From Saladoid to Taíno: Human Behavior from Human Remains in the Greater Antilles

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Abstract

This is a brief survey of some physical and potentially cultural traits found in the archaeological record along the Antilles chain. Continuity and change in physical attributes such as body size and robusticity are discussed in light of apparent population expansion from the South American mainland up into the Caribbean basin. A comparison of overall health between islands and what may represent social behavior is examined using the skeletal remains of prehistoric Caribbean individuals at the Peabody Museum of Natural History at Yale University.

Keywords

Saladoid, Taíno, Puerto Rico, Bahamas, tuberculosis.

Introduction

Studies of ancient human skeletal remains found on the islands surrounding the Caribbean can provide information on ancient communities and on the prehistoric immigrants who traveled up the Antillean island chains and their descendants. This discussion focuses on the horticulturists who made the trek, whether considered Cedrosan, Barrancoid or Ostionoid; the common ancestors are arguably the Saladoids of the region of the lower Orinoco Delta in what is now Venezuela (Rouse 1992; Wilson 1997). I examined these remains between 2002 and 2005 and my observations were the basis for my unpublished master's thesis (Drew 2003). While I have spent time working in the Dominican Republic and was fortunate to have discussed Puerto Rican archaeology with the late Irving Rouse, among others, I do not claim to have specialist knowledge of Caribbean archaeology.

The larger Antilles islands such as Puerto Rico and Hispaniola offered access to a superior range of resources compared to smaller islands, suggesting that the inhabitants of larger islands were healthier than those from the smaller land masses. Earlier "Saladoid" populations were more physically robust than the Contact-era "Taíno." In addition to information on past health, analysis of remains from pre-Columbian Puerto Rico and Hispaniola can augment cultural studies. The network of historical museums in Florida, USA, the Taíno display at the University of Florida at Gainesville and historical societies in various Caribbean cities such as Nassau, Grand Bahamas, make claims that the Taíno who encountered Columbus did not have a slave caste. Interpretations of their remains support these views (which are expanded on in the Commentary, below).

Background

In July 2002 work began on an assessment of the Caribbean human remains that had lain in storage at Yale University's Peabody Museum of Natural History for decades. Relics of the early expeditions

of the Yale Caribbean School in the 1930s, most had been retrieved from Puerto Rico, some by Froelich Rainey, others by the late Irving "Ben" Rouse (Rainey 1940; Rouse 1952a, 1952b). Individuals from the Bahamas, Haiti, the US Virgin Islands, Venezuela and Cuba are also in this collection. When Rouse encountered a burial, he would remove it only if it lay within his excavation units; materials that remained firmly within the walls of a pit were left *in situ.* During the course of this analysis, I discussed the remains several times with Rouse. His interest had been to discern migration timing and patterns using ceramic styles and other artifactual evidence, and the bones of the dead were not his focus. Perhaps he should have reburied these ancient individuals in their disturbed pits. However, he brought them back to Yale and thus has given us a valuable link to the early ceramic-using settlers of the Greater Antilles.

The individuals were examined over the course of a year or so (Drew 2003). They were aged and sexed and, using Rouse's extensive work on ceramic seriation (Rouse 1952a, 1992), were temporally sorted by relative dating. During the course of analysis, marked differences between individuals became apparent: some individuals had very robust, "muscular" bones compared to others; the variation seemed to correspond with certain associated artifacts within the grave.

The population movements of the Saladoid culture(s) are most easily traced through the continuity of their distinctive ceramic styles. Perishable items of plant or animal origin, such as housing posts and roof materials, clothing, wooden bowls and utensils have long disappeared from the tropical archaeological record in all but the rarest instances (Righter 2002). As the analysis of the Yale Peabody Museum materials continued it became clear that some remains were potentially very old, because they had been interred within or even beneath the village middens of the early "Cuevas" population, as the Saladoids and their distinctive white-on-red pottery (as found in the Greater Antilles) were originally termed (Rouse 1952a, 1952b). The excavation of remains were described in some detail by both Rouse and Rainey, including descriptions of associated items, whether sherds or entire vessels (Rainey 1940; Rouse 1952a, 1952b). Saladoid burial practices seemed to include the occasional use of ceramic bowls, whether placed under, beside or over the deceased. This may have originated on the mainland; a brief reference in the literature (Cruxent and Rouse 1958:246) mentions that in the 1940s Alfred Kidder discovered two primary burials in food refuse with Barrancoid series La Cabrera style vases over the skulls in the Lake Valencia area; see Gillott (2009), which discusses infant burials within bowls from Saladoid contexts. (Because of my limited experience with Caribbean burial practices, I apologize for any unfamiliarity with recent discoveries of Caribbean remains from later, post-Saladoid periods interred with bowls.)

Materials and Methods

The Yale Caribbean Collection of Human Remains

The human remains in the Yale Caribbean collection of consist of approximately 72 individuals, with skeletal preservation ranging from excellent to poor. Most remains can be associated with one discrete individual, or with a small group of individuals of very different ages (adult with young juveniles). The remains, especially those collected by Rouse, are assigned separate PA numbers and cardboard archival boxes.

Twenty-seven individuals are reported from Puerto Rico, of which 16 are reasonably complete. Thirty are attributed to smaller islands in the Bahamas, such as Eluethra Island, Long Island and Crooked Island, and of these 14 have relatively complete skeletons. Another 15 or so individuals are from Cuba, Haiti and Venezuela. These remains are more fragmented, with only one fairly complete individual; the rest are represented by mandibles, skull fragments, vertebrae and upper limbs.

Skeletal Element Identification, Ageing and Sexing, and Paleopathology

For the identification of skeletal elements I consulted standard texts, such as White (2000) and Bass (1995), and for ageing and sexing the remains Buikstra and Ubelaker (1994) supplemented these texts. Skeletal elements were considered to belong to one individual if they were of similar size and robusticity and did not contain duplicates. Ages were assigned according to the following criteria: degree and completeness of

long bone epiphyseal fusion; pattern and degree of cranial suture closure; presence and severity of age-trending pathologies such as osteoarthritis and tooth wear; and extreme bone shaft thinness attributed to osteoporosis or extreme inactivity. I interpreted skeletal pathologies and analyzed markers of potential "stress and occupation" and the possible significance of cortical bone mass using these standard texts, as well as Aufderheide and Rodriguez-Martin (1998), Bridges (1995), Hawkey and Merbs (1995), Işcan and Kennedy (1989), Larsen (1997), Mays (1996), Ortner (2003), Peterson (2002), Powell and Cook (2005), Ruff (2000a, 2000b), Ruff and Hayes (1983) and Rogers and Waldron (1995). I also had the benefit of personal instruction and advice from experienced physical anthropologists Don Brothwell, Della Collins Cook, Clark Spenser Larsen and the late Fernando Luna Calderón, among others.

Puerto Rico Materials: Assignment to Different Cultural Groups

Individuals are considered "Saladoid" if found interred in association with Saladoid style ceramics, with obvious grave goods of any sort or with bowls over or under their skeletons, or if buried in flexed, upright posture, as if seated (Rainey 1940; Rodriguez 1997:82–83; see also "La Caleta" in Veloz Maggiolo 1972). Depth of deposition is also considered; remains from deep levels of 1 m or more are also potentially Saladoid.

