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THE NEW YORK AFRICAN BURIAL GROUND:
Unearthing the African Presence in Colonial New York

Volume 1

Skeletal Biology of the New York African Burial Ground Part I

Editors: Michael L. Blakey and Lesley M. Rankin-Hill

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Michael L. Blakey and Lesley M. Rankin-Hill
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Detail of the Maerschalk Plan (Francis Maerschalk, 1754)

Artifacts from the New York African Burial Ground (Photographs by Jon Abbott):

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Bead Type 12, Burial 340, Catalog No. 01651-B.79.
Oval turquoise enamel face, Burial 211, Catalog No. 1186 -B.001.
Pins, Burial 12, Catalog Nos. 253-B.001, .002.
Ring, copper alloy with glass insets, Burial 310, Catalog No. 1486-B.001.
Bead Type 9, Burial 340, Catalog No. 01651-B.78.
Bead Type 15, Burial 340, Catalog No. 01651-B.75.
Button, bone, turned. Burial 171, Catalog No. 931-B.002.
Cast silver pendant, Burial 254, Catalog No. 1243-B.001.

Burial 335 (Photography by Dennis Seckler)

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Foreword

In 1991, during the excavation phase for the construction of the Federal Building now seen at 290 Broadway, New York City, a cemetery was uncovered containing human remains of Africans—most were enslaved, some free—who lived, worked, and died under inhumane conditions in colonial New York. This discovery, the largest bioarchaeological site of its kind, sparked heightened public awareness of an African heritage in the northern states of colonial America. An outcome of this awareness was the public's desire for amending and correcting the history of colonial New York during that period to reflect more accurately the lives and culture of these forgotten Africans and people of African descent and their contributions and roles in economic development. Several initiatives, sponsored by the General Services Administration on behalf of the American people, were launched to accomplish this goal.

The initiative to conduct historical and scientific studies of the remains and artifacts excavated at the site was entrusted to Howard University. There, Dr. Michael L. Blakey, now at the College of William and Mary, designed and implemented a comprehensive, interdisciplinary research program—the New York African Burial Ground Project—to address questions in three main areas: history, archaeology, and skeletal biology. As scientific director of the project, he assembled an international team of scholars, professionals, graduate and undergraduate students, technical staff members, and cultural specialists for various parts of the study.

The New York African Burial Ground: Unearthing the African Presence in Colonial New York serves as the culminating work of this project, reporting the research findings. This multivolume series covers broadly a contextualized historical perspective, details of the archaeological discoveries, and descriptions of the skeletal biology of the unearthed human remains. Each volume documents and validates the lives of African Americans' ancestors who lived and worked in colonial New York. Included in this work are detailed descriptions of the burials excavated, complete with drawings, figures, and tables, as well as a comprehensive appendix of the artifacts found within the burials.

Through the years of this project, membership of the research team changed, but the goal of the project remained constant, that of ensuring that the story of the origins, life, and death of the enslaved Africans of colonial New York would not be absent from the annals of world history.

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Editorial Method

For the sake of consistency and because this was primarily an archaeological project, all three technical volumes of this series, *The New York African Burial Ground: Unearthing the African Presence in Colonial New York,* were edited according to the conventions of the same style manuals: the style guide of the Society for American Archaeology and *The Chicago Manual of Style*, 15th edition.

Acknowledgments

It would be impossible to thank all of those in every walk of life who have helped the African Burial Ground Project over the past 12 years. All of those who stood for its preservation and dignity do, however, bear some responsibility for creating the information within this report, and we researchers are deeply indebted to them. We want to thank our supporters: especially the schoolchildren and their teachers. We also thank the churches, the civic and cultural organizations, the grass-roots political organizations, and the hundreds of visitors from around the world who visited our laboratories and offices. Other organizations that deserve recognition are: the Federal Steering Committee, the Schomburg Center; Friends of the African Burial Ground; the Committee of Descendants; Transafrica Forum; Malik Shabazz Human Rights Institute (NYC); Lift Every Voice, Inc. (Los Angeles); and many other organizations and institutions whose members have made this work possible by their moral and political support. Lastly, we would like to acknowledge New York City, State legislators, and their national counterparts, as well as our academic and professional colleagues. We cannot fail to point specifically to the enormous aid of those who stood closest to us for the longest time, including Mayor David Dinkins, State Senator (now Governor) David Paterson, Congressmen Charles Rangel, Jerome Nadler, and Gus Savage, and Senator Alfonse D'Amato. As opportunities are presented, we will continue to recognize every individual effort that has made this project possible.

Many individuals exhibited extraordinary and continuous participation in efforts to protect, elevate, and appreciate the African Burial Ground, without whom there would be neither a National Monument nor our research. Miriam Francis, Adunni Oshupa Tabasi, Dr. Muhammad Hatim, Reverend Herbert Doherty, Eloise Dicks, Mother Franklin, Queen Mother Blakely, Gena Stahlnecker (representing then, Senator David Paterson), Ayo Harrington, Christopher Moore, Renice Goode, Roger Taylor, Mary Lacy Madison, Folana Heidelberg, John Arbogast, Noel Pointer (deceased), Jackie Parker (Sen. Levin's Chief of Staff), Elombe Brath, Howard Wright and many others are deeply appreciated for building this monument. Howard Dodson and Peggy King Jorde, Chairman and Executive Director, respectively, of the Federal Advisory ("Steering") Committee provided the steadfast and wise leadership that focused community concern toward its most productive ends. Later as Project Executive for Memorialization, Ms. Jorde did the groundwork for the ultimate memorial and interpretation of the site for which we are truly grateful.

The Office of Public Education and Interpretation, the branch of the project that provided the vehicle for continuous and growing public involvement in the project by virtue of the outreach of its dedicated and bright public educators who are deeply appreciated, and through the programs designed by its anthropologist Director, Sherrill Wilson, Ph.D. John Milner Associates, who assisted us for several years in the massive early work of the project, especially in New York, we want to thank its principals Dan Roberts and Alan Steinhusen. Looking back, we recognize also the unique contributions of Dale Lanzone and Bob Leuffin of GSA during our most productive negotiations. Thanks especially to Professor Warren Barbour who walked Blakey through the inner workings of contract archaeology as a knowledgeable and trusted confidant during the early negotiations with JMA and GSA.

We want to thank our colleagues at Howard who organized the Ties That Bind ceremonies in 1994 by which the ancestral remains on which we report here were first received into our laboratories, including the

organizers, Eleanor Traylor and Roberta McCleod. We thank Dr. O. Jackson Cole and Dean James Donaldson, who carried out the tireless political and bureaucratic work required to keep Howard University at the center of this project while over time its personnel and funding changed. Others in Washington include Vincent DeForest of the National Park Service (NPS), who was ever present with resources to give, and in New York the founding NPS Supervisor of the National Monument, Tara Morrison, inspires confidence in the work going forward. At the College of William and Mary's Institute for Historical Biology graduate and undergraduate staff involved at the end of this writing project included Grace Turner, Christopher Crain, Renee Ferguson, Jenna Dutcher, and many others who contributed to and benefited from the opportunity to conduct research in the service of the struggle for human rights.

We want especially to take the opportunity to thank those who assisted in the preparation of this report. Even though most are named on the preceding pages, we want to especially thank the staffs of the Howard University Cobb Laboratory, the College of William and Mary Institute for Historical Biology, and the Department of Anthropology at the University of Oklahoma. These individuals conducted research and prepared reports under extraordinarily difficult circumstances, and they did this in the spirit of humane commitment and with high standards. These students, technicians, and senior researchers and directors often sacrificed by working without funding. Although at times there was uncertainty about the security of the project's future, they were nevertheless faithful to the mission for which these volumes mark the culminating success. It is only by virtue of that commitment that we were able to succeed. Among these there were those who devoted many years of their lives working to see that the laboratories and offices functioned for researchers and the public—that the work was done and the data properly organized. These prominently include the office manager of the Cobb Laboratory, Reba Brewington, and its laboratory director, Mark Mack, who devoted at least a decade of their lives to long days of excellence on behalf of the history of the colonial Africans we report on here. All of the writing of this final report and previous drafts relied on their contributions.

The final draft report was prepared starting in January 2003, and the final report unedited version was completed and submitted for transmission to the members of the peer review board near the end of June 2004. In the course of this work, as preparation of the final report versions, involving the merger of submissions from the various authors, was undertaken, all of the database, imaging, and text problems that had not occurred during the writing of the individual chapters and completion of the initial draft versions began to emerge. The smart and dedicated work of Christopher Null of the University of Massachusetts-Amherst and Shannon Mahoney at William and Mary corrected and refined the database and kept the information flowing to the authors. Autumn Barrett, also of the Institute at William and Mary, performed tirelessly and with an extraordinary range of skills as our editorial assistant. All of this was done in addition to their own graduate work and research contributions to the project. Thanks also to Cecelia Moore, administrative assistant, for unflinchingly hard work and dedication to the writing project. Paul Gattis at the University of Oklahoma also contributed to final database development in essential and important ways. Ryan Seltzer of Illinois State University provided key statistical advice. The project has been enormously fortunate to have received the focused attention of these special individuals.

Standing behind us were mentors and senior colleagues without whom there may have been more open fronts of professional warfare than we could have handled. George Armelagos at Emory University and Don Ortner of the Smithsonian Institution have given generously and courageously of their support to this project. As colleagues who shared our goals, Howard Dodson and Leith Mullings worked tirelessly from the very beginning to ensure that our efforts on behalf of this project received a fair airing in New York. We thank the three peer reviewers for useful criticisms of drafts of this manuscript. Finally, we thank our families and friends for giving every means of support imaginable.

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Section I:

Background of the New York African Burial Ground Project

Chapter 1

Introduction

Michael L. Blakey

The New York African Burial Ground was "rediscovered" in 1989 in the process of preparation for the construction of a proposed 34-story federal office building by the U.S. General Services Administration (GSA) at 290 Broadway in New York City (Ingle et al. 1990). The site for the proposed building was once part of the African Burial Ground that extended "from Chambers Street on the south to Duane Street on the north and from Centre Street on the east to Broadway on the west" (Yamin 2000:vii). A full-scale archaeological excavation was conducted by Historic Conservation and Interpretation (HCI) and John Milner Associates, Inc. (JMA), preceding the building project, as required under Section 106 of the National Historic Preservation Act of 1966 (NHPA) (as amended) in order to mitigate the destruction of potential cultural resources (Figure 1). The excavation and construction site on the African Burial Ground is located at Foley Square, in the city block bounded by Broadway, Duane, Reade, and Elk Streets in Lower Manhattan, one block north of City Hall.

Archaeological excavation and building construction began during the summer of 1991 and ended in the summer of 1992, when the U.S. Congress called for work on the site to cease in response to the public demand to properly memorialize and, ultimately, to learn about the people buried there. Beginning in April of 1992, Michael Blakey of Howard University's Department of Sociology and Anthropology assembled a research team for postexcavation analysis, laboratory, and interdisciplinary studies. The research team members, who studied the skeletal remains of the 419 individuals representative of eighteenth-century interred African captives and their descendants, were from Howard's W. Montague Cobb Biological Anthropology Laboratory and eight other affiliated universities. This report presents the data and analyses of human skeletal remains from the New York African Burial Ground, produced after more than 9 years of research.

Historic Background and Significance of the Cemetery

The original cemetery had been established by 1712; it was reportedly the location of the executions of participants in an African rebellion during that same year. Its use officially ended in 1794. There is no written record of the cemetery prior to 1712; however, a 1697 ban barring the burial of blacks, Jews and Catholics by Trinity Church suggests that the cemetery might have been created earlier than 1712 in response to a growing need for burial space. In 1712, Chaplain John Sharpe wrote of the burial of Africans "in the Common by those of their own country and complexion without the office, on the contrary the Heathenish rites are performed at the grave by their countrymen" (Sharpe 1881:335). The part of the Common on which the African (or "Negroes") Burial Ground was established (Figure 2) began outside the palisade of the colonial town near the summit of a hill whose slope inclined toward the fresh water pond known as the Collect (Kalkhook) (Foote 1993; Volume 3 of this series, *Historical Perspectives of the African Burial Ground: New York Blacks and the Diaspora* [Medford 2009]). The cemetery extended across 5.5–6 acres of land. Less than one city block of this site was excavated by archaeologists in 1991–1992. The filling of the Collect and the grading and flattening of that part of Manhattan Island at the turn of the nineteenth century preserved the excavated portion of the cemetery under 16–28 feet of fill.

The African Burial Ground appears to have been one of the first social institutions built by Africans in colonial New York City (Medford 2009). Burial

Figure 1. Early archaeological excavation of the African Burial Ground.

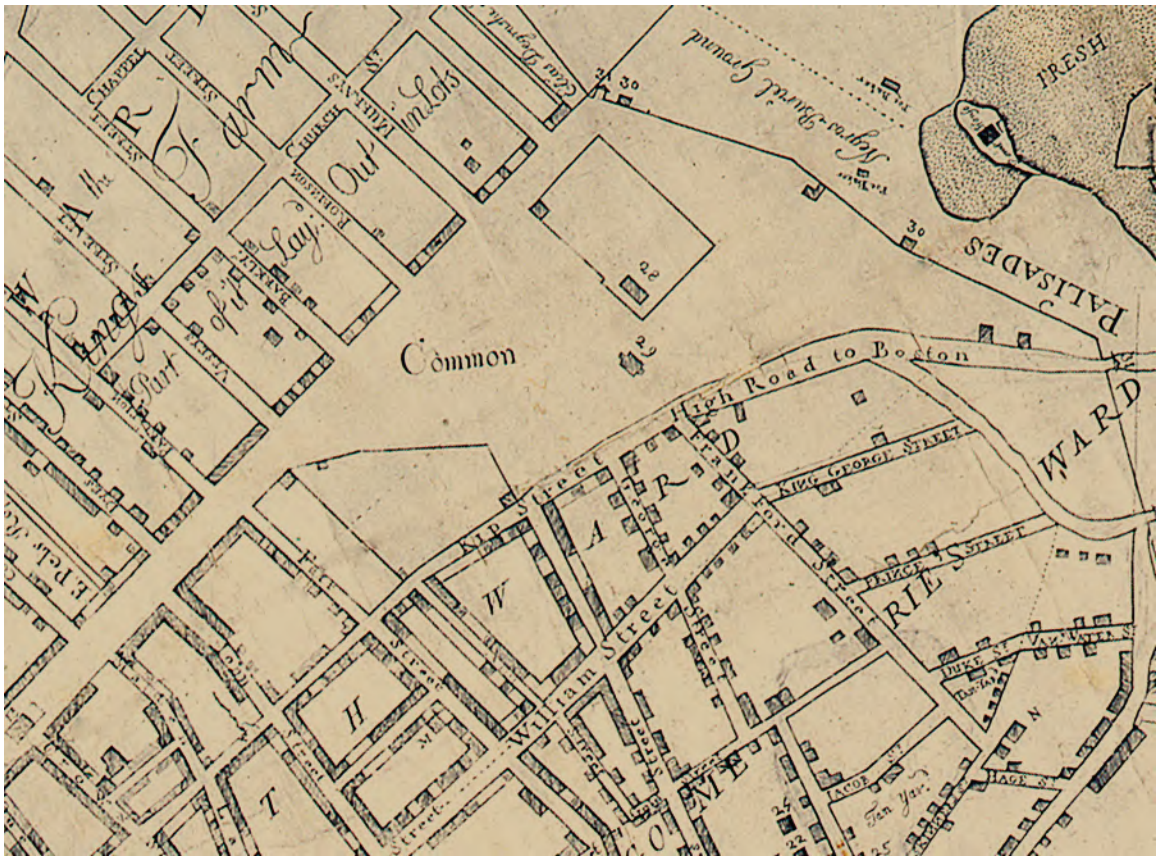

Figure 2. Map of the eighteenth-century African Burial Ground, Maerschalck Plan (1755) in African Burial Ground and The Commons Historic District Designation Report, New York Landmarks Preservation Commission, February 1993.

of the dead and other funerary rituals are definitive human characteristics. Such mortuary activities are as old as our species and are both ubiquitous and unique to humanity. The cemetery may well have taken on special significance for affirming that its participants were human beings, for preserving cultures, and for maintaining a sense of hopefulness among New York's African community. In the main, Africans in colonial

New York were enslaved, not free laborers, and thus experienced a particularly intensive contestation of their humanity by Europeans who were intent upon objectifying Africans as property. It is now obvious that in New York, as throughout the slaveholding Americas, enslaved Africans were arbitrarily stripped of names and renamed, family members were separated to be sold apart, social institutions and religious practices were disallowed or went underground, the use of African languages was suppressed, and the cultural history of those Africans was denigrated by slaveholders. In the urban context of colonial New York City, there were strikingly few opportunities for social interaction among African men, women, and children held in the isolated houses and businesses where they worked and slept (Medford 2009).

Thus, efforts were made to deny these Africans the basic qualities that were associated with a distinctly human existence, which even the poorest European colonist could claim. The attribution of the role of "slave" or property to a human being (their conversion to chattel) required a method for denying the existence of the African's humanity if both Africans and Europeans were to be convinced of the legitimacy of the master-slave relationship. Questioning the moral or other ideological legitimacy of hierarchy makes such inequitable structures vulnerable to internal questioning, conflict, and destruction (see for example Habermas's *Legitimation Crisis* [1975] or Frederick Douglass's analysis [Douglass 1950 (1854)] of the use of racist science in the mid-nineteenth-century attempts to justify slavery). New York's African Burial Ground, then, can be viewed as an important location at which human qualities and rights were struggled for simply by virtue of careful, customary burial practices that no human society has been willing to do without. This act of asserting their humanity simultaneously represented resistance to the legitimation of slavery.

The African Burial Ground was also a location for the contestation of African humanity and for the establishment of white authority. The ban on African interments at Trinity Church (Figure 3) and other Christian church cemeteries reflected the creation of social distance (the construction of the "Other") based not only on religion, but also increasingly upon "race" (see Epperson [1999] for an interesting discussion of the emergence of the race concept relative to the African Burial Ground).

Whether Africans were or were not Christian was an important distinction for the justification of enslavement. Like other attempts to distinguish enslaved blacks from true human beings, religious justification became a tangled web of desperate attempts to resolve its fundamental contradiction with the fact that blacks were indeed both human and considered property. The narrative of John Jea, who was brought to New York City from Calibar (bordering West and West Central Africa) and enslaved in the eighteenth century, is instructive (Gates and Andrews 1998). Jea described his enforced conversion to Christianity as a punishment by his "mean master" for questioning the duplicity of Christians who enslaved people. Indeed, most New England slaveholders sought to prevent Christian conversion in order to deny human rights to the enslaved, while others saw slavery and conversion as Christian charity and duty (Koo 2007). Jea discovered, however, that as a Christian convert, he obtained a legal right to manumission in New York. The project director argues that Jea had obtained by conversion a crucial measure of humanity in the logic of Western Europeans. This rather large contradiction, or loophole, in the ideological justification of slavery in eighteenth-century New York was amended by the requirement that Africans like Jea demonstrate the ability to read and understand passages from the Bible, while it had been made illegal to teach Africans to read. Jea claimed to have satisfied this requirement by divine intervention and gained his freedom (Jea in Gates and Andrews 1998).

Figure 3. Trinity Church in lower Manhattan today.

The spatial exclusion of blacks from burial with whites in Christian sacred space was a significant part of the attempt to establish ideas to bring about the social control of New York Africans. Yet, as in the above reference to Sharpe's criticism of traditional African religious rites, the African Burial Ground on the municipal Commons also presented the threat of autonomous African thought and activity.

Even in the unsanctified space of the Common, tight control of African activities was attempted. Night funerals were banned by law in 1722, and the gathering of more than "12 slaves admitted by the owner of the dead slave" was outlawed by a 1731 amendment to the law (Medford, Brown, Carrington, et al. 2009a:89; New York City Common Council 1905:4: 86–88). The assembly of larger numbers of Africans who expressed cultural independence—that is, conducted African funeral rituals—alarmed enslavers who were concerned that they were "plotting and confederating" for revolts and other "mischief" during funerals (Medford, Brown, Carrington, et al. 2009a:89; New York City Common Council 1905:4: 86–88). African revolts occurred regularly in the Atlantic world. It is perhaps not insignificant that of the few written references regarding the African Burial Ground by eighteenth-century whites, most refer to its possible use for organizing revolts, as a place where African rebels were executed, or as the location of objectionable independent cultural activity, for example, traditional African or syncretic activity such as Pinkster Day.

The research team has considered individual cases in the African Burial Ground for what they might reveal about these events. At best, such cases are only suggestive and cannot be established as having direct bearing on the revolts. For example, Burial 137, a 25–35-year-old adult (Figure 4), and Burial 354, a 35–45-year-old male, contained bones whose darkened, highly polished appearance was consistent with slight burning or singeing of bone. Historical evidence points to individuals being burned at the stake on the burial ground who were convicted of participating in the African revolt of 1712. The causes of the burns to Burials 137 and 354 are unknown. Other possible relationships between specific burials and corporal punishment or acts of terror were taken up in a previous report by Augustin Holl (2000) and are considered in Volume 2 of this series, *The Archaeology of the New York African Burial Ground* (Perry et al. 2009a).

The African Burial Ground was desecrated in diverse ways that relate to the contestation of African humanity. Archaeologists have found industrial waste from an adjacent ceramics factory on the site; this demonstrates its use as a dump by Europeans in the mid- to late-eighteenth century. In April 1788, the violent Doctors' Riot broke out when the petitions and published warnings of free blacks against grave robbers went unheeded by New York's medical establishment:

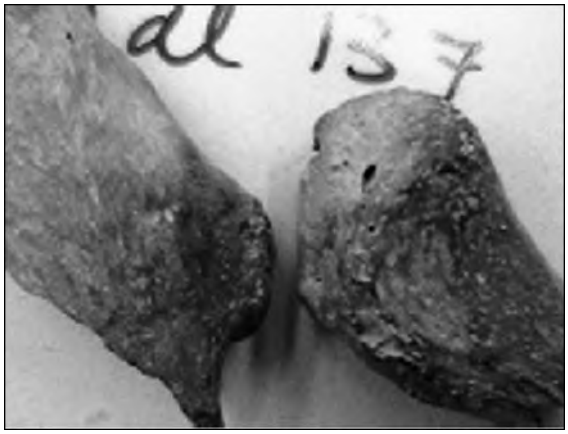

Figure 4. Rib ends from Burial 137 showing likely heat-induced darkening.

> That it hath lately been the constant Practice of a number of Young Gentlemen in this City who call themselves students of Physick to repair to the Burying Ground *adjudged* for the use of your Petitioners and under cover of the night and in the most wanton sallies of excess to dig up the bodies of the deceased friends and relatives of your Petitioners, carry them away, and without respect to age or sex, mangle their flesh out of a wanton curiosity and then expose it to Beasts and Birds [New York Municipal Archives, Unfiled Papers of the Common Council, 4 February 1788].

The abductors were subsequently warned that "they may not alone suffer abduction of their wealth, but perhaps their lives may be forfeit of their temerity should they dare to persist in their robberies, especially in unlawful hours of the night" (*The Daily Advertiser*, February 15, 1788). Again, these warnings suggest that the cemetery may have been especially important as an institution for the affirmation of African and African American humanity under the material conditions of slavery and in the pervasive presence of the psychological affront to black humanity required to morally justify those conditions.

Here too, a case can be presented that is possibly, although not certainly, associated with events

Figure 5. Burial 323 transverse section of calvarium (top of skull).

Figure 6. Burial 323 magnified saw marks.

surrounding the early desecration of the cemetery. Burial 323 was a 19–30-year-old male who exhibited evidence of substantial biomechanical stress and healed skull lesions that may represent an earlier period of nutritional inadequacy. The initial morphological assessment by the Metropolitan Forensic Anthropology Team (MFAT), a group of consulting physical anthropologists from the City University of New York's Lehman College, indicated a "Caucasian" affiliation for this individual. He is among the 7 percent of individuals of the New York African Burial Ground sample who were assessed as non-African or ambiguous using racial typology. Strontium data point to an American place of birth for this individual, which would be unusual for adult enslaved Africans in New York (see Chapter 6 for the methodology pertaining to these findings). This individual was buried holding the top half of his skull in his arms (see Burial Descriptions in Volume 2, Part 2, of this series, *The Archaeology of the New York African Burial Ground*). The skull had been deliberately sectioned transversely using a saw, as is done in autopsy or dissection in a gross anatomy laboratory (Figures 5 and 6). The burial is suggestive of the frequent grave robberies that had led to the Doctors' Riot of 1788. If this burial had previously been looted (which can only be speculated), this careful, unusual reburial is intriguing.

The African Burial Ground was closed in 1794 in the wake of the Doctors' Riot, the cemetery's overcrowding, and the petition of African Americans for a second "African Burial Ground." The land comprising the cemetery was restored to the Van Borsum heirs, who had long claimed to own this part of the Common, and they divided it into house lots. The archaeological excavation showed that their privies and foundations were often dug into the burials.

Finally, the site was buried under several feet of fill at the turn of the nineteenth century and nearly

forgotten. It is not known what African Americans thought of the elimination of their old cemetery. It is nonetheless evident that their century-long humane struggle to maintain their cemetery as sacred space was often challenged by desecration by whites and that the first African Burial Ground was eventually overwhelmed by those challenges. The African Burial Ground reemerged two centuries later surrounded by disturbingly similar issues to the human rights concerns of the eighteenth century.

Blacks, who constituted 20 percent of New York City's population at the time of the American Revolution, became a proportionately smaller community afterward. Although the massive waves of European immigration throughout the nineteenth and early-twentieth centuries account for much of the relative diminishment of blacks in the city, it should be mentioned that a major out-migration had occurred with the departure of the British and Tories immediately after the Revolution. Africans had fought for their own liberation on both sides of the War of Independence. Many of those who joined the British were manumitted and relocated to slaveholding Nova Scotia. Many of them remained dissatisfied and successfully negotiated their resettlement to Sierra Leone, West Africa.

In 1799, a law was passed that assured gradual emancipation in New York State, an emancipation that was effective, with few exceptions, in 1827. A dynamic free community then developed with important educational, religious, economic, cultural, and political institutions that continued to struggle with subtler forms of racial discrimination than experienced during slavery. Religious justifications for social inequities were replaced by anthropological notions of the racial inferiority of blacks who, by mid-century, were predominantly Christian. A great migration occurred during the first half of the twentieth century as African Americans left the desperate conditions of the tenant farms in the post-plantation economy and Jim Crow segregation of the South in search of jobs in northern cities. New York's black community saw renewed growth—even a "Renaissance" of the "New Negro" in Harlem—despite continuing problems of racism and poverty that also motivated antilynching campaigns and a Back-to-Africa movement there. Civil Rights, Pan African, Left, Black Consciousness, Black Nationalist, Integrationist, and other political tendencies would characterize the diverse views of African Americans regarding their identity and betterment in New York throughout the second half of the twentieth century.

Recent Public Significance of the African Burial Ground

Much had changed by the time New York's African Burial Ground reemerged as a public concern. Indeed, in 1991, New York City had its first African American Mayor, the Honorable David Dinkins, and African Americans were represented on the city council and key legislative posts. Yet, the contestations about the humanity of blacks had continued. It seems that in the 1990s, the struggle for human equality had to do with the effects of racism in lending institutions, the workplace, police departments, the courts, and education (including antiracist efforts to incorporate African and African American history in public school curricula). Although the protection of cemeteries as exemplars of human dignity never seemed to emerge, the reaffirmation of the fundamental significance of the cemetery was stunning upon the rediscovery of the African Burial Ground.

The GSA took an expeditious approach to its building project at the burial ground in 1991 and 1992; this approach was broadly perceived as desecration. Archaeological mitigation of the project's destructive effects was also rushed, as archaeologists worked 11 hours per day, 7 days per week to remove remains without benefit of the guidance of a research plan. At regular meetings between the African American public and the GSA, William Diamond, GSA Regional Administrator, claimed to take up the public's demands with his superiors. Later, Diamond admitted in a congressional hearing that he had never done so. The public requested an end to excavation and a fitting memorial. The GSA continued archaeological removal and building construction. Mr. Diamond described his feelings about those requests as resistance to being "blackballed or blackmailed" in a climate similar to the "Rodney King" incident (see the documentary film, *African Burial Ground: An American Discovery*, produced by David Kutz and written by Christopher Moore [Kutz Television, Inc. 1994]).

The situation was indeed tense, as the African American public became increasingly impatient with the GSA's dismissive attitudes that many felt would not have been directed toward the concerns of non-blacks in regard to the dignity of a historic cemetery (see testimony of Mayor David Dinkins [United States Congress. House. Committee on Public Works and Transportation. Subcommittee on Public Buildings and Grounds 1992:189–194]; Laurie Beckelman, Chair of

the New York Landmarks Preservation Commission [LPC] [United States Congress. House. Committee on Public Works and Transportation. Subcommittee on Public Buildings and Grounds 1992:212]; and others during congressional hearings on July 27 in New York City and September 24 in Washington, D.C.).

A Federal Advisory ("Steering") Committee would ultimately be established in the wake of massive protests, prayer vigils, and powerful black legislative intervention (Harrington 1993; LaRoche and Blakey 1997). The background to this situation, described in the committee's recommendations to GSA and to Congress, is summarized next:

> In June 1991, human remains were discovered during archaeological testing of the site. By October 1991, excavation for the Foley Square Federal Office Tower Building had begun. ACHP [Advisory Council on Historic Preservation] and LPC [New York's Landmarks Preservation Commission] recommended that excavation only continue with an approved research design and with the input of the African [American] community. Unlike the burial grounds of Native Americans that are protected by law from this type of desecration [NAGPRA legislation of 1990], however, there is no specific law preventing the desecration of the burial grounds of Africans. Without a specific law preventing the desecration of the burials of Africans, GSA felt no obligation to halt the exhumations, consult with the community, or even respond to the very community whose ancestors' remains were being disinterred. Over the course of the next year, community groups, individual members of the community, and other government offices registered ongoing concern and dissatisfaction with the continued excavation. In May 1992, Mayor David Dinkins of New York City called together a group of citizens and formed the Mayor's Task Force on the African Burial Ground. Members of the Task Force formed the basis of the Steering Committee. By July 1992, at least 390 burials had been removed.
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> In response to a letter from Mayor Dinkins, [indicating their violations of the NHPA by not responding to the community or having an acceptable research design] GSA stated that they would excavate an additional 200 burials on a portion of the site that was to become a four-story pavilion beside the office building. GSA's position was essentially that the voice of the citizens, or even the voice of the local government, was not its concern, and that it would only respond to specific instructions from Congress. On July 27, 1992 after a one-day hearing held by Congressman Augustus Savage [African American, Democrat from Illinois], Chairman of the House of Representatives' Subcommittee on Buildings and Grounds, GSA received those instructions. Congressman Savage heard testimony from Mayor Dinkins, LPC, GSA, and Dr. Sherrill Wilson (an African American anthropologist and historian), and Dr. Michael Blakey (an African American physical anthropologist). The Congressman expressed his dissatisfaction that, despite the recommendations to the contrary by both ACHP and LPC, construction had continued on the site without a research design that addressed the presence of human remains associated with the African Burial Ground. Congressman Savage found that the GSA had failed to live up to its Section 106 responsibilities and instructed the construction on the pavilion site halt immediately. Congressman Savage further informed GSA that no additional GSA projects would be funded until a meeting took place between the GSA Administrator and Congressman Savage.
>
> In late July, meetings took place between GSA and Congressman Savage, Congressman Robert Roe (Chairman of the House Public Works Committee), and Congressman John Paul Hammerschmidt. Additional meetings took place between city agencies involved, and the decision was made that a Federal advisory committee of primarily descendant African community leaders and professionals be established to make recommendations to GSA with regard to its Section 106 responsibilities at the site . . .
>
> The Steering Committee . . . was chartered in October 1992 to represent the interests of the community and make recommendations to GSA and Congress regarding the present and future activities affecting the pavilion portion of the Federal construction site now known as the African Burial Ground. [Building of the tower portion of the site was permitted, including interpretive elements regarding the Burial Ground on its first floor]. Its mandate includes: (1) the review of proposals regarding the human remains on the Pavilion site, (2) the analysis,

curation, and reinterment of remains removed from the African Burial Ground and (3) the construction of a memorial or other improvements on the Pavilion site.

Shortly after the Steering Committee was chartered, President Bush signed Public Law 103-393 ordering GSA to abandon construction on the Pavilion site, and approving the appropriation of up to $3 million to finance the modification of the Pavilion site and appropriate memorialization of the African Burial Ground. [Jorde 1993:6–7].

Ironically, the "disrespect for a segment of this community" of which GSA was accused by Congressman Savage at the July 27 field hearing in New York may in fact have helped galvanize public resolve to uphold the dignity of the cemetery. With the collaboration of community activists and the LPC, the site became a New York State and National Historic Landmark. Collaboration between private citizens and the National Park Service brought about the site's nomination to the United Nation's World Heritage Site list. It is the only African American heritage site on that nomination list. The United Nations Human Rights Commission sponsored briefings in Geneva on preliminary New York African Burial Ground Project research findings in 1995 and 1996 (Blakey 1998a) after New York and Los Angeles black human rights organizations (Malik Shabazz Human Rights Institute and Lift Every Voice, Inc.) brought the site to their attention. There had not been such public outcry about the desecration of an African American cemetery since the Doctors Riots' at the African Burial Ground and its adjacent pauper's field in 1788. The cemetery is of intense cultural and spiritual concern for many people of African descent in the United States and elsewhere. In 2007, New York's African Burial Ground became the first United States National Monument to its African Founders.

Significance of the Project's Analytical Approach

Many aspects of the project are novel, not the least of which is the large number of skeletons (419) from the site; this constitutes the largest colonial archaeological sample of any ethnic group available for study in the Americas and the earliest African cemetery in the United States. The human skeletal remains of the New York African Burial Ground provide a uniquely substantive body of primary evidence on eighteenth-century colonial North America. It is a window that faces most directly toward the presence and conditions of Africans enslaved to build the English colonial foundations of the United States. This research also examines facts of life in other parts of the Americas to which these once living individuals and colonial New York's economy were closely connected.

These "intrinsic" qualities of the age and size of the New York African Burial Ground hold particular value for exploring the earliest phases of American history and for making statistical inferences from archaeological populations to a broader, contemporaneous community that requires the large sample of individuals found here. During the research team's first involvement at the site, in March of 1992 by invitation of the ACHP and Mayor Dinkins' liaison, it was clear that "intrinsic" archaeological value is subjective (Figure 7). Whatever the number or quality of the material evidence in the ground, the knowledge derived from it is conditioned by the theoretical framework used to interpret data. The significance of data will depend partly on those interpretations as well as upon the ethical procedures (or lack thereof) by which the data were obtained; this will affect how people will or will not choose to relate to and use the information from an archaeological site.

The research project sought to maximize the significance of the information available from the site. New York's African Burial Ground clearly was and is a site of unique potential. Recognizing this fact, the research team drew from experts' firsthand experiences and benefited from the problems or limitations with previous studies. The research design also drew from compelling ideas under discussion by specialists in physical anthropology, archaeology, African Diaspora studies, epistemology, and ethics. The team believed that there were fundamental problems with the way in which smaller African American bioarchaeological sites had been studied in the past, and this project provided an opportunity and obligation to reformulate the research approach to reflect what the team had learned about those mistakes. The team would apply the alternative approaches that it considered to be appropriate for this kind of site. The praxis of applying these new approaches would lead to better and more exciting kinds of information, including a clearer elucidation of technical and theoretical

Figure 7. Mayor David Dinkins (*center*), Peggy King Jorde (Mayor's Liaison), and Howard Dodson (Chief, Schomburg Center) (*front*) are briefed on the excavation by Michael Parrington (Principal Archaeologist for HCI and John Milner Associates).

problems, than was obvious initially. Chapters 2 and 3 examine these past problems, our reformulation of research procedures in light of those problems, and the new avenues over which we were led by logic and circumstance in the course of the New York African Burial Ground Project.

The research team's combination of academic and contract archaeology departs from previous contract work and represents a particular trajectory in the practice of anthropology that is necessarily critical of previously acceptable standards. The New York African Burial Ground Project's alternative approaches seek to represent new and better standards of anthropological practice. The project has embraced the commitment that this important site, and the humane community interests to which it relates, deserve the best alternative to dehumanizing (objectifying) interpretations of African American identity and history that the team is able to advance. The project competed to direct burial ground research at the end of excavation. The research team encountered forensic anthropologists (cum bioarchaeologists) and contract archaeologists, some of whose typical approaches were acceptable to perhaps most of our colleagues (see Epperson, 1999 and "Comments on the Draft Research design for Archaeological, Historical, and Bioanthropological Investigations of the African Burial Ground and Five Points Area"), yet were unacceptable to the team. The research team strives still to pursue alternate research practices and methodologies; thus, some explanation is warranted, as the team encountered many colleagues who were either strongly opposed or strongly in favor of its approach. The team asserts that its alternative approach enhances the scientific rigor, humanistic meaning, and societal significance of New York's African Burial Ground research.

By the 1990s, two tendencies of African Diaspora bioarchaeology had become well defined. First, a biocultural approach uses the demography and epidemiology of archaeological populations in order to verify, augment, or critique the socioeconomic conditions and processes experienced by human communities. In its latest form, political economic theory structures the interpretation of biocultural relationships. The second, a forensic approach, uses, in part, the descriptive variables used by police departments for individual identifications (race, sex, age, and stature), along with pathology assessments, in order to analyze human remains from archaeological sites. Yet the bioarchaeological context is not the appropriate place for the application of forensics, which tends to reveal archaeological samples in descriptive rather than

historically dynamic ways. Although the majority of the procedures for the technical assessment of age, sex, and pathology are the same for both approaches, they differ in the extent to which a descriptive approach or forensics work relies on the objectified categories of biological race identification, without relying upon (or constructing) social, cultural, and historical information that is at the core of biocultural analysis. The result of descriptive/forensic work is the construction of an acultural and ahistorical group of individuals; the result of biocultural work is a biological reflection of the historical processes that bring about the social condition of a community of people. We maintain that the forensic or descriptive approach is appropriate for police identifications, not for the interpretation of the ways of life in past human communities. Forensics is not bioarchaeology or paleopathology. An example of continued and increasing confusion on this point is the common use of the term "forensic anthropology" to refer to bioarchaeology, perhaps due to the prominence of forensics in the American media.

A public struggle took place in New York that illustrates the contrast between these two approaches. The initial excavation teams at the site (HCI and the Metropolitan Forensic Anthropology Team [MFAT]) included only one senior anthropologist who had had experience studying African American populations. This person had no relevant academic training, and their legally mandated research design was glaringly absent in historical knowledge of New York's African American past. Their research design was twice rejected by the federal and city agencies that were responsible for its evaluation. Forensic methods of race estimation were presented throughout debates at the site as representing an objective approach to the construction of the identity of the colonial population. These anthropologists' emphasis on racial traits, their obvious lack of knowledge of the study population's culture and history, coupled with the efforts of some GSA officials to fend off African American influence on the cemetery's disposition, were responded to with deepening indignation by the descendant-community members who witnessed the excavation.

Michael Blakey, at the time a faculty member of the Howard University Department of Sociology and Anthropology and the Department of Anatomy, assembled a team of physical anthropologists, archaeologists, and historians in the spring of 1992. This team prepared a design that began to establish the full scientific and historical significance of the site. The majority of these researchers were African Americans, and the team was more ethnically diverse than those assembled for previous bioarchaeological projects. The scholars who were selected held advanced and terminal degrees from leading university programs, were established leaders in their fields, and had a track record of research on the African Diaspora. They were also willing to apply biocultural approaches and were inclined toward various forms of publicly engaged scholarship (Blakey et al. 1994) and activist scholarship or, minimally, respected the rights of descendant communities to influence the disposition of their ancestral remains at archaeological sites. These sensibilities to public accountability stemmed largely from influences of African American "vindicationist" scholarship (see Chapters 2–3 on the critical and corrective approaches to history, so labeled by the pioneering anthropologist St. Clair Drake) and by the heightened dialogue with indigenous peoples (some of us had participated in discussions of the World Archaeological Congress and Native American Rights Fund, when many anthropologists were resistant even to meeting with indigenous peoples on the issue) that had recently led to the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990. The research team assumed that the African American public should have the right to determine the disposition of the site as, indeed, that community insisted on using the more general imprimatur of the NHPA of 1966 (as amended) to assert its right of influence over "cultural resources." The research team has continued to develop upon the idea that these ethical demands and those of scientific rigor are not mutually exclusive and that the quality of knowledge can be enhanced by humane principles. The team invoked both the ethical principles of the American Anthropological Association and the Vermillion Accords of the World Archaeological Congress in support of community empowerment as a professional standard (La Roche and Blakey 1997).

By late June of 1992, the Congressional Subcommittee on Transportation and Grounds (chaired by Hon. Gus Savage), in support of the Mayor of New York (Hon. David Dinkins), found that the GSA was not in compliance with the NHPA and stopped excavation. The subcommittee turned over the decisions about what should be done with the excavated remains to a federal advisory steering committee. The Steering Committee was chaired by Howard Dodson, Chief of the Schomburg Center for Research in Black Culture with Peggy King Jorde as its Executive Director, and consisted mainly of African American activists

Figure 8. Night Procession of the Ties That Bind Ceremony at Howard University marking the transfer of the African Burial Ground ancestral remains to an African Diasporic cultural and research institution in November of 1993 (photograph by Roy Lewis).

and cultural workers. The project was then assigned to Howard University after a congressional review showed that its Cobb Laboratory was best suited for the technical demands of the remaining analysis (Figure 8). At that time, the Howard research project included the archaeological contract firm that had recently taken over the excavation (i.e., JMA) for an extended period of transition. The Howard researchers regarded the descendant community as their ethical client and entered into intensive dialogue with this community about the possibility of anthropological research. Decisions regarding the kind of research to be done, if any were to be done at all, would depend on community acceptance of an evolving research design that would include methods to address lay people's questions (see Appendix A). The accepted research design (Howard University and JMA 1993) proposed the most comprehensive interdisciplinary study then attempted, with studies that ranged from molecular genetics to African art history. Included on the team were specialists in the archaeology and history of relevant African, Caribbean, and North American diasporic populations, all leading scholars and their most energetic students. The full range of the latest techniques for skeletal recordation and assessment would be used; as a guide, we used a manuscript of *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994), then in final preparation. The problems presented for research included: the cultural origins, the physical quality of life, the transformations, and the resistance to slavery that could be gleaned from the data.

The current report responds to many of these problems and opportunities in all of its chapters. After completion of the approved research, the skeletons were to be returned for reburial, and thereafter a monument and interpretive center were to be constructed. The vast majority of the proposed research goals have been achieved by the present research, although some hoped-for objectives, particularly in ascertaining more fully the origins of the New York African Burial Ground sample, were not realized.

This study seeks to advance the biocultural approach in physical anthropology that resonated

with living African Americans rather than to engage in descriptive racialization and cursory history. The approach is amenable to synthesis with diasporic studies that both the researchers and lay community leaders found intuitive. The ample involvement of humanists—historians, cultural anthropologists, and even artists involved in facial reconstruction and the interpretation of mortuary art—along with archaeologists and biologists, is also consistent with the eclecticism of African American Studies as conceived since the turn of the twentieth century. We focused on revealing the diasporic experiences of the enslaved New York Africans, the history and identity of their descendants, and helped facilitate their descendants' empowerment in telling their own story and memorializing their own ancestors.

The team's facilitation of such African American perspectives and concerns for the past led to accusations of "reverse discrimination," even though the project director had for the first time brought together a uniquely ethnically diverse team of physical anthropologists, archaeologists, and historians. Nonetheless, critics raised objections from the vantage point of their traditional theoretical and methodological perspectives in all-white laboratories and fieldwork. Indeed, attention given to the initial problem of black exclusion at the New York African Burial Ground Project was also followed by a small but noticeable increase in outreach to black students by archaeological projects. It may simply have been the case that the debate about the consideration of race at the New York African Burial Ground site was contemporary with the wider debate then taking place throughout United States society.

During the 1990s, the New York African Burial Ground Project began developing a synthesis of biocultural anthropology with the African American tradition of diasporic studies. The signatories to the memorandum of agreement (the U.S. General Services Administration [GSA], New York Landmark Preservation Commission [NYLPC], and the President's Advisory Council on Historic Preservation [ACHP]) initially expressed discomfort with the incorporation of African American traditions of critical and corrective history and anthropology (earlier termed "vindicationist") in a draft of the research design. The research plan was technically sound despite the lack of "multicultural" approaches that these agencies insisted would make a more appropriate alternative, although such an alternative did not exist. The review of the April 1992 research design by the ACHP, for example, expressed concern that the local anthropologists did not have sufficient say in how the site would be treated and that too little attention was given to the spiritual significance of the site. They also stated that,

> In reviewing the research designs . . . we note a particular tone in several statements describing the historic context for the proposed research. While we appreciate that the African Burial Ground site is of particular importance to African Americans, we believe that such statements represent an ethnocentric perspective rather than the multicultural one appropriate for a document presented for federally sponsored scientific analysis, education, and public outreach. [Robert D. Bush to Robert Martin, letter, 28 May 1993].

The GSA's instructions to the project's scientific director, who was responsible for the research design's content, were as follows:

> As to the political or ethnocentric overtones in the research design described at page 3 of the ACHP comments, please understand that the United States Government may not be a party to, or engage in, any form of discrimination, either in acts or language. Accordingly, please review the entire research design, deleting any discriminatory references, inferences or attributions, etc., in the document [Lydia Ortiz to Michael Blakey, letter, 13 September 1993].

In fact, no changes would be made because no discriminatory content existed. The passages to which the ACHP referred were simply definitive of the concerns and critical perspective of African Diaspora scholarship. It seemed that to affirm the vindicationist or corrective value of the site made our work more meaningful to some and more threatening to others. This is not to lay blame, as indeed the ACHP would give key support to efforts to complete the research and memorialization of the site. It is to say that misunderstanding and philosophical differences related to America's racial divide emerged essentially around the fact that the research was being organized by blacks who were distinct in more ways than pigmentation. Many anthropologists expressed fears that the project supported the notion that only blacks could study black sites—a position never put forward by the project. Indeed, our research team consisted of racially diverse scholars. These "ethnocentric" concepts were sufficiently resonant with the descendant community's perceptions of the site's archaeological significance that whole paragraphs of the research design were

incorporated in the memorialization proposal of the steering committee, as a public expression without reference to the research design. Presented below is a key paragraph from the allegedly ethnocentric portion of the research design, which is quoted in the first case and paraphrased in the second:

> Due to the circumstances that have brought about their presence, these material remains of African ancestors present themselves during a time of social and emotional strife when inspirational uplift is most needed in the African American community; during a time when evidence of the significance of racism in America needs desperately to be brought to bear on the minds of Euroamericans; and during a time when there is a thirst for knowledge about African heritage that has propelled heated debates about the adequacies of American education. These African ancestral remains have presented both a challenge and opportunity to simultaneously address these issues [Research Design Subcommittee, 6 August 1993; see also Appendix A)]
>
> Today the remains of our ancestors present themselves, literally risen from their graves, during a time of social and emotional strife, when inspirational uplift is most needed in the African community, when evidence of the significance of racism in the United States needs desperately to be brought to bear in the minds of all persons, and during a time when knowledge about the African heritage is both distorted and inadequate. The memorialization of the African ancestral remains presents an opportunity to address these issues [International Reinterment Subcommittee, 6 August 1993].

