. 1).

[49] Suggested by the body part distribution of cattle (***5.5.1 –*** **Bos taurus** ***body part distribution***).

Topolnica (Iliev and Spassov 2007), limits the possibility of comparing the material between the two sectors beyond the level of the frequency of species.

7.4.3 – Phase III: a time of change?

As previously noted[50], the excavators of the site have argued that the settlement of Promachon-Topolnica was abandoned at the end of Phase II and it was reoccupied in Phase III for a short period of time (Koukouli-Chrysanthaki *et al.* 2007). This argument is based on the changes that were noticed in pottery decoration between Phases II and III. The material culture evidence from Promachon indicates that the pottery of Phase II is characterized by high quality decoration [*i.e.* thin and thick 'Strumsko' and 'Akropotamos' decorative lines, black-on-top and 'Bituminus' decoration, (Koukouli-Chrysanthaki *et al.* 2007; Vajsov 2007)], whereas that of Phase III is characterized by drab and incised decoration, which reveals "a dramatic reduction of stylistic variation and aesthetic brilliance" (Bailey 2000, 252). In addition, absolute dating has indicated a habitation gap of almost two centuries between Phases II and III. In general, it is suggested that the habitation gap between Phase II and Phase III represents a time-period of cultural discontinuity (Koukouli-Chrysanthaki *et al.* forthcoming).

The study of the faunal assemblage has highlighted a number of patterns that are consistent with the argument of changes at Promachon during this time-period. Perhaps most important is the decline in cattle frequency, which has in particular been highlighted by the *MNI* counts. The rise of caprines at the expense of cattle during Phase III probably indicates that there is indeed a change in the husbandry practices between Phases II and III in Promachon.

Of particular interest is also the fact that the study of the frequency of cut marks and chopping marks on the bones of the three main domesticates from Promachon, suggest differences in patterns of butchery between Phase

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[50] See also ***2.3.2 – Phase II (Layers 2-3)***.

III and the preceding Phases I and II. As previously noted, the frequency of chopping marks is higher than the frequency of cut marks on the bones of the three main domesticates during Phases I and II. The low frequency of cut marks in Phases I and II was interpreted as an indication that animal carcasses were processed in large chunks, possibly for consumption in large-scale social events. On the other hand, the study of the frequency of cut marks and chopping marks during Phase III indicates the exact opposite pattern. More specifically, cut marks are represented with a higher frequency than chopping marks on the bones of the three main domesticates during Phase III. The presence of a clay crucible that was found at the bottom of a small pit belonging to Phase III [which contained traces of copper smelting (Koukouli-Chrysanthaki *et al.* 2007)][51] might be suggestive of the use of metal tools and knives. However, there is also the possibility that stone tools and flints (rather than metal tools, which in any case were not found in Promachon[52]) might have been used more intensively during Phase III than earlier phases. In any case, the identification of stone marks *vs.* metal marks on site falls beyond the scope of this study; as already noted the study of the tool specialist (Rozalia Christidou pers. comm.) will provide valuable information with regard to this issue. What is really interesting however, is that the higher frequency of cut marks during the third phase of occupation in Promachon may indicate that animal carcasses were butchered more intensively, which in turn, might indicate an increase in household-based consumption during Phase III at Promachon.

Metrical analyses tentatively suggest changes in the size of sheep between Phases II and III. More specifically, shape indices showed that sheep from Phase III were more robust than their counterparts from Phase II. Despite the use of the scaling technique did not firmly confirm the previous point, there are some hints that different body parts of sheep were subject to various changes between Phases II and III[53]. It seems that sheep from Phase III

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[51] See also ***2.3.3 – Phase III (Layer 1)***.
[52] See also ***5.4 – The human agent: butchery and burning***.
[53] See also ***Figures 5.53*** and ***5.54***.

were slightly different in comparison to those from Phase II, but such difference could not be exemplified by concepts such as size and robustness. It is difficult to evaluate the reasons behind such difference, but considering the changes in the patterns of butchery as well as the changes in the frequency of caprines between Phases II and III, it is tempting to assume that such difference was the result of changes in the actual build of sheep, possibly due to the introduction of a new type of sheep during Phase III.

