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Isotopic and zooarchaeological approaches towards understanding aquatic resource use in human economies and animal management in the prehistoric Scottish North Atlantic Islands

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ABSTRACT

Despite being surrounded by aquatic resources, the Prehistoric populations of the North Atlantic Islands have a complex history of aquatic resource that until now has been little understood. Specifically the changing importance and uses of aquatic resources through time, and the role of aquatic resources in the management of animals in prehistory requires further attention. This paper presents results of faunal isotopic analysis in combination with existing human isotopic evidence and zooarchaeological datasets from Neolithic, Bronze Age and Iron Age sites in the Western Isles (also known as the Outer Hebrides) and Orkney to explore the importance of aquatic resources in the lives of these prehistory populations. In Orkney coastal grazing was an important aspect in the management of sheep throughout prehistory, whereas in the Western Isles this was only evident in the Bronze Age. Aquatic protein was also used in the management of pigs in the Western Isles during the Middle Iron Age. There is little evidence of humans consuming aquatic resources in the Neolithic, and only minor evidence of consumption in the Bronze Age. During the Iron Age aquatic resources become more important in the diet of humans. The Prehistoric Atlantic Islanders of Scotland had a complex and dynamic relationship with aquatic resources, especially in the role of animal management that changed throughout the course of prehistory.

1. Introduction

The ecotonal coastal environments of the Scottish North Atlantic Islands provided a potentially wide and diverse resource base for the Prehistoric inhabitants. Previous research has demonstrated that despite many settlements lying close to the coast the Neolithic populations of Scotland ceased to consume aquatic protein in any great quantity following the arrival of agriculture to the region (Schulting and Richards, 2002) other than during times of famine (Montgomery et al., 2013). Post-Neolithic little is known about the importance of aquatic marine resources in insular prehistoric human and animal diets, with studies predominantly focussing on individual site analyses or individual periods (Bond, 2007; McCormick, 2006; Mulville, 1999; Mulville and Powell, 2012; Nicholson and Davis, 2007). The wealth of archaeological data existing in the Northern and Western Isles, located off of the North and West Coast of Scotland respectively (Fig. 1) presents a valuable opportunity to understand the role of aquatic resources in human economic practises and in the management of domestic species.

This paper builds on previous datasets and discussions of aquatic resource use in the Scottish North Atlantic Islands, where elements of these results have previously been presented (Cramp et al., 2014; Jones et al., 2012, 2013), but to date have not been used to fully explore animal husbandry practises in both island groups throughout prehistory, a crucial aspect in understanding the importance of aquatic resources in economic behaviour. The liminal Scottish Island environments would have posed a challenge for farmers, and there are speculations as to whether high cattle mortality is a result of milking strategies (Mulville et al., 2005a; Mulville et al., 2005b) or an extreme response to coping with marginal environments (McCormick, 1998). Shorefront resources may have proved a valuable management strategy for coping in these harsh environments, where finding suitable fodder for animals throughout the year would have been challenging. The objective of this paper is to characterise the economic importance of aquatic resources throughout prehistory in human animal diets, within the Scottish Atlantic Islands with an emphasis on the use of aquatic resources in animal husbandry practises within these liminal environments.

2. Investigating Scottish Atlantic Islands diets and economy

In the North Atlantic Islands a wealth of pioneering archaeological studies based on bulk collagen isotopic analysis, on human bone, to reconstruct prehistoric diet in the islands exist (Barrett and Richards,

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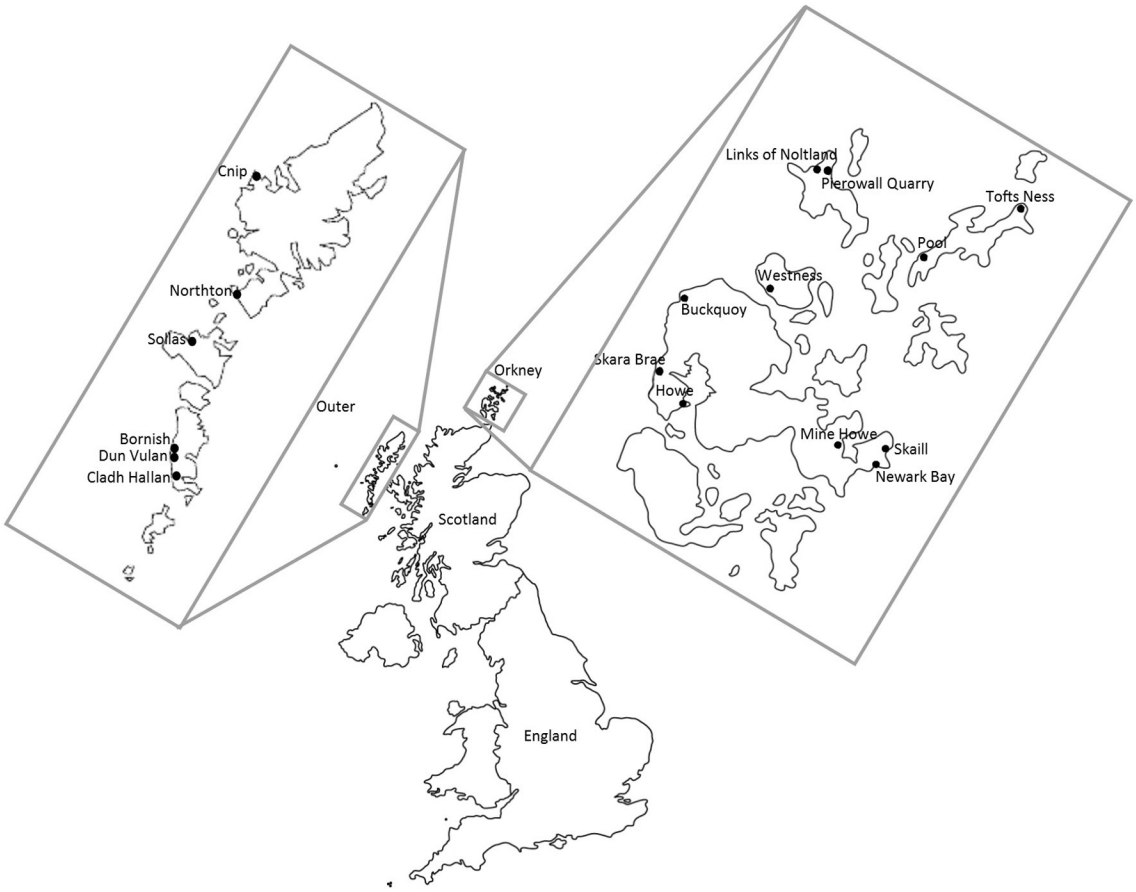

