WRITTEN IN BONE
READING THE REMAINS OF THE 17TH CENTURY

by Kari Bruwelheide and Douglas Owsley

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[Editor's Note: The Smithsonian's Department of Anthropology has had a long history of involvement in forensic anthropology by assisting law enforcement agencies in the retrieval, evaluation, and analysis of human remains for identification purposes. This article describes how Smithsonian physical anthropologists are applying this same forensic analysis to historic cases, in particular seventeenth century remains found in Maryland and Virginia, which will be the focus of an upcoming exhibition, *Written in Bone: Forensic Files of the 17th Century,* scheduled to open at the Smithsonian's National Museum of Natural History in November 2008. This exhibition will cover the basics of human anatomy and forensic investigation, extending these techniques to the remains of colonists teetering on the edge of survival at Jamestown, Virginia, and to the wealthy and well-established individuals of St. Mary's City, Maryland. These "bone biographies," as compiled through a unique combination of scientific and historical evidence, will provide intriguing information on people and events of America's past. At no other time in our history have we had the technological capabilities or opportunities to tell this story through archaeology. The colonists can now speak for themselves because their story, as ours, is written in bone.]

"There is properly no history; only biography." Ralph Waldo Emerson

If one views history, as Emerson did, as a compilation of individual personal biographies, think of how many gaps in history exist. This is especially true for the 17th century Mid-Atlantic region of North America for which little written documentation remains, but whose settlements had a tremendous impact on our nation as we know it today. The stories of only a few individuals stand out in this history—John Smith, John Rolfe, and Pocahontas, being the primary people who have shaped our understanding of this era. The vast majority of biographies are strikingly absent from the early colonial record. These are the untold stories of the countless men, women, and children who came to America, many willingly and others under duress, whose anonymous lives helped shaped the course of our country.

As we commemorate the 400th anniversary of the settlement of Jamestown, it is clear that historians and archaeologists have made much progress in piecing together the literary records and artifactual evidence that remain from the early colonial period. Over the past two decades, historical archaeology especially has had tremendous success in charting the development of early colonial settlements through careful excavations that have recovered a wealth of 17th century artifacts, materials once discarded or lost, and until recently buried beneath the soil (Kelso 2006). Such discoveries are informing us about daily life, activities, trade relations here and abroad, architectural and defensive strat-

Figure 1: Doug Owsley measures a human skeleton from a clandestine burial discovered during the excavation of a 17th century house cellar in Anne Arundel County, Maryland.

Figure 2: Kari Bruwelheide and Doug Owsley examine infant remains recovered during Project Lead Coffins, St. Mary's City, Maryland.

egies, and much more. But what do we know about the bearers of this material culture? Imagine how enhanced our view of the past would be if we were also able to fill in some of the human gaps of history, stories of individual lives not previously known to us. Wouldn't 17th century America seem more immediate and compelling if, instead of only reading about important dates and places in time, we learned more about the actual people who lived that past and heard their personal stories of life and death?

Although time travel has yet to be invented in the literal sense, for a number of years physical anthropologists from the National Museum of Natural History (NMNH) have had the privilege of "meeting" individuals from seventeenth century America on a daily basis and "hearing" their stories first hand. This is possible because physical anthropologists at the NMNH, like those elsewhere, have the job of examining human skeletal remains. In their role most familiar to the public they are the "forensic anthropologists" who locate and analyze bones from modern contexts, usually related to criminal or missing persons' investigations. The information these scientists obtain from contemporary bones and burials is used to solve crimes and identify individuals (see past issues of *AnthroNotes* for more details on forensic anthropology: 1993 Vol.15 No.1; 1998 Vol.20 No.1; 2006 Vol. 27 No.1; 2006 Vol. 27 No.2). Most people are not aware, however, that the same investigative techniques used to examine modern human remains are being applied to bones hundreds, or even thousands, of years old. Such work is conducted in much the same way and with the same degree of compassion, respect, objectivity, and scientific inquiry as are modern forensic investigations.

This is because people from the present and those from the past share a fundamental connection: we all have a skeleton. Bones provide the framework for our soft tissues, allow for movement, protect many of our vital organs, serve as the center for the production of blood cells, and help regulate tissue metabolism as an important warehouse of nutrients necessary for life. With this shared foundation, all humans are remarkably similar—from the number of bones in our bodies, to the types of bones present, to the way we grow and develop. And yet, differences in our bones do exist. These slight differences, mostly in size and shape, separate males from females, young from old, and tall from short. Slight variations in skull form give each of us our unique facial appearance, and more broadly, can differentiate people from various parts of the world. Injuries to bones can alter their shape permanently, and diet affects not only bone growth and form, but also affects bone chemistry. The old adage "you are what you eat" is certainly true for the skeleton. In short, bones store a vast amount of data on who we are and how we live.