All in all, the faunal evidence is consistent with the suggestion that significant changes occurred during the third phase of occupation. We should also consider that this phase corresponds to the late stage of the Late Neolithic (LN2), which is a time-period during which significant changes in settlement patterns, burial practices, economy and material culture took place in the area of the Balkans (Bailey 2000; Greenfield 2005; Whittle 1996). Bailey (2000) argues that the changes in this time-period were similar to those that distinguished mobile hunter-gatherers from the early villagers of the mid-seventh millennium BC of the Balkans:

"*However, whereas the mid-seventh millennium BC shift had been from flexibility and mobility to the physical demarcation and anchored residence of increasingly divided communities, the shift of this time period was from stable, but perhaps inflexible, village communities, in which the ideology of the household held sway, to mobile communities*" (Bailey 2000; 261).

It is possible therefore that the people who reoccupied Promachon during Phase III brought different ideas, new subsistence methods, and new methods in husbandry practices. In any case, the reoccupation of the site of Promachon did not last for a long period, since absolute dating indicates that the site was abandoned during the last quarter of the 5th millennium BC.

7.4.4 – Human remains

As previously noted, modern human is represented in Phase I with a proximal scapula and a proximal radius and in Phase II with a proximal ulna. The mixed deposits have also yielded a human proximal scapula (glenoid cavity). The occurrence of human remains at Promachon is interesting, but needs to be interpreted by considering the context of origin.

These human remains derive from a number of different contexts. The proximal scapula and proximal radius from Phase I derive from a ditch and a use surface (outdoor surface) respectively, while the Phase II proximal ulna derives from the floor of an aboveground structure. Of additional interest is the fact that a part of a human mandible and a fragment of a human skull were also found in the deposits of structure n. 4 at the time of the excavation (Koukouli-Chrysanthaki *et al.* 2007), while Theodorogianni and Trantalidou (2013) in their report on the faunal remains from the same structure argue for the presence of two human ulnae. On the other hand, no evidence of human remains was reported from the Bulgarian sector of Topolnica (Iliev and Spassov 2007).

In general, the evidence from the late 5th millennium BC in northern Greece, southern and western Bulgaria and Serbia, suggests that human bodies, whole or partial, were buried under the floors of buildings (Bailey 2000). For instance, in the western Thessalian plain at Ayia Sofia, two burials were associated with a mud-block mortuary structure, while at Pevkakia near Dimini people placed the burial beneath the floor of a structure (Andreou *et al.* 1996). There were also cases where burials were found in ditches or refuse pits (Bailey 2000). For instance, at the site of Makriyalos in Western Macedonia, primary or secondary burials were found in one of the site's three concentric ditches (Pappa 1993; Pappa and Besios 1998; Andreou *et al.* 1996).

The small number and scattered form of the human remains found at Promachon rules out the possibility that they may represent primary deposition, which leads to the following questions:

- Why are only a few parts of the deceased skeleton found.
- Where is the primary deposition area located.

Hourmouziadis (1973) suggested that, in Neolithic Greece, corpses could have been either cremated, or buried in cemeteries outside the settlements' limits. If we accept the assumption that cemeteries existed and were outside the limits of settlements, then it could be assumed - on the basis of the exemplified burial patterns from the Early Neolithic site of Prodromos (Hourmouziadis 1973) - that scattered bones might reflect exhumation and reburial of certain, selected parts of the deceased skeleton (Perlès 2001). In other words, it is possible that the deceased from Promachon were buried outside the settlement's limits and a number of certain parts of the skeletons were reintroduced to the site by being deposited in a number of different areas (*i.e.* beneath house floors or simply thrown inside pits and/or ditches). This entire process could be related to a change of status from deceased to ancestor, thus suggesting the existence of an ancestor cult (Perlès 2001), with the ultimate purpose of the protection of the world of the living.

Alternatively - if indeed a cemetery existed during the Late Neolithic at Promachon - this might as well have been located within the limits of the settlement, either in an unused part of the site, or in an area not affected by the excavation. For instance, the evidence from the site of Gomolava in Serbia (first half of the fifth millennium BC), suggests that the Neolithic people living there buried the deceased within the settlement's limits, but in an area of the site that was not intensively used. This eventually led some researchers to characterize this particular area as an "intramural necropolis" (Bailey 2000; Orton 2008). If the cemetery was located within the settlement of Promachon, then it is possible that digging activities may have easily disturbed the burials and led to the accidental scattering of human bones.