This is one of many examples of widely differing views, often along racial lines, of the research effort. In this instance, the ACHP raised formal objections to African Americans defining the significance of the African Burial Ground for themselves and for addressing their research effort to their own traditions of critical scholarship. Why, one might ask, are nationally or ethnically specific schools of thought such as "British social anthropology," "the Boasian school," or "French structuralism" acceptable avenues to follow, but influences of an African American school of thought are not? Perhaps the problem was simply the lack of familiarity regarding black intellectual traditions. The research team drew from the tradition of corrective scholarship (vindicationism), synthesizing what seemed useful in these and other ideas and taking a progressive approach to knowledge. As Chapter 3 will make clear, this is quite distinct from the classical orientation of what is often represented as Afrocentrism and Afrocentricity (see critiques by Blakey [1995]).

These ideas, in the context of the earliest, largest, and most publicly visible archaeological site in the United States, put African American bioarchaeology in the forefront of anthropological research for the first time (Blakey 2001).

The site's visibility was also a result of the public's struggles that were required to stop excavation. The ensuing controversy was viewed by the descendant community as a continued refutation of African American humanity and dignity. This attention to the site was also the result of the powerful revelations that the excavation and the research team's initial findings produced about a past of African enslavement and African contributions to nation building that had been buried and hidden from the American consciousness (Blakey 1998a). Indeed, the educated public had long been taught that there had been few blacks and no slavery in the American North. Now the undeniable contradictory evidence confirmed the African American vindicationist critique of pervasive Eurocentric distortion of American and world history.

Report Scope, Limitations, and Future Directions

Much has been accomplished with the approximately $6 million in federal funds awarded to Howard University for the New York African Burial Ground Project research. This document is the skeletal biology component of the three reports; the others cover the written history of these New York Africans (Volume 3 of this series, *Historical Perspectives of the African Burial Ground*) and the mortuary archaeological evidence (Volume 2 of this series, *The Archaeology of the New York African Burial Ground*). Together, these reports provide insight into how these people once thought and lived. Initially, the research design envisioned the incorporation of chemical and DNA research that would result in ancillary genetic and chemical studies reports. These five disciplinary reports were to serve as interim deliverables whose multidisciplinary data would be merged in an interdisciplinary, integrated report.

The research team's plan was to defer the complete DNA, chemistry, and histology research that it was proposing for support, because it would involve cutting samples of bone and teeth, and schedule it for the last two years of the project. Although GSA funded initial pilot studies (DNA, bone chemistry, histology, and amino acid analyses), it declined to fund the other proposed studies.

Hence, those components of the anticipated research were not undertaken for this report. Because the complete DNA and chemical studies were not performed, we could not pursue several key areas of research that depended on such data, including origins/cultural affiliation, individual geographical migrations, subadult sex determinations, ethnic and familial burial and social relationships, stasis and transformation in ethnic and familial spatial clustering, and studies of disease specificity—such as genetic anemia or specific treponemal diseases, for which the spirochete's DNA can be tested. However, such DNA and chemical studies have not been possible for most twentieth-century paleopathological studies, and thus this research project is not unusual in these respects. Data from our pilot studies have been useful, however, and our researchers have continued to conduct chemical and histological research with their own funding. Samples of bone and teeth have been archived for future studies.

The researchers in the skeletal biology component of the New York African Burial Ground Project, as with the other reports of the New York African Burial Ground Project, were influenced by the findings in other disciplines. The regular sharing of data across disciplines has produced an interdisciplinary dialogue. Especially helpful were the four-day Sankofa meetings, of which there were four, where two dozen project specialists participated, producing an interdisciplinary dialogue and common organizing themes and research questions (see Chapter 3 for the latter) that influence each disciplinary report. These organizing themes include origins and arrivals, life in New York, death in New York, and the meaning of ancestors to the descendant community. The present chapter focuses on those perceptions of ancestors. The remainder of Section I covers the theory that evolved for the entire project and the methods of the skeletal biology component. Section II is dedicated to the analysis of data pertaining to the origins and arrival of Africans in New York. Section III focuses on analyses of the conditions of life and death of the enslaved. Thus, the present skeletal biology volume is not meant to achieve the goals of interdisciplinary integration by itself, but has multidisciplinary influences that become evident. Because of the common organization of themes and questions, as well as 10 years of dialogue among specialists, the disciplinary reports such as this one are primed for integration into a single narrative about the New York African Burial Ground.

Organization of the Report

This volume is organized in four sections with 14 chapters (Sections I–III) and burial descriptions (Section IV). The first three sections constitute Part 1 of this volume. Part 2 consists of Section IV, Burial Descriptions, and Appendices A–C. Following this introduction, Chapter 2 provides a broad comparative context for the analysis of the remains from the New York site; the major reports on skeletal remains from African Diaspora archaeological sites in the Americas are reviewed. That chapter also develops a social historical and critical perspective on previous studies as background for the present study and its innovations. Chapter 3 describes the theoretical orientation of the project as a newly evolved program that is served by adherence to public accountability, a critique of the politics of history, publicly engaged scholarship, and aspirations toward rigorous multidisciplinary interrogation of the material data of the site within a broad geopolitical context. The complimentarity of ethical principles and high-quality information is emphasized as a benefit of this approach, which is catholic in its open-endedness in the application of many different theories that may be found useful for the diverse methods and research questions of the project. Finally, Chapter 4 describes the practical methods and work organization required for data collection in the laboratory. The analysis and interpretation of those data are taken up in the remaining chapters of this report.

Section II focuses upon the origins and arrival of Africans in eighteenth-century New York City. Chapter 5 examines the available biological information that verifies the African genetic backgrounds of the archaeological population. Fatimah Jackson and her colleagues advance theory, methods, and results related to estimation of the societal origins of the African Diaspora. The results of the morphological, chemical, and molecular studies are more extensive than are usually found in reports on sites of this kind (see Chapter 2) and give us a good idea of the range of origins of this sample. Yet, this chapter also demonstrates the much greater potential for DNA

analysis, towards which the theoretical development of this project continues to point. The New York African Burial Ground Project has stayed on the routes mapped out in the research design. Members of the research team, along with our students and interested colleagues, plan to continue on this course in our academic institutions over the coming years, supported by funding that we will seek from various intramural and extramural sources for proposed research. Bone and dental samples were prepared by the project with permission of the descendant community for these purposes. Therefore, for the components of the research plan that were not funded, we report on some of the project's contributions to theoretical and methodological developments toward such goals as the utility of DNA and chemical methods for estimating African American origins, the interest in which continues to grow among scholars and the public. Chapter 6 takes another approach to origins, applying new methodology to ascertaining the places of birth and geographical movements of the individuals who were buried in New York.

Chemical sourcing data derive from exposure to different proportions of chemical elements that characterized the different environments to which individuals were exposed during their lifetimes. Alan Goodman and his associates have discovered some of these chemical signatures in the teeth of individuals in the New York African Burial Ground sample that suggest where these individuals spent their childhoods. Modest alternative funding, the time of volunteers, and in-kind facilities partially supported these important studies. Although their potentials have not been fully realized, these DNA and chemical studies of the origins of the people in the burial ground have provided very useful information. Although doubted by many (see "Comments on the Draft Research Design for Archaeological, Historical, and Bioanthropological Investigations of the African Burial Ground and Five Points Area, New York, New York," GSA, Region 2, 1993) when first proposed, these chapters, we believe, make it clear in a material way that the proposals we advanced years ago were on the cusp of a wave of technology, and hence our ideas have been used to good purpose.

Chapter 7 reconstructs the structure of the New York African population using data on the sex and age estimates on more than 300 well-preserved skeletons. These data constitute the first and only systematic information on death rates among enslaved Africans in New York City. Information about migration and population growth—with implications for fertility—is generated on the basis of census records and other historical sources. In Chapter 13, these patterns of life and death described by Lesley Rankin-Hill, Michael Blakey, and their colleagues, are explained as resulting from political and economic forces, not only in New York, but throughout the Atlantic world. Michael Blakey and the coauthors of Chapter 8 analyze dental enamel defects due to the disrupted growth of teeth, which resulted, not from local problems in the mouth, but from generalized diseases and malnutrition. The results show high stress during childhood. These authors begin to explore comparisons of those known to have been born in Africa with those of unknown birthplace (probably a mix of African and American born).

Dental pathology is examined in Mark Mack's study of caries and abscesses in Chapter 9. These pathological conditions represent the infectious effects of carbohydrate-rich food, sugars, and poor dental care. These indicators also provide dietary information based on the local effects of food affecting the mouth during the consumption of meals. However, oral diseases may also burden the immune system's responses to other diseases in the body.

Chapter 10 reveals the remarkable similarity between the bony indicators of infectious disease rates and nutritional deficiency found in New York and in the small series of skeletons from Rathbun's (1987) South Carolina site. In addition, Christopher Null and his coauthors examine active and healed periosteal lesions, representing generalized infection, to show differences by age and sex. Special attention is given to treponemal diseases that connect New York to other regions and populations in the wake of European colonialism. Comparisons are also made with nineteenth-century Philadelphia and post-Reconstruction wage laborers.

The next set of chapters continues the examination of "Life and Death in New York." Chapter 11 focuses on the musculoskeletal effects of the mechanical forces of work and trauma. Cynthia Wilczak and her group found patterns of work stress evidenced by spinal and limb joint degeneration among men and women in the African Burial Ground community. Enlarged muscle attachments and other musculoskeletal stress markers (MSMs) also demonstrate that arduous labor had characterized the lives of both men and women. Some evidence may point to different kinds of work among some individuals within these groups. However, it is not materially clear just how different the work of many men and women had been. Traumatic fractures that occurred near to the time of

death are common in the population. Comparisons are made with studies of African American archaeological sites in different work settings that show a number of associations between the effects of work in New York and those on a South Carolina plantation.

In Chapter 12, Susan Goode-Null and colleagues examine childhood growth using dental development as a proxy for chronological age. They find evidence for slowed, disrupted, and stunted growth in long bones among the New York African Burial Ground sample when the results are compared against a model of current growth standards. These researchers reference a broad range of pathological, nutritional, and mechanical factors that relate to the delays that they found in the physical growth and maturation of the enslaved children interred in the New York African Burial Ground. The thirteenth chapter, as previously mentioned, returns to demographic analysis, but this now considers the data within a broader political-economic scope. Comparative analysis confirms the presence of unusual and previously unrecognized patterns of early death among the captive African community of early New York. Mortality data on the contemporaneous English slaveholding population are from Trinity Church burial records, organized and formatted for analyses by the New York African Burial Ground Office of Public Education and Interpretation in New York. There are some stunning comparisons of the massive population-wide effects of slavery. Slaveholders and African captives exhibit opposing demographic trends of privilege and abuse. This section ends with a synthesis of the report's findings in Chapter 14.

Section IV consists entirely of descriptions of individual burials by Rankin-Hill and her associates at the University of Oklahoma and the College of William and Mary, rendering a brief profile of each individual's case from data contributed by the various studies undertaken in this project.

New York's enslaved African population was highly stressed by all accounts. Specific variations in the skeletons have provided insight into certain aspects of the living experience of this otherwise poorly documented community of America's founders. The skeleton mainly imparts to us the physical quality of life against which an individual's social and psychological struggles and accomplishments may be appreciated. There is much that paleopathology cannot reveal, but skeletons offer leads to patterns and details of this human story that are absent in other lines of evidence; it is the combination of different lines of evidence that makes the New York African Burial Ground Project most exciting. This report constitutes the final step in the skeletal biology research team's study under the auspices of the GSA.

Chapter 2

History and Comparison of Bioarchaeological Studies in the African Diaspora[1]

Michael L. Blakey

This chapter surveys the full range of bioarchaeological studies conducted on African Diaspora sites in the Americas, thus providing a comparative context for the New York African Burial Ground. Skeletal data on people of African descent living under diverse conditions throughout the Americas are described to serve as a basis for comparisons with the burials that are studied in the African Burial Ground. These earlier studies used theoretical approaches different from those we employ. This history of diverse, evolving theoretical approaches is examined as a basis for understanding the scientific and societal implications of the research team's particular synthesis of theory (described in Chapter 3).

The review undertaken here is organized as a social history, emphasizing the interaction of diverse traditions of scholarship with the societal forces that have molded bioarchaeological interpretations of the African Diaspora. It is through the application of such an emphasis that our distinctive synthesis of analytical approaches will be clarified and placed in historical context. This chapter also surveys the major research findings of bioarchaeological studies of the diaspora in North and South America and the Caribbean. In addition, by simultaneously examining the societal influences of analytical approaches and the data these approaches have generated, social perspectives and scientific limitations become more apparent. It is also hoped that the advantages of the present study's perspectives, affording more dynamic interpretations of data and unusual public involvement, will thus be made more obvious.[2]

No condition has influenced the New York African Burial Ground Project more than the unique relationship that developed between this project and the African American public. Subsumed within this relationship is the infusion of mainstream bioarchaeology with the approaches to African Diaspora studies that had been developed by members of the diaspora themselves. In order to illustrate differing perspectives and the ultimate synthesis promulgated here, the tradition of African Diaspora scholarship is summarized; this is followed by a discussion of social history and a survey of bioarchaeological investigations that have run parallel to diasporan scholarship. These disparate ways of explaining black history form the basis of controversy at New York's African Burial Ground. Our project seeks to resolve those differences with a synthesis of the compatible aspects of diasporan and bioarchaeological theory and method. We begin with definitions of key concepts.

The African Diaspora in the Americas encompasses the populations, societies, cultures, and states created by enslaved Africans and their descendants. As these broadly dispersed legatees of forced migration came to conceive of themselves as recipients of a coherent set of historical experiences and affiliated identities, "diaspora" took on common meanings—both as lived reality and as a subject of scholarship. The African Diaspora, as currently conceived, is more a concept than either a technical specialization or geographical area of study. According to Harris (1993), "the African Diaspora concept subsumes the global dispersion (voluntary and involuntary) of Africans throughout history, the emergence of a cultural identity abroad based on origin and social conditions, and the psychological or physical return to the homeland, Africa. Thus viewed, the African

[1] The present chapter follows and extends the article by Michael L. Blakey, "Bioarcheology of the African Diaspora in the Americas: Its Origin and Scope," published in the *Annual Review of Anthropology* (2001 30:387–422).

[2] I am very thankful for the research assistance of David Harris who, with the help of Tomlinson, obtained copies of all of the literature in African diasporic bioarchaeology for my review. Thanks also to the many helpful colleagues who sent site reports and articles in the less accessible journals.

Diaspora assumes the character of a dynamic, continuous, and complex phenomenon stretching across time, geography, class, and gender." African Diaspora or Black Studies programs in today's universities emerged as interdisciplinary area studies with the above foci and motivations.

African American biohistory "has evolved into the study of both the biological and sociocultural factors that have affected and/or influenced the health, fertility, morbidity and mortality of African Americans in the New World within an historical context. African American biohistory is a meeting ground for the many disciplines that focus on the health and disease of African slaves and their descendants in the Americas" (Rankin-Hill 1997). Principal among these disciplines are history, archaeology, and biological anthropology. Although Rankin-Hill uses the term to encompass both historical and historical archaeological studies, I prefer to consider "biohistory" as research that relies primarily upon written records or anatomical collections, reserving the term, "bioarchaeology" for studies that focus upon excavated archaeological populations. Overall, the traditions of American history, archaeology, and physical anthropology have continued to merge in the development of these specializations.

By the above definitions, African American bioarchaeology and biohistory might have been subsumed under the broad umbrella of diasporic studies, but, for various reasons, that has not happened. During the last 20 years, these fields have evolved as distinct research traditions. Juxtaposed and periodically cross-fertilizing, these separate venues also reflect different ethnic and social vantages on the black experience, emphasizing distinctive ranges of methodology and motivations. Diasporic studies developed directly from the history of African American and other diasporic scholarship and rarely incorporated the tools of archaeology and biology. Bioarchaeology developed from two anthropological disciplines that, like biohistory, had evolved from Euroamerican and other traditions of "white" scholarship that rarely incorporated the social science, humanistic, and activist understandings of diasporic studies. Both traditions, however, developed within a common world of intellectual, social, and political change that connected and divided them.

These segmented trends, fostered by a racially segmented American society, have recently been merged in our study of the eighteenth-century African Burial Ground in the City of New York. This merger might not have been possible, were it not also for the recent emergence of biocultural and publicly engaged anthropologists whose liberal-left formulation achieved a new compatibility with diasporic intellectual traditions. In contrast, there remains a distinctive forensic tradition that racializes and dehistoricizes the African Diaspora experience. We examine next the history of each of these traditions and the data they generated on the African Diaspora past.

Origins of African Diaspora Studies

The first studies of the African Diaspora were initiated by Catholic priests, commissioned by the Spanish Crown, who deviated from their assignment of investigating Native Americans and developed initial reports of the cultures and languages of Africans enslaved in the West Indies. At the end of the legal British trade in human captives from Africa, British studies were also commissioned (Drake 1993; Herskovits 1941) which, taken with the detailed commercial data on enslaved Africans throughout the Americas, serve to anchor our knowledge of the diaspora during slavery. For example, an important new database at Emory University has amassed many of the diverse colonial records on the American slave trade.

Yet the accounting of chattel is an incomplete human history. The record of the human experience of Africans in the Americas during slavery is sparse, afforded mainly by the initial writings of people who had been enslaved. These writings, beginning 1772–1815, were primarily narratives about slavery (with comments on life in Africa), which focused on the humanity of blacks and the inhumanities foisted upon them by whites in the works of freed and escaped captives, such as Morrant, Gronniosaw, Cugoano, Equiano, and Jea (Gates and Andrews 1998; also see Harriet Jacobs 1861), often arguing their cases with moral fervor. Later, the narratives of abolitionist Frederick Douglass (1854) reported his life in slavery and damned the institution in a more analytical vein. In 1854, he also attacked Morton's, Agassiz's, Nott's and Gliddon's craniometry and racist Egyptology with sophisticated biocultural analyses, to which we will later return. With the publication of Douglass's "The Claims of the Negro Ethnologically Considered," an African American genre of critical, vindicationist, and activist scholarship had begun that would form a fundamentally distinctive diasporic scholarship. He raised his environmentalist argument against the contrasting Euroamerican racial reductionist scholarship at the origin of American physical anthropology (see

also Hrdlička [1918] on Morton's significance). Meanwhile, Antenor Firmin (1885) of free Haiti authored a scientific rebuttal to French racial reductionism with a holistic analysis (biological and cultural) in support of racial equality. The Parisian academy appears to have completely ignored or disregarded his 600 pages of elegant thought (Fluehr-Lobban 2000), but it remained part of the Haitian cannon for a century.

By 1861, Martin Delany, an African American motivated by missionary interests and African repatriation, reported on the Niger Valley Exploring Party and the relation of its findings to the interests of "the Coloured People of the United States" and African repatriation. In the same year, Alexander Crummell expressed a nascent Pan-African vision in *The Relations and Duties of the Free Colored Men in America and Africa*. The American Negro Academy, which he founded in 1897, served as a think tank for African Americans interested in the uplift of a global black race. W. E. B. Du Bois, a charter member of this Academy, published the first empirical urban ethnography in 1899, *The Philadelphia Negro*. Du Bois served for more than seven decades as the dean of African American social historical research, emphasizing Pan-Africanism, civil rights, and socialist organizing. The Atlanta University Studies, which Du Bois began in 1898, constituted a comprehensive program of sociological and historical research on blacks, and his editorship of the National Association for the Advancement of Colored People (NAACP) journal *Crisis* applied social science to the civil rights effort at the beginning of the twentieth century (see Harrison 1992 and others in this special issue of *Critique of Anthropology* devoted to Du Bois's influence in anthropology). His Jamaican-American contemporary of the early twentieth century, Marcus Garvey, a student of African and Biblical history and head of the Universal Negro Improvement Association, was far more concerned with building an ideology and organizing diasporic unity and African repatriation.

African American research was nearly always critical, for it began from the observation that white racism had distorted the historical record. Du Bois (1915) began an early study of Africa and its diaspora, stating that the "time has not yet come for a complete history of Negro peoples. Archaeological research in Africa has just begun, and many sources of information in Arabian, Portuguese, and other tongues are not fully at our command; and too it must frankly be confessed, racial prejudice against darker peoples is still too strong in so-called civilized centers for judicial appraisement of the peoples of Africa." The problem of an ideologically distorted Africana past continued to inspire a search for information by diasporic scholars, creating a large body of vindicationist literature (Drake 1980, 1993).

During the first part of the twentieth century, Zora Neale Hurston (Hemenway 1977; Mikell 1999) conveyed the complexity of African American and Caribbean cultures through literary works based on ethnology and folklore. The Haitian Marxist ethnologist, Jacques Roumain (Fowler 1972) helped found the Negritude movement that paralleled the "Harlem Renaissance" in Francophone Africa and the Caribbean. He wrote about Haiti in a humanistic vein similar to Hurston. Another Haitian scholar activist, Jean Price Mars, founded the Society of African Culture and helped found *Presence Africaine*, the scholarly organ of black Francophone intellectuals, located in Paris. It was there in 1955 that Senegalese scholar Cheikh Anta Diop first published portions of what would become the most influential classical archaeological and linguistic analysis of the Africanity of ancient Egypt among African and diasporic readers (Diop 1974). Another African American anthropologist, Katherine Dunham, through the vehicle of dance, studied and performed the common and deviating threads of African Diaspora culture and religion in Brazil, Haiti, Cuba, and the United States. African American anatomist and physical anthropologist W. Montague Cobb focused on issues of evolution, race, racism, and health care in the United States in the middle third of the century, combining his biology with humanism and politics. Fernando Ortiz (1929, 1947) conducted ethnographic work and a bioarchaeological study on the African influences of Cuba. Black anthropologist Irene Diggs, having worked both with Ortiz and Du Bois, covered a broad range of U.S. and Latin American subjects (see Bolles 1999). African American historian William Leo Hansberry was the first person to receive a degree in African Studies at Harvard before taking a faculty position at Howard University. However, it was Melville Herskovits who would start the first African Studies program at Northwestern University, following a 2-year visiting position at Howard where he studied "race crossing" (Herskovits 1928). In 1916, historian Carter Woodson, also at Howard University, established the *Journal of Negro History*. The organization for which this journal was the principal organ, the Association for the Study of Negro Life and History (today the Association for the Study of African American Life and History) began "Negro History Week" (today Black History Month) in order to disseminate the history of peoples

of African descent. The Fisk- and Harvard-educated historian, John Hope Franklin's seminal work, *From Slavery to Freedom: A History of Negro Americans* (1947), should also be noted among these pre-1960s contributions to diasporic studies.

This is but a small sample of the contributors of that period, suggestive of the breadth and focus of domestic and international work toward diasporic studies. With the exception of the enigmatic Hurston, all were involved in political activism and many were involved in the Pan-Africanist movement that sought to free the continent of colonialism and to unite its diasporic peoples. Their scholarly efforts were to preserve and report on African cultural persistence and creativity on the continent and in the Americas, to revise what they saw as Eurocentric distortions of the Africana world, and to foster an understanding of common cultural identity, albeit at times, incorporating an essentialized racial identity not unlike contemporary European romanticists.

White archaeologists and physical anthropologists had initiated no such journals and research organizations by the 1960s, nor did they publish in black journals. But some Euroamerican social and cultural anthropologists and historians did use the *Journal of Negro History* and *Phylon* (edited by Du Bois at Atlanta University).

Franz Boas's interest in African cultures provided an important foundation for American scholarship in this area. His empirical and cultural determinist approaches were both welcomed by, and in conflict with, African American scholarship, based on how the Boasians did and did not relate to civil rights goals (Baker 1998). Colonial European anthropological research in Africa was quite abundant but had limited the involvement of American anthropologists until the post-colonial and Cold War era breached the proprietary wall (see Mwaria 1999:280; an example of this change is a meeting between Evans Pritchard, Melville Herskovits, and a young Elliot Skinner at Oxford). Boas's student, Melville Herskovits (1930, 1941; see also Drake 1993:481), along with Roger Bastide (1967), were among the first non-African Americans to take an interest in a "hemisphere-wide synthesis" of black life in the diaspora. In the Boasian vein, their work focused on the persistence of African culture, acculturation, and miscegenation without devoting serious study to social and economic discrimination (Drake 1993).

Herskovits, like many diasporan scholars, poignantly recognized that the major corpus of existing popular and scholarly literature on African Americans constituted a "myth of the Negro past." In sum, this mythology conspired to present blacks as "a man without a past" who, being without cultural contributions of his own, had been readily and completely acculturated by Europeans. He intended to expose and correct the myth by undertaking the study of "Africanisms" among disaporic peoples (Herskovits 1941).

Yet the liberal white tradition of scholarship represented by Boas and Herskovits was also distinguished by a patronizing and instrumental approach to black scholars who were often already advanced in their African Diaspora interests. Boas took the conventional approach of using Hurston to gain access to data from black communities (Drake 1980; Willis 1999 [1972]), and Herskovits apparently discouraged African American students from pursuing diasporic subjects. Tellingly, some very prominent black scholars who had studied with Herskovits at Northwestern University (Johnnetta Cole and Joseph Harris, personal communication 1989) sought out other mentors because they had the distinct impression that Herskovits did not view blacks as the equals of whites. He also deterred black students from studying in Africa because it was too similar to their own culture (Mwaria 1999:280). A counterintuitive rationale from the perspectives of most African Diaspora intellectuals, the anthropological characterization of the etic (outsider's) perspective as "objective" had served to empower the voices of white anthropologists concerning the non-white world where they worked. The sense that Boas (see Baker 1998; Willis 1999 [1972]), or his most renowned former student, Mead (see Rankin-Hill and Blakey 1994), were patronizing toward and unaccustomed to the black world, punctuates the history of African American relations with these relatively antiracist scholars. Despite these American social constraints, some major Euroamerican cultural anthropologists and historians referred to the publications of the African Diaspora intellectuals, and vice versa.

These conflicts of liberal racism might explain partially why intellectual cross-fertilization between Northwestern and Columbia Universities (see Sanday [1999:248] on William Willis's experience at Columbia) tended to proceed through literary interaction, but the collective use of primary data by black and white scholars occurred at the University of Chicago during the same period. It is also important that the sociologists and social anthropologists at Chicago were willing to examine social and economic inequal-

ity, unlike the cultural focus of Northwestern. The exposure of the "Myth of the Negro Past," however, was meant to undermine the ideological legitimation of social and economic inequity as its contribution to Myrdal's study, *American Dilemma*, coordinated at Chicago. Rankin-Hill (1997) has suggested that Boas's motivations were similar to those of Herskovits.

Arguably, the Boasians and Chicagoans were each emphasizing different aspects of the same problem in segmented and competitive ways. The diasporic scholars were involved to varied degrees in both camps. But the diasporans had a long-established interest in culture on their own, which Herskovits's program overlapped. The diasporic scholars, being structured into a single "racial" intellectual community, drew upon each other and all of the scientific, humanistic, artistic, and political aspects of their subject, crossing the lines of disciplinary segmentation and camp competition that were hardening in white academia. The Harlem Renaissance, from which this work got its energy, is well named, not only because it ushered in a cultural rebirth and the "New Negro," but for the pre-Enlightenment sensibility manifested in the breadth of interdisciplinary synthesis openly advocated and developed in the work of individual scholars. Du Bois's seminal work, *Souls of Black Folk* (1903), is an equally influential example, as is the corpus of Montague Cobb's physical anthropology (Rankin-Hill and Blakey 1994). The Harlem Renaissance had taken New York and other major cities by storm in the 1920s, attracting masses of whites to its elevated and seemingly exotic African American culture. Surely this movement had stimulated the interests of the Columbians, as did the rise of antilynching campaigns that were visibly associated with Harlem life. Yet whites did not participate in the prolific writings of this Renaissance, and blacks did not publish in the leading (white) anthropological and historical journals.

By the 1960s, some Euroamerican cultural anthropologists were beginning to expand their thinking to include both a diasporic scope and critique of inequality. Norman Whitten (with a degree from North Carolina, Chapel Hill) and John Szwed (with a degree from Ohio State University) organized the first anthropological symposium on the diaspora that included white and black contributors. This led, 3 years later, to the publication of *Afro-American Anthropology: Contemporary Perspectives* (Whitten and Szwed 1970). Along with the work of Sidney Mintz (1951, 1974)—(with a degree from Columbia University)—in the Caribbean and Marvin Harris and others, who undertook the State of Bahia-Columbia University Community Study Project in Brazil (Hutchinson 1957), one began to see studies of the economic aspects of diasporic subordination conducted by Euroamerican anthropologists three generations down the Boasian lineage.

From 1930 to 1960, the University of Chicago was frenetically engaged in the social anthropology and the sociology of African Americans. This "Chicago school" emphasized the study of the problems of socioeconomic inequality, mostly in urban settings. Here, sociology and social anthropology merged in a way seldom seen in the United States. The participation of African American graduate students was more pronounced at Chicago than at Northwestern, and included such luminary graduates as St. Clair Drake (Baber 1999; Bond 1988), E. Franklin Frazier (1939; see Edwards 1968), Charles Johnson, Mark Hanna Watkins, and Allison Davis (who would join the department's faculty as "the first African American with a Ph.D. to hold a tenure-track position at a predominantly white university in U.S. history," receiving tenure at Chicago in 1947 [Browne 1999:173]). Drake and Clayton's *Black Metropolis* (1945), about a black Chicago community, is essentially a Du Boisian hybrid of the Chicago school and cited mainly the African American authors in urban studies of the previous 50 years. Most of these graduates pointed to the mentorship of W. Lloyd Warner (both at Harvard and Chicago) as the senior faculty member under whom they had worked. The Chicago school was not Boasian, but rather a synthesis of British social anthropology, sociology, and African American traditions of scholarship. It may have been the most collaborative academic program of white and black scholars in the white world, either before or after its moment. From it, Drake would expand upon his scope to include a broad sweep of diasporic space and time and became a framer of the concept of an African Diaspora. His last two-volume treatise, *Black Folk Here and There* (Drake 1987, 1990), was more than a nominal tribute to Du Bois's *Black Folk Then and Now*; it was a synthesis of global data on the social significance of color for African descent groups, beginning in ancient Egypt and ending in the twentieth century.

Throughout the early development of research on the African Diaspora, the members of that diaspora who framed that research approached the subject with both interdisciplinary and activist perspectives, whether missionary, integrationist, Marxist, or

Pan-Africanist. Drake (1980) described this African American intellectual tradition as "vindicationist," as meant to correct the omissions and distortions of the mainstream Eurocentric tradition. The research of some Euroamerican anthropologists in the Boasian lineage was useful in those efforts. The interethnic collaboration at Chicago had policy implications most clearly evident in the governmental use of Myrdal's *American Dilemma* (1945), which was funded by the Carnegie Foundation. Yet, black scholars, as they had done since the antislavery movement, maintained a frontline stance by asserting the need to increase this work against the prevailing denigration of the black experience that was systematically perpetrated by Western education. Frederick Douglass had elucidated an ideological myth of the Negro past nearly 100 years before Herskovits, and African American efforts to destroy the myth continued to evolve intellectual, organizational, and activist dimensions within the future black world.

Those mentioned above are prominent examples of the major sources of in-depth research on people of African descent from the mid-nineteenth century to 1960. Their research, humanistic expression, and political activism attended the global emergence of the African Diaspora from slavery, colonialism, and segregation. It deliberately contributed to an understanding of people of African descent and their relationship to the world that would empower those transitions and adjustments. A formal concept of diasporic studies, according to Harris (1993), achieved momentum in 1965 when the International Congress of African Historians convened in Tanzania and included in its program a session entitled, "The African Abroad or the African Diaspora" and continued as a recurring theme of United Nations Educational, Scientific, and Cultural Organization (UNESCO) publications in several languages. By that time, the emergent Pan-Africanist Congresses of African, Caribbean, and African American scholars, humanists, and political leadership were influencing the immediate post-colonial realities of the United Nations. The civil rights, black power, and black consciousness movements of the United States during the period between World War II and the end of the Vietnam War were fueling and fueled by diasporic Black Studies programs. Although many others should be credited, the intellectual leadership of anthropologists St. Clair Drake (Stanford) and Elliot Skinner (Columbia) and historian Joseph Harris (Howard) should be mentioned in the emergence of an academically grounded concept of the African Diaspora.[3] During the late 1960s and 1970s, scores of Black Studies programs and departments had sprung up at recently desegregated North American colleges and universities as black students physically took over campus buildings for that purpose. Although there are many Euroamerican and other scholars working in African American Studies programs at predominantly white institutions in the United States, those programs nevertheless remain the most likely academic home for black faculty and a sociocultural refuge for black students found in those majority institutions.

The articulation and disarticulation between these developments and the field of bioarchaeology is a major theme addressed below. This summary of intellectual history provides a reference point against which to contrast the development of an African Diaspora bioarchaeology which, although recently impacted by black and cultural scholarship, began along a segmented trajectory of white ecological and racial scholarship that has structured the study of black people very differently. That structuring has taken place, in fact, virtually without recognition of the older and deeper intellectual traditions described above. Archaeology and physical anthropology have experienced even less interaction with the black intellectual traditions than has American sociocultural anthropology. Now I turn to the mainstream traditions of physical anthropology and archaeology whose branches also penetrated African Diaspora research during the 1970s.

Physical Anthropology and the Negro

African American bioarchaeology as it has usually been practiced combines skeletal biology (principally the specialization in paleopathology or the

[3] Blacks took what they could use at Northwestern's African Studies Program and moved on to develop their own segregated turf. Joseph Harris, as an example, would ultimately extend his scope from Ethiopia to West and Eastern African "Return Movements" (1993). He organized a conference on the diaspora in 1979 (mainly involving historians from the diaspora), which would lead to the seminal volume *Global Dimensions of the African Diaspora* (1993). His scholarship helped mold a diasporic focus for the History Department at Howard, to which he devoted his career.

study of health and disease in ancient populations) and historical archaeology (the archaeology of the post-Columbian era in the Americas). Skeletal biology has a longer history of concern with people of African descent in the Americas than has archaeology, and for most of that time, physical anthropology followed a different trajectory from diasporan research; physical anthropology had little, if any, concern for culture during its first 100 years. Its focus upon racial differences meant that African descent populations, constructed as Negroes, Negroids, or biologically black, were considered an important group for comparisons with Caucasoids, Caucasions, or whites, who in turn were regarded as a biological standard of normalcy.

This racist nineteenth- and early-twentieth-century history of physical anthropology has been extensively critiqued (Armelagos and Goodman 1998; Blakey 1996; Gould 1996; Smedley 1993; and others). It is now sufficient to state that, apart from specific differences, physical anthropologists classified human populations racially and created hierarchical rankings of races. Whether these were evolutionary or pre-evolutionary rankings, European descent groups (Caucasoids) were placed at the top and Africans (Negroids) at the bottom, with Asians and Native Americans (Mongoloids) usually intermediate. Although racial classifications were at times more diverse, from Linnaeus's eighteenth-century taxonomy until the issuance of the UNESCO Statement on Race in 1951, this hierarchy was characteristic of Euroamerican and European physical anthropology. It was typical of the thinking and policies of the general white population of which these physical anthropologists were part.

The emphasis on race was part of a broader conceptualization of objective science defined by natural-historical explanations of variations in presumed natural biological categories (e.g., race). The goal was to develop a science of "man" grounded in the same principles that were applied to zoology, biology, anatomy, and medicine, the fields from which most physical anthropologists initially emerged. The resulting science, however, was clearly not objective. It served as a means of ideological production that naturalized and thus justified colonialism, racial segregation, eugenics, class, and gender inequity. Viewed through this racial lens, human populations had a phylogeny from which culture and history were mere adaptive by-products. The lower the type, the less interesting were its nearly extinct behaviors. The highest types received romantic eugenical characterizations, as was the case for certain sub-races of Western Europe (Grant 1916; Ripley 1899; Stoddard 1921).

African Diaspora cultures and history held no interest for physical anthropologists and archaeologists. This was especially true during the nineteenth and early-to-mid twentieth centuries in the United States, which had no African colonies to understand and manage, but instead sustained a system that maintained the subjugation of a black racial caste. "American Negro" was synonymous with former slaves who were thankful for the opportunities that Christianity and acculturation had afforded them to emerge above their assumed absence of prior civilization, as in Douglass's and Herskovits's American myth. There were no contradictions between this myth and the physical anthropological study of the Negro because the naturalized category of race was conceived of as acultural and ahistorical. Physical anthropology was the primary author of the myth.

Skeletal research on African descent populations (as racially black or Negroid) began with Samuel Morton's craniometry in the 1830s, which was popularized in 1854 by *Types of Mankind*, the work of Josia Nott and George Gliddon. Gould (1996) made the point that Morton's racial ranking was taken as evidence that then enslaved African Americans had the mentality of children who were better off under white authority. As mentioned earlier, this work initiated an immediate counterargument from the leading African American activist intellectual of that time, who added that the book's characterizations of Egyptians as Caucasoid were meant to deny the existence (and possibility) of civilized accomplishments among African peoples (Douglass 1854). *Types of Mankind*, which interpreted crania, was a nascent bioarchaeological interpretation in a classic racial-deterministic vein. The book was the first to popularize the American field of physical anthropology. Its use of archaeology initiates the sad fact that, from the nineteenth century until the present, the Nile Valley has been the only area in Africa on which a body of bioarchaeological literature has developed (Armelagos et al. 1971; Aufderheide and Rodriguez-Martin 1998), perhaps because dynastic Egypt continued to be viewed as Caucasoid, with Nubia as its Hamitic ("brown Caucasoid"), slave-bearing neighbor (Bernal 1987). Exceptions to this are the study by Armelagos (1968) that had a paleopathology focus but reflected a prescient bioarcheological orientation and the work of Greene (1972); both of these

show African continuity in the Nile Valley. Although most of the research has centered in the Nile Valley, there is presently work in southern Africa.[4, 5]

Measurements of the skull meant to show a racial evolutionary basis of social inequality (having evolved from pre-scientific phrenology) continued as the focus of the physical anthropology of the Negro until World War II. Craniometry would continue as the focus for descriptive racial taxonomic studies in colonial Africa (de Villiers 1968; Oschinsky 1954; Tobias 1953), as in American studies of racial admixture (Pollitzer 1958) and in forensic studies for the identification of crime victims and missing persons. The Smithsonian's leading physical anthropologist, Ales Hrdlička, was assigned the task of reviewing "all of the work on the Negro" in 1927 for the National Research Council Committee on the Negro (Hrdlička 1927). His bibliography included sociological works of Du Bois and Frazier and the historical work of Woodson and other African American writers. In addition, an extensive list of work by white scholars was included that analyzed what was then termed, "the Negro Problem." Hrdlička (1927:207) viewed the previous work as shoddy, not rigorous, and "tinged with more or less bias for or against the Negro." He proposed that future research should focus on the Negro brain (an organ he studied) which, after all, was the "real problem of the American Negro." He then continued work on measurements of the skulls of 26 living African Americans found at Howard University and fudged his data so that "the Full-blood Negro" appeared to be of inferior "mentality" (Blakey 1996; Hrdlička 1928). In fact, since Morton's time, the study of the Negro had been focused upon recently diseased in anatomical collections or on living populations. Davenport and Steggerda's eugenic research in Jamaica in 1929, for example, claimed to show the deleterious effects of miscegenation.[6]

Beginning in 1930, Earnest Hooton (Harvard) would follow Hrdlička as America's most influential physical anthropologist. Hooton's Pecos Pueblo study (1930) also initiated what has variously been called the statistical (Armelagos et al. 1971), paleoepidemiological (Buikstra and Cook 1980), or demographic (Aufderheide and Rodgriguez-Martin 1998:7) approach, which initiated the development of modern paleopathology, and started a research trajectory that continues today. During this time, however, the "Harvard-Washington [Smithsonian] Axis" (Spencer 1979) was at the core of a physical anthropology that was emphatically racially and biologically determinist (Blakey 1996). A substantial body of publications in modern paleopathology would not begin to emerge until the 1970s, and "1930s-type case reports" would persist even then (Lovejoy et al. 1982:334). Paleopathological data would characterize the core of African American bioarchaeological studies that emerged during the 1980s. Although a biocultural approach to paleopathology would begin then, the racial typological approach has continued.

The persistence of racial taxonomy has been most noted among forensic anthropologists who "in particu-

[4] The most influential work on ancient Egypt among diasporans themselves is Cheik Anta Diop's *The African Origin of Civilization: Myth or Reality* (1974), first published as an article in *Presence Africaine* in 1955. Anta Diop's evidence interprets Egypt as the racially black classical center of African culture (also see Holl [1995] on Diop). His work continues to fuel Afrocentric (or Afrocentricity) scholarship popular within the African American community (Blakey 1995).

[5] Recently, researchers at the University of Capetown have used isotopic analysis to demonstrate dietary change in the African victims of the wreck of the Portuguese slaving brig, Pacquet Real (Cox and Sealy 1997). Morris (1998) has examined dental modification in southern Africa from the early Iron Age onward. Perhaps these and other recent Cape Town studies will initiate an emergence of African bioarchaeology apart from the Nile Valley or the paleoanthropology of East African hominids. Human origins studies in Africa, like Nile Valley research, have traditionally sought to understand the origins of non-Africans. Textbooks and museum exhibitions usually shift from Africa (*Australopithecines*) to Asia (*Homo erectus*) to Europe (*H. sapiens*) attesting to the use of Africa (where evolution continues today) as only a precursor of modern Europeans. I was unable to identify a single bioarchaeological study in West or Central Africa, the regions most directly related to the origins of the American Diaspora.

[6] An interesting twist is found in the work of Caroline Bond Day, an African American whose first degree was earned at Atlanta University. Afterward, she attended Radcliffe College, where she wrote a Master's thesis on mixed-race families in her native Georgia (Ross et al. 1999). Earnest Hooton of Harvard, her Radcliffe advisor, introduced Day in the resulting book as a "proximate mulatto." In *A Study of Some Negro-White Families in the United States* (Day 1932), she adopted a more sociological analysis of racial intermarriage than Hooton had expected. It was an uneven book, without an analysis of the relationship between the extensive biological and sociological observations; physical anthropologists made no use of it, and blacks were uncomfortable with it. Ross and associates (1999:45) attributed this in part to the fact that "Hooton's goals were different from Day's. . . . Day wished to stress the sociocultural similarities between a black middle-class population and a white middle-class population, while Hooton wished to stress the biological differences between these two populations . . . Day attributes differences in lifestyle to racial segregation rather than to any innate biological differences." Day was also a humanist who devoted much of her energy to dramatic and fictional writing and did not continue to conduct physical anthropological research.

When the sociologists and anthropologists at Chicago were investigating the social causes of urban violence and crime, Earnest Hooton (1939) conducted a nationwide investigation of the racial and anatomical bases of different types of crime that included a black genetic propensity for rape.

lar find the phenotypic criteria associated with race to have practical applications because they are frequently called on by law enforcement agencies to assist in the identification of human remains" (Jurmain et al. 2003:396). Furthermore, according to Jurmain et al.'s (2003) prominent physical anthropology textbook, such classification "is viewed as no longer valid given the current state of genetic and evolutionary science," and "[o]bjections to racial taxonomies have also been raised because classification schemes are *typological"* and are "inherently misleading because there are also many individuals in any grouping who do not conform to all aspects of a particular type" (Jurmain et al. 2003:396; also see Armelagos and Goodman 1998). Racial inequality is ostensibly no longer the point of current racial classification, but when racial attributions substitute for specific cultural affiliations and historical contexts, inequality is implied. When researchers involved in forensics choose to apply the same descriptive approaches to African American bioarchaeological sites (as in MFAT's work on the New York African Burial Ground or other research discussed later), their interpretations are then loaded with the 150-year legacy of the objectification and generalization of African Diaspora identities. African Americans are consequentially dehistoricized and dehumanized. As will be shown later, the New York African Burial Ground Project chose to vary from that legacy and offers a historicized interpretation even of biological data used to track geographical origins and cultural affiliations.

There were alternatives to the dominant racial deterministic trend in the early years of physical anthropology. Franz Boas, the liberal socialist anthropologist, examined living populations and argued for the plasticity of human biology and behavior. His actual focus (and direct target of critique) was the study of European sub-races (Boas 1911; see Blakey 1996). His general critique of racial determinism was used by African American activist scholars such as Du Bois for their antiracist efforts (Baker 1998).

Studies of new documented anatomical collections (macerated cadavers from the dissecting rooms of medical schools) gained momentum during the 1930s. As it happened, the largest series was completed at Case Western Reserve University by T. Wingate Todd, a liberal Scottish physical anthropologist who had been an officer among colored troops in Canada (Cobb 1939a). Todd's analysis of the crania in the Hamann-Todd collection showed environmental causes of differences in black and white cranial development. In a presentation, which Todd delivered at a meeting of the NAACP (1937), he deduced that an equal potential for achievement existed in these "races."

T. Wingate Todd's liberal environmental analyses were furthered by W. Montague Cobb, his former student and an African American physical anthropologist who was professor of anatomy at Howard University from 1932 to 1969. Cobb (1936) used data from skeletal collections and living populations to show that biology did not determine the athletic acumen of blacks or whites. Furthermore, Cobb was one of the first physical anthropologists to use demographic data, within a synthesized evolutionary and social historical paradigm, to show high adaptability of the Negro against the adversities of slavery and racial segregation in the United States (Cobb 1939b) (Figure 9).

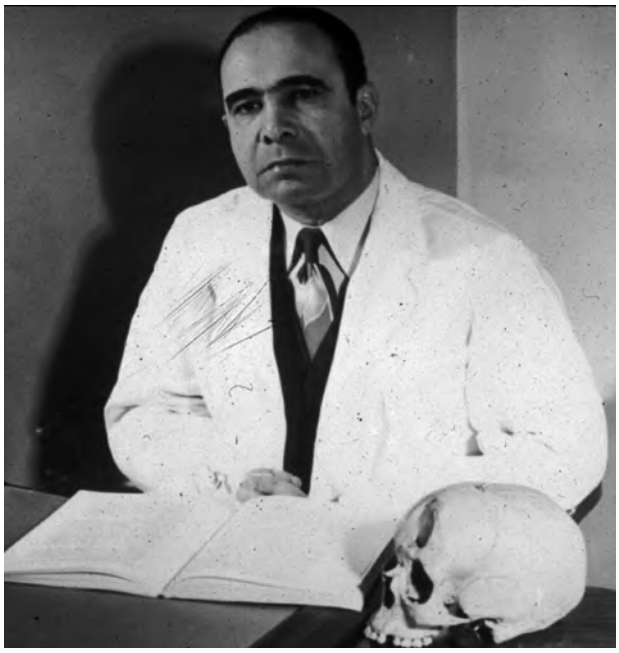

Figure 9. W. Montague Cobb with a pathological cranium from his documented anatomical collection at Howard University.

Cobb would later put his approach to physical anthropology and social medicine to service in the U.S. civil rights movement and the NAACP in the tradition of activist scholarship (Rankin-Hill and Blakey 1994). These studies, however, seem to have had very little impact on the development of physical anthropology.

Boas was opposed by mainstream physical anthropologists until after World War II, when anti-eugenic concerns swept the world and elevated the Boasian approach an advantage, fostering mainly cultural

and biocultural anthropology. Todd remained based in anatomy, rather than physical anthropology. Cobb was best known for his medical and civil rights work in the black world, although interest in Cobb's anthropological approaches was rekindled at Howard during the 1990s.

Conception of African Diaspora Archaeology

Physical anthropology slowly began to incorporate modern paleopathology during the 1930s. The field remained steeped in its long tradition of the racial classification of African-descent groups, using this to explain and justify their social status. African American bioarchaeology would begin during the 1930s. But African American scholarship was not involved, nor was there a keen interest in the Africana world. Instead, it would grow from the interest of many physical anthropologists of that era in race and evolution, particularly as applied to African Diaspora skeletons that were being discovered by archaeologists who were actually looking for extinct pre-Columbian Indians.

