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Isotopic Investigations at Newton Plantation, Barbados – A Progress Report

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Introduction

The article by Jerome Handler and Frederick Lange in the June 2006 issue of the *African Diaspora Archaeology Newsletter* prompts us to write a short progress report on isotopic investigations that are currently being undertaken on a series of burials from the Newton Plantation cemetery, Barbados. Some 25 years after Handler and Lange began archaeological research at Newton Plantation cemetery, researchers from Southern Illinois University and Syracuse University revisited the site and continued excavations (Shuler 2005, Pasquariello n.d.). The skeletal material from 1997-1998 yields valuable information regarding the life histories and origins of Newton's slave population. Using a combination of carbon and nitrogen isotope measurements on a number of different skeletal elements (Sealy *et al.* 1995) we are able to reconstruct the dietary histories of the individuals buried at Newton and to trace their life trajectories, in some cases back to their African origins. The use of strontium isotope measurements on tooth enamel (Price *et al.* 2006) provides further information regarding the origins and subsequent movements of the people buried at Newton. However, the limitations of the isotopic data require that we use conjunctive lines of evidence in our reconstructions of past life histories. We agree with Handler and Lange (1978 and 2006) that in particular the ethnohistorical record provides information without which the archaeological and isotopic data would be difficult to interpret and we are grateful for their pioneering work without which this study would be meaningless. The following presents a brief introduction to the use of isotope analyses in archaeology and a report of the first isotopic results for the burials from the Newton Plantation cemetery and their interpretation.

Isotope analysis of human remains from archaeological contexts

Since their earliest application in the late 1970s (Vogel and van der Merwe 1977) stable isotope analyses of human remains have matured into a well-established practice in archaeology. Particularly carbon and nitrogen stable isotope measurements are now being widely used to infer aspects of past human dietary histories (Sealy *et al.* 1995, Cox and Sealy 1997, Cox *et al.* 2001). More recently (Price *et al.* 2006), strontium isotope measurements have been employed to trace the origins and subsequent migration patterns of individuals and even groups of people. In combination, these isotopic techniques provide a powerful tool in the reconstruction of past life histories.