What, then, can we learn from our bones? The answers gathered from the forefront of scientific skeletal analysis are remarkably detailed and include a person's age, sex, and stature, as well as clues to their ancestry, diet, health, activity patterns, and much more. This information is encoded in the bones of past peoples and in our own bones and teeth throughout our lifetime. Skeletons may not provide information on one's thoughts or ideas, but they certainly yield information about our aches and pains, as well as providing a durable physical record of who we are as individuals—information that cannot be obtained so clearly from any other source.

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Reading the Remains

How is the information extracted from the bone? Much like the archaeologist who reads the clues left in the soil and material remains from a site in order to reconstruct life-ways, events, and habitation patterns, the physical anthropologist uses his or her training in human anatomy and human variation to read the clues left in the bones. The scientific methods used in this process are at the same time both basic and complex, and are often interdisciplinary, combining aspects of both human biology and chemistry.

At the most basic level, visual inspection of the bones is performed. This examination, sometimes done in the field (Figure 1, p. 9), but more often performed in the laboratory (Figure 2, p. 10), confirms the identification of bone as human or non-human, and is the first step toward compiling a detailed bone and tooth inventory for each set of remains analyzed. Determinations of age, sex, stature, body build, and sometimes ancestry then follow based on specific observations of bone morphology, such as shape, robusticity, and development of the areas on bones where muscles attach. Examination at this stage is assisted by methods of greater complexity involving two- and three-dimensional measurements of specific skeletal elements and mathematical calculations in order to determine stature and ancestry.

Radiography through standard X-ray and computed tomography (CT) complements the visual inspection of the skeleton by obtaining images of the internal structure of teeth and bone (Figures 3a & 3b). These images assist in evaluating the health and well-being of an individual: his or her dental pathology, childhood illness, nutrition, disease, and trauma, all of which can modify bone, both externally and internally. When performing these types of analyses it is essential to have a good understanding of the appearance of normal versus abnormal bone, in addition to understanding how natural processes can alter bone. More recently, CT scans have been used to compile three-dimensional coordinate data on bone size and shape, providing a virtual image record useful for comparing bone structure and form within and between populations. A model of the bone can also be made from the CT data creating an almost permanent anatomical record of the remains.

Perhaps most exciting within the field of physical anthropology are modern applications of molecular biology and bone chemistry, which are carrying the interpretative abilities of physical anthropologists one step further and are increasingly being used to answer questions of ancestry and diet. DNA retrieval and analysis, once implemented solely within the realm of contemporary forensic cases, is now being successfully attempted in studies of old bones (Owsley et al. 2006). If preservation allows, determination of biogeographical ancestry, sex, and even personal identity are possible through DNA studies of old skeletal remains. Dietary information is also obtainable through bone chemistry and is based on the different chemical signals of foods and the transmission of these differences to the tissues of the consumer. Dietary patterns, changes in diet, and the movement of people into new environments are often distinguishable by measuring the chemical signals in bone. The application of dietary studies to colonial period skeletal remains has proven especially useful in that for the first time in history we have the ability to identify the human remains of first generation immigrants versus American-born colonists by the chemical signals in their bone (Ubelaker and Owsley 2003).

The 17th Century Skeletal Record

Over the past decade numerous skeletons representing the first century of British colonial settlement in North America have been discovered. These human remains have come from a variety of contexts with differing circumstances prompting their removal. Burials dating to the 17th century have been discovered during archaeological excavations in Virginia and Maryland. Some of these discoveries are part of large-scale investigations at historically important sites such as Jamestown, Virginia, and Historic St. Mary's City, Maryland. Others have come from isolated, incidental findings of small, unmarked cemeteries removed by salvage archaeological work necessitated by land development and construction projects. A good place to live and build a residence community today often was a good place to live and bury the dead three centuries ago. Surprisingly, other 17th century remains come from seemingly unconventional discard contexts, such as old trash pits and wells linked to habitation areas.

Systematic study of all of these skeletal remains has resulted in the collection of life-history information on more than two hundred early European and a much lesser number of African immigrants who lived and died in the Chesapeake region during the 1600s. With rare exceptions, these remains have come from forgotten, unmarked, and unnamed burials, yet this fact doesn't lessen their identity.