7.4.5 – Beyond the site: Macedonia, Thessaly and the Balkans

One of the key aims of the current research was to understand the economy, the scale of animal husbandry and the nature of human-animal relations at Promachon. In this respect, the analysis of the animal bone assemblage from Promachon indicated a number of interesting patterns, which have been discussed earlier in this chapter. Also important is to incorporate Promachon in the context of contemporary sites from northern Greece and the Balkan regions. For this reason, the results of the faunal analysis from Promachon were compared to those from Late Neolithic sites of this broader area. This comparison placed Promachon in a regional context, but it also provided interesting insights into the diverse husbandry practices practiced among Late Neolithic sites in northern Greece.

Of particular interest is the consideration that the subsistence economy of Promachon could have been dictated by the environmental conditions of the Strymon river valley, as well as the cultural bonds that the Neolithic people of Promachon had with contemporary communities in the Balkans. It has been repeatedly argued that cattle at Promachon are represented with the highest frequencies among Macedonian and Thessalian Late Neolithic sites. The high frequency of cattle from Promachon can plausibly be attributed to the geomorphology, the environment, the vegetation and the climate in the region, which may have significantly favored the keeping and breeding of these animals.

However, the high frequency of cattle in Promachon cannot be attributed solely to the favorable environmental conditions of the area. The evidence from the pottery decoration and the structural features from Promachon, indicate that the site was culturally linked with contemporary communities from the Balkan regions, in which cattle had an important role. In terms of the economy, Promachon could have been linked to Aegean Late Neolithic communities; however, it is also highly likely that Promachon was linked with Late and Final Neolithic communities of the Balkans. This is one of the most interesting aspects of the analysis of the faunal material from Promachon, since it confirms previous suggestions of the excavators of the site with regard to the cultural bonds between Promachon and contemporary Balkan sites.

There is however, an interesting issue, which should also be considered. A number of settlements contemporary to Promachon are located in the southern part of the plain of Serres (*i.e.* Toumba, Dimitra, Kryoneri).

Promachon on the other hand, is the only Late Neolithic settlement in the northern part of the plain. It is possible therefore that, Promachon was rather isolated[54]. Unlike Promachon, Sitagroi might have belonged to a group of sites in the plain of Drama, which had progressed from small villages to being highly interacting communities. It is likely that the particularly large size of cattle and sheep from Sitagroi was the result of an agricultural system that had attained a high degree of expertise, thus permitting the people of Sitagroi to provide ample and/or better-quality fodder to their livestock. Sitagroi would not have overcome difficult situations, without being part of a wider network of communities in the plain of Drama, which interacted with each other in order to respond to economic and/or environmental constraints. It is likely therefore that Sitagroi - unlike Promachon - was part of a group of settlements with a more organized and centralized system of economy in the plain of Drama.

Biometry gave also important insights into the diverse husbandry practices between Macedonian and Thessalian Late Neolithic sites[55]. More specifically, metrical analyses indicated that cattle from Macedonia were larger than their counterparts from Thessaly, whereas the opposite pattern was suggested in the case for sheep and pigs. The large size of sheep and pigs in Thessaly could be the result of a particular emphasis on sheep and pig husbandry, whereas the large size of cattle in Macedonia might be the result of the particular attention on cattle husbandry. On the other hand, the comparison of the size of domestic ruminants and pigs between Thessalian sites indicates that each site possibly maintained their own types of livestock. If this was the case, then it could be argued that different sites in Thessaly were fairly independent from each other.

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[54] We should note however, that the scarcity of settlements contemporary to Promachon in the northern part of the plain of Serres might also be the result of ‘gaps’ in the archaeological research. It is likely that other contemporary sites will eventually emerge, thus adding to the information currently available.

[55] See also ***6.4.4 – Contemplating the size of domestic ruminants and pigs during the Late Neolithic of Macedonia and Thessaly***.

It should also be noted that the comparison of the size of domestic ruminants and pigs from Late Neolithic Macedonian and Thessalian settlements has not been attempted prior to this study. The collection of a larger body of metrical data from Late Neolithic Macedonian and Thessalian settlements should represent a priority for future research in order to provide clarification to some of the aforementioned issues.

Chapter 8 – Conclusions

In this chapter, we will present a number of key issues that have emerged from the current research. The subsequent paragraphs elaborate on each of the key issues.

- The faunal evidence exhibits a number of characteristics that are consistent with small-scale mixed economy rather than extensive and specialized herding.