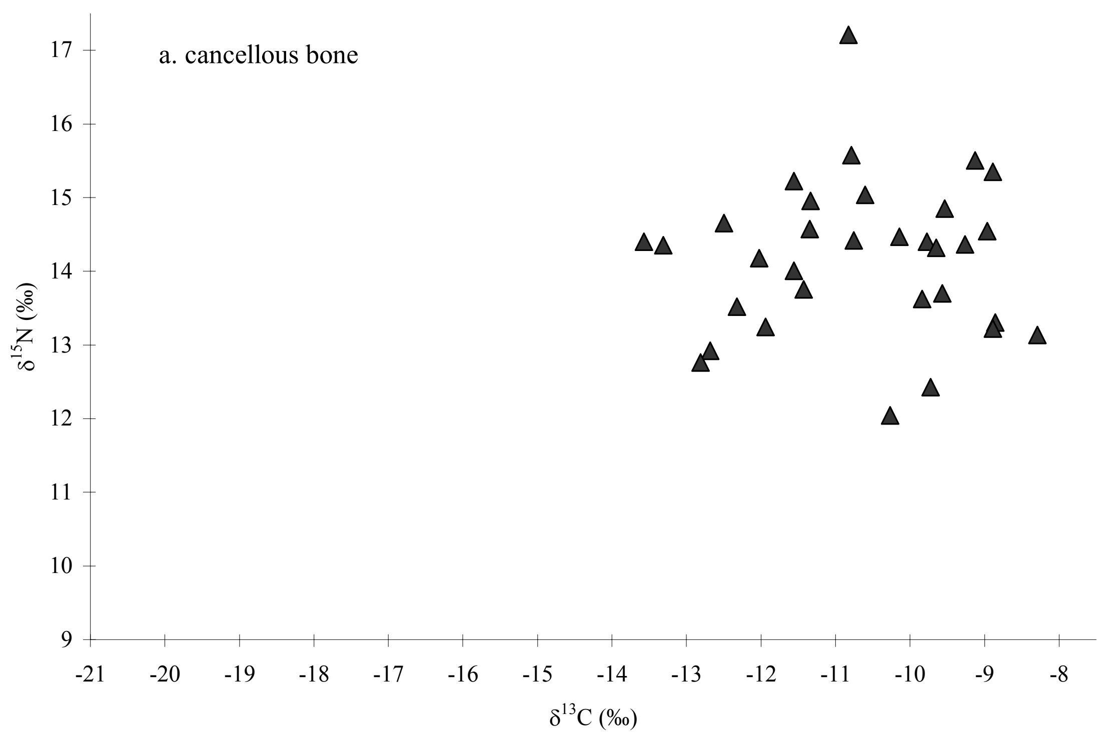
Stable carbon and nitrogen isotope ratios in bone collagen vary primarily in relation to diet. At the bottom of the food chain, the ratios of carbon isotopes in plants largely depend on the plants' photosynthetic pathway. These differ from temperate to tropical regions, so that crops such as wheat, barley, rice and virtually all fruits and vegetables, which use the C_3 pathway, have much lower carbon isotopic ratios than those that use a C_4 pathway. Important C_4 crops include maize, sorghum, millet and sugar cane. Consequently, people whose diet largely relies on C_3 crops or animals raised on these crops, typically exhibit bone collagen $\delta^{13}C$ values of around –21‰. People who rely mainly on C_4 crops, on the other hand, generally have bone collagen $\delta^{13}C$ values of about -7‰. The situation is complicated by the fact that eating large quantities of seafood also elevates the carbon isotope ratio in bone collagen, up to about -11‰. The overlap is such that it is not possible to distinguish between seafood and C_4-based diets using carbon isotopes alone. Both, however, are clearly distinguishable from C_3-based diets (Cox *et al.* 2001). Nitrogen isotope measurements can help to discriminate between marine and terrestrial diets, since nitrogen isotope ratios are generally lower on land than in the sea (Ambrose 1993). As a result, people eating large amounts of seafood commonly have highly elevated bone collagen $\delta^{15}N$ values of up to 20‰, whereas people whose diet includes no or only very little seafood have much lower values of about 10‰ or less (Cox *et al.* 2001). Strontium isotopes provide isotopic information that relates to the geographical area in which people live rather than the diet *per se*. The ratio of ^{87}Sr to ^{86}Sr varies depending on the age and composition of the local geology. While bedrock $^{87}Sr/^{86}Sr$ is very high (>0.750) in ancient West African gneisses, it is considerably lower (<0.710) in relatively recent geological formations, such as those of the Caribbean. These variations may seem small but they are exceptionally large from a geological point of view and far in excess of analytical error. Since they will ultimately be reflected in human body tissue, they can potentially serve as geological tracers for the areas where individuals grew up (Cox and Sealy 1997, Price *et al.* 2006).

