



Size and shape of Greek Late Neolithic livestock suggest the existence of multiple and distinctive animal husbandry cultures



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ABSTRACT

In this paper we discuss domestic livestock morphometric data from the Late Neolithic Greek regions of Macedonia and Thessaly. Six sites are considered, including a substantial and previously unpublished dataset from Promachon (Macedonia). The analysis of the size and shape of the animals indicates great variation between sites and regions, suggestive of the co-existence of multiple styles of husbandry. The site of Sitagroi stands out for its large and robust cattle and sheep, probably a consequence of its environmental setting, as well as the dynamism of its cultural and economic connections. In Thessaly, despite the existence of inter-site connections documented through the material culture, different sites maintained their independence in terms of husbandry choices.

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1. Introduction

Biometry constitutes one of the most important tools that zooarchaeologists have for the investigation of past patterns of human behaviour. It can inform us on many archaeological issues, ranging from animal domestication to husbandry practices, feeding regimes and the introduction of new breeds and improved livestock (Albarella, 1997, 2002; Davis, 1996, 2000; Rowley-Conwy, 1999; Zeder, 2008; Albarella et al., 2007).

Biometry has been used by European zooarchaeologists on a regular basis, but less so in Greece. For the Neolithic, the use of biometry is linked with the intensity of zooarchaeological research in different regions, with Thessaly a greater focus of research than Macedonia (Kazantzis, 2015). This is the result of an archaeological perception of the Neolithic cultures of Macedonia as largely derivative from, and marginal to, those of Thessaly (Fotiadis, 2001). This has led Macedonia to be discussed in the context of a Thessalian, rather than a local Macedonian Neolithic (Andreou et al., 1996; Perlés, 2001). Only in the past 20 years has the Macedonian Neolithic been placed in its original, regional context.

From the 1960's, many Neolithic excavations in Thessaly have been staffed with a variety of different specialists, including zooarchaeologists (Trantalidou, 2001). When it comes to data analysis there has, however, been a tendency for zooarchaeologists to confine the use of biometry to a limited range of issues, such as the origins of cattle domestication

(Boessneck, 1962; Bökönyi, 1989; Becker, 1999), the use of secondary products (Bökönyi, 1986) and the crossbreeding of wild and domestic forms (Becker, 1991, 1999; Bökönyi, 1989; Gejvall, 1969). The investigation of these issues was facilitated by the inclusion of raw metric data in publications. Nevertheless, temporal and regional comparisons of different metrical datasets between Neolithic Thessalian sites were attempted only by von den Driesch (1987).¹ Faunal reports from Neolithic Macedonian sites tend to provide only summary statistics of measurements. An exception is represented by the work of Bökönyi (1986) at the Late Neolithic Macedonian site of Sitagroi, which provides a full range of tooth and postcranial measurements. A lack of availability of raw data is therefore one of the reasons why metrical datasets between Neolithic sites from Macedonia have not been previously compared.

A further issue, which has not been adequately investigated, is the ambiguous status of pigs. In almost all sites from Macedonia and Thessaly, pig bones were - and still are - by default attributed to domesticates, while the identification of their wild counterparts is limited to cases of particularly large specimens (Kazantzis, 2015). This is also the case for domestic cattle and its wild progenitor, the aurochs. This obviously represents a potential problem, since it means that the significance of wild boar and aurochs has not been properly evaluated.

This paper will focus on a regional comparison of the size and shape of the main domesticates between Late Neolithic (6th–5th Millennium

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¹ In addition, Becker (1991) briefly compares the size of sheep, red deer and fallow deer between Zarkos and a number of Thessalian sites (Pevkakia, Argissa, Ayia Sofia and Kastanas), while Halstead (1992) compares ranges of measurements of domesticated and wild species between Dimini, Argissa, Zarkos, Ayia Sofia and Pevkakia.

BCE Cal) sites from Macedonia and Thessaly. For Greece, it constitutes the first attempt to identify local and regional patterns of livestock management in this dynamic period of change in the prehistory of south-eastern Europe (Bailey, 2000; Kotsakis, 1999; Renfrew, 1972). In Greece, in particular, the Late Neolithic is characterised by a considerable expansion in the number of settlements and a burst of innovations in the material culture sphere (c.f. Andreou et al., 1996; Fotiadis, 2001; Halstead, 1989a, 1989b; Kotsakis, 1999; Pappa, 2008). It is important to see how such changes can be compared with developments in stock-keeping strategies.

The exploration of livestock morphometry in Late Neolithic Macedonia and Thessaly will be used to clarify issues such as:

- whether livestock was properly kept and nourished
- differences in animal herding and livestock management between sites and regions
- the degree in which economic and other cultural considerations contributed to animal husbandry management
- the contribution of wild boar and aurochs to the life of late Neolithic communities located in different areas.

This will ultimately provide important insights regarding husbandry practices at both local and regional levels, assisting us in the understanding of the nature of human-animal relationships during the Late Neolithic of northern Greece.

2. Materials and methods

Published and unpublished metrical data of cattle (*Bos* sp.), sheep (*Ovis aries*) and pig (*Sus* sp.) from six Late Neolithic sites from Macedonia and Thessaly are used for regional comparisons (Table 1) (Fig. 1). Goats (*Capra hircus*) are uncommon and therefore, due to the restrictions of small sample size, they are not considered in this analysis.

