

ARCHAEOLOGICAL INVESTIGATIONS OF THE EASTERN STATE HOSPITAL CEMETERY (1839-1861), FAYETTE COUNTY, KENTUCKY

**Edited By
David Pollack and Heather Worne**

**With contributions by
Karen Hudson, Peter Killoran, Kim A. McBride,
Greg Maggard, Stuart Nealis, Nancy O'Malley, Emily Rinker,
Christopher Romanek, Millie Westmont, and Mindi Weitzal**



**Research Report No. 11
Kentucky Archaeological Survey**

ARCHAEOLOGICAL INVESTIGATIONS OF THE EASTERN STATE HOSPITAL CEMETERY (1839-1861), FAYETTE COUNTY, KENTUCKY

Edited By
David Pollack and Heather Worne

With contributions by

Karen Hudson
Peter Killoran
Kim A. McBride
Greg Maggard
Stuart Nealis
Nancy O'Malley
Emily Rinker
Christopher Romanek
Millie Westmont
Mindi Weitzal

Kentucky Archaeological Survey Research Report No. 11



Jointly Administered by: The University of Kentucky Department of Anthropology and
The Kentucky Heritage Council
Lexington, Kentucky

ACKNOWLEDGEMENTS

We would like to thank Ronald L. Harris of the Kentucky Finance Administrative Cabinet for his assistance in bringing this project to completion. He was a pleasure to work with, as was hospital administrator Susan Griffith. We also would like to thank Glen Crabtree of Congleton-Hacker who provided technical assistance in the field and the backhoe operators (Paul Dixon, Mark Mallott, and Teddy Kreckler) from Solid Rock Construction who carefully exposed the grave shafts.

We are most appreciative of Greg Maggard who directed the fieldwork, and without whose leadership the excavation of this cemetery would not have been as thorough and well-documented. The paid crew, students, and volunteers did an outstanding job in the field under less than ideal conditions. They included Jason Hodge, Jeff Young, Eric J. Schlarb, Kiristen Bright, Shawn Webb, M. Jay Stottman, Micky Loughlin, Kim McBride, A. Gwynn Henderson, Allison Esterle, Millie Westmont, Mindi Weitzal, Eddie Henry, Chris Gunn, Rick Burdin, W. Stephen McBride, Erin Sears, Maggie Pool, Rebecca Major, Cara Mosier, and Emily Elkins. Many of the same individuals assisted in the washing and cataloguing of the materials recovered. Thanks to Hayward Wilkerson for producing the graphics, and for Michelle Massey for providing editorial assistance. Finally, a special thanks to administrative staff Ed Winkle, Barbara Gortman, Steven Osborne, and Carol Cottrill.

Thanks to Chris Pappas for looking at and identify the fabrics recovered from Eastern State Hospital and to Melissa Bishop for processing the staple carbon isotope samples. We are especially appreciative of Svenje Weise, a visiting researcher from the Max Planck Institute for Demographic Research in Rostock, who did an independent aging and sexing of the burial sample during her visit to the William S. Webb Museum of Anthropology.

ABSTRACT

The Eastern State Hospital mortuary sample was comprised of a diverse group of individuals. They came from various social and economic backgrounds, and were brought to the hospital from counties throughout Kentucky. In many ways their lives parallel those of the general communities that they resided in, as most undertook a considerable amount of hard labor before and after they entered the hospital. At death, they were treated in a manner similar to those interred in other mid-nineteenth century cemeteries. The deceased were carefully laid to rest in hexagonal wooden coffins with their arms placed in the appropriate position pursuant to family, cultural, or religious traditions. Men were buried wearing shirts, jackets and pants, and women wearing dresses and shifts.

The bioarchaeological data indicates those interred in the Eastern State Hospital Cemetery suffered maladies common among pre-antibiotic nineteenth century agricultural societies where malnutrition, poor sanitation, and infectious disease were common. Instances of enamel hypoplasia, porotic hyperostosis, and cribra orbitalia indicate many individuals suffered from nutritional deficiencies during their early years, likely caused by infections and a poor diet. These maladies coupled with poor sanitation often made people susceptible to infectious diseases, such as respiratory infections and sinusitis. The onset of any of these infections could have begun before these individuals entered the hospital, or been contracted once admitted. Some evidence of physical anomalies is evident in the burial population in the form of bruxism and teeth grinding and poor dental health due to medical treatments. Surprisingly, they consumed a more diverse diet than cemetery populations associated with other central Kentucky urban neighborhood and rural cemeteries.

The presence of mass graves points to the need to bury people quickly, perhaps due to cholera epidemics. These efforts ultimately resulted in the disturbance and commingling of earlier single interments. A disconnect between the living and those interred within the cemetery coupled with nineteenth century mortuary customs that often involved the reuse of burial plots also may have contributed to the commingling of human remains.

TABLE OF CONTENTS

Chapter One: Introduction by David Pollack and Greg Maggard.....	1
Overburden Deposits.....	5
Cholera Epidemics	6
Changing Landscapes	7
Summary	8
Chapter Two: Historic Background by Karen E. Hudson	9
Historic Context.....	9
Treatment of the Mentally Ill by Nancy O’Malley.....	37
Chapter Three: Cultural Materials Recovered by Kim A. McBride and Victoria Westmont	40
Introduction	40
Coffins And Coffin Hardware	40
Clothing And Personal Objects	44
Miscellaneous Artifacts	55
Discussion.....	56
Summary.....	61
Chapter Four: Population Characteristics by Heather Worne, Emily Rinker and Stuart Nealis	62
Introduction	62
Taphonomy	62
Demographicprofile	64
Stature	66
Pathology	68
Arthropathies	75
Specific And Non-Specific Infection.....	76
Pathology By Age And Sex.....	80
Summary.....	83
Archaeological Site Comparisons.....	85
Conclusions	88
Chapter Five: Dental Analysis by Mindi Weitzal.....	90
Introduction	90
Demographics	91
Ancestry.....	91
Sex	94
Dental Health.....	95
Discussion.....	108
Summary.....	116
Chapter Six: Isotopic Analysis by Emily Rinker and Christopher Romanek	117
Carbon Isotope Ratios.....	117
Nitrogen Isotope Ratios	122
Archaeological Cemetery Comparisons	125
Summary.....	127

Chapter Seven: Mortuary Patterns and Interpretations by David Pollack, Heather Worne, and Peter Killoran.....	127
Introduction	127
Mortuary Patterns	130
Population Characteristics	142
Diet	147
Commingling/Lack of Connectedness.....	147
Conclusions	149
References Cited	151
Appendix One- Burial Descriptions.....	A-1
Appendix Two -	A-2

LIST OF TABLES

3-1. Nail pennyweights	43
3-2. Nail distributions.....	44
3-3. Frequency of screws per burial	44
3-4. Breakdown of bone button types by burial	46
3-5. Comparisons by gender.....	59
3-6. Inter-Cemetery Clothing Closure Comparisons.....	60
4-1. Skeletal preservation codes (Matternes et al. 2012:183)	63
4-2. Eastern State Hospital skeletal preservation	64
4-3. Demographic profile	65
4-4. Age-at-death estimated using CEI	66
4-5. Descriptive statistics for stature by sex.....	67
4-6. Comparative stature of other sites in surrounding area.....	68
4-7. Individual Cases of Metabolic Disorders	69
4-8. Individual Cases of Trauma	72
4-9. Individual Cases of Infection.....	77
4.10. Frequencies of paleopathological conditions by age and sex	80
5-1. Morphological Traits Recorded for the Eastern States Hospital Sample.....	91
5-2. Summary of Carabelli's Trait and Shovel Shaped Incisors	92
5-3. Individuals retaining both maxillary molars and incisors observable for Carabelli's Trait and Shovel Shaped Incisors	93
5-4. Ancestry Probability based on M5 and M7	94
5-5. Distal Accessory Ridge Scores	95
5-6. Probabilities of Indeterminate Sex Based on Dental Metrics	96
5-7. Gold and Amalgam Fillings.....	103
5-8. Permanent Tooth Crown Formation Times (Massler et al. 1941)	106
5-9. Sex categories based on Skeletal Analyses.....	106
5-10. Comparison of Enamel Hypoplasias by Sex.....	107
5-11. Dental Health of the Eastern State Hospital Sample.....	108
6-1. $\delta^{13}\text{C}$ ranges of corn consumption	119
6-2. $\delta^{13}\text{C}$ ratios by Sex Category.....	119
6-3. $\delta^{13}\text{C}$ ratios within the Eastern State burial sample	120
6-4. $\delta^{13}\text{C}$ ratios by Age Category	121
6-5. $\delta^{15}\text{N}$ ratios within the Eastern State burial sample.....	123
6-6. $\delta^{13}\text{C}$ ranges and means between regional cemetery samples	126
6-7. $\delta^{15}\text{N}$ ranges and means between regional cemetery samples	126
7-1. Eastern State Hospital admissions and Deaths (1839-1861).....	130
7-2. Coffin orientation by sex	134
7-3. Demographic Profile	144
7.4. Life Table for Eastern State Hospital and Old Frankfort Cemetery.	144

LIST OF FIGURES

1-1.	Location of Eastern State Hospital on USGS Topographic map	2
1-2.	Location of Cemetery	3
1-3.	2011 Cemetery Excavations looking north	3
1-4.	Map showing distribution of Grave Shafts	4
1-5.	Profile of deposits overlaying Cemetery (see Figure 1-4).....	6
2-1.	York Retreat, 1792, perspective view of the north front (Yanni 2007)	10
2-2.	Ground plan of the Friends Asylum, Pennsylvania, 1813-1817 (Yanni 2007).....	10
2.3.	Elevation of Friends Asylum Pennsylvania, 1813-1817 (Yanni 2007)	10
2-4.	Plan of hospital on the linear plan, as illustrated in Kirkbride (1880), <i>On the Construction, Organization, and General Arrangements of Hospitals for the Insane</i>	11
2-5.	Elevation of hospital on the linear plan (Kirkbride 1880)	12
2-6.	Kirkbride's Pennsylvania Hospital for the Insane, 1841, first building built on site (Yanni 2007).....	12
2-7.	Kirkbride's Pennsylvania Hospital for the Insane, 1856, second building built on site (Yanni 2007)	13
2-8.	1847 view of Lunatic Asylum of Kentucky (Kentuckiana Digital Library 2014).....	16
2-9.	Nineteenth-century photograph of elevation of Lunatic Asylum of Kentucky (Lancaster 1978:45)	17
2-10.	1837 ground section of Kentucky Lunatic Asylum	19
2-11.	Nineteenth-century lithograph of Eastern Kentucky Lunatic Asylum, Male Building to the right and Female Building to the left (Ranck 1884)	21
2-12.	Ca. 1903 photograph of a corridor in Resource 2 within the Female Building (Annual Report 1903).....	23
2-13.	Ca. 1903 photograph of parlor the Female Building (Annual Report 1903)	24
2-14.	Nineteenth century post card showing Administration Building (Brinegar 2006b).....	25
2-15.	Ca. 1899 photograph of “Colored Building.” No longer extant (Annual Report 1899)..	28
2-16.	An 1861 map of “The Pleasure Grounds & Farm” showing the general location of the cemetery (Brinegar 2006b)	31
2-17.	Nineteenth-century photograph of Eastern State Hospital showing reservoir	32
2-18.	1871 birdseye view of Eastern State Hospital showing Male and Female Wards, circular drives and groves of trees (Ehrgott & Krebs Lith. 1871)	32
2-19.	1877 atlas of Eastern State Lunatic Asylum showing circular drives and walks (D.G. Beers & Co. 1877)	33
2-20.	1938 plan of Eastern State Hospital show general location of the cemetery	34
2-21.	Ca. 1903 photograph of Superintendents Residence (Annual Report 1903)	35
2-22.	Ca. 1899 photograph of Infirmary (Annual Report 1899).....	35
2-23.	Ca. 1914 photograph of Tuberculosis Hospital (Annual Report 1914-1915).....	36
2-24.	Ca. 1914 photograph of ward in Tuberculosis Hospital (Annual Report 1914-1915).....	37
2-25.	Deeds Relative to Location of Cemetery (Note relationship of Cemetery to the northern corner of 1839 addition).....	39
2-26.	Haag and Sons (1855) Map of Lexington Showing Lunatic Asylum (Note Location of Cemetery and Property boundaries)	39
3-1.	Nails and screws	42
3-2.	Crossed nails	42
3-3.	Buttons	45
3-4.	Burial 44B: Distribution of buttons and brass buckle.....	46

LIST OF FIGURES (CONTINUED)

3-5.	Straight pin, and hook and eye fragments.....	50
3-6.	Hooks and Eyes associated with Burial 13 <i>in situ</i>	50
3-7.	Buckles.....	51
3-8.	Glass beads associated with Burial 50B	53
3-9.	Hair combs.....	54
3-10.	Coronet One Cent coin associated with Burial 39C	55
4-1.	Average stature by sex.....	67
4-2.	Percentage of Eastern State Hospital sample (n=142) displaying pathologies by age (excludes 2005 sample).....	81
4-3.	Percentage of Eastern State Hospital sample (n=142) displaying pathologies by sex (excludes 2005 sample).....	81
5-1.	Carabelli's Trait on upper left maxillary molar (Burial 57A).....	92
5-2.	Percent of teeth with chipped occlusal surfaces due to parafunctional activity.....	98
5-3.	Parafunctional wear and chipped enamel evident on anterior dentition of Burial 60D, a 20-24 year old male.....	98
5-4.	Burial 44B (20-25 year old male) showing chipped occlusal edges of UL11, LL12, and ULC with no corresponding parafunctional evidence on the opposing tooth.....	99
5-5.	Burial 60E (27-37 year old male) showing parafunctional wear on lingual surfaces of maxillary teeth	100
5-6.	Average wear score by tooth type for Individuals with chipped teeth.....	100
5-7.	Caries by tooth type	102
5-8.	Crowns lost to carious lesions by tooth type.....	102
5-9.	Teeth lost pre-mortem by tooth type.....	102
5-10.	Abscesses by tooth type	104
5-11.	Heavy calculus on Burial 29D mandibular molars	104
5-12.	Average number of enamel hypoplasias per tooth type.....	107
5-13.	Cumulative number of hypoplasias per tooth type according to age at onset for the Eastern State Hospital sample.....	107
5-14.	Comparison of Eastern State Hospital to other nineteenth century populations.....	111
5-15.	Comparison of the Cross Cemetery and Eastern State Hospital samples	112
5-16.	Loss of maxillary alveolar bone and teeth attributed to calomel poisoning.....	115
6-1.	Distribution of $\delta^{15}\text{N}$ by sex	123
6.2.	Distribution of $\delta^{15}\text{N}$ by age.....	124
7-1.	Location of Eastern State Hospital Cemetery	128
7-2.	A mass grave documented in 2005	130
7-3.	Single and Mass Grave Shafts (Shafts 61, 65, and 69 not excavated)	131
7-4.	Distribution of single interments and mass graves	132
7-5.	Five Primary Forearm Placements.....	135
7-6.	Arm placement combinations	136
7-7.	Burial 15A, a 22-32 year old female.....	138
7-8.	Burial 18B, 18-21 year old female.....	138
7-9.	Burial 66E, 30-40 year old male	138
7-10.	Burial 34, a 14-16 year old juvenile who may have suffered from polio	139
7-11.	Burials 13, 18-28 year old male.....	139
7-12.	Burial 63F, a 53-68 year old male	139
7-13.	Burial 23, 28-53 year old male	140
7-14.	Burial 44B, a 20-25 year old male	140
7-15.	Burial 20A, a 23-26 year old male.....	140

CHAPTER ONE: INTRODUCTION

By

David Pollack and Greg Maggard

In 2005, Kentucky Archaeological Survey archaeologists documented the presence of an unmarked cemetery at Eastern State Hospital in Lexington, Kentucky (Favert 2006). The cemetery was rediscovered during the construction of a new waterline, when the backhoe operator reported that he had disturbed human remains. As a result of this investigation, it was determined that construction of the water line had disturbed two individuals, both of whom had been interred in a grave that contained the remains of eight additional individuals. Investigation of this mass grave documented that it overlaid an earlier single interment. At that time it was suspected that the investigated graves were associated with a larger cemetery, and additional work was recommended to confirm this suspicion. A report documenting this work was completed in 2006 (Favert 2006), and the remains were reinterred in the hospital cemetery that year.

Based on archival and deed research and temporally diagnostic artifacts, it was concluded that the multiple and single interment contained the remains of individuals who died sometime between 1839 and 1861. The graves were located along the northwestern edge of a parcel that was acquired in 1839, and in 1861 this portion of the hospital grounds was repurposed as the female pleasure garden. All of the coffins were hexagonal in shape and constructed with late machine-cut nails, which became popular after 1830. The absence of more ornate coffins, which increase in popularity in the late 1850s and 1860s, also is consistent with a mid-nineteenth cemetery. Clothing related items consisted primarily of porcelain Prosser buttons, which were in use after 1840.

With Eastern State Hospital moving to a new facility and the planned redevelopment of the existing grounds in anticipation of Bluegrass Community and Technical College's relocation, between November 2008 and February 2009 the entire campus was examined by professional archaeologists (Figure 1-1) (Loughlin and Stottman 2010). This work documented the location of several no longer extant structures, including a greenhouse, attendants quarters, and privies, but did not locate any additional cemeteries on the hospital grounds.

Subsequent work in 2011 focused on the excavation of the staff quarter's and attached greenhouse, stand alone greenhouse, and four privies (see Stottman 2014), and locating and excavating any additional graves located in the project area. The latter involved using heavy equipment to remove the overburden to locate additional grave shafts. After the spatial extent of each shaft was defined, it was assigned a number, photographed and drawn in planview. Shovels and trowels were then used to remove the remaining grave shaft fill. The first step in this process was to document the outline of each coffin. The human remains and associated artifacts were then carefully exposed by hand using bamboo or wooden tools and brushes.

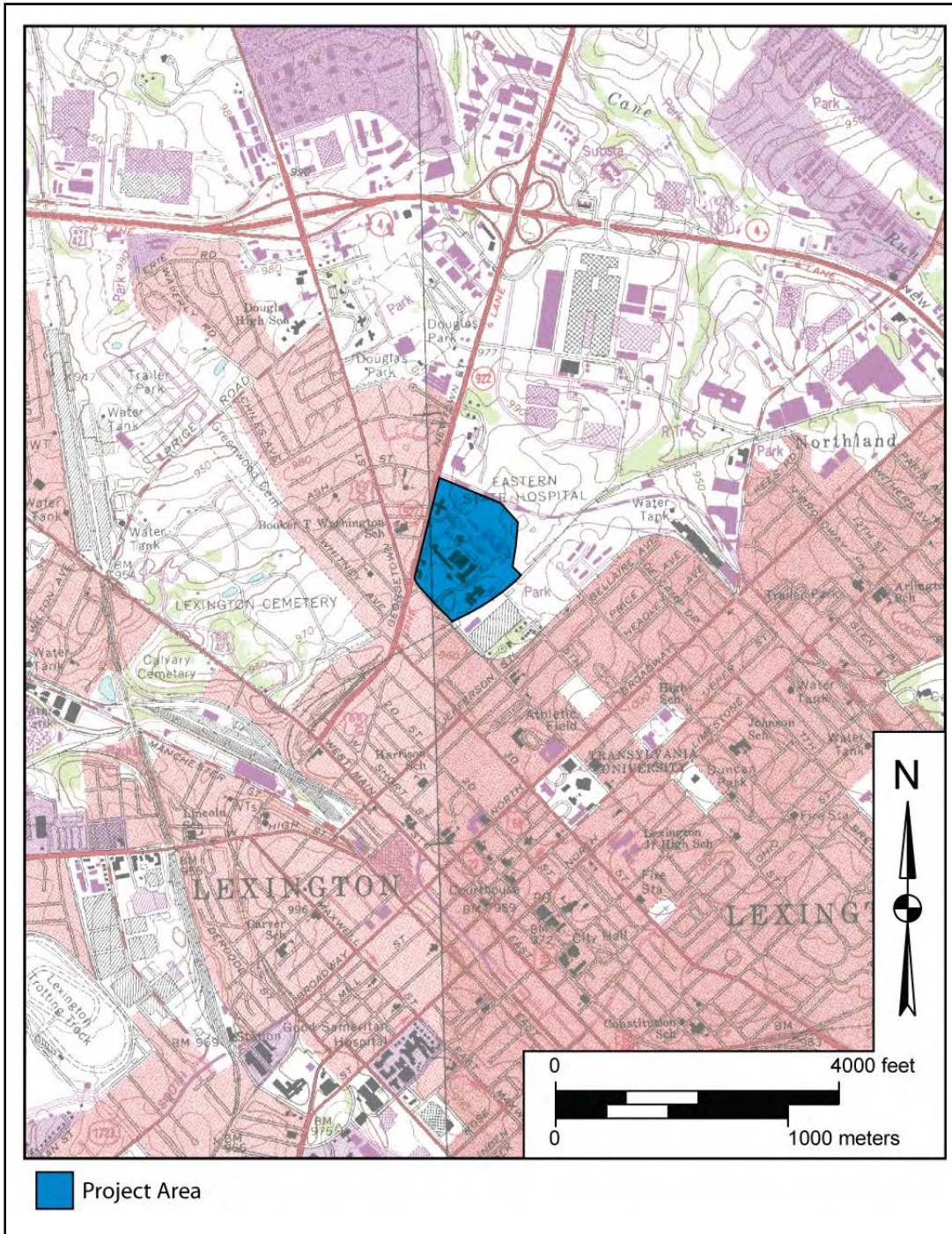


Figure 1-1. Location of Eastern State Hospital on USGS Topographic map.