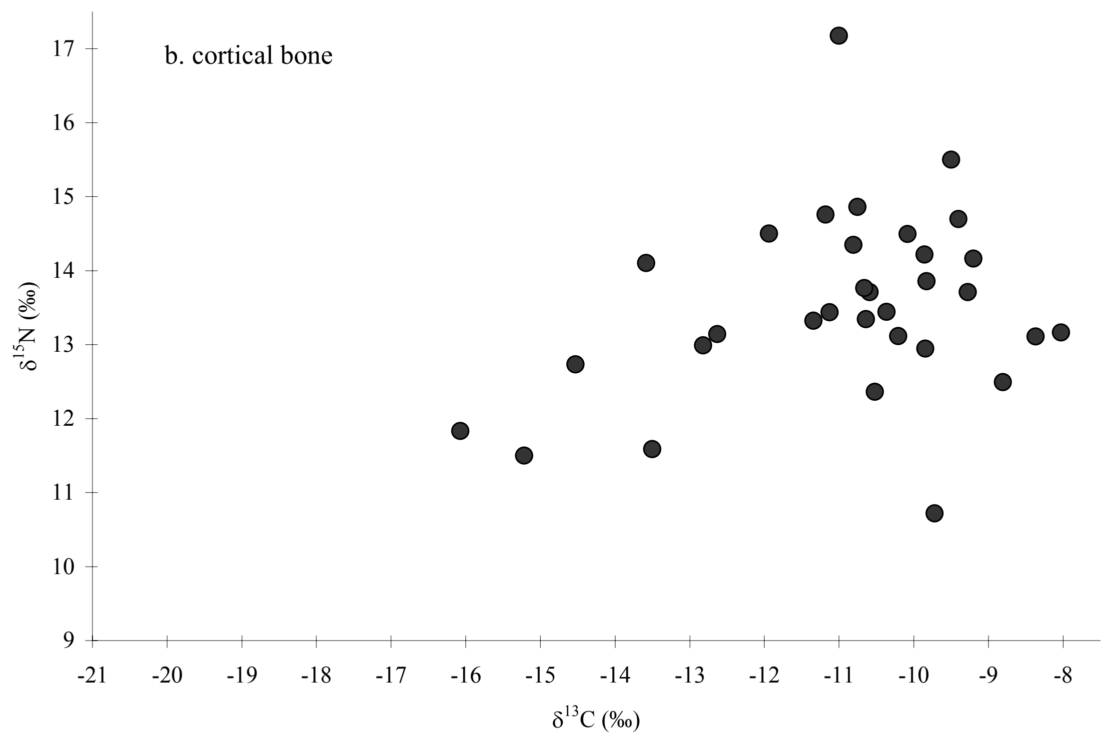
The analytical methodology employed in this study largely follows an approach first described by Sealy *et al.* (1995). It involves measuring the ratios of carbon and nitrogen in a number of different skeletal elements of the same individual, which yields more information than one measurement alone. For instance, it is possible to establish whether individual dietary regimes changed significantly over the course of a lifetime. The approach is based on the assumption that different calcified tissues have different histories of formation. Tooth enamel, for instance, is laid down *in utero* and during childhood. Enamel does not remodel in later life. Tooth dentine, also forms during childhood but small amounts of secondary and tertiary dentine might be added later in life. Essentially, however, dental tissues remain largely unchanged after their initial deposition and therefore reflect the diet ingested during childhood and early life. Bone, on the other hand, is a much more dynamic tissue that is continually remodelled throughout life. The rate at which the bone is resorbed and re-deposited differs, however, between different skeletal elements. Cancellous bone, such as it is found in ribs, remodels much faster than the denser, cortical bone of the femur mid-shaft. Hence, cancellous bone values reflect the diet of the later stages in life, whereas cortical bone yields values that reflect the dietary intake over the last fifteen to twenty years (Sealy *et al.* 1995, Cox and Sealy 1997, Cox *et al.* 2001). Stable isotope analyses of different skeletal elements can thus be used to reconstruct individual dietary histories, whereas strontium isotope measurements on tooth enamel samples can be used to identify 'migrants' within a population and, possibly, to trace their origins (Sealy *et al.* 1995, Cox and Sealy 1997, Cox *et al.* 2001).