I relied on Rouse for relative dating, as he was meticulous in his description and analysis of the ceramic series. A pattern emerged as the remains were placed into context and dated using undisturbed stratigraphy, depth of burial and the assumed dates of associated ceramics. Tall individuals or those with very robust frames were often associated with the deepest deposits and what was at that time termed "Cuevas" pottery, and in some instances had been buried in the "clean yellow sand" (Rouse 1952a, 1952b) below a Cuevas–Saladoid midden, as if buried early in the formation of a midden. Rainey also referred to burials found in "the [clear yellow] sand below refuse practically at [1930s] sea level" (Rainey 1940:196–197); these burials are often associated with white-on-red painted bowls (Righter 2002; Rodriguez 1997; Gillott 2006).

To further differentiate between Saladoid and Taíno cultures, individuals are considered to be "Taíno" if they have deliberate cranial modification (after Rouse 1986, 1992) or are buried in midden graves in association with Boca Chica or Santa Elena style potsherds. Again I apologize for lack of familiarity with alternate interpretations of cultural affinity; at the time of analysis, cranial modification of the infant skull using boards to shape the thin skull vault was considered a "Classic Taíno" practice (Rouse 1992; Rouse pers. comm. 2002; Tavarez Maria, pers. comm. 2004).

Apparent Differences in Bone Mass and Shape

Gracility and robusticity are associated with sexual dimorphism and also activity. While males build more bone because of testosterone (Walker 1995), a heavier individual of either sex will subject her or his frame, especially the lower limbs, to increased loading, which will result in thicker bones (Bridges 1995; Larsen 1997; Ruff 2000a, 2000b; Peterson 2002; O'Neill and Ruff 2004). The two variables to most differentially affect the size and shape of bones are nutrition and activity (Larsen, pers. comm. 2003).

Many of the long bones in this collection were fragmented, lacked epiphyses (ends of a long bone) or had breaks at or near midshaft. While this created challenges for taking metrics as outlined in Buikstra and Ubelaker (1994), it also presented the opportunity to observe the interior of the bone shaft and the cortical mass. As a novice working without regular instruction from a human osteologist, I made naïve errors in taking metrics on fragments; however, by recording the length of fragments workers can judge the usefulness of a bone sample on the basis of the size of the fragment (Drew 2003); in addition to stature and dimorphic information, large segments of relatively complete long bones can offer a host of other information, such as upper- or lower-shaft robusticity, epiphyseal dimensions, and muscle attachment diameters.

Cortical mass (unfortunately lacking an overall shaft width) was measured with hand-held Mitutoyo dial sliding calipers, recording the width of the "average" cortical aspect. More recent work has qualified this method to a measurement of overall midshaft diameter, the locale of which varies from element to element, omitting highly responsive muscle attachment crests such as the inter-

roseous crest of the radius and ulna and the linea aspera of the femur. The diameter of the medullary canal was then taken along the same plane of the recorded shaft diameter, and the medullary diameter was deducted from total cortical diameter to provide the cortical width of the bone shaft itself. This mass can then be compared to the overall shaft diameter as a percentage.

Because this is a review of old data, up to six years after its acquisition, proper cortical mass percentages cannot be calculated. Therefore, the relative terms "comparatively thick" cortex and "comparatively thin" cortex can be taken to imply overall bone robusticity (or gracility). Robusticity also refers to the overall appearance and physical size of skeletal elements and to the exuberance of muscle attachment sites.

Femora of early, hunter-gatherer populations tend to have flatter shapes to the bone shaft, while more modern remains have more rounded femoral shafts, a result of a more sedentary lifestyle. This has been explained by the differences in distance routinely traveled and the topography of terrain experienced by the different subsistence styles (Ruff et al. 1984; Bridges 1995; Larsen 1997; Stock and Pfeiffer 2001). Shape differences of the proximal femur were calculated as an index for the non-Puerto Rican remains and could be reconstructed for one of the Puerto Rican samples. This index, termed the Platymeric Index (Bass 1995:225) is the ratio of the sagittal diameter (anteroposterior, or front to back) to the transverse diameter (mediolateral, or side to side) of the upper femur.

The remains excavated by Rouse were found with no *obvious* grave goods in association (Rouse 1952a, 1952b) and, therefore, as previously mentioned, the antiquity and seriation of associated pottery styles were the primary method to gauge relative dating of the remains. At the time of this analysis, other dating methods, such as accelerator mass spectrometry (AMS) measurement of ^{14}C, were not available to me, and destructive sampling was not done. Dating was based on ceramics found in midden layers above remains and, more rarely, below. Rouse revised his relative dating of styles throughout the 1940s and 1950s and completely reevaluated the timing of ceramic styles with the advent of radiocarbon dating (Cruxent and Rouse 1958; Rouse 1986). Debate still continues on the timing and extent of pottery styles.

Results

Differences in Robusticity

While assessing the Puerto Rican remains in 2002 and 2003, a pattern in robusticity emerged. The remains associated with "Cuevas" style pottery represented individuals with noticeably "thick" cortical bone and robust muscle attachments, while individuals who dated to more recent times had "thick" and robust cortical mass, but generally less robust muscle attachment sites. For example, a juvenile of approximately 2.5 years (PA 162) found in Collores at a depth of 1.5 m and associated with Cuevas pottery had well-marked muscle attachments sites, while an adult male (PA 170) associated with Boca Chica sherds and found at less than 25 cm had a more moderate robusticity to his muscle attachments. But the pattern is not definitive. PA 151, an arthritic, older female (more than 50 years of age) with pronounced muscle attachment sites had retained "thin to moderate" cortical mass, which could be attributable to age. It is presumptive to assign her to Saladoid affiliation, but she was encountered at a depth of 1.2 m below grade, and below a charcoal lens.

The few burials from shallower levels associated with what Rouse termed Ostiones or Boca Chica style pottery sherds are of individuals with more gracile frames, less robust cortical bone and less pronounced muscle attachment sites as compared with remains from the deeper, older deposits that are associated with "Cuevas" style pottery. At least one individual is marked as "Classic Taíno" by the deliberate cranial modification of flattened frontal bones molded during infancy by the use of boards (Rouse 1992), but most skulls were not modified culturally, or were either missing or shattered and incomplete.

In this analysis of few individuals placed into assumptive cultural groups using relative stratigraphy and associated potsherds, 7 of 11 "Saladoid" individuals(64%), were assessed as having both "comparatively" thick cortical mass as well as exuberant muscle attachment sites or enthesopathies (damaged muscle sites), or both. The other four (36%) are as follows: a female (PA 164) with abnormally thin cortical bone consistent with osteopenia or osteoporosis; a male that cannot be firmly included as a Saladoid or excluded as a Taíno (PA 167, also included as a "Taíno" below), but who nevertheless had pronounced

muscle sites and "thick" cortical mass; an older female (PA 151) with exuberant muscle sites, but comparatively thin-to-moderate cortical mass; and a juvenile approximately 6 to 8 years old (PA 168) who lacked virtually any muscle tone at all (Table 1).

