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Stable isotope and dental pathology evidence for diet in late Roman Winchester, England

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ABSTRACT

We combine analysis of carbon and nitrogen stable isotopes and dental pathology to reconstruct diet in a population from late Roman Winchester. The study's aim was to compare isotopic and dental indicators of diet, and combine these with other archaeological evidence to provide a more complete picture of food-ways in a late Romano-British town. Mean $\delta^{13}C$ and $\delta^{15}N$ values indicate a diet based largely on terrestrial C_3 resources, and comparison with faunal values suggests that meat and/or dairy products from domesticates likely contributed the bulk of dietary protein. Dental pathology points to a carbohydrate-rich diet. Considered together, the isotopic and dental pathology data suggest a predominantly plant-based diet, with moderate consumption of meat and/or secondary products. A second aim of the study was to compare the findings with the contemporaneous but distinct cemetery assemblage from Lankhills School, Winchester, to test the theory that diet may have differed between sub-populations of the late Roman town. The results suggest broad similarity in the diets of individuals interred in different cemetery areas.

1. Introduction

Recent years have seen growing interest in the study of food-ways to explore economic organisation, social dynamics and cultural interactions in Roman Britain (Cool, 2006; Dobney, 2001; Hawkes, 1999; Meadows, 1995; van der Veen, 2008). Often, studies focus on specific categories of archaeological evidence, such as plant or animal remains (e.g., King, 1999; Locker, 2007; van der Veen et al., 2008). More recently, stable isotope analysis has become a popular method for studying Romano-British dietary habits, providing direct evidence for consumption, and revealing how diet varied within and between populations (Müldner, 2013). However, isotopic data are often presented in isolation from other, complementary skeletal and dental evidence for diet, such as dental disease (e.g., Cheung et al., 2012; Richards et al., 1998). Stable isotope analysis allows reconstruction of individual as well as group diets, but predominantly gives information about protein intake (Tykot, 2004), while oral health reflects broader dietary habits at the population level (Hillson, 1979). Here, we combine analysis of carbon and nitrogen stable isotopes and dental pathology to reconstruct diet in a population from late Roman Winchester. The study's primary aim was to compare isotopic and dental pathology data, and combine these with archaeological evidence (e.g., Maltby, 2010), to achieve a more nuanced interpretation of diet in late Roman Winchester (cf. Prowse, 2011). C and N isotope analysis has previously been conducted on Romano-British burials from elsewhere in Winchester (Cummings and Hedges, 2010); however, this focused on graves from Lankhills School, in the town's Northern Cemetery, which, for reasons discussed below (Section 6.4), may differ from other Winchester cemetery areas (cf. Ottaway et al., 2012: 369-70). The present study examines burials from elsewhere in Winchester. A second aim was to compare the results with Lankhills to explore possible inter-cemetery dietary differences.

2. Archaeological setting

Winchester (Fig. 1) is located in Hampshire, southern England, on the River Itchen. Roman habitation at Winchester (*Venta Belgarum*) was established in the mid-first century AD. The settlement underwent significant development in the later first and second centuries, acquiring an orthogonal street system and monumental public buildings (Wacher, 1995: 293-6), and became the fifth largest town in the province (Millett, 1990: Table 6.4). Winchester was a *civitas* capital, meaning it served as the political and economic centre of a larger administrative region (Wacher, 1995: 19, 293). Varied economic activities took place in Roman Winchester, including bone working, metal production and weaving (Rees et al., 2008). Most inhabitants were probably traders and artisans, although some might have farmed surrounding lands (Birley, 1980; Salway, 1993).

Cemeteries were located in extramural suburbs beyond the town's main gates (Fig. 2). With the exception of 189 (mostly cremation) burials of first and second century date at Victoria Road East, graves at Winchester date predominantly from the later third to early fifth centuries AD (Booth et al., 2010; Ottaway et al., 2012). Most late Roman burials were extended, supine inhumations, aligned with the head to