The exposed human remains and associated artifacts were then photographed, mapped, and carefully removed. Within each grave shaft multiple graves were assigned letters ranging from A to J. All materials recovered, including both skeletal and cultural, from the Eastern State Hospital were washed, analyzed, and catalogued at the University of Kentucky Archaeology Laboratory. The human remains were reinterred at the hospital cemetery in 2012.



Figure 1-2. Location of Cemetery.



Figure 1-3. 2011 Cemetery Excavations looking north. The Cemetery likely extends from the light pole to the white truck.

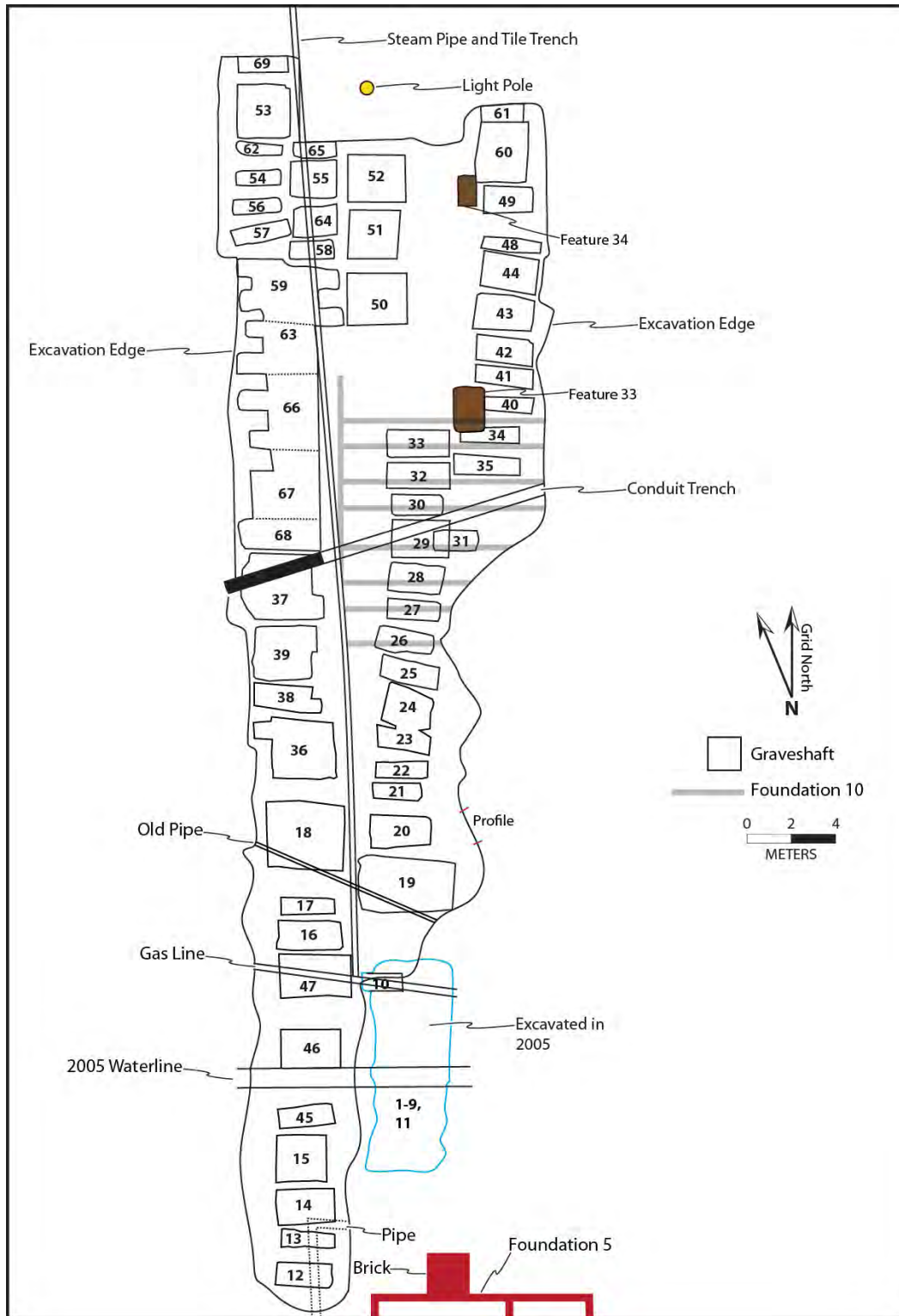


Figure 1-4. Map showing distribution of grave shafts (dotted lines indicate arbitrary edges of mass graves). (Grave Shafts 61, 65, and 69 were not excavated.) (Features 33 and 24 are late nineteenth century privies; Foundation 5 is the late nineteenth century staff quarters, and Foundation 10 is a possible mid-twentieth century greenhouse; see Stottman 2014).

Working out from the previously documented multiple grave, it was determined that grave shafts extended an additional 5 m to the south of the 2005 graves and an additional 40 m to the north (Figures 1-2, 1-3, and 1-4). While the southern, eastern, and western edges of the cemetery have been documented, the northern edge still needs to be determined. It is believed to extend an additional 20 m to the north, and may contain from 75 to 100 additional interments. Since this portion of the cemetery is not going to be impacted by the initial development of the BCTC campus, the current plan is to designate the remaining portion of the cemetery as green space. As the campus grows it may be necessary to also identify, document, and relocate these graves.

The 2011 investigation of the cemetery determined that it primarily consisted of three somewhat irregular rows, each of which paralleled the hospital's 1839 northwestern property line. Within this area, 69 grave shafts were documented (Figures 1-3 and 1-4). They consisted of 35 single interments and 34 multiple interments. In this report, grave shafts containing multiple interments are considered to be mass graves. This is not to suggest that the bodies lack individual identity as is often the way this term is used in the literature (Rugg 2000). Nor is the use of the term "mass grave" intended to refer to the commingling of human remains; though in the case of Eastern State Hospital, the remains of 24 commingled individuals were recovered from six multiple interments. But rather than representing those interred during a single mortuary event, the commingling occurred during the excavation of the grave shaft for a multiple coffin, with the earlier remains deposited back in the grave shaft at the conclusion of the mortuary event. Thus, the commingling occurred sometime after the single interments had been placed in the ground.

Overburden Deposits

The cemetery was covered by asphalt, demolition debris, and structure remains (Figures 1-4 and 1-5). Examination of a 1.5 m wide profile to the east of Burial 20 documented an example of the stratified deposits overlying the grave shafts (Figure 1-5). The soil profile overlying three graves in this area consisted of a 12 to 15 cm thick dark brown silt loam topsoil (Stratum I); a 5 to 8 cm thick black silt loam layer of coal (Stratum II); a 8 cm thick slightly mottled gray brown silt clay (Stratum III); a 7 cm thick black silt clay loam with coal and gravel inclusions (Stratum IV); a 23 to 27 cm thick mottled orange brown and light brown silt clay with coal inclusions (Stratum V); a 10 to 15 cm thick gray brown silt loam clay (Stratum VI); a 15 to 18 cm thick mottled red brown silt clay (Stratum VII); a 43 cm thick slightly mottled silt clay loam with coal flecks and artifacts (Stratum VIII); and a reddish brown silt clay subsoil (Figure 1.5).

Stratum I represents an organically enriched topsoil, and Strata II-VII represent different fill episodes. In comparison, Stratum VIII represents deposits and associated materials that are thought to be contemporary with the cemetery. Artifacts recovered from this stratum consisted of green tinted window glass (n=37), white granite undecorated flatware (n=1), white granite cup fragments (n=2), and faunal remains (n=5). As a group these artifacts are suggestive of domestic and architectural refuse. The flatware fragment has a maker's mark from the John Ridgeway company that dates from

ca. 1841 to 1855 (Figure 4.1b) (Kowalsky and Kowalsky 1999) and could have been discarded during the early years of the cemetery's use. But factoring some time for the use, breakage, and discard of this plate it may have not have entered the archaeological record until the latter years of the cemetery's use.

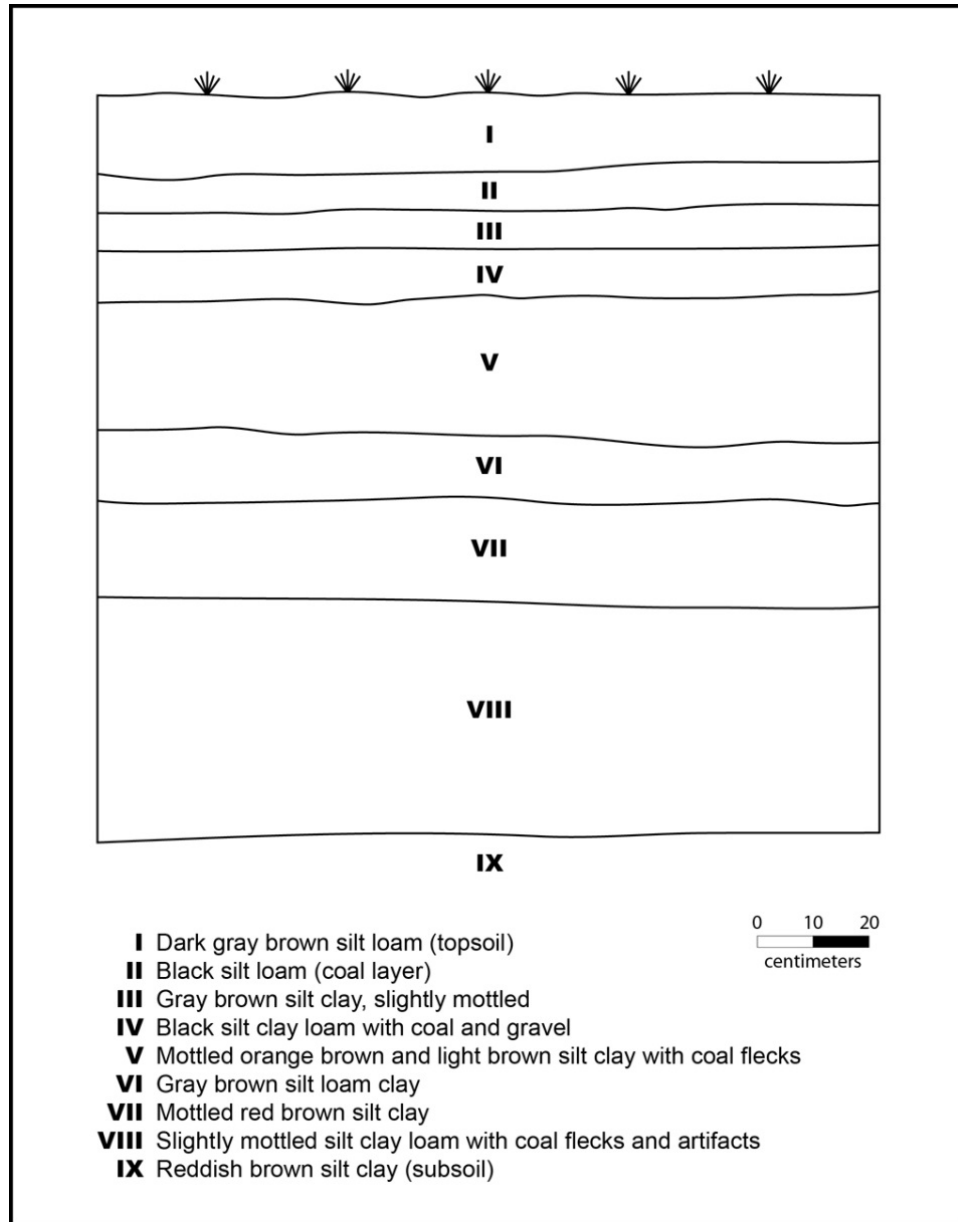


Figure 1-5. Profile of deposits overlaying cemetery (see Figure 1-4).

CHOLERA EPIDEMICS

The large number of mass graves found at the Eastern State Hospital may in part be attributed to the cholera epidemics of 1849, 1850, and perhaps 1856. From 1849 to 1850, almost 200 hospital patients died, most of them from cholera (White 1984).

Originating in Asia, disease spread from the East, where numerous shipping ports are located, to the Midwestern United States. Cholera can be spread from one person to another, but it is primarily contracted through water contaminated by human feces (Pyle 1969). The spread of cholera is heavily reliant on sanitation and infrastructure. During the 1830s, industry heavily relied on water transportation, which allowed the disease to move rapidly through waterways. The path of the earlier 1832 epidemic, for example, can be traced relatively easily from Plattsburg, New York on June 11, 1832 to New Orleans, Louisiana on November 18, 1832. The disease traveled down the Hudson Valley, through the Erie Canal, and down the Ohio Canal to the Ohio and Mississippi Rivers (Pyle 1969:62, 64). The 1849 epidemic followed a similar pattern, but extended to Wyoming and California (Pyle 1969:67).

As the disease spread throughout the eastern United States, larger cities and towns tended to be hit harder and for a longer period of time than smaller ones (Yandall 1833). According to Pyle (1969:74), cholera spread according to degrees of urbanization. From 1832 onward, city size became a prime factor in the spread of cholera due to changes in transportation, the urban environment, and proximity to the natural environment (Pyle 1969:74). Cholera was a disease that impacted enslaved African Americans, the poor regardless of biological affiliation and those who were institutionalized, such as patients at Eastern State Hospital, to a much greater extent than it did more wealthy families. In part, this was because the wealthy had access to better drinking water. But variation in the degree of impact that the disease had on different socioeconomic groups also is due to the fact that one of the major responses to an outbreak was to flee, a recourse that was not available to a patient living at Eastern State Hospital. For instance, during the 1849 epidemic, 1600 of the 2000 residents of Aurora, Indiana fled. Of 400 who stayed in town, 120 died. In comparison, there were only 13 deaths among the 1600 people who fled (Daly 2008:145). At Eastern State Hospital, cholera and other forms of dysentery haunted the asylum until 1856 when the cause, sewage flowing into the asylum's source of drinking water, was discovered and alleviated.

CHANGING LANDSCAPES

In Kentucky and elsewhere, within urban contexts prior to the creation of perpetual care cemeteries in the 1840s, the dead were primarily buried in family/neighborhood burial grounds (Pollack et al. 2009; Stottman 2009, 2012; Strezewski 2003). These cemeteries may have been maintained by family members and relatives for an unspecified amount of time, but as they moved away and the land containing the cemetery was sold those left to care for it may have had little or no connection to those interred within it. As properties continued to change hands, owners were even further removed from the cemetery, often to the point of not even knowing that one was located on their property. In time, they may in fact have come to see the cemetery as a nuisance, resulting in a lack of upkeep and in many cases the destruction or relocating of grave markings. Even when the original family retained ownership of the cemetery, this information was not always incorporated into subsequent deeds.

In urban contexts, buildings and parking lots were constructed over earlier burial grounds, they were incorporated into parks, or in the case of Eastern State Hospital a pleasure garden (Pollack et al. 2009; Stottman 2009, 2012). Reuse of a cemetery for other than its intended purposes may reflect mid-nineteenth century attitudes about earlier burial grounds. Today people think of cemeteries as the final resting places of their ancestors and if not viewed as sacred places they are at least considered to be deserving of a certain amount of civic respect. The status of cemeteries as park like areas, where there was some contestation of social status in monumentality and grave goods is more typical of the Victorian and subsequent eras than the Antebellum period (Francaviglia 1971; Strange 2003). During the Antebellum, cemeteries may not have been treated in the same way. In the past they may have simply been viewed as burial grounds; places where the dead were interred (Rugg 2000; Strange 2003). As such the upkeep and maintenance of urban cemeteries may not have been as important a social consideration for the living as it is today. The end result of local land use histories being that by the mid-twentieth century for all intents and purposes many urban cemeteries had been lost to history.

SUMMARY

Based on archival research and temporally diagnostic artifacts, the Eastern State Hospital cemetery appears to have been used from 1839 to 1861, when it was repurposed and became the female pleasure garden. Certainly the history of the Eastern State Hospital cemetery is in part a reflection of the social and economic status of those interred within this burial ground. Patients interred in this cemetery were mentally ill, or had social problems that led to them being admitted to the hospital. Many also may not have had relatives or family living in the Lexington area, who would take responsibility for taking care of their grave. All of these factors may have contributed to the Eastern State Hospital being forgotten.

This report sheds light on the identities of those who resided at Eastern State Hospital, and how the hospital may have responded to a high number of deaths occurring within a short period of time, potentially due to the pandemic Cholera outbreaks of the mid-nineteenth century. The following chapter presents an overview of the nineteenth century growth and development of the hospital. It concludes with a review of early to mid-nineteenth century deeds and archival records pertaining to the parcels where the cemetery is located. Chapter Three describes the coffin hardware and personal objects associated with those interred within this cemetery. Chapters Four and Five present the analysis of the human skeletal remains, with Chapter Four focusing on the bones and Chapter Five the teeth. Chapter Six presents the results of the isotopic analysis and what can be inferred from this data about the diets of those interred within this cemetery. Finally, Chapter Seven describes and interprets the mortuary patterns documented at the Eastern State Hospital Cemetery and summarizes the results of this study. Appendix One, provides individual descriptions for each documented burial, and Appendix Two provides a summary in table form of the pathologies documented at the cemetery.

CHAPTER TWO: HISTORIC BACKGROUND

By
Karen Hudson¹¹
With a contribution by
Nancy O'Malley

HISTORIC CONTEXT

Insane asylums were once a common sight on the edge of American towns. Approximately 300 were constructed in the United States before 1900. For most of the nineteenth century, doctors believed that between 70 and 90 percent of insanity cases were curable, if patients were treated in specially designed buildings. In *The Architecture of Madness*, Carla Yanni demonstrated that nineteenth-century psychiatrists considered the architecture of their hospitals to be one of the most powerful tools for the treatment of the insane. By mid-century, a “linear plan,” also called the “Kirkbride plan,” after its major proponent, Dr. Thomas Kirkbride, had become the model of choice in the United States (Yanni 2007:1).

According to Yanni, the York Retreat, built in 1796 near York, England, was an important architectural model for American asylums (Figure 2-1). The plan included a central structure for both administration and for the Superintendent's home, to either side of which were double-loaded corridors lined with single bedrooms. The York Retreat was a country farmstead rather than a grandiose urban edifice and its founders believed that was part of its therapeutic power. Airing courts and gardens, with low walls which separated the men from the women, were located to the rear of the building. These were furnished with animals such as rabbits, seagulls, and chickens, because it was believed that interacting with these creatures was therapeutic. At the York Retreat, its founder, Quaker William Tuke, required medical practices such as feeding the patient well, maintaining bodily hygiene, encouraging sleep, and insisting on a daily regimen. This type of treatment was called moral management (Yanni 2007:27-28).

Tuke's grandson, Samuel, corresponded with Quakers in the United States about starting an asylum based on his grandfather's experiment at York. The result was the Friends Asylum outside Philadelphia founded in 1817. Scholars usually give credit to the Friends Asylum for bringing moral treatment to the United States. It was a linear structure with a central house-like building flanked by wings with return wings perpendicular at the ends (Figures 2-2 and 2-3). Men lived on one side of the central building, women on the other. The central building housed male and female parlors as well as a reception room and office. According to Yanni (2007:33), this most basic plan, consisting of a central building with wings, was already the accepted model for insane asylums in the United States by 1817.

¹¹ Adapted from Hudson 2010. Historic Context. In *A Cultural Historic Survey of Eastern State Hospital (Faw-44) Fayette County, Kentucky* By Karen E. Hudson, Kentucky Archaeological Survey, Lexington



Figure 2-1. York Retreat, 1792, perspective view of the north front (Yanni 2007).