Three of the five individuals (60%) assumed to be more recent, and therefore of a "Taíno" affiliation, have skeletal elements that do not have exuberant muscle sites, but do have thick cortical mass (PA 150, PA 170, PA 173, see Table 1). PA 173 retains the left femur, which is platymeric (see below) and seems to have a culturally modified skull, although it had been found shattered and was reglued by an earlier worker. The fourth individual (PA 167) cannot be firmly included as either a Taíno or Saladoid. The fifth individual (PA 166), collected by Rainey, is from an unknown location and has a shattered, partial skull, extremely robust muscle sites and a thick cortex; the frontal bone could have been modified in life, but is incomplete.

Omitted from these counts are other "unknown," co-mingled individuals collected from enormous excavation sites by Rainey; these lack assessable skulls and cannot be assigned to specific depths or associated with pottery styles (PA 165, PA 166), or are scant elements representing additional individuals that cannot be properly assessed.

Differences in Bone Shape

The femora of the putative Taíno from Puerto Rico were observed to be rounder in shaft shape than those of assumed Saladoids, which can indicate sedentary, village-focused lives (Ruff et al. 1984; Bridges 1995, Larsen 1997; Stock and Pfeiffer 2001). The exception to this is PA 173, who seems to have had a culturally modified skull shape and also platymeria (82.1 index; see below). Flatter, more oval femoral outlines of some of the individuals attest to lives spent walking great distances and trekking across hilly terrain, actions that place greater strain on the anterior and posterior regions of the femur, in contrast to the more spatially constrained movements of the sedentary Taínos.

The upper femora of the Bahamian individuals, if the elements had been retained, were measured both mediolaterally (side to side) and anteroposteriorally (front to back), and these two diameters were compared (Table 2). This ratio (the Platymeric Index) informs on the shape of the bone shaft; the closer the number is to 1, the rounder the shaft, because both diameters would be of similar numerical value (Bass 1995:225); any ratio below 84.9 is considered "platymeric," or flattened along the anteroposterior plane.

The platymeric indices were recorded for the Bahamian remains (see Table 2) and for two individual from Puerto Rico (PA 161 and PA 173; see Table 1). Unusually "flattened" femora were observed in Puerto Rican samples PA 152, PA 153 and PA 165, but diameters were not recorded. PA 165 (see Table 1) consists of up to five comingled individuals that cannot be assigned to a cultural group. The Bahamian remains cannot be assigned to a cultural group and would benefit from AMS ^{14}C dating, but the individuals with platymeric femora were considered to have "thick" cortical mass and robust muscle sites. The platymeric individuals are PA 4686, PA 4688, PA 4689–4692 and PA 4694.

Variation in Cortical Mass and Muscle Attachment Sites

The analysis of the Caribbean remains instigated a fascination in the potential interpretations of differential cortical thickness between individuals, particularly as related to musculature and element size. One area of the study of human skeletal remains relates to the study of size and shape differences between populations and individuals; for example the differences between the overall size and "robustness" of the bones of a larger, stronger individual compared to the gracile or more slender, "graceful" bones of a smaller, less muscular individual. Overall degrees of robusticity can be seriated within a single population or compared between populations. Studies of bone shape and apparent robusticity and "strength" (resistance to mechanical failure) have occupied physical anthropologists and biomechanical engineers in increasing numbers since the middle 20th century (for example, among many others, Evans and Lebow 1957; Currey 1959, 2002; Frost 1987; Cowin 2001; Kontulainen et al. 2002; Ruff et al. 2006), with the realization that long bones can be understood in terms of their mechanical properties and adaptation to loads and strains (deformation under loading).

Another difference between the frames of individuals is expressed inside the bone and focuses

Table 1. Saladoid and Taíno individuals from Puerto Rico (Drew 2003). Asterisk indicates depth below grade (in meters) in the 1930s; MNI, minimum number of individuals.

Shore	Catalog number	Site	Association	Depth* (m)	MNI and condition of remains	Age, sex and summary
South (mid)	PA 161	Collores	Saladoid (Cuevas sherds)	1.5	1 fairly complete	Adult female, robust elements, pronounced muscle attachments, platymeric femora, index 75.0. Comparatively thin cortex. Pathology: healed right mid-femoral fracture.
South (mid)	PA 162	Collores	Saladoid ("Red culture layer" Rainey 1940)	1.5	1 fairly complete	Juvenile 2.0 to 3.0 years, robust elements, pronounced muscle attachments, comparatively thick cortical bone.
South (mid)	PA 164	Cañas	Saladoid ("Crab level refuse" Rainey 1940)	1.25	2 partial	Adult female, moderately robust elements, abnormally thin cortical of 1 to 2 mm. Juvenile 10 to 13 years, robust elements, comparatively thick cortex.
South (mid)	PA 165	Unknown	Unknown (stored with D loop handle, and sherd labeled Cañas #1)	Unknown	2 fragments 3 partial	Older male, robust bones and muscle attachments, comparatively thick cortical. Older male, moderately robust attachments, comparatively thick cortex. Platymeric femora, but index not recorded. Adult female, moderately robust elements, comparatively moderate cortical mass. Skull fragments of 1 juvenile, elements of 2 juveniles.
South (mid)	PA 166	Unknown	Unknown	Unknown	1 partial	Adult male, remarkably robust muscle attachments, comparatively thick cortical. Possibly modified skull.
Southeast	PA 167	Salinas	Possible Saladoid / early Taíno (Cuevas and Ostiones sherds)	1.0	1 partial	Adult male, robust elements, pronounced muscle attachments, comparatively thick cortex. Pathology: abnormally thin cortex in an arm.
Southeast	PA 170	Santa Isabel	Taíno (Boca Chica)	0.25	1 partial	Adult male, moderately robust, comparatively thick cortex.
Southwest	PA 173	Yauco	Taíno (Ostiones sherds)	0.25	1 partial	Adult male, old, moderately robust, comparatively thick cortex. Modified skull.
North (mid)	PA 151	Toa Baja	Taíno? (below charcoal fire lens)	1.2	1 partial	Older female, pronounced muscle attachments, moderate osteoarthritis, moderate cortical mass for advanced age.

Continued

Table 1 continued.

Shore	Catalog number	Site	Association	Depth* (m)	MNI and condition of remains	Age, sex and summary
North (mid)	PA 152	Toa Baja	Saladoid (below 151 and 153)	1.8	1 partial 1 fragment	Adult male more than 35 years, comparatively thick cortical bone. Some elements included from more gracile individual.
					2 fragments	2 juveniles: 2 years and 0 years.
North (mid)	PA 153	Toa Baja	Saladoid (below 151)	1.6	1 partial	Adult male, very rugose muscle attachments, robust, comparatively thick cortical bone. Platymeric femur, index not recorded. Potentially suffered from treponemal disease (yaws).
					3 fragments	3 juveniles: 1 year, 2 years and 5 years.
Northeast	PA 163A–B	Monserrate	Saladoid? (below shell strata, fire lens; with Cuevas sherds)	1.25	1 fairly complete 1 partial 2 fragments	Juvenile, probable male, age 12 to14 years. Robust elements, pronounced muscle attachment,comparatively thick cortical bone. Skeleton fairly complete.
						Adult female, robust elements, pronounced muscle attachments, comparatively thick cortical bone.
						Older male fragments and skull and maxillary dentition of 16- to 18-year-old.
Northeast	PA 168	Trujillo Alto	Saladoid (Cuevas sherds)	1.5–1.75		Moderate thick cortical, 5 to 6 years old, minimally robust (only feel muscle attachments, not measure).
West (south)	PA 150	Cabo Rajo	Taíno? (Ostiones sherds)	0.5	1 partial	Small-statured adult, moderately robust attachments, comparatively thick cortical bone.
West (south)	PA 169	Cabo Rojo	No affiliation	0.25	1 fragments	Highly degraded possible human bone, associated with identifiable *sus* bones.