The economy of Promachon is based on the exploitation of a highly mixed composition of livestock (cattle, caprines and pigs), rather than a strong focus on the exploitation of a single domestic species. The ageing evidence indicates that animals were bred and kept primarily for their meat. However, a small-scale exploitation for milk could also be inferred: the ageing evidence suggests that sheep - unlike goats - were used for milk. This represents a rare occasion in Greek archaeology for the kill-off patterns of the two species to have been analysed independently. There is also tentative evidence for the use of cattle for milk, given the high proportion of calves in structure n. 4. On the other hand, the use of cattle for traction and the exploitation of caprines for their fleece seem rather unlikely.

- Cattle were the species with the highest economic importance; in addition, they had a symbolic significance.

The environmental conditions in the area of Promachon could have significantly affected the decision of the Neolithic people of the site to invest substantially on cattle. Due to their large size, cattle would have undoubtedly provided the largest quantities of meat than any other domesticates. Of particular interest is also the fact that, at Promachon, cattle are represented with the highest frequency among contemporary settlements in Macedonia and Thessaly. Metrical analysis indicated that cattle from Promachon were larger than their counterparts from Macedonia (with the exception of Sitagroi) and Thessaly. It is possible therefore that the Neolithic people of Promachon placed particular attention on cattle husbandry, and provided them with ample and/or better-quality fodder in order to increase their size. However, the large size of cattle at Promachon may also be attributed to the likely symbolic role that the species probably had for the Neolithic people of the site. The presence of 35 bucrania from structure n. 4 constitutes the most substantial source of evidence for highlighting the symbolic importance of cattle at the site.

- The faunal evidence suggests that the consumption of animal carcasses took place primarily communally. However, we cannot exclude also the possibility of some household consumption.

The low frequency of butchery marks on the postcranial bones of the three main domesticates suggests that animal carcasses were not intensively butchered, in order to be consumed communally. In other words, it is highly likely that the consumption of meat at Late Neolithic Promachon was practiced at a large social scale. However, we cannot exclude the possibility of the consumption of some meat at the domestic level, too.

- The comparison of the faunal material between structure n. 4 and the rest of the deposits of Phase I indicates spatial differentiation during the first phase of occupation in Promachon.

Unlike the deposits of Phase I, where the consumption of animal carcasses was practiced (primarily) communally, and (to a lesser extent) at the level of household, the deposits of structure n. 4 were the recipients of consumption residues probably associated with large-scale feasting. It seems that the communal consumption of animal carcasses between the two areas of the settlement did not have the same significance. Probably, the large-scale consumption events that took place in structure n. 4 were of higher symbolic (and/or ritual) significance than those from the rest of the settlement during Phase I.

- The study of the faunal assemblage has highlighted a number of patterns that are consistent with the argument of changes in Phase III.

The rise of caprines at the expense of cattle (in terms of *MNI*) during Phase III probably indicates that there is a change in the husbandry practices between Phases II and III at Promachon. In addition, the higher frequency of cut marks than chopping marks on the bones of the three main domesticates during Phase III, may also indicate that animal carcasses were butchered more intensively in Phase III than the preceding phases. If this was the case, then it follows that there is an increase in household-based consumption during Phase III. Metrical analysis tentatively suggests changes in the size of sheep between Phases II and III; this could be the result of the introduction of a new 'type' of sheep during the third phase of occupation in Promachon.

- Pig hunting was particularly important for the Neolithic people of Promachon and Sitagroi.

Biometrical analysis has not confirmed the presence of the aurochs at Promachon, even though Theodorogianni and Trantalidou (2013) and Iliev and Spassov (2007) argue for the species' presence in structure n. 4 and the Bulgarian sector of Topolnica respectively. However, biometrical analysis has indicated the presence of a substantial number of wild pig remains. This mirrors Bökönyi's (1986) assessment for the situation at Sitagroi. The pattern does not necessarily imply that the Neolithic people from Promachon and Sitagroi were hunting wild pigs more regularly than the people from other contemporary settlements in Macedonia; rather, the lack of in-depth biometrical analyses at other Neolithic sites from Macedonia resulted in the significance of wild pig hunting not being properly evaluated. In this respect, the possibility of a similar level of wild pig hunting at other sites - contemporary to Promachon and Sitagroi - cannot be entirely excluded. The importance of the use of biometry for the identification of wild pigs from Macedonian Late Neolithic settlements must be emphasized. Biometrical analysis also suggested that wild pig heads were disposed off-site and the

Neolithic people of Promachon were transferring to the site the rest of their carcasses.