In 1938, a team of Oxford archaeologists (funded by Northwestern and Columbia Universities) excavated one of the first bioarchaeological sites in the African Diaspora (Buxton et al. 1938). In 1939, T. Dale Stewart, who had long been Hrdlička's assistant curator at the Smithsonian Institution, responded to the article by Buxton and colleagues and to correspondence by E. M. Shilstone, who had made a related find in the British colony of Barbados (Stewart 1939). Stewart's position at the U.S. National Museum made him a likely expert on the racial identification of the curious remains of the one male African-looking skull found in an apparently Arawak (Taino) midden in Barbados and the two "Negro" skulls that were found on Water Island, St. Thomas, U.S. Virgin Islands. These were believed to be intrusive to the indigenous deposits that had been of interest to the archaeologists. Stewart argued that the Water Island remains were "Negro instead of Negroid" on cranial morphological grounds and concluded that they were therefore intrusive. The Barbados Negro showed a craniometric association with Stewart's Gabon data. Although the measurements showed some inconsistencies with African comparative data in both cases, they were "more in the direction of the Negro" (Stewart 1939:50). Buxton et al. (1938) commented on a similar situation reported by Duerden for a Jamaican site in 1897, in which the craniometric methods seemed unreliable for explaining the presence of Africans among the remains of the Arawak.

With these studies, the physical anthropology of race assessment in diasporic archaeological populations had begun. Antemortem loss of mandibular incisors in Burial 40.1.2 and wedge-shaped filing of the maxillary incisors in Burial 40.1.1 from St. Thomas were consistent with distinctly African aesthetic practices; the unmodified cranial shapes at both sites were unlike the customary practice of shaping the skull in Tainos from Hispañola. From these facts, Stewart concluded that these were not the remains of indigenous people. Indeed, given the problems of determining population affiliation with only one or two skulls, the cultural data exhibited the most convincing qualitative distinction.[7]

There was, however, no serious consideration by Stewart or the archaeologists of the possibility of cohabitation of Africans and Tainos. The St. Thomas individuals (an adult male and female) were buried in association with red ochre mounds, stone artifacts, and with a pot over the face of one of the individuals. They were amongst 19 Taino burials. The site had been disturbed by previous archaeological excavation and was difficult to assess, yet there might have been historical reasons for 2 Africans to have been among a group of Tainos. It is not at all clear from these publications why the site was assumed to be pre-Columbian (the authors actually refer to pre-1700) simply because there were Taino artifacts. Tainos were present in the Caribbean in early colonial and genocidal times. The remains were curated at the University Museum at Oxford, but the temporal relationships might never

[7] Paleopathology had first focused on individual specimens, not populational structure and dimensions of health. Traumatic lesions and syphilis, trephination (evidence of pre-scientific brain surgery), dental "mutilation" (aesthetic modification of the shape of anterior teeth), and deliberate cranial "deformation" (aesthetic modification of skull shape) provided exotic and sensational single specimens on which to report (Armelagos et al. 1971). Yet, many of the individual cases reported were probably essential to the development of type specimens for diagnosis that would be needed for later paleoepidemiological work. Reports of individual cases, racial taxonomic studies, and descriptive research with vague ties to evolutionary theory (and which were uninformed by social history) continued throughout the 1970s (Armelagos et al. 1982). By that time, a modern statistical paleopathology and bioarchaeology had also become well established. Not until the 1980s, 40 years after its application to Native American and other cultural groups, would the paleodemographic or statistical approach come to be used for the study of people of African descent in the Americas. African American physical anthropologists would also participate in that work for the first time during the 1980s, bringing their intellectual traditions with them.

be resolved. There would not be another such study until 30 years later and under similarly accidental circumstances.

A notable comparison is found in the work by Ortiz (1927, 1929), followed by Rivero de la Calle (1973), on several cases of dental modification ("*mutilación*") in Cuban skeletal remains. Although the general assessment of the skeleton was limited, the historical, ethnographic, and folkloric context was extensively revealed in the analysis of the significance of this practice. Dental modification was associated with maroons (*cimarrones*) and religious enclaves. These are also the only examples of dental modification that have been evaluated as a possible local practice, rather than having occurred among Africans brought to the Americas subsequent to the modification of their teeth.

In 1974, two skeletons were found at site 2-AVI-1 -ENS-1 at Hull Bay, St. Thomas, which Smithsonian Institution physical and forensic anthropologists also assessed to be "Negroid" (Ubelaker and Angel 1976). Skeleton A (a 33–41-year-old man, 5 foot 7 inches in stature) had only slight periostitis (indicating infection) on the tibia (lower leg) but showed extensive dental decay and abscesses. Skeleton B (a 30–38-year-old man, 5 foot 8 inches in stature and with a morphology remarkably similar to Skeleton A) was shown to have extensive spindle-shaped periostotic tumorlike lesions of the right femur (upper leg) and left middle arm, accompanied by active cloacae associated with blood-borne infection. He had a partially healed fracture of the left humerus (upper arm) near the lesion and a healed fracture of the left clavicle (collar bone), both of which caused significant shortening of these elements. Skeleton B also had very extensive tooth loss and abscesses. Skeleton B was associated with coffin nails and therefore reasonably of the colonial period. But, Skeleton A was definitely associated with an indigenous pottery fragment (Elenoid period, dated A.D. 800–1200) and no colonial artifacts. Radiocarbon dating only resolved that the skeletons were not recent, important for the forensic concerns of the investigation. In this example of another accidental bioarchaeological encounter with an African skeleton, the methods to assess race, age, sex, and stature continued to be important for forensic identification, yet the assessment of pathology marked a more modern approach than the earlier St. Thomas study. None of these examinations attempts to explore the population, history, or social condition of Afro-Caribbean people.

Another Smithsonian publication by Angel in 1976 examined "Colonial to Modern Skeletal Change in the U.S.A." The study compared 82 skeletons from archaeological collections (1675–1879) with 182 modern forensic or donated skeletons. Angel (1976:727) anticipated increased body size in both the Euroamerican and African American populations due to increased genetic heterosis and "improvements in disease control, diet, and living conditions." This was a traditional study in its reliance upon physical anthropological and anatomical literature, early military data on stature, and evolutionary interpretations. The study showed remarkably little skeletal change, albeit greater in the black population than in whites. Life expectancy increased, as did a pelvic indicator of nutritional adequacy, but poorer dental health and the increased frequency of traumatic fractures were seen to reflect modern stresses.

Angel's study was flawed by the nature of skeletal collections. The continuing dearth of middle- and high-status Euroamerican skeletal collections meant that comparisons of the physical differences relating to socioeconomic variation and change among Euroamericans could not be adequately made.[8] Class analyses, especially for the Euroamerican population of the past, also cannot be made on the basis of existing skeletal collections because these have practically no class variation. Comparisons with historical-period African American or Native American populations with Euroamericans also cannot be accurately made unless these are strictly meant to show relationships among the Euroamericans who were desperately economically poor and/or institutionalized. The fact that physical anthropologists had focused upon the analytical category of "race" meant that the socioeconomic character of these populations was seldom viewed as important because a Caucasoid was a Caucasoid, whatever his or her class. The political economy of collections acquisition is also evident, given that the

[8] Angel did what was probably the only means of addressing the problem of the very low economic status of individuals comprising modern skeletal collections by using donated skeletons and crime victims that included the non-impoverished. Angel's sampling probably came closer to a proper comparison than usual. El-Najjar et al. (1978), for example, studied secular change in dental enamel hypoplasia frequencies (evidence of childhood malnutrition and disease) in U.S. blacks and whites without addressing these biases. The fact that both the perpetrators and victims of violent crime tend to be among the desperate poor, however, means that some class bias likely remained in Angel's study. The extent of class continuity among these temporally differentiated groups should be considered when the modesty of change observed by Angel is considered.

poor and the "other" could readily be dug up or dissected, preserving the burial rights of financially stable whites. An increased interest in the biological effects of socioeconomic environment during the 1970s is certainly apparent in the Angel paper, despite his continuing reliance upon the use of evolutionary principles. With Angel, the Smithsonian Institution had taken a significant step forward from an earlier preoccupation with the racial evolution of "Old American" whites during U.S. history (Hrdlička 1925).

In 1977, the skeletons of two enslaved African American men (Burial No. 3 was 30–40 years of age and Burial No. 5 was 40–45 years of age) were reported from a 3,000-year-old burial mound on St. Catherine's Island of the Sea Islands off the Georgia coast (ca. 1800). These skeletons, too, were found accidentally during a long-term study of the island's native archaeology by the American Museum of Natural History. The analysis (Thomas et al. 1977) was, however, less forensic and more pertinent to historical interpretation than were the Smithsonian studies. Racial identification was made, as in the other studies, along with a modern paleopathological assessment. One man (Burial No. 3) had fractured a leg shortly before death; it had become infected and probably led to his death. The other "was probably shot to death by a military-type weapon" (Thomas et al. 1977:417). Both men had evidence of arduous labor by virtue of their robusticity and muscle development and had "abysmal" dental health. David Hurst Thomas and his associates also encountered the fancy burial of the slaveholder's son in a separate location, showing him to be physically young, gracile, and lacking in evidence of hard work. However, evidence of childhood illness and poor dental health in this individual was similar to the African American skeletons. These comparisons were used to examine the relative quality of life and condition of the two plantation groups, bringing to bear both written and oral historical sources. The researchers could not determine why the burials had been made in a Native American burial mound, and they left open the question of relations with native people after considering the generalization of an historian:

> If the [African American] emphasis on burial with one's family spirits was as strong in the early nineteenth century as Combes suggests it was later, the fact that burials were placed in Cunningham Mound D—isolated as they seem to be—becomes a relevant factor for interpretation [Thomas et al. 1977:418].

With such a small number of burials (n = 3), there was no statistical analysis, and there was only a rudimentary historical and cultural analysis. But this study did engage historical analysis and was therefore more advanced than previous reports on accidentally encountered African American sites by suggesting new motivations in addition to its use of the new paleopathology. These authors were examining people, not a race, and probing the conditions of slavery. They reinterred the remains, rather than curating them, and made recommendations about historical-period burial sites that were considerate of both public sensibilities and scientific concerns for improved rigor and cultural interpretation:

> We do not of course, advocate wholesale archaeological investigation of historic graveyards. Prevalent social and religious customs are to be respected in matters of this sort. But we do urge that as graveyards are required to be moved to make way for progress, archaeological mitigation should include adequate research designs to raise some of the germane questions regarding past human behavior and belief systems [Thomas et al. 1977:418].

These are the only African Diaspora bioarchaeological studies prior to 1980. After this time, sample sizes and geographical ranges would increase, historical and cultural interpretations would become more sophisticated, and "customs . . . respected in matters of this sort" will overwhelm bioarchaeology. What would be responsible for these dramatic changes?

The emergence of an active research interest in African American sites developed as a result of the NHPA of 1966. This act required the funding of archaeological work to mitigate the effects of all federal construction projects, including buildings and highways, in order to preserve cultural heritage. These cultural resources management (CRM) projects caused the growth of private archaeological consulting firms, which quickly became the main source of archaeological employment in the United States. CRM also meant that contract funding was available for site excavation and descriptive reporting for sites that were encountered accidentally. Federal road and building projects across the United States produced a number of sites, some of which resulted from encounters with African American cemeteries. Although it can

be acknowledged that mitigation is a form of cultural resources preservation, that ideally sites are protected, and that projects halted or impacts mitigated, it also is the case that, potentially here was a target of opportunism for archeologists seeking contract work in an area they had not studied before, but also of opportunity for the launching of African American archaeology.

The first work at an African American site was not on a cemetery, but rather on a plantation site—the Kingsley Plantation in Florida, excavated by Charles Fairbanks in 1967. Departing from the new archaeology's emphasis upon ecological determinants, Fairbanks took a historical approach. According to Ferguson (1992:xxxviii), "Fairbanks was not bowing to professional pressure or pleas for a new and more objective archaeology; he was addressing black demands for more attentiveness to black history, and without that political pressure African American archaeology would have developed much more slowly, if at all." I agree with Ferguson that this new specialty resulted from a combination of the structure of the law, together with the pressure of black political and social protest. African American archaeology received increased funding because such sites were repeatedly found in the way of U.S. government roads, buildings, levies, parks, and other construction projects.

Black protest had created both an interest in, and market for, black history, but archaeologists and bioarchaeologists showed little or no interest during the final decade of the twentieth century. Archaeologists did not take courses in African American Studies departments that were multiplying during the period between the 1970s and 1990s, a time when an archaeological shift took place. These departments remained marginal to the university education of whites. Nor did most archaeologists excavating black sites collaborate with African Americanists, most of whom were black, who had the most extensive knowledge of African Diaspora history and culture. Furthermore, archaeologists did not participate in the Association for the Study of African American Life and History or any other scholarly associations African Americans had long ago established for purposes similar to those that archaeology was just beginning to serve.

This lack of regard for the intellectual fundamentals of African American Studies reflects the continued segmented social relations (legal and de facto segregation) between U.S. whites and blacks, who make up the archaeologists and African Americanists, respectively. For two more decades, this situation would continue to produce important limiting effects on African American archaeology and African American Studies. Notably, plantation archaeologist Theresa Singleton (Smithsonian Institution and Syracuse University) and African American Studies specialist Ronald Bailey (Northeastern University) organized a weeklong meeting at the University of Mississippi in 1989 with the goal of bringing practitioners of both fields together in dialogue. It is not sociologically surprising that as the only black Ph.D. archaeologist working on plantation sites, Singleton would be the one to notice that something was wrong and to try to bring African American Studies and archaeology together to talk.[9]

In the most extensive review of "The Archaeology of the African Diaspora in the Americas," Singleton and Bograd (1995) found that African American archaeology had expanded since the 1960s to include greater regional and industrial diversity of southern sites and to address issues of race and ethnicity, acculturation, inequities, and resistance. Moreover, their exhaustive survey also revealed that most of the literature had been largely descriptive, relied too heavily upon flawed analytical techniques or very narrow perceptions of ethnicity, and had been slow to incorporate African American perspectives in developing this research (Singleton and Bograd 1995:30). Continuing, these authors observed

> that race predominates in discussions of plantation life or defines the presentation of blacks' lives following emancipation may in part reflect white archaeologists' and white America's preoccupation with race. There is a tendency to presume that race, or ethnicity, is significant, which is not to say that race is not important. Rather it is to assert that white preoccupations are not always the same as black preoccupations [Singleton and Bograd 1995:31].

The authors argued that it is best to consider ethnicity as a process that is both forced upon and

[9] It should be noted that Merrick Posnansky (UCLA)—who would introduce Theresa Singleton at the first session ever on historical archaeology at the tenth Congress of the Pan-African Association for Prehistory and Related Studies in Harare in 1995 as the "mother of African American archaeology"—had been an important mentor to many of the new Africanists and diasporic archaeologists who emerged from UCLA in the 1980s. Professors DeCorse and Agorsa represent Professor Posnasky's influence within the New York African Burial Ground Project. Perry, Howson, and Bianchi of our project, furthermore, had studied or worked with Schuyler and others at the forefront of African American historical archaeology in the Northeast United States.

creatively used by African Americans, rather than creating an archaeology of "the other," consisting of static typologies that identify a group with objects. In most cases, the absence of type objects comes to constitute evidence of acculturation and assimilation when other plausible interpretations exist. I suspect that this typological approach is tethered to both the American myth of the Negro past and Herskovits's search for Africanisms. According to Singleton and Bograd (1995:23–24), "The tenor of many ethnicity studies is problematic. One problem is that they tend to take a perspective from the outside, how archaeologists and others define ethnics or cultural groups, rather than how ethnics define themselves." Similar issues have been raised in a critique of African archaeology (Andah 1995).

Historical archaeologists' publications rarely reflect African Diaspora scholarship, which has been the most prolific literature on this subject for more than a century. What is most often evident in their work, however, is the influence of the new historiography of plantation life that had also been fostered by the social changes of the 1960s. After 1980, physical anthropologists would also draw from this important literature, central to the maturation of African American bioarchaeology. Although space will not allow extensive discussion of the emergence of African American research in mainstream historiography, a few examples seem essential to understanding its emergence and influence upon bioarchaeology.

The same sociological phenomena that spurred African American archaeology fostered historical research on the subject, but the marketing and funding venues for history were different from those of contract archaeology. The Black Consciousness movement had succeeded in producing a market for history books and lectures, and the civil rights movement had stimulated interest in both blacks and American racism. The historical works of Woodward (1968), Jordan (1968), and Genovese (1976), which followed the early work of the left-leaning Aptheker (1943), are examples of an emerging Euroamerican interest in African American historiography that explained the origins of American racism and the condition of blacks. Herbert Gutman's (1976) historical and demographic study, *The Black Family in Slavery and Freedom*, opposed Senator Daniel Moynihan's (1965) influential report, *The Negro Family in America: The Case for National Action*. Moynihan had attributed urban black poverty to a typically "dysfunctional" slave family, which Gutman showed to have little historical basis. But it was Fogel's and Engerman's (1974) economics treatise, *Time on the Cross*, that stirred a major debate about whether or not working-class whites were similarly oppressed as enslaved blacks, whom the authors claimed were more than adequately nourished. Like Moynihan, *Time on the Cross* raised the specter of apology when blacks were found to have been worse off in many respects after Reconstruction than during slavery. The critiques of this work by Gutman (1975) and David et al. (1976) were quite devastating. This new historiography drew heavily upon the prior work of black scholars. Add to these Phillip Curtin's (1969) *Atlantic Slave Trade: A Census*, which estimated the death toll of the Middle Passage in the millions—millions more perhaps than most whites wanted to acknowledge and millions fewer than estimated by some black scholars—and became a major historical grist for the mill of scholarly and politicized debate.

Physical anthropologists began to use data about the demography, nutrition, and health of enslaved African Americans to address questions regarding the quality of life among the enslaved. Curtin's article on the slave trade and Steckel's (1977, 1986) work on problems of nutrition, disease, and mortality on plantations followed Stampp's (1956) *The Peculiar Institution* in showing the dire demographic and health consequences of American slavery. Higman's (1979) extensive Trinidadian data on the demography of the slave trade represents an early example of how this type of research uniquely found its way to the *American Journal of Physical Anthropology*. Kiple and Kiple's (1977) and Savitt's (1978) apologetic theories attributing chattel slavery and racism to black genetic immunities to disease also resonated with the evolutionary bent of physical anthropology. The biological data generated by these biohistorical debates interested physical anthropologists who were poised to enter the discussion with the bones and teeth of the enslaved people themselves. Nonetheless, Rankin-Hill (1997:12) seems correct in saying that "little has been accomplished in expanding the conceptual limits of [biohistory]. In fact, much of the emphasis has been on the intricacies of quantification and data manipulation, and not on different approaches to interpreting and/or examining the data generated."

The stage for the nascent bioarchaeology of the 1980s was set. Political events spurred a broader societal interest in blacks. Government funding options and markets opened for research and publications in African American archaeology, in particular, and historical archaeology, in general. Accompanying these trends, a biohistorical literature came to prominence that spoke to the biological anthropologists who had seized upon epidemiological and demographic approaches.

As interest in racial studies waned—apart from forensic anthropology—physical anthropologists were looking for new ways to apply their methods to societal issues (Armelagos and Goodman 1998; Blakey 1987). Biocultural approaches that sought to use biological stress indicators as evidence of societal variation and change began to emerge during the 1970s (Goodman and Leatherman 1998). Biohistorical approaches, if applied to bioarchaeological contexts, were ideal for biocultural studies. The students of George Armelagos and others at the University of Massachusetts, in the forefront of biocultural anthropology, had particular impact on the evolving shape of African American bioarchaeology. Finally, the hurricane-like sweep of successful efforts by Native Americans in the 1980s to control the disposition of their skeletal remains and sacred objects (Thomas 2000) culminated in the passage of federal preservation legislation (Native American Graves Protection and Repatriation Act [NAGPRA] 1990). By 1985, the Native American Rights Fund and the U.S. Congress focused their objections upon the Smithsonian Institution. The writing was on the wall. American physical anthropologists were losing access to their main source of professional reproduction—Native American bioarchaeological research. The field of African American bioarchaeology loomed, therefore, to some as an open niche.

The Birth of African American Bioarchaeology

The first extensive African American bioarchaeological study was conducted by Jerome Rose and his colleagues at the University of Arkansas in 1982. The Cedar Grove cemetery site (3LA97) in Lafayette, Arkansas, was in the path of the U.S. Army Corps of Engineers construction of a revetment on the Red River. This African American cemetery had been used during the post-Reconstruction period, 1890–1927, when freed blacks in Arkansas were engaged mainly in tenant farming. Yet, it was the prehistoric site that lay beneath Cedar Grove that had initially been found significant and for which "mitigation" of the adverse impact of revetment construction was necessary, according to the ACHP that oversees the NHPA of 1966. Although the ACHP would later accept the African American cemetery for listing in the National Register of Historic Places as significant and deserving mitigation, little time and few resources were available for the study of the effects of the revetment construction on the site. The Cedar Grove Baptist Church gave the anthropologists permission to conduct research during a 24-hour period prior to relocation and reburial. The University of Arkansas team excavated and analyzed the 79 remains extremely rapidly, salvaging an extraordinarily sophisticated set of paleopathological data, given the limited amount of available time. In the analysis, Rose (1985) also used the biohistorical literature and thus entered into the ongoing debates.

The Cedar Grove burial sample was shown to have been highly stressed by all indications. Neonatal mortality (always underestimated using skeletons because of the deterioration and loss of small bones) was 20 percent, and 55 percent of all individuals died before reaching 15 years of age. Only a single individual died between the ages of 15–19.9 years of age; most of the remaining members of the sample died between the ages of 30 and 50. Ninety percent of the individuals had evidence of infectious disease and nutritional problems, which is very high. Among infants and children, there were high frequencies of anemia, rickets, scurvy, and protein malnutrition. For adults, the evidence was mostly of healed or chronic infection, degenerative arthritis, healed fractures in men, and one male and one female with bullet wounds. Evidence of poor nutrition, high disease loads, and arduous work regimens was further supported by the bone histological study of Martin et al. (1987). Rose (1985:v) surmised that the work regime for these freed men and women "had not changed since slavery" and that the "general quality of life for southwest Arkansas Blacks had deteriorated significantly since emancipation due to the fall in cotton prices and legalized discrimination."

In 1985, there had been sufficient African American research by physical anthropologists for Rose

and Ted Rathbun (University of South Carolina)[10] to organize the first symposium on "Afro-American Biohistory" at the Annual Meeting of the American Association of Physical Anthropologists. Reference at these meetings to blacks in ethnic and historical—rather than racial—terms, was novel in and of itself. The symposium was published as a special issue of the journal in 1987 (volume 74), with one paper appearing later (Blakey 1988). Rose coauthored the histological study of Cedar Grove with Debora Martin and Ann Magennis. Also, there were bioarchaeological studies of the remains from a South Carolina plantation near Charleston showing evidence of childhood malnutrition and disease in a sample of 28 individuals who died ca. 1840–1870 (Rathbun 1987). Dental and skeletal growth disruption was found to be highest for male children, 80 percent of whom had evidence of anemia and infection. Most men and women (69 percent and 60 percent, respectively) had bone reactions to infection; they also had relatively high lead and strontium concentrations, indicating a diet high in plant foods. No clear evidence of syphilis was found (Rathbun 1987). This study contained a useful review of the biohistorical and archaeological literature, again showing the close connection to debates in history and archaeology at that time. This site was removed because of private development, and the law did not require mitigation. The research team was able to convince the landowner to allow research prior to reburial.

The demography and pathology of 13 individuals from the eighteenth- and early-nineteenth-century St. Peter Street Cemetery in New Orleans gave evidence of arduous labor among younger males and comparatively less such evidence among the many females and older adults; these individuals were interpreted as house servants (Owsley et al. 1987). The further racial analysis of this study, which attributed lower life spans to racial admixture, along with the dearth of social and historical analysis, shows continuity with older racial traditions. This paper also described a deeply infected distal right tibia, which Blakey and Ortner had diagnosed as osteomyelitis, the result of chronic infection of an ankle shackle (see plate in Owsley et al. [1987: 191] for this extraordinary example).

Another study (Owsley et al. 1990) compared the 149 black and white skeletons from Cypress Grove Cemetery (1849–1929) of Charity Hospital of New Orleans with burials at other sites. Excavation at this site also had been mitigated in the course of a federal highway project. Similarities were found with the St. Peter sample, and the infection rates paralleled those of a New York State pauper's cemetery used by whites. The analysis of cut bones indicated that both blacks and whites who died at Charity were often dissected prior to burial. Consistent with the forensic approach frequently used in CRM bioarchaeology, the descriptive data were not integrated with community history. The accompanying volume prepared by archaeologists provided historical description (Beavers et al. 1993) dealing mainly with the city health and medical context of the hospital.

Several biohistorical studies appeared during the final decades of the twentieth century that also show clear anthropological influences. Hutchinson (1987), using Harris County, Texas, slave schedules of 1850 and 1860, in combination with a credible range of biohistorical literature, explained marked regional population growth as a function of importation rather than natural increase. She showed that enslaved persons who were recorded as "black" tended to have higher life expectancies on small farms and those termed "mulattoes" were on average older on large plantations; this possibly was because there was more mulato house servitude on large plantations where black field hands were exposed to the worst conditions. Alternatively, mulatoes might have more often been native to the Harris County plantations and therefore younger, on average, than the blacks who most likely included imported Africans. Immunities to yellow fever (following Kiple and King 1981) also might have contributed to differences in life expectancy between the blacks and mulatoes (Hutchinson 1987). Wienker (1987) combined traditional evolutionary and biodeterministic tendencies with a new bioculturalism in his study of an early-twentieth-century logging-company town in Arizona. Although he acknowledged health care inadequacies for blacks in the town's deeply segregated context, Wienker considered the possibility that dark pigmentation might have had deleterious effects in the temperate Arizona highlands.

[10] Although Rathbun at South Carolina also studied with Bass, his work stands out as exceptionally informed by an appreciation for the biohistorical debates. Rathbun and Scurry (1991) also compare the evidence of infection, malnutrition, mortality, and lead content in skeletons of enslaved Africans and slaveholders from the Belleview Plantation (1738–1756) near Charleston, South Carolina. These authors indicate that the Africans clearly had harder work and lower status than the English plantation owners. The health of the two samples was similarly very poor, although the owners had twice the exposure to lead as did workers owing to food-preparation and -storage differences.

A clearer break toward a non-biodeterministic view—as seen in Rose (1985), Martin et al. (1987), and Rathbun (1987)—is also found in the symposium paper by Blakey (1988). This paper traced ethnogenesis and demographic change in an Afro-Native American ethnic group (Nanticoke-Moors) in rural Delaware, from the colonial period until 1950. The study used a political economic analysis of 406 cemetery headstones, archival data, and oral history. It proposed that community responses to racial policies and industrialization brought about a single community's segmentation into different socially constructed races. Although genetically similar, Nanticoke-Moors experienced different educational and economic options depending on their "racial" affiliations. Increased isolation was required to maintain Indian identity, with increasingly higher life expectancy among the industrializing African American identified kin, than among Indian identified kin, who maintained a farming economy. Notably, this study considered few biohistorical debates, with the exception of Eblen (1979), and focused instead upon historical and ethnographic literature that examined African American–Native American relations in the region.

During the mid-1980s, a collaboration was initiated between the Smithsonian Institution and JMA (a CRM firm), that led to excavation of the First African Baptist Church (FABC) cemetery in downtown Philadelphia and, as a consequence, also contributed to the Afro-American Biohistory symposium. The FABC had been used primarily by free, freed, and escaped African Americans between 1821 and 1843. Because it was in the path of subway expansion, the site required archaeological mitigation. JMA excavated 144 burials, by far the largest African American archaeological sample to that date. The FABC was also unique as a northern black bioarchaeological site and a rare urban example; St. Peter in New Orleans is the other urban exception. The fact that the analysis was led by J. Lawrence Angel, a preeminent physical anthropologist at the Smithsonian Institution, raised the status of African American bioarchaeology as surely as had the Rose-Rathbun symposium. Angel, who had first established his reputation on the social biology of ancient Greece, had turned to the study of secular change in the European and African American skeletons from the colonial period to the present (Angel 1976). Along with his assistant, Jennifer Kelley, the principal archaeologist, Michael Parrington, and the collaboration of Lesley Rankin-Hill and Michael Blakey (who coordinated and completed the project at the Smithsonian following Angel's death), J. Lawrence Angel personally conducted the core research and also made the collection available to other researchers. This combination of researchers, we believe, may have helped the FABC cemetery work evolve even further beyond the descriptive approaches that Angel typically had employed.

Of the 75 adult skeletons, males had a higher average age of death (44.8 years) relative to females (38.9 years), which compares favorably with most other nineteenth-century African American sites. The individuals in this burial sample appeared to have been stressed by inadequate nutrition, arduous labor, pregnancy and childbearing, unsanitary conditions, limited exposure to the sun, and extensive exposure to infectious diseases. Nutritional and growth indicators showed little better conditions than those for enslaved blacks at the Catoctin Furnace ironworks of Maryland, 1790–1820 (Kelley and Angel 1983), although arthritis and violence-related fractures were fewer in Philadelphia (Angel et al. 1987). Consistent with the tradition of physical anthropology, the studies of ancestry were also of interest, with the resultant observation that 30 percent of individuals with os acromiale (non-union of part of the shoulder joint) being interpreted as a familial trait, when it might have been evaluated as the result of persistent mechanical, labor-induced stress during adolescent development (Rankin-Hill 1997:152; Stirland 2000:118–130).

The comparative analysis of Angel and Kelly was further developed in a second symposium paper (Kelley and Angel 1987) for which they had assembled 120 colonial African and African American skeletons from 25 sites in Maryland (Catoctin), Virginia, and the Carolinas, as well as forensic cases in the Smithsonian's collections. Nutritional stresses were very evident in many skeletons, including anemia, which these authors incorrectly attributed to sicklemia. Adolescents and many adults (both male and female) showed exaggerated development of skeletal features associated with lifting muscles, including the deltoid and pectoral crests of the humeri. The researchers also noted degeneration of the vertebral column and the bones of the shoulder at relatively young ages. Evidence of skull trauma and "parry" fractures of the lower arm suggested that violence had been especially common at Catoctin Furnace. In these examples, historical references were rarely used.

The FABC skeletons were reburied in Eden Cemetery, Philadelphia, by the modern congregation in 1987. At a time when Native Americans were calling

for reburial of 18,000 remains at the Smithsonian, the institution's initial interest in announcing the FABC ceremony was administratively quashed. And, little more than marginal interest was expressed by the church congregation. The attitudes of African Americans regarding this research, little of which had been made available to them, were mixed. In contrast, 5 years later, the New York community would explode over a similar project.

JMA continued to develop the preliminary work of Parrington and the foundation study of Angel (Parrington and Roberts 1984, 1990). Blakey and his associates at Howard University's Cobb Laboratory published articles on childhood malnutrition and disease using a detailed analysis of dental developmental disruption, enamel hypoplasia (Blakey et al. 1992, 1994; Blakey et al. 1997). Dental defect frequencies in the FABC cemetery sample were at frequencies similar to those found in the Maryland and Virginia collections that Angel had described, pointing to a similar degree of childhood malnutrition and disease in the recently free North as in the plantation South (Blakey et al. 1994). Both reported hypoplasia frequencies between 70 and 100 percent, which were among the highest in any human population studied by anthropologists.[11] This demonstrated the capability of paleopathology to render this type of comparison across a broad span of human experience. In Philadelphia, these stresses occurred during fetal development as well as throughout the first 7 years of life. The advantage of historical records for some FABC individuals included documented causes of death. These causes prominently included infectious diseases, and 10 percent of Philadelphia's children had reportedly died of marasmus (starvation) (Blakey et al. 1994).

Lesley Rankin-Hill (1997) published the first book that synthesized a breadth of African American bioarchaeological and biohistorical data for the interpretation of the FABC, *A Biohistory of 19th-Century Afro-Americans: The Burial Remains of a Philadelphia Cemetery*. Based upon her 1990 Ph.D. dissertation, this extensive treatment of modern paleopathological and demographic methods and the use of general and site-specific historical sources is commendable. Particularly important was her use of a basic model of biocultural stress developed at the University of Massachusetts by Goodman et al. (1984). This general model, which places culture in the role both of stress adaptation and stress inducer, was elaborated by Rankin-Hill (1997:164–165) as an organizing scheme for the particular historical stressors and effects of nineteenth-century urban African American life. She did, in fact, present the most developed theoretical formulation for African American bioarchaeology, which included the political and economic factors interacting with the physiology and health of early African Americans. She described the multiple stressors, cultural buffers, and skeletal effects of physiological stress in the lives of Philadelphia laborers and domestic workers; we will compare these to the earlier skeletal record of New York City. The emphasis on adaptation anchors this work to the evolutionary tradition of the field.

Although there are other influential centers, the influence of the University of Massachusetts is tangible, having been the graduate institution of Rose, Martin, Magennis, Rankin-Hill, and Blakey, as well as Robert Paynter in African American archaeology. It can be distinguished from the other centers of the development of this specialty by its unabashed advocacy and development of biocultural theory (Goodman and Leatherman 1998; Rankin-Hill 1997). Early biocultural models were developed from the synthesis of the human adaptability interests of R. Brooke Thomas, the biocultural paleopathology of George Armelagos, and the historical demography of Alan Swedlund during the late 1970s and early 1980s at Massachusetts. These models were honed and evolved by their students in order to incorporate political and economic factors that would expose the biological effects of oppression. The influence of faculty in cultural anthropology, economics and African American studies influenced the physical anthropologists and archaeologists, all of whom were exchanging information at a time when walls were being erected between subdisciplines at many other anthropology departments.

The involvement of African Americans was also unusual, including one faculty member—the influential Johnnetta Cole—and one-third of all the black physical anthropology students in the United States (Lesley M. Rankin-Hill and Michael L. Blakey) during this crucial period. More importantly, they were

[11] Rathbun's results on a South Carolina plantation were very similar, as was the mutual finding of significantly higher hypoplasia frequencies in male than female children (Guatelli-Steinberg and Lukacs 1999). The Howard study also first showed that the dietary stresses of weaning were not the primary cause of hypoplasia (see review of Katzenberg et. al. [1996]) in African Americans, raising questions about this assumption of Rathbun (1987) and Corruccini and coworkers (1985).

steeped in African American traditions of scholarship, which they inserted into the departmental discourse. The progressive intellectual developments of the 1960s and early 1970s were well recognized at Massachusetts, as was the abysmal record of physical anthropology regarding race. Research on the political history of physical anthropology was exceptionally active there, and the emphasis was on the development of new theory. The core of the New York African Burial Ground Project skeletal biologists come from this background. They also have been influenced by African Diaspora scholars, prominently including Montague Cobb of Howard University.

In contrast, during that period, many of the forensics-oriented academic and museum programs that also conducted bioarchaeological investigations, still were hampered by approaches reflective of the racial-descriptive tradition. In places like the Physical Anthropology Division of the Smithsonian Institution, or forensics-oriented physical anthropology at the University of Tennessee, a technical emphasis on human identification appeared to grow in isolation from social, cultural, and political theory and African American studies. Despite their then embrace of conservative traditions, these and other institutions and their graduates have been much involved in the shaping of bioarchaeology of the African Diaspora, and during the 1960s and early 1970s, they were perhaps the most influential institutions for forensic anthropology.

The racial-descriptive approach, rather than a biocultural one, dominated MFAT's initial field analyses of skeletons at the New York African Burial Ground site. Their apparent efforts to define the population racially, with little regard for its cultural and historical interpretation, appeared in awkward contrast to the critical, humanistic, and diasporic sensibilities of the descendant community; it was also in contrast to the biohistorical research orientation of the new project leadership that took charge of the laboratory and analytical phases of research described in this final report and its two companion reports.

The distinctions between these approaches are recognized by many practicing paleopathologists. Scholars from any of the specializations and institutions described above are, of course, diverse and individual in the ways that they have developed expertise and should not be stereotyped by the examples or general trends explicated earlier herein. The goal of this chapter is to clarify the difference that each historical, intellectual trajectory makes for the study of African American bioarchaeology. The clashes between these approaches in the 1990s, highlighted by the African Burial Ground phenomenon in New York City, are understandable from this vantage (see Epperson 1999; La Roche and Blakey 1997). The New York African Burial Ground Project chose its epistemological path among these available avenues.

Some very interesting diasporic bioarchaeology was also conducted by researchers outside the United States by the end of the 1980s. The most sophisticated is the work of Mohamad Khudabux (1989 and 1991), sponsored by the Universities of Surinam, Kuwait, and Leiden. His studies have referred extensively to much of the recent United States skeletal literature and to Higman's (1979) archival data on statures of different African ethnic groups enslaved in the Caribbean. A study of the 38 African skeletal remains (57 burials) of the Waterloo Plantation (1793–1861) in coastal Surinam is striking for its combination of modern paleopathological methods (from the Workshop of European Anthropologists), its use of historical documents, and political economic analysis (akin to the most advanced stage of North American biocultural theory as represented in Goodman and Leatherman (1998). The overarching question of the study is whether the skeletal data would confirm the eighteenth- and nineteenth-century chronicles pointing to poorer health and quality of life among the enslaved Africans of the Caribbean than among those of the United States. The data generally did confirm, but the detailed analysis is all the more interesting.

Mortality on this cotton plantation was highest among 0–5 and 35–60-year-olds, producing a life expectancy at birth of approximately 40 years. This life expectancy, higher than at sugar plantations, was attributed to the less extreme arduousness of cotton work. The study made skeletal statural comparisons to those from Caribbean and North American sites and considered the influences of both genetics and diet. Unusually and especially significant, it included descriptions of variation in African cultural origins during the course of the trade, including Ewe, Fon, Yoruba, and Akan (Gulf of Guinea), thus giving a cultural texture to bioarchaeology that racial assessment otherwise obscures.

This study's evidence demonstrated the skeletal effects of heavy work, poor housing, and poor nutrition as did the contemporary research on North Amer-

ica. A distinct pattern for Surinam, which the authors effectively generalized to much of the Caribbean during the active slave-trade period, was the small proportion of women on Surinam plantations. There were approximately twice the number of skeletons of enslaved men as there were of women at Waterloo, and historical documents report a less extreme but consistently low sex ratio for Surinam as a whole. They also presented convincing evidence for syphilis in 27 percent of the population (with vault stellate lesions); 8 of these individuals were diagnosed with the acquired venereal form. "Saber shin" (sword-shaped tibiae associated with syphilis and yaws) was present in 6 individuals between 5 and 15 years of age who were thought to have contracted late congenital syphilis. Combining the 6 individuals with saber shin and the 8 individuals diagnosed with acquired venereal syphilis, a total of 14, or 56 percent of the population, displayed evidence of treponemal infection. Skeletal manifestations at this level point to a heavily treponema-infected group, most of which appeared to be syphilis. Treponemal diseases in the New York African Burial Ground sample occurred at dramatically lower rates than were found in the Surinam sample and included no examples of stellate lesions.

What stands above most U.S. observations of this colonial disease in blacks is the incorporation of a dynamic historical context by the Surinamese researchers. Documentation shows that veneral syphilis was introduced to Africans by the frequent rape and abuse of women on slaving ships, and the widespread concubinage of female house servants, which spread contagion. Because the sex ratio was so low, as was the woman's control of her own body, the clear inference would be that European and African males would have been sexually active with the same women. A relatively large proportion of males was instrumental to the cotton industry, as with the even more labor intensive sugar industry. Under conditions of slavery, the Caribbean sex ratio contributed to the spread of treponemal disease. Fertility in the Caribbean was noted as being flat or below replacement, similar to what Volume 3 of this series, *Historical Perspectives of the African Burial Ground: New York Blacks and the Diaspora*, documents for eighteenth-century New York. During the period of intensively active transatlantic trade, Africans could simply be replaced when made to work beyond the physiological requirements of fecundity. Khudabux and his associates showed that when the transatlantic trade was outlawed and Surinam needed to foster fertility among the Africans enslaved there, the ravages of syphilis had become so great that it would be a long time before its population could grow, which ironically hindered Surinam's economic development.[12]

U.S. anthropologists also were examining Caribbean bioarchaeological data during the late 1980s and 1990s. The historical archaeological report of Handler and Lange (1978) spurred many subsequent skeletal studies of Newton Plantation in Barbados. Because the archaeological excavation of the skeletons had been less than systematic, skulls predominated the collection and hence dental studies were emphasized. These studies revealed high frequencies of enamel hypoplasia, indicating high nutritional and disease stresses in early childhood (Corruccini et al. 1985). Three individuals with Moon's molars and Hutchinson's incisors were reported, which was extrapolated to a 10 percent syphilis rate for the living plantation population (Jacobi et al. 1992). Studies of trace elements isolated very high lead contents, which, if not the result of contamination, suggested a high intake of rum distilled in leaded pipes (Corruccini, Aufderheide, et al. 1987). They also reported dental modification ("tooth mutilation"), high frequencies of tooth root hypercementosis associated with chronic malnutrition and periodic, seasonal rehabilitation (Corruccini, Jacobi, et al. 1987) and high childhood mortality. One of the important generalizable findings of the study involved infant mortality, which these authors found to be about 50 percent of mortality reported in archival records. Less than half this percentage—16 infant deaths in a total population of about 104 skeletons—was observed from infant skeletons, which were disproportionately destroyed by taphonomic processes

[12] The incisiveness of a political economic approach to bioarchaeology was developing well outside of the United States. It may also be worthy to note that although African Diaspora studies were not undertaken, the Mexican tradition of physical anthropology spurred by Juan Comas has been well ahead of the United States in the use of a political economic analysis (Marquez-Morfin 1998). A recently discovered sugar plantation cemetery for enslaved Africans in Oaxaca (Hacienda de San Nicolas Ayotla) was reported by historian Arturo Mota and anthropologists Abigail Meza and Socorro Baez at the X Coloquio Internacional de Antropología Física, Juan Comas. The site, on which excavation began in 2000, is the first African Diaspora bioarchaeological project in Mexico.

(Jacobi et al. 1992). These differences between archival and skeletal data for estimates of infant mortality will be important to recall when New York African Burial Ground Project comparisons are made between skeletal data on African captives and Trinity Church burial records on the English slaveholding population.

The work of the physical anthropologists discussed earlier is modestly integrated with the more cultural and historical work reported elsewhere in other, specialized articles (e.g., Handler 1997). This common limitation of disciplinary and specialist journals leaves biological assessment in isolation and thus limits biocultural interpretations. Site reports can overcome this segmentation; for example, Armstrong and Fleischman (1993) evaluated four African skeletons from the Seville Plantation, Jamaica, combining paleopathology, history, and archaeological analysis. The elegant simplicity of these house burials, which showed cultural continuity between the Asante, plantation laborers, and maroons and their symbolic goods, accentuated their evocative individual biological characterizations. The sample was, however, inadequate for statistical analysis.

A good example of decontextualized, descriptive approaches is also found in the Caribbean, the Harney Site Slave Cemetery, on private land in Montserrat. The site was being destroyed by swimming pool construction when archaeologist David Watters obtained the owner's cooperation in salvaging some of the skeletal remains. The site was so much disturbed that artifacts could not be established as grave goods, although a few pottery sherds were found, including imported and "Afro-Montserratian" unglazed wares. Like Newton Plantation and the New York African Burial Ground site, graves were in west-east/head-foot orientation (Watters and Peterson 1991). The remains of 17 black slaves were discovered during construction (only 10 of which were in situ burials) and were sent to the University of Tennessee for study (Mann et al. 1987). There were 6 adult males (average stature 5 feet 11 inches), 6 adult females (5 feet 1 inch), 1 probable male, and 4 subadults, but no infant or young child remains.

The study was forensic in that its purpose was to estimate "age, race, sex, and stature" and was highly descriptive. The authors also reported that 17 of 92 teeth exhibited caries, 2 showed pipe notches, and the cases of root hypercementosis and hypoplasia were shown to be "similar to those described by Corruccini et al." (1982, 1985) in Barbados. Anemia (porotic hyperostosis) was frequent, but periostitis (representing infectious disease) was low. Three women had fractures, one of the right fibula (lower leg), one of the left thumb, and one of the right ankle that had become severely infected. Degenerative joint disease was moderate and related mainly to aging. The authors pointed to a harsh lifestyle with periodic severe malnutrition and common illnesses, leading to early death.

Although the size of the sample was small, the lack of local historical context is striking. West Indies shipping data from one historical source is mentioned along with two comparisons with the Newton Plantation skeletal study. The remaining literature was solely forensic or skeletal biological. There was no discussion of the conditions of life on the Bransby Plantation (or of Montserrat as a whole), where the interred had previously lived and worked. The repeated references to their study of the "Negroid traits" of the "Black slaves" (Mann et al. 1987; and Watters and Petersen's [1991] recapitulation of Mann et al. [1987]) showed a remarkable similarity to the outmoded typological approach of an earlier era in which "racial" identification substituted for the construction of a human cultural and historical identity.[13] Indeed, these same criticisms have been raised regarding the initial forensic field studies of the New York African Burial Ground Project.

The bioarchaeology of the African Diaspora in the Americas has today developed several different trajectories. The biocultural and descriptive/forensic approaches represent polar opposites of a

[13] The study of the Mt. Pleasant Plains (1850–1900) in Washington, D.C., is highly descriptive and shows a similar disregard of known history. Although a census of local migration is discussed and there is an extensive review of old Washington cemeteries, little is said of the people who used them. The 13 African American skeletons showed apparent good health, which may indicate a more affluent black urban population or a rural existence during the pre- and early industrial period, a time before a rapid decline in dental health and relative physical health. Such interpretations would be very much enhanced by some details about the social and economic situation of the people who used this cemetery. Notably, recent community activity has focused on this site. Once owned by the Colored Benevolent Association, much of the cemetery was purchased by the Smithsonian's National Zoological Park in 1890, and another portion (from which the 13 skeletons originated) was sold to a developer in 1959 who was supposed to have relocated the remains. Recent public objections grew out of the zoo's attempt to convert part of this land into a dump while claiming that the Smithsonian was not bound by the NHPA (Coates in *Washington City Paper* 3 April 1998).

continuum.[14] Our project has made use of the biocultural approaches that emphasize the need for substantial historical background and analysis of the political and economic relations upon which a population's biological condition depends. The Boasian cultural environmentalist tradition can be found at the root of biocultural anthropology, yet a theory of the impact of social "circumstances" upon the "physical man" is also found a half century prior to Boas's work in the diasporan writings of Frederick Douglass, followed by Firmin and Cobb. Douglass's dialectic of social action and biology (e.g., "a man is worked upon by what he works on") was pitted against the racial reductionism of the founding fathers of American physical anthropology (Douglass 1854:304–305). As with the biocultural and historically grounded bioarchaeological studies that began to appear in the 1980s, our research project is interested in the dialectical relations of biology, culture, and history. The relationship among these fields tells a human story of the bones of a past community. The New York African Burial Ground Project, furthermore, utilizes the kinds of broad interdisciplinary syntheses, diasporic concept, geographical scope, critique, and public engagement that are consistent with the intellectual traditions of diasporic people. The following chapter describes how these aspects of theory further advance the effort to reveal dynamic, human history while striving to resolve some of the ethical and epistemological dilemmas of nonreductionist research.