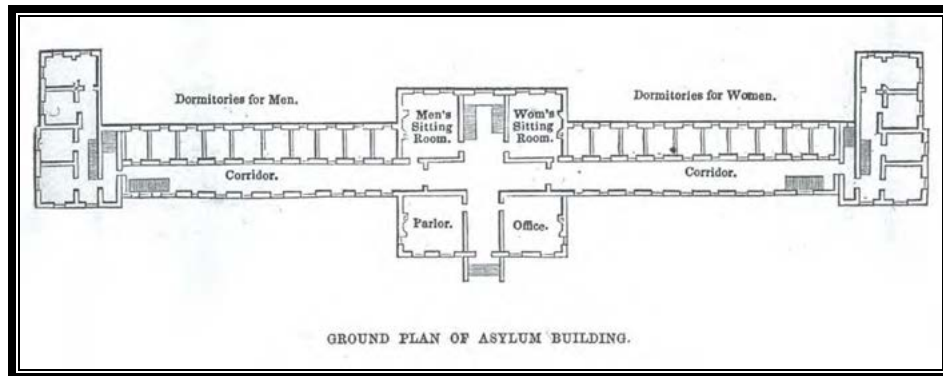


Figure 2-2. Ground plan of the Friends Asylum, Pennsylvania, 1813-1817 (Yanni 2007).



Figure 2.3. Elevation of Friends Asylum Pennsylvania, 1813-1817 (Yanni 2007).

In 1844, psychiatrists created a professional organization called the Association of Medical Superintendents of American Institutions for the Insane (AMSAI). The organization held annual meetings, published a journal and guided states in the establishment of hospitals. In 1851 the organization published architectural guidelines for insane hospitals. The guidelines were heavily influenced by Dr. Thomas Kirkbride who, in 1854, wrote his own influential book on the architecture of insane hospitals. In it he expanded on the basic plan consisting of a central unit flanked by wings. Though he referred to his model as the “linear plan,” it did not dictate a long straight building, but one that consisted of a central block with multiple wings set back *en echelon* forming a shallow V (Figures 2-4 and 2-5). The AMSAI held fast to the Kirkbride plan even when cottages were being constructed in the 1870s and tentative experiments with community care were under way in the 1880s. For most of the nineteenth-century, Kirkbride's model, known as the “Kirkbride plan,” dominated American asylum building.

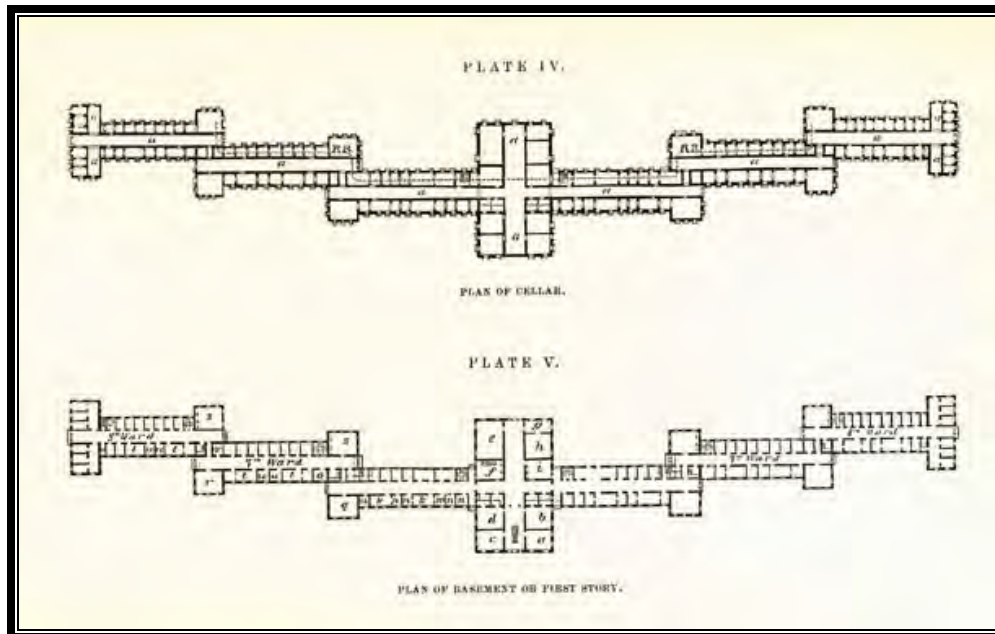


Figure 2-4. Plan of hospital on the linear plan, as illustrated in Kirkbride (1880), *On the Construction, Organization, and General Arrangements of Hospitals for the Insane*.

Kirkbride was devoted to moral treatment. Patients would live a regimented life, eat healthy food, get exercise, avoid the vicious city, and visit daily with the superintendent and his wife. Additional principals included that patients should be unchained, granted respect, encouraged to perform occupational tasks (such as farming, carpentry, or laundry), and allowed to stroll the grounds with an attendant (Yanni 2007:38).

Kirkbride presided over the private Pennsylvania Hospital for the Insane. The first hospital on the site, completed in 1841, was built before he was given complete

supervisory duties (Yanni 2007:38-39). It consisted of a central administrative unit flanked by three story wings capped by three-story return wings. The central unit was topped by a large lantern and each return wing was marked by smaller lanterns (Figure 2-6).



Figure 2-5. Elevation of hospital on the linear plan (Kirkbride 1880).

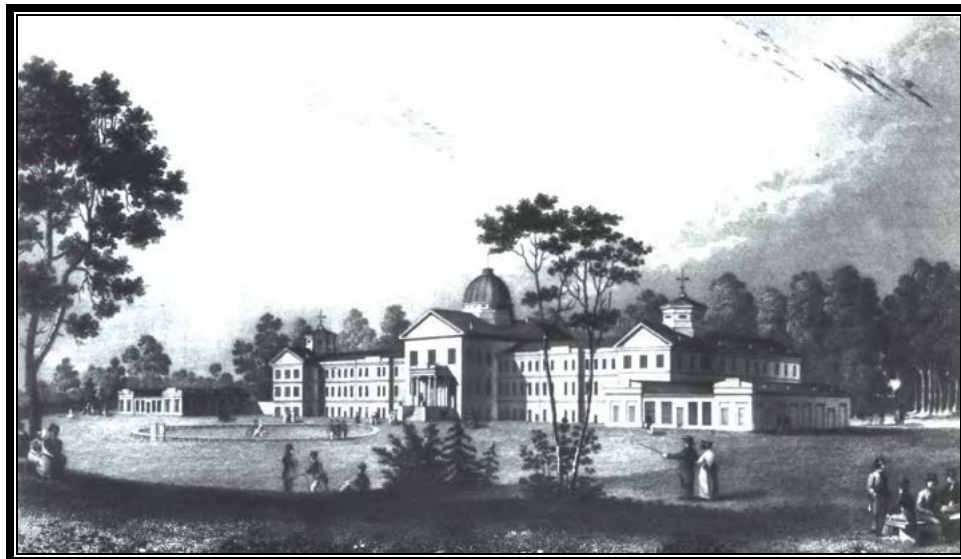


Figure 2-6. Kirkbride's Pennsylvania Hospital for the Insane, 1841, first building built on site (Yanni 2007).

In 1856, when Kirkbride's hospital needed to expand to relieve overcrowding, he did not add recessed wings to the existing hospital, as the Kirkbride model would have suggested. Instead, he argued that there were many advantages to treating men and women in different buildings and as a result, he chose to construct an entirely new building (Figure 2-7). The original building became the female department, the new structure the male department (Tomes 1994: 154). The new building looked similar to the old, down to the lanterns on the roof. Because it is smaller, the plan appears less linear than the model that appeared in Kirkbride's book (Figure 2-4), in spite of the fact that he used the term “linear” to describe it. Thus, while incorporating many of its principals, Kirkbride's own hospital does not demonstrate the ideal Kirkbride plan (Figures 2-4 and 2-5).



Figure 2-7. Kirkbride's Pennsylvania Hospital for the Insane, 1856, second building built on site (Yanni 2007).

Bringing the Type to Kentucky

On February 15, 1816 the Kentucky General Assembly passed an act establishing a public hospital in Fayette County. The act incorporated a group of citizens, the “Contributors of the Fayette Hospital,” who wished to erect a building at their own expense to serve as a hospital for the accommodation of “lunatics” as well as other “sick poor.” The act gave the Contributors the right to establish a committee, elect officers, raise money to purchase a piece of land in or near Lexington, and to contract for the construction of a building to serve as the hospital (Kentucky Reporter 1816a).

The Contributors met on March 1, 1816 and elected a building committee consisting of Andrew McCalla, Sterling Allen, Stephen Chipley, Thomas January, and Richard Higgins. McCalla was appointed chairman (Kentucky Reporter 1816b). In an open letter in the *Kentucky Reporter* (1816c) on April 17, 1816, the Committee presented

their mission and asked for assistance. They noted that there were many “poor, disabled, and infirm members of society” without the aid of medicine who with the assistance that could be provided by a “Public Hospital,” might become useful to themselves, their families, and society. They also noted that “lunatics,” who have no “rich relatives” to care for them, “roam at large through the country...” and in many instances “endanger the lives of other members of society.” The best remedy, they suggested, was the erection of a public hospital. They argued that the hospital was not only their best chance at a cure but also a means by which physicians could acquire “superior skill” by treating them. Finally, they declared that “society itself would be made more secure against the wild and desperate actions of lunatics, if provision was made to contain them within its walls.” The Committee concluded the letter by requesting that “ALL” people of Kentucky contribute to the support of the hospital (Kentucky Reporter 1816c).

The Contributors immediately began fund raising. They employed many of the methods used by nonprofits today, for example, in 1816 they held a performance at the theatre, in 1817 they sponsored an exhibit of paintings, casts, and engravings and in 1818 they held a lottery. All of the proceeds from these events went to the fund to erect the Fayette Hospital (Kentucky Reporter 1816d; Kentucky Gazette 1817, 1818).

Their early efforts must have been effective for not long after their incorporation, the Building Committee purchased the “Sinking Spring” property on which the present hospital now stands (Perrin 1882:391). On June 30, 1817, the corner-stone of the “Fayette Hospital” building was laid in the presence of a large group of spectators. The oration was given by Henry Clay, U.S. Representative from Kentucky. In the corner-stone were deposited the newspapers of Lexington for that week, some silver and copper coins, two publications in favor of the institution, and a brass plate bearing the name of the engraver and the following inscription:

State of Kentucky
LEXINGTON,
June 30, A. D. 1817 Deposited in the Corner-stone of the
FAYETTE HOSPITAL
The first erected west of the
Appalachian Mountains.
Built by contribution, under the direction of
the Building Committee of the Contributors
Andrew McCalla
Thomas January
Stephen Chipley
Sterling Allen
Richard Higgins

Despite the Contributors’ efforts, the unfinished building was abandoned during the financial panic of 1819. Lexington was devastated by the economic crisis. In fact, one affluent member of the Hospital’s Building Committee, Thomas January, was forced to close his factory after 24 years of successful operation (White 1984:24).

In 1820, as the abandoned structure remained unfinished, Governor Adair began to question the economic feasibility of continuing to appropriate state funds for the maintenance of the insane within their communities. In an address to the Legislature, he suggested that:

“This expense has been increasing annually for several years....much of this expense may be saved, by preparing the Hospital now established in Lexington, for the reception and maintenance of those unfortunate fellow beings. There they will be better provided for, and at a less expense than under the present mode, in the different counties” (Journal of the Senate 1829:9).

Governor Adair's address led to the formation of a committee to inquire into the feasibility of taking over the old Fayette Hospital and establishing a “State Lunatic Hospital.” In 1821, the Committee reported their findings to the Legislature. They discovered that the lot measured about 10 acres. It was supplied with a never failing spring and was well situated as to “health, beauty, and convenience, and may in future be extended to any limits or size commensurate with the objects of the said institution.” As to the building erected upon the site, they reported that it was “spacious, remotely situated from any other, and the workmanship, as far as it has been executed, is neat and faithfully done.” They estimated that the building when it “is properly finished, will afford accommodations for sixty or seventy lunatics, and all necessary attendants” (Journal of the Senate 1821:139).

According to the Committee, \$15,111.33 had already been expended on the lot and building. They estimated that the building could be finished for another \$5,000. The Fayette Hospital contributors owed \$11,220.05. The Committee believed the Contributors “considering that the public good will be much better promoted by its becoming a State institution, are willing to resign it...to the Legislature” for the amount owed. In conclusion, they recommended that the Legislature purchase the property (Journal of the Senate 1821:139).

The Legislature agreed with the Committee's recommendation. The property was purchased and the “Lunatic Asylum of Kentucky” was established by an act passed on December 7, 1822. The Legislature appointed commissioners and appropriated \$10,000 to finish the “skeleton of a house” in a “plain, substantial manner, and to erect such out-houses as are absolutely necessary....” The plan originally called for the addition of two wings so that the building could accommodate two hundred patients. They found, however, that the appropriation was insufficient to complete the wings and thus the building could only house one hundred and twenty patients. They estimated that it would cost an additional \$10,000 to complete the two wings (Journal of the Senate 1823:120).

The building was finished and the hospital formally opened on May 1, 1824 (Journal of the Senate 1824:177). When completed, the brick building measured approximately 20 x 20 m (66 x 66 ft) and was three stories tall over a stone basement

(Theobald 1829). An 1847 lithograph, is the earliest identified illustration of this building (Figure 2-8). The original Fayette Hospital building, is the three-story square block with hipped roof located at the center of the illustration. The building was made of handmade brick laid in Flemish bonding. A skylight was located on the hipped roof. Tall chimneys pierced the roof at each corner. An arched doorway with fanlight was located in a three-bayed pedimented central pavilion with two bays to each side. The original doorway as well as the 16/12 windows are illustrated in Figure 2-9, a nineteenth century photograph of the hospital.



Figure 2-8. 1847 view of Lunatic Asylum of Kentucky (Kentuckiana Digital Library 2014).

The Fayette Hospital was originally designed to serve as a general medical hospital, not as a specialized insane asylum. As a result, like other medical hospitals of the time, it contained large rooms that functioned as wards with several beds in each room, unlike most asylums which usually contained small individual cells. In their first report to the Legislature, the Commissioners reported problems with the design of the building.

“The building is large and spacious, sufficient as a hospital, to contain and accommodate one hundred individuals, for the purpose originally planned and the walls erected. The rooms are generally large and spacious, and well adapted to the comforts and conveniences of the sick and infirm; but wholly unfit for the maniacs. They require confinement to prevent injuries to themselves, or those around them; they require separate apartments for

their quiet and repose; they require, in the winter season, small apartments that can be comfortably warmed, without placing fire within their reach, and in the summer, all the indulgences of air and exercise that can be extended towards them” (Journal of the House of Representatives 1824:246).

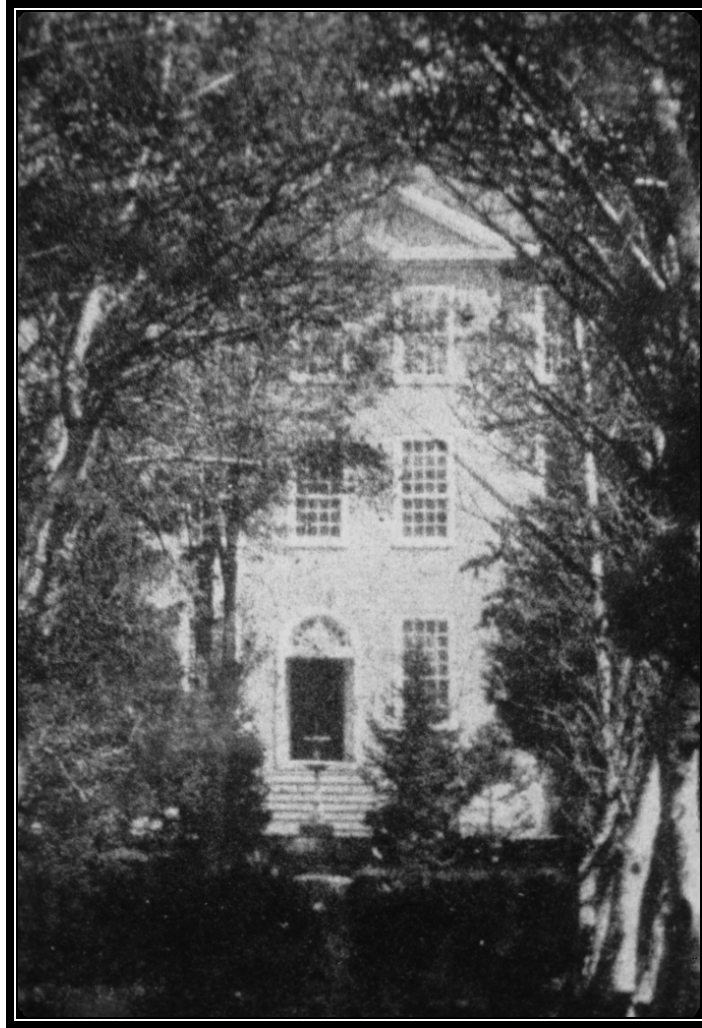


Figure 2-9. Nineteenth-century photograph of elevation of Lunatic Asylum of Kentucky (Lancaster 1978:45).

To try to solve the problem, the Commissioners erected, on the third floor, small temporary cells of plank. They reported, however, that the cells were all in one room, in which there was only one fire place, and consequently, only a few patients could receive the heat. Also, the “quiet and repose” sometimes essential to treatment was impossible when the patients were “separated only by a plank partition.” As a result, they concluded that the building:

“however well adapted to the purpose of a hospital for the sick, for which it was originally intended, will require material alteration and some additional buildings, before it can be rendered a suitable asylum for the maniac” (Journal of the House of Representatives 1824:243).

Apparently the Legislature agreed for in 1825, they appropriated \$5,735.74 for the building of one of the wings contemplated in the original plan of the building. The new brick wing measured 62 feet long by 22 feet wide and was two stories over a stone basement. It consisted of six “commodious cells” per floor with spacious aisles running the whole length of the wings, and meeting corresponding aisles in the main building (Journal of the Senate 1825:76; Theobald 1829). In 1826, they erected a second wing, thereby completing the original plan of the building. Its dimensions were identical to the wing constructed the previous year. The cost of the new wing was \$4,505.39 (Journal of the Senate 1826:92). The two wings are illustrated on Figure 2-8.

By 1828 the total number of patients had grown to eighty-five and the Commissioners reported that:

“Greater space is required to accommodate Lunatics than was originally contemplated, and the buildings are barely sufficient for the present number, to render their situation comfortable (Journal of the Senate 1828:87).”

As a result of their pleadings, in 1829 and 1830, “return wings” were constructed at the ends and perpendicular to the earlier wings (Tomes 1994:150). The brick return wings, three-stories tall over a stone basement, are illustrated on Figure 2-8. Each return wing measured 60 by 19 feet and contained 32 rooms (Theobald 1829). When the four wings were completed, the left wing and return wing were used to house the male patients and the female patients were housed in the right wing and return wing. The twenty-five “spacious” rooms in the original center building were used to accommodate the Superintendent and his family, the resident physician, and separate day-rooms and dining rooms for the male and female patients. One room on the upper floor, well lighted from a skylight on the roof, was used for surgical purposes. The basement under the original center building as well as the wings served as the kitchen which consisted of nine rooms containing cooking apartments, store-rooms, and servants’ rooms (Annual Report 1832; Theobald 1829;).

Though greatly altered, the original Fayette Hospital building and some of its early additions are extant today. A comparison of the early Kentucky Lunatic Asylum (Figure 2-8) and the Friends Asylum in Pennsylvania, described in the previous section (Figure 2-2), reveals remarkable similarities. Both consisted of a central house-like building flanked by wings with return wings at the ends. The wings consisted of small rooms arranged along corridors. Men lived on one side of the central building, women on the other.

Soon after the wings were added to the original hospital, a separate building was constructed about “forty paces” to the rear. It was approximately 6 x 6 m (20 x 20 ft) in size, two-stories high, and contained 16 small rooms or “cells,” intended for the “worst class of patients,” and for withdrawing temporarily the “most turbulent and ungovernable” (Theobald 1829). The structure was identified as the “box room” on an 1832 ground plan of the hospital (Figure 2-10). This structure is no longer extant. The 1832 plan also shows the location of the original building with its wing additions, two privies, a smoke-house, stable, wash-house, burying place, fences, pump and cistern and men's and women's airing yards.