Figures 3a & 3b: Radiographies of a child's skull showing internal structure and development of the deciduous ("baby teeth") and permanent (adult) dentition.

Each individual becomes known through the biological data obtained from their skeleton, along with information from the burial context and period documentation. This evidence produces amazingly detailed personal profiles for each set of human remains.

One Boy's Case History

An excellent example of this can be found in the human remains dating to 1607 Jamestown, the first permanent English settlement in the New World. Efforts by archaeologists to uncover the original James Fort have simultaneously resulted in the discovery of human skeletons buried within and near the three-sided log palisade, including the remains of men and boys from the first voyage. During the Association for the Preservation of Virginia Antiquities (APVA) excavation of James Fort in August, 2005, a skeleton was discovered along the western palisade wall (Figure 4, p. 12). Clues from the grave, including its location relative to the fort, indicate the burial took place early in the settlement. The original burial shaft, distinguishable by slight variation in the color and consistency of the soil, appeared to have been poorly and hastily prepared as indicated by the unevenness of its walls and floor and its length, which was short relative to the length of the body. No coffin was used, as no remains of one were visible. The presence of a loose shroud was evidenced not by the material itself, which had decomposed long ago, but by the position of the mandible, legs and feet of the skeleton within the grave. The mandible had fallen out of articulation with the upper jaw during decomposition and had shifted downwards due to the pressure of the earth on the shroud covering the face. If a shroud had not been used, the mandible would have been held in place by the surrounding soil. The position of the mandible also reveals that no wrapping or chin strap was used around the head to hold the mouth closed and which would have also held the jaw in place in the grave. The shroud appears to have been tied or wrapped around the ankles keeping the lower appendages together. Also, the feet remained pointing upward toward the top of the grave. The shroud wrapped around the ankles prevented the feet from falling laterally to the grave floor after the body was buried. The arms, however, were not tightly secured within the shroud, allowing them to fall at awkward angles as the body was lowered into the grave.

The position of this skeleton not only yields clues on how the body was prepared for burial, but also provides evidence regarding the actions of the burial party.

Figure 4a (left): In situ remains of a boy found buried within the original perimeter of James Fort. The contorted position of the right arm, a broken clavicle, and the presence of a stone arrowhead pointing towards the boys left thigh bone suggest traumatic death. Figure 4b shows a close up of the arrowhead against the thigh bone.

The position of the bones indicates that the burial party lowered the remains from the left side of the head and foot ends of the grave shaft. This interpretation is evidenced by the slight upward inclination of the left side of the remains, the position of the arms, and the body's curvature. The right side of the torso settled first leaving the left side at a slightly higher elevation in the grave. A consequence of the weight of the torso falling to the right side of the body is that the untied arms gravitated toward the right side of the shroud. The abdominal and hip regions of the body are more toward the right side grave wall, while the head and feet regions are directed slightly toward the left wall. This subtle curvature of the extended body suggests the burial was somewhat rushed, as is also indicated by unevenness of the floor of the grave, resulting in slightly higher elevations of the head and feet. As stated, the grave was too short to fully accommodate the individual. Thus, the feet are elevated from the grave floor and are in direct contact with the bottom grave wall. The head is uplifted as well by a pedestal of dirt. In effect, the *in situ* positioning of the arms and the distortion in the body layout indicates that no effort was made to reposition the body in the grave after it was lowered.

Circumstances relating to the subtle neglect of care in the burial process are further revealed by clues in the bones. The skeleton does not represent a grown man, which excludes identification of the remains as one of the older "gentlemen" of the Jamestown venture. Rather, the body is that of a young boy. The bones and teeth show incomplete growth, and suggest an age of about 15 years. Features of the skull and additional dietary information obtained through bone chemistry indicate the boy is of Eu-

ropean decent. His socioeconomic status is unknown, but was likely modest as suggested by bone markers of poor health and nutritional stress. The skull has a remodeled depression fracture on the bone of the forehead, above the left eye orbit indicating a healed blow. The boy has signs of nutritional deficiency in the form of porosity in the roofs of both eye orbits. This condition, known as cribia orbitalia, is typically related to iron deficiency and anemia. In addition, radiographs of the boy's leg bones reveal multiple, transverse, radiopaque bands. These bands, or lines, are markers of disturbed bone growth and are referred to as "Harris lines." They form during periods of arrested and then resumed growth and are the result of nutritional or disease stress during childhood. Most telling of the boy's health, however, is a severe tooth abscess that was active at the time of death. The abscess had its origin in a broken mandibular incisor crown, which exposed the pulp chamber to bacterial infection. The cavitation formed by the abscess is large and includes most of the chin (Figure 5). In life, the chin would have been inflamed, undoubtedly painful, with sinuses of draining pus into the vestibule between the lower lip and front teeth. The severe tooth abscess had turned into a severe osteomyelitis, an expanding bone infection that was destroying the front portion of the jaw.