Studies that substitute racial identification for culture and pathological assessments for history remain antithetical to these approaches. Their narrowness of scope appears to be consistent with the European Enlightenment's reductionist notions of objectivity in which "parts" (especially biological parts) become important to understand as abstractly separable from the larger "whole" of their interaction. It is clear nonetheless that these descriptive studies are not without political messages and biased characterizations of the populations under study. Looking back at the development of African Diaspora bioarchaeology, it becomes apparent that a lack of interest in, and understanding of, the social, cultural, and historical dimensions of "the black" often allowed researchers to be satisfied with very narrow interpretations of bioarchaeological sites. The experiences of the people buried at these sites were dehumanized by the ostensible objectification of racial classification and ahistorical pathology assessments. Opportunities to explore the complex human dimensions of each skeletal biography, to know a population's cultural identity and societal origins, or to examine the local and international political and economic "circumstances" of a now-skeletal population were lost. Studies that fail to examine such human dimensions of African Diaspora skeletal data ultimately create the impression of people without a history.

[14] As these specialties differ much in theory but little in method, the specialty of "forensics" (which is the more recognizable of the two to the public ear) has often been used as a catch-all for crime-scene and archaeological research involving skeletons, although the term forensic actually refers to the identification of recently disposed (usually no older than 100 years) human remains for the police and courts. The required training for forensics has to do with the identification of individuals, not the analysis of populations that must be understood in a social and historical context. When skeletal remains are first discovered, forensic anthropologists are the proper specialists for establishing whether the remains are crime-related (therefore falling under their purview) or whether they are older, archaeological remains (requiring demographic and epidemiological analysis as well as knowledge of the specific historical context of the remains under study). The increasingly sloppy usage of a "forensics" expertise in government contracting for bioarchaeological research, beyond first discovery, would tend to reinforce ahistorical interpretations of skeletal populations. These differences are especially important when, in the interest of objectification, race substitutes for the history of African Diaspora sites when there is no "Negroid" culture or history. Thus, what this research team considers an overextension in use of forensics consultation instead may simply be a utilitarian and convenient approach for contractors and clients, the frequent use of which occurs not in order to deliberately undermine the construction of African American history and identity, but rather as the unconscious residual of a "bottom line" orientation, naïve scientism, insensitivity of the potential for historical context, or social distance from black people who might be more inclined to question its application.

Chapter 3

Theory: An Ethical Epistemology of Publicly Engaged Biocultural Research

Michael L. Blakey

The approach taken to the organization and interpretation of data from the African Burial Ground involves the following four main elements. The ways in which these elements have guided the research are discussed in this chapter. These theoretic principles can be generalized and extended to a broader range of research projects than our study of the New York African Burial Ground.

1. While seeking to recognize sociocultural and ideological influences of research, critical theory in the vindicationist vein allows the interpretations to be scrutinized, empowering factual information through scientific and other scholarly research. The fundamental principle rests upon acknowledging that political and ideological implications are intrinsic to science and history, and that choices about these are unavoidable (Blakey 1996, 1998b; Douglass 1854). The pervasive incorporation of African Diaspora intellectual traditions of this kind into the dialogue around New York's African Burial Ground opened a special opportunity for applying this long-standing critical view of historical knowledge to a bioarchaeological study. Many brands of "critical theory" have emerged in recent decades, including neo-Marxist and postmodernist thought in American and European archaeology. The synthesis of criticism that emerges in this case was referenced previously (Chapter 2) as part of the evolved understandings of the social and political embeddedness of history and anthropology among African Diasporans. Yet as participants in the intellectual development of a broader "Western" world, such critical thought connects with other intellectual traditions whose experience has led to similar insights.

2. Public engagement affords the communities most affected by a research program a key role in the design and use of research results. A respect for pluralism and the ethics of working with groups of people who historically were placed at risk of social and psychological harm recommends an acknowledgement of this community's right to participate in research decisions. Scholars balance ethical accountability to such communities with responsibility to standards of evidential proof or plausibility that define the role of scholars. The goal of this collaboration is not simply ethical: public engagement affords opportunities for advancing knowledge and its societal significance by drawing upon broader societal ideas and interests. The democratization of knowledge involved here is not predicated on the inclusion of random voices, but on democratic pluralism that allows for a critical mass of ideas and interests to be developed for a bioarchaeological site or other research project, predicated on the ethical rights of descendant or culturally affiliated communities to determine their own well-being.

3. Multiple data sets facilitate cross-validation of the plausibility of results. Results may be rejected, accepted, or recombined into newly plausible narratives about the past based on how diverse results of different methods compete or reconfigure as a complex whole. The required multidisciplinary experts engage in a "conversation" that produces interdisciplinary interpretations of the archaeological population or sample. Diverse expertise provides for recognition of a subject matter that might otherwise go unnoticed in the individuals and communities under study. By revealing multiple dimensions of human subjects, this approach can characterize even skeletal individuals that more nearly resemble the complexities of human experience than are possible in simple, reductionist descriptions.

4. An African Diaspora frame of reference for the New York population provides a connection both to an Atlantic-world political economy and a transatlantic cultural history that is more reflective of the

causal conditions existing throughout the life cycle of members of this eighteenth-century community, than was the local Manhattan context of enslavement. The broader diasporic context of their lives also adds to an understanding of the population as more fully human than is afforded by a local context of enslavement. Non-African Diaspora research might also circumscribe, differently, the scope of time and space required to examine a sufficiently large political economic system and social history to begin to explain how, what, and why its subject came to be.

Critical Theory

African Diaspora intellectuals have, since late slavery, acknowledged the intrinsically political implications of anthropology and history with which they were confronted. Indeed, the historical record of American physical anthropology has continued to demonstrate that the physical anthropologists with the most emphatic interest in "objectivity" have nonetheless participated in the creation of racial and racist ideology (Blakey 1987, 1996; Gould 1996; Rankin-Hill and Blakey 1994). The previous chapter has shown how even highly descriptive studies can represent political ideology. White supremacist notions are supported when representations of blacks are so shallow and biological as to denude them of human characteristics and motivations. As racialized "black slaves," African Diaspora populations may be removed from culture and history, an objectification that some view as consistent with the ideals of Western science. Here, it is both the biological categorization of identity (race) and the omission of history and culture that deny humanity to these historic populations. While this process dehumanizes the black past, Euroamerican history is also transformed to one in which Africans are not recognizable as people. They become instead a category of labor, the instruments or "portmanteau organisms" of whites (see Crosby 1986), that are therefore not readily identified as the subjects of human rights abuses. These aspects, even of description, transform American history.

Douglass (1854) asked scholars to simultaneously take sides *and* be fair to the evidence. This contrasts with differences from Enlightenment notions of objectivity because it is accepted that science and history will always be subjective, influenced by current biases and interests. How can one take a position and be fair to the evidence? One conceptualization of the purpose of historical research that may not violate either of these goals is the assumption that research into the diasporic past is not simply the pursuit of new knowledge. Indeed, African Diaspora traditions of critical scholarship have assumed that the search is for the reevaluation of old, politically distorted and conveniently neglected knowledge about black history. The research design of the New York African Burial Ground Project asserts that the motivation to correct these distortions and omissions will drive the research effort in part. This understanding of the ideological nature of the constructed history allows our team to scrutinize data more critically than were the research team to assume ownership of special tools for neutral knowledge. We need to be more circumspect and aware of how our interpretations may be used and influenced by societal interests beyond the academy walls. In the tradition of vindicationism and activist scholarship, our criticism holds as an assumed goal the societally useful rectification of a systematically obscured African American past. The fact that the African Burial Ground should not have existed, from the standpoint of the basic education of most Americans, supports the need for a vindicationist approach. The history of the northern colonies and of New York has been characterized as free and largely devoid of blacks. That of course is untrue. The history that denies the presence of blacks and of slavery in places where these actually did most certainly exist is not accidental. Such a history must be deliberately debated. Yet societal interests also influence our alternative interpretations, and they may influence policy and social action. We are tinkering with other people's identities. Who are we as individual scientists to decide how to formulate our research plans relative to such potentially powerful societal effects?

Public Engagement

Although we are responsible for our epistemological choices, it is perhaps inappropriate for researchers to make those choices in isolation. The epistemological choices—that is, the choice of ways of knowing the past by virtue of the selection of research questions, theories, and analytical categories—are also the justifiable responsibility of the broader communities whose lives are most affected by the outcome of research. This recognition of the potential for a democratization of knowledge merges epistemological concerns with ethical ones. The community with which we work—the living descendants or culturally affiliated

groups—has an ethical right to be protected from harm resulting from the conduct of research. The American Anthropological Association's Statement on Professional Responsibility and Ethics, the World Archaeological Congress's Ethical Statement, and the new ethical principle of the American Association of Physical Anthropologists, which largely recapitulates the former, are key examples of this ethical standard. Community members have a stake in how research is conducted if it might impact them negatively or positively. The National Historic Preservation Act allows the public a say in whether research will be done at all, and NAGPRA legislation gives federally recognized Native Americans and Pacific Islanders rights to determine the disposition of their ancestral remains and sacred objects.

Many archaeologists and physical anthropologists have resisted these ethical and legal obligations, arguing that the autonomous authority of researchers needs to be protected for the sake of objectivity and the proper, expert stewardship of knowledge about our past. That position is based on assumptions that are inconsistent with our critical theoretical observations of intrinsic cultural embeddedness of science that have informed the activist scholarship in the diaspora. If science is subjective to social interests, it seems fair, at least, in the American cultural ethos, to democratize the choice of those interests that scientists will pursue. Because the people most affected are also to be protected, it is least patronizing for anthropologists to enter into a research relationship with descendant communities by which those communities protect themselves by participating in the decisions regarding research design. Indeed, a "publicly engaged" anthropology of this kind has been proposed by a panel of leading anthropologists who have linked the practice to American values of democratic participation and pluralism (Blakey et al. 1994a; Forman 1994). Useful and exciting paths of inquiry, as well as elevated scrutiny of evidential proof, are revealed when naïve objectivity is replaced by ethics. It is very interesting to consider that the idea of objective methods, capable of revealing universal truths, may have served to obscure the need for ethics of accountability to nonscientific considerations in the pursuit of knowledge.

Our project has conceived of two types of clients, the descendant community most affected by our research (the ethical client) and the GSA that funds the research (the business client). Although both clients have rights that should be protected, the ethical requirements of the field privilege the voices of descendants. Descendants have the right to refuse research entirely, and the researcher's obligation is to share what is known about the potential value of bioarchaeological studies. Our project received permission to present a draft research design to African Americans and others interested in the site. Our purpose was to elicit comments, criticism, new ideas, and questions that the descendant community was most interested in having answered. The result of this public vetting process is, we believe, a stronger research design with more-interesting questions than would have likely come from researchers alone. A sense of community empowerment, in contrast to the preexisting sense of desecration, was fostered by our collaboration. Permission to conduct research according to the resulting design was granted by both clients. Public pressure in support of a more comprehensive research scope than usually afforded such projects resulted from the fact that the research questions interested them and that they claimed some ownership of the project. Thus, research directions, an epistemological concern, were fostered by public involvement, an ethical concern. The queries produced by the engagement process were condensed to four major research topics:

1. The cultural background and origins of the population

2. The cultural and biological transformations from African to African American identities

3. The quality of life brought about by enslavement in the Americas

4. The modes of resistance to slavery

In applying this approach to an ethical epistemology, experience has shown that social conflict is an inherent possibility of public engagement, as are bonds of common meaning and interest between scholars and the public that would not otherwise have been possible. In 1993, while vetting the research design in a Harlem State Government auditorium, the panel of researchers was confronted by some African Americans who objected to our references to slavery in Africa, insisting that slavery had never existed there. We were able to convey familiarity with what we considered to be a reflection of the concern of some African Americans that the Euroamerican community's frequent references to African slavery were often meant to suggest that Africans were responsible for the slave trade. That apologetic spin abdicates the responsibility of Europeans and Euroamericans (the

"demand" side of the trade) for American slavery. We were also sensitive to the frequent misconception that those brought to the Americas were slaves in Africa, rather than free people who had been captured and enslaved. With recognition of this understanding, and of differences and similarities between chattel and African household slavery, our requirement as scholars was, nonetheless, to indicate that we would refer to slavery in Africa because of the material evidence for its existence there. It was the community's right to decide whether or not it would engage scholars to conduct research on the African Burial Ground or to have only religious practitioners or some other treatment. If we were to be involved, it was to be as scholars and that meant standing on evidence. It is significant, too, that the diasporic scholars on the panel knew the critique that had informed the community concern about African slavery and understood it to be more than a matter of emotional sensitivity. The panel responded that we would attempt to maintain an awareness of the misuses of the fact of slavery in Africa in the course of our work, which we did.

The researchers were strongly urged to refer to the Africans of colonial New York as "Africans" or "enslaved Africans," rather than slaves. This recommendation, upon deliberation and discussion, seemed cogent and not inconsistent with material facts. The critical consideration of the community representatives was that "slave" was the objectified role that Europeans and American whites had sought to impose. The Africans themselves, although clearly subject in large part to the conditions of the role of "slave," had often both previous experience and self-concepts that were as complex human beings "who had their own culture before they came here," as community activist and artist Adunni Tabasi put it (New York Beacon, 23 August 1995), and who resisted slavery psychologically, politically, and militarily according to material facts. Thus, we agreed that we represented the perspectives of slaveholders by using the dehumanizing definition of the people we were to study as slaves, when "enslaved African" reasonably emphasized the deliberate imposition of a condition upon a people with a culture. Similarly, we accepted, as did the state and federal agencies, the naming of the "Negroes Burying Ground" the African Burial Ground for similar reasons to the use of "enslaved Africans." Sherrill Wilson found, in the course of background research for the National Historic Landmarks designation of the site, that Africans named their institutions "African" in New York City as soon as they obtained the freedom to put such nomenclature on record in the early nineteenth century.

This case exemplifies the value of the process of public engagement and the deliberation, potential conflict, and reasonable compromise that was often involved in this process. The purpose was to find a synthesis of scholarship and community interests, if a synthesis could be achieved. Such deliberations rely upon trust, and that is as well established by a demonstration of the integrity of scholarship as it is by the researcher's recognition of the community's ultimate right to determine the disposition of its ancestral remains.

Choice of language was one of the most emphatic contributions of the community that did not seem as comfortable with questioning some of the methodological techniques that were under consideration for study of the remains from the African Burial Ground. Invasive methods were discussed and accepted as required to answer the important question of origins that has long been keenly important to African Americans. Family roots and branches had been deliberately severed by the economic expediencies and psychological control methods of slavery. Another community emphasis of importance to the course of the research project was the insistence on including African and Caribbean research in our geographical and cultural scope and on extending the temporal parameters back to the Dutch period when, despite the lack of historical reference, the cemetery might have been used for the burial of Africans and their descendants. These ideas helped to define the project's research questions and choice of expertise that expanded to an African and diasporic scope; this has proved to be essential for recognizing the specific artifactual, genetic, and epidemiological effects of the cemetery population throughout its history and at different points in the life cycles of the persons buried there. Furthermore, our team's recognition of African suppliers for a Euroamerican-driven transatlantic trade in human captives positioned us properly to receive a senior delegation of the Ghanaian National House of Chiefs. They acknowledged regretfully the involvement of some past African leaders in this practice.

Especially during the earlier stages of the research, there were attempts to contain or reduce the project by limiting project and community input into aspects such as the memorialization plans, the interpretive center, and others. Whenever the project was burdened by apparently intractable bureaucratic procedures, the leadership returned to the public forum and was

brought as community advisors to local, state, and national legislators to make these efforts transparent to the public. Congressmen and community members were able to reiterate their support by letter and verbally to the GSA, which over time became more responsive and supportive of the project, but ongoing challenges to sustained and smooth operations still occurred at times. Although some proposed aspects of the research design (Howard University and JMA 1993) were not funded, the integrity of the researchers' relationship to the ethical client—the descendant community—was maintained by standing steadfast with the community's insistence that GSA carry through with its commitments. The GSA was not allowed to disregard its obligations or promises to the black community. After its building was completed, the agency approved funding for additional aspects of the research design and engaged in interactions with the community related to memorialization, reinterment, and interpretation, among others. This project's leadership sought always to give GSA its best and honest advice.

Were this project not linked to community interests, there might have been fewer conflicts with the federal agency. On the other hand, community engagement defined much of the significance of the project that would represent descendant community empowerment. Harrington (1993) has maintained that part of that empowerment was shown by the community's resolve and effective opposition to desecration by the insensitive leadership of a large federal agency. On the other hand, the project's ability to withstand and negotiate prevailed as a result of having a strong base of support in the general public and among concerned legislators. Funding, even under these conditions, was adequate for the broad scope of work, which is described in this volume, and the project's two companion reports, Volumes 2 and 3 of this series, on the archaeology and history, respectively, of the New York African Burial Ground.

Finally, the project was designed to utilize a biocultural and biohistorical approach and rejected race estimation in favor of culturally salient categories of ethnic origin using DNA, craniometry, archaeological artifacts and features, and the available historical record. We had no need to reinforce the concept of race through our research, especially when that concept obscures the cultural and historical identity of those who are made subject to its classification. Moreover, new molecular technologies and specialists in African mortuary data could put us on the trail of ethnic groups with discernible histories.

Over 50 physical anthropologists wrote to the GSA, generally supporting the forensic approach to racing (Cook 1993; Epperson 1996). Indeed, a number of these letters and comments suggested that the use of DNA, chemistry, and cultural traits such as dental modification could be of no value in determining origins. However, the backing of the descendant community, which was far more interested in social and cultural history than racial classification, enabled the project to maintain its programmatic thrust, despite the opinions expressed by these physical anthropologists.

The essential point here is that the questions and approaches that have driven the research of the New York African Burial Ground Project were produced by a public process of empowerment that involved distinct supporters and detractors. What we have been able to accomplish for present evaluation and future development has been the result of protracted struggle with those researchers who customarily have expected to control this kind of contracted study in order to create a research enterprise that is not repugnant to the African American community. It is also a project of unusual epistemological complexity. As a result, the project has had an impact upon both the scientific community and public discussions of human rights and reparations for slavery (see Blakey 1998a, 1998a, 2001; La Roche and Blakey 1997; Perry and Blakey 1997). Six documentary films and frequent and lengthy textbook references to the New York African Burial Ground Project (Pearson [1999] and Thomas [1998], among others) also suggest that the project has raised interesting issues for a broad range of people.

Multiple Data Sets

Multidisciplinary expertise was repeatedly shown to be essential in our attempts to answer the project's major questions regarding the origins, transformations, quality of life, and modes of resistance of New York Africans. Examining a question such as the origin of the population with different sets of data such as genetics, anthropometry, material culture, history, and chemistry was valuable.

1. Cross-validating the plausibility of findings on the part of a particular specialized method or set of data is provided in the form of complementary or conflicting results from an alternative data set. Contrasting results were at least as useful as complementary data because these raised new questions and possibilities about interpretation or the need for methodological development. Biological data (such as molecular genetics)

have often been privileged over cultural and historical data. We found that genetics data, read in isolation of other information, can lead to erroneous conclusions relative to more verifiably accurate cultural and historical evidence. We did not privilege the biological data but benefited from the discussion among the differing results that led us to mutually plausible conclusions. Metaphorically, one voice allowed the floor with impunity can easily make false representations without there being any means of evaluation or accountability. When there are several voices in a dialogue about facts, the standards of plausibility are elevated by the accountability that the facts generated by each method have to one another. This sort of "discussion" among different data sets becomes a means, if not of objectivity, of raising standards of plausibility and of fostering a dialectical process by which new research directions would emerge.

2. Multidisciplinary research has allowed us to recognize more diverse dimensions of the individual biographies and community histories than any one discipline could allow us to "see" in the data. By assessing layers of origins data, for example, we construct the population in terms of its demography, pathology, genetics, cultural influences on burial practices, environmental exposures in teeth, religious history, and art that allow the construction of a more complexly human identity at the site. A fraction of these disciplines would have produced only a portion of these richer human qualities we have worked to understand because observations are largely limited to the specialized knowledge and research tools required to make them.

3. This disciplinary breadth, inclusive of biology, culture, and history, makes possible the kind of political economic analysis in which we are interested as biocultural anthropologists. The biological data are interpreted in relation to the population's social, political, and economic history. Yet some studies, such as those found in Chapter 5, will rely on evolutionary theory but remain historical in its attempt to discover cultural origins with biological evidence. There needs to be a "tool kit" of theories for purposes of different research questions. The break with tradition here is that such an approach is not in search of a unifying theory; physical anthropology and human evolution are not synonymous.

Diasporic Scope

The descendant community had been forceful in its insistence upon our examination of the African backgrounds for the New York population. Their idea was that these were people with a culture and history that preceded their enslavement and continued to influence them even in captivity. We found the African and Caribbean connections important for understanding the site in many ways. We therefore engaged archaeologists, historians, and biologists with expertise and experience in research in all three areas. Similar to the value of multidisciplinary resources of the project, the diasporic scope of expertise allowed us to find meaningful evidence where narrower expertise could not have seen it. The use of quartz crystals as funerary objects required an African archaeological background because Americanist archaeologists might have assigned them no meaning (see Perry 1997, 1999); the heart-shaped symbol believed to be of Akan origin and meaning (see Ansa 1995) was assumed to have a European, Christian meaning in the absence of anyone who could recognize an Akan *adinkra* symbol. Thus, the geographical and cultural connections to the site have been enlarged by the diasporic scope of the researchers.

The previous chapter showed how bioarchaeological projects are often limited to very localized spatial and temporal contexts of interpretation. Were this project to have limited its scope of interpretation to New York City's history, or to the cemetery itself, the African Burial Ground would have revealed a colonial New York population understood for the immediate conditions of its members' enslavement, or less. A larger international context has revealed a cultural background for captives and their descendants, an ebb and flow of migration between different environments and social conditions, shifting demographic structures related to a hemispheric economy, and the interactions of people and environments that changed over the course of the life cycle to impact their biology in multiple unhealthy ways. By understanding these African captives as people from societies of their own, who were thrust into enslavement in an alien environment, perhaps their human experience can be more readily identified. This, at least, was the expressed goal in meetings of descendant community members that informed the research design. The desire to reach back and critically examine that experience is motivated by the scope of interests of an African Diaspora concept that has traditionally included a vindicationist approach to black history that stands against Eurocentric historical apologetics.

A variety of other specific theories (or explanations relating observations to systems that can be

generalized, within which they have meaningful implications for us) have been applied in explaining particular phenomena observed at the New York African Burial Ground. The above approaches, however, form the most general framework of our analyses. The metatheoretical approach described above comprises a process for generating the questions we ask, for assessing the reasons why we are asking those questions, and for selecting the theory with which the information is organized to answer those questions. These approaches are also perhaps the most unique to our situation in which they emerged as special opportunities to resolve problems and contradictions met with at the site. These are, nonetheless, procedures that can be generalized for bioarchaeological work in many kinds of situations, not limited to this site or to African Diaspora bioarchaeology.

The three separate disciplinary reports for the New York African Burial Ground Project modestly represent the potential for interdisciplinary integration of data. The four Sankofa Conferences (1995, 1998, 2002, and 2004), which involved 24–33 of the project's multidisciplinary specialists, and the exchange of ideas that have proceeded over the intervening years in a decade of research, have influenced substantively most of the biological analyses of this report. Moreover, this report as well as *The Archaeology of the New York African Burial Ground* and *Historical Perspectives of the African Burial Ground*, Volumes 2 and 3 of this series, are meant as the last stage prior to a synthesis of these into an integrated report, which we look forward to developing in the future. That latter report is projected to be less technical and more accessible to the general public.

Skeletal Biology of the New York African Burial Ground, therefore, is one major achievement in an ongoing research program that the researchers expect to continue beyond the current contract with the GSA. It nonetheless represents the results of an exhaustive skeletal recordation on 419 human skeletons from the largest and oldest colonial archaeological population in the Americas that has been studied to date. The extensive methods of cleaning, inventorying, reconstructing, data gathering, and documentation for this and future studies—an enormous amount of careful work of more than 100 professionals, technicians, and students—are reported in the following chapter.

Chapter 4

Laboratory Organization, Methods, and Processes

M. L. Blakey, M. E. Mack, K. J. Shujaa, and R. Watkins

Laboratory Organization

This chapter describes the organization of skeletal recordation in the laboratory. This work required specialized personnel, task teams, and processes that converted fragile fragments of soil-encased bone into skeletal elements that revealed accurate anatomical structure and observable effects of physiological processes that could be assessed for genetic, demographic, and pathologic information. That information was then coded and entered into a computer database where all information on each individual could be tracked and statistical data on sample groups of skeletons could be manipulated. Skeletal recordation was completed in 1999 resulting in an estimated 250,000 observations on remains representing 419 individuals. Photographic and radiographic documentation and sampling of bone and dental tissue were also taken for future research. A collection containing more than 55,000 photographs (mainly slides and digitized images) and more than 2,000 X-ray radiographs, and a small sample of cranial CAT scans has been assembled.

Facilities and Environment

Skeletal recordation (processing and data collection) was conducted in the W. Montague Cobb Biological Anthropology Laboratory of Howard University. The Cobb Laboratory consists of approximately 3,000 square feet of space. Three laboratory rooms, a storage room and hallway, and two offices make up the laboratory, which is equipped throughout with electronic security and environmental controls (Figure 10). During the study, room temperature was maintained at 70–72°F and 50 percent relative humidity. Three free-standing back-up dehumidifiers were used during summer rains, when humidity briefly exceeded the desired level. Humidity was monitored by hygrometers in each laboratory room, and a handheld hygrometer was used to monitor the interior environment of skeletal storage boxes. Only once was there an observed distortion of bone due to humidity; this involved the slight expansion of a postmortem humeral fracture that had been out on an examination table during a roof leak. The airtight interior steel cabinetry, in which remains were stored, further limited the effects of environmental fluctuations in bone.

Exterminators eliminated pests annually. Moth crystals are regularly used inside cabinets of the laboratory's permanent anatomical collection (the Cobb Human Skeletal Collection) but were not required for the remains from the New York African Burial Ground. No evidence of insect or mammal infestation was observed in this collection during skeletal recordation.

Fungi were observed in 25 skeletons, and 3 additional skeletons were isolated with the 25 infested cases because of their close proximity to 2 of them. Procedures for handling these cases are discussed later in this chapter. All skeletons were sampled for fungus identification and stored in airtight steel laboratory cabinets labeled with biohazard signs required by Occupational Safety and Health Administration (OSHA).

The laboratory is equipped with benches, tables, stools, clean bench, fume hood, proper lighting, sinks, refrigerators, photography equipment, a small X-ray machine, computers, mechanical and digital calipers, a microscope, and other necessary research tools.

Personnel

The following Cobb Laboratory personnel were involved in skeletal recordation and related admin-

Figure 10. Work space in the main "blue" laboratory.

istration of the New York African Burial Ground Project.

Project and Scientific Director

The scientific director had responsibility for all project administration and scientific design, research, and reporting as well as public and client relations. The scientific director organized, controlled quality, and directed all research activities and wrote all research designs, cost proposals, and reports with the assistance of senior personnel. This position coordinated all components of research within and apart from the Cobb Laboratory. A Ph.D degree, experience and scholarly productivity in bioarchaeological research were requirements for this position.

Laboratory Director/Osteologist

The laboratory director was responsible for laboratory management, including relevant organization, technician training and quality control, supervision, and maintaining adequate laboratory supplies. The director was also responsible for dental data collection and contributed to research analysis, reporting, and public and client relations. The director managed the flow of information and materials exchange with other laboratories, scheduled and conducted public tours, and reported to the scientific director. An M.A. degree and experience in bioarchaeology were requirements for this position.

Office Manager/Administrative Assistant

The office manager had oversight of office management including the laboratory's payroll, bookkeeping, purchasing, travel arrangements, communications, and records keeping and assisted the scientific director in all administrative tasks of the project while supervising clerical staff. A B.A. degree in management and clerical experience were requirements for this position.

Osteologist

The osteologist conducted assessments of bone pathology with the scientific director's supervision and assisted the laboratory director and scientific director in technician training and quality control. The osteologist supervised assisting technicians, advised photography as needed, and contributed to analysis and reporting. An M.A. degree and experience in paleopathology were requirements for this position.

Osteological Technicians (Four Simultaneous Positions)

Osteological technicians (OTs) conducted age and sex assessments, took anthropometric measurements, supervised processing staff and quality control at their work stations, supervised or conducted photography and radiology as needed, assisted curation, and conducted public tours. The most experienced OTs conducted bone pathology and dental assessments under supervision of the scientific director and laboratory director and contributed to analysis and reporting. Osteological technician assistants reported to the laboratory director (except those persons conducting bone-pathology assessments), who also reported to the scientific director. A B.A. degree in anthropology

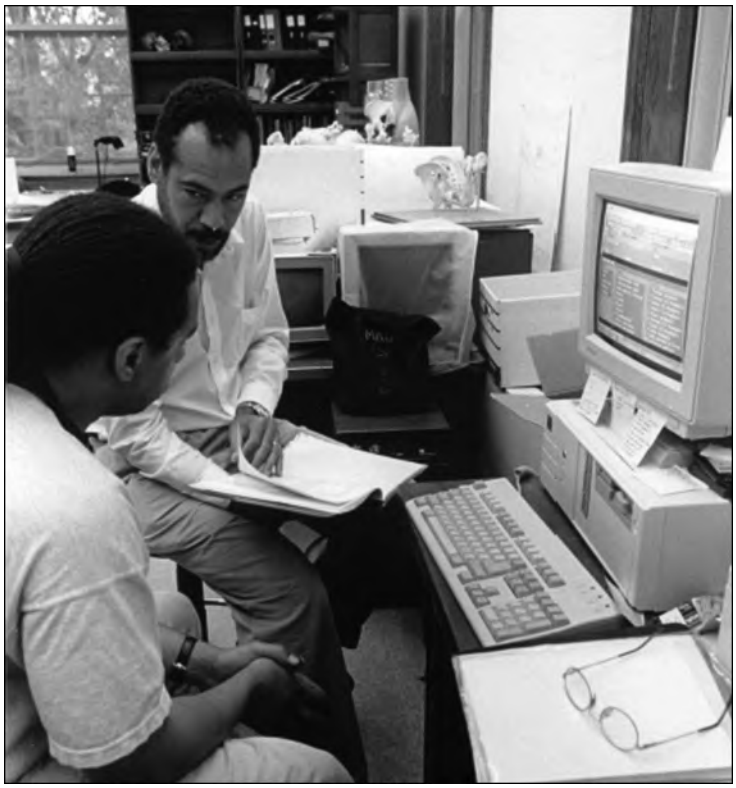

Figure 11. Data Systems Manager Douglas Fuller and Project Director Michael Blakey discuss organization of the database.

and experience in skeletal biology were requirements for these positions.

Osteological Technician Assistants (up to 12 Simultaneous Positions)

Osteological technician assistants (OTAs) assisted in all technical tasks of recordation, especially processing, which included pedestal reduction, cleaning and reconstruction of skeletal elements, photography and its organization, inventory radiology, and public tours. The most advanced OTAs were also involved in supervised anthropometric measurement, dental casting, sectioning and sampling of bone, and curation. OTAs mainly reported to the OTs and were assigned to the laboratory director and osteologist as needed. OTAs were graduate and undergraduate students of anthropology, anatomy, human development, and history and related fields, who had completed a course in human osteology and had specialized training in recordation techniques in the laboratory.

Medical Photographers

The medical photographer undertook photographic documentation of skeletal observations and inventory, managed the photography laboratory, assisted in purchasing photographic equipment and supplies, and kept the log of photographs. This position reported to the laboratory director and was advised by the osteologist and OTs. The medical photographers were required to have experience in skeletal-recordation photography or a related subject of medical photography.

Data Systems Manager

The data systems manager was responsible for maintaining the relational and statistical databases, computer hardware and software, and producing statistical analyses for the scientific director (Figure 11). This position reported directly to the scientific director and required an individual with at least a B.A. degree and experience in database management.

Botanist (Two Positions)

The project botanists sampled and identified fungi (molds), determined their genera, advised the scientific director regarding any potential biohazards, and recommended biocides and safety procedures. These botanists reported to a senior botanist with a Ph.D. degree. Enrollment in a doctoral program in botany was a requirement for this position.

Figure 12. Cobb Laboratory staff.

Conservators (Two Positions, as Needed)

Conservators were contracted as consultants to work as needed to stabilize artifacts found during skeletal processing. They reported to the scientific director.

Consultants and Specialists (Several Positions)

Consultant positions were filled by specialists in bone and dental chemistry, DNA, and histology, the associate director for biological anthropology and other senior researchers. These consultants, in general, held Ph.D degrees and were recognized nationally or internationally as leading scholars in their areas of specialization.

Secretary

The secretary, who reported to the office manager, was responsible for communications and assisted with all clerical work.

The above positions composed the technical, management, and administrative staff of the Cobb Laboratory. All laboratory staff collectively contributed to the interdependent processes required for all data collection and analysis. Weekly meetings and periodic training sessions facilitated staff development and the integration of laboratory tasks. Respect for specialized skills and responsibility for productivity was part of a laboratory philosophy that also emphasized training. Each member of the team was expected to teach others how to perform the member's work (to make that individual "redundant") as a means of continual improvement of the laboratory's resources and opportunities for individuals (Figure 12).

Burial Processing and Methodology

Cleaning and Reconstruction

During burial processing, OTs and OTAs wore latex (or nonallergenic) examination gloves, dust masks, and laboratory coats as a barrier to contagion and to prevent the contamination of bones with the researcher's own DNA. All sachets (acid-free tissue packets with the bones) were wrapped for shipment and storage.

In addition to wearing the protective clothing mentioned above, respirators replaced dust masks when sachets were opened for the first time because of the unknown nature of fungi that had infested some of these remains in New York (Figure 13). If no molds appeared to be present, the technicians proceeded with cleaning, reconstruction, and data collection. If molds did appear to have infested the remains, the entire burial was immediately isolated in airtight cabinets until project botanists could sample these molds for identification. After the application of ethanol as a biocide, some fungal-infested remains would later be processed under conditions specified by the University Biohazards Committee guidelines. Two sets of remains infested with nonhazardous levels of

Figure 13. Safety while unwrapping burials.

the harmful and enigmatic fungus, *Blastomyces*, and three individuals located near to them which shared the same cabinet, remained quarantined.

Each skeleton was cleaned of the surrounding soil matrix in order to observe the bone surfaces for information. In many instances, the remains were encased in soil blocks, or "pedestals," that had to be reduced by excavating as much of the soil as was practical in order to remove or reveal bones (Figure 14). The scientific director, laboratory director, or osteologist advised the OTs and OTAs on the extent of possible reconstruction and efficient techniques for cleaning and reconstruction under different circumstances and made decisions about immediate photography or data collection to prevent data loss when bones seemed in jeopardy of collapse. It was often not feasible to spend many hours or days completely reducing soil pedestals or reconstructing tiny fragments of bone when they could ultimately reveal little information because of very poor preservation. Frequently, the block of soil matrix was all that prevented a bone from disintegrating, making it advisable to expose as much informative bone as possible while keeping it partly encased and maximally intact. Photographs were regularly taken before and after the pedestal-reduction process for full documentation, because some friable bones and important observations will inevitably disintegrate when removed from soil that reinforced their integrity. The vast majority of skeletal elements, however, were removed from their matrices and observed complete.

Cleaning was accomplished with small dental tools and brushes, and cotton applicators were used to apply a 75 percent ethanol/25 percent water solution to soften the soil that had become dehydrated and hardened in New York. Measures were taken to minimize the application of ethanol to the bone itself, however, in order to limit destruction of DNA-bearing proteins. Bones earmarked to be sectioned were flagged with colored tape to be sampled for later genetic, histological, radiographic, and chemical analyses. When archeological artifacts such as floral and faunal remains, beads, shroud pins, or coffin nails were recovered, they were stabilized by conservators, recorded on individual artifact-location maps for each skeleton, and sent to the archaeological laboratory for curation and analysis.

Figure 14. OTA Joseph Jones involved in cleaning and reconstruction.

Whenever practical, fragmented skeletal elements were reconstructed using polyvinyl acetate (PVA) as an adhesive so that anthropological measurements, observations, and assessments would be maximized. The application of PVA was also minimal. Bone surfaces were not coated in order to reduce contamination of chemical studies and to leave the bone surface visible. After the skeletal elements of an individual were cleaned and mended, initial data collection (inventory, age, and sex estimation) was performed by the OT responsible for that burial with the advisement of the laboratory director and/or the osteologist.

Data Collection and Skeletal Assessment

An inventory of all complete and fragmented skeletal elements was conducted for each burial to ascertain the relative state of preservation for each individual and the number of skeletal elements and their aspects that could be used as "populations" for group comparative purposes. For example, a research question concerning the knee joint might refer to the number of arthritic distal anterior femora (the upper part of the knee joint) as a percentage of all observable distal anterior femora, not as a percentage of skeletons from the burial ground. Therefore, keeping careful records of the preservation status of every significant bone by aspect (proximal third, middle third, less than 25 percent present, etc.) provides an important statistical control. The inventory was conducted according to *Standards for Data Collection from Human Remains* (Buikstra and Ubelaker 1994), hereafter referred to as the *Standards*.

A skeletal inventory was taken of every observable bone and tooth with the following preservation scores:

blank = missing data
1 = greater than 75 percent present = complete
2 = 25–75 percent present = partial
3 = less than 25 percent present = poor

The preservation of vertebral bodies and neural arches were recorded separately. Long bones were given separate scores for proximal end, proximal third, middle third, distal third, and distal end. Appendix C provides an accounting of the preservation status of this archaeological sample.

An anthropometric record was compiled for each measurable cranial dimension and postcranial element whose measurements bore potentially useful information (Figure 15). Measurements were not taken if damage, incomplete preservation, warpage, or limited reconstruction made accurate measurement improbable. Occasionally, measurements were approximated for bone elements with minimal alteration of size (as in some cases in which exfoliated cortical bone produced a 1–2 mm difference in length) and when we could estimate where a landmark had been and the degree of error involved. Any approximated measurements were specifically noted.

Figure 15. Allison Davis and Keisha Hurst take anthropometric measurements.

Measurements were taken bilaterally and in the metric system, using the following instruments as appropriate: (1) digital sliding caliper, (2) spreading caliper, (3) osteometric board, (4) measuring tape, and (5) mandibulometer.

Separate forms were used to record measurements for immature (less than 20 years old) and adult remains. All measurements for infants (defined as fetal to 3 years) were taken according to standards recommended for immature individuals. Postcranial measurements for children (3–12 years) and for adolescents (12–20 years) were recorded according to the same standards; however, when sufficiently complete, cranial and mandibular measurements were taken according to the more extensive adult anthropometric standards. Adolescent bone elements with fused

epiphyses (growth plates) were considered adult and measured as such.

Quality control was maintained by recording two sets of measurements for each skeleton, taken by different technicians or on different dates. The two sets of measurements were then compared in order to assess the degree of difference between them. When the degree of difference was greater than 5 percent of the average value of two measurements, then a third measurement was taken and compared to the previous two. This process continued until two measurements remained with a degree of difference of less than 5 percent. These two measurements were then averaged for analytical purposes. The 5 percent rule was applied as an alert to serious error. In fact, acceptable measurements were always much closer together than 5 percent of the size of the bone. We are confident of the accuracy of the final mean measurements used in our studies. The last two sets of measurements taken are available for examination as part of the permanent record of the project.

Sex Determination

Determination of sex was based on observed skeletal variations in shape and size known to differ between males and females. Each of 10 cranial, 7 pelvic, and 7 other postcranial characteristics were assigned a score on a scale of 1–5, with 1 demonstrating typical female configuration, 5 marking male morphology, and 3 being indeterminate. In most cases, a sex determination was achieved by finding the average score for all attributes. Commonly, however, skeletons with average scores denoting one sex also exhibited some characteristics indicative of the other sex. In such cases, greater weight was given to the most reliable sex determinants; these are elaborated below. When poor preservation eliminated all reliable sex indicators, sex was estimated as undetermined. Rationales for sex determination were recorded in the section reserved for comments in addition to the 24-item score sheet. Age was always a consideration when estimating sex, as many older skeletons may undergo degenerative changes, such as bone resorption or remodeling, which, if not accounted for, can complicate a sex assessment. Sex assessment in children is categorically questionable. We consider our sex assessments to be reliable for individuals who were 15–19 years of age and older. Although there are currently no widely accepted standards for determining sex in younger juveniles, a specialized study was conducted using an experimental approach that will be included in a subsequent chapter of this report.

When sufficiently complete, the pelvis is the most reliable indicator of sex. The subpubic angle (Figure 16), the ventral arch (Phenice 1969a, 1969b), and the presence or absence of the preauricular sulcus are particularly useful. Each trait was evaluated independently according to standards delineated by Phenice (1969a), Sutherland and Suchey (1991), and others. Older adolescent individuals whose pelvic bones showed qualitatively distinct female characteristics were generally assessed as female. An adolescent pelvis exhibiting male patterns, however, was considered ambiguous, as this could have also represented a female skeleton that had not yet reached full maturity (Buikstra and Ubelaker 1994:16). Considerable additional data would be needed to establish the sex of such a person.

Though not so reliable as the os coxae, estimation of age based on cranial morphology was also very useful for sex determination, especially in cases involving typically robust or gracile features. Each trait was scored according to standards described by Bass (1971, 1987), Krogman (1962a, 1962b), and Buikstra and Ubelaker (1994). For adolescents, in the absence of convincing pelvic indicators, a robust cranium was interpreted as an indication of overall maleness, and a gracile skull often resulted in an ambiguous overall diagnosis. Older age was also a consideration when determining how much influence to assign to cranial features in an overall sex assessment, as many adult skulls of either sex may exhibit a more masculine morphology with increasing age (Meindl et al. 1985). Additionally, with tooth loss, the mandible may undergo remodeling, which can also complicate sex determination (Figure 17).

Postcranial size dimensions proved highly variable in this sample. Measurements were taken and applied using the guidelines for sex determination in Dittrick (1979) and Thieme (1957). Many of the measurements conflicted with more accurate indicators such as pelvic morphology; therefore, they were often of less value in sex estimation. Except in cases of denoting "typical" maleness or femaleness, postcranial measurements (length of long bones, for example) were usually assigned less weight in sex determination than reproductive anatomy (pelvic characteristics). Given the robusticity of many of the New York African Burial Ground females, sexual characteristics that were not heavily influenced by biomechanical factors were favored over those that were most influenced by muscularity.

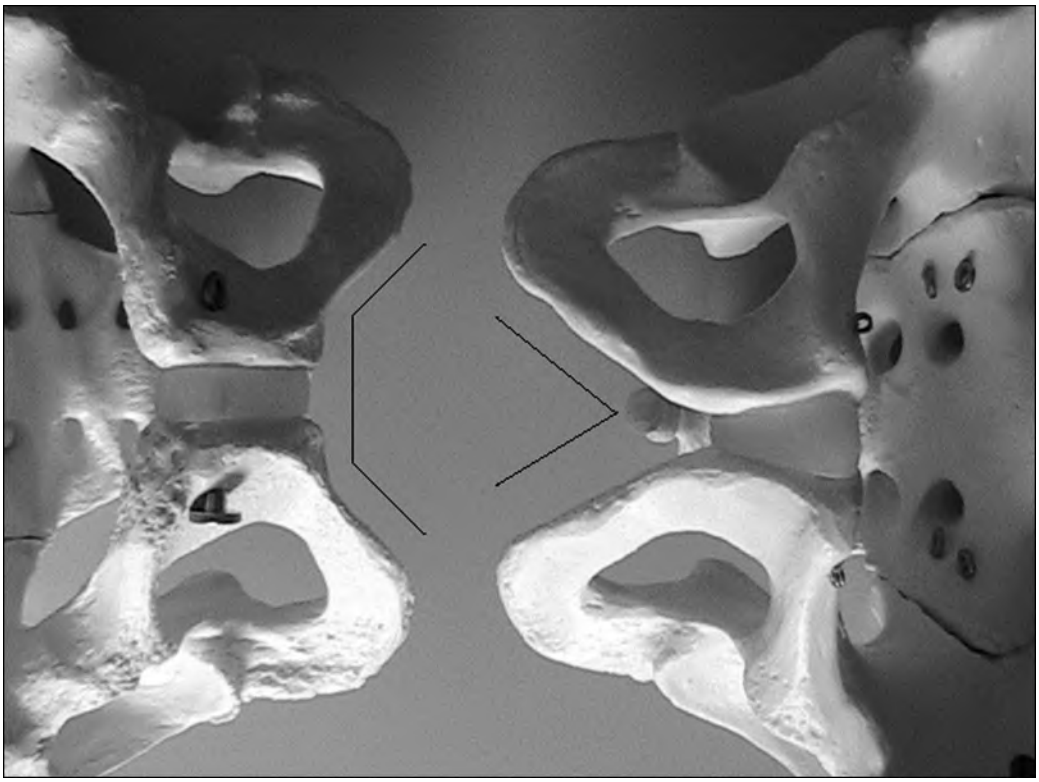

Figure 16. Comparative male and female pelvic shapes. Note the wide subpubic angle in the female (*left*) in relation to the male (*right*).

Figure 17. Geriatric left mandible for which long-standing toothlessness has obliterated most evidence of dental "sockets" (Burial 209).

Age Determination

Estimation of age at death involves the observation of numerous indicators of growth, development, and age-related degenerative changes. The desired composite age for each individual consisted of an estimated age range and mean age (mean of age range) obtained by evaluating and weighing the age estimates derived from several different aging criteria, such as epiphyseal closure and dental attrition. The estimates of each criterion were usually based upon age scores or estimates from a variety of bones or teeth. Although efforts were made to provide a mean age and age range for each skeleton assessed, advanced age and/

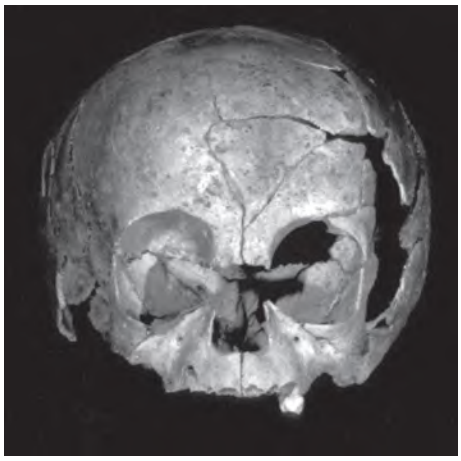

Figure 18. Cranium of infant 1–2 years of age (Burial 252).

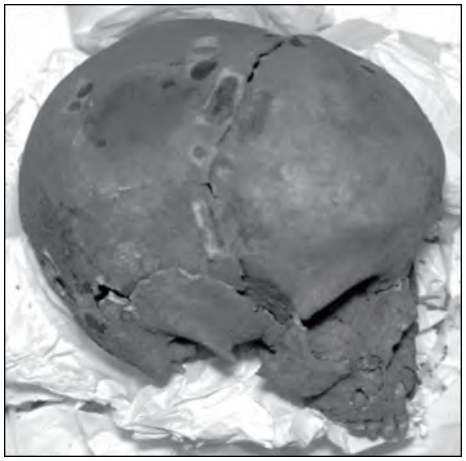

Figure 19. Child 5–7 years of age (Burial 39).

or poor preservation sometimes rendered this impossible. In such cases, only a minimal age was given (e.g., greater than 55).

When it was impossible even to calculate a minimal age, an attempt was made to assign the skeleton to one of the age classes listed in *Standards*: fetal (<birth), infants (birth–3 years), children (3–12 years), adolescents (12–20 years), young adults (20–35 years), middle adults (35–50 years), and old adults (50+ years). We were successful in estimating reliable upper and lower age ranges on three-quarters of the skeletal population without resorting to these general categories because of the large number of individuals (301) with well-preserved and sufficiently complete demographic indicators. The demographic analyses of the project rely solely upon this unusually large group of accurately aged individuals. Thus, statistical analyses at times refer to first- or second-year infants and other operationally convenient age ranges other than those of the *Standards* (see also pages 83–84 in this chapter).

