DOES DIET REFLECT GROUP MEMBERSHIP? A STABLE ISOTOPE ANALYSIS OF HUMAN REMAINS FROM THE ROYAL NAVAL HOSPITAL CEMETERY AT ENGLISH HARBOUR, ANTIGUA, W.I.

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Questions of identity commonly surround colonial cemeteries in the Caribbean, particularly those whose context suggests lower social standing or a diverse interred population. Recent studies have applied stable isotopic techniques to establishing identity and tracing life histories in archaeological contexts. Identity can be established through stable isotopic analysis when different groups within a society may maintain different diets that are then reflected in the stable isotopic values of hard tissues. Bone collagen and bone apatite from 30 individuals from the Royal Naval Hospital (English Harbour, Antigua, WI - A.D. 1793-1822) were analysed for stable carbon and nitrogen (collagen only) isotopes. The results demonstrate that two groups can be separated on the basis of their stable isotope values that correspond to racial affiliation determined by osteological analysis. When linked with historic knowledge on dietary preferences, identity can be established such that questions of health, lifestyle, and resource use/allocation can be addressed.

Cuestiones de identidad rodean comúnmente los cementerios coloniales en el Caribe, particularmente aquellos cuyo contexto sugiere un estatus social más bajo o una población enterrada diversa. Estudios recientes han aplicado técnicas isotópicas estables para establecer la identidad y localizar historias de vida en contextos arqueológicos. Se puede establecer la identidad a través del análisis isotópico estable cuando diferentes grupos dentro de una sociedad pueden mantener diferentes dietas que se reflejan después en los valores isotópicos estables de los tejidos duros. Se analizaron el colágeno y la apatita de los huesos de 30 individuos del Royal Naval Hospital (English Harbour, Antigua, Las Antillas – 1.793-1.822 D.C.) para isótopos estables de carbón y nitrógeno (colágeno solamente). Los resultados demuestran que se puede separar a los dos grupos con base a sus valores de isótopo estable que corresponden a la afiliación racial determinada por el análisis osteológico. Cuando se asocial con el conocimiento histórico sobre preferencias alimenticias, se puede establecer la identidad de tal manera que se puedan abordar cuestiones de salud, modo de vida, y uso/reparto de recursos.

Des questions d'identité entourent généralement les cimetières coloniaux dans les Caraïbes, en particulier ceux dont le contexte suggère une position sociale inférieure ou une population diverse enterrée sur un même lieu. Les études récentes ont appliqués des techniques isotopiques stables pour établir l'identité et retracer les histoires de la vie dans des contextes archéologiques. L'identité peut être établie par l'analyse isotopique stable quand les différents groupes dans une société peuvent maintenir différents régimes qui sont alors reflétés en valeurs isotopiques stables des tissus durs. Le collagène d'os et l'apatite d'os de 30 individus de l'hôpital naval royal (Port Anglais, Antigua, WI - 1793-1822) ont été analysés pour les isotopes stables de carbone et d'azote (collagène seulement). Les résultats démontrent que deux groupes peuvent être séparés sur la base de leurs valeurs stables d'isotope qui correspondent à l'affiliation raciale déterminée par analyse ostéologique. Une fois liée avec la connaissance historique sur des préférences diététiques, l'identité peut être établie de façon à ce que des questions de santé, de style de vie, et de ressource puissent être adressées.

Introduction

Investigation of colonial cemeteries in the Caribbean is a relatively recent phenomena stimulated by increased development of land and frequency of hurricanes, both of which can lead to the disturbance of burials. Many islands have also recently implemented or are drafting protection protocols for archaeological sites. One of the main questions facing researchers working on the mitigation of cemeteries and isolated burials is that of the identity of the interred individuals. Many of the sites in question are unmarked and/or have few, sometimes, no associated historical documents. Location of site and burial style often does not have much to offer in terms of identifying the social status or class of the interred individuals. Application of forensic anthropological methods of assessing ancestry from the cranio-facial skeleton is not always possible due to ambiguity of features, or lack of preservation of the necessary elements.