This boy's compromised health and weakened condition provides context for evidence pointing to his violent death. The boy exhibits a fracture of his right clavicle that is unhealed and therefore, was broken at or near the time of death. This trauma is supported by the positioning of the right shoulder and arm in the grave. In order for the shoulders to have been so close together, one or both of the clavicles had to have been broken, indicating upper thoracic trauma. This extreme compression of the upper thorax was not caused postmortem, or by natural conditions in the grave after burial. Furthermore, a stone projectile point was found with the skeleton. The point of the arrowhead was directed toward the lateral surface of the distal left femur (Figures 4a & 4b). No tip damage is evident indicating the projectile did not directly impact bone, but its position indicates that it was lodged in the flesh of the lower thigh. This arrow injury might not have been immediately fatal, but combined with evidence of upper body trauma signifies a violent confrontation that ended in death.

Figure 5: Skull of the boy from James Fort showing a large area of missing bone in the front of the jaw. This hole was formed in life as a result of a cracked tooth, which allowed bacteria to enter the pulp chamber, resulting in a deep bone infection.

This boy's story, as told from the remains, parallels two historic accounts from the early days of Jamestown. Both can be found in "Jamestown Narratives," a compilation of eyewitness accounts of the Virginia Colony during its first decade (Haile 1998). Both accounts relay the circumstances of an attack in May 1607 on the Englishmen by Native Americans soon after the men landed. Both accounts mention the death of a boy, but neither referred to him by name, possibly due to his younger age and/or lower status within the group. Regardless, the

event and death were traumatic enough to warrant description in diary entries from the time.

. . .They came up almost into the fort, shot through the tents, appeared in this skirmish, which endured hot about an hour, a very valiant people.

They hurt us 11 men, whereof one died after—and killed a boy, yet perceived not they this hurt in us. We killed divers of them, but one we saw them tug off on their backs, and how many we hurt we know not . . .

. . .28. Thursday. We labored palisading our fort.

Gabriel Archer: *A relation of the discovery of our river from James Fort into the main, made by Captain Christofer Newport, sincerely written and observed by a gentleman of the colony*. (pp.115)

. . .Had not God beyond all their expectations, by means of the ships at whom they shot with their ordnances and muskets, caused them to retire, they had ent'red the fort with our own men, which were then busied in setting corn, their arms being them in dryfats and few ready but certain gentlemen of their own; in which conflict most of the council was hurt, **a boy slain in the pinnace**, and thirteen or fourteen more hurt. . .

John Smith: *A True Relation / of such occurrences and accidents of note as hath hap'ned in Virginia since the first planting of that colony which is now resident in the south part thereof, till the last return from thence. Written by Captain Smith, one of the said colony, to a worshipful friend of his in England. [1608]* (pp. 147).

The story of this boy, compiled through clues from the bones and grave, is compelling in its own right. More fascinating is its ability to fill in the narrative of a known event and place it in early colonial history. It cannot yet be said for certain that these remains are those of the boy killed in the referenced attack, but the evidence along these lines is intriguing. What the skeleton does provide with relative certainty is physical evidence for early conflict between the English and the native population, a tenuous relationship that held the lives of many people, both Englishmen and Native Americans, in the balance. It also provides an intimate portrait of the harsh conditions faced in the New World, even by the young, who were also participants and victims of the Jamestown venture.

The ability of this boy's skeleton to introduce us to the events of the past is not unique. From the indentured servant, to the African slave, to a ship's captain, to the established families of England, each individual who came to and died in America left behind an equal and lasting legacy of bone. It is the job of physical anthropologists specializing in human skeletal research to reveal the legacy and investigate the "mysteries of history" as they present themselves through archaeology. It is this message that will be featured in the exhibition, *Written in Bone: Forensic Files of the 17th Century*.

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We thank the APVA and lead archaeologist William Kelso for allowing us to assist with the exciting investigations being conducted at Historic Jamestown. Photography was done by Chip Clark, Scientific Photographer, Smithsonian Institution.

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