on the construction of the bone shaft itself, which is analogously termed the cortex, compact or cortical bone. This is considered in terms of its mass as well as the distribution of this mass, reflected in the shape of the shaft (oval, round) and the comparative thickness of some walls compared to others (mediolateral aspects, anteroposterior aspects). Study of the cortical thickness or robusticity gives an understanding of the interplay between bone shape, size and thickness, and gauges the "strength" and "rigidity" of bones, either for an individual or in a population study. One of my research interests has been the consideration of cortical mass at both the locations of muscle (tendon) insertion sites (e.g., Wilczak 1998; Holt et al. 2002) and at the midshaft. It is vital to consider body mass as well as body size; males tend to be larger than females, especially in archaic or pre-sedentary populations (Bridges 1995), and larger people of either sex have thicker, larger bones both in terms of shaft width and cortical mass (Auerbach and Ruff 2004).

A third aspect concerns the markers of past muscle use and muscle insertion sites on the pe-

riosteal (outer) surfaces, where tendons and ligaments once attached muscle to bone, referred to as markers of occupational stress (MOS), musculoskeletal stress markers (MSM), or entheses (Hawkey and Merbs 1995; Rogers and Waldron 1995; Stirland 1998; Peterson 2002). As muscles exert pull and strain on the tendons and then in turn onto the shaft region that the tendon enters for attachment, this pull will instigate bone growth (Peterson 2002). Under extreme strain, the tendon site will be torn, damaged, or will experience robust growth (Rogers and Waldon 1995). By observing patterns in rugose, damaged insertion sites (enthesopathies), an assessment of potential, habitual labors can be surmised; arguably, past activities can be reconstructed (Işcan and Kennedy 1989; Peterson 2002). This is a contentious field of study, alternatively proclaimed as a means to reconstruct past behaviors and activities (Hawkey and Merbs 1995; Peterson 2002) or blind alleys "doomed to failure" (Stirland 1998:360).

Saladero skeletal materials reanalyzed at the Yale Peabody Museum in 2005 add support to the conjecture that the oldest skeletons from Puerto Rico, from the deepest burials in clean sand within or below middens containing "Saladoid" artifacts, were rather robust people with long bones of hefty cortical mass and cranial vaults up to 8 to 10 mm in thickness. The remains collected by Rouse from Managas Saladero, Venezuela, are only isolated elements or are partial skeletons (PA 278, PA 280–PA 282, PA 383–PA 385) but do seem to be similar to what this study has determined to be early Saladoid remains from Puerto Rico, with the specific physical properties of exuberant muscle sites and thick cortical mass.

Many factors influence the cortical mass of bones (the cortical bone, or cortex, that constitutes the outer shaft), although they differ in the extent of this influence. Primarily these are nutrition and activity (Larsen 1997), but also include sex, genetic influences, age, hormones, metabolism and disease. Cortical mass and distribution can be determined by direct sectioning of the bone shaft, or by using noninvasive methods such as multiple-plane radiographs, computed tomography (CT) scans, or contour molds of the external bone surfaces that can then be sliced and measured (Trinkaus et al. 1994; Larsen 1997; Ruff 2000b; O'Neill and Ruff 2004). The analysis of the Caribbean remains in the Yale Peabody Museum and the Museo del Hombre Dominicano was restricted to gross observation of the bones and use of convenient, preexisting breaks in bone shafts to measure interior aspects. Particular focus was placed on regions nearest the midshaft, which have traditionally been chosen for cortical mass analyses (such as Ruff and Hayes 1983; Trinkaus et al. 1994; Ruff 2000b; O'Neill and Ruff 2004).

Health and Disease

Deficiency diseases such as rickets, scurvy and osteomalacia, and infectious diseases such as osteomyelitis, septic (infectious) arthritis and tuberculosis, can reduce cortical bone mass (Aufderheide and Rodriguez-Martin 1998; Ortner 2003), but these diseases were not noted among the Puerto Rican materials. Merely "getting on in years" will also thin the bone shaft, as will prolonged bedrest and extremely reduced physical activity. Some workers contend that "osteoporosis" in the modern sense was not prevalent in earlier populations, because people of both sexes stayed active, worked hard and enjoyed exposure to sunlight (for vitamin D production) during their labors (Agarwal et al. 2004), while other workers find evidence consistent with age-related bone mass loss in medieval British populations that did indeed endure hard labor (Mays 1996). Females lose bone mass during pregnancy and early lactation, but will restore this loss during prolonged lactation and weaning with adequate nutrition (Agarwal et al. 2004); a younger female with abnormally low bone mass may have died during or shortly after childbirth, before her bone mass was restored (Agarwal et al. 2004:42). Because one of the greatest health risks to premenopausal females throughout history has been childbirth (Ortner 2003), relieved only in the modern era and with access to modern medical practice, analyzing the cortical mass of younger females may prove to be difficult when attempting to tease paleopathology away from parturition. This may explain female Saladoid remains with thin cortical bone (e.g., PA 164; see Table 1).

The overall health differences between individuals who lived on large islands compared with those who had lived on smaller islands seemed to be markedly different. The individuals from larger islands were healthier overall than contemporaries living on smaller islands such as St. Thomas, US Virgin Islands, who are reported to have shown

skeletal evidence of anemia (Righter 2002), or in the Bahamas. Significant benefits to living on larger islands such as Hispaniola and what is now Puerto Rico included access to large rivers and the opportunity to exploit a variety of ecozones (mountain, coastal plain, riverine) with superior potable water and a variety of foods. Overcrowding was avoided, with ample space reducing the spread of disease and competition for resources, and providing a means of mediating disputes with unhappy neighbors able to relocate to avoid conflict.

Work in 2004 and 2005 on putative Saladoid remains from the Dominican Republic, with Glenis Tavarez Maria of the Museo del Hombre Dominicano, further confirms that while treponemal diseases may have been present, individuals of the Saladoid period living on larger islands were generally robust and avoided infectious disease.

There are some discrepancies, however, in that some materials from Haiti show evidence of healed anemia and possible periostitis, as well as chronic treponemal disease. Fragmentary Taíno remains of a juvenile from Fort Liberté, Haiti (not listed in Table 2), and an older probable male from Haiti (PA 158) show evidence consistent with treponemal disease (nonvenereal syphilis, most likely yaws) or with periostitis, the latter a chronic inflammation of soft tissues that can extend into and mark the skeleton (Larsen 1997) and that can be considered symptomatic of community health (Powell 1988; Larsen 1997). One skull from PA 149 (Haiti) has evidence of healed porotic hyperostosis, a bone reaction considered to be a response to anemia (Aufderheide and Rodriguez-Martin 1998; Ortner 2003). The presence of periostitis and anemia are at odds with the conjecture that life on larger islands could offer an overall healthier existence, but one case of anemia and one of possible periostitis do not indicate population-wide prevalence. For an example of higher frequencies of severe health issues from a smaller island, several sets of remains from Eluethra Island, the Bahamas, have skeletal evidence consistent with tuberculosis as well as other infectious disease and metabolic disorders, diseases not noted among either the Puerto Rico or the Dominican Republic samples.