Unmarked graves, even those with seemingly obvious associations, can present challenges to establishing identity of the interred, requiring new approaches. Information on diet found in historical literature and gross analyses of human remains are combined with chemical analyses, in this case stable isotope analyses of bone to reconstruct the diet of the interred, in an attempt to narrow down the possible identity of the interred in a colonial era cemetery on Antigua. This work is part of a larger study of the application of stable isotopes to questions of establishing identity in colonial cemeteries of the Caribbean (Varney 2003). Although it is the first such study in the Caribbean region, it builds on the pioneering work of Sealy and colleagues in colonial slave and underclass cemeteries of South Africa (Cox and Sealy 1997; Cox et al. 2001; Sealy et al. 1993, 1995).

Archaeological Research at the Royal Naval Hospital Cemetery

The Royal Naval Hospital cemetery is associated with the former site of the Royal Naval Hospital (RNH), located on a hilltop overlooking a former Naval dockyard at English Harbour and dates to the approximate period from AD 1793-1822 (Nicholson 1995). The author directed excavation of this site from 1998 to 2001 in collaboration with Dr. Reginald Murphy of the

National Parks Authority of Antigua and Barbuda with the annual University of Calgary archaeological field school. The site was mitigated in response to disturbance by a modern residential development, and local landowners allowed us to exhume the graves on their properties (Varney and Nicholson 2001).

There were few grave markers remaining *in situ*, and prior salvage investigations of a nearby midden indicated that the RNH had served not only regular Naval personnel, but also slaves owned by the Naval personnel and the Navy itself (Nicholson 1995). However, it was naively assumed that the interred population of the cemetery would mainly be comprised of Royal Naval personnel of European ancestry. However, this assumption was quickly challenged, as some of the individuals did not have cranio-facial traits consistent with European ancestry (Gill and Rhine 1990).

In total, 26 grave shafts were excavated, and since some had been used for more than one interment, the remains of 30 individuals were recovered. Only one grave appeared to have been a purposeful double burial containing an adult male interred with a newborn resting on his chest. There was little difference between graves in terms of burial style. All were interred in supine position in simple six-sided coffins. Very few associated funerary objects accompanied the skeletons. The exception to this rule was the finding of either copper pins or small rolled copper beads with the remains of children.

Demographic Profile

In terms of demographic profile, the recovered remains represent 21 adults ranging in age from 18 to 60+ yrs, four adolescents between 14-18 yrs, and five children under the age of 5 yrs. Due to the partial nature of some of the recovered skeletons, only 21 of the 25 adult and adolescent skeletons could be assessed for sex and all of those had characteristics consistent with them being male. Unfortunately, only 14 of the individuals had skulls that were preserved well enough for assessment of ancestry using methods of forensic anthropological analyses of cranio-facial features (Gill and Rhine 1990).

Seven individuals exhibited features typical of white/European[i] ancestry and seven exhibited features typical of black/African[ii] ancestry. The remaining 11 adults and adolescents could not be assessed for ancestry due to poor preservation of the skull. In addition, the five children could not be assessed for ancestry due to the lack of development of the relevant features at such a young age.

In summary, ancestry could be assessed for only 14 out of 26 of the individuals recovered from the cemetery. Although this information provides only limited information on the identity of these 14 individuals, it does afford some key information on establishing the identity of these people. It would be valuable to able to have a means by which to narrow the identity of those for which ancestry could not be assessed through the gross morphological observations of standard forensic anthropological techniques. It was at this point that the idea of exploring the potential of establishing aspects of identity via reconstruction of diet using stable isotope analyses was explored.

Stable Isotope Analysis

A review of historical sources for information on diet in the colonial period of the Caribbean depicts a picture in which people consumed diets that were in keeping with the population and geographic region for which they had ancestral ties. Historical sources generally describe the diet of African-derived slave populations as having marked contrast to that of European-derived populations in that the former was largely comprised of foods commonly found in the diets of African, particularly West African diet (Klein 1999; Lewicki 1974). The primary staples of slave diet are generally described as consisting of a combination of maize/corn and/or millet with root crops such as cassava, yams and taro, rounded out with a variety of vegetables and fruits. The main protein sources are usually attributed to imported salt fish, with smaller amounts of poultry and meat of both imported and local origin (Abrahams and Szwed 1983; Debien 1964; Dunn 1972; Foster and Foster 1996; Higman 1984; Sheridan 1985; Ward 1988). In contrast, European colonists and military personnel are portrayed to have eaten a diet in which the primary staples were imported cereal grains such as wheat and oats rounded out with locally available foodstuffs. Much of their dietary protein was also imported in the form of salted beef and pork but little salt fish (Buckley 1998; Duffy 1987; Dyde 1997; Lloyd and Coulter 1961). If the dietary differences were real it should be detectable in human skeletal remains via stable carbon and nitrogen isotope analyses providing additional information about identity for the interred population of the RNH cemetery.

