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Diet and collapse: A stable isotope study of Imperial-era Gabii (1st–3rd centuries AD)

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ABSTRACT

The city of Gabii arose just east of Rome around the 8th century BC. By the Imperial period, it had all but collapsed, its habitation areas either abandoned or repurposed for industrial production. Burials within the city, however, may speak to the urbanization and collapse of Gabii. Twenty-one skeletons from the Imperial era (1st–3rd centuries AD) were analyzed for stable carbon and nitrogen isotopes in an effort to understand palaeodiet. Adults' diets are relatively homogeneous, particularly in comparison with samples from nearby sites dating to the same period, and reflect consumption of terrestrial meats and C_3 plants. Subadult diets do not reflect breastfeeding at the time of death. One individual with anomalous isotopes may have been an immigrant to Gabii.

1. Introduction

Throughout the Imperial period (1st–5th centuries AD), Rome was the largest city in the world, with an estimated one million or more people living within the urban center and the suburban area that sprawled outward in all directions (Scheidel, 2001; Wiseman, 1969; Champlin, 1982; Storey, 1997). Within the hinterland, however, formerly independent cities now under Roman rule such as Gabii saw a contraction of their population and eventual abandonment (Becker et al., 2009). While previous palaeodietary analyses have focused on skeletons from Imperial cemeteries associated with the active cities of Rome and Portus Romae (Prowse et al., 2008; Rutgers et al., 2009; Killgrove and Tykot, 2013), recently excavated graves from Gabii offer the opportunity to investigate the foodways of individuals buried in a collapsed former city.

The present study focuses on 21 skeletons from burials made at Gabii during the Imperial period. While the socioeconomic composition of the burial population is not known, most burials were simple in nature with few artifacts. It is also unclear whether these individuals were living at Gabii or were living somewhere else; that is, because of the general proscription against burial within city walls, these individuals could have been living anywhere in Rome or its suburbs. Some evidence for contemporaneous architecture exists, but largely in the form of public baths and *tabernae* or shops (D'Agostini and Musco, 2016; Farr and Hasani, 2017). This continued use of Gabii implies the presence of a local population to staff these public places, but it is unknown if those buried at Gabii were affiliated with these businesses or if they lived in the surrounding area. In antiquity, Gabii was flanked by numerous cemeteries (Bietti Sestieri, 1992a,b), making it plausible that the defunct parts of the city were seen as a natural burial place. We aim to explore with this study the variation in the Imperial Roman diet by focusing on a skeletal sample from an area of urban collapse that is not well known historically.

Textual evidence of the ancient Roman diet comes from authors like Cato the Elder, who suggests in *de Agricultura* that slaveholders should feed their farmhands wheat, olive oil, salt, fish pickle, and wine. Wheat was by far the most popular grain eaten (Garnsey, 1999), particularly considering it formed the majority of the food dole for poor male citizens (Garnsey and Rathbone, 1985; Garnsey, 1988, 1991). Millet was also grown easily and cheaply, but tended to be seen as a famine food (Evans, 1980; Spurr, 1983, 1986; Nenci, 1999) even as growing evidence points to its regular consumption (Killgrove and Tykot, 2013). Most Romans also had access to vegetables, fruits, and nuts, either grown locally or purchased at market (Garnsey, 1988).

The protein component of the Roman diet is still somewhat unknown, as it varied with socioeconomic status. In rural areas, historians like Pliny comment on the use of legumes, consumed on their own or mixed with grains like millet and wheat (Faas, 1994; Garnsey, 1999; Evans, 1980; Spurr, 1983). The extent to which legumes formed the basis of the lower-class diet, however, is still unclear (Garnsey, 1991, 1999). Given the livestock trade, Romans certainly ate meat from goats, sheep, fowl, and pigs (Kron, 2002; MacKinnon,

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2004). Beef was not commonly eaten, and fish consumption outside of the ubiquitous sauce garum is also much lower than expected considering how many people lived near sources of freshwater fish and seafood (Purcell, 1995; Beer, 2010; Craig et al., 2009).