- Promachon was probably isolated from the rest of the sites in the southern part of the plain of Serres.

This argument is mainly based on the archaeological rather than zooarchaeological evidence. The absence of sites contemporary to Promachon from the northern part of the plain of Serres indicates that Promachon was probably a distant and isolated site. However, we should not exclude the possibility that the absence of Late Neolithic sites in the north part of the plain of Serres could be the result of gaps in the archaeological research.

- Promachon was linked with Late and Final Neolithic communities of the Balkans.

The substantially better representation of cattle at Promachon than any other settlement in Greek Macedonia, along with the evidence from pottery decoration and structural features, suggests that - to some extent - Promachon was linked to Balkan Late and Final Neolithic communities. This evidence is complementary to that obtained from other sources of archaeological data suggesting a link between Promachon and other contemporary sites in the Balkans.

- The large size of cattle and sheep from Sitagroi (in comparison to other sites from Macedonia) may be the result of a highly proficient feeding regime at that site. This may indicate that settlements in the plain of Drama were part of a network of communities, which could overcome economic as well as environmental constraints through cooperation.

It is likely that the large size of cattle and sheep from Sitagroi was the result of an agricultural system that had attained a high degree of expertise, thus permitting the Neolithic people of Sitagroi to provide ample and/or better-quality fodder to their livestock. The plain of Drama is characterized by a wide network of sites - among them also Dikili Tash - in relatively close proximity, which had possibly proceeded from small villages to being highly interacting communities. Sitagroi was probably one of the most important. Conversely, Promachon may have been isolated from the other contemporary sites in the plain of Serres.

- Biometry gave important insights into the diverse husbandry practices between Macedonian and Thessalian Late Neolithic sites.

Biometrical analyses indicated that cattle from Macedonia were larger than their counterparts from Thessaly, whereas the opposite was the case for sheep and pigs. The large size of the livestock may be indicative of the focus that husbandry in different regions had on different species. As concerns pigs from Thessaly, the possibility of the interbreeding of domestic and wild pigs must be considered. The comparison of the size of livestock between different Thessalian sites indicates that each of them possibly maintained their own types of livestock; if this was the case, then it can be assumed that different sites in Thessaly were fairly independent from each other.

The comparison of the size of domestic ruminants and pigs between Thessalian and Macedonian sites had not been attempted prior to this study - yet it can be very informative. The collection of a larger body of metrical data from Late Neolithic Macedonian and Thessalian settlements should represent a priority for future research, in order to provide clarification to some of the aforementioned issues.

– Epilogue

I would like to close this thesis with three final comments.

Unfortunately, the lack of contextual information from the Bulgarian sector of Topolnica limited the possibility of comparing or at least combining the results between the two sectors. In addition, the comparison of the faunal assemblages between structure n. 4 and the rest of the deposits of Phase I has some inevitable limitations due to the differences in the methods of study of the faunal material between the two areas. However, and despite the differences in the methodology, such comparison have provided interesting insights, though the interpretation had to be kept at an inevitably approximate level.

Biometrical analysis provided important insights regarding husbandry practices at both local (Promachon and Strymon river valley) and regional (Macedonia and Thessaly) levels. Given the general scarcity of biometrical data from Macedonian settlements, this thesis has hopefully demonstrated the importance of biometry for the investigation of aspects of economy and animal use.

Finally, a note about archaeology in Greece; it is true that the financial crisis has affected the archaeological research in Greece in a profound way. Political decisions have depreciated Greek archaeologists in many ways, and a large number of colleagues with many qualifications remain jobless for many years. Cultural heritage is Greece’s largest asset: if, as citizens, we hope to get out of this crisis, the investment in culture and archaeology should represent a top priority.

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Appendix A: Database fields and codes

Note: In the tables below, database fields and codes are presented in the form of a list, accompanied by a short description.