Stable carbon (C) and nitrogen (N) isotope analyses are well established in terms of their applications for reconstructing past diet in archaeological contexts. A detailed review of the theoretical background to stable isotope analysis and methodology are beyond the scope of this paper and the reader is directed to Ambrose (1993) and Katzenberg (2000). However, there are a few details that must be stated here in order to facilitate clear communication of the results and their interpretation. The goal of stable C and N analyses is to measure the relative importance of general food categories in the diet of the individuals or population(s) under study. Analytical results are expressed as del or δ values in parts per mil (‰) where the given value is the ratio of stable isotopes (for carbon, $^{13}C/^{12}C$; for nitrogen, $^{15}N/^{14}N$) in the sample relative to that of an international standard. Since biological tissues generally contain less ^{13}C than the standard, their $\delta^{13}C$ values are negative numbers. In contrast, $\delta^{15}N$ values of biological tissues are usually positive numbers since they generally contain more ^{15}N than atmospheric N_2 (Ambrose 1993). The following is a very brief and basic outline of the basic principles of stable isotope variation. Detailed discussion can be found in Katzenberg (2000) that includes the many factors that affect isotopic variation. Briefly, variation in the $\delta^{13}C$ values in consumers such as humans reflects that of the plants that provide the base staple of their diet; the $\delta^{13}C$ values of these plants are incorporated into the body tissues of consumers. Plants can be divided into two groups, denoted C3 and C4 plants that have non-overlapping $\delta^{13}C$ values. C4 plants include maize/corn, millets and sugar cane and have $\delta^{13}C$ values ranging from -21 to -9‰ with a mean of -13‰; C3 plants include wheat, rye, oats, barley, temperature trees, rice, beans, fruits, and vegetables including root crops and have $\delta^{13}C$ values ranging from -22 to -38‰, with a mean of -27‰. A third group, CAM plants (succulents), has $\delta^{13}C$ values intermediate to the C3 and C4 plants. Marine resources have $\delta^{13}C$ values that overlap those of C4 plants. The use of $\delta^{15}N$ values can elucidate more detailed dietary information particularly in cases where foods with overlapped or intermediate values may be being consumed. $\delta^{15}N$ values indicate the overall trophic level at which a consumer is feeding and are higher towards the upper end of the foodchain so that herbivores have higher values than plants, and carnivores have higher values than herbivores.

Analysis of different components of bone provides somewhat different information about diet. The $\delta^{13}C$ and $\delta^{15}N$ values of bone collagen (protein) reflect dietary protein while the $\delta^{13}C$ values of bone apatite (mineral) reflect the whole diet and are strongly influenced by carbohydrates and fats (Ambrose and Norr 1993; Tieszen and Fagre 1993). Bone collagen and apatite $\delta^{13}C$ values are approximately +5‰ and +9‰ respectively relative to dietary values, while $\delta^{15}N$ values of bone collagen tend to be about +3‰ relative to dietary values; these values do show some variation depending upon the exact composition of the diet (Ambrose et al. 1997).

Given the general diets that were portrayed in the literature, it was expected that individuals consuming a ‘European or colonial’ diet would have bone collagen $\delta^{13}C$ values ranging from about –21 to –17‰ and $\delta^{15}N$ values ranging from 9 to 12‰. In contrast, it was expected that individuals consuming an ‘African or slave’ diet would have bone collagen $\delta^{13}C$ values ranging from about –16 to –12‰ and $\delta^{15}N$ values ranging from 13 to 15‰.

In order to obtain stable isotope values for the interred population, bone samples weighing approximately 1g were taken from of each individual using either a rib, or a long-bone if the ribs were not well preserved. Bone collagen was isolated following the method of Sealy (1986) with modifications to remove humic contaminants (Varney 2003:110) and bone apatite was isolated using the method of Lee-Thorp (1989) with modifications by Garvie-Lok and colleagues (2004). Samples that had collagen and apatite of good integrity (see Varney 2003 for full description of all methods) were then subject to stable isotope analyses at the Stable Isotope Laboratory, Department of Physics and Astronomy at The University of Calgary.