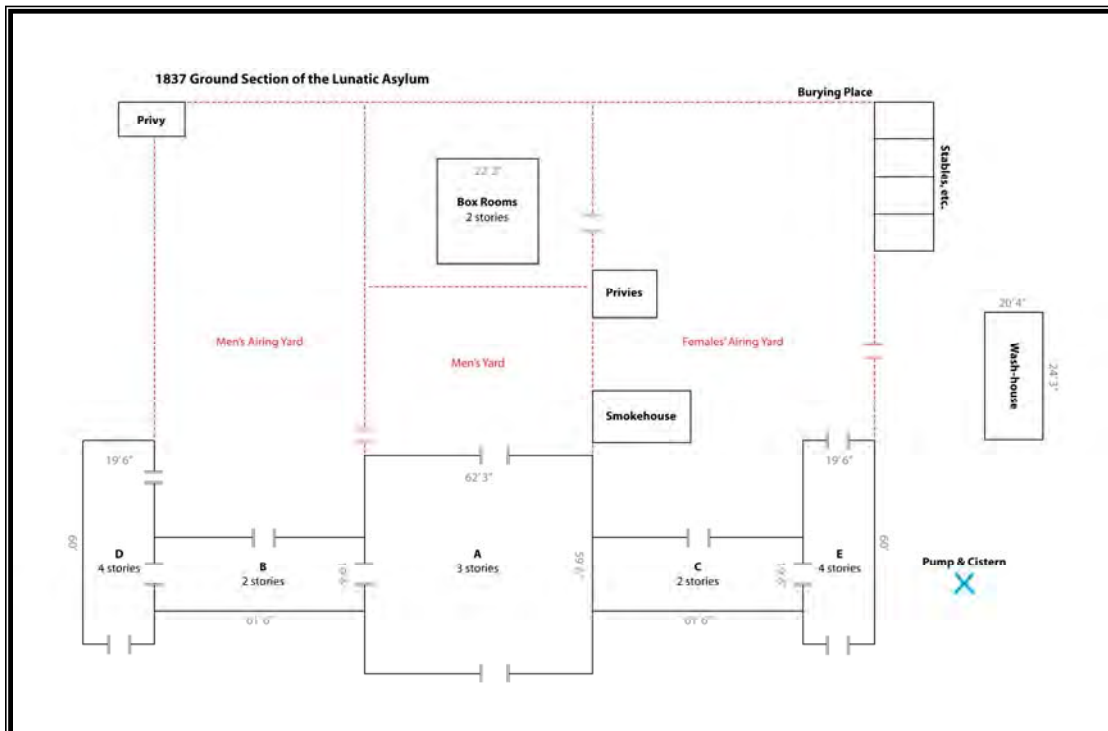


Figure 2-10. 1837 ground section of Kentucky Lunatic Asylum (from hand drawing in Eastern State Hospital library).

In 1846, the Directors reported to the Legislature that they were not happy with their cure rate. They attributed the failure, in part, to the “defective state of the buildings, preventing classification.” Nineteenth-century asylum doctors believed patients should be separated according to classifications based on race, gender, class, and disease. The directors believed each class of patients should be offered the “various conveniences and comforts usual in families.” They thought each class should have separate “day rooms, dormitories, halls, dining-rooms, privies, supplies of water, &ca...” (Annual Report 1846:616). They believed an addition to the original building that was “so inconvenient, uncomfortable, and ill suited in almost every way, for the purposes of a Lunatic Asylum” (Annual Report, 1846:615), would solve their problems. As a result, in 1847, the building was once again enlarged with the addition of a rear ell.

The new ell was 33.3 m (110 ft) long, 19.4 m (64 ft) wide, and 2.1 m (7 ft) deep. It was united to the rear of the “central building” by an open porch, 19.4 m (64 ft) long by 4.8 m (16 ft) wide, with galleries corresponding with the floors of the main building and its wings. From the porch, entrance to the building was had by a wide passage and doors. On either side of this passage were placed dining rooms, one for each class of patients on either side of the building. The main passage ran the entire length of the building, and was cut, at right angles, in the center of the plan by another. In the angles made by the crossing of the passages were formed rooms, designed for the residence of the steward and his family, and other family and business apartments. These arrangements continued up to the third floor, which was designed to occupy dormitories. In the basement, arrangements were made for kitchens, washing and ironing rooms. Cisterns, for supplying water to the whole establishment, were located in the attic (*Annual Report*, 1846:617, 619).

The Directors reported that the bricks for the new ell were made and carried to the site by the patients, who had performed all the labor, including the digging of the foundation. The rock for the foundation was blasted and quarried by the patients and they also performed a “considerable amount of the carpenters work.” According to the Directors, the labor was beneficial to the health of the patients and they regretted that there was not enough suitable labor to employ all of the Asylum patients (*Annual Report*, 1846:599).

In 1852, a fire destroyed a part of the building “erected at an early day.” Though the cause of the fire was never determined, the Superintendent recommended that the Asylum switch to gas lighting which could be obtained from the city. He explained to the Legislature that:

“Lights are kept burning during the whole night in each ward, to prevent delay in case of any occurrence demanding attention. The ordinary lard, or oil lamp, is now used for this purpose, and common candles for other apartments. This mode is objectionable as being slovenly, hazardous, and extravagant” (*Annual Report*, 1853:23).

In 1863 the Managers reported that:

“Iron bath-tubs have replaced decayed wooden ones. Worn out floors... have been laid. The leakage through the old floors had destroyed much of the plastering on our ceilings, all of which has been renewed chiefly by the labor of one of our patients.... Besides these, all the ordinary repairs throughout the building have been made, But the most important improvement of the year is the introduction of gas for lighting the building (*Annual Report*, 1863:12).

While there was constant maintenance and remodeling of the older buildings, the next major construction project took place in 1867 when a new building was erected to

house the women. This was the first major addition to the hospital since the AMSAII and Kirkbride published their recommendations on asylum architecture. The Directors of the Kentucky Lunatic Asylum were well aware of their work, for in 1859 they hosted the annual meetings of the AMSAII in Lexington and they quoted Kirkbride (Conventions, 1859) and summarized the AMSAII's propositions on the construction and organization of hospitals for the insane in their annual reports (*Annual Report 1859:35-37*).

In 1856, when Kirkbride expanded his Pennsylvania hospital, he argued that there were many advantages to treating men and women in different buildings and as a result, he chose to construct an entirely new building (Figure 2-7). The original building became the female department, the new structure the male department (Tomes 1994:154). Kentucky followed Kirkbride's lead and in 1868 when they enlarged the hospital, they chose to construct an entirely new building. In this case, however, the new building served as the Female Ward and the old building became the Male Ward (Figure 2-11).



Figure 2-11. Nineteenth-century lithograph of Eastern Kentucky Lunatic Asylum, Male Building to the right and Female Building to the left (Ranck 1884).

The new building looked similar to the old. It was built of Flemish bond brick and consisted of a central block with wings capped by return wings. It was built just 12.1 m (40 ft) left of, and in-line with, the old structure, creating a long linear plan. The new structure was larger, however. It measured 133.3 m (440 ft) long, and varied in depth from 10.9 to 21.8 m (36 to 78 ft). The entire structure sat over a basement. The center four-story block and one of the three-story return wings were topped by lanterns similar to that on Resource 1.

Entries in the report of receipts and expenditures confirm that the new Female Ward was designed by renowned Kentucky architect, Thomas Lewinski (Legislative

Documents 1867). While entries in his 1845 account book indicate that Lewinski had a previous professional association with the Asylum, this was a much larger project (Lancaster 1952:13). Like the original structure, Lewinski chose to construct the new building out of Flemish bond brick. Flemish bond was a pattern of alternating stretchers and headers, horizontally and vertically. It was usually reserved for walls of greater visual elegance, usually the front facade. Perhaps Lewinski chose to employ the older method of bonding in order to blend with the existing structure, suggesting he visualized the two buildings as one unified linear plan.

The wings of the new structure consisted of a broad corridor, approximately 3.6 m (12 ft) wide, flanked on each side by small rooms. The rooms located nearest the center building measured approximately 5.5 x 3.3 m (18 by 10 ft), but it appears that most of the rooms measured about 3.3 x 2.4 m (10 by 8 ft). It is likely that the larger rooms near the center building were reserved for the boarders. While most of the patients at the Kentucky Lunatic Asylum were paupers, their care paid for by the State, there were always a small number of boarders whose care was paid for by their families and friends. Henry Clay's son, Theodore, for example, was a patient at the Kentucky Lunatic Asylum in the 1830s. Unlike the typical patient, he was allowed to bring along his favorite horse (White 1984:144). There is other evidence that the paying boarders were offered preferential treatment, for example, in 1845, the Superintendent suggested that in order to attract paying boarders, they needed to “fit up a sufficient number of rooms in a handsome style, to accommodate a class of patients whose friends wish them supplied in a way to which they have been accustomed...” (*Annual Report 1845:629*).

All of the rooms in the new Female Ward had a window to the outside and a door leading to the hall. There were large transoms over the hall doors (*Annual Report 1879:19*). The walls were “plastered with a smooth white finish.” All the floors were “deadened” with a coat of mortar between a rough floor of hemlock boards and an upper one of pine. In the annual report, the Managers explained that this arrangement was “well calculated to prevent the rapid spread of fire....lessens the transmission of sounds..., is an effectual remedy for leakage, which is so destructive to plastered ceilings, and adds to the comfort of the house in winter” (*Annual Report 1869:15*). Starting in 1898, all of the wooden base boards were removed and replaced with “cement bases,” “thereby excluding cockroaches and other insects” (*Annual Report 1898, 1899, 1903*).

A photograph of one of the corridors (Figure 2-12) from 1903 shows a carpet running the full length of the hall, a chair at each door, and pictures on the walls. Yanni suggested that when families visited most asylums, they did not meet patients in the wards, but rather in public parlors in the center main. These parlors were often decorated like those in middle-class homes. The 1903 view of one of the parlors at the Kentucky Lunatic Asylum (Figure 12), for example, shows a rug on the floor, pictures on the wall, a couch, tables, plants, and a piano.

According to the annual report, the windows in the new Female Building were of a “novel style, which give great security to the patients, while dispensing with iron bars and sash.” The whole building was covered with a tin roof. The cornice and down pipes

were galvanized iron (*Annual Reports* 1868, 1869). The “bath-rooms and water-closets” were located on one side of the corridor in each ward. “They were a source of constant trouble and gave the wards a very unpleasant odor.” “Having wooden floors, and often being overflowed, they were always needing repairs.” In 1879, they were moved outside, and constructed approximately 2 m (six feet) from the center building in brick octagon-shaped three-story buildings resting on a basement. They had floors “made of the best slate, one and one-half inches thick, laid in concrete.” The platform, which was 6 feet by 6 feet, leading to the closets, was also laid with the same slate, and guarded by a wrought iron latticing. Instead of plastering the ceilings, they were finished with paint and “beaded strips,” so that in case there was any leakage from floor to floor, it could be kept aired and quickly dry. They were heated with steam coils placed in the basement. The two octagonal towers had a full north-western exposure, with four large windows and two doors to each story. There were six “bath-rooms” in each of the towers, three rooms to each story (*Annual Report* 1879).



Figure 2-12. Ca. 1903 photograph of a corridor in Resource 2 within the Female Building (*Annual Report* 1903).

In 1894, the Administration Building (Figure 2-14) was constructed to serve as offices, sleeping quarters and a ballroom. The three-story, brick Neo-Classical style building was designed by Curtain & Hutchings, a Louisville architectural firm (*The Leader* 1894). The Administration Building was located between and slightly in front of the Female and Male Buildings, creating an assemblage of buildings resembling a Kirkbride plan. The new Administration Building became the new center block and the

Female and Male Buildings, set back *en echelon*, became the wings. The structure has survived today with little alteration.



Figure 2-13. Ca. 1903 photograph of parlor the Female Building (Annual Report 1903).



Figure 2-14. Nineteenth century post card showing Administration Building (Brinegar 2006b).

A ballroom was located on the third floor of the Administration Building. Parties and dances were commonplace at nineteenth-century asylums. Frequently called “lunatic balls,” they were often used as fund raisers. There is evidence that the Eastern Kentucky Lunatic Asylum held a ball as early as 1869 (Observer and Reporter 1869). Over 300 guests attended the event in 1888 (Lexington Transcript 1888).

A collection of buildings as large as these required an enormous amount of maintenance. Take, for example, the 1894 maintenance report:

“A large amount of general repairing to the buildings was done during the past year. New floors were laid in the halls, day-rooms and bed-rooms of many of the wards; the interiors of all the wards and public offices were painted, and almost all the roofs were repaired and painted, and some new roof put on. The boilers were repaired, and the heating apparatus and steam fitting generally overhauled. The cost of repairs during the year was over seven thousand dollars, and nearly as much will be necessary every year to keep the buildings in good condition....” (Annual Report 1894:6).

In addition to routine maintenance, the buildings were constantly being updated and remodeled in order for them to meet current standards for a medical facility. In 1898, for example, the Commissioners reported that:

“This first building erected, still retains the narrow, dark cells wherein the insane, in the early part of the century, were confined. The heavy doors to these cells still bear evidence of the small aperture through which food was delivered from the outside to the chained maniac. It is true this building has been greatly improved, if not remodeled, and is now used for the accommodation of patients. Necessarily it can never be regarded a suitable building as a hospital for the insane. Even its present condition, however, can be greatly improved; especially in enlarging the windows and thereby giving more sunlight and air. The successive additions to this building are undoubtedly improvements upon the old, but even these additions, neither in their conveniences nor appointments, approximate the type of the modern hospital for the insane” (Annual Report 1898:7).

Despite the Commissioners arguments about the inadequacies of the buildings, the State continued to remodel the existing structures. In 1898, for example, the Commissioners reported that a modern electric light plant was nearing completion (Annual Report 1898:23) and in 1898, they again pleaded for the alteration of the windows.

“The windows of many of the wards are too small, and some are obstructed by clumsy mullions, which almost exclude the light. The small windows should be enlarged, the mullions from all removed, and in lieu thereof iron gratings should be placed over all the windows, thus securing a sufficiency of light and air so necessary to produce the

highest sanitary condition to which each ward may be susceptible (*Annual Report* 1888:2).

In 1898 the Superintendent requested money to remodel the bath-rooms. He noted that the “plan and general arrangement of this department, which was put in about thirty or forty years ago, is very inefficient in every particular, but was, I believe, about as well executed as the average plumbing of that day.” He went on to describe the bath-rooms. The bath tubs were iron, the toilet seats wood, and the lavatories were iron basins, set on cast iron tables. All were “corroded and most unsightly.” He recommended “a new and complete system, with...sanitary fixtures, modern baths, and improved lavatories of durable material that will not corrode or absorb foul odors” (*Annual Report* 1898:26).

The Superintendents were constantly experimenting with the care of their patients, which often resulted in alterations to the buildings and grounds. In the 1920s, the Superintendent reported that Eastern State Hospital was the only institution in the United States experimenting with the use of sawdust beds for the “helpless, untidy insane.” He explained that once he learned of their use in Germany he had thirty-four of the beds installed at Eastern State Hospital. They were oblong boxes, made of one-inch dressed boards six and one-half feet long, thirty inches wide, and eighteen inches deep, standing on legs twelve inches high and painted white. They were filled with fresh sawdust to within six inches of the top. According to the Superintendent, the patient, clothed in a short night shirt, laid directly on the sawdust, which conformed to the shape of the body. A pillow was placed under the head and the patient was covered with a sheet and blanket. He explained that the excrement from the bowels and kidneys with the small amount of sawdust that was soiled was scooped out immediately with an ordinary six inch scoop. Fresh saw dust was added from time to time to keep the total amount up to the twelve-inch level (*Annual Report* 1925-1927). It is unclear how long sawdust beds were employed at Eastern State Hospital.

The African American Experience

In her study of asylum architecture, Yanni demonstrated that the values and social relationships of society at large were reproduced inside the nineteenth-century insane hospital. For example, the poorest patients were not allowed to mix freely with the wealthy. The wealthy patients were accommodated on the best-maintained wards and could often bring their own furniture, books, and even servants. Like class, race also determined how a patient was treated (Yanni 2007:5). Yanni found that racial segregation manifested itself in physical space. She observed that although southern superintendents believed state funds should be used to treat all the insane regardless of race, they deemed segregation necessary (Yanni 2007:64).

According to Perrin, the first patient admitted to the Kentucky Lunatic Asylum was a “negro” woman from Woodford County. Unfortunately there are no records that reveal the living conditions of African American patients during the earliest years of the institutions history. At the Alabama Insane Hospital, blacks were assigned to the basements, which were considered the worst of the wards, until separate facilities were

constructed (Yanni 2007:64). It is likely that this was the case at the Kentucky Lunatic Asylum as well.

It appears, however, that there may not have been many African Americans admitted to the Kentucky Lunatic Asylum until after the Civil War. In 1845, for example, the Superintendent pleaded to the legislature for the appropriation of funds to build accommodations for blacks.

“I would further suggest, that there are a number of insane negroes within our State that claim a portion of our provident sympathy. We have been much grieved to be compelled to refuse admission to a number of blacks during this year. These poor creatures are entitled to some attention, as they are equally subject with ourselves, to the pains and sufferings consequent upon mental alienation. They surely are not beneath the reach of humanity, and I sincerely hope some plan for their benefit may be devised” (Annual Report 1845:628).

In 1869, in districting the state between the Lexington asylum, now called the Eastern Lunatic Asylum, and the new asylum constructed in Hopkinsville, Kentucky, called the Western Lunatic Asylum, the Legislature drew a geographical line which gave each asylum part of the population, white and black. Before it passed, however, a proviso was added to the bill, assigning the entire black population to the Lexington asylum (Annual Report 1869:7). At this time, money was appropriated to enlarge an existing building, located about two hundred yards from the main white ward, for the use of “negro lunatics.” It was a brick structure, eighty-five feet long, forty-four feet deep, having three stories and a basement (Annual Report 1869:16).

In 1879, the Superintendent reported that “The two wards occupied by the colored people have undergone thorough repairs, making that building, which is located some distance from the hospital proper, one of the best we have (Annual Report 1879:20). By 1888, however, he reported that:

“The department known as the negro quarter is too small; especially is this true respecting the day-rooms, into which are crowded during the day all the inmates....This condition cannot be improved, except by increasing the capacity of the day-rooms, or building two additional rooms for said purpose....they should be two stories high (that is above the basement), and the upper rooms used as dormitories. This improvement should be made at the earliest moment practicable, for the condition of this class of unfortunates is deplorable, and every instinct of humanity demands that this long-felt want should not be disregarded” (Annual Report 1888:3).

He went on to describe the recommended addition. He suggested that it should consist of a new day-room, 6 x 7.5 m (20 by 25 ft), on each side of the building, one each for males and females. The rooms should be well lighted and ventilated and open into the present day hall by an arch. This, he suggested, would cost \$2,500. For \$5,000, however,

the additions could be built three stories, creating four dormitories the same size as the day-rooms. This, he explained, would provide room for 25 more patients (Annual Report 1888:7). The legislature approved the larger addition and the work was completed by 1889 (Annual Report 1889:6) (Figure 2-15).



Figure 2-15. Ca. 1899 photograph of “Colored Building.” No longer extant (Annual Report 1899).

In 1896, the Superintendent once again warned that the accommodations for the “colored patients” was “totally unfit.” “The building is old and dilapidated, ventilation poor, day-rooms too small, and the lights bad.” He recommended that a brick building, sufficient to accommodate two hundred and fifty patients, with hospital wards attached for males and females, be erected. In the meantime, a building disconnected from the main building that was formerly an engine room and laundry was converted into quarters for the “quit colored female patients,” thereby relieving the main “colored” building from crowded conditions (Annual Report 1896:14).

The relief was temporary, however, for in 1898, he reported that the “negro male patients, irrespective of the types of their maladies, are crowded into one ward. Every consideration dictates that these patients should be intelligently classified and separated into wards according to the nature of their respective maladies, as is attempted to be done with the white patients” (Annual Report 1898:8).

In 1913, the Superintendent pleaded that a “new building for colored females” was an “absolute necessity.” He explained that in “a building erected in 1817, with no modern improvements, we are conducting a male and female ward, separated only by a brick partition wall, with a sufficient number of colored male patients to fill the whole building, nearby, we have another colored female ward in a building at one time used as a laundry, and which now should be condemned” (Annual Report 1913:40).

It does not appear that a new building dedicated to the housing of African American patients was constructed until 1951 when the Wendell building was constructed. The building was named after Thomas Tyler Wendell, an African American physician who served the Asylum as well as the Lexington community during the late nineteenth and early twentieth centuries.