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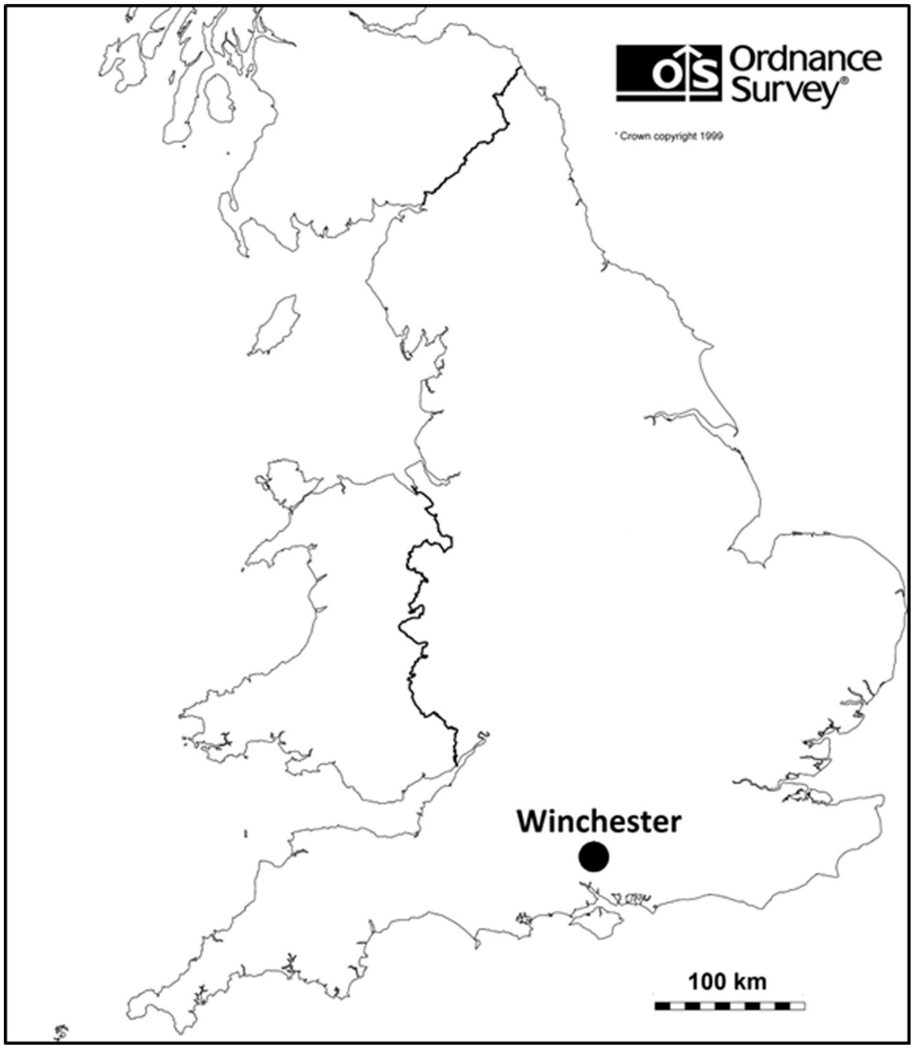

Fig. 1. Map showing the location of the study site. Reproduced from Ordnance Survey map data by permission of Ordnance Survey © Crown copyright 2013.

the west. Up to half of individuals were interred in wooden coffins, but other containers (e.g., stone and lead sarcophagi) were rare. Grave goods were also uncommon (Ottaway et al., 2012), as is typical of late Romano-British burials (Philpott, 1991). A notable exception is the Lankhills School site, at the edge of the Northern Cemetery, where significantly more burials were furnished (Booth et al., 2010; Clarke, 1979).

The study material derives from collections held by Winchester City Museum, and includes individuals from four sites in the Northern Cemetery, three in the Western Cemetery, and one in the Eastern Cemetery (Table 1; Fig. 2). Excluding Lankhills, these sites are among the largest assemblages excavated from the Northern, Eastern and Western cemetery areas. No material from the Southern Cemetery was included, as very few burials have been excavated from this area (Ottaway et al., 2012).

3. Dietary reconstruction

3.1. Stable isotopes

The principles of carbon and nitrogen stable isotope analysis for palaeodietary reconstruction are well-established (Katzenberg, 2008; Schwarz and Schoeninger, 2011; van der Merwe and Vogel, 1978; Walker and DeNiro, 1986). The technique relies on measuring carbon ($^{12}C/^{13}C$) and nitrogen ($^{14}N/^{15}N$) isotope ratios ($\delta^{13}C$ and $\delta^{15}N$, respectively) in human tissues, most commonly bone collagen (Sealy et al., 1995). $^{12}C/^{13}C$ and $^{14}N/^{15}N$ are incorporated into plant tissues during photosynthesis. In the case of carbon, the isotope ratio varies between plants according to whether they use the C_3 or C_4 photosynthetic pathway; this variation is passed on through the food chain to human consumers. Human $\delta^{13}C$ values can thus be used to infer the relative importance of C_3 plants (e.g., wheat, barley, most fruits and vegetables) versus C_4 plants (e.g., millet, sorghum, sugar cane and maize) to diet (DeNiro and Epstein, 1978; Tykot, 2004). $\delta^{15}N$ values exhibit a 'trophic level' effect, becoming more 'enriched' with each step in the food chain. Therefore, human $\delta^{15}N$ values indicate the relative contribution of animal versus non-animal proteins to diet (DeNiro and Epstein, 1981; Tykot, 2004). $\delta^{13}C$ and $\delta^{15}N$ values are also used to explore the consumption of terrestrial versus marine foods. $\delta^{13}C$ values vary between terrestrial and marine food-webs owing to differences in environmental carbon sources, with marine resources being relatively higher. Generally, marine resources also have enriched ^{15}N values, as aquatic food-webs tend to be more complex, comprising more trophic levels (Chisholm et al., 1982; Schoeninger and DeNiro, 1984).

The basic principles of bone collagen stable isotope analysis have remained largely unchallenged since early palaeodietary applications in the late 1970s. However, it is now recognised that various factors can complicate dietary interpretations. For example, pathology and pregnancy stress can result in non-diet related variation in intra- and inter-individual isotope values (e.g., Fuller et al., 2005; Olsen et al., 2014). Precise evaluation of the relative contribution of plant foods