For immature remains, composite age was determined by evaluating dental development, epiphyseal and primary ossification center fusion, and long-bone diaphyseal length. When possible, tympanic plate development was also evaluated for infants. Because of its high variability, long-bone diaphyseal length and iliac width were used as a primary age indicator only when no other elements were sufficiently preserved. Dental development, being little influenced by environmental factors, is the most accurate indicator of subadult age (Figures 18 and 19). Dental development was evaluated according to sequences of tooth formation and eruption (Figures 20 and 21) compiled by Ubelaker (1986, 1989), Gustafson and Koch (1974), and Moorrees et al. (1963a, 1963b). Up to 75 different developmental indicators were evaluated in estimates of the ages of immature individuals. Of these indicators, 32 were observations of epiphyseal union and primary centers of ossification. Each of these was scored in three stages that include nonunion, partial union, and complete union of the epiphyses and metaphyses of bones; these stages correspond to different developmental ages.

Degree of fusion for epiphyses and primary centers of ossification was also a valuable age indicator (Figures 22 and 23), yet there were a number of cases in which ages reached by assessing union were inconsistent with those determined by observing dental development. When this occurred, greater weight was given to dental development because of the greater environmental influences on bone growth and development. Fusion of primary ossification centers was evaluated for the vertebrae, os coxae, and the basilar portions of the occipital bones. Epiphyseal union was assessed for long-bone epiphyses, clavicles, and scapulae. For older adolescents, degrees of fusion were also assessed for bones of the hands and feet.

For adults, age at death was estimated by evaluating age-related degenerative changes on the pubic symphysis and auricular surfaces of the os coxae (Lovejoy et al. 1985), cranial sutures (Meindl and Lovejoy 1985), and sternal rib ends (İşcan et al. 1984a), and dental attrition (Figure 24). Osteoarthritic changes (eburnation, erosion, lipping, and various manifestations of osteophytosis) were also assessed for vertebrae and for the articular surfaces of various long bones. Late-

Figure 20. Mandible of 9–10-year-old child with permanent teeth in various stages of eruption compared with a dental aging chart (Ubelaker 1989) showing ages associated with different eruption stages.

Figure 22. Unfused epiphysis comprising the immature head of the femur of a 3–5-year-old (Burial 138).

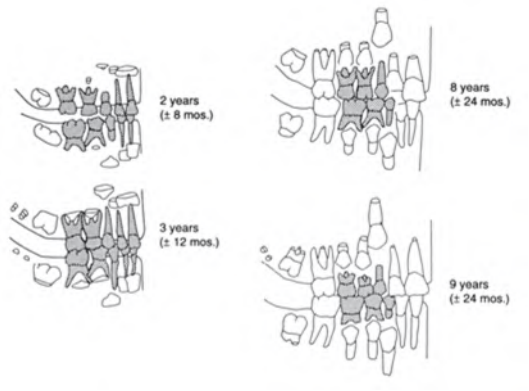

Figure 21. Deciduous teeth are shown in gray; permanent teeth are shown in white. Note the 9-year-old's development in lower right-hand corner.

Figure 23. Unfused epiphysis of a juvenile distal femur compared to a fully fused adult epiphysis.

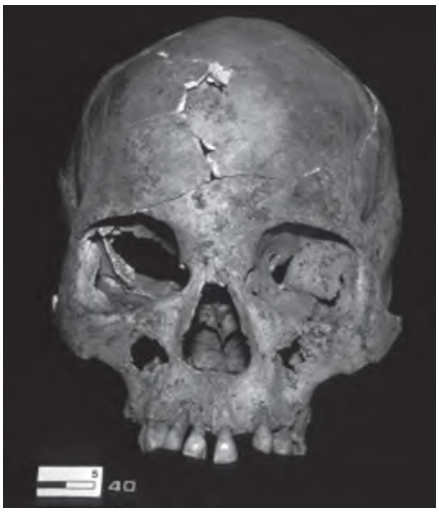

Figure 24. Elderly woman 50–60 years of age (Burial 40).

fusing skeletal elements, such as the sacral vertebrae, basilar synchondrosis, and the medial epiphysis of the clavicle, were also useful for distinguishing young adults from older remains, although there were a few cases in which skeletons that demonstrated advanced age-related changes in other features had incompletely fused sacral vertebrae. Delayed development of this kind, when not consistent with several other reliable age indicators, was considered an anomaly and was noted but discounted for age estimation. Evidence of delayed development has been considered however, in relation to load-bearing and other stressors that might reasonably have interfered with the development of

Figure 25. Pubic symphysis of a 45–50-year-old male (Burial 20, *left*) and Todd's 10 typical phases of age in the pubic symphysis.

particular bones. The potentially high skeletal stress of forced labor may also have brought about premature degeneration of the bones of the spine and true joints relative to chronological age. We believe that a conservative and reasonable accounting was given to each of these considerations.

The auricular surfaces of the ox coxae were more frequently preserved than pubic symphyseal surfaces. Age-related changes in auricular surfaces were evaluated in accordance with phases delineated by Lovejoy et al. (1985). Changes in the morphology of pubic symphyseal faces were documented by comparison with standard casts according to Todd (1921a, 1921b) and with consideration of methodological issues raised by Brooks and Suchey (1990) and Katz and Suchey (1986, 1989) (Figure 25). For both the auricular surface and the pubic symphysis, differences between the left and right sides were noted and recorded. Sternal rib change was evaluated according to phases defined by İşcan et al. (1984), and osteoarthritic variation was scored based on standards devised by Stewart (1958).

Various degrees of cranial suture closure were evaluated according to the scoring system devised by Meindl and Lovejoy (1985). When possible, suture closure was scored bilaterally because asymmetry in fusion rates was noted frequently. We were pleased to find that, although the age ranges estimated by this method tended to be very widely distributed, the mean age based on suture closure tended to be consistent with those of other aging methods. This method is clearly superior to earlier aging methods using this criterion. A maximum of 65 degenerative indicators of aging were scored for each individual.

After all available indicators had been evaluated, a composite age range and mean were determined. When ages ascertained from various features clustered tightly (usually within 6–24 months for subadults and within 5–10 years for well-preserved adult skeletons), every indicator was included in the composite age range, defining the low and high possible ages for the individual. In some cases, however, the age range estimated from perhaps one criterion differed widely from the others. This was usually cranial suture closure, according to the method of Meindl and Lovejoy (1985), which produced unusually broad age ranges but whose medians were very consistent with those of other methods. When this occurred, more weight was given to indicators that rendered ages that clustered than to outlier ages, such as cranial-suture age-range scores. Such outliers were recorded but did not become part of the composite age. A mean of the resulting composite age has been used for all analyses for ease of statistical manipulation. Wider age ranges, however, are especially useful when considering an individual skeleton because it will describe the likely error, the possible ages of that person at his or her death. Such broad age ranges are used in the descriptions of individual skeletons in Part 2 of this volume, *Burial Descriptions and Appendices*, and in Volume 2, Part 2 of this series, *The Archaeology of the New York African Burial Ground, Part 2: Descriptions of Burials (*Perry et. al. 2009b). When samples or groups of individuals are evaluated, especially the sizable archaeological population reported here, the single, average age for each individual becomes an adequate operational summary of their ages for statistical manipulation**.** Having many individuals within each analytical cell or field (such as the 5- or 1-year age categories we have used) means that they will represent the range of error (randomly biased above and below the true age) by virtue of the diversity and number of individual age estimates that, when large,

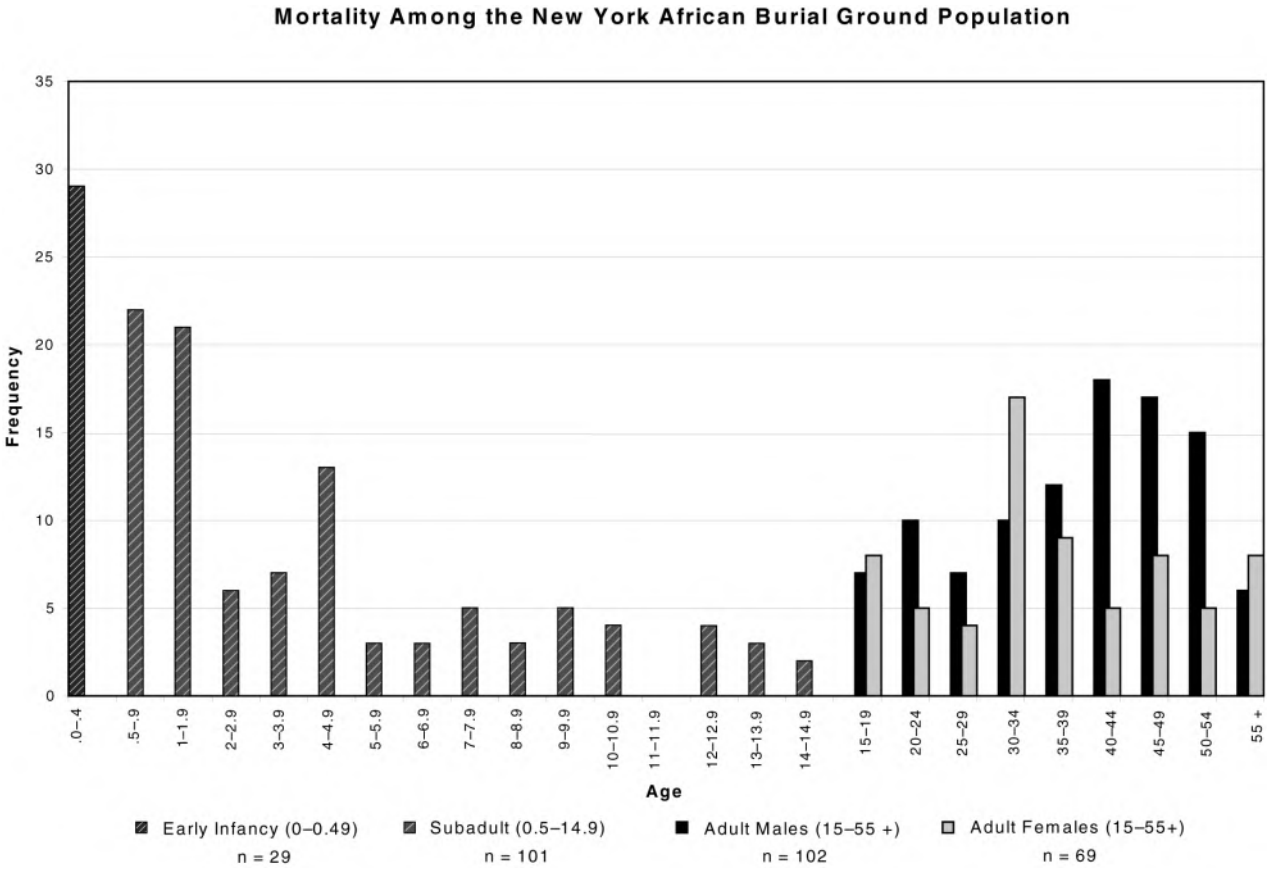

Figure 26: Bar graph representing sex and age at death using average ages for the 301 individuals observable for age and/ or sex.

begin to approach theoretical probability in which the biases cancel each other. In other words, the errors of bias are reduced in statistical treatments of groups by having sizable numbers of age-estimated individuals whose biased ages will be randomly too low for some and too high in others. Because these random, but small, errors in each direction will cancel each other out, the narrow age range in which their means fall (the 1- or 5-year interval around their mean ages in the histogram in (Figure 26) constitutes a reasonable operational summary age for the age group in question. One solution to the problem of smaller archaeological populations is to use very broad age groupings to accommodate the random errors of small populations/sample sizes so that one is reasonably certain an individual lies within the category of say, adult or infant. We believe that our sample was sufficiently large and the data set was extensive enough to use 1-year-age intervals for the demographic analysis of subadults whose developmental ages were the most accurately assessed and 5-year intervals for adults under 55 years of age. The idiosyncrasies of skeletal variation in older individuals are too great for a more reliable age estimate than 55 and older.

Dental Assessment

After the skeletal remains of each burial were cleaned and reconstructed, the dentition for each burial (permanent and/or deciduous) was cleaned, identified, assessed, and curated separately by the laboratory director and his assistants (Figure 27). Data collection was performed under the guidelines set forth in *Standards* and the *Arizona State University Dental Anthropology System*, under the methodological considerations of Goodman and Rose (1990), Blakey and Armelagos (1985), Rose et al. (1985), Rudney et al. (1983), Scott (1979), Smith (1984), and others. Recordation for the deciduous and/or permanent teeth included dental inventory, measurements, morphological traits, attrition rates, enamel defects, culturally induced alterations, and pathological observations (Table 1). A complete photographic record was constructed for each tooth, the overall dentition, and the

Figure 27. Laboratory Director Mark Mack conducts dental recordation.

maxillary and mandibular alveoli. If all teeth were present, we made a maximum of 96 measurements and 231 coded observations of morphology and developmental pathology. We also made numerous additional descriptive assessments of dental pathology.

Assessment of Bone Pathology

An experienced osteologist and an OT, with assistance of an OTA, in consultation with the scientific director, assessed each set of skeletal remains for pathologies, anomalies, and nonmetric genetic traits in bone. For consistency, the same osteologist carried out most of these assessments. Where staffing changes were made for pathology assessment and coding, care was taken by the scientific director to establish comparability among researchers. Assessment methods included the descriptive classifications of abnormality of shape, abnormality of size, abnormal bone loss, abnormal bone formation, fractures and dislocations, porotic hyperostosis, vertebral pathology, arthritis, and epigenetic traits used in the *Standards*. More specific descriptive subcategories of the *Standards* and traditional diagnostic interpretations (such as "meningitis," which is not included in the *Standards*) were included in these assessments. Pathology assessments were made as narrative descriptions as per earlier approaches than the *Standards* (such as the Paleopathology Association's guidelines for assessment) but with the *Standard's* coding method in mind. The project's use of "slight" versus "moderate to "severe" degrees of pathology, for example, is equivalent to the use of the *Standards*' categories of "barely discernable" and "clearly present," respectively (Figures 28 and 29). Having begun this research while *Standards* were still in development, we had the benefit of our colleagues' generous provision of the early manuscripts, and we developed an approach that bridged (and included) the traditional diagnostic and new, more descriptive methodologies. Chapter 10 addresses the pathology codes in greater detail.

Subsequently, an OT coded these descriptions with input from the scientific director and associate director for biological anthropology. The project's own coding method utilized a spreadsheet format that encompassed virtually all useful information of the *Standards'* coding scheme in one-third of the time required to use the latter code. As one of the first projects to test the *Standards,* we consider our approach to coding to be advisable because difficulties in coding have often been noted by those attempting to use the new protocol. Additionally, we compiled a complete photographic record of all pathologies by continuous consultation between the photographers and osteological staff. Detailed descriptions of pathologies can be found in subsequent chapters of this report. The project's database contains approximately 12,000 coded pathologies observed in the New York African Burial Ground population.

A photographer trained and experienced in the photographic documentation of skeletal remains was enlisted to carry out this task with the assistance of one OTA (Figure 30). The skeletal remains were photographed from a number of orientations to fully document each bone that contained information, as called for by the *Standards*. Photographic documentation was essential because the remains were to be reburied, and photographs would provide the only visual evidence for future researchers. OTs and OTAs contributed to photography as their experience increased over the life of the project. Photographs were later digitized at the Institute for Historical Biology at the College of William and Mary and the Cobb Laboratory.

Additionally, as a means of documentation, radiographs were taken of useful crania and long bones to discover pathologies that were not readily apparent by

Table 1. Codes for Dental Morphology and Dental Measurement

Code No.	Description
15	Tooth missing.
16	Not fully erupted; prevents measurement.
17	Calculus prevents observation.
18	Carries damage prevents measurement/scoring.
19	Crown missing or broken off.
20	Enamel wear; attrition prevents scoring.
21	Root unobservable (tooth in occlusion).
22	Postmortem enamel damage; prevents measurement.
23	Incomplete crown formation prevents measurement.
24	Tooth in occlusion, in pedestal, prevents measurement.
25	Tooth not in occlusion, prevents scoring.
26	Dental modification prevents measurement.
27	Pipe notch prevents measurement/scoring.
28	Filling, prevents measurement/scoring.
29	Scored only in the absence of Cusp 6.
30	18, 20
31	22, 26
32	17, 22
33	20, 22
34	22, 28
35	Incomplete root formation.
36	CEJ damaged, prevents measurement.
37	Root damage, prevents measurement/scoring.
38	Peg incisor (used only when scoring shoveling trait and peg incisor involved).
39	Enamel defects prevent measurement/scoring.
40	Traumatic fracture; prevents measurement/scoring.
41	Root fusion; prevents measurement/scoring.
50	Entire tooth surface affected by enamel defect.
51	Occlusal surface of incomplete crown affected by enamel defect.
52	Coronal surface of incomplete crown affected by enamel defect.
53	Enamel defect present but can’t be measured.

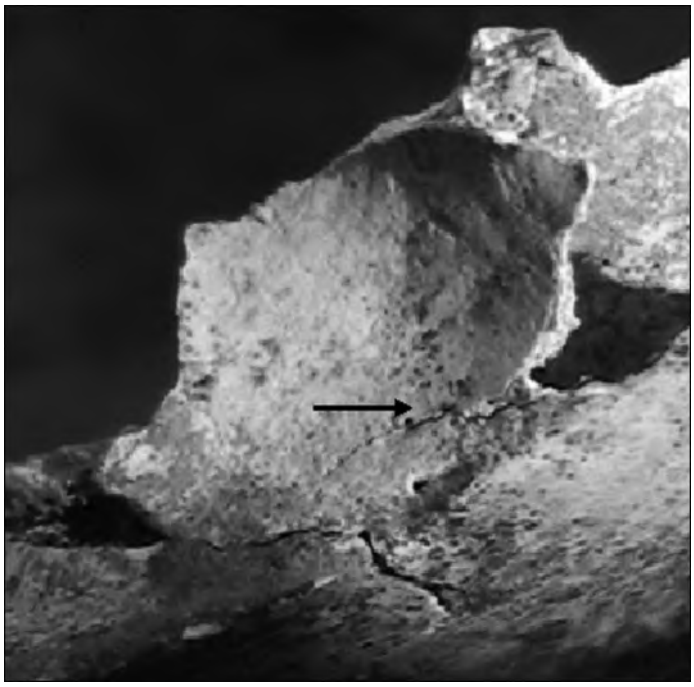

Figure 28. Barely discernable porotic hyperostosis.

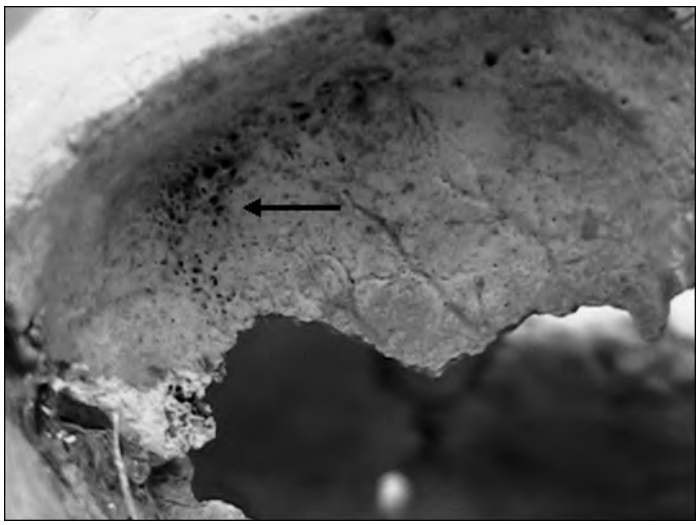

Figure 29. Clearly present porotic hyperostosis.

visual observation. Inventory radiographs made by the Department of Radiology at Howard University Hospital and by the Department of Orthopedics and the College of Dentistry at Howard University utilized X-ray settings recommended by the *Standards.* Specialized radiographs made with a portable machine at the Cobb Laboratory provided immediate images that aided in the assessments of age and traumatic fracture.

Sectioned Bone Samples

Samples of right femora, humeri, fibulae, and ribs were taken according to the *Standards* protocol for sectioning. Sectioning was done after all other work was completed. Bone and dental tissue samples are to be used for histology, chemistry, DNA, histomorphometry, and curation. DNA samples (from the right

Figure 30. Photographer Jerome Otto Edwards and Osteologist M. Cassandra Hill photographing cranium.

fibulae) were cut using a clean bench with reverse airflow, and handsaws were bathed in ethanol and chlorine to remove all proteins between cuts in order to eliminate interindividual DNA contamination (mixing). Gloves and dust masks were worn at all times. All other samples were obtained with a band saw, using steel mesh gloves for personnel safety. A total of 8 cm of bone was removed from each skeleton when possible. Appendix B contains an example of a file for a well-preserved adult (Burial 101), showing the specific methods or observations mentioned in this chapter.

The New York African Burial Ground sample database is too large to be rendered as tables in this volume and is to be made available in electronic media.

Skeletal Curation

After photography and radiography, the bones from each individual were carefully stored in airtight metal cabinets under the controlled conditions described in the previous chapter of this report. The skeletal remains were routinely monitored, and we took curation and protection of these ancestral remains as an important, traditional, custodial duty. Public care for the remains has taken other forms including religious observances. Provision was made for a shrine at the laboratory entrance that has been kept by Ife (Yoruba) cultural practitioners (Figure 31). All skeletal remains were reburied as part of the Rites of Ancestral Return ceremonies in October 2003.

Figure 31. African American Ife Shrine in the Cobb Laboratory.

Section II:

Origins and Arrival of Africans in Colonial New York

CHAPTER 5

Origins of the New York African Burial Ground Population: Biological Evidence of Geographical and Macroethnic Affiliations Using Craniometrics, Dental Morphology, and Preliminary Genetic Analyses

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Introduction and Theoretical Perspectives

Origins are central to understanding the past and present identity of a people. Origin studies provide, under optimal conditions, a context for all other assessments, such as archaeological, biomedical, and nutritional evaluations. Characterizing the phenotypic status and determining the origins of the eighteenth-century New York African population and those individuals interred in the New York African Burial Ground were among the project's major goals. Toward that end, our craniometric, dental morphology, and genetic teams collaborated extensively with project historians and archaeologists to develop a biocultural, interdisciplinary research strategy for a historically and ethnographically informed interpretation of the ancestral origins of the people disinterred from the New York African Burial Ground. Our research strategy addressed the inquiries of the descendant African American community with the professional scientific rigor demanded by our disciplines.

At this point in our investigations, the craniometric and dental morphology data are the most complete and well-developed lines of evidence for establishing relationships between the New York African Burial Ground individuals and other world groups. Craniometric evaluations for the purpose of determining ancestral origins have been applied to anthropological populations for a very long time and have a rich history. Classically, such studies were focused on typological racial assessments. This was not the case in the studies by Froment and Keita and Shujaa discussed within this chapter that quantified craniometrical diversity and then compared this variability with a broad range of historical-period and modern African and non-African groups. Dental morphology studies are a well-established basis for assessing presumable genetic relationships between skeletal populations. This chapter contains a dental morphology study by Mayes and Mack that addresses the biological diversity in dentition observed among the New York African Burial Ground individuals and the historical population affiliations associated with this variability. Both the craniometric and dental morphology studies confirm the African regional backgrounds of the New York population and probe the current limits for establishing greater ethnic specificity using such traditional methodology and comparative statistics.

Molecular genetic assessment, our third approach to determining ancestral origins, is a rapidly emerging and extremely precise set of techniques used to match individuals with specific geographical regional groups, often with a high degree of reliability. Preliminary genetic studies by George and Kittles suggest that, based upon DNA analysis, much of the genetic diversity characterizing a subsample of New York

African Burial Ground individuals was decidedly West and Central African in origin. In a few cases, these preliminary results localized specific individuals to precise geographical regions of West and Central Africa and suggested macroethnic affiliations. These preliminary studies, which focused on a subset of the New York African Burial Ground individuals, clearly point to the feasibility and utility of continued research in this area. Jackson's initial work provides a road map for these future studies.

Database Limitations, Research Strategies, and Historical and Evolutionary Contexts

Despite this focus, all four bioanthropological lines of evidence—dental morphology, nonmetric phenotypic traits, craniometrics, and molecular genetics—encountered problems in the comparative analysis of the data. The most significant problem encountered was the dearth of appropriate, nonracialized studies of African, Native American, and European population biology diversity for comparative assessments with the individuals of the New York African Burial Ground. Of particular note is the continued paucity of data on intra-African diversity. For example, substantive nonmetric-trait studies that include African populations are not available in the published literature. This important limitation in the database is being partially addressed at a number of levels, including the development, in 2002, of the first human DNA bank in Africa by Jackson, Mbah, and colleagues. The aim of this project, as a direct response to the needs of the New York African Burial Ground analyses, is to have a full representation of—and public access to—continental-African molecular genetic diversity that can be linked to geographical region, ecological setting, national identity, and ethnicity. Similar efforts are underway to characterize the genetic diversity among East Coast Native American groups (David Glenn Smith, personal communication 2003).

Another limitation of our sample for broader extrapolations is that the Africans and African Americans enslaved in New York represent a distinct minority of North American captives. In 1790, there were nearly half a million Africans and African Americans enslaved in the United States. Of these 491,157 individuals, only 21,193 (approximately 4.3 percent of all enslaved persons) resided in New York State. The majority of these individuals were in New York City. Therefore, the representativeness of this subset of North America's enslaved population is likely problematic. The origins of the New York African Burial Ground individuals may not reflect the origins of enslaved Africans elsewhere in the Americas.

A third limitation in extrapolating results from our studies was the size of the subset of retrieved individuals from the New York African Burial Ground. The approximately 400 individuals retrieved from an estimated 15,000 of those interred represent less than 3 percent of the estimated total number of buried individuals. The representativeness of this subset for all of New York City's enslaved persons is likely problematic. The retrieved individuals came from a limited area of the actual burial ground and may represent a clustering of genetically related and/or phenotypically affiliated individuals. Indeed, a preliminary analysis of mitochondrial DNA (mtDNA) based interrelationship in a small group of interred individuals suggests close maternal affiliations between particular burials. Additional genetic tests based on Y chromosome haplotypes and autosomal genes are warranted to further illuminate the genetic interrelationships of the individuals recovered from the New York African Burial Ground; along with molecular sex determinations of all individuals.

Finally, for a number of historical and evolutionary reasons, it was very difficult to reconstruct the exact modern or historical African ethnic group(s) to which a specific New York African Burial Ground individual belonged, because New World Africans (including African Americans) are highly heterogeneous and represent an amalgamation of genes from diverse African ethnic groups in addition to highly variable genetic contributions from non-Africans, primarily Europeans and Native Americans. Many of the European slaving vessels picked up shipments of captive Africans from various points on the coasts of Africa. In gathering captives in this manner, the vast majority of shipments contained a rainbow of ethnicities that eventually found their way to the docks, households, and plantation work sites of the Americas. This created a plethora of African ethnicities with maximal opportunities for gene flow between individuals that had, on the continent of Africa, remained distinct. On the small island of Dominica alone, there were captives from diverse areas in Africa, such as Old and New Calabar, Gambia, Cape Mount, Angola, Bonny, Cameroon, and Anamaboo (Selwyn H. H. Carrington, personal communication 2002). These

names only refer to the regions from which the Africans were acquired for shipment, not their specific ethnic groups. A similar scenario was anticipated for New Amsterdam/New York City, thus complicating the efforts to link specific New York African Burial Ground individuals to particular African ethnic groups. As the specificity of the African databases improves, we should be able to detail regional and macroethnic levels of genetic nuance. Indeed, our preliminary molecular genetic studies have already allowed this level of sophisticated assessment.

The Atlantic trade in 10–50 million enslaved Africans and the interactions of the survivors and their descendants in the Americas provide the ancestral foundations for the individuals interred in the New York African Burial Ground. Both the geographical extensiveness of the trade in enslaved Africans, often deep into the interior of the continent, and the diversity of their interactions with each other and with non-Africans (Europeans and Native Americans) warrant that a broad array of regional groups be included for origin-reconstruction studies. This is reflected in the research strategies implemented for the craniometric, dental morphology, and molecular genetic components of our study; comparisons were made with available African, Native American, and European groups. However, the dominant African origins of New York African Burial Ground individuals became evident early in our analyses. Once the primacy of African origins was obvious from craniometric, dental, and molecular genetic data, we sought to further refine our studies to identify where in Africa these individuals may have had their strongest ancestral ties.

The historical record indicates 10 major geographical regions as sites from which enslaved Africans were likely exported to New Amsterdam/New York during the time frame of the New York African Burial Ground (Figures 32 and 33). Additionally, the origin, number, initial entry points, and subsequent reexportation routes of enslaved Africans to the Americas (e.g., Caribbean trade to New York) have been identified (see Volume 3 of this series, *Historical Perspectives of the African Burial Ground*, Chapters 2, 6, and 7). These historical data help us better understand the potential for genetic and phenotypic variations among the New York African Burial Ground individuals, based upon the likelihood of gene flow among previously diverse Africans, gene flow with non-Africans, possibilities of genetic drift and bottleneck effects, and various types of selection at particular points in the historical record. The historical information also suggests the ethnic and regional identities of potential reference ancestral groups (specific groups of Native Americans that may have biologically interacted with the Africans of New York), as well as the characteristics of the data banks (e.g., distinctive morphological traits) necessary to ascertain the origins of New York Africans interred in the New York African Burial Ground.

The larger context for reconstructing the origins of the New York African Burial Ground individuals is within the current paradigm of modern human origins. The available molecular and skeletal information on recent human evolution favors a recent African origin of modern humans who spread out of Africa approximately 100,000–200,000 years ago (Ayala and Escalante 1996). In this context then, non-African diversity represents a subset of African heterogeneity, complicating somewhat our search for continental and population-specific phenotypic and genotypic markers. However, for all of the useful polymorphic traits studied, African levels of diversity have exceeded those observed in non-Africans, and much of the African diversity appears to be clustered geographically and/or ethnically. Theoretically, this implies that genetic and phenotypic assessments of the New York African Burial Ground individuals should be able to identify whether they are of predominantly African or non-African origin, and, if they are African, with which regions of the continent they share ancestral affinities. Furthermore, existing craniometric, dental morphology, and molecular genetic variation allow us to characterize these individuals in relation to themselves and to address questions of kinship within the group.

Research Questions

The four major questions to be addressed in using genetics and phenotype to reconstruct the ancestral origins of the New York African Burial Ground population are:

1. Is it possible to differentiate between continental groups (Africans, Europeans, and Native Americans as a subset of Asians) at the genetic and/or phenotypic levels?

2. In the New York African Burial Ground sample, is it possible to differentiate genetically and/or phenotypically among the ancestral Africans, ancestral Europeans, and ancestral Native Americans coming from various historically relevant geographical areas and germane ethnic groups within a specific continent?

Figure 32. Major African exit points for enslaved individuals bound for New York in the seventeenth and eighteenth century. Additional exit points (not shown) include Mozambique and western Madagascar as well as the Atlantic islands off of West Africa (e.g., Cape Verde).

3. Is it possible to differentiate sex-linked differences in ancestral origins and biological affinity among those interred in the New York African Burial Ground?

4. Most importantly, is it possible to differentiate among the Africans, who most likely contributed disproportionately to the ancestral backgrounds of those interred in the New York African Burial Ground, from various regions of Africa and between different macroethnic groups of Africa?

In other words, we are especially interested in the complex relationships of this sample population to each other and to the larger world. These distinct but complementary levels of assessment are critical for ascertaining the origins of those interred in the New York African Burial Ground and for refining existing databases for future genetics studies of the origins of the people of the African Diaspora. The New York African Burial Ground Project research team has begun to notably contribute to the existing databases.

Research Background Synopsis

The importance of integrating phenotypic and genotypic variation in our assessments of biological lineage and ancestral origins is evident from the wealth of such studies in the published literature. There is considerable variation between and within populations

Figure 33. Exit regions for enslaved Africans bound for New York, Central and South America, and the Caribbean in the seventeenth and eighteenth centuries.

(e.g., with regard to such traits as tooth size, congenitally missing teeth, crown morphology, mtDNA haplogroups, etc.). These differences are a reflection of the ongoing process of evolution and can be used to accurately reconstruct ancestral origins in specific populations when contextualized by an appropriate understanding of history and the environment.

Craniometric Assessments

Assessments of craniometric variation from Africa, Europe, and Asia basically support the dominant African-centered genetic and archaeological models of human origins and microevolution (Relethford and Jorde 1999). The average heterozygosity is significantly higher among Africans indigenous to the sub-Saharan areas of the continent than among non-Africans. An early study (Relethford and Harpending 1994) of worldwide variation in within-group phenotypic variation used a large set of craniometric data that represented major Old World geographic regions. The study included 57 measurements for 1,159 cases in four regions: Europe, sub-Saharan Africa, Australasia, and the Far East. Relethford and Harpending predicted a linear relationship between variation within populations (the average within-group variance) and variation between populations (the genetic distance of populations to pooled phenotypic means). If this prediction continues to hold true, craniometric data should also facilitate testing our hypothesis about the ancestral origins of individuals retrieved from the New York African Burial Ground.

Dental-Trait Variants

The study of teeth has historically been an informative means of demonstrating patterns of human dispersals (Shields 1999). The multivariate analysis of worldwide dental-phenotype microevolution suggests that world patterns are also broadly in accord with the dominant interpretation of genetic, archaeological, and other dental data. Like these data, dental morphology suggests an African (i.e., San, West Africa, and Bantu) origin and subsequent dispersal for extant humanity. According to a prevailing interpretation of dental-trait variation, the first modern-human African

emigrants who did not become extinct were Southeast Asian Negritos. All Eurasians then emerged and expanded through a series of now extinct antecedent populations branching from the short lineage extending from Negritos to Australian aborigines. Proto-Europeans were the first group to fission from this lineage. Under this dental-morphology-generated hypothesis of modern-human origins and subsequent differentiation, the next groups to have emerged were antecedent Southeast Asians, from which present Southeast Asians and then antecedent east Central Asians then diverged. Independently, people from the region of Mongolia and all Native Americans arose as daughter populations from antecedent East Central Asians (Shields 1999). Given this scenario, we should be able to find dental variants that distinguish between various continental groups of contemporary humans as well as high dental-morphology diversity within Africa.

Fortunately, the study of European genetic diversity has been quite extensive, and the characterizations of the relevant groups for our intracontinental comparisons are more advanced. Of greatest relevance to our testing of the second research question is evidence of genetic and phenotypic diversity among the Dutch, Spaniards, Portuguese, English, Scots, Irish, French, Danes, and Germans because these groups were the most active in the transatlantic trade in enslaved Africans and/or maintained the greatest potential (based on proximity) for contributing to the gene pool of the New York population.

Molecular Genetics

Applied genetics is of increasing relevance in our efforts to reconstruct the origins of long-deceased populations. New methods, new techniques, and the increased ease with which sophisticated assessments can be made have provided new ways of knowing the long-buried histories of individuals and, by extension, their groups. In a recent article, senior geneticists Cavalli-Sforza and Feldman (2002) noted that the past decade of advances in molecular genetic technology has heralded a new era for all evolutionary studies but especially the science of human evolution. Data on various kinds of DNA variation in human populations are rapidly accumulating, particularly markers from mtDNA and the Y chromosome. The evolution of the human mitochondrial genome is characterized by the emergence of geographically distinct lineages or haplogroups. Significant differences between the three African, nine European, and seven Asian (including Native American) haplogroups make it now possible to confirm or reject an African genetic origin from studies using mtDNA. Indeed, the analysis of nucleotide sequences of the D-loop of mtDNA derived from the aDNA of a small sample of New York African Burial Ground individuals has been very informative in confirming the continental origin (Africa) and in its subsequent elaboration of the geographical region, within-continent identities of nearly 50 New York African Burial Ground individuals.

Methods, Data, and Results

Craniometrics

The scope of the present study is not about human variation in general and therefore does not include populations from all around the world; the issue was to assess the origins of the people buried at the burial ground as they represent the New York African community of the time. These origins combine three roots:

1. The geographical origin in Africa (according to the historical analysis, the primary sources of the enslaved population was from Central and Western Africa, with minor Madagascan and Southern African components)

2. Some admixture with the European colonists in America and traders in Africa

3. Some admixture with Native Americans

To undertake such a comparative study, it was necessary to first build a reference collection of European, African, and Native American populations, ideally of the same period (ca. 1650–1769). Two decisions were made: (1) we would consider only adults, and (2) we would limit comparisons to skull measurements. The first decision was based on the fact that there are virtually no studies on subadult skeletons, due to the underrepresentation of subadults in cemetery populations (because of preservation and/or cultural processes); the disarticulated nature of subadult crania; and the difficulty in determining sex until late adolescence (unless performing DNA testing).

The second decision, to study only crania, was based on the status of this type of research and not the potential utility of the postcranial skeleton for assessing ecological variation. Unfortunately, most skeletal biological research concerning anatomical variation focuses on stature, race, and sex assessments, whereas the primary research on anatomical varia-

tion has been developed within human adaptability research on living populations. These data have not been correlated with skeletal analyses. Therefore, the cranial element of the human skeleton remains the most-studied element for comparative analysis and is still highly racialized.

A literature review for intercontinental and intracontinental crania variation was undertaken. The literature review revealed that there was a paucity of individual-level data, and sample variation was reported primarily by means and standard deviations only. In addition, only limited standardized measurements (usually 6–15) have been published, resulting in a loss of biologically relevant information. In this study, no reference to any "racial" definition was made, as the multivariate analysis does not require it, and the scatter plots speak for themselves to express the resemblance between individuals, without the use of closed biological categories. Table 2 identifies the populations used in this study and the sources from which they came.

Statistical Analysis

A stepwise discriminant function analysis was undertaken using the statistical software package Statistical Package for Social Sciences (SPSS). The purpose of the analysis was to classify a series of unknown origin objects, the New York African Burial Ground skulls, into groups defined on a geographical basis by simultaneously using multiple variables (cranial measurements). A preliminary, univariate statistical analysis verified that the variables studied display a normal distribution. Then canonical discriminant functions were generated, each function expressing a part of the total variance and displaying, more or less, an important correlation with some of the discriminating variables. We calculated distances between individuals and plotted crania in a hyperspace of the same dimension as the number of variables considered. The Mahalanobis metric, a generalized Euclidean metric, was employed to measure the distance between two points in this hyperspace because it adequately accounts for correlated variables.

Associated with each group in a sample is a point called the group centroid; this represents the means for all variables in the hyperspace defined by variables in the model. A case is said to belong to a group if the Mahalanobis distance of the case from the group's centroid is smaller than the Mahalanobis distance from any other group's centroid.

The number of variables included for analysis must be smaller than the size of the sample; this condition was met in this study. The number of individuals in each subsample (n = 20–28) was greater than the number of variables, which varied from 5 to 12 based on the completeness of the crania. When a cranium was incomplete, the number of variables was reduced; we did not attempt to replace any missing measurement by an estimate. An individual with a missing variable was excluded from the analysis, thus explaining the variation in sample size. Therefore, the strategy was to maximize the number of individuals without minimizing the number of variables for analysis.

Results

Although the New York sample was heterogeneous craniometrically, this analysis indicates that a majority of New York African Burial Ground individuals can be considered African. Four individuals (n = 20–28 complete skulls) were closer to Europeans than to Africans, yet they were within the overlapping ranges of both geographic populations (Figure 34). Because the greater proportion of West and Central African crania clustered closely, they are not distinguishable. Most New York African Burial Ground crania were clearly primarily Central and West African, although four to five individuals were within the range of South Africa.

When comparing the New York African Burial Ground sample with a sample from a Guadeloupe, French West Indies, cemetery that had only enslaved Africans, both the New York African Burial Ground and Guadeloupe samples clustered with Africans (Figure 35). The Native American component in the New York African Burial Ground sample could not be definitively confirmed; in fact, only one individual plotted close to a Native American, and both of these individuals were in the overlapping range with Europeans (see Figure 35).

In any world population, there is considerable individual variation. In a sample of heterogeneous origin, such as the New York African Burial Ground sample, variation is even greater. Yet this analysis demonstrates that those individuals interred in the burial ground were of African origin; what this analysis cannot do is to identify the specific geographic areas narrowly, nor can it identify specific African ethnic groups. Based on adaptation and ecological theory and other lines of evidence, this should be possible, but only substantive, relevant reference populations

Table 2. Population Sources for Craniometric Analysis by Froment

Population	No. of Individuals	Reference
New York African Burial Ground	59	present study
Europe		
City of Lyon (France)	271	Buyle-Bodin 1982
Valais (Switzerland)	785	Pittard 1911
City of Firenze (Italy)	131	Florence Museum collection
Norse (Norway)	110	Howells 1989
Grodek, Poland, thirteenth to seventeenth centuries	264	Belniak et al. 1961
West Africa		
Ashanti (and other Ghanaians)	114	Shrubsall 1899a
Ibo and Calabar area (Nigeria)	71	*in* Ribot 2002
Senegal (Seerer and Iron Age)	96	*in* Ribot 2002
Dogon (Mali)	127	Howells 1989
Tellem (early Mali)	134	
Togo and Benin	22	*in* Ribot 2002
Central Africa		
Cameroon (mainly Grassfields)	133	Drontschilow 1913
BaSuku D.R.Congo	155	*in* Ribot 2002
Various D.R.Congo (Zande, Kongo)	68	*in* Ribot 2002
Tetela, D.R.C.	82	Benington 1912
Bantu from Gabon	141	Benington 1912
South Africa		
Zulu	125	Howells 1989; Shrubsall 1899b
Nguni	27	*in* Ribot 2002
Xhosa	48	*in* Ribot 2002
Various Bantu South Africa	19	*in* Ribot 2002
Ovambo	36	Hrdlička 1928b
East Africa (just for comparison)		
Dschagga Kilimandjaro	30	Wide 1896
Teita (Kenya)	29	Kitson 1931
Native Americans		
Algonquin (mainly Virginia)	111	Hrdlička 1927b
Connecticut, Delaware, Maine	53	Hrdlička 1927b
Huron	24	Hrdlička 1927b
Massachusetts	41	Hrdlička 1927b
Manhattan, Long Island, Rhode Island	115	Hrdlička 1927b
Central California	120	Breschini and Haversat 1980
Labrador "Indians"	89	Stewart 1939b
Guadeloupe slave cemetery (French West Indies)	43	Patrice Courtaud, personal communication 2002; Courtaud 1999

Note: The study by Ribot (2002) is a large compilation of available literature, where complete references can be found; many series have been measured by Ribot, M. Lahr, or G. Thilmans; unpublished studies by Froment have also been included.

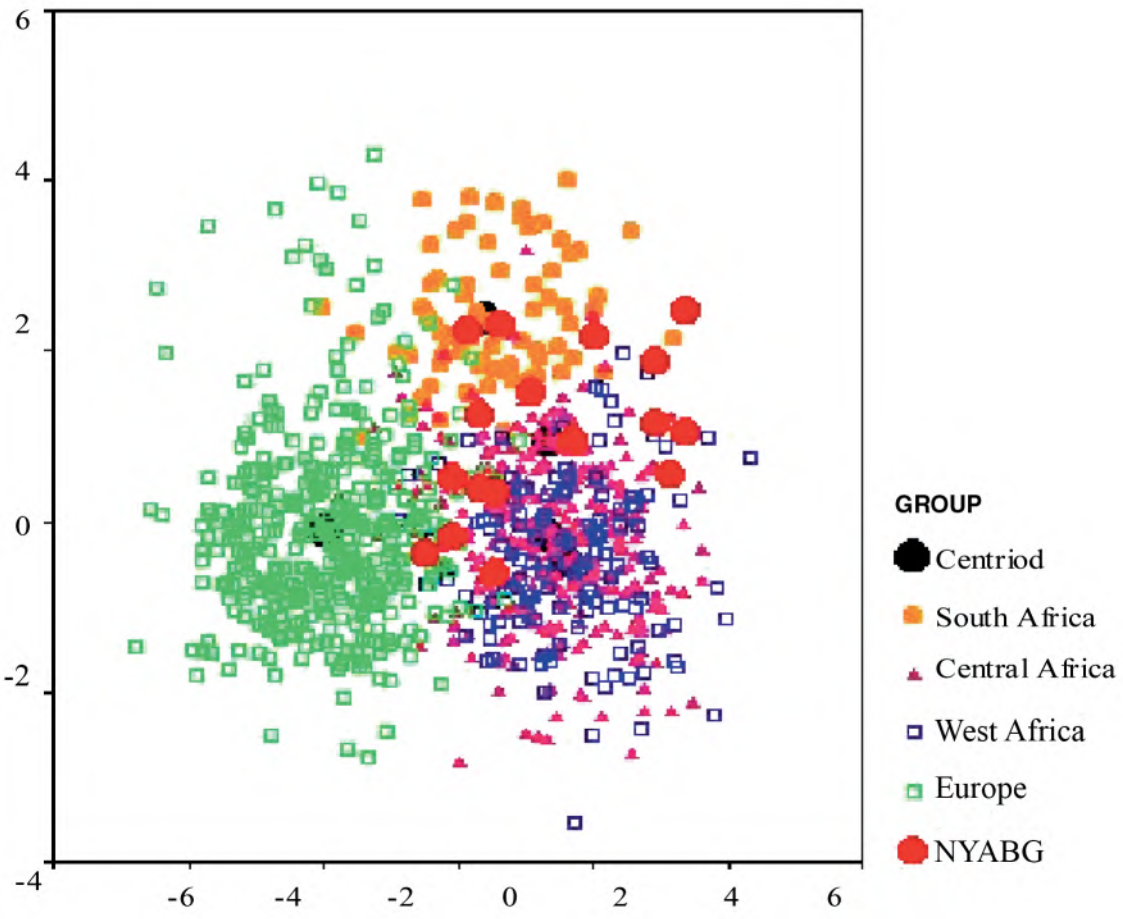


Figure 34. New York African Burial Ground skull shape analysis (Mahalanobis Distance): New York African Burial Ground population (red dots) compared to Southern and Northern Europe (green squares, n = 357), West Africa (blue squares, n = 115), Central Africa (pink triangles, n = 342), South Africa (brown dots, n = 59). Centroids are in black.

would provide a means to test hypotheses and undertake these analyses.

In another craniometric analysis, Keita and Shujaa used exclusively male crania to assess population affinities using the requirement of at least 10 measurements per skull; they used male crania because more of these were intact or sufficiently reconstructed (n = 26 with at least 10 standard measurements) than female crania for the required sex-specific analysis. These crania were from burials distributed across the site. The comparative material was from Howells's (1973) study (Table 3), measurements of crania from Gabon taken by Keita, and crania measured by Shujaa at the American Museum of Natural History (AMNH) for the New York African Burial Ground Project researchers (see Table 3).

Ten craniometric variables were taken: maximum breadth, biauricular breadth, basion-bregma, height, maximum length, upper facial height, nasal breadth, nasal height, bizygomatic breadth, basion-prosthion length, and basion-nasion length. Using the SPSS, the New York African Burial Ground cranial series was analyzed with the others using canonical discriminant functions (see Table 3). The centroid values place the New York crania nearest the series from the Akan-speaking Ashanti (Asante) and Gold Coast series of the AMNH, which form the modern nation of Ghana. Statistical proximity to populations that are historically unlikely to have had an opportunity to contribute genes to the New York population may exhibit morphological similarity that is unrelated to any close lineage affiliations. Thus, Gold Coast individuals may be considered relevant candidates for a parental population to the New York African Burial Ground individuals, but others, such as the Tolai of New Guinea, are historically implausible.