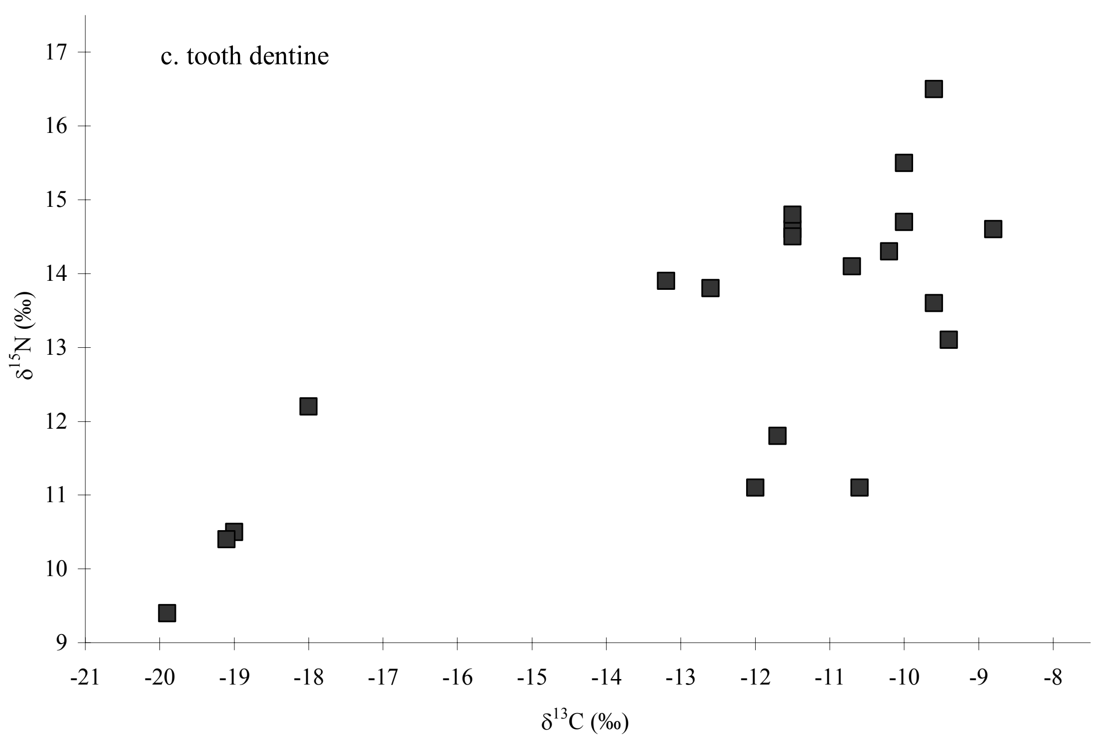
Isotope results

The range of carbon and nitrogen isotopic ratios varies considerably between different skeletal elements of the thirty-two individuals analysed in this study (figure 1). The cancellous bone values, which reflect the most recent dietary history of the individuals buried at Newton, are tightly clustered. The cortical bone values, on the other hand, show a much wider spread and for the dentine values the scatter is still greater, which attests to the diverse origins of the individuals in this group. The values derived from cancellous bone average around -11‰ in $\delta^{13}C$ and 14‰ in $\delta^{15}N$, which is consistent with a diet that mainly relied on C_4 crops such as maize, millets, sorghum and sugar cane, as well as marine resources. Historical records suggest that these were the main staples in the diet of West Indian slaves (Handler and Lange 1978: 86-88). The most depleted values are found among the dentine samples. These values, which appear as outliers at the left-hand side of the graph, are consistent with a mainly terrestrial based diet. During their childhood, this group of individuals relied thus largely on C_3 crops such as rice, fruits and vegetables. Seafood, however, seems to have been absent from their diets. Another group of outliers among the dentine samples is relatively depleted in $\delta^{15}N$ but shows the same elevated $\delta^{13}C$ values as the cancellous bone, which suggests that these individuals also ate tropical C_4-based diets during their childhood but only little, if any, seafood.

Figures 1a-1c: $\delta^{13}C$ and $\delta^{15}N$ values for all skeletons under study, by skeletal element.
NB: the tooth dentine and cortical bone values show a greater spread than those derived from cancellous bone collagen, which attests to the diverse origins of the individuals in this group.