Fig. 1. A location map of the Scottish Islands, with a focus on the Western Isles and Orkney showing the relationship between the key sites mentioned in the text. Island groups are not to scale.

2004; Richards and Mellars, 1998; Schulting and Richards, 2002; Schulting and Richards, 2009; Schulting et al., 2010). These provide invaluable insights into the dominant foods consumed by human populations, but are less sensitive to low or occasional marine resource consumption (Hedges, 2004; Richards and Schulting, 2006). Integrating more traditional zooarchaeological methodologies with human isotopic evidence can provide different insights into marine resource use. Zooarchaeological research has a long history in the Scottish Isles, with analyses first published in the 1930s (Platt, 1934, 1937), and continues to be the primary method to assess diet and subsistence in the islands (Bond, 2007; McCormick, 2006; Mulville, 1999; Mulville and Powell, 2012; Nicholson and Davis, 2007). As zooarchaeological datasets can represent different timescales, from individual consumption events, to food debris accumulating over extended periods of time they can inform on infrequent or occasional uses of aquatic resource use where isotopic methods are not sensitive enough to do so (Hedges, 2004; Richards and Schulting, 2006). By applying stable isotope analysis of bulk bone collagen to zooarchaeological material animal management strategies can be explored (Madgwick et al., 2012a; Mulville et al., 2009; Stevens et al., 2010, 2013). The technique is crucial in identifying coastal grazing pastures and the input of marine resources into the diets of domestic animals (Müldner et al., 2014; Jones et al., 2012), informing on the importance of aquatic resources in animal management. Individually the isotopic and zooarchaeological datasets each provide information on different aspects of aquatic resources use on different scales, from long term consumption patterns to occasional or infrequent uses of marine resources, and the use of coastal pastures in the management of animals. Together this suite of datasets can provide a holistic understanding the role of aquatic resources in the lives of humans and animals in the Prehistoric Scottish Islands.

The Scottish Islands have a rich archaeological heritage, dating from the Neolithic onwards. This chronological span, in combination with the wealth of archaeological data makes them ideal locations to explore the role of aquatic resources in the islands across time. This paper is based on material from excavations across the archipelagos dating from the Neolithic (c. 4500 cal. BC to 2500 BC), Bronze Age (c. 2500 cal. BC to 600 cal. BC) and Iron Age (c. 600 cal. BC to 900 cal. AD) periods in the islands; with sites from all periods found across the island groups (Table 1) enabling chronological and spatial trends in diets and economies can be explored. The location of the key sites discussed in this study is shown in Fig. 1.

3. Materials and methods

Pre-existing human isotopic data was collated from published and unpublished sources, many of which were available from recently radiocarbon dated materials. The accuracy of isotopic results achieved through radiocarbon dating has been criticised as potentially being less precise than values acquired from collagen-specific analysis due to differences in the pre-treatment methods for radiocarbon dating techniques that may affect stable isotope values (Schulting and Richards, 2002, 163). Modern radiocarbon dating laboratories routinely analyse bulk collagen stable isotope values prior to graphitisation (see Brock et al., 2010), enabling greater reliability in results. Small scale comparisons of $\delta^{13}C$ and $\delta^{15}N$ specific analysis with results achieved through radiocarbon dated demonstrated no difference between the two methodologies (Jay, 2005, 201). For specimens with isotopic measurements achieved through radiocarbon dating techniques, C:N ratios were consulted to ensure only specimens with high quality collagen were used. DeNiro (1985, 807) suggests that prehistoric specimens

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