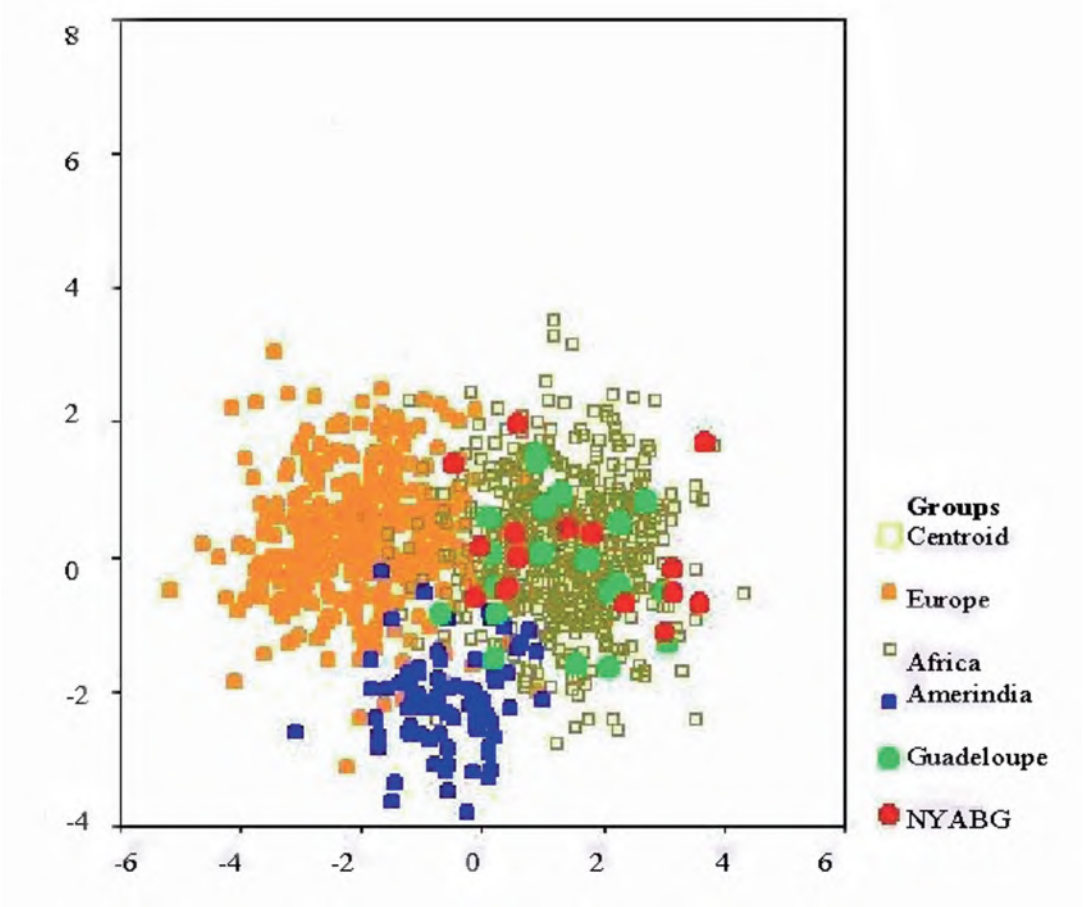


Figure 35. Scatter plot of craniometric distance: New York African Burial Ground population (red dots) compared to all Europe (orange squares), all Africa (olive squares), Native Americans (blue squares), and a seventeenth- and eighteenth-century cemetery from Guadeloupe, French West Indies (green dots).

The first two functions account for 54 percent of the variance, with eigenvalues of 2.03 and 1.05, respectively. The results of this study are consistent with known historical data. Many Africans were brought to English colonial America from what are now the modern nations of Ghana, Angola, Democratic Republic of Congo, and the Senegambia region (modern-day Senegal and Gambia) (Curtin 1969; Diouf 2003; Gomez 1998).

Future research should include an analysis that only uses skeletal series from the regions that "contributed" most heavily in the seventeenth through eighteenth centuries to the Africans who were captured and enslaved in New York. The New York African Burial Ground Project collected primary data on Ghanaian populations at the AMNH, which provided a more diverse array of ethnic affiliations than was previously available from the published data on historical-period populations. Previous genetics and physical anthropological research has not focused on the question of African American ethnic origins and thus has not over time produced a body of literature and appropriate comparative series for such analyses to be readily undertaken. Where African affinities or admixture have been studied, "racial" composites of diverse "sub-Saharan" or, at best, "West African" groups were constructed for analysis. The discussion of dental morphology below raises similar issues to these. There is a clear need to collect metric data on culturally specific, historically relevant comparative populations in order to fully examine the range of the New York African Burial Ground origins.

In fact, much the same can be said of colonial English and Dutch populations. The closest Western European groups available in the Howells series (the most extensive series, generously provided to us by its author) are Scandinavian. The AMNH collections (also graciously made available by Dr. Ian Tattersall) do not have a European series. Alternate collections that include the appropriate populations have been

Table 3. Centroid Values for Howells's, AMNH's, and Keita's Cranial Series, Functions 1 and 2

Group	Population Source	Function 1	Function 2
	Howells's Cranial Series		
1	Norse (Norway)	0.49	-0.81
2	Zalavar (Hungary)	0.67	-0.28
3	Berg (Sweden)	2.00	-1.33
4	Teita (Kenya)	-1.84	-0.48
5	Dogon (Mali)	-1.08	-0.80
6	Zulu (South Africa)	-1.56	-0.26
7	Australia	-2.48	-0.62
8	Tasmania	-1.32	-0.55
9	Tolai (New Guinea)	-2.02	0.46
10	Mokapu (Hawaii)	0.52	1.54
11	Easter Island	-1.39	2.25
12	Moriori	1.10	0.73
13	Ankara (Plains Indians)	1.83	0.33
14	Santa Cruz	0.70	-0.78
15	Peru	0.77	-0.82
16	North Japan	0.81	0.36
17	South Japan	0.37	0.73
18	Hainan	0.77	0.62
19	Atayal	0.23	0.21
20	Philippines	0.62	0.47
21	Guam	0.66	1.76
22	Egypt (ancient, Late period)	0.24	-5.62
23	Bushman	-1.63	-2.49
24	Andaman Islands	-1.90	-1.00
25	Ainu	-0.21	0.19
26	Buriat (Siberia)	3.70	-0.63
27	« Eskimo »	-0.29	1.58
28	Anyang	0.62	1.41
29	S. Maori	1.02	1.25
30	N. Maori	-0.27	1.22
	AMNH and Keita's Cranial Series		
31	Angola	-1.92	0.09
32	Ashanti (Ghana)	-2.31	0.18
33	Congo	-1.06	-0.38
34	"Gold Coast"(Ghana)	-2.03	0.17
35	New York City	0.23	1.28
36	New York City	1.82	0.18
37	Staten Island	0.16	2.97
38	Gabon	-0.83	0.51
39	New York African Burial Ground	-1.51	0.53

Note: Canonical discriminant functions evaluated at group means (group centroids).

identified, and every effort will be made to include them in future studies. The current study nonetheless contributes substantially to the search for origins of New York's earliest Africans by pushing the limits of current reference collections and showing the general craniometric affinities of the New York African Burial Ground sample. This study has demonstrated statistical relationships to specific ethnic populations to the extent available, although these statistical relationships need always to be measured in relation to historical plausibility. Furthermore, this examination has pointed to problems and their likely solutions if more robust ethnically specific research on diasporic origins is to be conducted in the future.

Dental Morphology

Analyzed in this section are dental trait frequencies and their intra- and interpopulation differences. Different populations appear to have similar ranges of dental cusp variation. As with other inherited traits, however, some distinct shapes of dental crowns (e.g., cusp patterns) are found more often in particular regions, ethnic groups, and families than in others. This section examines an extensive range of dental variation in more than 200 individuals from the New York African Burial Ground site. This part of the chapter explores the possible origins of the Africans in colonial New York City by comparing the frequencies of different dental shapes (morphology) found in the New York African Burial Ground sample to those of historically relevant, potentially paternal populations in Africa, Europe, and North America. Using specific dental traits, several pertinent questions arose: how does the New York African Burial Ground sample compare to other world populations? How does this sample compare to other African populations, based on the dental evidence? What is the relative degree of relationship within the population? Given the history of slavery on the African continent, can we determine the region of Africa in which this population originated, based on dental morphology?

Dental Comparison of New York African Burial Ground Individuals with Populations of the World

Variations in the degree and type of expression of dental morphology can be shown for different regional groups. These geographical and cultural patterns of frequency distribution are used to generate hypotheses about historical population relationships. This fact and the archaeological sturdiness of enamel make dentition valuable repositories of information on migration. Scott and Turner (1997) have recently provided an in-depth and detailed review of discrete dental variation among modern and recent human populations. This analysis incorporated data collected by many researchers during the past few decades. However, although extensive in scope, it should be noted that data for certain traits that we have noted are not included for many of the populations presented by Scott and Turner.

In their analyses of biological distance, Scott and Turner used Nei's distance statistic and the hierarchical clustering algorithm known as the unweighted pair-group method using arithmetic averages (UPGMA) to produce trees, or dendrograms. As with most multivariate clustering techniques, there is no direct way to evaluate significance or error. They did find, with their rather large samples, that they would get essentially the same dendrograms no matter what combination of a standard-distance measure and clustering algorithm they employed (Scott and Turner 1997:288). Scott and Turner's analysis was based on single-trait frequencies on a single tooth on one side of the dental arcade. This was true even for traits that potentially can be exhibited across dental fields, as well as bilateral occurrences. This technique is favorable for a more complete collection that is taphonomically in good shape and that enables the researcher to control for large amounts of data. The dendrogram in Figure 36 shows the relationship between worldwide populations based on 23 crown traits (Scott and Turner 1997). It contains five clusters of world groups: Western Eurasia, Africa, Sunda-Pacific, Sahul-Pacific, and Sino-American. The African cluster is made up of two subgroups, West Africa and South Africa. This larger world classification of Africa is more closely aligned with the Sunda-Pacific populations than with the Western Eurasia populations. In Scott and Turner's analysis, North Africa is clustered with Western Eurasia. The same 23 dental traits used by Scott and Turner were compared to the data set from the New York African Burial Ground sample (Table 4). We used the SPSS average lineage (UPGMA), with Euclidean distance as the distance statistic, to produce our dendrograms (SPSS 1997) (Figures 37–39).

Based on Euclidean distance, the New York African Burial Ground data clustered closely to Scott and Turner's South African population data. Both, in

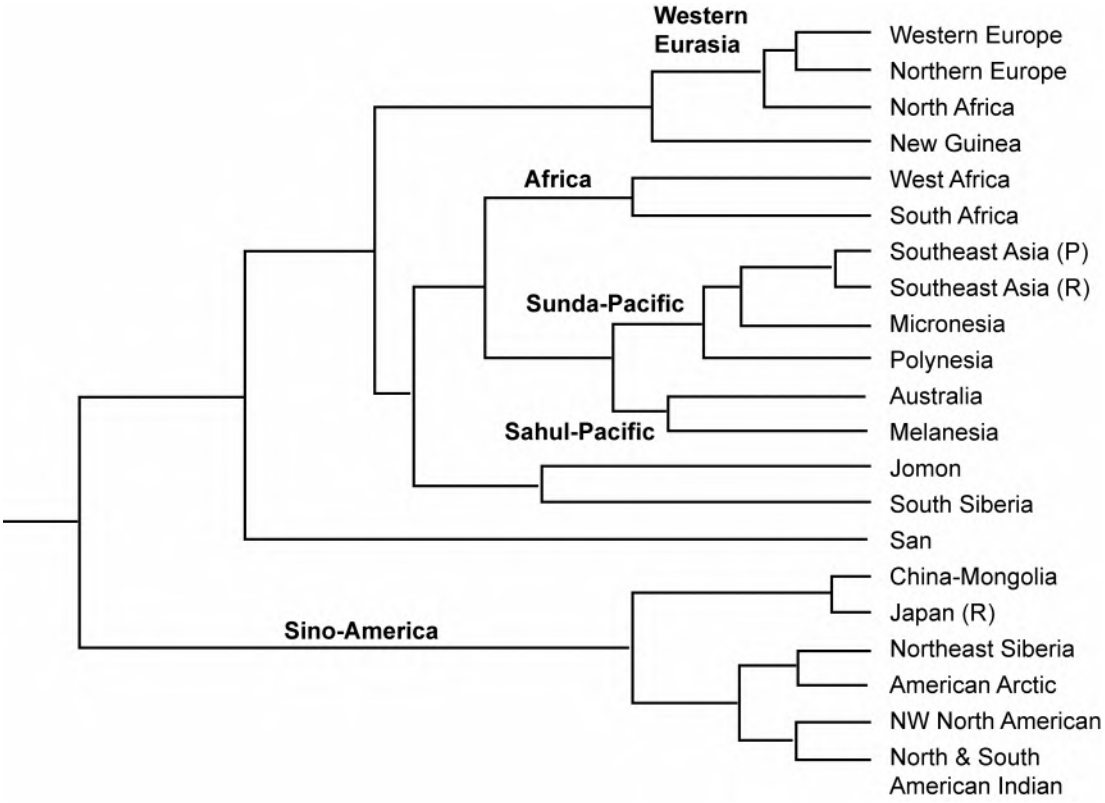


Figure 36. Worldwide populations based on 23 crown and root traits. (From *The Anthology of Modern Human Teeth,* by Richard Scott and Christy G. Turner II © Cambridge University Press 1997. Reprinted with the permission of Cambridge University Press.).

turn, grouped closely to a second cluster involving Western Europe, Northern Europe, North Africa, and New Guinea. Interestingly, West Africa and Khoisan-speaking people in the San region clustered together and were distant from the other African populations (see Figure 37).

When the same distance analysis compares only the African populations and Western Europe, the New York African Burial Ground sample clustered closely to North and South Africa and then Western Europe. The West African and Khoisan populations fall further from the previous groups (see Figure 38). Finally, when compared only to the African populations, the New York African Burial Ground sample clustered closely to North Africa, followed closely by South Africa, and clustering further from West Africa (see Figure 39).

Scott and Turner's classification of North, South, and West Africa can, however, be misleading. The category labeled South Africa in this data set was made up of populations from South, East, Central, and West Africa. Some Nubians of northeast Africa are included in the West Africa sample (Table 5). Within this framework, the New York African Burial Ground sample actually clustered closely to a pooled sample of Africans south of the Sahara and some populations north of it.

From the above analysis, we can determine that the individuals from the New York African Burial Ground sample were most biologically similar to individuals in West, Central, North, and South Africa. This trend continues as individual frequencies for each dental trait are partitioned. The farthest population clusters—thus the least biologically related to the New York African Burial Ground—were from Northwest North America, North and South America, the American Arctic (i.e., Native Americans), China-Mongolia, recent Japan, and northeast Siberia (see Figure 37). As noted in our earlier discussion of craniometry, lumping diverse populations into arbitrary categories limits our ability to examine greater ethnic specificity with these methods. These data are, nonetheless, generally consistent with the regional origins of New York Africans as reported by the New York African Burial Ground Project's historians.

Another problem of comparative databases might be resolved in future studies. As previously discussed, most dental traits are measured in terms of grades, with the realization that scoring different levels of a grade

Table 4. New York African Burial Ground Dental Traits Distribution

Dental Trait	Observations/Total Sample
Winging/left	2/117
Shoveling ULI1	6/117
Double shoveling ULI1	5/140
Interruption groove LI2	15/136
Canine mesial ridge left (bushman)	19/122
Odontomes	1/117
3-cusped UM2	8/106
Carabelli's cusp ULM1	18/123
Cusp 5 ULM1	24/120
Enamel extensions ULM1	6/108
4-cusped LM1	4/92
4-cusped LM2	51/87
Y-groove pattern LLM2	26/95
Cusp 6 LLM1	7/95
Cusp 7 LLM1	11/102
Deflecting wrinkle left	6/94
2-rooted ULP1	42/76
3 rooted ULM2	70/73
2-rooted LC	—
Tome's root left	32/84
3-rooted LM1	—
1-rooted LM2	1/63
Distal trigonid crest left	2/80

Note: Sample sizes vary for different traits for the same tooth owing to postmortem deterioration and the amount of enamel damage during life and after burial. See Table 4.x for a list of conditions affecting sample size.
Key: LC = lower canine; LI2= left second incisor; LM1 = lower first molar; LM2 = lower second molar; LLM1 = lower left first molar; LLM2 = lower left second molar; ULI1= upper left first incisor; ULM1= upper left first molar; ULM2= upper left second molar.

is just as, if not more, relevant as simply noting its presence or absence. Even so, Scott and Turner (1997), when comparing world frequencies, analyzed a trait as either present or absent, or only considered the most prominent form of a morphological trait. For comparative purposes, we chose the same 23 dental traits and followed the same methodology. For example, Carabelli's cusp is a dental trait found on the mesiolingual cusp of a maxillary molar. Carabelli's cusp can be exhibited in different grades, ranging from a groove or pit to a freestanding cusp in the same location. Following Scott and Turner's methodology, only grades 5–7 were considered in trait frequencies for comparison to other world populations. If scoring only grades 5–7, only 7 percent of the individuals from the New York African Burial Ground sample (with observable denti-

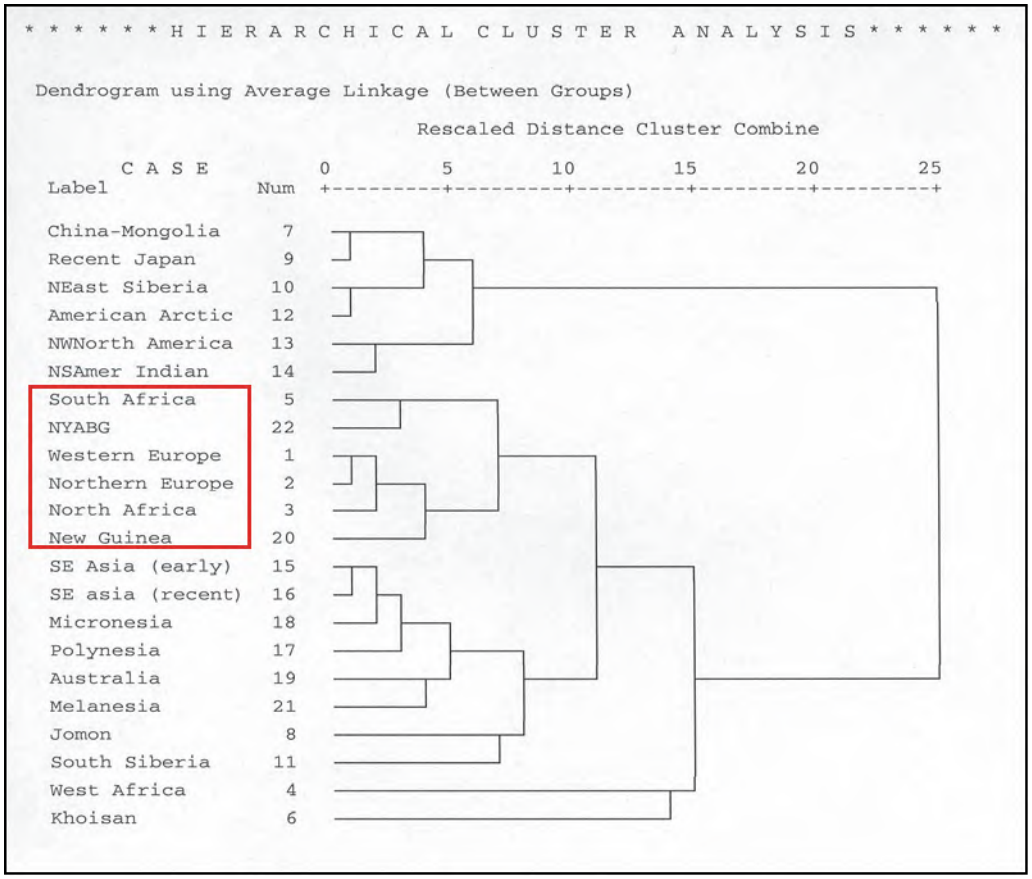


Figure 37. New York African Burial Ground compared to other world populations based on 23 crown and root traits (adapted from Scott and Turner 1997 by Arion Mayes for the 2004 version of this report).

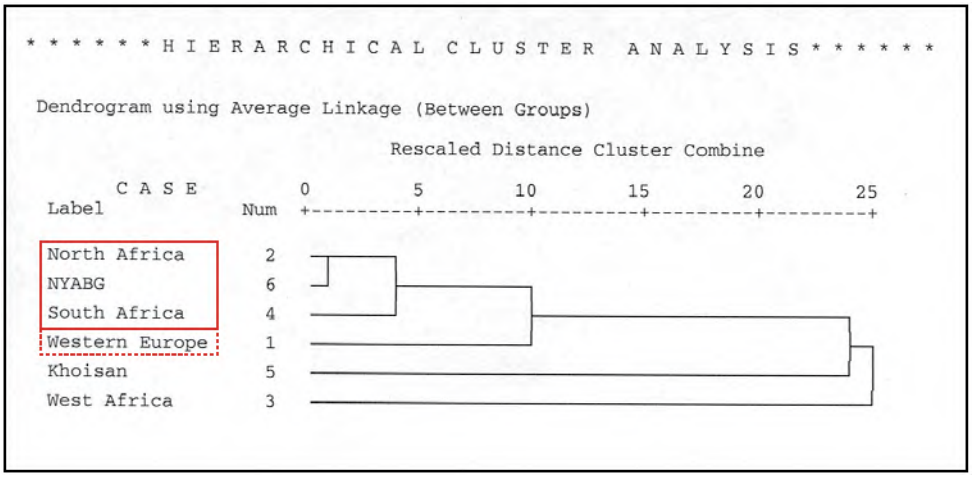


Figure 38. New York African Burial Ground compared to other African populations and Western Europe based on 23 crown and root traits (adapted from Scott and Turner 1997 by Arion Mayes for the 2004 version of this report).

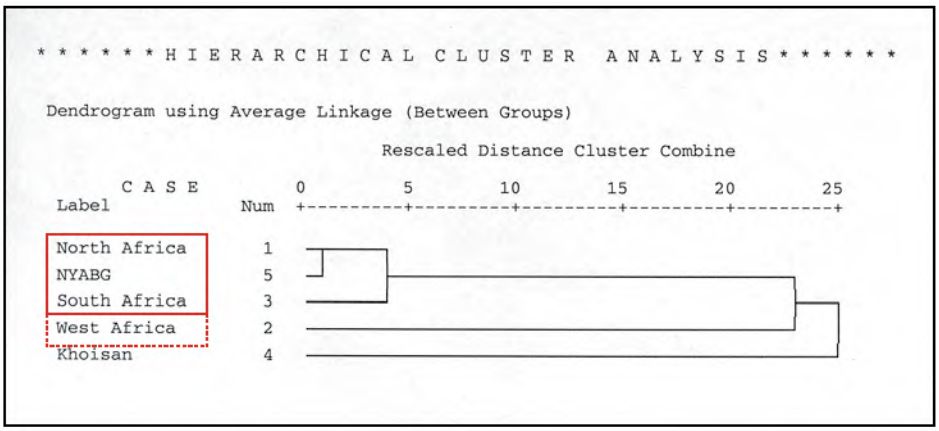


Figure 39. New York African Burial Ground compared to other African populations based on 23 crown and root traits (adapted from Scott and Turner 1997 by Arion Mayes for the 2004 version of this report).

Table 5. Scott and Turner Population Descriptions

Western Eurasia	
Western Europe	Lapps, Reindeer Is., Karil Peninsula, England (Poundbury), Netherlands (Dorestad de Heul), Lent, Danish Neolithic
Northern Europe	Medieval Norway, Greenland, Iceland
North Africa	Algeria, Bedoin, Canary Islands, Carthage, Chad, Christian (Sudan), El Hesa, Kabyle, Kharga, Lisht, Meroitic, Mesolithic Nubians, Soleb, X-Group, North Africa (Algeria, Chad)
Sub-Saharan Africa	
West Africa	West Africa, Nubia No. 117, Nubia No. 67/80
South Africa	Congo, Gabon, Ghana, Nigeria/Cameroon, Pygmy, South Africa, SeneGambia, Sotho, Tanzania, Togo/Benin, Tukulor
San	San, Khoi khoi

Note: From Scott and Turner (1997:318).

tion) exhibited the Carabelli's trait. However, if the lower grades (1–4) are considered unto themselves, then 33 percent of the individuals exhibited Carabelli's trait. When all scores are considered (present or absent), 40 percent of the New York African Burial Ground individuals exhibited some form of Carabelli's trait. An increase in worldwide sample sizes has now led to a more comprehensive understanding of how to interpret patterns of trait expression through grades rather than simply as present or absent.

Multivariate cluster analysis on the same 23 dental traits was used to determine genetic affinity within the New York African Burial Ground sample. Although small clusters were apparent, no major groupings were visible. However, a variation in methodology to include all gradients of dental morphology may

clarify this point. These data are consistent with the historical expectation of the New York African Burial Ground sample as highly diverse, even if it consists of the expected range of African populations.

> Tooth morphology is part of the biological heritage that humans carry with them when they migrate, much like their blood group genes, fingerprint patterns, PTC taste reactions, and other biological traits. When human groups are isolated from one another for a period of time, their crown and root trait frequencies diverge to varying degrees, depending on population size and the extent and temporal duration of isolation. When divergent populations come in contact and interbreed, the resulting populations possess convergent morphological trait frequencies. In other words, these polymorphic features of the dentition behave like other biological variables that are used to assess population history and evolutionary process [Scott and Turner 1997:12].

Following Scott and Turner's theoretical perspective, the analysis of discrete dental traits strongly indicates that the New York African Burial Ground sample is biologically similar. Multivariate analysis indicates a close degree of relationship between the New York African Burial Ground and other African populations, particularly West, Central, and South Africa. Of note is the consistent clustering of the New York African Burial Ground sample with Scott and Turner's Western European population, which includes a sample from the Netherlands. There is a degree of relationship that is worth further investigation given the population history of New York City. These data add to an expanding database on world population dentition and demography. The use of dental morphology in the discussion of population movement is not unique. However, the New York African Burial Ground provides an opportunity for investigating such techniques to shed light on a population of widely displaced individuals. That situation, and the fact that teeth are visible in the living and the dead, offer an opportunity to assess biological relationships between living populations, their relatives, ancestors, and descendants. The New York African Burial Ground, as we have approached it, also allows corroboration of these results against other biological traits, and historical, cultural, and artifactual evidence. Indeed, we have been guided by the preliminary archaeological data showing evidence of African cultural continuity in some funerary decorations at the site.

Molecular Genetic Assessments

Introduction: Overview, Limitations, and Approach

The genetic analyses of the New York African Burial Ground sample provide an unparalleled opportunity for understanding the population origins and demographic structure of this unique group. Unfortunately, DNA extracted from these samples suffers from a fragmented genome and the presence of polymerase chain reaction (PCR) inhibitors, some of which were comingled with the extracted DNA. Critical to our analyses has been the quality of the aDNA. The quantity and quality of aDNA is dependent upon the interment conditions, as well as the excavation specifics at the archaeological site. Therefore, we used the best standardized and established methods for aDNA analysis available at the time of analysis 1995–1999, so as to maximize genomic yield.

In 1995, GSA funded a small feasibility study with the following aims and objectives:

1. To isolate nucleic acids from bones and/or hair samples

2. To amplify specific mtDNA sequences via the PCR technique

3. To sequence the amplified products

4. To clone the amplified sequences for further study and provide a reservoir of these fragile sequences

5. To perform a phylogenetic analysis of the sequences to determine possible kinships and sites of origins for a small number of these individuals

Initial work on this small feasibility study was led by George, and this feasibility study was then extended by Kittles. The details of our methods and materials are reported below.

1995–1997 Protocol for Genetic Analyses of the New York African Burial Ground

As referenced above, the initial subsample was identified in 1995. We were able to extract and isolate nucleic acids from nine 200-year-old hair and bone samples by mid-June 1995. The aDNA from the New York African Burial Ground sample was extracted using the following standard methods.

Contamination control was maintained by providing separate rooms for extraction, amplification, and sequencing. All glassware, solutions, chemicals, instruments, and bones were sterilized either by autoclaving or by ultraviolet (UV) irradiation. Additionally, the bones were subjected to filing of a 1–2-mm layer of outer material to reduce the risk of surface contamination.

Pre-extraction-processing techniques included breaking the cleaned and resurfaced bone into small pieces, wrapping it in previously autoclaved heavy-duty aluminum foil, placing the wrapped bone in liquid nitrogen, and placing this between sterilized metal plates wrapped in heavy-duty aluminum foil. The treated bone was then pounded into a fine powder using the metal plate. Liquid nitrogen was not required for the pre-extraction processing of the hair root samples.

DNA extraction and isolation involved subjecting 0.25 g of powdered bone to the silica and guanidinium thiocyanate (GuSCN) extraction protocol of Boom and colleagues (1990) and Höss and Pääbo (1993). In this protocol (discussed in more detail below), the strategy was to release nucleic acids by enzyme digestion, bind these to a silica column, and later elute them for quantification.

PCR amplification was prepared for 5 µl of the 65 µl of nucleic acid extraction volume. Using specific oligonucleotide primer pairs, in which one of the pairs had a biotinylated 5' end, the DNA was subjected to 35 cycles of PCR amplification (Höss and Pääbo 1993). The results were examined on a 2 percent NuSieve agarose gel.

1995–1997 Protocol Results

Results of the initial molecular genetic study were partially successful. We obtained aDNA from 9 of the 15 New York African Burial Ground samples studied during 1995–1997. Four of these 9 samples were successfully amplified using specific mtDNA primers. The amplified mtDNA sequences from the skeletal remains were not successfully cloned using the TA cloning vector (see Chen and Janes 2002:114) and the sequences were not subjected to successful phylogenetic analysis. Evidence of population affiliations contradicted more plausible cultural evidence in at least two cases, pointing to the necessity of methodological refinement (see Mack and Blakey 2004).

1998–1999 Protocols for Genetic Analyses of the New York African Burial Ground Sample

The second subsample consisted of seven New York African Burial Ground bone samples, some of which had been initially studied by George. Samples for the Project's mtDNA studies were selected based on our desire to represent the full spatial distribution of burials, age, and gender variation, and to include some individuals associated with definitive cultural artifactual evidence to provide an independent line of evidence for origins studies. The latter criterion was dominant for the first, or pilot, study of 15 individuals. The broad range of criteria mentioned above was most equitably applied in the third study involving 48 individuals (inclusive of the samples of earlier mtDNA studies). Kittles was able to bring an updated methodology to the project.

Contamination prevention was maintained by extensive autoclaving (of all buffers and water); regularized filtration purification (of these buffers and water); exclusive use of disposable lab coats, gloves, sleeves, masks, and caps; and bleach wipes of equipment followed by UV light irradiation. All pipette tips contained filters, and all PCR reagents were separated into aliquots to reduce the risk of cross-contamination. The mortars and pestles used to grind the bone to a fine dust were treated with 1N hydrogen chloride (HCl), rinsed with double-distilled water, and subjected to UV irradiation before each use.

Pre-treatment of bone for DNA extraction and isolation consisted of cutting off about 2 mm of the entire bone surface with scalpel blades. The resulting internal bone fragments (300–500 mg) were ground in a specimen-dedicated mortar and pestle to a fine dust.

DNA extraction and isolation continued using a silica-based protocol. In this procedure, silica powder was introduced to the digested sample, and the DNA bound under the influence of GuSCN; this allowed the remainder of the contents of the digest to be washed away. In following this established technique, the ground bone was incubated in 1000 µl of GuSCN extraction buffer overnight at room temperature resulting in the release of nucleic acids by enzyme digestion. The extraction buffer consisted of 4.7M GuSCN, 20 mM EDTA, 46 mM Tris (pH 8.0), and 1.2 percent Triton X-100. After incubating the solid-

tissue remains in the buffer, a pellet was produced by several centrifugations. The supernatants were then added to a silica suspension, and nucleic acids were isolated, eluted in 30 µl aliquots, and quantified. As our experimental control, a blank extraction containing all reagents, but no tissue, was included in every set of extractions.

PCR amplification and sequencing was based on the amplification of the hypervariable segment I (HVS-1) of mtDNA and Y-chromosomal and autosomal microsatellite amplifications. Four sets of primers produced overlapping fragments of a 300-base-pair segment of the HVS-1. Primers were also included that amplified highly variable microsatellite markers of the Y chromosome–specific locus (DYS390) and the autosomal DNA locus (D5S471).

Amplification of mtDNA was performed in 30 µl reaction volumes of 150 µM dNTP's 10 mM Tris-HCl (pH = 8.3), 50 mM KCl, 1.0–2.0 mM $MgCl_2$, 0.6 units of AmpliTaq polymerase, 3.0 µl of 5 µM primer mix, and 7.5 µl of the DNA extract. The PCR conditions consisted of 40 cycles at 95°C for 50 seconds, 55°C for 50 seconds, and 72°C for 50 seconds. Amplification products were visualized on 3 percent agarose gels. Both DNA strands were then sequenced using fluorescent-labeled dideoxy terminator cycle sequencing chemistry using the ABI 373A DNA sequencer (ABI, Foster City, California). The *Seq A* and *AutoAssembler* programs (ABI, Foster City, California) were used to align and overlap both sequenced strands of DNA, allowing for the visual inspection of any ambiguities in the sequence.

Amplification of the Y chromosome and autosomal microsatellites used 10 µl of DNA added to 200 µM of dNTPs, 10 mM Tris-HCl (pH = 8.3), 50 mM KCl, 1.0–2.0 mM $MgCl_2$, 0.6 units of AmpliTaq polymerase (Perkin Elmer), and 0.33 µM of primers. The PCR cycling conditions were 93°C for 3 minutes, 10 cycles at 94°C for 15 seconds, 55°C for 15 seconds, and 72°C for 30 seconds. Then samples were run at 20 cycles at 89°C for 15 seconds, 55°C for 15 seconds, and 72°C for 30 seconds. The final extension cycle was at 72°C for 10 minutes.

1998–1999 Protocol Results

Results of the molecular genetic analyses of the second subsample indicated a strong West and/or Central African ancestral presence in the studied New York African Burial Ground individuals. Only three of the mtDNA samples exhibited unknown molecular variants of mtDNA. Even in these cases, an African maternal ancestral origin may be present, as the background database on African mtDNA diversity is still in an early stage of development.

1999 Protocols for Genetic Analyses of the New York African Burial Ground Sample

Analysis of the third subsample included 48 bone and 2 hair and/or tissue samples from the New York African Burial Ground. Analyses were completed in 1999.

Contamination prevention was maintained by autoclaving and purification of all buffers and water by filtration. Disposable lab coats and gloves were used during all steps. Benches and equipment were treated with bleach and irradiated by UV light. All pipette tips contained filters. PCR reagents were separated into aliquots. The mortar and pestle (used to grind the bone into a fine dust) were treated with 1N HCl, rinsed and double-distilled water, and UV irradiated before each use.

Pre-extraction practices involved small samples of bone being cleaned by removing about 2 mm of the entire bone surface with sterile scalpel blades.

DNA extraction and isolation used internal bone fragments (300–500 mg) ground into a fine dust using a project-dedicated mortar and pestle. The ground bone was then incubated in 1,000 µl of GuSCN extraction buffer overnight at room temperature. The extraction buffer consisted of 4.7M GuSCN, 20 mM EDTA, 46 mM Tris (pH = 8.0), and 1.2 percent Triton X-100. After incubation, the solid-tissue remains were pelleted by centrifugation and supernatants added to a silica suspension. Nucleic acids were isolated and eluted into 30 µl aliquots. A blank extraction containing all reagents, but no tissue, was included in every set of extractions, as a control.

PCR amplification and sequencing used four sets of primers to amplify the HVS-1 of mtDNA. The primers produced overlapping fragments of a 300-base-pair segment of the HVS-1. Amplification of mtDNA was performed in 30 µl reaction volumes of 150 µM dNTP's 10 mM tris-HCl (pH = 8.3), 50 mM KCl, 1.0-2.0 mM $MgCl_2$, 0.6 units of AmpliTaq polymerase, 3.0 µl of 5 µM primer mix, and 7.5 µl of the DNA extract. The PCR conditions consisted of 40 cycles

Table 6. Countries, Geographical Regions, and Historical Export Sites for Enslaved Africans

Modern Country Represented in the 1999 Database	Geographical Region Represented in the 1999 Database	Nearest Probable Historical Slave Export Site(s)
Benin	West Africa	Bight of Benin
Burkina Faso	West Africa	Gold Coast
Cameroon	West Central Africa	Bight of Biafra
Central African Republic	Central Africa	Bight of Biafra
Guinea	West Africa	Senegambia/Upper Guinea
Mali	West Africa	Senegambia
Morocco	Northwest Africa	Moroccan west coast
Niger	West Africa	Senegambia
Nigeria	West Africa	Bight of Biafra/Bight of Benin/Calabar
Senegal	West Africa	Senegambia
Sierra Leone	West Africa	Windward Coast

at 95°C for 50 seconds and 72°C for 50 seconds. Amplification products were visualized on 3 percent agarose gels. Both DNA strands were then sequenced using fluorescent-labeled dideosy terminator cycle sequencing chemistry (ABI) and the ABI 373A DNA sequencer (ABI, Foster City, California) and the Seq A and AutoAssembler programs (ABI, Foster City, California). The Seq A and sequenced strands of DNA allowed for the visual inspection of ambiguities in the sequence. Sequence comparisons were accomplished using PAUP Version 4.0 (Swofford 1999). Because of the large data set, an exact search was unfeasible, so extensive branch swapping was performed in order to find optimum trees.

1999 Protocol Results

Results from the molecular genetic analysis of the third subsample allowed the comparison of our results with a database of published mtDNA sequences from around the world. Currently, 1,800 sequences have been entered in the database. Accessible Native American and European sequences were represented among the published mtDNA sequences; however, of the 48 mtDNAs sequenced from the New York African Burial Ground, 45 evidenced mtDNA haplogroups found in West and Central African populations and their recent descendants. The remaining three sequences were unknown, as previously noted. In the published mtDNA database, the number specific to African populations is about 849. Among these 849, those observed in West and Central Africa includes a total of 520 populations. The database includes individuals sampled from the following countries: Benin, Burkina Faso, Cameroon, Central African Republic, Guinea, Mali, Morocco, Niger, Nigeria, Senegal and Sierra Leone. In Table 6, we note for each country the geographical region and nearest probable historical export site for enslaved Africans bound for the Americas during the seventeenth and eighteenth centuries.

At the time of our analyses, no samples were included on the published database from Ghana, Angola, Gabon, Congo, Liberia, or other areas known historically to have included important catchment areas or export sites for the transatlantic trade in enslaved Africans to the Americas.

Nucleic acids were extracted from all 48 of the bone samples provided in this subset of the New York African Burial Ground. Extractions from the two tissue samples, Burials 23 and 97, failed to yield adequate DNA. For the successful 48 DNA extractions, mtDNA control region sequences (fewer than 300 base pairs [bp]) were amplified by PCR, and the products were visualized using ethidium bromide–stained agarose gels. Direct sequencing of the products revealed several polymorphic sites among the samples.

The level of genetic diversity observed in Subsample 3 from the New York African Burial Ground was quite high. Forty-five of the 48 sequences

were unique, and the haplotype diversity closely approached 1.0 (0.997 + 0.01). This high level of haplotype diversity is common for populations of African descent (Vigilant et al. 1991; Watson et al. 1997). Countries, geographical regions, and macroethnic groups are listed when haplotypes appear restricted to such units. Sequences that were phylogenetically related to West or Central African sequences but are not observed in any particular geographical region or among a specific macroethnic group, are designated West/Central African. Haplogroups are also noted. Although there has been limited and sporadic sampling of Africans for genetic studies, by 1999 many studies had identified at least three mtDNA haplogroups in African populations: L1, L2, and L3. Table 7 details the genetic affinity of samples as they relate phylogenetically to the published data (as of 1999).

All three haplogroups were observed in the third subsample from the New York African Burial Ground individuals. Not surprisingly, the L1 haplogroup is observed in the least-sampled geographical area of Africa, so we expect that it may be more common than reported. Haplogroup L2 is common among the Niger-Kordofanian speakers from the Senegambia and Gold Coast regions of West Africa. The L2 haplotypes, which may represent the descendants of migrants of Bantu speakers into West Africa, constitute 71.1 percent of the studied New York African Burial Ground individuals.

The third mtDNA haplogroup, L3, is quite common in East Africa and in the Horn region of Africa. Although the L3 group is more common in East Africa, it is observed at an appreciable frequency in West Africa, particularly among Afro-Asiatic speakers. Because many of the enslaved Africans came from more inland areas of West and Central Africa, such as northern Nigeria, northern Cameroon, and southern Niger, for example, this may explain our observation of the L3 haplogroup in 22.2 percent of the New York African Burial Ground individuals. Table 7 summarizes the molecular genetic affinities of the New York African Burial Ground sample.

Genetic Initiatives and Protocols for 2000–2004

When 219 New York African Burial Ground samples were transferred to the Bioanthropology Research Laboratory at the University of Maryland in 2000, our initial assessment identified four major problem areas:

1. Inadequate database on contemporary and archaic African genetic diversity

2. High diversity levels of intra-African genetic variability

3. Complex ethnic histories and demographic patterns

4. Difficulty in extracting sufficient quantities (and quality) of archaic skeletal DNA for multiple analyses

Our solutions were to:

1. Establish an international advisory board of senior anthropological geneticists

2. Identify historians and anthropologists with specific regional expertise

3. Utilize pooled regional samples to recreate regional clusters of marker genes (possibly using DNA microarrays)

4. Apply advanced biotechnological techniques to recover aDNA and test against regional pools

5. Set up a National African DNA Bank(s) for future reference

Our initial focus was to address the serious lapses in the exiting database on African genetic diversity on the continent and throughout the Atlantic diaspora. For some time, we had known that the limitations in the existing comparative database posed a significant hindrance to the reliable placement of New York African Burial Ground individuals in particular geographical regions of Africa and among specific contemporary African macroethnic groups. In an effort to begin to tie particular genetic variants to specific regional areas of the world, we began several important initiatives.

In 2000, several senior geneticists agreed to serve on an advisory board related to genetic analyses for the New York African Burial Ground. They were Dr. Kenneth Kidd (Yale University), Dr. Kenneth Weiss (Pennsylvania State University), Dr. Michael Crawford (University of Kansas), Dr. Robert Ferrell (University of Pittsburgh), Dr. Alain Froment (Orleans University), and Dr. Robert Murray (Howard University).

Information from the New York African Burial Ground historians suggested that West Central Africa was an important source of the Africans of eighteenth-century New York. Therefore, we recruited and worked closely with the following regional experts:

Table 7. Molecular Genetic Affinities of Individuals in the NYABG

Burial No.	Tissue Site Sampled	mtDNA Haplo-group	Geographical, Country, and Macroethnic Genetic Affinity
1	right radius	L2	West/Central African
6		L2	West Africa, Benin (Fulbe peoples)
7	not indicated	L3	West Africa, Niger
9	right radius	L2	West Africa, Benin (Fulbe peoples)
11	right ulna	L2	West/Central African
12	not indicated	L2	West/Central African
16	right ulna	L2	West/Central African
20	right fibula	L2	West/Central African
25	right ulna	L3	West/Central African
32		L3	West Africa, Niger
37	right fibula	L2	West/Central African
40	right fibula	L3	West Africa, Niger
47	right ulna	L2	West Africa, Benin (Fulbe peoples)
49	right fibula	L2	West/Central African
51	right fibula	L2	West/Central African
56	right radius	L3	West Africa, Niger
58	not indicated	L2	West/Central African
63	not indicated	L2	West/Central African
67	right radius	L2	West/Central African
71		L2	West/Central African
73	right radius	L2	West Africa, Nigeria (Yoruba peoples)
76	right fibula	L3	West Africa, Niger
89	right ulna	L1	West/Central African
97	right ulna	L2	West Africa, Nigeria (Fulbe peoples)
101	not indicated	L3	West Africa, Niger
105	not indicated	L1	West/Central African
107	right fibula	L2	West Africa, Nigeria (Hausa peoples)
115	right fibula	L3	West Africa, Niger
122	right ulna	L2	West Africa, Nigeria (Hausa peoples)
135	right fibula	L2	West//Central African
138	right fibula	L2	West Africa, Senegal (Mandinka peoples)
144	not indicated	L2	West/Central African
151	right ulna	L2	West/Central African
154	right fibula	L3	West Africa, Niger
158	right fibula	L2	West Africa, Senegal (Mandinka peoples)

Burial No.	Tissue Site Sampled	mtDNA Haplo-group	Geographical, Country, and Macroethnic Genetic Affinity
171	right ulna	L1	West/Central African
176	not indicated	L2	West/Central African
180	right radius	L2	West Africa, Senegal (Mandinka peoples)
194	not indicated	L2	West Africa, Nigeria (Fulbe peoples)
219	right fibula	L3	West Africa, Niger
226	not indicated	L2	West/Central African
242	right fibula	L2	West Africa, Nigeria (Fulbe peoples)
310	right rib	L2	West/Central African
335	right ulna	L2	West/Central African
340	not indicated	L2	West Africa, Nigeria (Fulbe peoples)

- Dr. Paul Nkwi, Executive Secretary, Cameroon Academy of Sciences, Editor of *African Anthropologist,* and internationally known social anthropologist
- Professor Victor Ngu, President, Cameroon Academy of Sciences, noted physician and inventor
- Dr. Peter Ndumbe, Dean, Medical School, University of Yaounde 1, physician, specialist in infectious disease, and director of the Research Institute associated with the medical school
- Dr. Ugo Nwokeji, Professor of History, University of Connecticut, expert on the export of West and Central Africans during the transatlantic slave trade
- Dr. Charles Dimintyeye, Cultural Attaché, Embassy of the Republic of Cameroon, Washington, D.C., professor of French and expert on francophone West and Central Africa
- Professor Joseph-Marie Essomba, Professor of Archaeology, University of Yaounde I, expert on archaic evidence for human occupation in West and Central Africa

In 2000–2002, efforts were underway to develop the first human DNA bank in Africa. Dr. Fatimah Jackson made two critical collaborative contacts: Dr. Jeanne Beck, Vice President of Coriell Institute for Medical Research, Camden, New Jersey, and Dr. Peter Ndumbe, Dean of the Medical School, University of Yaounde I, Yaounde, Cameroon. After a series of meetings and working sessions with scientists at Coriell Institute for Medical Research (New Jersey Medical and Dental School) and the University of Yaounde I College of Medicine (Yaounde, Cameroon, West Central Africa), plans were implemented to lay the foundations for this bank. Cameroon's central location in Africa and highly genetically diverse population—as well as the presence of an adequately developed infrastructure and enthusiastic and supportive scientific and political communities—made the country an ideal choice for housing this bank. Coriell Institute for Medical Research offered to train Cameroonian technicians in DNA banking techniques. The University of Yaounde I offered its Research Institute as a permanent site for the bank. With the permission and support of the Cameroonian Academy of Sciences, the Cameroon Prime Minister's Office, and the Ministry of Health, the bank began in July 2002. In November 2002, an international workshop was held in Yaounde, Cameroon; the goals and objectives of the bank were outlined, its direct relationship to the ABGP indicated (Dr. Michael Blakey was among the participants at the workshop), and the plans were laid for a collaborative grant proposal to the National Institutes of Health to support the bank. To date, the bank has already collected and extracted DNA samples from over 400 West and Central Africans and is officially linked, through the Ministry of Tourism, with the United Nations Educational, Scientific and Cultural Organization's (UNESCO's) "Route of the Slaves" Project.