Because the ancient Roman diet is not well characterized through textual sources, particularly for lower class people, human skeletal remains provide an ideal opportunity to investigate dietary resources at the level of the individual. Stable carbon and nitrogen isotope analyses are frequently used to provide an overview of pre-mortem diet from the last several years of a person's life. The protein component of the diet can be gleaned from carbon isotope ratios measured from the collagen component of bone (written as δ^{13}C or $\delta^{13}C_{co}$), while carbohydrates and lipids as part of dietary energy can be seen in the isotopes from bone apatite ($\delta^{13}C_{ap}$) (Katzenberg, 2008; Krueger and Sullivan, 1984). Stable carbon isotopes can distinguish between C_3 and C_4 plants as well, indicating whether the dietary energy source was composed primarily of temperate grasses such as wheat, tropical grasses such as millet, or a mixture (Kellner and Schoeninger, 2007). For populations consuming both C_4 and aquatic resources, though, analysis of nitrogen isotopes is necessary to discriminate between them (Larsen et al., 1992; Schoeninger et al., 1983; Katzenberg, 2008). Nitrogen isotopes suggest an individual's position in the food chain, with higher δ^{15}N values correlating with an increase in trophic level (Schoeninger and DeNiro, 1984; Hedges and Reynard, 2007). Measuring $\delta^{13}C_{co}$, $\delta^{13}C_{ap}$, and δ^{15}N from human bones therefore provides an understanding of the protein and energy sources in the ancient diet. Additionally, these isotopes can be used as a proxy for understanding breastfeeding and weaning practices, as nursing infants tend to be at a higher trophic level than older children and adults (Katzenberg et al., 1996; Fuller et al., 2006; Katzenberg, 2008), with a 2–3‰ ^{15}N enrichment and a 1‰ ^{13}C enrichment (Fogel et al., 1989; Fuller et al., 2006).

Palaeodietary analysis is growing in popularity as a method for understanding the ancient Roman diet in the Imperial period. Our previous study of two cemeteries from Rome, Casal Bertone and Castellaccio Europarco, found heterogeneity in dietary resources (Killgrove and Tykot, 2013). At Isola Sacra, the cemetery associated with Portus Romae, researchers found that people living along the Tyrrhenian Sea 25 km from Rome were eating a varied diet, including aquatic resources (Prowse, 2001; Prowse et al., 2004, 2005; Prowse et al., 2008). St. Callixtus, an early Christian necropolis in the Roman suburbs, produced surprisingly low carbon isotope values, which researchers concluded could reflect a freshwater fish-based diet (Rutgers et al., 2009). Another early Christian necropolis in Rome, that of Sts. Peter and Marcellinus, has produced palaeodietary data, but those are as yet unpublished (Salesse, 2015). At Velia, far south of Rome on the Tyrrhenian coast, researchers characterized the diet as low in aquatic resources and terrestrial meat (Craig et al., 2009) (see Fig. 1).

While the dietary practices at these sites are quite varied, researchers have found preliminary differences within the samples based on age, sex, and social status. Older individuals at Isola Sacra were more likely to be consuming aquatic resources than were younger individuals (Prowse et al., 2005), while males at Velia appear to have consumed more aquatic resources than did females (Craig et al., 2009). People living closer to Rome were more likely to eat a wheat-based diet than were those in the suburbs, unless they were buried in a low-status manner (Killgrove and Tykot, 2013). A change from a millet- to a wheat-based diet can also be seen in those individuals who immigrated to Rome after childhood (Killgrove and Montgomery, 2016). These studies therefore reveal a variegated and heterogeneous Roman diet that can be dissected in order to learn more about historically underrepresented groups such as children, women, the lower classes, and immigrants. More specifically, engaging in palaeodietary research at Gabii during the period in which it declined and collapsed allows us to investigate whether the isotopic pattern is more similar to that of urban sites like Casal Bertone or to that of suburban sites like Castellaccio Europarco. This line of evidence can then be added to historical and archaeological context to more fully understand the effects of this urban transition on average Romans.