The Pleasure Grounds and Farm

During the nineteenth century, the natural environment was thought to be essential to the cure of insanity, and thus the site of an insane hospital was as crucial to its success as its buildings. The designers of asylums believed it was important that they be located in the country or at least suburban areas, for nature was curative and exercise therapeutic. In 1829, Samuel Theobald, the attending physician at the Kentucky Lunatic Asylum, described the site of his hospital:

“It is situated... North-west of the town, and 2 or 300-yards within the mile square which determines its limits, yet sufficiently without the business and bustle of the streets to be entirely free from any annoyance or inconvenience from that source” (Theobald, 1829).

Theobald went on to describe the grounds of the asylum in detail.

“The whole extent of land at present owned by the Institution is about 17 acres. Of this near 4 acres are appropriated as a yard in front of the Asylum. This, handsomely set with grass, and ornamented with trees, stretches a distance of about 150 yards to the street or road, along which is the only approach to the buildings. About mid-way between the road and house is a spring of abundant, never failing, and excellent water..., Here too is a dairy, wash house, and bathing house under the same roof. Another portion of the ground, embracing about 5 acres, is appropriated as a garden, in which a variety of vegetables is cultivated, and in sufficient quantity to supply the demand of the institution for great portion of the year. The residue is appropriated for the out buildings, stable, cow-house, &ca. These are enclosed at present by a common post and rail fence” (Theobald 1829).

In 1829, the Legislature appropriated \$1,200 to erect three brick walls, to enclose a yard around the asylum for the exercise of the patients. The walls were to enclose about

an acre and a half, in the rear of the buildings. The ground to be enclosed by the walls was to be divided into three yards; one for females and the other two for males; so as to allow a separation of the males into two classes (Theobald, 1829). Figure 2-10, an 1837 site plan of the hospital, depicts the three “airing yards” that were created by the construction of the fences.

Samuel Theobald, noted, however, that it “is frequently very desirable, not only as an agreeable indulgence, but as a means of restoration, to allow individuals the privilege of more pleasant and extensive walks than can be enjoyed in the closed yards” (Theobald, 1829). By 1842, the Commissioners reported that they were “laying out and ornamenting” grounds as “pleasure walks for the exercise and recreation of the patients” (Annual Report 1842:259-260).

Nineteenth-century physicians believed labor was also an important part of the treatment of insanity. As early as 1830, Theobald noted that:

“There are a number both of males and females who are regularly employed in the domestic avocations of the house and grounds. Indeed the largest proportion of the drudgery and labour, required about the institution, is performed by the insane; but deficiency consists in not having sufficient regular and appropriate employment for all who are capable of manual labour.... The limited extent of land owned by this institution, at present, presents some difficulty to the employment of all who are capable and might be safely and beneficially engaged in the cultivation of a farm” (Theobald 1830).

By 1843, the Commissioners reported that a neighboring farm had been rented to “experiment, as to the influence of labor upon the Lunatics.” They found the result “most satisfactory” and went so far as to attribute it to that years' success. They reported that the farm could be purchased for \$15,000. In their plea for the purchase, they quoted Kirkbride on the benefits of farms:

“a farm should be connected with every insane Hospital, not only from the valuable supplies derived from it, but as a part of the treatment, adding, as it is sure to do, immensely to the comfort of the patients, and promoting their restoration” (Annual Report, 1843:494-495).

In 1861, one hundred and thirty acres of land was added to the asylum. A stable for milk cows, 25.4 m (84 ft) long and 4.8 m (16 ft) wide was erected, along with a carriage house, wagon shed, piggery and a slaughter house (*Annual Report* 1861:5). A comparison of the small rectangular airing yards for males and females depicted on the 1837 site plan (Figure 2-10), and the 1861 topographic map titled “The Pleasure Grounds” (Figure 2-16) shows how far landscape design had come at the Kentucky Lunatic Asylum. The 1861 map depicts circular drives, groves of trees, a flower garden, fountain, orchard, and fish pond. They continued to add to the grounds over the years. For example, in 1875 a large reservoir was completed (Figure 2-17). In 1898, they

supplemented the orchard by planting 400 fruit trees (100 plum, 100 peach, 100 pear, and 100 cherry) (Annual Report 1898:18). In addition to the male and female buildings, an 1871 birds eye view of the asylum (Figure 2-18) shows a network of circular drives and groves of trees and an 1877 atlas of the site (Figure 2-19) shows an even more extensive network of roads and walks. In fact, as late as 1901, several thousand additional feet of walks were being laid (Annual Report 1901:18). In 1869, the Directors reported that “our pleasure grounds, provided with seats, arbors, flower gardens, swings, & ca, are extensive, and are growing more beautiful every day (Annual Report 1869:16).

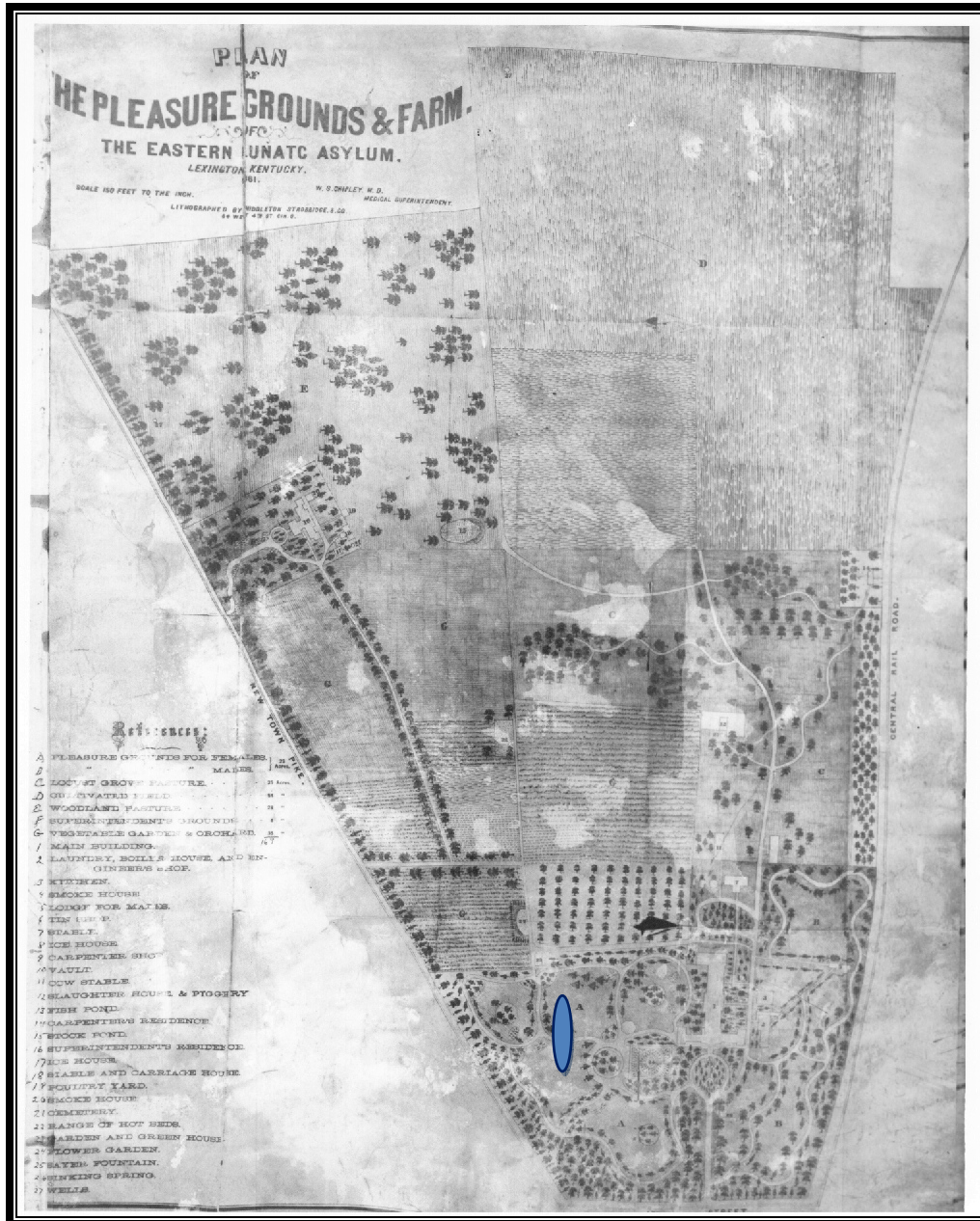


Figure 2-16. An 1861 map of “The Pleasure Grounds & Farm” showing the general location of the cemetery (Brinegar 2006b).



Figure 2-17. Nineteenth-century photograph of Eastern State Hospital showing reservoir. No longer extant (Brinegar 2006b; photographer J. Soule Smith).

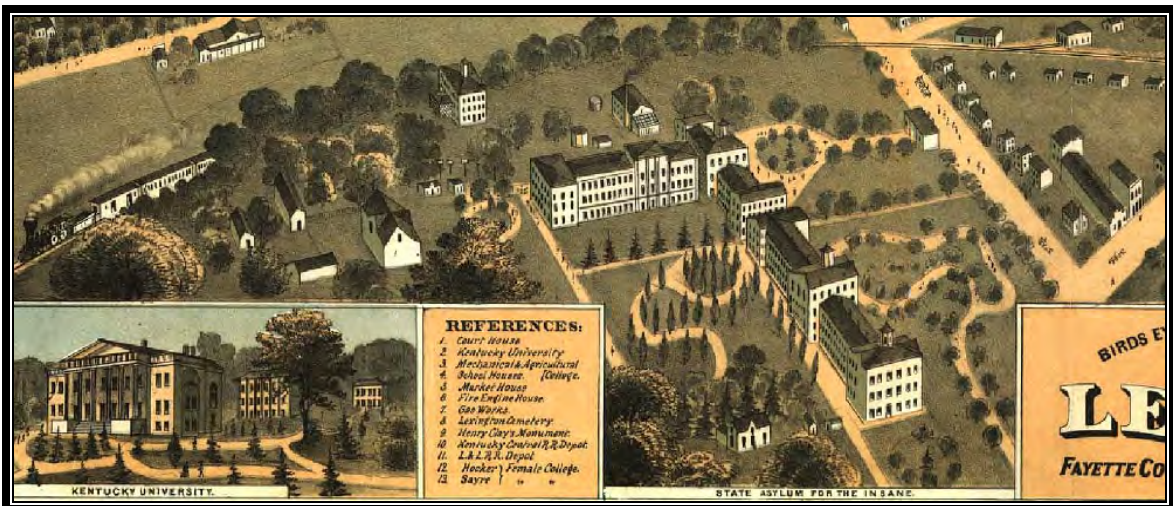


Figure 2-18. 1871 birdseye view of Eastern State Hospital showing Male and Female Wards, circular drives and groves of trees (Ehrgott & Krebs Lith. 1871).

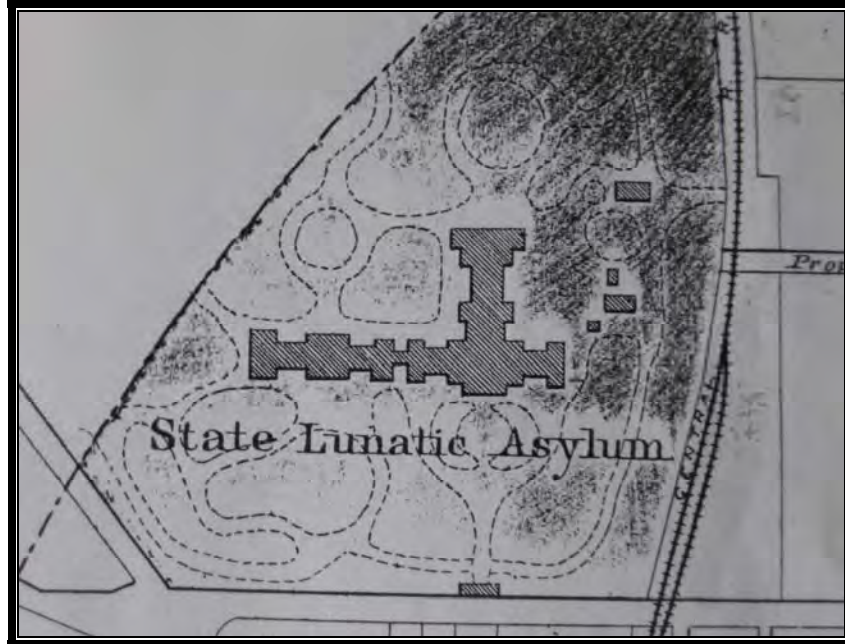
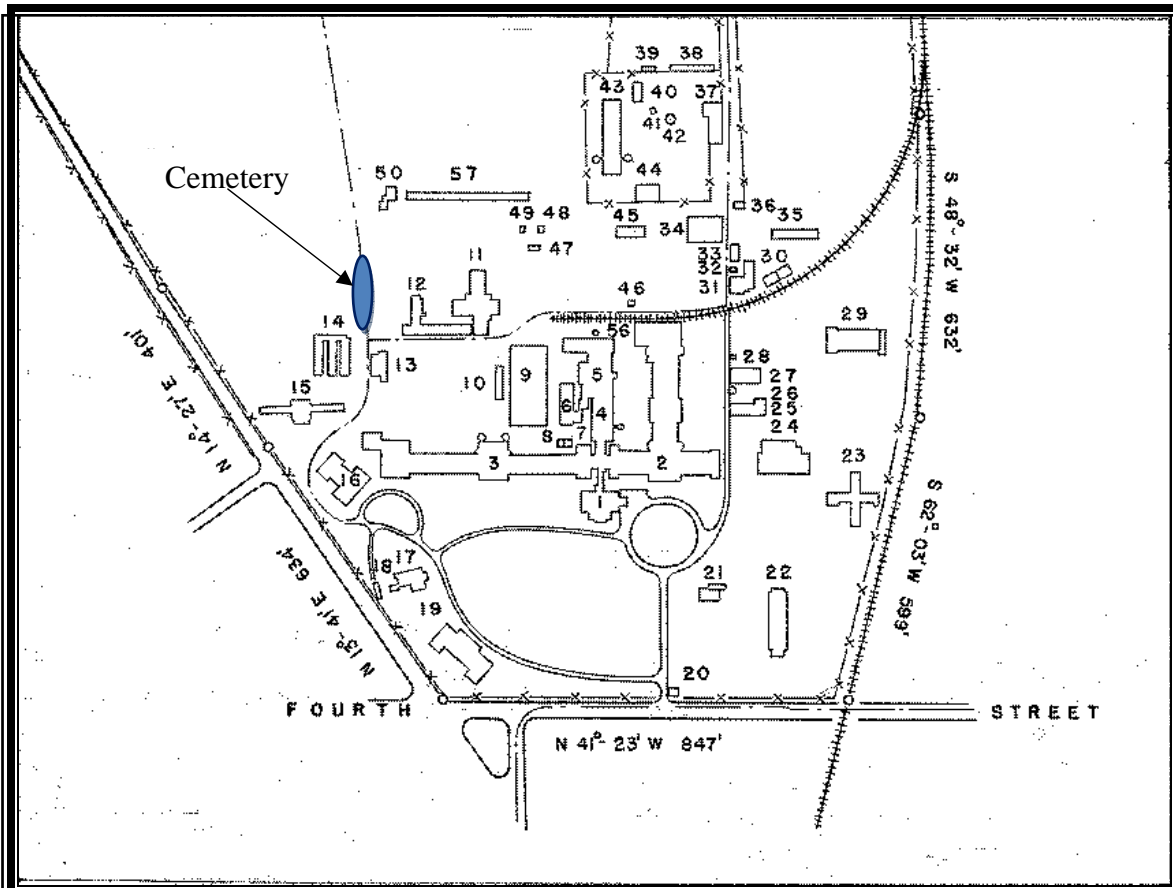


Figure 2-19. 1877 atlas of Eastern State Lunatic Asylum showing circular drives and walks (D.G. Beers & Co. 1877).

In his 1896 annual report, the Superintendent argued that there was a need for an infirmary to care for the sick and guard against contagious diseases. At the time, he reported, the sick were cared for on the wards (Annual Report 1896:14). The funds for the infirmary were appropriated and the building was complete by 1899 (Figure 2-22). It contained four wards, with bath rooms attached, fitted with all “modern sanitary fixtures; an operating room, second to none in the state, a diet kitchen, equipped with electrical cooking utensils, ten private rooms for special cases, nurses and attendants” (Annual Report 1899:11). The two-story, brick, Victorian style infirmary had a one-story wrap-around porch (Figure 2-20 - Building Number 16).

In 1904, a pair of bowling alleys by the Brunswick Balke Collender Company, and a new building to house them was constructed (Figure 2-20 - Building Number 23) (Annual Report 1904:8). In 1905, an article appeared in the local paper announcing that:

“The high board fence.., on West Fourth Street, which has been an eye sore for years, obscuring from view the beautiful grounds of the institution is shortly to give place to a handsome iron fence to cost between \$2,500 and \$3,000.... The new iron fence will be 766 feet long and extend along the entire front of the asylum grounds from the L & N railroad crossing to the Newtown Pike. It will be placed on a stone foundation about two feet high. The fence proper, which will be of ornamental pickets of the latest design, will be about six feet high, the whole being about eight feet high. This change will be a decided improvement and will add greatly to the beauty of the grounds which are among the most attractive in the city” (The Leader 1905).



Building Index

- | | |
|--------------------------------------|----------------------------|
| 1. Administration Building | 26. Electrical Repair Shop |
| 2. White Male Ward | 27. Supply Store |
| 3. White Female Ward | 28. City Fire House |
| 4. White Male Ward | 29. Colored Male Ward |
| 5. Engine-Machine-Power Shops | 30. Unloading Pit |
| 6. Storage | 31. Woodwork Shop |
| 7. Milk Pasteurizing Room | 32. Colored Farm Building |
| 8. Smoke House | 33. Garage |
| 9. Dining Room- Male White Ward | 34. Horse Barn |
| 10. Paint-Broom-Shoe Shop | 35. Garage |
| 11. Laundry | 36. Corn Crib |
| 12. Farm Storage-Attendants Quarters | 37. Cow Barn |
| 13. Attendants Quarters | 38. Cow Shed |
| 14. Greenhouse | 39. Bull Shed |
| 15. Taburcular Ward | 40. Cow Shed |
| 16. Infirmary | 41. Equipment Building |
| 17. Superintendent's Quarters | 42. Water Trough |
| 18. Superintendents Garage | 43. Dairy Barn |
| 19. Female Attendants Quarters | 44. Cow Barn |
| 20. Commissary | 45. Cannery |
| 21. Well-Pump House | 46. Male Toilet |
| 22. Male Attendants Quarters | 47. Storage |
| 23. Occupational Therapy | 48. Morgue |
| 24. Colored Female Ward | 49. Storage |
| 25. Tailor Shop | 50. Attendants Quarters |

Figure 2-20. 1938 plan of Eastern State Hospital show general location of the cemetery (Map provide by Kentucky Finance Cabinet).



Figure 2-21. Ca. 1903 photograph of Superintendents Residence (Annual Report 1903).



Figure 2-22. Ca. 1899 photograph of Infirmary (Annual Report 1899).

The construction of the fence was put out to bid and the contract was awarded to the Stewart Iron Works Company, of Cincinnati, Ohio (Annual Report 1904:8).

In 1904 the Superintendent requested an appropriation for the erection of a “modern laundry.” He explained that the present one was situated over the engine room, where steam and coal dust filter through the floor and make it next to impossible to properly launder the clothing. In addition, he argued, during the warm months the laundry employees are forced to do their work in a temperature of one hundred and twenty to one hundred and thirty degrees, owing to the excessive heat from the engine room (Annual Report 1904:8-9). The new laundry was completed in 1906.

In 1913, the Superintendent declared that in “this day of enlightenment, a hospital for the insane without special quarters for Tubercular and Pellagra patients separate and distinct from the main buildings, is criminal negligence, and should not be tolerated” (Annual Report 1913:41). A tubercular hospital, designed to comfortably accommodate twenty-two patients, was completed in 1914 (Figure 2-20 – Building Number 15; Figures 2-23 and 2-24).

In 1915, the Superintendent proclaimed that a “nurses home” is “badly needed” and “would enable us to have better nurses and retain them longer. Working and sleeping in the same ward, and surrounded by patients, year after year, is not conducive to health or capacity” (Annual Report 1915:14). In 1927, the nurses’ home was constructed. It was a two-story brick building with a capacity for thirty-six nurses. All of the excavating work was done by inmate labor, and the entire upper floor of the building was completed by the institution forces (Annual Report 1927:71) (Figure 2-20 – Building Number 19).



