

CHAPTER 1:

INTRODUCTION

'Varying levels of nutrition – permanent or transient- can modify temporarily or permanently the shape, size and robustness of bones' (Brothwell 1978, 91)

1.1 ORIGINS AND JUSTIFICATION

Archaeozoologists have been measuring bones for many years and those working in the North Atlantic were no exception (e.g. Degerböl 1929). However in the past the importance of taking and publishing bone measurements has needed to be emphasised by some researchers (Boessneck & von den Driesch 1978; Albarella 2002) as there have been times when these studies have been neglected. The current research project was started in 2002 around the time Albarella (2002) published his paper *“Size matters’: how and why biometry is still important in zooarchaeology’*. A time when there was a lull in interest in biometrical studies, many researchers, as Albarella (*ibid.*) noted, seeing them as ‘old fashioned’.

The original idea for this research was influenced by two factors. The first was work completed by the author on bone measurement data from the site of Pool, Sanday, Orkney (Cussans *et al.* 2007), which looked at size changes in domestic and wild animals at the site. Secondly was the observation by Bond and Nicholson (1998) that sheep of different sizes were present at the site of Old Scatness, Shetland during the Post Medieval period. This apparent sudden size change was intriguing and sparked an interest in why animal bones might change in size. Following this the current

author noted that for many sites in her region of study (the Northern Isles of Scotland), bone measurements were often taken and presented as part of zooarchaeological reports but very little was said about them beyond quoting means and withers height calculations or making comparisons to known breeds (see Chapter 2 for examples). A few, more widespread, studies had been completed for the North Atlantic region (Noddle 1979; Russel 1985; Cussans *et al.* 2007) and will be discussed in a little more detail below. All of these concentrated on size of bones and paid very little attention to the shape variation, which after some initial research (e.g. Albarella 1997a & b; Armitage *et al.* 1984; Weinstock 1999) was thought to be of equal, if not greater, importance than variation in size alone in terms of the information that could be gained and the strength of the conclusions that could be drawn.

Therefore the idea was formed that some better use could be made of this apparent glut of barely employed biometrical data and the current research project was created. The rest of this chapter looks briefly at what biometrical research has been carried out in the North Atlantic, the aim and objectives of the research, the project outcomes and finishes with a brief outline of the rest of the thesis.

1.2 BIOMETRICAL EVIDENCE IN THE NORTH ATLANTIC

As mentioned above three main studies have been identified as presenting reasonably extensive biometrical evidence for parts of the North Atlantic region. The first of these was a study of sites in Orkney by Barbara Noddle (Noddle 1979). She collated a series of sheep and cattle bone measurement data from a selection of sites from different time periods on Orkney and made some comparisons with primitive

breeds and wild counterparts, for example the Soay and the Mouflon. In addition through the use of histograms of bone measurements she examined changes in sheep and cattle size over time. The main trends observed were a reduction in cattle size after the Neolithic and a change in the form of the horncores and for sheep a general size decrease over time (*ibid.*).

Russel (1985) made a metrical analysis of cattle and sheep/goat metapodials from Iceland and compared these to measurement data from a variety of other Scandinavian North Atlantic settlements: Norway, Denmark, Orkney, Shetland and Greenland. He hypothesised that there would be a decrease in size over time across the region and a clinal decrease in size moving westwards, away from the homelands, culminating in 'dwarf cattle' identified in Norse Greenland (*ibid.*). He also proposed that if this change were apparent, it may be caused by the same biogeographic and physiogeographic factors that cause island dwarfism. There was found to be a decrease in cattle stature in Iceland between settlement and the 17th-18th centuries; however there was no evidence for an east-west cline in cattle size across the Scandinavian North Atlantic settlements mentioned above (*ibid.*).

Cussans *et al.* (2007) examined select biometrical data from the site of Pool, Sanday, Orkney. Data for cattle showed that although preservation was poor animals from the Neolithic phases were large compared to those from the Iron Age and later phases and were found to be comparable with those from other Neolithic sites in Orkney. There did not appear to be any change in cattle stature between the Iron Age and Norse phases and horncore and metapodial measurements indicated a

higher presence of females over males (*ibid.*). Very few measurements were available for Neolithic sheep and hence were inconclusive; little change at first seemed present for the rest of the phases but withers height data showed a significant reduction in height in the Norse phase (*ibid.*). Data for red deer and cats were also examined.