1. Preservation

A	Awful
B	Bad
M	Medium
G	Good
E	Excellent

2. Element (Bones database)

CR	Cranium
AT	Atlas
AX	Axis
SC	Scapula
OTHU	Humerus proximal
HU	Humerus
OTHRA	Radius proximal
RA	Radius
UL	Ulna
C3	Carpal: (2)+3 (bovids, cervids); 3 (pigs, carnivores)
MCI	Metacarpal
MC2	Metacarpal half
MCIII	Metacarpal third
MCIV	Metacarpal fourth
PE	Pelvis
OTHFE	Femur proximal
FE	Femur
OTHTI	Tibia proximal
TI	Tibia
AS	Astragalus
CA	Calcaneum
MT1	Metatarsal
MT2	Metatarsal half
MTIII	Metatarsal third
MTIV	Metatarsal fourth
MP1	Metapodial
MP2	Metapodial half
P1	Phalanx first
P2	Phalanx second
P3	Phalanx thid
OTH	Specify element in ‘commnents’

3. Element (Tooth database)

Wear stages follow Grant (1982) for pigs and cattle, and Payne (1973; 1985) for caprines. Eruption stages follow Ewbank *et al.* (1964). Presence/absence is indicated by using the codes: P = present (wear stage not recordable) and 'blank' = absent.

X	Maxilla
N	Mandible
L	Loose tooth
J	Tooth attached to jaw
I1	First incisor (presence or absence)
I2	Second incisor (presence or absence)
I3	Third incisor (presence or absence)
I	Incisor (indeterminate)
dI1	Deciduous first incisor (presence or absence)
dI2	Deciduous second incisor (presence or absence)
dI3	Deciduous third incisor (presence or absence)
dI/dC	Deciduous incisor/canine (presence or absence)
C	Canine (presence or absence)
dC	Deciduous canine (presence or absence)
P1	First premolar (presence or absence)
P2	Second premolar (presence or absence)
P2L1	Length of the second premolar
P2Wa	Width of the anterior cusp of the second premolar
P3	Third premolar (presence or absence)
P3L1	Length of the third premolar
P3Wa	Width of the anterior cusp of the third premolar
P4	Wear stage of the fourth premolar
P4L	Length of the fourth premolar
P4Wa	Width of the anterior cusp of the fourth premolar
P	Loose Premolar (indeterminate)
dP2	Deciduous second premolar (presence or absence)
dP3	Deciduous third premolar (presence or absence)
dP4	Wear stage of the deciduous fourth premolar
dP4L	Length of the deciduous fourth premolar
dP4WP	Width of the posterior cusp of the deciduous fourth premolar
M1	Wear stage of the first molar
M1L	Length of the first molar
M1WA	Width of the anterior cusp of the first molar
M1WP	Width of the posterior cusp of the first molar
M1hyp	Hypoplasia on the first molar (P: a single line; PP: multiple lines)
M2	Wear stage of the second molar
M2L	Length of the second molar
M2WA	Width of the anterior cusp of the second molar
M2WP	Width of the posterior cusp of the second molar
M2hyp	Hypoplasia on the second molar (P: a single line; PP: multiple lines)
M3	Wear stage of the third molar
M3L	Length of the third molar
M3WA	Width of the anterior cusp of the third molar
M3WC	Width of the central cusp of the third molar
M3WP	Width of the posterior cusp of the third molar
M3hyp	Hypoplasia on the third molar (P: a single line; PP: multiple lines)
M12	Wear stage of the first/second loose molar (indeterminate)
M12L	Length of the first/second loose molar
M12WA	Width of the anterior cusp of the first/second loose molar
M12WP	Width of the posterior cusp of the first/second loose molar
M12hyp	Hypoplasia on the second molar
M	Wear stage of loose molar (indeterminate)
P1/M3L	Length from the first premolar to the third molar
P2/M3L	Length from the second premolar to the third molar
P1/P4L	Length from the first premolar to the fourth premolar
P2/P4L	Length from the second premolar to the fourth premolar
M1/M3L	Length from the first molar to the third molar
H	Height of the ramus mandibulae

4. Sexing

M	Male
F	Female
MA	Male alveolus
FA	Female alveolus

5. Taxon

AV	*Aves*
ANS	*Anser anser*
B	*Bos*
BUT	*Buteo lagopus*
CAC	*Capreolus capreolus*
CAH	*Capra hircus*
CAF	*Canis familiaris*
CB	*Cervus/Bos*
CD	*Cervus/Dama*
CEE	*Cervus elaphus*
COC	*Corvus corax*
CV	*Canis/Vulpes*
CYPR	*Cyprinidae*
DAD	*Dama dama*
GRGR	*Grus grus*
HO	*Homo sapiens*
LEE	*Lepus europaeus*
LY	*Lynx lynx*
MAFO	*Martes foina*
MEL	*Meles meles*
MUTR	*Murex trunculus*
MUER	*Mustela erminea*
MUPU	*Mustela putorius*
O	*Ovis/Capra*
OCC	*Ovis/Capra/Capreolus*
OVA	*Ovis aries*
RUP	*Rupicapra rupicapra*
S	*Sus*
SILGL	*Siluris glanis*
TEST	*Testudinidae*
UR	*Ursus arctos*
VUV	*Vulpes vulpes*