Promachon is an open-air (also known as flat-extended) site dated to the Late Neolithic (Koukoulis-Chrysanthaki et al., 2007, 2014). The site is located at the northernmost edge of the Aegean world, in the Serres basin, close to the Balkans. The faunal material from this site constituted the subject of a doctoral research (Kazantzis, 2015). Measurements were taken on teeth and on fused, fusing and unfused specimens, as suggested by Zeder (2008). These generally follow von den Driesch (1976), with some additional measurements from Albarella and Payne (2005); Davis (1992) and Payne and Bull (1988). In this paper, however, we only use metrical data from fully fused specimens.

The tell site of Sitagroi (Bökönyi, 1986) is fairly close to Promachon and it is one of several known Neolithic settlements located in the plain of Drama (Renfrew et al. 1986). Due to restrictions of small sample size, the Late Neolithic sheep measurements were combined with those from the Final Neolithic.

Makriyalos is a Late Neolithic open-air site (Pappa and Besios, 1999), located in the southernmost part of Macedonia, close to the Thessalian plain. From Makriyalos, we use unpublished pig metric data originally collected by Umberto Albarella and Keith Dobney, courtesy of Paul Halstead. Unpublished metric data for cattle and sheep from Makriyalos are not

included in this paper. They have, however, been provided by Paul Halstead to be used as part of Kazantzis' doctoral research (Kazantzis, 2015).

Few Late Neolithic sites from Thessaly have an adequate number of measurements for regional comparison, but an exception is represented by the open-air site of Ayia Sofia (von den Driesch and Enderle, 1976). To increase sample size, measurements from the Late Neolithic deposits of the tell site of Zarkos (Becker, 1991) were combined with those of the Early Bronze Age. Overall, three PhD publications focus on the faunal material from Pevkakia (Amberger, 1979; Hinz, 1979; Jordan, 1975), but the data used in this paper exclusively come from Jordan's thesis as it is the only one focusing on the Late Neolithic. Due to restrictions of small sample size the measurements from the Late Neolithic (Dimini era) deposits were combined with those of the Final Neolithic (Rachmani era).

Measurements used by the zooarchaeologists who conducted faunal research in these sites generally follow von den Driesch (1976). However, different researchers chose to take different measurements and this limits somewhat comparability (see Supplementary Online Material 1 for more details). Supplementary Online Material 2 presents a table with the list of measurements used in this paper, while Supplementary Online Material 3 presents the full ranges of postcranial and tooth measurements from all sites under study.

In this analysis there will be a heavy reliance on astragalus measurements, firstly because it is a compact and dense element, which tends to survive well, therefore providing good metric sample sizes. Secondly, the astragalus rapidly reaches adult size and, once fully ossified, it exhibits limited size change, despite not having an epiphysis, as is constrained in an articulation and has limited room for growth (Albarella and Payne, 2005; Payne and Bull, 1988; Rowley-Conwy et al., 2012). To minimise age-related variation, at both Promachon and Makriyalos we only measured fully ossified astragali. Though such approach is not explicit in the older datasets that we use for comparative purposes, it is unlikely that immature/porous astragali were measured, as in the past there was no tradition to measure juvenile bones (cf. von den Driesch, 1976).

Astragalus measurements are plotted for each species, first between the three Macedonian and then the three Thessalian sites. Then, we compare astragalus measurements between the two regions (Macedonia and Thessaly). For pigs, we also plot distal humerus and distal tibia measurements, as there are sufficient sample sizes. The distal tibia in particular, is a valuable bone in providing information about the actual average body size of a certain population, as it 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). The chosen measurements of the distal humerus (BT and HTC) are less affected by post-fusion growth than the commonly taken Bd (Albarella and Payne, 2005; Albarella et al., 2006; Rowley-Conwy et al., 2012), which means that age plays a less confusing role in their interpretation. However, the humerus is likely to be substantially affected by sex variation (Payne and Bull, 1988).

The significance of the statistical difference between samples was evaluated using an ANOVA *t*-test. Statistical analysis was carried out by using an IBM SPSS Statistics software package. In addition to the use of individual measurements, we have also applied a scaling index technique (Albarella, 2002; Meadow, 1999), by calculating log ratios of measurements compared to a standard (Albarella and Payne, 2005; Payne and Bull, 1988; Simpson et al., 1960).

Table 1

Sites from Macedonia and Thessaly considered in this paper (see also Fig. 1).

| N | Site | Region | Cultural periods | Metrical data – sources |
|---|------------|-----------|-----------------------------------|---|
| 1 | Promachon | Macedonia | Late Neolithic | Kazantzis (2015) |
| 2 | Sitagroi | Macedonia | Late Neolithic – Final Neolithic | Bökönyi (1986) |
| 3 | Makriyalos | Macedonia | Late Neolithic | Albarella and Dobney (unpublished data) |
| 4 | Ayia Sofia | Thessaly | Late Neolithic | von den Driesch and Enderle (1976) |
| 5 | Pevkakia | Thessaly | Late Neolithic – Final Neolithic | Jordan (1975) |
| 6 | Zarkos | Thessaly | Late Neolithic – Early Bronze Age | Becker (1991) |

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