These inconsistencies are emblematic of the dangers of making firm pronouncements on most of the materials from the Yale Caribbean Collection, remains that represent a wide geographical and temporal range. Sample sizes for each region are small, consisting of about 30 relatively complete individuals and other, more scant remains (see Tables 1 and 2). Also, anemia and other disorders that indicate a lack of adequate resources are different from yaws. If the diagnosis for the Haiti remains (PA 158) is determined to be consistent with treponemal disease, widespread prevalence would indicate a population exposed to a stressful, chronic condition spread by very young children, considered a common ailment of coastal subtropical peoples (Phillip Walker, pers. comm. 2005), but it would not be evidence of material poverty.

Health on Larger Islands

The remains excavated by Rainey and Rouse from Puerto Rico show no macroscopic evidence of tuberculosis, osteoporosis, septic arthritis, scurvy or rickets. There were no indicators of anemia or lines of enamel disruption on the teeth (which can indicate enamel growth interruptions); there were few dental caries among the Greater Antilles Saladoid remains.

Similarly, an adult female from Punta Macao, Dominican Republic (not recorded in Table 2), was observed to have "thick" cortical bone, mild osteoarthritic changes in the spine and at the long bone articulations, and was interred with ceramic vessels (Tavarez Maria, pers. comm. 2004). Tavarez Maria considers the remains (examined by me and Tavarez Maria) to date to the Saladoid period. The older adult female had suffered a severe mid-back injury in life, with a crushing trauma at the location of the T12–L1 junction, located at the last thoracic (rib-supporting) vertebra and the first lumbar vertebra. The crushed vertebrae had healed into one conglomerate of fused bone. Tavarez Maria considers this individual to have had high status in life, because the injury did not result in cortically "thin," undernourished and underused lower limbs, nor in marked osteoarthritc changes in upper limb joints. She was assessed as "older" adult because of the moderate-to-extreme degree of tooth wear, the complete epiphyseal fusion of all long bones, and cranial suture closure. Indeed, most of her remaining vertebrae, with the exception of the lower neck and the lowest lumbar vertebrae (potentially from sitting for long periods and from leaning forward at the

TABLE 2. Individuals from Venezuela, Haiti, Cuba and The Bahamas (Eluethra Island, Crooked Island, San Salvador Island, Rum Cay and Long Island). The latter are mostly cave burials, called "surface finds" on the notes stored with the remains. Most of the information is from notes taken during 2003 and 2004. Asterisk indicates a cross-reference with text of handwritten field notecards stored with some of the remains see Table 3 (for example, note 1 refers to the text of the note 1 stored with PA 4683, listed as note1 in Table 3; note 2 refers to the text of the note stored with PA 4692, and so on); MNI, minimum number of individuals.

Catalogue number and location	MNI, age and sex	Summary
PA 278, 280, 281, 282 (Venezuela Saladero)	MNI 3+ Probable adults, fragments	278: midshaft left and right humerii. Notably robust. Small to average diaphyses, but thick cortex, no pathology: no treponematoses, periostitis, osteomyelitis. 280: midshaft robust humerus, right ulna, moderate. 281: Thick skull fragment approx. 8 mm vault thickness. 282: right ulna, expanded diaphysis, affected medullary canal, possible pathology.
PA 383 and 384 (Venezuela Saladero)	MNI 1 Adult, older male partial	384: skull only. 383: postcranial. Extremely robust elements with remarkably pronounced muscle attachments, mild sharpening/ lipping at articular margins, strong male aspects to skull, cortical mass comparatively thick. All upper limbs and some vertebrae represented. C2 and C3 vertebrae fused.
PA 385 (Venezuela Saladero)	MNI 2 1 adult male, partial 1 juvenile, mandible only	Adult male, skull and mandible. Gracile mastoid, frontal abnormal with orbits displaced, mandible left and right coracoids abnormal. Entire right humerus present, but broken, enthesopathies at attachment sites, extremely comparatively thick cortical bone. Second individual age 6 to 10 years, right half mandible M1 erupted, M2 and PM4 in crypt.
PA 96 (Cuba)	MNI 1 Adult, older male Fragments	Extremely thick cranial vault fragments of up to 15 mm in thickness; pathological (possibly anemia). Robust male aspects to crania and mandible. Almost all teeth lost premortem with sockets completely resorbed; 1 worn M3 in socket.
PA 149 (Haiti)	MNI 4 Adult crania	Three modified skulls and 1 nonfitting mandible. One from older male with flattened frontal aspect, evidence of healed porotic hyperostosis; 1 calvaria only, sex unknown, frontal region flattened; and 1 probable female, flattened frontal aspect. Mandible probable female, rounded mental eminence.
PA 157 and 159 (Haiti)	MNI 4 3 adults and 1 juvenile Partial and fragments	1. Younger male more than 20 years, right humerus head in PA 159 fits right humeral diaphysis in PA 157, unfused medial aspect left and right clavicles, left mandible in PA 159, right half in 157 with M3 still in crypt, left maxilla in 157 fits right maxilla in 159, teeth unworn, most of vertebral column with unfused centrae, left pubis billowy, youthful; thick ramus and pronounced tubercle: male aspects.

Continued

Table 2 continued.

Catalogue number and location	MNI, age and sex	Summary
		2. Adult male with 8 mm thick skull vault fragments, full mandible, M2 M3 resorbed.
		3. Robust older male represented by mandible, thin-walled right humerus with pronounced osteophytes on distal and notable and rugose proximal muscle attachments sites, very thin cranial vault fragments of 2.5 mm at lambda and 4 to 6 mm parietal, vertebral centrae and facets with osteoarthritic changes.
		4. Possible female represented by gracile elements with comparatively thick cortex: Proximal left humerus, moderate muscle sites; proximal right radius, comparatively thick cortex.
		Overall: teeth with several caries and many lost premortem; moderate to severe osteoarthritic changes in foot phalanges and tarsals, and vertebral facets; vertebral centrae with Schmorls nodes and osteophytes.
PA 158 (Haiti)	MNI 4 1 fairly complete 3 fragments	1. Large older male, skeletal evidence consistent with diagnosis of treponemal disease (yaws); mandible and maxillae (teeth resorbed), vault fragments up to 9 mm thick, distal left humerus, incredibly robust right ulna with enthesopathies and comparatively thick cortex, left ulna distorted and abnormal shape, left radius rugose muscle site, all present vertebrae with Schmorls, osteo-arthritic facets, 2 lumbars fused, fragments of robust right femur, right tibia, abnormal left fibula, robust right fibula.
		2. Proximal right humerus 8 to 9 years old.
		3. Young adult/older juvenile left humerus with missing and unfused proximal epiphysis, gracile muscle sites and moderate cortex, distal right humerus, left maxilla with unworn C and mild wear M1.
		4. Left humerus with pronounced muscle sites, enthesopathies, comparatively thick cortex, right distal humerus that visually matches.
PA 4682 (No island specified)	MNI 2 Older adult male, partial Adult female, fragments	1. Older male treponemal disease with active periostitis on left and right ulnae, sclerotic apposition on right fibula; male left and right ox coxae present, used for ageing.
		2. Female represented by right os coxae. List with bones cites 7 removed "to teaching collection": 2 right humeri, 1 left humerus, right and left tibiae, right ulna, left os coaxe.
PA 4683 (Eluethra Island) Note 1*	MNI 2 Young adult female, fairly complete Juvenile, fragments	1. Young female. All elements extremely gracile and short, possible osteopenia. No epiphyses in collection nor fused to bones but articular surfaces with youthful billowing as well as eburnation and lipping. Abnormal bone growth right humerus, left humerus, right femur (see text). Left femur hypervascularized with multiple foramina. Exposed cortical bone thin, muscle insertions mild. Skull culturally modified. Excessive parietal bossing; porotic hyperostosis on occipital.
		2. Right femur of 2.5- to 3.5-year-old juvenile.