6. Side

L	Left
R	Right

7. FusP: Fusion proximal; FusD: Fusion distal

F	Fused
G	Fusing
H	Fusing/fused
UD	Unfused diaphysis
UE	Unfused epiphysis
UX	Unfused diaphysis & epiphysis (both present)

8. Butchery

P	Chopping marks
T	Cut marks
PT	Chopping marks & cut marks

9. Gnawing

C	Carnivore
R	Rodent
CR	Carnivore and rodent

10. Burning

B	Burned
S	Singed
C	Calcined

11. Measurements (postcranial)

For a complete description of postcranial measurements see ***4.3 – Recording protocol***.

GLl (astragalus) and H (atlas) were recorded under the column GL.

BT (humerus) and BFcr (atlas for pigs) were recorded under the column Bd.

Dl (astragalus), DC (femur), GD (calcaneum) and 3 (metapodials) were recorded under the column Dd.

GLm (astragalus) and 6 (metapodials) were recorded under the column HTC.

SLC (scapula) was recorded under the column SD.

LA (pelvis for pigs) was recorded under the column LAR.

12. Element (Vertebrae and ribs database; Verribs)

Ver L	Vertebrae large (cattle-size)
Ver M	Vertebrae medium (caprine- and pig-size)
Ver S	Vertebrae small (smaller than the previous)
R L	Rib large (cattle-size)
R M	Rib medium (caprine- and pig-size)
R S	Rib small (smaller than the previous)

The Promachon database is provided on a CD (see inside back cover).

Appendix B: Plates

Plate 1: Red deer antler; Phase I.

Plate 2: Hare humeri; Phases I, II and III.

Plate 3: Bear third metacarpal; Phase I.

Plate 4: Badger ulna; Phase III.

Plate 5: Cattle mandibles broken beneath the tooth root line for marrow extraction; Phases I, II and III.

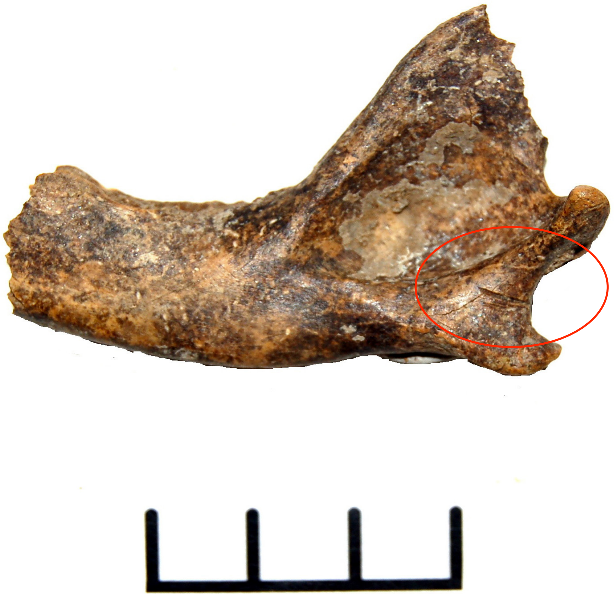

Plate 6: Dog mandible with traces of cut marks on the ramus mandibulae, suggestive of skinning; Phase II.

Plate 7: Caprine humeri with traces of dismemberment; these are cut marks, not fusion lines. Phase II.

Plate 8: Pig scapula with traces of chopping marks; Phase III.

Plate 9: Cattle humerus with traces of cut marks on the distal end; Phase I.

Plate 10: Pig astragalus with traces of cut marks; Phase III.

Plate 11: Cattle mandibles; Phases I and II.

Plate 12: Caprine mandibles; Phases I, II and III.

Plate 13: Pig mandibles; Phases II and III.

Plate 14: Caprine molars with root infection; Phase III.

Plate 15: Caprine mandible with abscess development; Phase II.

View of the eastern bank of the Kerkini Lake. Photo copyright: Athanasiadis Athanasios (used with permission).