Figure 2-23. Ca. 1914 photograph of Tuberculosis Hospital (Annual Report 1914-1915).



Figure 2-24. Ca. 1914 photograph of ward in Tuberculosis Hospital (Annual Report 1914-1915).

TREATMENT OF THE MENTALLY ILL

Take from O'Malley 2006

Initially, the asylum made a distinction between ‘lunatics of unsound mind,’ particularly those who posed a danger to themselves, their families, or their community and those who were sick or imbecile. The distinction would not last, and soon the asylum became home to individuals with congenital mental handicaps (termed “idiots” or “imbeciles” in the language of the day), as well as those who developed mental illnesses. Epileptics also were frequently admitted. Although the Governor had criticized the county level system of caring for the mentally ill and intended the Lexington asylum to replace this system, the legislature reinstated the policy of funding facilities at the county level. The retention of this policy created the unique and unfortunate situation in which the asylum became the institution of last resort for people who had become unmanageable and essentially incurable.

Nonetheless, the association of the Transylvania Medical College with the Asylum fostered programs of treatment intended to cure people of their mental afflictions. These programs changed over time as different theories were promulgated and practiced by the medical community. The earliest treatment program was based on the work of Benjamin Rush who taught that the brain became diseased because of inflammation (White 1984). Bloodletting was the standard treatment for this condition along with other depletive prescriptions, such as emetics and purgatives. Rush also

advocated confinement in total darkness and physical restraint in strait jackets or other devices that today would be considered forms of torture. Rush and his students recognized both moral and physical causes of mental illness. Moral causes derived from the “passions,” which were subdivided into stimulant passions (hope, joy, love, courage, ambition, and anger) and sedative passions (fear, grief, despair, jealousy, hatred, envy, and remorse) (White 1984). The sedative passions and anger were thought to be the chief culprits in the development of mental illness through moral causes.

Physical cause was recognized as organic dysfunction within the brain. Specific conditions that could lead to mental problems, included intoxication, inordinate venereal indulgence, worms in the alimentary canal, head injuries, syphilis, improper use of mercury, pregnancy, parturition, gastric problems, and narcotic poisoning.

The public perception of the asylum in its early years was that it was an exemplary institution, but insiders knew that the institution had many problems. A persistent difficulty was the inadequacy of the old Fayette Hospital building (White 1984). The building as constructed was not big enough to hold everyone associated with the asylum and the inmate cells built on the third floor were heated by a single fireplace. Additionally, the violent patients could not be easily segregated from the more manageable inmates (White 1984).

Location of Cemetery

In 1839, two tracts of land, totaling almost three ha (just over seven acres), were added to the property (Fayette Deed Book 16:164, 263) (Figure 2-25). These tracts, which were attached to the rear of the original 4 ha (10 acres), extended the property's boundaries to the northeast. In 1842, two more tracts totaling just over nine acres were added (Fayette Deed Book 20:184, 330). In 1843, a stone vault was built to hold the bodies of inmates that died during the winter when graves could not be dug. This was a temporary holding area used until burial could take place. In 1854, another land acquisition extended the asylum property along Henry's Mill Turnpike (later Newtown Road) (Fayette Deed Book 29:398). By 1855, the asylum property amounted to about 16 ha (40 acres) (Figure 2-26). Through the 1860s, land acquisition and building construction continued to expand and transform the asylum property (Fayette Deed Book 37:274, 43:511, 44:346).

The inmate population increased steadily through the nineteenth century, and the low rate of cure resulted in a large number of inmates spending many years there. Throughout this period, the death rate fluctuated but remained high compared to the general population. When an inmate died, the remains were either claimed by the family for burial elsewhere or buried on the asylum grounds. The second asylum cemetery, established by 1861, was located at a considerable distance from the main building complex on property that was not part of the original 4 ha (10 acres). An 1887 map of the property shows the buildings, but not the cemetery. Over 4,000 burials from this cemetery were disinterred and reburied in the northeast corner of the current asylum property in the 1980s.



Figure 2-25. Deeds Relative to Location of Cemetery (Note relationship of Cemetery to the northern corner of 1839 addition).

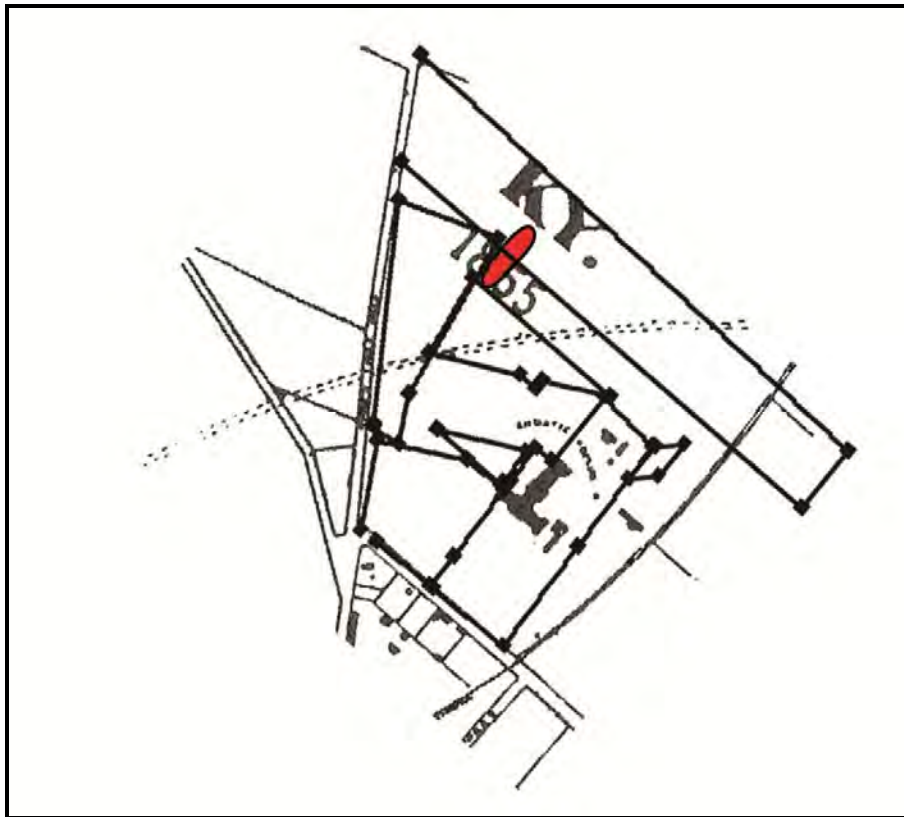


Figure 2-26. Haag and Sons (1855) Map of Lexington Showing Lunatic Asylum (Note Location of Cemetery and Property boundaries).

CHAPTER THREE: CULTURAL MATERIALS RECOVERED

By
Kim A. McBride and Victoria Westmont

INTRODUCTION

This chapter describes the cultural materials recovered from the Eastern State Hospital Cemetery. Whenever possible the location of coffin hardware and personal artifacts was noted in the field and recorded on burial forms, as line drawings, and digital photographs. Others were noted when the materials were processed at the University of Kentucky Archaeology Laboratory where they were washed, identified, and cataloged. They were then analyzed to provide information about the cemetery's history, coffin construction, and mortuary patterns. The materials from Burials 1 to 11 were originally described by Sarah Miller (Miller 2006).

The artifacts are presented in this chapter by the following categories: coffin hardware; personal objects; and miscellaneous artifacts (i.e., items incidentally included in the grave shaft or found adjacent to a grave shaft). Materials associated with the coffins were fairly limited in diversity, consisting primarily of nails and screws, with only a few wood fragments being recovered. Cultural materials associated with individuals interred within the Eastern State Hospital Cemetery were more varied, consisting of buttons, hooks and eyes, straight pins, buckles, beads, hair combs, a coin, and remnants of clothing (textiles).

A few caveats should be offered. First, preservation of personal objects, such as pins, was poor. Thus, the recovered assemblage very likely represents a sample of the personal objects interred with the dead. Second, due to poor preservation conditions, many of the items recovered are very fragmentary, hindering their identification or rendering some identifications as tentative. In a few cases, artifacts observed during excavation did not survive transporting to and processing in the laboratory. Whenever possible information regarding the nature and location of these objects (e.g., torso or pelvis) was noted. In addition, poor preservation conditions may account for the absence of shell buttons.

COFFINS AND COFFIN HARDWARE

The evidence suggests all individuals were interred in coffins. Those that lacked coffin hardware had been disturbed by later interments. This resulted in the commingling of remains and the truncating of earlier graves (see Chapter Five).

While some small fragments of wood from coffins were found during the excavations, the only intact coffin consisted of a Fisk metallic (cast iron) burial case (Burial 39B). This cast iron coffin had a length of 183 cm and a width of 55 cm. It was

of the sarcophagus style, with molded lines that resembled draped fabric, and floral designs at the feet. Sarcophagus style Fisk coffins were manufactured between 1848 and 1854 (Allen 2002). The Eastern State Hospital example had eight handles along the sides, and a viewing window at the head. The case was in a good state of preservation. Nails surrounded the metal casket, suggesting it was enclosed in a wooden box. As Fisk coffins were shipped from the factory in a wooden packing crate, it is highly likely that this crate was reused when the coffin was placed in the ground. Since the Fisk coffin was not opened, no additional information was collected on the individual interred within it.

Coffin hardware refers to those items attached to a coffin or casket, for decorative or functional purposes, or items used in its construction. Most of the burials at Eastern State Hospital were marked by some sort of coffin hardware, typically machine-cut iron nails and in some cases screws. Due to the acidic nature of the soils, the preservation of the nails and screws was very poor, so those associated with each individual may not represent all of the nails or screws used to close their coffin.

Nails

By far the most common coffin hardware recovered were late machine-cut nails (n=936 whole and 3,763 fragments) (Figure 3-1). Most were individual nails, but some were crossed (Figure 3-2). The latter were created when nails intersected at the corners of the coffins, and rusted together. Nails were identified as whole when a head and an unbroken tip could be clearly seen, or when the shape of the rust enclosed nail (appropriate bulge at the head, combined with a proportion of length to width similar to that of other nails) was suggestive of completeness. Pennyweight (size) was only determined for whole nails.

Burial 39E, an adult male, is the only disturbed grave for which there was no evidence of a coffin as represented by nails or screws. This individual appears to have been severely impacted by the digging of a grave shaft for the Fisk Casket (Burial 39D).

For four interments (Burials 28, 43A, 58, and 68D), coffin nails were documented in the field but did not survive removal and transportation to the laboratory. In these cases, counts derived from field drawings were used to determine the number of associated coffin nails. Burials 19D, 19F, 37A, 39D, 53D, 55B, 55D, 59G, 59H, 60E, 62, 63F, 66G, 67B, and 68I yielded only coffin nail fragments. Burials 25B and 53B yielded only whole nails and no fragments. The rest of the burials produced a mixture of whole nails and nail fragments, typically many more fragments than whole nails. These divisions are purely a matter of preservation, since all the nails would have entered the ground as whole nails.

An average of 30.3 nails was associated with 155 coffins, with a minimum of 2 and a maximum of 95 nails. Whole nails (n=936) were associated with 136 coffins. The frequency per coffin ranged from 1 to 21 whole nails, with a mean of 6.9 nails. The 3,763 nail fragments were recovered from 155 coffins. Nail fragments range from 2 to 84 per coffin, with a mean of 24.1 nail fragments.



Figure 3-1. Nails and screws. Upper left to right: a whole nail and three nail fragments. Lower: screws.



Figure 3-2. Crossed nails.

Nail pennyweights range from 3 to 20d (Table 3-1), with 7d nails being the most common, followed by 6d, 8d, and 9d. At Eastern State Hospital these types account for 83.7 percent of the nails. A preference for mid-size (6 to 9d) framing nails also was documented at the early to mid-nineteenth century Horse Park (Fayette County) and Old Frankfort (Franklin County) cemeteries where they accounted for 66.0 and 54.4 percent, respectively, of the coffin nail assemblage (Miller 2007; Pollack et al. 2011).

Table 3-1. Nail pennyweights.

Pennyweight Size	Eastern State		Old Frankfort		Horse Park		Avondale	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
2d			87	5.7	3	1.6	13	0.7
3d (1.25 inches or 3.18 cm)	2	0.2	212	14.0	16	8.6	32	1.7
4d (1.50 inches or 3.81 cm)	37	4.0	181	11.9	15	8.0	40	2.2
5d (1.75 inches or 4.45 cm)	27	2.9	123	8.1	29	15.5	245	13.3
6d (2.00 inches or 5.08 cm)	229	24.5	95	6.3	40	21.4	108	5.8
7d (2.25 inches or 5.72 cm)	250	26.7	350	23.1	20	10.7	653	35.4
8d (2.50 inches or 6.35 cm)	197	21.0	245	16.2	57	30.5	206	11.2
9d (2.75 inches or 6.99 cm)	107	11.4	134	8.8	7	3.7	109	5.9
10d (3.00 inches or 7.62 cm)	71	7.6	55	3.6			354	19.2
12d (3.25 inches or 8.26 cm)	15	1.6	30	2.0			78	4.2
13d							1	0.1
14d							1	0.1
16d (3.50 inches or 8.89 cm)		0.0	3	0.2			7	0.4
20d (4.00 inches or 10.16 cm)	1	0.1						
Total	936		1515		187		1847	

At the Old Frankfort cemetery, Miller noted a bimodal coffin nail distribution, with a peak in the 7 to 8d range (39.3 percent) and another in the 3 to 4d range (25.9 percent). This led her to suggest that the Old Frankfort Cemetery's nail size distribution was the byproduct of coffin makers using specific nail sizes for different parts of the coffin. A preference for medium-sized framing nails seems to hold at a broader regional level. For example, at the slightly later Avondale cemetery (Bibb County, Georgia), nails in the 7 to 10d range accounted for 71.7 percent of the coffin nail assemblage with 7d nails being the most common (Matternes et al. 2012:340). Davidson (2006:117), who has probably analyzed more historic burial assemblages than any other historical archaeologist, concluded that 6d and 8d were the most common nails used in coffin construction. The Eastern State Hospital nail assemblage is consistent with this pattern. A preference for nails in the 6 to 9d range could reflect the production of coffins at the Hospital.

Coffin nail location was derived from measured drawings and photographs associated with each burial (Table 3-2). Nails tended to be located around the edges of the coffin shaft rather than its interior. This indicates that they do not represent decorative nails. The most common pattern was for nails to be clustered at the head and feet (62.1 percent). Over a third (37.9 percent) of the burials had a more even distribution with a greater number of nails being located along the sides of the coffin.

Table 3-2. Nail distributions.

Nail patterns	Burials	Freq	Perc
More even distribution, moderate amount along sides of coffin shaft	3, 4, 5, 6, 8, 10, 11, 12A&B, 15D, 19A, 20B, 26B, 27, 29C, 31, 32, 34, 36B, 36D, 36E, 37C, 37F, 38B, 38D, 39B, 39D, 40, 42, 43A, 45, 47A, 47B, 53C, 55A, 57A, 57B, 59C, 59D, 59F, 59G, 59I, 60A, 60B, 63B, 63G, 66B, 66C, 66D, 66G, 66H, 67B, 67C, 67E, 68E, 68G	55	37.9
Cluster more at feet	18A, 19B, 31B, 49, 50B, 50C, 52B, 63D, 63F, 68B, 68C	11	7.6
Cluster more at head	13, 16A, 19C, 23, 28, 29A, 30, 37D, 43B, 51D, 51H, 53B, 55A, 59E, 63C, 63E, 66F, 68D, 68F, 68H	20	13.8
Cluster at both head and feet	2, 7, 9, 14B, 15A, 15B, 15C, 16B, 18B, 18C, 18D, 18E, 19D, 19E, 19F, 19G, 20A, 21, 22, 24A, 24B, 25, 29B, 29D, 33, 35, 36C, 37B, 37E, 38A, 39C, 41, 44A, 44B, 46A, 46B, 48, 50A, 51A, 51B, 51C, 51G, 53A, 54, 55B, 55C, 55D, 56B, 58, 59A, 59B, 59H, 59J, 60C, 60D, 62, 64B, 66B, 67D	59	40.7

Screws

Screws (n=42) were associated with 32 coffins (Table 3-3; Figure 3-1). They were identified by viewing threads on the shaft, or if the general shape of the rust enclosed object strongly suggested a screw (bulkier and heavier than typical nails, stronger tapering, and shorter than most nails). Due to the poor preservation conditions, more detailed identifications of the head or tip form could not be documented. A screw from Burial 53B's coffin, however, appears to have a pointed end (gimlet screw). The presence of this type of screw indicates that the person interred in this coffin died after 1836. One of the two screws from Burial 48's coffin appears to have a flat tip. Both of these identifications should be treated as tentative.

Table 3-3. Frequency of screws per burial.

Number of screws	Burials
1	15C, 15D, 18C, 19A, 19B, 19G, 20A, 36D, 38B, 44A, 44B, 46B, 49, 51B, 53B, 53C, 59A, 59D, 59J, 63B, 64A, 66C, 66G, 67B
2	29C, 36B, 36E, 37B, 39C, 48
3	46A, 51A

CLOTHING AND PERSONAL OBJECTS

Personal artifacts recovered from the Eastern State Hospital Cemetery are primarily related to clothing fasteners (buttons, hooks and eyes, straight pins, and buckles). Items, such as beads and hair combs, that would have been used for personal adornment were found with a few burials. Except for the possible exception of a coin, there are no items that can be considered to be burial goods, or tokens or offerings of luck or affection.

Buttons

Buttons (n=254) recovered from the Eastern State Hospital Cemetery were manufactured from bone (n=161), metal (n=34), or porcelain (n=59) (Figure 3-3). While buttons were primarily worn by men in the seventeenth and eighteenth centuries, they began to appear more frequently on women's clothes in the nineteenth century, although other methods of closure, including lacing, pins, and hooks and eyes were still quite common (White 2005:57).

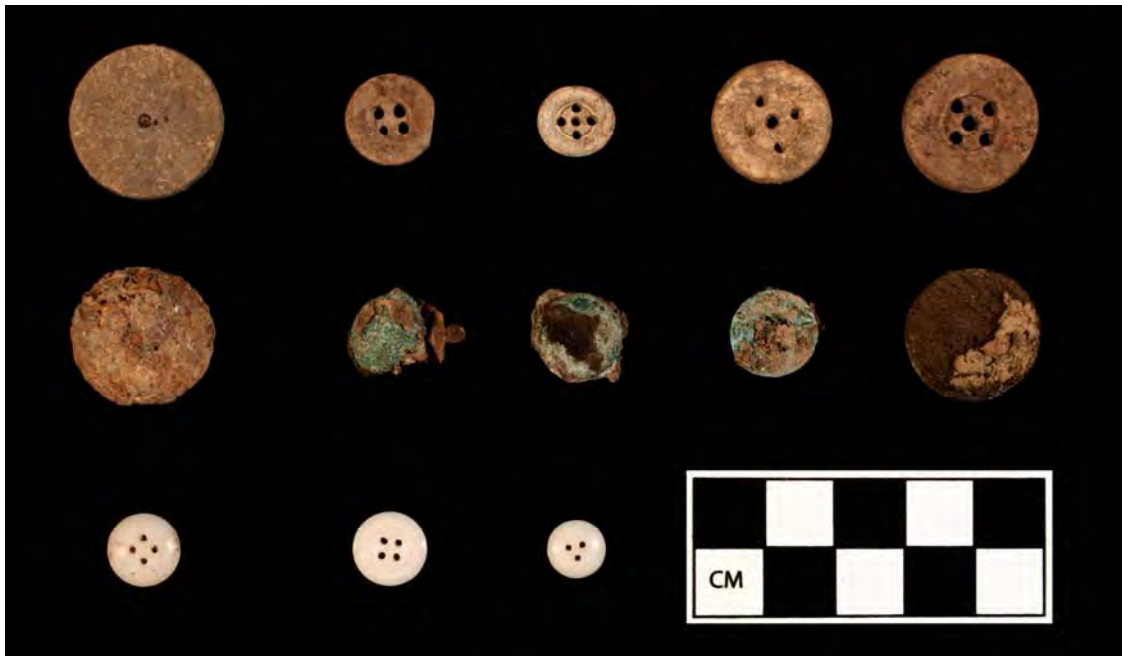


Figure 3-3. Buttons. Top, bone buttons (left to right): one-hole; four-hole; three five-hole. Middle, metal buttons (left to right): three dome; stamped sheet metal; coin. Bottom, Prosser (left to right): plain four-hole, hob-nail edged four-hole; plain three-hole

Bone

Bone buttons (n=161) were associated with 36 individuals (Table 3-4; Figure 3-3). They represent three identifiable types: one-hole (n=8), four-hole (n=23), and five-hole (n=129). The four- and five-hole buttons represent 'sew-through' button types. The one-hole variety could have been attached via a pin shank (Lindbergh 1999).