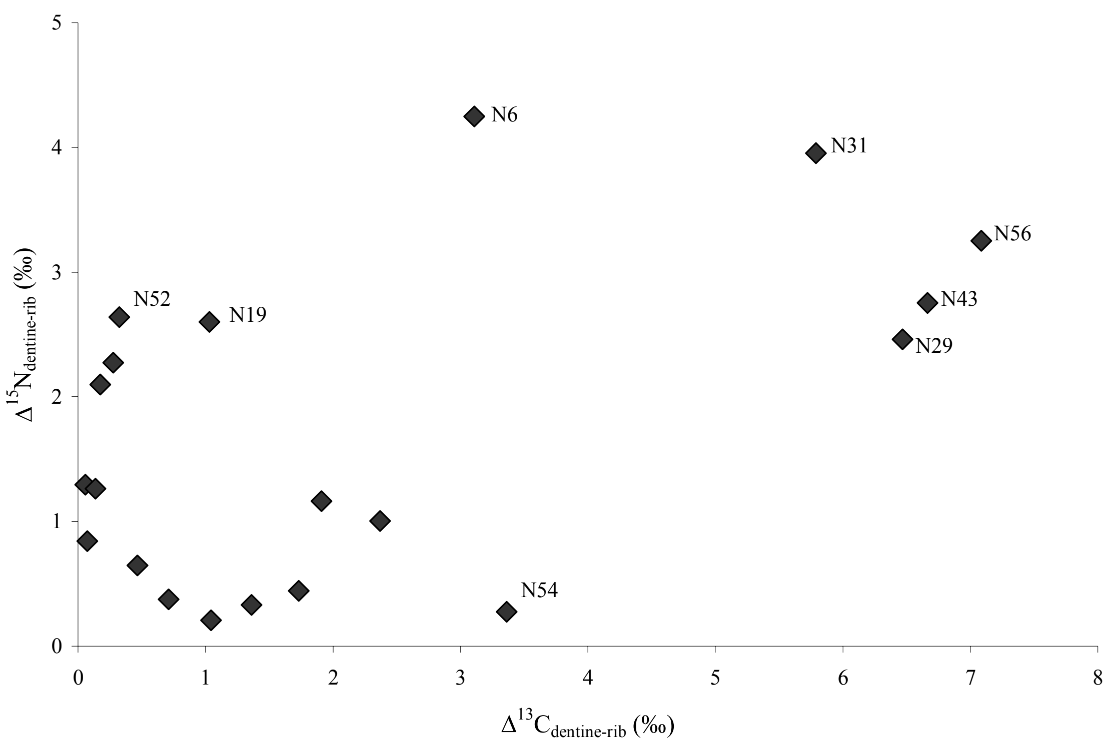






In Figure 2, the δ^{13}C and δ^{15}N values for cancellous bone have been subtracted from those derived from tooth dentine samples in order to illustrate the extent to which individual diets changed over a lifetime. For five (N6, N29, N31, N43 and N56) out of the thirty-two individuals analysed the difference exceeds 4‰. This represents a radical change in diet that reflects a behavioural change, rather than normal physiological variation (Cox *et al.* 2001). In other words, such a shift can only be explained by a drastic change to the way of life. Considering the nature of the burial ground, it is likely that this group of people represents first generation captive Africans and that the change we perceive in their isotopic histories coincided with their enslavement and subsequent displacement from West Africa to the West Indies. A number of other individuals, in particular N19 and N52, also show differences between the two skeletal elements but they are not as large as in the previous five cases and could be explained by other behavioural or physiological processes other than enslavement and transhipment to the New World. The remaining individuals exhibit no substantial isotopic differences between the various skeletal elements and it can be assumed that we are dealing with slaves of 2nd or subsequent generations who were born on Barbados.

Figure 2: Changing diets: difference between rib and tooth dentine $\delta^{13}C$ and $\delta^{15}N$ values for each individual in the study. NB: Labels mark burial numbers.



The strontium isotope results were obtained using a laser ablation technique and multi collector inductively coupled plasma mass spectrometry (LA-MC-ICPMS). The analyses were conducted on tooth enamel samples from ten individuals. On the whole, the results confirm the findings of the stable isotope analyses. However, they also add some information. The three lowest values (ranging close to 0.711) all derive from individuals who experienced no substantial changes to their diets (N7, N38 and N53). Such a low value is consistent with the Barbadian limestone geology and local ground water values (Banner *et al.* 1994), which confirms that we are dealing with Barbadian-born individuals. The higher values, on the other hand, ranging close to 0.715 exclusively derive from individuals who did experience drastic changes to their diets during their lifetime (N6, N29, N31, N43 and N56). At this stage in research it is too early to speculate on the precise origin of these individuals. However, it is clear that they were not born on Barbados but likely somewhere in West or West-Central Africa (Price *et al.* 2006). The two most elevated values, which are clearly not Barbadian either, were obtained from N19 and N52. Interestingly, these are the two individuals who could not be clearly identified as first-generation African captives using the stable isotopic evidence alone. Although the stable isotope results did suggest that they experienced a change to their diet during their lifetime, it had not been as drastic as for other individuals in the group. The very elevated strontium isotopic signatures in their teeth suggest, however, that they were indeed born in Africa.