2. Materials and methods

Samples in this study come from skeletons buried at Gabii (Fig. 1). Along with Rome, just 18 km to its west, Gabii urbanized in the Early Iron Age (c. 8th century BC). Situated between two lakes, and apparently an important religious site, Gabii is mentioned in later texts as the place where Romulus and Remus were educated (Plutarch VI *Life of Romulus*). Gabii is named by the historian Livy (6.21–7) in the 4th century BC as Rome's close ally and a participant in the war against Praeneste. The Republican and Imperial periods saw widespread depopulation of the city, however, as the *lapis Gabinus* quarry expanded rapidly (Farr, 2014) and the *Aqua Alexandrina* aqueduct, which siphoned water from one of Gabii's lakes, was constructed in the second quarter of the 3rd century AD (Mogetta and Becker, 2014). Since historical records are spotty, most of the information known about Gabii comes from archaeological excavation.

Archaeological evidence of settlement at Gabii dates back to the late 8th/early 7th century BC, and the city was most densely populated during the Archaic and Early/Middle Republican periods (c. 6th–2nd centuries BC). By the Late Republican period, the city was contracting, with abandonment by the Late Roman/Early Medieval period (Becker et al., 2009). During the Imperial period, there is evidence for continued use of the temple to Juno, at least one public bath, and a monumental storefront, but not for large-scale settlement. Although numerous other cemeteries existed in the area (Bietti Sestieri, 1992a,b), and although the Romans had laws prohibiting burial within the populated city (Toynbee, 1971), the burials at Gabii are found within the previously inhabited area during the Imperial period (Fig. 2). Most of these burials are simple in nature, with graves cut directly into the tufo or made in the *cappuccina* style in the collapsed remains of buildings, but there are three burials involving lead, including one individual in a large, sarcophagus-like lead container (Becker, 2010). Gabii's city center was apparently slowly transformed into an ad hoc cemetery (Mogetta and Becker, 2014), with some burials being made within and on top of abandoned buildings on the periphery of the public/mercantile area that was still in use during the Imperial period. The abandonment layer into which burials were made dates to the middle of the 1st century AD (Opitz et al., 2016). Skeleton 8 in the lead sarcophagus was likely the first buried in this period, and there is a carbon-14 date for tomb 16 of *cal* 240–440 CE (2σ) (Calcagnile, 2010). Gabii was essentially completely abandoned by the Late Imperial/Early Medieval period (c. 4th–5th centuries AD), although there is evidence after that period of land use related to agricultural production (Zapelloni Pavia et al., 2017).

Rib samples were taken from both adult and subadult individuals from the Imperial phase burials. The demographics of the 21 individuals are provided in the first two columns of Table 1 – there were 9 females, 9 males, and 3 subadults (one infant and two young children). Age-at-death of adults was based primarily on the pubic symphysis (Brooks and Suchey, 1990; Todd, 1921a,b), the auricular surface (Lovejoy et al., 1985; Buckberry and Chamberlain, 2002), and cranial suture closure (Meindl and Lovejoy, 1985), and is reported using categories in Buikstra and Ubelaker (1994): Young Adult (20–35), Middle Adult (35–50), Older Adult (50 +). Subadults were aged based on dental development (Moorrees et al., 1963a,b; White and Folkens, 2005; Gustafson and Koch, 1974; Anderson et al., 1976) and epiphyseal closure (Baker et al., 2005), and age categories were assigned based on Baker et al. (2005): Infant (0–12 months), Young Child (1–6), Older Child (7–12), Adolescent (12 – 20). Sex of adults was based on pelvic morphology (Phenice, 1969; Buikstra and Ubelaker, 1994) and cranial features (Acsádi and Nemeskéri, 1970).

Collagen was extracted from bone following procedures based on Ambrose (1990) and modified by Tykot (2004, 2014), which were used