Continued

Table 2 continued.

Catalogue number and location	MNI, age and sex	Summary
PA 4684 (associated with 4685) (Eluethra Island)	MNI 1 Adult male, partial	1. Lumbar vertebrae, burned ribs, bag of charred shellacked material. Burned bones in PA 4684 and 4685, all element of large robust male. Some bones not burned but reddened from soil or other means. Curved transverse cracks indicate green stick burning. Lumbar with indications of tuberculosis (see text). Deltoid insertions on humeri rugose with enthesopathies.
PA 4685 (associated with 4684)	MNI 1 Adult male skull,	1. (cont'd from PA 4684) Burnt skull with cranial modification, extremely robust features.
(Eluethra Island)	plus adult male from materials from PA 4684	2. Adult male skull.
PA 4686 (Long Island)	MNI 2 adult males 1 juvenile 6 to 8 years	1. Left femur adult male platymeric 80.6 index. 2. Second left femur adult male. Robust shafts and muscle insertions for adults.
	3Partial	3. Juvenile with oval vertical defect in wider oval trench (possible treponemal disease).
PA 4687 (Eluethra Island)	MNI 1 1 adult male, partial	1. Male: mandibular M1, M2, M3 in socket, very worn, mild osteoarthritis. Single ceramic sherd, thick coarse redware with grey interior.
PA 4688 (Long Island)	MNI 2 1 adult female 20 to 25 years, fairly complete 1 adult, fragment	1. Young adult female, aged by fusion line on iliac crest, complete right seventh rib with youthful costal end. Moderate to severe lipping on most articular joints including osteophytes extending approx. 8 mm from S1 centra. Elements rugose, muscle insertion sites pronounced. Platymeric femur with 83.3 index (see text).
		2. Long gracile left tibia of different individual.
PA 4689 (Eluethra Island)	MNI 1 Adult male, fairly complete	Left femur robust and heavy shaft, but septic arthritis has destroyed femoral head. Head separated in vivo, collected in field with femur. Proximal cortical very thin. Right mastoid process lumpy, distorted. Right parietal on skull with healed rounded concave defect. Femur very platymeric, 77.5 index. Collected with thick, poor quality grainy sherd.
PA 4690 (San Salvador Island)	MNI 1 Adult female, partial	Right femur gracile and hypervascularized with multiple foramina on anterior and mediolateral aspects. Possible treponematosis due to sclerotic healed reactive bone. Platymeric, 83.3 index.
PA 4691 (Rum Cay)	MNI 2 Adult female, adult male	1. Female, robust elements, complete left and right femur, left tibia. Platymeric, 80.0 index.
	Fairly complete	2. Male with robust elements and rugose and damaged muscle insertions (enthesopathies).
PA 4692 (Crooked Island) Note 2*	MNI 1 Adult male, fairly complete	Left and right femora very rugose, large, exuberant muscle insertions. Stature possibly 170 cm in vivo. Platymeric 80.1 index.
PA 4693 (Crooked Island) Note 3*	MNI 2 Adult female and juvenile, fragments	Right half mandible, 4 right metatarsals, adult. Adult thoracic vertebrae. Two sterna, 1 adult 1 juvenile.

Continued

Table 2 continued.

Catalogue number and location	MNI, age and sex	Summary
PA 4694 (Crooked Island) Note 4*	MNI 3 2 adult males and possible third individual 2 fairly complete, 1 fragment	1. Mandible older male, very large robust post crania. 2. Male large yet smaller than first. Lateral vertical ridge extends from glutes, similar to PA 153 (see Table 1). Platymeric femora, 79.3 index.
		3. Only evidence of third individual is a gracile right fibula that does not "fit" with other elements, but is not redundant: possibly from smaller second male.
PA 4695 • (Crooked Island) Notes 5a, 5b	MNI 3 Adult male, young adult female more than 23 years, juvenile Fragments	Small postcranial elements, no long bones, and 2 left iliae, 1 of young adult female and 1 of a juvenile. Sets of hand and foot bones, metapodials to phalanges.
PA 4697 (Crooked Island) Note 6*	MNI 2 Young adult female, juvenile Fragments	Os coxae and forearm bones of young female 16 to 22 years and left os coxae of a juvenile. Redundancies with other Gordon Cave units.
PA 4698 (Crooked Island) Note 7*	MNI 2 Older adult female, fragments Younger adult, partial	Complete os coxae of older female, and postcrania of younger larger individual.

neck), are relatively free of osteoarthritic changes that can be potentially associated with overexertion or a life of continuous labor (Işcan and Kennedy 1989; Rogers and Waldron 1995; Hawkey and Merbs 1995).

Other remains from the east coast site of Punta Macao showed evidence of an endemic nonvenereal syphilis, probably yaws. The distal half of a left humerus, adult (probable male), displays characteristics of treponemal disease, including periostitis, osteomyelitis and hypervascularization. Although one isolated element cannot be used for proper diagnosis, treponemal disease was common among prehistoric coastal populations (Powell and Cook 2005; Phillip Walker, pers. comm. 2005). Most individuals and isolated elements at this site show "good health" in cortical mass, robusticity and robust muscle insertion sites.

A cemetery of individuals left partially exhumed and exposed *in situ* at La Caleta, Dominican Republic, allows us to see individuals interred with bowls and in upright flexed positions, a configuration described as a Saladoid convention (Rodriguez 1997; Tavarez Maria, pers. comm. 2004). On inspection of the exposed remains, the exposed cortical bone of adult long bone elements was robust.

In general, the remains of putative Taíno individuals from Puerto Rico that offer interior views of the long bones have thinner cortical mass; externally, their remains are more gracile and have less robust muscle insertion sites, and the femur midshafts are more rounded (see Table 1).

Health on Smaller Islands: Evidence of Tuberculosis

The other Caribbean islands visited by Rouse, Rainey and Yale Caribbean Field School workers tell different stories about the past. Elizabeth Righter has reported on dental hypoplasias (interruptions of enamel formation on permanent teeth during development, in infancy and young childhood), skeletal manifestations of anemia, and on other diseases of deficiency evident in the remains of Saladoid people who had lived on St. Thomas for the 1,500 years or so before European contact (Righter 2002).