In 2002, Dr. Jackson began discussions with technical experts at Affimetryx Corporation to develop a DNA microarray that would provide rapid assessments of African regional markers. At that time, each gene

chip could contain 2,000 single nucleotide polymorphisms (SNPs). Our plan is to identify, through the literature and through direct collections, regional African variation in SNPs. SNP variation among specific African regions will then be used to design custom-made DNA microarrays for target testing, analysis (bioinformatics), and interpretation. The geographical regions identified as major sources of genetic polymorphism for eighteenth-century New York Africans include Central Africa, Bight of Biafra, Mozambique, Senegambia, Upper Guinea, Bight of Benin, and the Gold Coast. We continue to concentrate our research on groups from these geographical regions, as they provide the strongest baseline information on the New York African Burial Ground ancestral template; these regions provide insights into eighteenth-century levels of African American genetic sequence polymorphisms. Further, these regions most powerfully permit reconstructions of African and non-African origins. Our methods for these ethnogenetic reconstructions include the following:

1. Archaic map analysis

2. Regional ethnic reconstructions

3. Group displacement tracking

4. Ethnic and regional verification using alternative documentation

5. Geographical information system (GIS) mapping using vector and raster maps

6. Contemporization of the findings (i.e., determining the modern equivalents)

6. Statistical analysis

In 2003–2004, Dr. Jackson received Institutional Review Board (IRB) clearance to initiate genetic studies among the African-descended student, faculty, and staff population at the University of Maryland. The aims of this project were to:

1. Attract 100–200 African, Afro-Caribbean, and African American students currently enrolled at the University of Maryland to a workshop-dinner on genetics and health

2. Provide these students with an opportunity to extract DNA from various fruits to learn about some of the latest advances in the genetics of disorders disproportionately affecting peoples of African descent

3. Collect and analyze buccal (cheek) cell samples from each student for the presence of genes associated with specific regional origins. This DNA will become part of a database for future comparative analyses with the New York African Burial Ground individuals

To date, we have collected 183 DNA samples from individuals from all over the world, including Europe (Scotland, Ireland, Denmark, Germany, Italy, and Spain), South America (Brazil, Colombia, and Peru), Asia (Nepal, India, Butan, Pakistan, China, and Korea) and Africa (Ghana, Nigeria, Cameroon, Liberia, Congo, Guinea, Ethiopia, Senegal, Kenya, and Tanzania), as well as the United States. In April 2004, our first paper was presented at the annual meetings of the American Association of Physical Anthropologists entitled "African-American lineage markers: determining the geographic source of mtDNA and Y chromosomes" (Lorenz et al. 2004).

Summary of Planned Future Analyses and Proposed Timetable

The genetic analysis of the New York African Burial Ground provides a unique opportunity to explore and understand human biology and biodiversity at a very technologically sophisticated level. To our knowledge, our studies represent the first attempt to characterize an African–African American historical-period population at the molecular genetic level of assessment. With full access to the New York African Burial Ground sample and adequate time to complete these analyses, we feel that a major contribution can be made to the knowledge base, with positive effects for the entire nation. Table 8 summarizes the planned future analyses, the timetable for these analyses, and the support structures already in place to address these analyses.[1]

[1] These studies were included in the original research design of the project (Howard University and John Milner Associates), and bone samples were collected for this purpose. The GSA denied Dr. Jackson's team access to the bone samples for these studies in 2004 (the editors).

Table 8. Anticipated Future Genetic Analyses of the NYABG Samples

Type of Analysis	Relevant Genomic Segments for Study	Project Initiation Date	Anticipated Project Completion Date	Project Support Status as of June 2004
NYABG ancestral origins (African, European, Native American)	mtDNA haplo-groups, Y-chro-mosome and autosomal STRs	2002	2009	Funding received from David C. Driskell Center for Diaspora Studies (UM) and Nyumburu Cultural Center (UM); currently working on NIH proposal with colleagues at Coriell Institute for Medical Research.
Biological affinities among NYABG individuals	mtDNA haplo-groups, Y-chro-mosome and autosomal STRs	2003	2007	Critical feedback received from NYABG archaeologists for "in progress" NSF grant proposal.
Molecular sex of NYABG individuals	amelogenin gene located on the human sex chromosomes	2004	2008	NSF grant proposal in advanced stage of development.

Key: NIH = National Institutes of Health; NSF = National Science Foundation; STRs = short tandem repeat polymorphisms; UM = University of Massachusetts

Chapter 6

Isotopic and Elemental Chemistry of Teeth: Implications for Places of Birth, Forced Migration Patterns, Nutritional Status, and Pollution

A. H. Goodman, J. Jones, J. Reid, M. E. Mack, M. L. Blakey, D. Amarasiriwardena, P. Burton, and D. Coleman

Introduction

Concerns about individual and group origins are central to the study of the New York African Burial Ground. A key goal of the project is to provide scientific insights into the geographic origins of individuals. Enslaved Africans came from different regions of Africa. Can we determine more precisely the geographic area where individuals and groups came from and what their ethnic affinities were? At what ages were enslaved individuals forced to involuntarily leave their homelands? Which individuals came to New York via the Caribbean or some other destination in North America? Who was the first generation enslaved, and who was born into slavery?

Although origin questions are central to this project, providing insights into origins is difficult. To date, few methods provide clear answers. Historical documents such as slave-ship manifests and auctions provide an overall and indispensable source of information on geographic origins, ethnicities, demographic patterns, and even names (e.g., see Gomez 1998; Hall 1992; Lovejoy 1997, 2003). However, there is no method we are aware of that can link these historical records to individual burials.

Archaeological information such as artifacts and burial position may suggest an individual's natal home (geographic place of birth), possible ethnic affinity, or status within an enslaved community (Corruccini, Aufderheide, et al. 1987; Handler 1997; Samford 1994). However, because cultural practices, such as placing a burial in extended position or facing east, are generally without fixed temporal and spatial boundaries, suggestions as to geographic and ethnic origins must be appropriately broad and speculative (DeCorse 1999) and sensitive to the fact that such practices potentially convey multiple messages (Perry and Paynter 1999).

Information derived from bones and teeth—that is, bioarchaeological information—may similarly provide insight into geographic and ethnic origins. Genetic information derived from bone and tooth size and shape and, more directly, from mtDNA provide a means to compare an individual or group with values from contemporary "ethnic groups" (see Chapter 5) (Jackson 1997; Watson et al. 1996). The resulting data provide insights into genetic and, by extension, ethnic affinities. Although extremely powerful, these methods are also limited. Because humans historically do not live in closed communities, genetic traits and frequencies are fluid, open, and not culturally bounded. As well, the relationship between genetic affinity and ethnicity may change over time because of group fissioning, exogamy, and the fluidity of ethnic categories (Goodman 1997).

Other types of bioarchaeological information may provide insights into natal homes and ages at forced

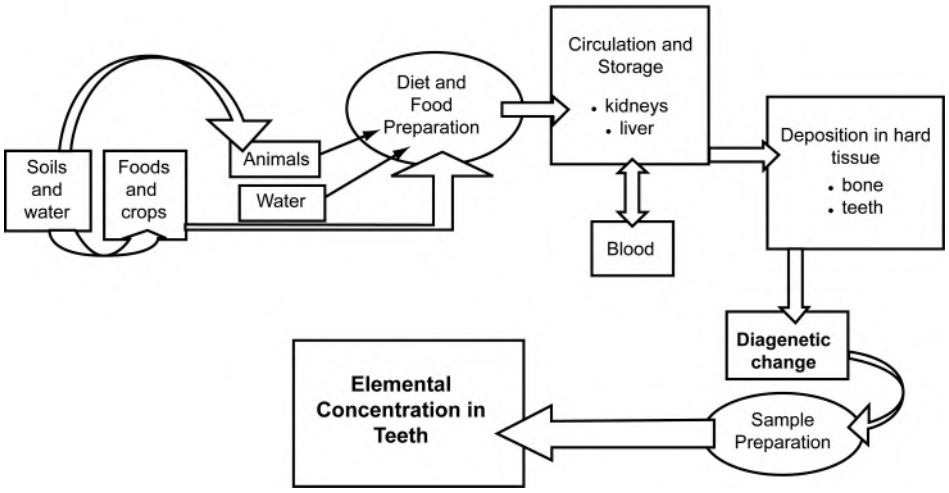


Figure 40. Elemental Uptake/Deposition Model.

migration. For example, death in the first decade of life suggests that an enslaved child was born in the Americas versus Africa or the Caribbean because historical documentation shows that enslaved African New Yorkers were most often "young adults from whom the buyer could expect many years of service" (McManus 2001:36; see also Lydon 1978). Corruccini, Jacobi, et al. (1987) have suggested that generalized tooth-root hypercementosis, associated with seasonal "rehabilitation" following cycles of poor nutrition throughout most of the year, may distinguish Caribbean-born from African-born individuals among an enslaved population in Barbados.

Conversely, Handler (1994) has suggested that culturally modified teeth (CMT), teeth that have been intentionally and decoratively chipped, filed, or otherwise modified, in enslaved Africans in the Americas, is a marker of African birth. Permanent teeth begin to erupt after about 6 years (Smith 1991), and historical documentation of CMT in Africa consistently shows that the practice was most often performed on individuals approaching their teens and older (van Rippen 1918). More important still, Handler (1994) made a strong case for the assumption that this cultural practice was discontinued under enslavement in the Caribbean and the Americas. In this chapter, we provide two pilot chemical tests of the hypothesis that young individuals were born into slavery and individuals with CMT were born in Africa.

One of the most exciting technical developments in analytical chemistry is the maturation of multiple techniques for analysis of the geographic origins of humans and other organisms with sequentially calcifying tissues such as fish otoliths and human teeth (Campana et al. 1994; Cox et al. 1996; Evans et al. 1995; Lee et al. 1999; Lochner et al. 1999; Outridge 1996; Outridge et al. 1995). At the time of rediscovery of the burial ground, chemical ecology studies were just beginning to show that strontium and oxygen isotopes in hard tissues reflect landscapes during their calcification and that each landscape has a somewhat unique elemental and isotopic signature (Ambrose 1991; Blum et al. 2000; Ericson 1985, 1989; Larsen 1997; Price, Grupe, et al. 1994; Price, Johnson, et al. 1994; Schwarcz et al. 1991; Schwarcz and Schoeninger 1991; Sealy et al. 1991; Sealy et al. 1995; White et al. 1998) (Figure 40). Emerging with the development of studies of enamel, which forms in early life, these new techniques provided the first unambiguous methods for reconstructing human landscapes at the time of birth and through the first decade (Cox and Sealy 1997; Cox et al. 2001; Grupe 1998; Gulson et al. 1997; Sealy et al. 1995).

The ability to track individuals' natal homes and then their ages at movement from their places of birth is based on the fortunate codevelopment and intertwining of three advancements: (1) better understanding of the geology and chemical ecology of landscapes; (2) better understanding of patterns of calcification of dental enamel, dentin, and cementum; and (3) the development of chemical analytical methods that allow for the "microsampling" of enamel and other hard tissues.

The hard-tissue samples provide a chemical signature of individuals at different ages of development. With samples taken from sequentially developing

areas, one can track changes over the life of an individual. Cementum provides information on annual changes (Evans et al. 1995; Hals and Selvig 1977; Tsuboi et al. 2000), whereas primary enamel and dentin can provide a chronology of change in early months and years.

The purpose of this chapter is to present results from our ongoing research on the use of multiple chemical methodologies to provide insights into the geographic origins and ages at migration of individuals from the New York African Burial Ground. The first part of the chapter provides an overview of chemical methods that are relevant to a full study of geographic origins, ages at migration, nutritional status, and pollution exposure. In the second section, we provide detailed methods and the results of research that have been completed thus far on strontium isotope ratios and variation in multiple elemental concentrations, or elemental signature analysis (ESA). We then compare the chemical signatures of individuals assumed to be African born based on the presence of modified teeth with individuals assumed to be born around New York because of their young age at death. We highlight an unexpected finding: that lead concentrations are significantly elevated in the individuals who were born in New York and that these elevations appear to begin in the first years of life. Finally, we discuss the implication of the completed research and the benefits that would accrue from additional research.

Tooth Development and Chemistry

Teeth contain unique information about past environmental and physiological conditions. The pattern of formation of enamel and dentin is clearly demarcated and ringlike, much like the rings of trees (Goodman and Rose 1990; Kreshover 1960) or, more so, the leaves of an onion or an artichoke. Furthermore, once formed, the dental hard tissues, and especially enamel, which is acellular and nearly totally mineralized, are essentially inert (Carlson 1990). Earlier in this century, Massler et al. (1941:36) confidently stated that "enamel and dentin in the formative and calcifying stages of their growth serve as kymographs on which are permanently recorded physiologic or pathologic changes in metabolism."

The potential of the dental hard tissues continued to be echoed through the second half of the twentieth century. Sharon (1988:124) advocated for a scientific "tooth bank" because "teeth are storehouses of invaluable information for biological, physical, and medical sciences. . . . Teeth can provide keys to provenance, development . . . exposure to pollutants and provide a permanent cumulative, qualitative, and quantitative record of insult." In a commentary in *Science* on the developing field of biogeochemistry, Kohn (1999:335) noted that "enamel retains an exquisite microstructure produced when the animal precipitated its tooth and is the material of choice for terrestrial studies." All authors assert that with further research, teeth will yield information applicable to a wide variety of environmental and biological questions.

Indeed, teeth have begun to yield insights about life conditions during their formation. Starting with the work of Massler and colleagues (Sarnat and Schour 1941), many researchers have evaluated variations in enamel's external morphology and histological structure in relationship to histories of disease and other conditions that might disrupt development (see Chapter 9). These studies have shown that linear enamel hypoplasias, lines or bands of decreased enamel formation, are linked to a wide variety of conditions that are sufficiently severe and long lasting to disrupt ameloblasts, the enamel-forming cells (Goodman and Rose 1990). Furthermore, the locations of these defects on tooth crowns reflect the timing of the physiological disruption (Goodman and Song 1999; Sarnat and Schour 1941). The sensitivity of ameloblasts to physiological conditions, enamel's inertness once formed, and the ability to discern the timing of disruption from their location make linear enamel hypoplasias biological records of past physiological statuses (see Chapter 8).

In a prior study of the burial ground, Blakey and coworkers (see Chapter 8, this volume) used enamel hypoplasias recorded on the teeth of adults as an index of childhood conditions; permanent tooth crowns develop from about the time of birth to approximately 7 years of age. Blakey and coworkers found a moderate rate of enamel defects compared to Caribbean slaves (Corruccini et al. 1985), suggesting less stress in childhood. However, these preliminary results are complicated by the fact that many of the adults may have grown up in Africa rather than as enslaved Africans in New York. Tooth chemistry may be able to resolve who grew up in the New York area, somewhere in Africa, or in a third location, such as the Caribbean. Furthermore, taking advantage of the

different times of calcification of different teeth and regions within a tooth, it may be possible to estimate the age of individuals at the time of forced migration or any other geographic relocation.

Indeed, analyses of the chemical composition of dental tissues may provide new and complementary insights into (1) hard-tissue chemistry and development, (2) diet and nutritional physiology, (3) the movement and migration of individuals, and (4) diverse environmental conditions such as industrial lead production. For example, paleonutrition, the study of the diet and nutrition of past peoples, emerged in the 1970s from developments in the chemical analysis of bone, combined with an understanding of ecological and physiological processes governing the deposition and retention of elements in calcified tissues (Aufderheide 1989; Price et al. 1985). The promise of this field is that isotopic and elemental concentrations in preserved hard tissues would reflect aspects of dietary intakes or nutritional status. Recent developments are just now beginning to suggest that the potential of chemical studies of teeth may be reached.

Relative to morphological and histological analysis, the delay in maturity of this field is based on at least three factors.

- First, bone was initially the preferred hard tissue for study. However, as results accrued, many researchers began to realize that the processes governing elemental and isotopic incorporation and turnover of bone (and in the case of archaeological bone, postmortem changes) were more complex than previously realized.
- Second, until recently, methods were not widely available to chemically relate areas of enamel to known periods of development (prenatal, early infancy, childhood, etc.). The development of microsampling methods and. in particular laser ablation analysis, which is keyed to the ring-link development of enamel and dentin, is now solving this second problem (Outridge 1996).
- Third, interpretations of bone elemental values are limited because of lack of background information and lack of controlled studies of ecological, physiological, and biochemical processes. Although enamel offers important advantages of highly regulated calcification geometry and inertness once formed, our understanding of the significance of its elemental concentrations remains rudimentary for the same reasons.

The Histology and Development of Dental Calcified Tissues

Human teeth consist of three hard tissues: enamel, dentin, and cementum (Figure 41). Enamel forms the exterior of the crowns of human teeth; dentin makes up the interior of the crown and roots, and a thin layer of cementum covers the roots. In addition to the "primary" cementum and dentin, which is formed early in life, secondary (circumpulpal) dentin and secondary cementum are continuously deposited.

A summary of variations among the dental hard tissues and bone is presented in Table 9. Some key differences are the hardness of enamel and its lack of regenerative (turnover) abilities.

Enamel

The hardest and one of the most specialized tissues in the body, enamel covers the crowns of teeth (see Figure 41). The thickness of the enamel layer ranges from less than 0.1 mm near the cervical border of deciduous teeth to a few millimeters on the crowns of permanent molars. Enamel is formed from ameloblasts that derive from the inner enamel epithelium. After odontoblasts begin secreting the dentin matrix, adjacent ameloblasts quickly begin secreting enamel matrix. Once the full thickness of enamel matrix is reached, ameloblasts change morphology and physiology consistent with a change in role from matrix secretion to absorption of protein and water and calcification. After enamel is fully calcified, ameloblasts become senescent; mature enamel is acellular and essentially dead; it is 97 percent calcified tissue. The temporal record of past physiology and chemistry may be seen to follow the enamel growth lines, stria of Retzius (see Figure 41). Enamel is the tissue of choice for our research because its formation is well understood, and it is acellular, nonvital, and nearly completely composed of apatite crystals (Cleymaet et al. 1991).

Dentin

Tooth formation begins with the secretion of predentin by odontoblasts, the dentin-forming cells. Dentin formation is highly regulated and occurs in layers or sheets, as odontoblasts are recruited to secrete dentin matrix. The pattern of formation of dentin is visible in growth lines called contour Lines of Owen (see Figure 41). Dentin calcification occurs relatively quickly after the collagenous dentin matrix is formed. Like all

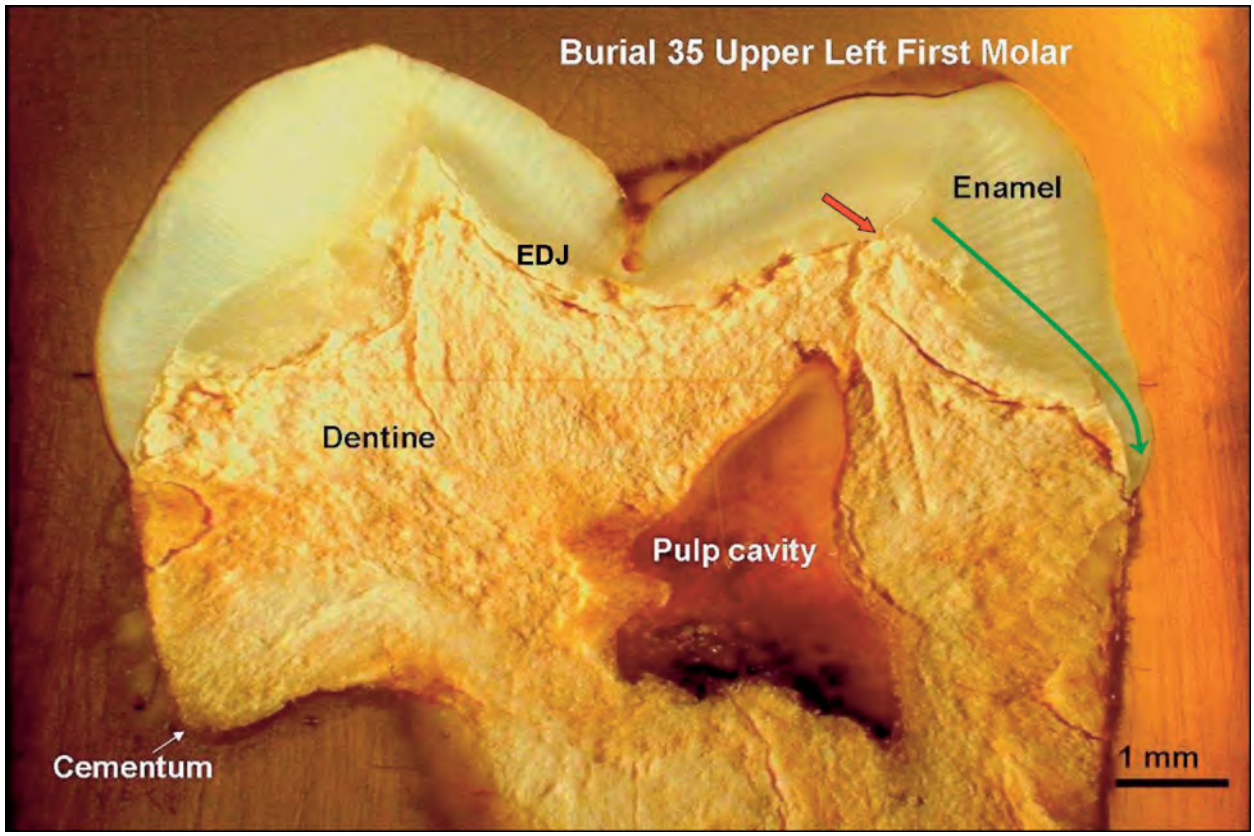


Figure 41. Longitudinal cross section of a permanent upper left first molar from Burial 35, an 8–10-year-old child. The dental tissues—enamel, dentine, and cementum—and the pulp cavity are labeled. The green arrow indicates the general orientation of crown formation. Enamel formation and calcification begin at the enamel-dentine junction (or EDJ) near the "dentine horn" (indicated by the red arrow) and continues outward and downward until the crown is complete. As a result, early forming layers are "buried" within the crown, whereas the last layers are completed at the surface, near the root.

Table 9. Comparison of Dental Hard Tissues and Bone

Tissue	Origin	Organic Framework	Crystal	Internal Cell Space	Turnover Ability	Chemical Composition (Average %)		
						Organic	Inorganic Salt	Water
Enamel	ectoderm	pseudokeratin	apatite	none	none	0.3	97.2	2.5
Dentin	ectomesenchyme	collagen	apatite	dentinal tubule	odontoblast	15	75	10
Cementum	mesoderm	collagen	apatite	canaliculi	cementoblast	23	65	12
Bone	mesoderm	collagen	apatite	canaliculi	osteoblast	21	65	14

other calcified tissues, apatite is dentin's main crystal component (Ten Cate 1985).

A small amount of secondary (or circumpulpal) dentin is continuously deposited after eruption. Chemical characterization of this dentin is useful as a referent for average conditions over a long span of time, such as long-term lead exposure (Needleman and Bellinger 1991).

Cementum

Cementum (or cement) is a thin covering on the roots of teeth. It is relatively similar to bone in a number of

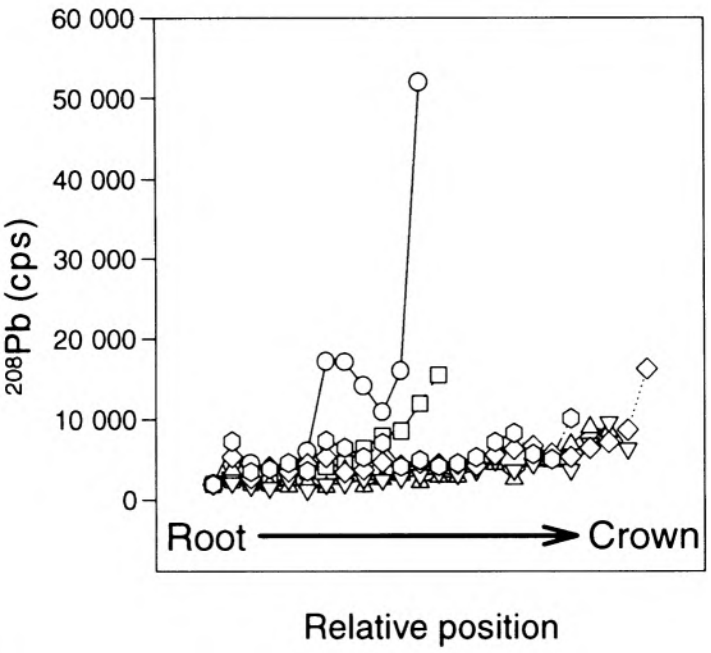


Figure 42. Outridge and coworkers (1996) were the first group to use LA-ICP-MS to study chemical changes in teeth, In this figure (Outridge et al. 1995:167), they illustrate changes in ^{208}Pb content of six adjacent annual cement rings of a walrus tooth (Pb is estimated as counts per second). Each layer is represented by a different symbol, with 11–20 ablation areas per layer. A spike occurs in one layer; however, the lead content is quite variable. Because human cementum is very thin and more vital than enamel and dentine, we have not chosen to focus on it. However, if time permits, we will pilot a laser ablation study of human cementum.

respects, including embryological origin, basic structure, and degree of calcification. Its apatite crystals are similar in size and structure to bone and dentin, about 200–1,000 angstroms in length and 30 angstroms in width (Carlson 1990). One notable feature of cementum is that in addition to a primary layer in mammals, it is continuously deposited in annual rings, which has been used in wildlife biology and bioarchaeology as a method for determining age at death (Charles et al. 1986; Condon et al. 1986; Kagerer and Grupe 2001). Because of its continued deposition, the analysis of cementum chemistry provides a means of tracking annual life-history changes until death. Outridge et al. (1996) have shown that lead varies by cementum layers (Figure 42).

Instrumentation and Methods of Analysis

One of the challenges of hard-tissue chemical studies is to be minimally destructive and at the same time provide chemical information based on the pattern of development and calcification of enamel and dentin. Until the last few years, two general methods have been used to analyze lead and other elements in dental samples: digestion of whole teeth or major portions of teeth for wet analysis and surface profiling. Neither method provides the much-needed time-specific information. However, in recent years, techniques that do provide time-specific information have come to maturation. These involve either ablating or microdrilling small areas of hard tissue. We have employed laser ablation to provide elemental information and drilling to provide information on isotopes. The following is a brief description of the instrumentation, coordination of activities, the utility of each methodology, and an overview of the main questions to be addressed.

Instrumentation and Coordination of Samples

Elemental analyses have been carried out utilizing Hampshire College's Inductively coupled plasma mass spectrometer (ICP-MS) (Perkin Elmer Elan 6000A, Shelton, Connecticut) and attached laser ablation (LA) system (CETAC LSX 100, Omaha, Nebraska). The marriage of the high-precision, high-sensitivity, and multielement capacities of a state-of-the-art ICP-MS with the spatial resolution capabilities of laser ablation (LA-ICP-MS) provides us with a unique opportunity to construct detailed maps of elemental concentrations in teeth with minimal sample preparation and minimal destruction. The method is particularly ideal for chronologically developing tissues such as those found in trees, shells, and teeth (Outridge 1996). Our laser ablation system was obtained to study hard tissues.

Tooth samples have also been prepared at Hampshire College and then sent to other laboratories that

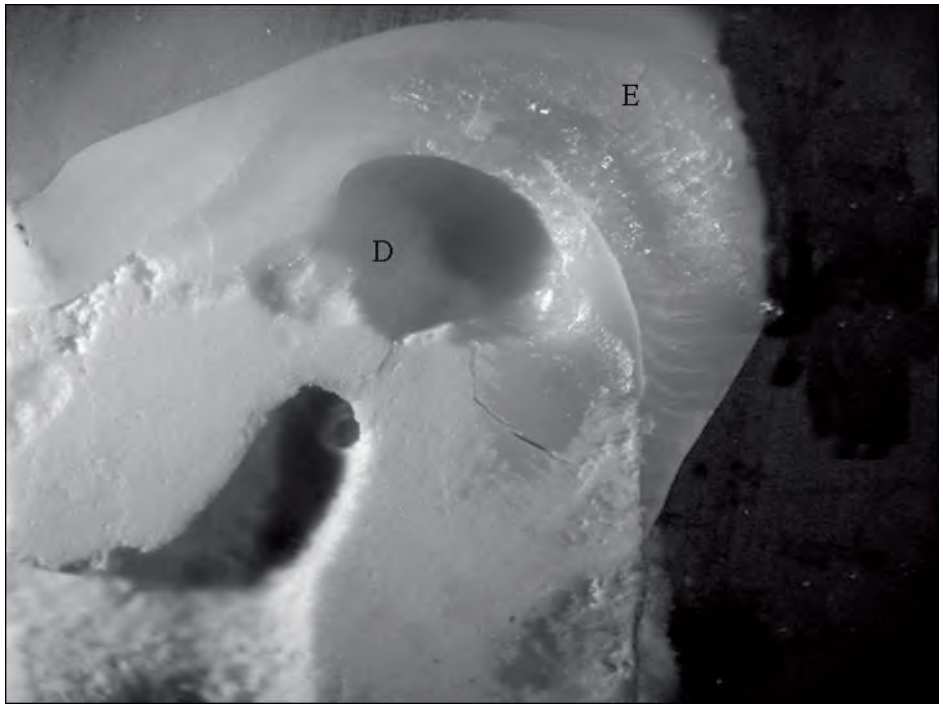


Figure 43. Dremel Drill drilling (Burial 266, LRM1). D = dentine, E = enamel.

specialize in isotopic analyses. In the early stages of research, samples were removed using a Dremel Drill (Figure 43). The results presented below on strontium isotopes are based on enamel and dentin removed by this method and analyzed at the University of Kansas by Doug Walker. In May 2002, we obtained a precision micromill (New Wave Research), allowing us much better control of the location and size of the sample. For example, the micromill allows us the potential to sample multiple isotopic systems at dozens of locations within a single tooth.

The Chemical Tool Kit

The major dietary methods are presented first: elemental strontium, barium, zinc, iron, and carbon and nitrogen isotopes. These are followed by methods for evaluating environmental change: ESA, oxygen isotopes, and strontium isotopes. Finally, we present methods that indicate pollutant exposure and ingestion (lead, arsenic, and mercury, etc.) that might also imply location via anthropogenic sources. We wish to eventually employ multiple chemical methods in order to obtain multiple confirmations of origins and nutrition. However, because of funding limitations, here we focus on results obtained thus far for three methodologies that relate to origins and anthropogenic pollution: ESA, elemental lead, and strontium isotope ratios.

Strontium and Barium

Studied relative to calcium (Ca) concentrations, strontium (Sr) and barium (Ba) concentrations provide a means for evaluating the trophic level of diets. Sr and Ba substitute for calcium in hydroxyapatite, the major inorganic component of all hard tissues. However, Ca is "favored" or enriched over the other two divalent cations because of its smaller size. An enrichment, or fractionation step, occurs as food moves through trophic levels (Figure 44). Therefore, herbivores have more Sr and Ba relative to Ca than primary carnivores, which have more Sr and Ba than secondary carnivores. Thus, ratios of Sr and Ba to Ca have become well established as indicators of the relative portion of meat in diets (Ambrose 1993; Blum et al. 2000; Burton and Price 1990; Gilbert et al. 1994; Runia 1987; Sealy and Sillen 1988; Sillen and Kavanagh 1982).

Because breast-feeding is a higher trophic level than weaning, an increase in Sr/Ca and Ba/Ca ratios in teeth may also be used to pinpoint the age at weaning (Katzenberg et al. 1996). Here, LA-ICP-MS is a particularly excellent methodology. It is one of just a few instruments that can measure Sr and Ba in small, targeted samples, with the needed sensitivity, and can evaluate change in elemental ratios virtually by week. LA spot size can be as small as 10 µm, which is equal to about 2–3 days of enamel development.

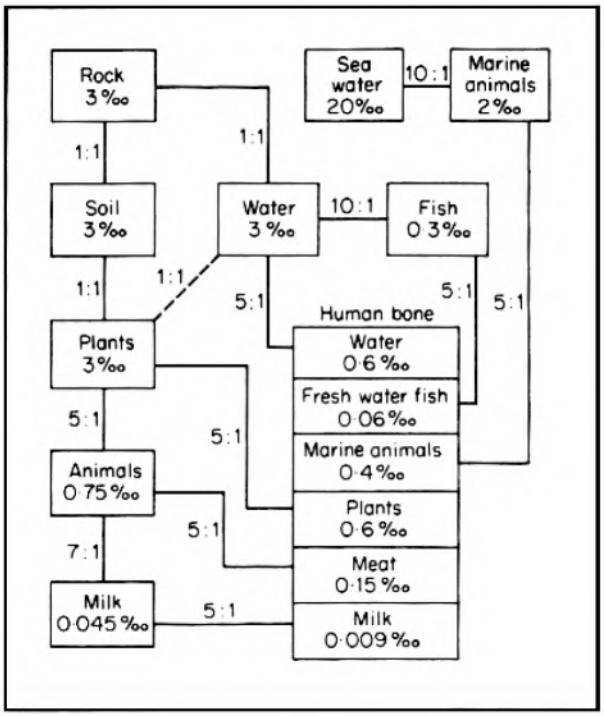


Figure 44. Diagram from Price et al. (1985: 423) showing the five-fold fractionation of Sr/Ca occurring during human digestion, and the contributions to the composite Sr/Ca of bone from various diet components. With knowledge of environmental levels of Sr and Ca and of fractionation dynamics, one can balance the relative input of Sr and Ca into bone or other calcified tissues. Ezzo (1994a; 608) suggests that strontium "is the only firmly established elemental model in bone chemistry analysis." Yet, this is not a simple system, nor has it been fully tested for either bone or dental hard tissues. We propose to test various links in the Sr system and also to use this diagram as a model for study of other systems such as Fe, Ba, Sr and Pb.

Zinc and Iron

Zinc and iron are essential elements that are frequently deficient in diets. Their deficiency may cause a wide spectrum of functional consequences. Both nutrients are key to maintaining linear growth and resistance to infectious disease. Iron also affects cognitive development and work capacity. Although the consequences of these micronutrient deficiencies are often masked by protein-energy malnutrition, deficiencies in these two elements can have severe consequences for the individual, the family, and the social group (Allen 1993; Subcommittee on Zinc, Committee on Medical and Biologic Effects of Environmental Pollutants 1979; Golden 1988; Scrimshaw 1991). Contemporary diets are frequently deficient in one or both of these micronutrients, especially when dietary diversity is low, and meats and fresh fruits and vegetables are limited.

It is highly likely that zinc and iron deficiency were prevalent and consequential to the lives of the enslaved Africans, and it is also likely that their consequences may have been masked by gross protein-energy deficiency. Thus, direct measurement of iron and zinc concentrations will supplement prior analyses of porotic hyperostosis (an indicator of iron deficiency anemia) and bone growth (reflecting overall nutritional status).

Since the 1970s, these elements have been studied in bones and, more recently, in teeth. Ezzo (1994b) warned that interpretations are not unambiguous. We have studied zinc concentrations in deciduous teeth of contemporary Mexican children with known diets during their tooth formation. Our main finding was that enamel zinc concentrations are not related to total zinc intake, but they are strongly associated with factors affecting bioavailability such as phytate and Ca intake (Goodman et al. 2003).

Carbon and Nitrogen Isotopes

The combined analyses of stable carbon isotopes on enamel carbonate, bone carbonate, and bone collagen (respectively, mineral and organic fractions of bone), and nitrogen isotopes on bone collagen, provide data on the macronutrient components of diets, as well as the degree of herbivory versus carnivory. This method can provide distinctions between consumption of different plant groups (e.g., maize versus most other plants); terrestrial, freshwater, and marine resources; and legumes versus other plants. This analysis will (1) help to refine understanding of nutritional (and possibly infectious) diseases in individuals, (2) provide a means of looking at social differences within and between groups, and (3) document major dietary shifts that can be caused by geographic relocation. Paralleling the analysis of oxygen isotopes (described below) and changes in Sr and Ba relative to Ca, nitrogen isotopes can distinguish nursing infants who are one level higher in the food chain than their mothers as well (Katzenberg et al. 1993; Schurr 1997). Lastly, these isotopic data will be integrated with the elemental data (iron, zinc, Sr, and Ba, etc.) from the same tissues to refine our reconstruction of food consumption and nutritional status.

Elemental Signature Analysis

The ICP-MS allows for the simultaneous analysis of a wide suite of elements (approximately 90) and

Table 10. Range of Element Concentrations in Human Dental Enamel

Concentration Range (ppm)	Elements
>1000	Na, Cl, Mg
100–1000	K, S, Zn, Si, **Sr**
10–100	Fe, Al, **Pb**, B, Ba
1–10	Cu, **Rb**, Br, Mo, Cd, I, Ti, Mn, Cr, Sn
0.1–0.9	Ni, Li, Ag, Nb, Se, Be, Zr, Co, W, Sb, Hg
<0.1	As, Cs, V, Au, **La**, **Ce**, Pr, Nd, Sm, Tb, Y

Note: Modified from Curzon (1983:5). Elements in bold are research foci. A suite of elements will be used in some studies.
Key: Ce = cerium; La = lanthanum; Pb = lead; Sr = strontium; Rb = rubidium.

their isotopes in semiquantitative mode (Table 10). This methodology provides a rapid assessment of the presence of pollutants and additional elements of possible interest, especially those that might be useful to discriminate subgroups (such as those who grew up in New York vs. elsewhere). For example, results from this mode of analysis may be analyzed with discriminant function or cluster analysis to identify groups of individuals and outliers who may have been migrants. ESA will complement more specific methods noted below for evaluating migration and change in environment.

Strontium Isotopes

The isotopic composition of Sr is widely used in the earth sciences to discriminate between differing geologic terrains and, as a result, may be valuable in tracing the places of birth and early life of the enslaved African. Sr, which has chemical affinities to Ca and concentrates with Ca in hard tissue, appears as four stable isotopes, ^{84}Sr, ^{86}Sr, ^{87}Sr and ^{88}Sr. ^{87}Sr is the decay product of the long-lived radioactivity of ^{87}rubidium (Rb); with time, the proportion of ^{87}Sr to total Sr grows at a rate dependent on the available Rb. Geologic environments rich in Rb relative to Sr will undergo large increases in the ratio$^{87}Sr/^{86}Sr$, and regions of the earth with low Rb/Sr ratios will retain low values of $^{87}Sr/^{86}Sr$ for long periods of geologic time. Because Rb is a particularly weak-bonding element in the high temperatures of the earth's interior, it has been flushed to the surface through volcanic activity over time and has been concentrated in the continental crust. Stronger-bonding Sr is less fractionated and remains in higher concentration in the earth's interior. As a result, old continental rocks have developed high $^{87}Sr/^{86}Sr$, and volcanic islands, recently formed by partial melting of the Rb-poor mantle of the earth, have dramatically lower $^{87}Sr/^{86}Sr$. The $^{87}Sr/^{86}Sr$ ratios in the teeth and bones of humans whose food and water are locally obtained should reflect the $^{87}Sr/^{86}Sr$ ratios of their environment.

Continents typically consist of regions of ancient rock (cratons) stitched together by zones of younger mountains created during relatively more recent continental collisions. West Africa is typical in that a zone of approximately 600-million-year-old mountains (in Nigeria) lies between very old (more than 2 billion years) cratons to the west and to the south. $^{87}Sr/^{86}Sr$ in the cratons will be very high, and the mountains created in more recent times will have a contribution from the earth's interior and have lower $^{87}Sr/^{86}Sr$. The strongest potential differences in $^{87}Sr/^{86}Sr$ will exist between the cratons of Africa (with a $^{87}Sr/^{86}Sr$ ratio often above 0.80000) and the young volcanic rocks of the Caribbean, particularly the modern volcanic rocks of the outer Antilles (with $^{87}Sr/^{86}Sr$ ratios in the range of 0.7020–0.7040).

Cuba, Dominica, and the western islands of the Caribbean have a continental component and should be distinguishable from the younger, more fully mantle-derived volcanics of the outer Antilles. Because modern $^{87}Sr/^{86}Sr$ analytical procedures produce ratios that are resolvable to the sixth figure beyond the decimal place, there is great potential for finer discrimination among populations. Figure 45 provides a general sense of the geographic pattern of Sr isotope ratios.

As with the other provenance methods, analysis will focus on a life-span perspective with separate analyses of bone and different teeth and parts of teeth

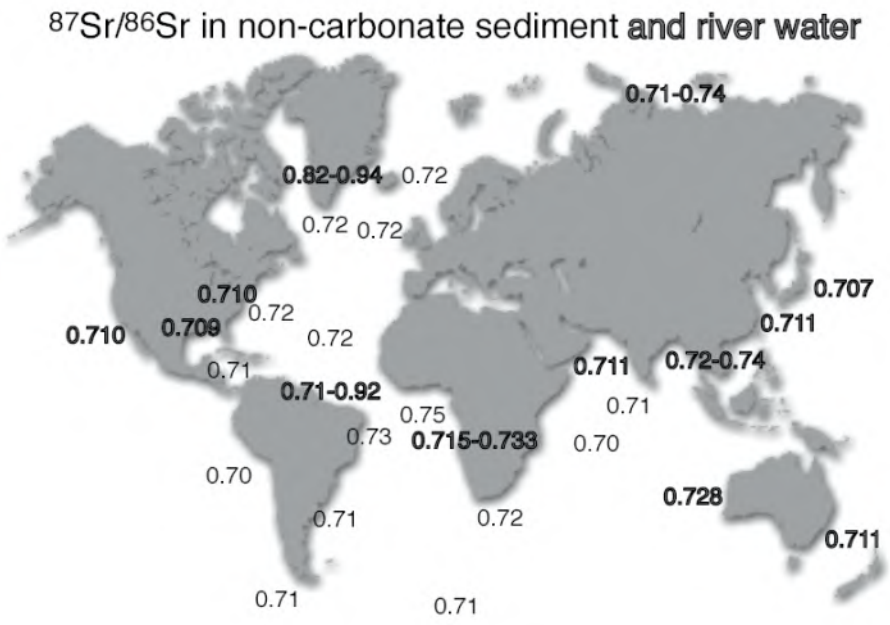


Figure 45. Broad geographic pattern of strontium isotope distribution. Data from Dasch (1969), Allegre et al. (1996), Goldstein and Jacobsen (1988), Palmer and Edmond (1992), and Huh and Edmond (1996).

that calcify at different times in life. Thus, it may be possible to pinpoint the age of an individual at time of movement from one location to another and any subsequent movement.

Oxygen Isotopes

Oxygen isotope analysis has recently been developed for bone and enamel phosphate (White et al. 2002; Wright and Schwarcz 1998). In contrast to carbon isotopes, which are based on the premise that "you are what you eat," oxygen isotope analysis is based on the premise that "you are what you drink." Values in our body fluids reflect those of the water we drink, and the values of environmental water are a function of complex physiographic and climatic variables including temperature, humidity, rainfall, distance from the ocean, and altitude. By analysis of teeth that have formed at different ages in life, it is possible to estimate the age at which individuals moved from one environmentally distinct region to another. As in other analyses, bone values reflect more-recent and final locations.

This methodology has been employed on ice cores from Greenland to plot annual changes in the earth's temperature. Oxygen isotope ratios are sensitive to minor changes in ambient temperature. White et al. (2002) have employed this isotope to discriminate between individuals who grew up at Teotihuacán, in the Valley of Mexico, and those who may have grown up at Monte Alban, Oaxaca, and in the Maya highlands farther to the south. Oxygen isotopes should distinguish with great fidelity individuals who grew up in a tropical area (West Africa and Caribbean) from those who grew up in a more temperate zone (New York). In trying to pin down the possibilities of a two-step migration from Africa to the Caribbean to the United States, this method perfectly complements the analysis of Sr isotopes.

Because nursing infants are one level higher in the food chain than their mothers, their oxygen isotopic ratios are enriched. Because the balance of protein, fat, and carbohydrate is unique in nursing children, the difference between the collagen and carbonate values is much smaller than it is in adults in the same population. These techniques allow us to tell how long the nursing period lasted and how prolonged the weaning period was.

Environmental controls—that is, water and tooth samples from present-day or historical-period inhabitants of New York and areas where the enslaved African may have lived—are crucial to take maximum advantage of oxygen isotope results. Oxygen isotopes without environmental controls can identify outliers and the number of movements (useful information in itself). But without control data, it cannot identify

location of origin. To establish a baseline for the location of an individual, a contemporary or archaeological bone or tooth sample (either human or animal) can be used, along with water samples. Suspected locations of origin would be similarly sampled.

In summary, oxygen isotope analysis, when combined with insights from analyses of ethnohistorical information and other chemical and DNA analyses, may provide a powerful tool for locating regions from which individuals may have moved. Oxygen isotope analysis can be used to specifically test hypotheses derived from other analyses.

Lead, Lead Isotopes, and Heavy Metal Pollution

Lead has frequently been studied in deciduous teeth to track current lead exposures and in bones to provide a history of pollution exposure (Aufderheide et al. 1988; Budd et al. 1998; Fergusson and Purchase 1987; Gulson and Wilson 1994; Purchase and Fergusson 1986; Shapiro et al. 1972). Based on bone lead levels and historical documentation, Corruccini, Aufderheide, et al. (1987) have suggested lead poisoning from rum intake and inhalation of fumes during sugar manufacturing was an "unrecognized epidemic" in the Caribbean during the seventeenth and eighteenth centuries that would have affected both enslaved African and white health and mortality.

By using LA–ICP-MS, we can pinpoint the age and chronological nature of exposure to pollutants (Evans et al. 1995; Outridge 1996; Outridge et al. 1995). Such data provide insights into maternal exposure (via analysis of deciduous teeth), occupations, and movement. The analysis of lead isotopes provides a means to evaluate the potential source of lead (as each source has a unique isotopic signature), and this method, too, may be used to evaluate change in location. Gulson et al. (1997) found that differences in lead (Pb) isotope ratios ($^{207}Pb/^{206}Pb$ and $^{206}Pb/^{204}Pb$) of permanent and deciduous teeth enabled distinction between immigrants and long-term residents in Australia; they hypothesized that observed differences in blood-enamel and blood-dentin isotope exchange rates may be used to estimate individuals' residence time in Australia.

Methods and Results

In this section, we first review the working hypothesis that individuals with CMT were African born. This hypothesis sets up the expectation that individuals with modified teeth might chemically cluster differently from individuals who died in the first decade of life and are assumed to be New York born. We then test this hypothesis by ESA and Sr isotope analysis.

African Cultural Modification of Teeth

The practice of intentionally modifying teeth spans thousands of years and is geographically widespread. Morris (1998) noted that dental chipping and intentional removal was observed in Early Iron Age (ca. 1500 years B.P.) skeletal remains from southern Africa. Britain, India, China, Southeast Asia, Japan, the Malay Archipelago (including the Philippines and New Guinea), Australia, Oceania, the Americas, Hawaii, Grenada, and the Virgin Islands have also produced excavated, culturally altered dentitions (Milner and Larsen 1991). With declining prevalence, members of some societies—notably in Africa, although elsewhere—continue to alter their physical appearances by decoratively filing, chipping, ablating, or otherwise modifying dentitions (Inoue et al. 1992; Inoue et al. 1995; Jones 1992; Milner and Larsen 1991; Morris 1998). Although culturally (i.e., intentionally and nontherapeutically) modified teeth "indicative of different ways of life" have long interested anthropologists, Milner and Larsen (1991:357) noted that studies tend to be "particularistic, frequently focusing on single specimens or skeletal series from a certain site," and reflect the discipline's "descriptive phenomenologically oriented tradition." Recent work, however, considers dental modification as a "biocultural attribute," possibly linked to "social distinction" and "cultural integration" at pre-Hispanic Mayan archaeological sites (Tieslerbos and Frausto 2001:149) and social status among pre-contact Guamanians (Ikehara-Quebral and Douglas 1997).