Discussion and concluding remarks

When the available archaeological, historical and isotopic evidence is combined, three major patterns emerge to reveal the life histories of these thirty-two individuals who were interred on the Newton cemetery. Three major groups appear whose members might have shared similar life histories. The first group includes all those individuals who were born on Barbados and therefore do not show any substantial changes to their dietary histories, as well as similar strontium isotopic values. Considering the historical evidence (Handler & Lange 1978: 104-105), it is likely that we are dealing with people of African descent who were born into slavery on Barbados, as the sons and daughters of first generation imported slaves. The six individuals (N12, N25, N29, N31, N43 and N56) in the second group also share similar dietary histories. However, these are clearly distinct from those of the first group and show clear evidence for drastic lifetime dietary changes. Most likely, these individuals are first generation captive Africans, whose diet changed from a mainly terrestrial C_3-based diet to the West Indian diet, which was dominated by C_4 crops such as maize, millets and sugar cane. However, their similar dietary histories do not imply that these individuals arrived from the same region in Africa, let alone at the same time. Yet, the fact that the strontium isotopic signatures in their teeth are also very similar suggests that they may indeed have come from the same part of Africa, possibly even as a group. The three individuals (N6, N19 and N52) in the last group have different dietary histories from one another and from the rest of the group. The stable isotopic evidence demonstrates that their diets also changed considerably over their lifetime, albeit in different ways. While C_4 plants such as millets and sorghum seem always to have played an important role in their diet even during their childhood in Africa, consumption of seafood seems to have increased only after their arrival in the West Indies. As noted earlier, these three individuals also exhibit clearly distinct strontium isotopic values, which suggest that they originated from different parts of Africa. By linking bone chemistry and somatic modification, we are thus able to identify first-generation African captives and to trace their life history trajectories back to their homelands in Africa. The limitations of the isotopic data are such, however, that they would be difficult to interpret on their own. Here the use of conjunctive lines of evidence, archaeological as well as ethnohistorical, is key.

In the past the occurrence of dental modification has been used to infer an African origin for individuals found in New World contexts (Handler 1994). Among the individuals in this study two (N19 and N52) show clear evidence for this custom. Incidentally, both burials also exhibit the highest strontium isotopic ratios (0.719 and 0.725, respectively) of all. Therefore, there can be no doubt that we are dealing with first generation imported slaves. N19 was identified by Shuler

(2005) as a probable male, approximately 21 years of age at the time of death, while N52 is a female between 30-35 years of age. Most likely, these individuals grew up somewhere in tropical West Africa, where C_4 crops dominated the diet, only to be captured in their youth, transhipped to the West Indies and sold as a slaves. A similar life history trajectory may be ascribed to those individuals from Newton who show no evidence for dental modification but who have a similar dietary history. This goes to show that a sole reliance on dental modification as an indicator for African birth will inevitably lead to an underestimation of the number of African-born individuals within any given New World population (cf. Handler 1994). If we combine osteological data and mortuary data with isotopic evidence, however, we will be able to build more convincing arguments and to be more accurate in our reconstructions of past life histories. Apart from the archaeological and isotopic data, the ethnohistorical record is, of course, of great importance in the context of African diaspora studies. As Handler and Lange (1978) rightly point out, even "the initial identification of a slave system in a society and at a particular site, or areas to be excavated, depends on historical proof" (Handler and Lange 1978: 224). In case of the Newton Plantation, the presence of a slave system from its earliest days until abolition in 1834 is beyond doubt. Even so, the specific social status of individuals is impossible to ascertain. Whether a particular individual died as a slave or was manumitted before he/she died or whether someone enjoyed certain privileges over someone else, as overseer or skilled labourer, cannot be determined. In fact, it is unlikely that we will ever know whether using isotopes or not, for these are social distinctions that leave no archaeological or somatic trace.

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