From 2003 to 2005, other Caribbean skeletal remains were examined. Skeletal materials from the Bahamas, Cuba and what is now Haiti were reexamined in 2005. The Bahamian materials came from Eluethra Island, Long Island, Crooked Island, San Salvador Island and Rum Cay. Most graves are of commingled individuals; they were excavated by Rainey in February 1934, according to handwritten cards with some of the remains (Figure 1). At least one individual (PA 4692) was tall in life, up to 170 cm (using stature formulae from White

2000) and the others are predominately robust with pronounced muscle insertions, including enthesopathies.

There is evidence of possible yaws in the Bahamian remains and also tuberculosis in several sets of Eluethra Island remains. With the proximity of the Bahamas to Florida, contact with mainland North America was possible. An endemic form of tuberculosis was present in prehistoric North American populations (Buikstra and Williams 1991; Ortner 2003).

Further anecdotal support for prehistoric Florida–Bahamian contact is found in Rainey's Scientific Survey of 1940. He cites a description of four skulls from New Providence, the Bahamas, and "anonymous out-islands" as the first published account on the archaeology of the Bahamas, in an 1888 paper by W. K. Brooks (cited in Rainey 1940:149). The paper, in a publication by the National Academy of Science, describes them as follows: "All the skulls are large, massive, and artificially flattened with fronto-occipital pressure" (Brooks 1888 in Rainey 1940:149). This brief paragraph in Rainey continues to cite Brooks as also referring to the Fourth Annual Report of the Peabody Museum of Archaeology and Ethnology at Harvard University (Wyman 1871, cited in Rainey 1940:149) and a German publication by Ecker (1878, cited in Rainey 1940:149) describing similar "large, massive and artificially flattened" skulls found in Florida. Rainey concludes that Florida Indians are an offshoot of inhabitants of the Greater Antilles (Rainey 1940:149).

Ragged perforations are visible on the centra surfaces of almost all of the lumbar vertebrae of an adult male (PA 4684) and can be considered consistent with potential evidence of tuberculosis, specifically the "discitis" instigated by *Mycobacterium tuberculosis.* The pathogen invades the disc, and then moves throughout the bodies of contiguous vertebrae (Ortner 2003). The vertebrae of PA 4684 are porous and have osteophytes ringing the margins; some workers have contended the "discitis" are eroded Schmorl's nodes, depressions on centrae associated with osteoarthritis of the spine, and may be remnants of herniated discs (Rogers and Waldron 1995). However, Schmorl's nodes are rounded depressions. Further, as previously mentioned, the presence of widespread osteoporosis in the vertebrae is arguably not common in prehistoric or medieval populations (like in theBritish medieval sample [Agarwal et al. 2004] and the Pecos Pueblo Amerindian sample [Ruff and Hayes 1983; Ruff 2000a]). Further, PA 4684 had a nonspecific infection active at time of death, with mediolateral periostitis on the distal right fibula. His skull had been culturally modified.

Another individual, island unknown (PA 4682) has possible evidence of septic arthritis in the right hip. In one-third of individuals with skeletal evidence of tuberculosis, the hip joint is involved (Aufderheide and Rodriguez-Martin 1998; Ortner 2003), and as the infection spreads the joint can be destroyed. Septic (infectious) arthritis is a destructive infection that can rapidly destroy articular joints and can be caused by an unfortunate "inoculating" injury (such as a penetrating wound) that introduces staphylococcus or streptococcus bacteria into the body, or by the spread of a body-wide infection such as tuberculosis; red-blood-cell-enriched articular ends of bones are most attractive to bacteria. The bone above and below the infection site will be reduced in mass and size as a result.

With tuberculosis, septic arthritis can be caused by invading *M. tuberculosis.* True septic arthritis destroys the bone and cartilage of a joint and can instigate a bony ankylosis (fusion) of the affected joint, but in tuberculosis the joint tends not to fuse, but undergoes fibrous ankylosis (Rogers and Waldron 1995). Tuberculosis-instigated septic arthritis can result in osteopenia, an osteoporosis that also causes rather notable atrophy of the bones on either immediate side of the joint infection (Rogers and Waldron 1995; Aufderheide and Rodriguez-Martin 1998; Ortner 2003). The femur of PA 4682 is not present, but the right ilium (pelvic bone) is paper thin, and the acetabulum is expanded to a wide, flattened shape with sclerotic woven bone (a healing periosteal reaction) on the superior and anterior aspects of the joint, which suggests the joint had limited mobility. This individual needs further study.

PA 4683, from Eluethra Island, is a young adult female of uncertain age who endured an unusual pathology, as well as yet another example of septic arthritis, in this instance destruction of the left distal humerus. In every element present, the normal articulations are absent, but the metaphyses (end regions) of the diaphyses (bone shafts) have osteoarthritic lipping around their margins and eburnation (bone on bone polishing) of their

surfaces. The epiphyses of these bones seem never to have fused onto the main shaft, or perhaps never even to have been formed; and yet the joints continued to be used until the individual developed osteoarthritis. In normal development of the skeleton, a juvenile bone has a separate, unfused epiphysis at either end that nevertheless articulates with the epiphysis of the adjoining element, forming a movable joint. As a juvenile grows, longitudinal growth occurs at the metaphyses; at completion of the growth cycle the metaphyses fuse to their epiphyses. This systematic growth and fusion of bones can be used to age an individual (White 2000).

PA 4683 possibly suffered from tuberculosis, which may have retarded growth and development, or from treponemal disease that affected her drastically. The latter diagnosis is supported by hypervascularization of the left femur, abnormal bone growth on the left and right humerii and both femora. Her skull had been culturally modified. Finally, she has evidence of porotic hyperostosis on her occipital, which indicates inadequate iron (anemia).

A third Eluethra Island individual (PA 4689) apparently suffering from the rare condition of septic arthritis shows a severely abnormal left femur, with the head of the femur separated from the shaft in life, due to infection, and the proximal shaft osteopenic.

Suggestions for Further Investigations of Bahamian Materials

This examination of a sample of individuals from Hispaniola and Puerto Rico, and another set from smaller Caribbean islands, suggests that life for folks on the smaller, carbonate (limestone) islands was not as healthy as life on the larger islands. Fresh water was dependent on rainfall and parasitic contamination of water sources meant exposure to intestinal parasites, which cause blood loss and lead to anemia. Smaller islands have smaller habitation areas and diseases can spread more easily in overcrowded conditions. Less arable land will create greater dependence on the sea and coastal populations are prone to nonvenereal treponematosis (Phillip Walker, pers. comm. 2005). Further analyses on the Haitian and Bahamian remains would ideally include: (1) analysis of teeth from Haitian remains, specifically stable isotopes such as Sr86/Sr87, to verify Haiti as origin of birth (periosteal reactions may indicate immigration); (2) aDNA of Bahamian vertebrae for evidence of tuberculosis; (3) literature review for reports of pre-Columbian tuberculosis in the Merrit Island region of Florida; and (4) AMS (^{14}C) dates for the Eluethra Island remains.