Anthropologists have offered different explanations linking cultural dental modification and African birth. Stewart and Groome (1968) suggested dental modification would have seemed "hostile" to European slaveowners, who, as a result, would have prohibited its practice whenever possible. Handler and coworkers' (1982) analysis of the late-seventeenth- to early-nineteenth-century Newton sugar plantation cemetery in Barbados included a more complex explanation based on integrated archaeological, bioanthropological, and ethnohistorical data. Although European traders in West Africa regularly commented on African cultural practices as "heathenish" or "savage," Handler and coworkers (1982) suggested scarce documentary refer-

ence to dental modification in colonial settings makes it difficult to reliably assess slave owners' perceptions of the practice as "hostile" or otherwise problematic. In fact, where dental modification is mentioned—that is, in runaway advertisements, it is for the purpose of enhancing descriptions of African escapees in order to facilitate their recognition and recapture.

Handler and coworkers (1982) noted that runaway attempts were frequent in the Caribbean and other parts of the New World during this period. Interestingly, they further noted that posters to help find the runaways with modified teeth invariably included reference to African birth in the form of cultural attributes such as cicatrization (or "country marks") or through ethnic distinctions of varying precision such as "Ibo" or "Coramantine." Handler (1994) offered further support for this hypothesis in the form of similar findings from British colonial North America, noting that contemporaneous runaway advertisements from Georgia, Maryland, Virginia, and North and South Carolina also mention dental modification only with respect to individuals whom slave owners believed to be African born. Like Stewart and Groome (1968), Handler and coworkers (1982) and Handler (1994) have suggested that African dental modification indicates an African birth, as the practice was most likely discontinued in the Americas. However, following Price and Price's (1972) discussion of cicatrization in Suriname, Handler and coworkers (1982) and Handler (1994) have argued that, unlike more easily hidden or coded African cultural practices, dental modification was voluntarily discontinued because of its highly visible, "immutable and indelible" results—that is, as "an adaptive response" enabling greater anonymity during escape efforts.

If fleeing enslavement was central to cultural reasoning that concluded dental modification was maladaptive in the New World, one might still expect this practice to be more visible in the bioarchaeological record. This is because of the prevalence of dental modification in those areas from which most enslaved Africans were extracted during the period of the transatlantic trade (Table 11), as well as the fact that most enslaved persons apparently did not attempt escape. Although Handler and coworkers (1982) correctly noted that many did, the majority of enslaved Africans engaged in often more-subtle forms of resistance, such as working slowly, intentionally breaking tools to disrupt production, or maintaining African cultural practices. In such contexts, dental modification may have taken on importance as a marker of social identity in the Americas, perhaps even more acute than seen generally in Africa, where its meanings were sometimes sacred, but sometimes superficial (van Rippen 1918).

The ethnohistoric component of Handler's (1994) hypothesis obscures this possibility and limits the practical relevance of his analysis to those members of the enslaved population that anticipated escape. Thus, runaway advertisements, although useful, are not directly relevant for testing connections between an African birth and dental modification for most archaeologically recovered African Diasporan remains. As well, early ethnographic accounts, occupied primarily with describing modification patterns, are of limited use for estimating birthplace, because those patterns often are not geographically confined. Table 12 makes this point with respect to modification patterns observed at the New York African Burial Ground. Chemical analyses should more reliably assess the nature of such connections for a greater number of individuals and possibly provide clues for understanding dental modification's limited presence among African Diasporan populations.

Geographic birthplace among enslaved Africans with CMT has been chemically estimated before, with low skeletal-lead content relative to age interpreted as an indicator of African birth at the Newton Plantation (Corruccini, Aufderheide, et al. 1987). More recently, Sealy and colleagues (1995) analyzed bones and teeth to shed light on an understudied dimension of the transatlantic slave trade: Africa's internal diasporas produced through involuntary migration. Sr, carbon, and nitrogen isotopic variation proved useful for establishing nonlocal origins and dietary patterns of individuals, some enslaved and bearing dental modifications, buried during the eighteenth and nineteenth centuries along the coast of Cape Town, South Africa (Cox and Sealy 1997; Cox et al. 2001).

We combined LA–ICP-MS ESA and Sr isotopic analyses to analyze permanent first and third molars (and one central incisor) from a total of 40 modified adult and nonmodified subadult teeth excavated from the New York African Burial Ground. ESA is based on the incorporation into enamel of elements that are not nutritionally essential and not directly bioregulated. These nonessential elements may be used to estimate the relative geographic relatedness of individuals during tooth formation and to identify possible clusters among and between modified and nonmodified individuals. Because they are not actively physiologically regulated, elements such as

Table 11. African Dental Modification Patterns

A. Filing mesial maxillary central incisors (Guinea, Togo, Angola, Democratic Republic of the Congo, Uganda, Kenya and Tanzania)
B. Filing mesial and distal of maxillary central incisors (Guinea, Central African Republic, Democratic Republic of the Congo, Angola)
C. Filing six maxillary anterior teeth to pointed shape (Democratic Republic of the Congo, Zimbabwe)
D. Filing four maxillary and four mandibular incisors to pointed shape (Guinea, Cameroon, Republic of the Congo)
E. Horizontally filing maxillary central incisors (Guinea, Democratic Republic of the Congo)
F. Centrally notched incisors (Sierra Leone)
G. Serrated incisors (Mozambique)
H. Mesial triangular notch cut in gingival one-third of central incisors (Republic of the Congo, Sudan)
I. Concave filing of maxillary incisor, convex filing of mandibular incisors (Tanzania, Mozambique)
J. Extracting maxillary central incisors (Zambia)
K. Extracting mandibular central incisors (Uganda, Kenya)
L. Extracting primary mandibular canines (Democratic Republic of the Congo, Sudan, Uganda)
M. Extracting four maxillary incisors (South Africa)
N. Extracting four mandibular incisors (Sudan)
O. Extracting four maxillary and four mandibular incisors (Democratic Republic of the Congo, Uganda)
P. Extracting single lateral incisor[a] (South Africa)
Q. Artificial prognathism with facially flared maxillary central incisors (Senegal, Kenya)

Note: From Gould et al. (1984).
[a] Maxillary in diagram.

lead reflect anthropogenic landscape interactions and patterned pollutant exposure. By comparing early- and later-developing enamel, we are able to more directly consider natal age as well as identify possible migration patterns observed as shifting first- and third-molar elemental signatures.

This study provides chemical evidence for identifying the birthplaces of the New York African Burial Ground individuals with modified and nonmodified teeth, while piloting the bioarchaeological application of LA–ICP-MS ESA. Cultural dental modification is considered here in biohistorical context as an archaeo-

Table 12. NYABG Modification Patterns with African and African Diaspora Reference Populations

Modification Pattern	Burial Number(s)	Referenced Population(s)	Reference(s)
Wave (incisors and canines)	47	none	none
Wedge (central incisors)	23	Cuba via Congo (Bakongo); SW Angola (Ngumbi); Cape Town via SE Africa (Makua, Maravi and Yao)	Cox and Sealy 1997; Ortiz 1929; Wentzel 1961
Mesial filing (incisors)	6, 114, 326, 366, 377	S Angola (Owampo) and N Namibia (Damara); Virgin Islands	Buxton et al. 1938; von Ihering 1882
Distal chipping/filing (incisors)	101, 241, 367, 397	Barbados	Handler et al. 1982
I^1, I^2 mesial, distal chipping/filing	68, 194, 243, 403	Grenada; Cuba via Congo (Loango)	Ortiz 1929; Stewart and Groome 1968
I^1, I^2 mesial, distal with C^1 mesial chipping/filing	115, 384	none	none
Point (incisors)	9, 106, 151, 192	Barbados; Cuba via Congo Calabar); Gold Coast (Ashanti, Aksin)	AMNH; Ortiz 1929; Stewart 1939
Blunt point (incisors)	266, 270, 340	Southern Dem. Republic of Congo	Torday 1919
Hourglass (incisors)	281	Dem. Republic of Congo; Barbados	Handler et al. 1982; Lignitz 1919–1920
General (occlusal) chipping/filing (incisors)	165	none	none

Key: AMNH = American Museum of Natural History; C^1 = upper canine; I^1 = upper first incisor; I^2 = upper second incisor
Note: Modified from Blakey (1998b).

logically retrievable biocultural practice. That is, dental modification is an example of how humans modify and reshape physical features to communicate cultural meaning and expression. Where such practices affect the bones and teeth, they take on added importance for the reconstruction of lived experience.

The New York African Burial Ground sample is unique in that the number of observable modified dentitions (n = 26) yielded by its excavation is the largest associated with an African Diaspora population to date. The site is also a window onto colonial Africans' under-explored northern experiences. Chemical estimation of birthplace addresses the first of four primary questions developed by researchers in collaboration with the skeletal population's descendant (i.e., New York's African American) community: what are the geographic (and/or) ethnic origins of the population? We also implicitly test Handler's (1994) conclusions, based largely on ethnohistorical data, with biochemical analytical methods that are potentially applicable to other African Diaspora skeletal populations.

Beyond its absence or presence as a cultural "retention" or "survival," dental modification observed among African Diasporans may provide direct evidence of African origins and childhood, and a means of assessing African and American health environments. To date, Handler's (1994) work at the Newton Plantation in Barbados has most thoroughly explored the meaning of African dental modification in the Americas, concluding that its presence likely indicates African birth. However, Handler's (1994) hypothesis is limited by its emphasis on escape from enslavement as an impetus to discontinue dental modification. We employed chemical analysis in the form of LA–ICP-MS ESA to estimate African birth among modified and nonmodified individuals from the New York African Burial Ground in an effort to further

Table 13. NYABG Chemical Analysis Sample

NYABG Modified Adult		NYABG Nonmodified Subadult		Ghanaian and Other	
ID (Age Ranges [in years], Sex)	Tooth	ID (Age Ranges [in years], Sex)	Tooth	ID	Tooth
Burial 6 (25–30, M)	LLM1	Burial 7 (3–5, N/A)	LRM1	CREGEG	LRM1
Burial 9 (35–45, M)[a]	LLM1	Burial 22 (2.5–4.5, N/A)	LRM1		
Burial 9 (35–45, M)[a]	LRM3	Burial 35 (8–10, N/A)	ULM1		
Burial 23 (25–35, M)	URM1	Burial 39 (5–7, N/A)	LRM1		
Burial 47 (35–45, M)[a]	LLM1	Burial 43 (2.5–4.5, N/A)	LRM1	CREGDO	LLM1
Burial 47 (35–45, M)[a]	LRM3	Burial 45 (2.5–4.5, N/A)	LRM1		
Burial 101 (26–35, M)[a]	LRI1	Burial 55 (3–5, N/A)	URM1	Pig molar associated with Burial 137	molar
Burial 101 (26–35, M)[a]	LLM3	Burial 126 (3.5–5.5, N/A)	LLM1		
Burial 106 (25–35, PF)	LRM1	Burial 138 (3–5, N/A)	URM1		
Burial 115 (30, F)	LRM1	Burial 160 (3.5–5.5, N/A)	LLM1		
Burial 165 (16+, I)	LLM1	Burial 167 (8.5–12.5, N/A)	LRM1		
Burial 266 (25–35, F)	URM1	Burial 169 (5.5–9.5, N/A)	LRM1		
Burial 270 (16+, M)	LLM1	Burial 180 (11–13, I)	ULM1		
Burial 281 (16+, M)	ULM1	Burial 219 (4–5, N/A)	LRM1		
Burial 340 (39.3–64.4, F)[a]	LRM1	Burial 236 (4–5, N/A)	LLM1		
Burial 340 (39.3–64.4, F)[a]	LRM3	Burial 244 (5–9, N/A)	LLM1		
Burial 366 (34–62, I)	LLM1	Burial 286 (4.5–8.5, N/A)	LLM1		
Burial 367 (25–35, F)	ULM1	Burial 304 (3–5, N/A)	LRM1		
		Burial 405 (8, N/A)	URM1		

Key: For "Sex": F = female; PF = probable female; I = indeterminate; PM = probable male; M = male; N/A = not applicable. For "Tooth": LLM1 = lower left first molar; LLM3 = lower left third molar; LRM1 = lower right first molar; LRM3 = lower right third molar; ULM1 = upper left first molar; URM1 = upper right first molar; LRI1 = lower right first incisor.
Note: Age is given in years.
[a] These individuals were analyzed for early- and later-forming enamel (two teeth were sampled).

understand this population's origins and to establish a more widely applicable means of testing Handler's (1994) findings.

Materials and Methods

Sample Selection and Preparation

LA–ICP-MS ESA was applied to 40 teeth. Thirty-seven teeth from New York African Burial Ground individuals included a permanent first molar from 13 modified adults and 19 nonmodified subadults; a permanent first incisor from 1 modified adult (Burial 101); and a third molar from 4 modified adults. Additionally, an intrusive pig tooth found with Burial 137 was analyzed for its presumably New York values, as were 2 permanent first molars from individuals excavated in coastal Ghana in order to provide possible examples of "West African" trace-elemental profiles (Table 13). As we show below, our assumption that the pig tooth came from a local pig is no longer justified based on its high Sr isotope ratio, which suggests that the tooth came from an African-born pig.

Burial 101 was included despite his lack of a permanent first molar because his analysis offered the opportunity to compare chemical findings with skeletal biological data suggestive of time spent in

Africa—that is, possible evidence of yaws in the form of platycnemia and striated lesions observed on the tibiae. Also, the presence of what appears to be an Akan Adinkra ("Sankofa") symbol tacked to Burial 101's coffin lid reflects perhaps the most ethnolinguistically specific material-culture evidence recovered from the site. The Ghanaian individuals were excavated in Eguafo (Tooth ID No. CREGEG) and Dominase (Tooth ID No. CREGDO) villages during the summer of 2000 as part of ongoing archaeological research into the dynamics of early West African and European "culture contact" in coastal Ghana's Central Region (see DeCorse 2001).

Sample preparation proceeded as follows. Teeth were first soaked for 2 days in distilled, deionized water and brushed to remove loose debris. Organic material was removed with a 2-day soak in a 1 percent papain solution, after which teeth were thoroughly rinsed with distilled, deionized water. Following a 30-second, 3 percent (v/v) hydrogen peroxide bath for removal of inorganic material, teeth were rinsed and soaked again for 2 days in distilled, deionized water. Upon drying, teeth were embedded in Buehler Epoxide Resin with the procedure detailed by Marks et al. (1996). However, teeth were secured in plastic containers with glue instead of copper wire. Two bucco-lingual thin sections approximately 0.20–0.25 mm in thickness were made with a diamond-coated copper blade affixed to a low-speed Buehler Isomet cutting unit for histological analysis. The exposed surface of the embedded tooth and the thin sections were etched with 1M hydrochloric acid. Embedded teeth were polished, cleaned with acetone, and rinsed with distilled, deionized water just prior to ablation. All glassware was cleaned with 50 percent (v/v) nitric acid and rinsed three times with distilled, deionized water.

Sample Collection and Analysis

Selected teeth were ablated with a 266 nm UV-pulsed Nd:YAG laser (CETAC, LSX 100, Omaha, Nebraska). Trace elemental intensities (counts per second, or cps) were determined by ICP-MS (Perkin-Elmer Sciex, Elan 6000a, Norwalk, Connecticut). Semiquantitative analytical software (TotalQuant II, Perkin-Elmer, Norwalk, Connecticut) was employed to determine intensities of 64 elements across a mass range of 40.078 (Ca) to 204.383 (bismuth [Bi]), and including 232.038 (thorium [Th]) and 238.029 (uranium [U]).

Before laser ablation of each tooth, response factors stored in TotalQuant II were updated to reflect instrument sensitivity under current operating conditions by external calibration with National Institute for Standards and Technology (NIST) standard reference material (SRM) trace elements in glass (NIST SRM 612). SRMs are matrices containing certified or known major and trace elemental compositions for a given material used in the development of chemical methods of analysis for trace elements. Certified and known values are both used for calibration in semiquantitative analysis, but only certified values necessarily reflect agreement between two or more methods or laboratories and thus are more reliable (NIST 1992). The glass matrix (NIST SRM 612) was used because currently there is no enamel hydroxyapatite SRM, which would more closely approximate human tooth elemental composition.

Following optimization of the operating conditions of the ICP-MS for TotalQuant II analysis, calibration and sample collection were performed as follows. First, an argon blank was run as a procedure blank. Next, NIST SRM 612 was ablated as an external standard, with certified/known concentration values of iron (Fe), nickel (Ni), Rb, Sr, lanthanum (La), Pb, and Th used to construct a calibration curve covering the desired mass range. The NIST SRM 612 was then ablated as a sample, and found and certified/known values were compared in order to evaluate the calibration (Table 14).

Upon verifying accuracy, teeth were ablated as samples. At least two 2.5–3.0-minute raster-pattern ablations were conducted for most teeth and, whenever possible, from earliest-formed enamel (i.e., from the cusp or occlusal area) in order to increase the likelihood of analyzing natal landscape interaction (Figure 46). Another calibration was then performed prior to ablation of the next tooth. Counts per second (or intensities) for nonessential, nonbioregulated elements measured within semiquantitative range—Rb, Sr, La, cerium (Ce), and Pb—were averaged and interpreted with SPSS 11.0 hierarchical cluster analysis as representations of individuals' relative relatedness. For a detailed discussion of calibration and other theoretical and methodological issues concerning semiquantitative ICP-MS analysis, see Amarasiriwardena et al. (1997) (although their research involved liquid nebulization sampling).

Results

The cluster diagram (Figure 47) includes the following information from left to right: (1) four main

Table 14. ICP-MS External Calibration Results for NYABG Burial 6 Lower Left First Molar

Element	NIST SRM 612 Concentration (ppm by weight)		%ΔE
	Found	Certified/Known	
Ti[a]	0.083	(50.1 ± 0.8)	-99.830
Mn	30.175	(39.6 ± 0.8)	-23.800
Fe	46.099	51 ± 2	-9.600
Co	29.121	(35.5 ± 1.2)	-17.969
Ni	33.331	38.8 ± 0.2	-14.095
Cu	33.205	(37.7 ± 0.9)	-11.923
Rb	29.061	31.4 ± 0.4	-7.449
Sr	75.738	78.4 ± 0.2	-3.395
Ag[a]	5.642	22.0 ± 0.3	-74.360
Ba	56.424	(41)	37.620
La	32.249	(36)	-10.419
Ce	35.407	(39)	-9.213
Nd	29.498	(36)	-18.061
Sm	26.344	(39)	-32.451
Eu	28.616	(36)	-20.511
Gd	20.648	(39)	-47.056
Dy	19.722	(35)	-43.651
Er	19.931	(39)	-48.895
Yb	23.701	(42)	-43.569
Au[a]	0.146	(5)	-97.080
Tl	12.025	(15.7 ± 0.3)	-23.408
Pb	32.957	38.57 ± 0.2	-14.553
Th[a]	13.120	37.79 ± 0.08	-65.282
U[a]	4.557	37.38 ± 0.08	-87.809

Note: $\%\Delta E$ = (Found concentration – certified or known concentration)/certified or known concentration x 100. ( ) = informational, uncertified value. Certified/known range of concentrations is equal to the larger value of entire range of observed results or those within 95 percent confidence interval (NIST 1992).
[a] Percent of error is below semi-quantitative range ($\%\Delta E$ ± 30–50).

clusters or statistical groupings (C1, C2, B1, and A); (2) burial number or sample and tooth sampled; (3) sex; (4) estimated age in years; (5) presence and type of dental modification; and finally (6) the cluster linkages. The lengths of the arms linking the clusters represent the estimated geochemical distance between individuals or groups (clusters). For example, the greatest distance is found between Burial 165 and the remaining individuals.

As just noted, the analysis produced a first division between Burial 165 (labeled cluster A, bottom), and the remaining individuals were subsequently divided, first separating cluster B1 from the remaining individuals, then subdividing cluster C1 from C2.

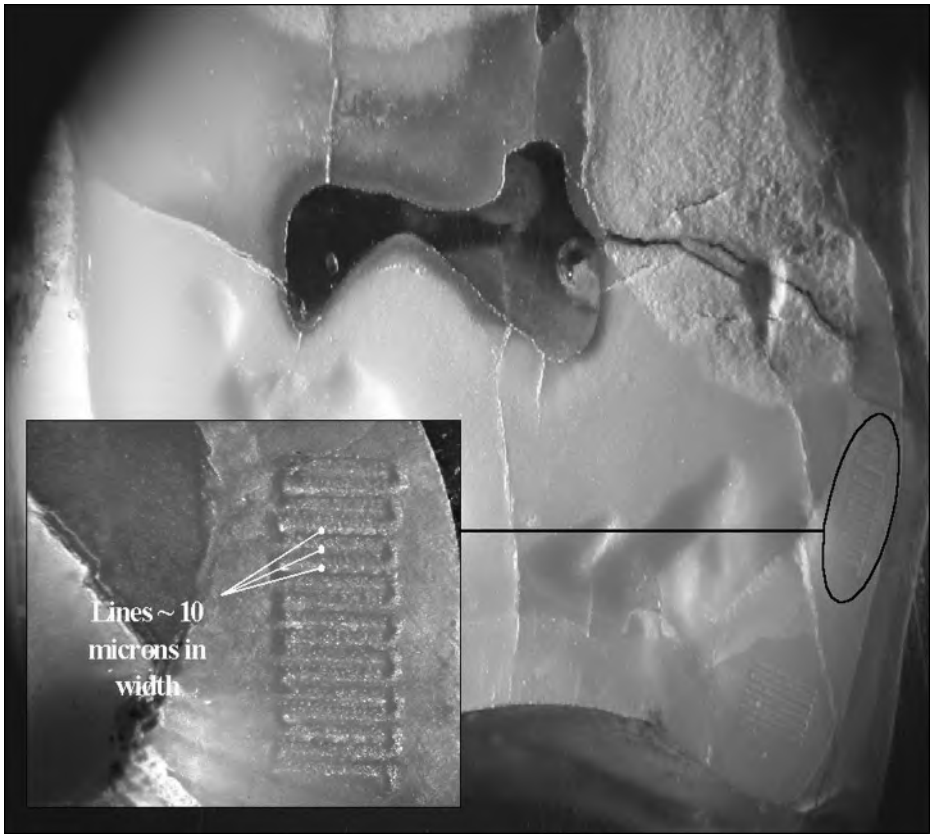


Figure 46. Raster ablation (Burial 23, URM1)

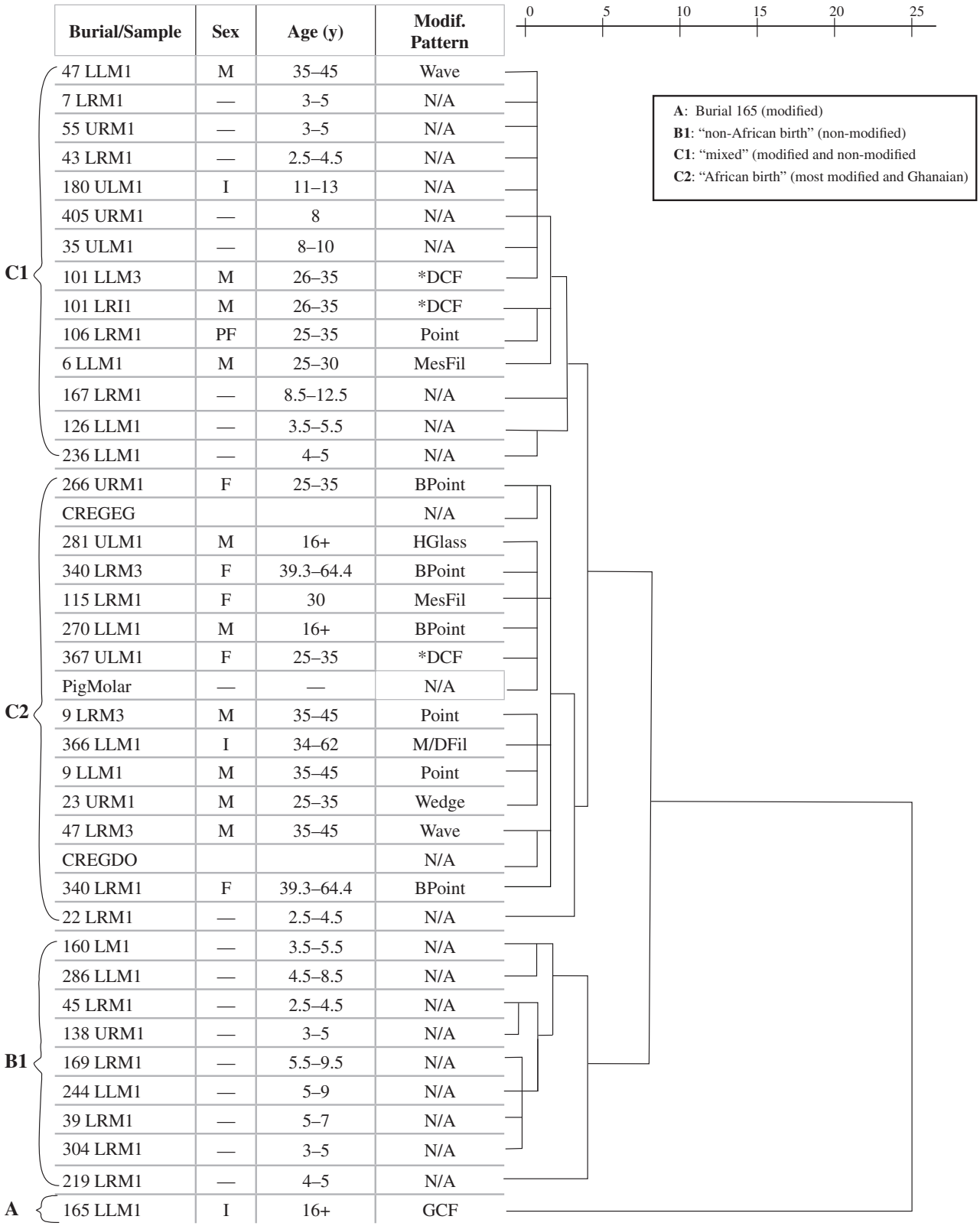
The interesting result concerns which individuals were designated to each cluster. Cluster B1 consists of nine teeth representing nine individuals, from Burial 160 to Burial 219 (see Figure 47). All of these individuals died before 8 years of age. Cluster B1 appears to be a natal New York cluster.

Cluster C2 includes 14 individuals, represented by 16 teeth, starting with Burial 266 and ending with Burial 22 (see Figure 47). The 16 teeth include 2 teeth from Ghana, the intrusive pig molar, and 13 teeth (representing 11 individuals) from the burial ground. Two individuals in this cluster, Burials 9 and 340, were represented by a first molar (M1) and a third molar (M3). With the exception of Burial 22 at the bottom of the cluster, all of the New York African Burial Ground individuals in Cluster C2 displayed dental modifications. These results suggest that the individuals in this cluster were born in Africa.

Cluster C1 is more mixed than the others. There are 14 teeth representing 13 individuals in this cluster; Burial 101 is represented by two teeth. The majority of the teeth, 9 individuals represented by 9 teeth, were from children without dental modifications. Five other teeth were from 4 individuals (Burials 47, 101, 106, and 6) with CMT. Finally, Burial 47 is represented in this cluster by its first permanent molar and in the C2 (African natal) cluster by its third permanent molar. This cluster switch is intriguing, as it suggests a movement from an as-yet unknown area.

In summary, ESA, a first methodology, has successfully separated the majority of individuals, as represented by teeth, into coherent clusters. This helps affirm the utility of the method, on one hand, and that young individuals were indeed born near New York while the majority of individuals with modified teeth were African born.

A key implication of these data is that, depending on how they cluster, it may now be possible to determine the broad geographic birthplace of older individuals without modifications. However, some interesting questions remain before we can take this next step with confidence. Why does Burial 22, an individual that died at 3.5 years of age, cluster with African-born individuals? And why do four individuals with dental modifications cluster with nine young individuals without modifications? One complication is that the chemistry of a first molar may partly



	Burial/Sample	Sex	Age (y)	Modif. Pattern
C1	47 LLM1	M	35–45	Wave
	7 LRM1	—	3–5	N/A
	55 URM1	—	3–5	N/A
	43 LRM1	—	2.5–4.5	N/A
	180 ULM1	I	11–13	N/A
	405 URM1	—	8	N/A
	35 ULM1	—	8–10	N/A
	101 LLM3	M	26–35	*DCF
	101 LRI1	M	26–35	*DCF
	106 LRM1	PF	25–35	Point
	6 LLM1	M	25–30	MesFil
	167 LRM1	—	8.5–12.5	N/A
	126 LLM1	—	3.5–5.5	N/A
	236 LLM1	—	4–5	N/A
C2	266 URM1	F	25–35	BPoint
	CREGEG			N/A
	281 ULM1	M	16+	HGlass
	340 LRM3	F	39.3–64.4	BPoint
	115 LRM1	F	30	MesFil
	270 LLM1	M	16+	BPoint
	367 ULM1	F	25–35	*DCF
	PigMolar	—	—	N/A
	9 LRM3	M	35–45	Point
	366 LLM1	I	34–62	M/DFil
	9 LLM1	M	35–45	Point
	23 URM1	M	25–35	Wedge
	47 LRM3	M	35–45	Wave
	CREGDO			N/A
	340 LRM1	F	39.3–64.4	BPoint
	22 LRM1	—	2.5–4.5	N/A
B1	160 LM1	—	3.5–5.5	N/A
	286 LLM1	—	4.5–8.5	N/A
	45 LRM1	—	2.5–4.5	N/A
	138 URM1	—	3–5	N/A
	169 LRM1	—	5.5–9.5	N/A
	244 LLM1	—	5–9	N/A
	39 LRM1	—	5–7	N/A
	304 LRM1	—	3–5	N/A
	219 LRM1	—	4–5	N/A
A	165 LLM1	I	16+	GCF

Figure 47. ESA Cluster Diagram based on concentrations of five trace elements: Rb, Sr, La, Ce and Pb. BPoint (blunt point); DCF (distal chipping and filing); GCF (general chipping and filing); HGlass (hourglass filing); M/D Fil (mesial and distal filing); MesFil (mesial filing).

reflect the chemistry of the mother's environment if the mother loses bone apatite during breast-feeding. Another hypothesis is that dental modification continued in New York. Our hope is that another method will help resolve alternative hypotheses.

Strontium Isotope Ratios

As previously noted, the ratio of ^{87}Sr to ^{86}Sr has emerged as a powerful method to distinguish the age of landscapes. Because the isotopes are not fractionated in biological tissues, the tissues of animals living on these landscapes reflect the landscapes.

Methods and Materials

As in the ESA analysis, for this pilot or testing study we selected teeth from dentally modified individuals as well as teeth of young individuals from the New York African Burial Ground. In most cases, analyses focused on the first permanent molars, which develop during the first few years of life. All samples were obtained by drilling dentin and enamel using a Dremel tool and stainless steel bits (see Figure 43). The bit was thoroughly cleaned with water in an ultrasonic bath and visually inspected under a microscope for contamination between samples. Analyses of replicate drill samples from the same tooth suggest contamination by the bit and cross-contamination between samples was negligible. Powder was collected and placed in an ultraclean teflon beaker with approximately 1 mL of 7M HNO_3. The beaker was sealed and placed on a hot plate at 100˚C overnight for dissolution. After cooling, the beakers were opened, returned to the hot plate, and evaporated to dryness. The sample was cooled and dissolved again in 600 µL 3.5M HNO_3 in preparation for isolation of Sr. All samples were centrifuged prior to column chemistry; however, no solid residue was ever observed. Sr was separated using standard, Sr-specific crown-ether resin chromatographic techniques. Columns used had a total column volume of approximately 35 µL. Rinsing was done with 3.5M HNO_3, and Sr was eluted with water. Total procedural blanks during analysis were less than 100 pg Sr and comprise a negligible portion of the Sr analyzed. Separated Sr was dried in H_3PO_4 and loaded onto single rhenium (Re) filaments using a $TaCl_5$ emitter solution for analysis. Analysis was accomplished on a VG Sector (University of Kansas analyses) and Sector-54 (University of North Carolina, Chapel Hill analyses) thermal ionization mass spectrometer. Both labs used identical 3-cycle dynamic Sr analysis routines, and all data were normalized to $^{86}Sr/^{88}Sr = 0.1194$. Replicate analyses of NIST-987 yielded $^{87}Sr/^{86}Sr = 0.710262 \pm 0.000009$ (2σ).

Results

Results are reported as the ratio of ^{87}Sr to ^{86}Sr (Figure 48). Although results appear to tightly cluster around 0.710–0.720, the method was accurate to six significant figures. Thus, it may eventually be possible to suggest that a difference as small as 0.710450–0.710460 is meaningful.

Figure 48 provides a summary of results. The $^{87}Sr/^{86}Sr$ ratio is plotted on the y-axis, and individuals span across the x-axis. Approximate ages are at the bottom and in boxes are the individuals' $^{87}Sr/^{86}Sr$ ratios with enamel represented by open circles and dentin represented by dark diamonds. Individuals lacking decorative dental modifications are on the left and the individuals with decorative modifications are toward the center; the Ghanaian teeth, Ghanaian well water, and the intrusive pig molar are located on the right.

Enamel

Based on prior geological studies and the clustering of young individuals, the "local" Manhattan $^{87}Sr/^{86}Sr$ value is likely to be approximately 0 .711–712. And, in fact, most young and nonmodified individuals (left side of figure) have both enamel and dentin values that cluster in this range.

On the other hand, the Ghanaian teeth and waters and the intrusive pig have much higher $^{87}Sr/^{86}Sr$ values. The highest $^{87}Sr/^{86}Sr$ found was from a river sample collected in Ghana, with value over 0.735. All of these samples have significantly higher Sr isotope ratios than those found in those born in New York and suggest a wide range of values in Africa. These results are consistent with prior findings.

The individuals with decoratively modified teeth seem to divide into two or even three groups. Many individuals have high enamel values (Burials 106, 165, 6, 241, 266, 9, 367, and 23). Others such as Burial 47, Burial 114, and Burial 270 may be below the Manhattan value, and others (Burials 115, 281, 366, and 101 are, at the moment, indistinguishable from the Manhattan value.

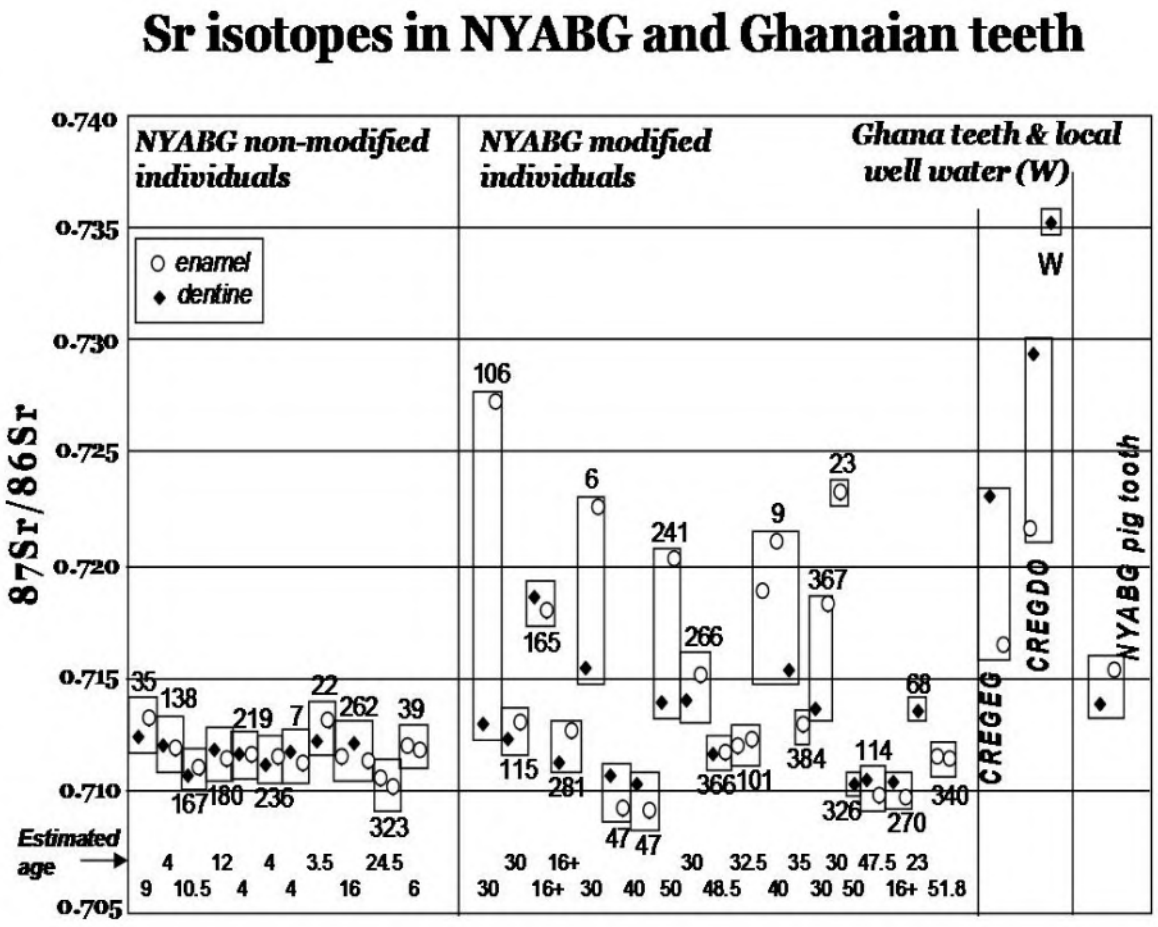


Figure 48. Strontium Isotopes Chart: Ratio of ^{87}Strontium to ^{86}Strontium in samples of enamel and dentine of individuals from the New York African Burial Ground, plus two individuals from Ghana; water from Ghana; and an intrusive pig molar (recovered with Burial 137).

Dentin vs. Enamel

Dentin values relative to enamel values provide some potential insights. In all of the young individuals without dental modification, the dentin values are close to the enamel values, suggesting little movement or migration during life. On the other hand, the Ghanaian dentin values are high relative to the enamel values, suggesting possible movement to the African interior.

Most interesting is that all individuals with enamel ratios above the suggested Manhattan range have dentin values that are closer to the Manhattan range. This suggests that dentin may be chemically equilibrating to the lower Manhattan range. Possible explanations for this movement of dentin toward the Manhattan range might be either postmortem diagenesis, the incorporation of vital secondary dentin, or changes in primary dentin chemistry during life. In the future, we intend to test among these different explanations because they have different implications for the interpretation of dentin chemistry.

Enamel Strontium Isotopes Ratios Compared to Elemental Signature Analysis

The combined results of two independent sourcing methods suggest the following. First, the vast majority of young individuals cluster together in both methods. This suggests that they indeed spent all of their short lives in and around New York. Similarly, most individuals with modified teeth cluster together in both the ESA and Sr isotope studies, suggesting that they spent their early lives in Africa.

A few individuals in particular require further study by more detailed examination of sequentially devel-

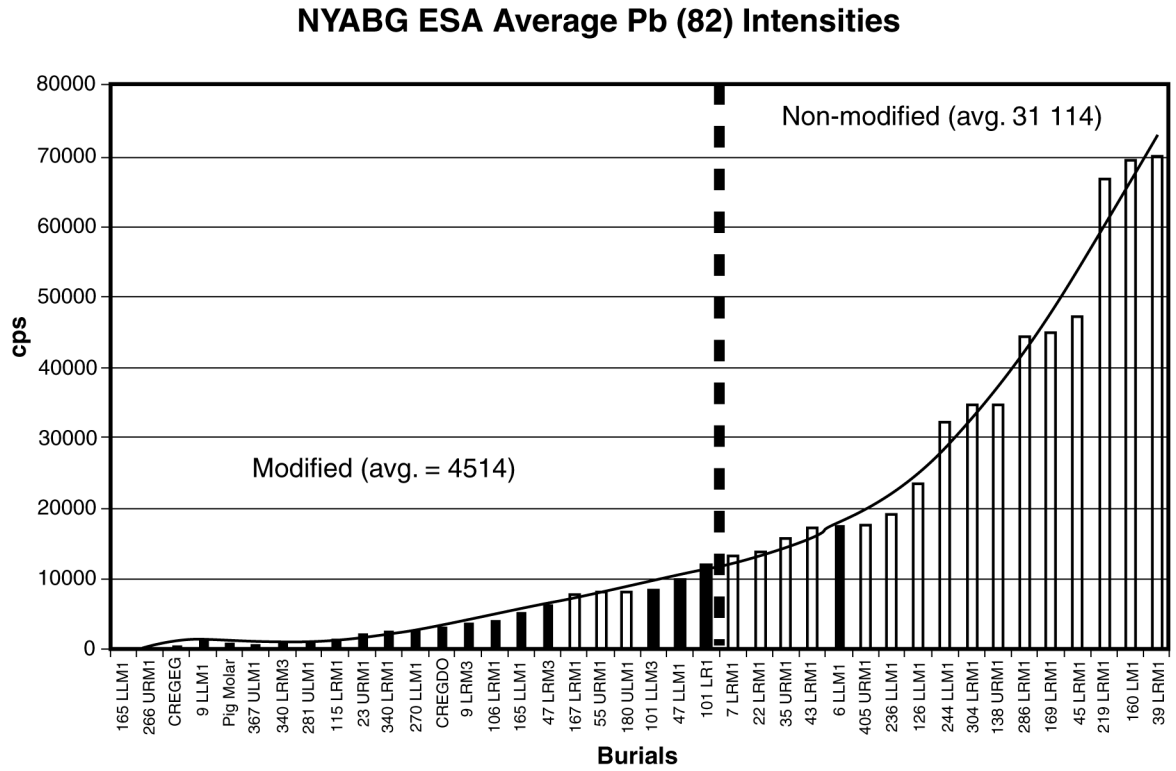


Figure 49. Lead variation. Ranking of intensities of lead in teeth studies for ESA. Teeth from individuals with dental modifications (dark bars) tend to have low lead levels compared to individuals without dental modifications (white bars).

oping enamel and dentin by the above methods and new methods. For example, Burial 101 falls within the range of the New York born on both methods, suggesting the possibility that this individual's teeth were modified in the Americas. On the other hand, Burial 106 clearly appears to be African born based on Sr isotopes, but not based on ESA.

Enamel Lead Content

As part of the collection of data for ESA, data were collected semiquantitatively for nutritionally significant elements such as Sr and iron and heavy-metal pollutants such as lead. Here, we provide a brief note on lead variation within the teeth of individuals from the New York African Burial Ground.

Figure 49 presents lead intensities for samples with dental modifications (dark bars) and other individuals. Intensities are ordered from lowest to highest and vary from near nonexistent, less than 100 cps, to over 50,000 cps. The average intensities of lead in nonmodified teeth were over 30,000 cps, compared to an average of fewer than 5,000 cps for modified teeth.

Without a doubt, lead was significantly higher in the teeth of some individuals from the New York African Burial Ground. As part of a broader study, six individuals were analyzed quantitatively for lead concentrations by liquid nebulization–ICP-MS (Webb et al. 2003). Despite the small sample size, it is worth noting that two nonmodified children's (Individuals 304 and 405) whole-tooth lead levels were significantly higher than those of four modified adults (Individuals 47, 266, 340, and 367). Lead levels ranged from 1.2 to 112.2 µg/g (ppm), observed in Individuals 405 and 367, respectively. Although it is as yet unclear precisely how lead levels of different regions in teeth relate to blood levels, 10 µg/dL in blood is above the Centers for Disease Control (CDC) threshold for unsafe lead levels. A concentration in whole teeth of over 100 ppm is undoubtedly unsafe and would have neurological and behavioral consequences (Purchase and Fergusson 1986).

Lead burden variation observed in the New York African Burial Ground sample underscores the need to assess the distribution and biohistorical impacts of elevated lead burden within and across populations. For example, the lead levels in the bones of enslaved

Africans were apparently more variable and generally higher in Barbados than in at least some parts of southern mainland North America. Corruccini, Aufderheide, et al. (1987:238) suggested that many enslaved Africans buried at the Newton Plantation experienced "only mild, intermittent symptoms of lead intoxication . . . [while others] probably suffered moderate to severe symptoms." Aufderheide et al. (1981, 1988) associated high bone-lead values from the Clifts Plantation in eighteenth-century Virginia primarily with wealthy white slave owners who ingested "very substantial" quantities of lead via foods stored in relatively expensive, pewter containers. Likely also affected, however, were domestic laborers whose access to such foods and subsequent lead burden would have been greater than that of other enslaved Africans, which is a possible explanation for the high lead content observed for an 18-year-old female (Aufderheide et al. 1988). Rathbun (1987) reported mean bone-lead values intermediate to those from the Caribbean and Virginia studies for African American remains excavated from a nineteenth-century plantation cemetery in Charleston, South Carolina.

As lead is found in enamel formed during the first year or two of life, the public health significance of better understanding the social and biocultural etiology and consequences of lead poisoning becomes even clearer. It is highly likely that lead is transmitted from mother to child through breast-feeding and may even be transmitted prenatally (Schell 1991, 1997). Thus, the distribution of elevated lead levels is in part a reflection of maternal lead burden—a "multigenerational experience" (Schell 1997:72) historically and organically linked to race, residence, and economic status in the United States. Hence, lead poisoning is no longer an "unrecognized" epidemic affecting primarily white landowners. Today, lead poisoning constitutes a "silent" epidemic disproportionately affecting African Americans "hypersegregated" in low-income, urban areas where malnutrition, old housing, and prolonged exposure due to low social mobility maximize lead levels (Lanphear et al. 1996; Needleman 1998; Reed 1992; Weintraub 1997).

This finding of unusually high lead levels among first-generation African Americans, especially in individuals who died at an early age in New York, provides important historical context and leads to a number of important questions. We would like to know the prevalence of lead pollution, the source of the pollution, the age of individuals who were ingesting high lead levels, and whether lead is implicated in their early deaths. Expanded lead analysis may help to distinguish other groups within the New York African Burial Ground sample whose work environments or status placed them at higher risk for lead poisoning. These would include domestic workers, mine workers, and possibly freed people, some of whom would have had greater access to pewter items (see Aufderheide et al. 1985; McCord 1953).

Conclusions

Preliminary studies of teeth from individuals buried in the New York African Burial Ground confirm that most individuals who died at an early age spent their lives in and around Manhattan, and most individuals with CMT appear to have spent their first decades somewhere in Africa. Sr isotopes also suggest that a few individuals may have spent time in the Caribbean. High lead levels in the teeth of individuals who lived their lives around Manhattan and died at an early age is an entirely new finding.

These pilot studies have significantly furthered our understanding of the lives of the individuals who are buried in the New York African Burial Ground. The results strongly hint at the capability to tell the geographic histories of individuals, along with individual histories of nutrition and pollution exposure. Combined with historical, archaeological, and other bioarchaeological information, additional studies modeled on the ones conducted here will lead to the clearest understanding of enslaved Africans.

Therefore, based on the outcomes obtained in these pilot studies and the experience gained from research on the New York African Burial Ground sample, the New York African Burial Ground skeletal biology team intends to pursue additional funding for future studies[1] that would explore, among others, the following:

- Extension of studies to bone to better understand chemical conditions nearer the time of death
- Establishing the cause of variation in chemistry between enamel and dentin of the same tooth
- Extensive analysis of soils and fauna from New York and possible other natal homes (West Africa

[1] These studies were included in the original research design of the project, and dental samples were collected for this purpose. The GSA reversed its denial of access to dental samples to allow Joseph Jones and Alan Goodman to continue chemical research in 2004 (the editors).

and the Caribbean) in order to better establish values at possible source locations
- Extension of analyses to other teeth and a finer-grained analysis of teeth
- The addition of new methodologies, such as oxygen isotopes, to further resolve natal homes

Acknowledgments

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