Bone buttons, typically manufactured from cattle bones, predate the seventeenth century but by the early nineteenth century had become one of the most common materials for utilitarian buttons (Jones 1924; Lindbergh 1999). Though bone buttons were often made in factories, they stand apart from metal or porcelain buttons in that they could also be made in the home or in small institutional settings, and were likely popular in areas where market access to commercially produced buttons was restricted. Bone buttons frequently served as a closure for underwear or shirts and trousers, but also were

used on other garments. One-hole bone buttons were often covered with thread or cloth (Jones 1924; Lindbergh 1999; Luscomb 1967; White 2005).

Table 3-4. Breakdown of bone button types by burial.

Button Type/Size	Burial
Button fragment	59I
1-hole (n=8)	20A, 27, 44B
4-hole (n=23)	8, 10, 20A, 23, 34, 36D, 38A, 42, 53B, 53C, 55A, 57A, 59D
5-hole–Small (n=18)	10, 18B, 19D, 26B, 29B, 32, 33, 42, 43B, 50B, 53C
5-hole–Medium (n=76)	15A, 15C, 18C, 20A, 25, 26B, 27, 28, 30, 31B, 32, 33, 42, 46A, 46B, 48, 53B, 55B, 60E, 64A
5-hole – Large (n=34)	18C, 23, 24B, 27, 30, 31B, 32, 44B, 60E

One-hole buttons (n=8) were recovered from three male burials (Table 3-4). In general, these types of buttons tend to be larger than other button types, ranging in diameter from 21.27 to 22.53 mm, with a mean of 22.15 mm. This type of button was found in association with the pelvis (Burial 27; n=2), and right humerus (Burial 20A, n=2, along outer edge, and Burial 44B, n=4, two along outer edge and two along inner edge) (Figure 3-4). Those associated with the pelvis could represent pants closures or suspender buttons. Their association with upper right humerus is unusual for all button types and is suggestive of some type of a clothing that had closures along just one side.

Four-hole buttons (n=23) were found in association with 13 burials (Table 3-4; Figure 3-3). These types of buttons were found with both males (n=7; Burials 20A, 23, 38A, 42, 53B, 55A, and 57A) and females (n=5; Burials 8, 10, 36D, 53C, and 59D). The sex of Burial 34 could not be determined. Bone four-hole buttons range in diameter from 11.1 to 17.8 mm, with a mean of 14.33 mm. These types of buttons were primarily found at the pelvis (Burials 10, 20A, and 34), where they likely represent pants or skirt closures, or the torso (Burials 8, 38A, 55A, and 59D) and wrists (Burials 23, 36D, and 53C), where they likely represent shirts or shifts.

Five-hole buttons (n=129) were recovered from 31 burials, both males and females (Table 3-4; Figure 3-3). This makes the five-hole button the most common bone button type associated with the Eastern State Hospital interments. Slightly more than eighty-five percent (n=109) of these types of buttons were found with males (n=22; Burials 15A, 15C, 18C, 19D, 20A, 23, 24B, 25, 26B, 27, 28, 30, 31B, 32, 33, 42, 44B, 46A, 53B, 48, 60E, and 64A). Of the

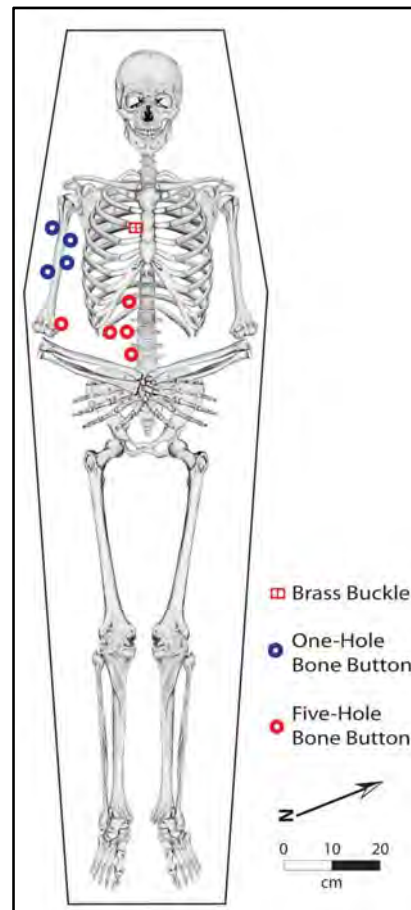


Figure 3-4. Burial 44B: Distribution of buttons and brass buckle.

remaining 19 buttons, 16 were associated with females (n=7; Burials 10, 18b, 29B, 43B, 50B, 53C, and 55B), and three were associated with individuals (n=2; Burials 46B and 59I) whose sex could not be determined.

Bone five-hole buttons range in diameter from 9.8 to 21.87 mm. Given this large diameter range, five-hole bone buttons were assigned to one of three groups: small (<12.6 mm in diameter), medium (12.6 to 18.5 mm in diameter), and large (>18.5 mm in diameter). Small five-hole bone buttons range in diameter from 9.8 to 12.5 mm, with a mean of 11.14 mm. Medium five-hole buttons range in diameter from 14.2 to 18.33 mm, with a mean of 17.24 mm. Large five-hole bone buttons range in diameter from 18 to 21.87 mm, with a mean of 20.3 mm. In the Eastern State assemblage, five-hole bone buttons were mainly found in the vicinity of the pelvis (Burials 10, 15A, 15C, 18C, 20A, 24B, 25, 26B, 27, 29B, 30, 31B, 32, 33, 42, 46A, 46B, 48, 53B, 55B, 60E, and 64A). With the exception of Burials 29B, 46B, and 55B, all are males. The location of these buttons suggests that they probably represent pants fly closures, both straight fly and drop down styles, though those found near the waist could be from suspenders. On the other hand, five-hole bone buttons associated with the shoulder of Burial 19D, neck of Burial 43B, back of the spine of Burials 27 and 53C, and torso of Burials 23, 31B, and 43B (all males, except for Burial 43B), likely were associated with shirts or shifts.

Metal

Brass metal buttons (n=34) were recovered from three burials (23, 52B, and 55A) (Table 3-4; Figure 3-3). They are represented by iron dome (n=24), coin (n=3), and stamped sheet brass (n=7) buttons. All would have likely been covered in fabric. Brass buttons, which were commonly produced in Europe by the eighteenth century, were widely exported. Though brass buttons were manufactured in the American Colonies as early as 1750, this industry did not really take off until the early 1800s when several factories, especially in Philadelphia, New York, and Waterbury, Connecticut, began producing them in large quantities (Hughes and Lester 1981:216; Jones 1924).

Dome buttons, also referred to as “ball buttons,” featured spherical fronts with flattened backs. These types of buttons range in diameter from 18.95 to 21.88 mm, with a mean of 19.95 mm. The larger buttons were likely used on men’s coats. Within the Eastern State Hospital Cemetery, 13 dome buttons were associated with Burial 23, a male. They were located on the left and right chest areas, and the right abdominal area. These buttons were most likely part of a jacket, which might have been double-breasted. Many had fabric remnants adhering to them, but the fragments were so deteriorated that the type of material could not be determined.

Three dome buttons were found in the torso area of Burial 52B (female) and eight were found in the torso area of Burial 55A (male). The buttons from Burial 55A had plainweave fabric remnants attached to them. The location of these buttons suggests that they may have been associated with a coat. The association of a four-hole bone button near the left shoulder of Burial 55A is suggestive of a shirt pocket.

Coin buttons are characterized by flat, round, stamped surfaces that bear a strong resemblance to eighteenth and nineteenth century coins. The three coin buttons recovered from the Eastern State Hospital Cemetery are of the two-piece style, which dates to ca. 1830 (Adams-Graf 2000:194). These buttons have a diameter of 18.8 mm and were found in the torso area of Burial 23 (male), in association with the dome buttons. The coin buttons, which were covered in a plainweave fabric of unknown material type, could represent elaboration of the jacket worn by this individual, or a vest, as these types of buttons were commonly used in the manufacture of these types of garments (Miller 2007). Outfits of matching vests and coats also could be purchased (Severa 1995:169).

The two-piece stamped sheet brass buttons feature a recessed center and drilled holes for attachment purposes. They are commonly thought of as trouser buttons but were also used on other garments (Lindbergh 1999; Jones 1924). While these buttons were made in Europe by the 1820s (Jones 1924), they likely did not achieve widespread use in the United States until the mid-1840s (Davidson 2006:177). The six two-piece metal buttons recovered from the pelvis area of Burial 16A (an individual of indeterminate sex), and the one from the pelvis area of Burial 51B (male), range in diameter from 12.42 to 16.14 mm, with a mean of 13.38 mm. They likely represent closure of a pants fly. The buttons from Burial 16A had been covered in a plainweave fabric, likely of wool.

Porcelain (Prosser)

The 59 porcelain (Prosser) buttons were recovered from 28 burials (Table 3-4; Figure 3-3). Slightly more than seventy-five percent (n=45) of these types of buttons were found with males (n=17; Burials 6, 18C, 18E, 24B, 31B, 36A, 38A, 53B, 55D, 59F, 63B, 63D, 63F, 66E, 66G, 67D, and 67E). Of the remaining Prosser buttons, 12 were found with females (n=9; Burials 3, 4, 11, 18B, 19C, 29D, 36D, 47A, 63E), and two were found with individuals whose sex could not be determined (Burials 16A and 34).

Although initially rare, porcelain buttons were being manufactured by the early 1700s (Rotman et al. 2000:75). They did not, however, gain prominence until the 1840s when Richard Prosser patented the Prosser process on June 17, 1840 in London, England. His brother, Thomas Prosser, patented this same process in the United States the following year (Sprague 2002). After this time they were mass produced and became one of the most common button types until they were replaced by plastic buttons in the 1950s (Sprague 2002:115).

Most of the Prosser buttons (n=53) measured about 10.00 mm in diameter. All were plain, with the exceptions of two specimens with “hob-nail” raised dots edge decoration associated with Burial 63B (male) and one with a “pie-crust” or crimped edge decoration associated with Burial 38A (male). Six plain buttons of a smaller size, roughly 7.50 to 7.75 mm in diameter, were recovered in association with Burial 63F (male). No printed or “calico” Prosser buttons are present in the button assemblage.

The Prosser buttons likely represent shirts or shifts, and most were found in the vicinity of the neck (Burials 6, 11, 18C, 18E, 34, 36A, 36D, 47A, 67D, and 67E), torso

(Burials 3, 18B, 24B, 29D, 31B, 53B, 59F, 63B, 63D, 63E, 63F, and 66E), wrist (Burials 18E, 36A, 38A, 53B, 66G and 67D), or elbow (Burial 19C) areas. A Prosser button associated with the left leg of Burial 55D (male) could represent a button sewn into the bottom of a pants leg. Alternatively, it may not have been found in its original location, having been moved as a result of post-burial taphonomic processes. The six smaller three-hole buttons that were found along the spine of Burial 63F (male) may represent some form of undergarment, or the use of smaller buttons on a shirt or shift.

Hooks and Eyes

Eastern State Hospital burials contained 108 identifiable hooks and 81 identifiable eyes (Figures 3.5 and 3.6). They were associated with 20 burials, both males (n=6; Burials 13, 21, 23, 58, 63D, 63F) and females (n=13; Burials 18B, 19A, 20B, 24A, 29B, 29D, 31A, 36F, 38D, 45, 50B, 53A, 63C, 63E). Hooks and eyes were made from copper or brass alloy (Figure 3-5). The use of hooks and eyes to fasten edge-to-edge garments dates at least to the fourteenth century in Europe, but they were especially popular whenever closer fitting garments were fashionable. They became common on corsets and other undergarments, especially after 1830 (Lossing 1878; Souder 1922). Hooks and eyes became cheaper and easier to access in the United States after 1840, when, due to innovations in manufacturing, their price dropped from a dollar and a half a gross (a dozen dozens or 124) to fifteen to twenty cents a gross (Lossing 1878:266). Thus they should be much more common in contexts dating after 1840, though this has yet to be documented at later cemeteries. Besides their use in undergarments, hooks and eyes were utilized on both men's and women's outer clothes, sometimes in conjunction with a decorative button at the waistband of skirts or pants, or on blouses or dresses with neck closures, or even on garments as heavy as capes or men's coats (Severa 1995; White 2005:74-76).

Hooks and eyes were usually used in pairs, and this appears to have been how they were used at Eastern State Hospital, with as many as eight pairs being found with Burials 13, 18B, 24A, 29B, 50, 63D and 63E (Figure 3-6). Hooks and eyes from the Eastern State Hospital burials were most commonly located in the vicinity of the spine (torso [Burials 13, 18B, 20B, 21, 23, 24A, 29B, 29D, 31A, 36F, 38D, 45, 50B, 63C, and 63E] and near the neck [Burials 13, 18B, 29B, 36F, 63F]) and likely were associated with undergarments (such as corsets for women), shifts, or shirts. The less common locations were the wrist (Burial 24A) and pelvis (Burial 63D) areas. Hooks and eyes found in these areas could indicate sleeve closures, or waist band closures for skirts or pants. They sometimes had fabric remnants adhering to them, but typically were not in a sufficient state of preservation for detailed identification. The more identifiable fabric fragments include a plainweave fine gauge cotton fabric from Burial 20B, and a plainweave, possibly wool fabric, from Burial 53A.

Straight Pins

Twenty-four straight pins were recovered from 16 burials (Figure 3-5). They were primarily associated with females (n=11; Burials 15D, 18B, 20B, 22, 24A, 29D,

36F, 39D, 45, 53C, 54), but some were associated with males (n=3; Burials 13, 15C, 63D). The sex of Burials 35 and 59I could not be determined. All of the recovered pins are of the one-piece machine produced style (Figure 3-4). Invented in 1832, the one-piece pin replaced the two-piece swirl headed-type pin, which consisted of a shaft and a separately attached head (Lubar 1987). Straight pins were commonly used to secure burial shrouds on deceased individuals, but could also be used to secure or position clothing or secure coffin linings. Since no coffin lining tacks were recovered from the cemetery, it is more likely that these pins represent clothing or shroud closures.



Figure 3-5. Straight pin (left), and hook and eye fragments (center and right).



Figure 3-6. Hooks and Eyes associated with Burial 13.

Only four of the 16 burials (Burials 22, 45, 54, and 59I) with straight pins did not also produce evidence of clothing via buttons or hooks and eyes. In the Eastern State Hospital sample, pins were most commonly found in the vicinity of the pelvis (Burials 18B, 45, 53C, and 63D) or torso (Burials 13, 20B, 22, 24A, 39D, 54, and 59I), and less commonly near the skull (Burials 35 and 36F). Although one could argue that straight pins at the skull present the best suggestion of use of a shroud within the Eastern State Hospital burial population, the presence of porcelain Prosser buttons with Burial 35, and hooks and eyes with Burial 36F suggests that these individuals also were wearing clothes when they were buried. Other possibilities for straight pins being present at the skull of these individuals would be to fasten a scarf or hat, or a hair decoration.

Metal (Brass) Buckles

Six brass buckles were recovered from five burials at the Eastern State Hospital cemetery (Burials 10, 42 [n=2], 44B, 55A, and 59D) (Figure 3-7). They range from 26 to 54 cm in width. Brass buckles are known to have been used since the eighteenth century.



Figure 3-7. Buckles: left, conventional style; center and right, cinch style.

The buckles from Burials 55A (male) and 59D (female) are of the small cinch variety with several small prongs (Figure 3-7, center and right). These buckles were commonly used to draw in the sides of a vest, or in stocking or sock garters. The buckles from Burials 55A and 59D were located in the torso or upper pelvis area, more typical for a vest or suspenders than for stockings.

The buckles found with Burials 10 (female) and 44B (male) as well as one of the buckles with Burial 42 (male) are of the standard convention buckle style, having an outer frame with a center prong (Figure 3-7, left). These types of buckles were commonly associated with belts, and suggest the presence of pants or skirts. The buckle

associated with Burial 10 was located above the right pelvis, suggesting a belt. The buckle with Burial 44B was located between the scapulae and vertebrae, and partially underneath the latter. It may have been associated with pant suspenders.

One of the buckles from Burial 42 was located above the right pelvis, a prime location for a belt buckle. The other was located on the left rib cage around mid-torso, still close enough to the waist to possibly suggest association with a vest or suspenders. Wool and a purple silk fabric, possibly from a coat lining, adhered to these buckles, suggesting a fairly complex outfit for Burial 42.

Personal Objects

The few personal objects recovered from the Eastern State Hospital Cemetery are described in this section. They consist of beads suggestive of a piece of jewelry, two hair combs, and a large one cent coin. Poor preservation conditions may have contributed to the dearth of personal artifacts. Support for this suggestion comes from a possible ring that was documented in the field with Burial 18A (female), but disintegrated upon removal. Alternatively, the low frequency of personal items may reflect the institutional nature of these interments. Individuals at the hospital may not have brought with them, or been allowed to have, a large number of personal items. In addition, those burying the dead likely would not have been aware of “favorite” items to consider for interment, in the way a family member might have. It is also possible that early to mid-nineteenth century mortuary customs did not involve the placement of large amounts of personal objects with the deceased.

Beads

Fifty-four drawn glass beads were recovered from Burial 50B (female). Glass beads are the most commonly recovered type of bead in North American historic period archaeological contexts. Drawn beads are created by drawing molten glass into a tube that is cooled and broken into smaller lengths (White 2005:81). The versatility of beads as decorative elements makes it difficult to identify the exact object the bead was once attached to (White 2005:83). The beads with Burial 50B were located around her neck, and intermingled with the chest cavity, suggesting a necklace. All bead types appear to have been interspersed amongst each other (Figure 3-8).

The beads were classified within the typology developed by Karlis Karlins (1985), in which they fall into five types. The first type is Class IIa, non-tubular drawn bead with monochrome bodies. The 11 beads of this type are a dull yellow (Mustard Gold, 2.5YR4/6). These beads are somewhat crudely made, with asymmetrical cutting patterns and warping appearing in six of the 11 specimens (average 5.84 by 4.94 mm).

The second type is Class IIIf, tubular drawn beads with multi-layered bodies and surfaces that exhibit grinding. This type of bead is medium in size, translucent in diaphaneity, and faceted. The 39 blue (5PB5/7, Copen Blue/Cornflower Blue) glass beads assigned to this type average 5.64 by 5.15 mm in size.

Type three, Class III F, is represented by one small, white (N9/0), translucent, faceted bead, 4.62 by 5.69 mm. The fourth type, Class I f, drawn, tubular, single-layered example with edges that have been ground, is represented by one large, white (N9/0), transparent bead (6.84 by 5.72 mm), and one large, cinnamon (10YR5/6) color, translucent, faceted bead (7.05 by 6.89 mm). The fifth type is Class II a, represented by one large blue (5PB5/7 Copen Blue/Cornflower Blue) translucent bead (7.5 by 4.19 mm).

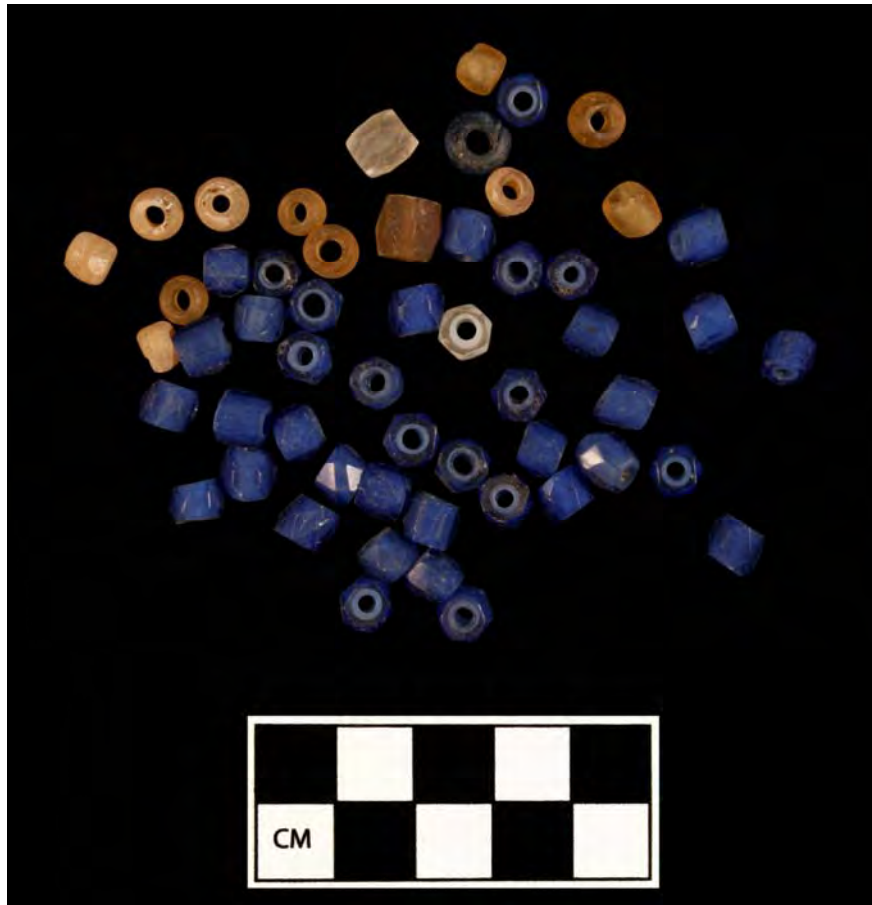


Figure 3-8. Glass beads associated with Burial 50B.