Commentary

Saladoids and earliest ceramic-horticulturists preferred "high, well-watered islands" (Petersen 1997:130) most similar to their mainland ancestral home and practiced tropical forest subsistence patterns based on the root crops manioc and yucca. The Saladoid cultures did not fully exploit the unfamiliar marine resources that first surrounded them in the Greater Antilles (Petersen 1997), which may explain the abundance of crab shell remains found in early Saladoid-era middens compared with the shift to shellfish in the later middens (Rainey 1940). The search for mountainous, forested islands with riverine and floodplain ecozones may also explain the apparent haste with which the Saladoids moved up and past the Lesser Antilles, stopping at Borinquen in Puerto Rico (Rouse 1992). I have spent years wondering whether the small, triangular stone "three pointers" associated with older deposits are portable idealized mountains that could evolve into enormous effigies only once the Saladoids had found a permanent home.

The "Saladoid" and "Taíno" remains from what is now Puerto Rico are remarkable for the absence of blatant skeletal pathologies associated with infectious disease, inadequate nutrition and overly strenuous workloads. While it is true that some individuals (potentially European, especially British) are born "bone formers" and will easily add bone at muscle insertion sites and in cortical bone (Rogers and Waldron 1995:53–54), such individuals will appear to be rather "florid" in appearance (Rogers and Waldron 1995:53) and would have been notable among a cross section of the population that potentially includes multiple status ranks.

The Taíno remains examined by a novice armed with an osteometric board, textbooks and calipers, and assessed somewhat naively in the recording of standardized skeletal measurements, are few. Most of the remains exhumed by Rainey

Table 3. Transcripts of field notes 1 through 7 stored with Bahamian remains. Several copies of each note were stored in some boxes; notes actually written in the field were likely transcribed later, possibly by Rainey, and both copies retained. Transcription approximates appearance of the writing on the notecards.

Note 1

1. Feb 9, 1934 Bahamas
W Emyss Bight Cave
\surface burial---secondary (?)
skull -- jaw—
various skeletal material
no artifacts
So End Eluethra Island

Note 2

2. c 4692
Mixed Group
Bones excavated by earth
diggers--------

#1 burial cave
Gordon Hill Caves
Crooked Island

Note 3

3. c 4693
Mixed Group

Bones excavated by
earth diggers
#1 Burial cave
Gordon Hill Caves
Crooked Island Bahamas

[*Author's note:* date torn off note]

Note 4

4.
Mixed Group.

Bones excavated
by earth diggers
#1 burial cave

Gordon Hill Caves
Crooked Island

[*Author's note:* date torn off note]

Note 5a

5a. West Indies
4722 c Crooked Is
Bahamas

Skeletal Material
Rainey Collection
WI
4722 4695
Bahamas

Note 5b

5b. c 4695
Central Prime
burial----

Found in position
of burial—-

#1 burial cave
Gordon Hill Caves
Crooked Island

Note 6

6. 4697
#2 burial
cave

Gordon Hill Caves
Crooked Island
2 arm bones in
place---the
rest strewn about
disturbed by
earth diggers

March 2, 1934

Note 7

7. c 4698
Burial Cave
South Side
Pelvis in place
lying on rocks

Gordon Hill Caves –
Crooked Island

and Rouse are apparently of Saladoid individuals (or certainly early populations), which is not surprising considering both the longevity of human occupation on Puerto Rico and that both Rainey and Rouse excavated until they reached sterile soil (Rainey 1940; Rouse 1952a, 1952b). More recent burials were likely removed by generations of agricultural and village activity; shell middens that would have promoted superior bone preservation were along coastlines, the prime locations for enormous hotels with deep, multi-storied foundations.

One individual (PA 170) was discovered by Rouse in an excavation on private property. Rouse tended to excavate at the four sites that Rainey had dug, either at the sites themselves or as close to the original locations as possible. He chose a further 40 sites on the basis of the remnants of shell middens. When Rouse was working in the late 1930s and early 1940s, Punta Cayito, 2 km from the town of Santa Isabel and near the mouth of the Rio Coamo, still had a shell heap large enough to be measured in acres and in places was over half a meter deep. At that time it was also covered almost entirely by the inhabited village of Playa. Rouse obtained permission to dig in a private backyard; the burial he encountered was only 25 cm below grade (Rouse 1952b: 531). This fairly recent, probably "Taíno" individual, an adult male, presented with gracile bones of moderate cortical thickness in relation to the overall shaft diameters. It was associated with Boca Chican sherds.

One interpretation of the more recent individuals is consistent with modern Taíno lore and oral histories. The remains are to be of either of hard-worked individuals, who nevertheless had adequate nutrition, or of individuals with more gracile bodies; it is not unreasonable to conclude that lower status did not constitute slavery, but more likely just "working class" wear and tear. Notably absent are diseases of deficiency and extreme osteoarthritis from both early "Saladoid" and later "Taíno" remains. The Taíno at the time of European contact were observed and recorded by sailors and priests acting as inadvertent ethnographers, who described a stratified society comprised of an aristocratic layer, the *nitainos,* from which *caciques* (chiefs) could be drawn, and the common class of workers, the *naborias* (Rouse 1992). The Spanish found no evidence of an even lower class or a "slave caste," although they apparently searched for one (Rouse 1992:9). This supports the claims of modern museums and historical societies in The Bahamas and Florida that the Taíno who encountered Columbus did have a highly stratified society, but did not have a slave caste.

Such claims could be discounted as post-Conquest revisionist history if I had observed examples of truly deprived individuals, but during a three-year stint examining the remains of Caribbean individuals I encountered none. PA 151, from the north coast of Puerto Rico at Rouse's site of Toa Baja (Santa Elena), represents the remains of an older adult female with robust muscle insertions, extreme osteoarthritis of the entire cervical vertebrae section, and two naturally fused thoracic vertebrae. She was practically edentulous at death, retaining only a few heavily worn anterior teeth, and yet seemed to have enjoyed adequate nutrition.

To confound assumptions, the more pathologically affected PA 164 is an adult female with humeral shafts that are literally paper thin (less than 1 mm in some areas). Notes at the Yale Peabody Museum indicate she may have come from Cañas. This woman's upper arm muscles seem to have been very strong, but the bone is only 1 mm thick there; strong muscles and thin cortical bone can indicate an inadequate diet. She is harder to place in sequence, because she arrived at the Yale Peabody Museum with Rainey but was subsequently given over to Rouse to curate, and therefore is lacking provenience.

Even the possibly tuberculosis-ridden remains from Eluethra Island tend to have sturdy cortical mass, adequate or even exuberant muscle insertion sites, and to be free of other indicators of deprivation or chronic illness, such as cribra orbitalia or porotic hyperostosis, cranial markers of overt porosity that have been generally accepted to indicate an anemic condition.

It is difficult to justify direct comparison of remains from areas as diverse as the Caribbean and Andean Peru, but female remains from Peru have exponentially more indications of extreme labor and inadequate nutrition, metabolic disease, or both, with cervical (neck) vertebrae that are less than 2 mm high in areas with retained superior and inferior surfaces; this can indicate stress fractures from severe osteoporosis, or bones labored to nothingness. Females in the Inca Empire experienced extreme osteoarthritis, paper-thin cortical

bone, osteoporosis, anemia and short lifespans (as examined among remains also curated at the Peabody); in comparison, the individuals from the Caribbean had lives of greater ease.

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