As shown in Figure 1, the isotopic ratios of the bone collagen samples demonstrate that individuals of different ancestry[iii] among the interred population from RNH cemetery did indeed consume different diets although not as drastically as predicted. The $\delta^{13}C$ values of the white group are typical of what is expected from consuming a largely European style diet. Although three of seven in the black group do have some overlapping $\delta^{13}C$ values with white group, overall the black individuals have a greater range of $\delta^{13}C$ values that includes higher values. And it is in this higher range of values that we would expect to see people consuming the typical slave diet described in historical sources. Both groups have similar $\delta^{15}N$ values, with the black group having slightly more diversity. This can be interpreted as both groups eating similar protein from similar sources in terms of trophic level, probably terrestrial mammals. The five children at the Royal Naval Hospital have $\delta^{13}C$ that overlap only with those of the black adults, and tend to have both higher $\delta^{13}C$ and $\delta^{15}N$ values than all adults indicating that the children were consuming a diet that had greater similarity to the black adults that the white adults.

The bone collagen data give a general pattern, and the apatite data refine the picture for us (see Figure 2). The same three black individuals again have $\delta^{13}C$ values overlapping with those of the white group; however, the mean $\delta^{13}C$ values of apatite for the two groups are more disparate than the mean $\delta^{13}C$ values for collagen. The values of the children once again only overlap with the black adults. Since the $\delta^{13}C$ values of apatite reflect the whole diet and are strongly influenced by carbohydrates, the greater difference in $\delta^{13}C$ values between the two groups most likely reflects different dietary staples rather than protein sources. On the individual level, the adults of the black group appear to have been consuming a more diverse diet in terms of staples with some individuals eating staples similar to the white group. In terms of protein sources, all adults regardless of ancestry appear to have been consuming a very similar diet.

The 26 adult individuals from the RNH cemetery comprise an admittedly small sample, and we do not have another equivalent sample of mixed ancestry to compare it. However, there is stable carbon and nitrogen isotope data for humans from two roughly contemporaneous probable slave cemeteries on adjacent islands: the Harney site, Montserrat (n=8) and Sainte-Marguerite site, Guadeloupe (n=60), which is part of a larger study (Varney 2003). The isotopic values for bone collagen and apatite from these other cemeteries meet with the expectations of a population that was consuming the 'slave diet' as described in historical sources. As illustrated in Figures 3 and 4, when compared to the isotopic data for both bone collagen and apatite from the Naval Hospital cemetery, we see that the $\delta^{13}C$ values of these other cemetery populations overlap considerably with those of the RNH cemetery black group but the former groups have a much narrower range of values. Only a few individuals from the Montserrat (1 of 8) and Guadeloupe (3 of 60) cemeteries overlap with the $\delta^{13}C$ values of the RNH white group. There is a small overlap in the $\delta^{15}N$ values of bone collagen but it is not substantial.

The children from the RNH cemetery have isotopic values that are remarkably similar to these other two cemetery populations indicating that these three groups were consuming a similar diet that was consistent with the historical accounts for the general diet of slaves. This strongly suggests that these children were those of slaves working for or owned by the Navy. The fact that the black adults from the Naval Hospital cemetery have isotopic values indicating a diet with more individual diversity in carbohydrate staples and a protein source very similar to the white group is likely related to their status as Naval owned slaves. This status may have allowed them different access to resources, as well as influenced their choice of resources to utilize (Buckley 1998; Dyde 1997; Voelz 1993). This latter point reinforces the heterogeneity of African-derived groups that may be difficult to elucidate from standard historical and archaeological sources alone. In this case, the diversity of individual diet and its influencing factors were masked until integration of stable isotope analyses into the investigation.

Conclusion

In conclusion, this study demonstrates that there is potential for using stable isotope analyses as one of a suite of criteria for establishing the identity of the interred in colonial cemeteries. The expansion of the number of sites and individuals subject to analysis does need to be increased to further elucidate the range of isotopic values that can be expected for individuals in different social spheres. Furthermore, it demonstrates that the application of isotopic data is not limited to establishing identity, but also to aspects of resource use and allocation. This latter application promises to reveal diversity within groups with shared ancestry that may otherwise remain masked.

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Notes

[i],[ii] former terms are consistent with those given in forensic anthropological methods while the latter are most likely geographic origin of ancestry

[iii] as identified by cranio-facial features