1.3 AIM AND OBJECTIVES

The main aim of this research is to examine the size and shape change of the bones of domestic mammals, principally sheep but also goat and to some extent cattle, in relation to a variety of environmental, economic and social factors identifiable in the region of the North Atlantic varying over both temporal and spatial scales. Such factors include climate change, geographical location, status and agricultural practices.

This will be achieved through several key objectives. The first is the collation of a large database of bone measurements from both published and unpublished sources from sites across the study region including Greenland, Iceland, the Faroe Islands, and the Northern and Western Isles of Scotland. A detailed study of the factors involved in influencing bone growth and eventual size and shape of domestic mammals will be made and following this the study area will be examined to identify possible sources of variation in bone size and shape, for example, time periods, sites or regions where variations in economy or environment may cause changes in the growth patterns of domestic mammals. Finally the collected data will be analysed in

relation to the identified economic or environmental variations to examine their effects on bone size and shape.

1.4 PROJECT OUTCOMES

One of the key outcomes of this research will be the creation of a large database of measurements of domestic mammals from c. 40 sites of varying dates from across the North Atlantic region. It is hoped that at some point in the near future this database can be made widely available to other researchers with interests in biometry, archaeozoology and the North Atlantic region, following the example of the ABMAP database (Serjeantson 2005) stored on the Archaeology Data Service website (<http://ads.ahds.ac.uk/>). It is hoped that this can then be used in further biometrical research and as a comparative tool for other biometrical datasets.

One of the main research outcomes of this project will be a thorough review of evidence for the factors affecting bone growth and the size and shape of adult bones of domestic mammals. Influences such as breed, nutrition, environment, husbandry methods and sex will be explored and discussed in detail.

Further insight into the environmental and economic changes taking place in the North Atlantic region, particularly during the Iron Age and Viking/Norse period will be gained through the examination of the bone measurement data and its discussion in light of the proposed hypotheses and other lines of evidence relating to economy and environment. The effects of changes in size and conformation in domestic mammals on the humans that raised and consumed them will also be considered,

not only in terms of the direct relationship between body size and quantity of food but also in terms of what mammalian body size indicates about the environmental situation and the effect of this on the human population.

Finally the usefulness of biometrical studies will be emphasised and suggestions of how they can be integrated with other forms of evidence in the future will be made.

1.5 OUTLINE OF THESIS

The thesis consists of seven chapters including this introduction. Chapter Two examines a variety of archaeozoological studies that have employed biometrical data in the past and discusses them under three headings: genetic issues, economic issues and environmental issues. Biometrical data are found to be able to inform on all three of these topics but the distinction between them is often blurred in terms of the biometrical evidence. Chapter Three makes a detailed examination of factors affecting bone growth and the adult size and shape of bones in domestic mammals. The effect of sex, breed, biogeography, climate, nutrition and the provision of shelter are all discussed. Many of the factors are found not to have a direct effect on bone size and shape but rather an effect on the nutrition that is made available, which in turn affects bone growth, size and shape.

Chapter Four describes the geography, geology, climate, vegetation and settlement history, and economy of the study region. The evidence is discussed by region starting with the Western Isles and moving on through the Northern Isles, Faroe Islands, Iceland and Greenland. Topics of specific interest to each area are

highlighted and discussed, bearing in mind the evidence presented in the previous chapter. The final section of this chapter goes on to propose four hypotheses based on the evidence discussed in this and the preceding chapter which are to be tested through examination of the biometrical data collected.

Chapter Five gives details of the sites examined, the sources of data used and the methods of data collection and analysis. Chapter Six starts with a brief overview of the results followed by detailed analysis of each of the four hypotheses; each analysis is followed by a discussion of the results for that individual hypothesis and the chapter ends with a summary discussion exploring issues of domestic mammal bone size and shape change, the reasons for these and the implications for the human populations associated with them. The final chapter, Chapter Seven, presents a series of conclusions on this research and biometrical studies in general and makes several suggestions for how the work presented in this thesis can be expanded and supplemented through integration with other lines of archaeological and environmental evidence.