Hair Combs

Two horn hair combs were recovered, one each from Burials 60B (female) and 63F (male) (Figure 3-9). Horn combs have been produced since the sixteenth century, but manufacturers incorporated dyes and metal decorations producing specimens similar to those recovered from Eastern State Hospital from ca. 1805 until the 1870s, after which celluloid combs gradually replaced them (Bachman 1998:80). Both combs are very fragile. The comb recovered from Burial 60B has a width of 114 mm and has 22 teeth (Figure 3-9 top). The right side of the comb has two rivets in the upper right corner of the comb's body, suggesting fastening to another part that has not survived. The hair

comb from Burial 63F has a width of 70 mm and has at least 48 teeth (Figure 3-9 bottom).

Coin

One coin (Figure 3-10) was recovered from the cemetery. It is associated with Burial 39C (male). The coin is a copper large one cent, called a Coronet Head Cent, which was manufactured between 1816 and 1857. The numbers “184x,” and mostly likely “1844” are faint but identifiable on the reverse side.



Figure 3-9. Hair combs: top associated with Burial 60B; bottom associated with Burial 63F.

Coins are most commonly found in burials near the eye sockets, having been used to keep the eye lids closed (Pollack et al. 2009). Coins found near the head could also relate to the practice of placing coins in the ears to keep out ghosts (Parler 1962; Rotman et al. 2000:81). The location of the coin to the right of Burial 39C's lumbar vertebrae and above the right pubis suggests it was in a pocket of the deceased's pants. Coins were sometimes seen as tokens of good luck, sometimes matching the date of the coin with the birth date of the individual, or buried with individuals to provide for needs in the afterlife. The latter was especially true among African-American populations (Matternes et al. 2012; Russell 1997). It is also possible that the coin was incidentally in the pocket of the pants worn by the deceased, and not deliberately placed there as part of a burial ritual. In any case, it provides useful chronological information about this burial, which occurred not before 1840, and most likely in 1844 or later.



Figure 3-10. Coronet One Cent coin associated with Burial 39C.

MISCELLENEOUS ARTIFACTS

A small quantity of non-mortuary artifacts was recovered, either from grave shaft fill or the general vicinity of a grave shaft as it was being delineated. These artifacts,

which represent a sample of the materials observed, with most not being collected, are likely not associated with any specific individual but were present when the grave shafts were originally back-filled. They do provide limited information on the chronology of the interments, as the artifacts from the grave shafts should predate the burial event.

These miscellaneous artifacts consist of coal (n=1), ceramics (n=5), container glass (n=2), and flat glass (n=11). These materials were found in association with Burials 4, 5, 7, 8, 9, 11, and in general collections in the vicinity of some grave shafts, especially in the area of the northern conduit. The one fragment of coal found near a grave shaft is not especially diagnostic. Two undecorated whiteware body sherds were recovered from Burial 4's grave shaft fill, one was recovered from Burial 11's grave shaft fill, and one was recovered from the general cemetery area. Whiteware was first produced in 1805 by Wedgwood but was not common on American sites until after 1820-1830 (Price 1979:31; des Fontaines 1990:4). One sherd of undecorated porcelain was found in the general cemetery area. It is not especially diagnostic in terms of chronology. One fragment of thin olive bottle glass was found in the general cemetery area, and one was found next to the left humerus of Burial 8. No mold seams or diagnostic traits were visible on the bottle glass fragments, but this glass color was very common in the early to mid-nineteenth century.

A small amount of flat window glass was recovered from grave shaft fill associated with Burials 4 (n=1), 5 (n=1), 7 (n=5), 8 (n=1), 9 (n=2), and 11 (n=1). None of the window glass fragments appears to be derived from a coffin viewing glass window, which was typically much thicker (Davidson 2006:163). Rather, these fragments were incorporated in the fill of the grave when the coffin was covered with dirt. The thickness of the glass ranges from 1.10 to 1.80 mm, with a mean thickness of 1.55 mm. This mean thickness suggests a ca. 1843 manufacture date for the window glass assemblage (Moir 1987). Due to the small sample size the date is somewhat tentative, but it fits well with the chronology of the other artifacts recovered from the cemetery.

DISCUSSION

The most precisely coffin-related dated item is the Fisk metallic burial case (Burial 39B). This casket is of the sarcophagus style, which was produced by the Fisk company from 1848 to about 1854 (Allen 2002). The most precisely dated personal item is the 1840s (possibly 1844) coin.

A mid-nineteenth century date for the Eastern State Hospital interments is suggested by the lack of mass-produced caskets, which would be represented by coffin handles or other more ornamental or decorative coffin hardware (Favret 2008; Mabelitini 2008; Miller 2005; Stottman and Pollack 2005). These were patented ca. 1859 (Davidson 2000:245-6), and with the "beautification of death" movement of the late nineteenth century soon gained in popularity (Bell 1990, 1994; Bybee 2009a; Mainfort and Davidson 2006). It should also be recognized that the cemetery's institutional setting

might also have favored the use of less expensive wooden coffins over mass produced caskets.

Other information comes from the nails and screws used to close the coffins. While these cannot be dated as precisely as the Fisk metal casket, they still offer excellent chronological information. Many of the nails from the Eastern State Hospital assemblage are too rusted for a precise identification, but those that can be viewed in more detail are all of the late machine-cut variety, which date from ca. 1833 to ca. 1890 (Nelson 1968). Thus, the coffins were likely built between this time range. A mid-nineteenth century interment date is also supported by the low frequency of screws, associated with only 32 coffins. Davidson (2006:145) suggests screws were much more common as coffin closures after 1850. The presence of one possible pointed tip (gimlet) screw from Burial 53B suggests this burial took place after 1836, the earliest date for pointed screws (Davidson 2006; White n.d.). The lack of thumbscrews also is suggestive of a mid-nineteenth century interment date. Thumbscrews were meant to provide a way to close a coffin without the need for other tools (such as a screw driver), but by the late nineteenth century they had become a decorative element (Garrow 1987; Mabelitini 2008; Matternes et al. 2012; Miller 2005). Davidson's (2006:134) research into patents and mortuary artifacts suggests thumbscrews were not widely available until ca. 1869. Garrow's (1987) comparative analysis of their presence in a number of cemeteries in Georgia supports this date for their introduction.

The range of variation in coffin hardware is so slight that it is difficult to make inferences about the nature of the interments, or social status of the deceased, from the associated artifacts. The general lack of variation may point to the institutional nature of these burials, in which most persons received the same treatment, possibly buried in coffins made at an on-site carpentry shop. There is no indication that most individuals were buried in anything but a plain wooden coffin, as no bail handles, screw caps, or other signs of more elaborate or ornamented caskets were recovered. Also absent from the Eastern State Hospital assemblage are hinges, suggesting most of these coffins did not have lids that were meant to open and close.

The main exception is the Fisk metallic burial case (Burial 39B). While wooden coffins likely could be purchased for a few dollars if not built on site, the Fisk case would have required a much more substantial outlay, likely from \$50 to \$100, suggesting the involvement of family or friends in purchasing this individual's coffin. The Fisk casket was patented in 1848. Perhaps Lexington residents were more likely to know about the metal caskets since Lexington's prominent resident Henry Clay had, in conjunction with Jefferson Davis and Daniel Webster, given it a public endorsement as "the best article known to us for transporting the dead to their final resting place" (Coachbuilt n.d.). Clay himself was buried in a sarcophagus style Fisk burial case in 1852 (Coleman 1951; Remini 1991). While the original A.D. Fisk company was based in Providence, Rhode Island, they had by 1852 expanded their production rights to the W.C. Davis Company of Cincinnati. Davis passed the rights to Crane and Barnes of Cincinnati in 1853 (Coachbuilt n.d.). The Cincinnati manufacturing location would have facilitated access for potential customers in Lexington.

The personal items, mostly originating from clothing, are in agreement with the coffin hardware in suggesting a mid-nineteenth century date for the burials. The horn combs likely date between 1805 and 1870, the two piece shank dome buttons after 1830, the brass sheet buttons after 1840, the Prosser buttons after 1840, and the straight pins after 1832. Ending dates are a bit harder to establish, but the lack of celluloid or hard rubber suggests the cemetery did not continue to be used into the third quarter of the nineteenth century, which is consistent with the 1860s transformation of the cemetery into a pleasure garden. The most precisely dated item is the large one cent coin which likely dates to 1844, certainly to the 1840s. The miscellaneous artifacts from the grave shaft fill or the general cemetery area are also most likely from the mid-nineteenth century. The fact that all the bottle glass is olive green, with no clear glass, supports a mid-nineteenth century date, as does the whiteware ceramic sherds, and the window glass manufacturing date of ca. 1843. It is certainly worth noting that the window glass date is only one year different from the likely date of the only coin.

The personal items are also similar to the coffin hardware in their fairly restricted range of variation. The vast majority of the personal items are from clothing. Clothing related items were associated with slightly more than fifty percent of the males and females (Table 3-5). But due to the generally poor preservation of the bone buttons and pins, caution should be used before suggesting that those individuals lacking clothing related items were interred only in shrouds that lacked pins.

Buttons are plentiful, but there is a lack of ornate or fancy buttons. In general, the clothes represented are shirts or shifts, dresses, pants, skirts, undergarments (including corsets), jackets, vests, belts, and possibly suspenders. The abundance of dome buttons associated with Burial 23 and the presence of coin buttons associated with this individual distinguishes this adult male from others interred within the cemetery. He was likely buried wearing a vest and possibly a double-breasted jacket. It seems likely he and other hospital residents may have owned and worn their own clothing. They are known to, at least on some occasions, have been allowed to wear such, as evidenced by the following commentary upon the 1870 death of Theodore Clay, son of politician and lawyer Henry Clay:

At the occasional balls given to the inmates (averaging some 500 in number), he [Theodore Clay] was always exquisitely dressed in the style of his day, and was the beau *par excellence*. (Cincinnati Enquirer 1870).

An unusual button distribution pattern is seen in the two burials (20A and 44B) with two to four large one-hole buttons along the right humerus. This pattern was not replicated among the other button types. The closest to this pattern is found in Burial 59D, where two four-hole bone buttons were located almost to the outer edge of the right rib cavity. Could these buttons represent some specialized medical restraint garment? It is hard to imagine such a garment being used for burial, but perhaps if a deceased person was thought to have died from a contagious disease, such as cholera, the corpse might not have been undressed and redressed for burial.

Table 3-5. Comparisons by gender.

Object Type	Females		Males		Indeterminate	
	Individuals	Freq	Individuals	Freq	Individuals	Freq
Hooks	13	78	6	30		
Eyes	14	58	5	23		
Bone button, one-hole			3	8		
Bone button, four-hole	5	10	7	8	1	5
Bone button, five-hole	7	16	22	110	2	3
Metal coin or stamped			2	4	1	6
Metal dome	1	3	2	21		
Prosser	9	12	17	45	2	2
Straight pins	11	13	3	6	2	5
	31 out of 52*		42 out of 78*		5 out of 10*	
	59.6 percent		53.8 percent		50.0 percent	
*Does not include disturbed, truncated, and commingled individuals.						

Interesting differences are apparent by gender (Table 3-5). Most striking is that hooks and eyes are associated with about twenty-five percent of the female burials, possibly indicating their association with dresses or shifts worn by women, and especially as part of undergarments, such as corsets. Many of these hooks and eyes were found in linear patterns down the spine which would be consistent with a corset. Another pattern is that the one-hole bone buttons and almost all of the metal buttons (with the exception of the three dome buttons from Burial 52B), are only found with males. Five-hole bone buttons also are predominantly associated with males. The metal coin and dome buttons may be more commonly found on men's jackets and vests, and the metal stamped and five-hole bone buttons on pants fly closures. Straight pins seem more common with females. The two hair combs were found: one with a male and one with a female. The only jewelry, a necklace and possibly a ring, were found with females.

Inter-cemetery comparisons of the use of buttons, and hooks and eyes, points to differences that could reflect site preservation conditions and access to resources (Table 3-6). Among the three cemeteries compared, bone buttons account for more than fifty percent of the Eastern State Hospital and the Old Frankfort assemblages, and are fairly common within the Horse Park assemblage. On the other hand, metal buttons account for slightly more than fifty percent of the Horse Park and more than thirty percent of the Old Frankfort button assemblages, but only 13.5 percent of the Eastern State Hospital assemblage. The higher representation of metal buttons at the Horse Park and Old Frankfort cemeteries may indicate a higher incidence of burials with pants and coats at these cemeteries.

Also of note is the total absence of shell buttons within the Eastern State Hospital assemblage. Shell buttons are commonly found on mid-nineteenth century domestic sites, and according to Rotman et al. (2000:76), by then their use rivaled that of bone buttons. The absence of shell buttons at Eastern State Hospital and their relatively low frequency of occurrence at the other two cemeteries may be tied to site preservation conditions.

Porcelain Prosser buttons are most common in the Eastern State Hospital assemblage, where they account for almost one-quarter of the buttons. In comparison, they account for less than five percent of the buttons at the Old Frankfort Cemetery. Unlike shell buttons, the more durable porcelain Prosser buttons would not be adversely affected by poor site preservation conditions. Since all of the burials at the Old Frankfort Cemetery post-date 1840, a greater preference for Prosser buttons at Eastern State Hospital could reflect temporal trends in button use, as the other two cemeteries contain interments that pre-date 1840. Or they could indicate a higher incidence of clothing that utilized these types of buttons. Possibly the Prosser buttons in the Eastern State assemblage functioned much like the shell buttons did in the other two assemblages, as underwear, shirt, and shift closures. Lindbergh (1999) suggests that shell and porcelain buttons are often found together in nineteenth century archaeological contexts, and have been observed together on historical clothing items. The higher incidences of Prosser buttons also could reflect the purchasing power of the Hospital, which allowed them to acquire these mass produced buttons or clothing that utilized Prosser buttons.

Table 3-6. Inter-Cemetery Clothing Closure Comparisons.

Closure Type	Eastern State Hospital		Old Frankfort		Horse Park	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Bone buttons						
One hole	8	3.2	117	25.0	5	8.6
Four-hole	23	9.1	27	5.8	4	6.9
Five-hole	129	51.0	115	24.6	6	10.3
Unidentified	1	.004	5		1	
Total*	160(161)*	63.2	259(264)	55.3	15(16)	25.9
Metal buttons	34	13.4	151	32.3	33	56.9
Prosser buttons	59	23.3	21	4.5	7	12.1
Shell buttons	0	0	37	7.9	3	5.2
Total buttons	253(254)		468(473)		58(59)	
Hook and eye	189		0		0	

*Total identifiable bone buttons. Figure in parenthesis includes unidentifiable buttons. Percentages were calculated using only the identified specimens.

Another important difference is the total absence of hooks and eyes at the Old Frankfort and Kentucky Horse Park cemeteries, and their prominence at the Eastern State Hospital Cemetery. While this again could be influenced by differences in preservation issues, metal buttons were well preserved within both the Old Frankfort and Horse Park cemeteries, as was metal ornamental jewelry at the Old Frankfort Cemetery, suggesting that the lack of hooks and eyes at the other two cemeteries is a real and significant difference compared to the Eastern State Hospital assemblage. One explanation might be a higher incidence of undergarments, especially corsets, within the Eastern State Hospital burial population. As with the Prosser buttons, perhaps the hospital staff were able to purchase clothing that utilized hook and eye closures.

Non-clothing related items were rare within all three assemblages. Within the Eastern State Hospital Cemetery, jewelry was limited to a bead necklace and possibly a

ring. This compares to one burial out of 34 with jewelry (a ring) at the Horse Park Cemetery and 17 (two necklaces and 15 rings) out of 254 burials at the Old Frankfort Cemetery (Pollack et al. 2009, 2011). The only hairdressings associated with the Eastern State Hospital burials were two horn hair combs. The comb from Burial 60B is similar to a comb found at the Horse Park Cemetery. No hair combs were found at the Old Frankfort Cemetery.

The only other item found with the Eastern State Hospital burials was the 1840s coin found in the pelvic area of Burial 39C; this compares to an absence of coins at the Horse Park Cemetery and the association of coins with five burials (all used to cover the eyes) at the Old Frankfort Cemetery. The other non-clothing items found with burials at the Old Frankfort Cemetery were a bullet and eyeglasses (Pollack et al. 2009). No similar items were found at Horse Park or Eastern State cemeteries (Pollack et al. 2011).

SUMMARY

Analysis of the coffin hardware, clothing-related, and personal objects recovered from the Eastern State Hospital Cemetery has pointed to commonalities with other cemeteries, but also identified some patterns that are unique to this cemetery. As with contemporary cemeteries, most individuals were interred in plain hexagonal wooden coffins, manufactured primarily with late machine-cut nails (most of pennyweights 6 to 9d), sometimes supplemented with screws. Clothing related items are primarily buttons, with a small number of buckles being present. The large number of hook and eye closures, associated primarily with females, serves to distinguish Eastern State Hospital from other cemeteries. Their presence along with a relatively large number of Prosser buttons may reflect the hospital's purchasing power, either to buy large numbers of closures to manufacture clothing on site or to purchase mass produced clothing. Personal objects recovered from the cemetery, consisting of two hair combs, a necklace, a ring and a coin, are consistent with those found at contemporary cemeteries.

CHAPTER FOUR: POPULATION CHARACTERISTICS

By

Heather Worne, Emily Rinker, and Stuart Nealis

INTRODUCTION

This chapter presents the analysis of the human skeletal materials recovered in 2005 and 2011 from the Eastern State Hospital Cemetery. Of the 186 documented individuals, 11 were investigated in 2005 and 175 in 2011. They were associated with single interments and mass graves. The human remains from the 2005 investigation were reinterred in 2006, and those from 2011 in 2013. In this chapter, the results of taphonomic, demographic, stature, and pathological analyses are presented for the entire burial sample. For some analysis, however, the 2005 sample and the commingled remains were excluded. This was due to missing data, or the data not being comparable.

Following excavation, all human remains were cleaned and processed at the William S. Webb Museum of Anthropology at the University of Kentucky. All materials were boxed and bagged by burial number. Skeletal analyses were conducted by Stuart Nealis, Emily Rinker, and Heather Worne. Methods outlined in the Standards for Data Collection for Human Skeletal Remains (Buikstra and Ubelaker 1994; hereafter referred to as *Standards*) were used to ensure that data collected would be comparable to data sets used by other researchers.

TAPHONOMY

A majority of skeletal remains recovered from Eastern State Hospital were in a fair to poor state of preservation. In general, cranial and postcranial remains were predominantly fragmented and showed various stages of flaking, peeling, and weathering. Smaller, more fragile bones (such as those in the hands and feet, the vertebrae, and ribs) were often damaged, incomplete, or missing. This is in large part attributed to the acidic nature of the clay soils in which the burials were interred; low soil pH has been demonstrated to significantly affect bone preservation in archaeological contexts (Gordon and Buikstra 1981). This can lead to preservation bias within a skeletal sample.

Each individual was evaluated for preservation at seven distinct locations throughout the skeleton (vault, face, C7/T1, L5, pubis, ala, tibia, ulna, hands, and feet). Because the burials were in poor condition overall, the integrity of any given individual could vary considerably from initial excavation to removal to analysis in the laboratory. As such, all burial preservation scores were recorded from excavation photographs taken prior to the skeletal materials being removed from the ground to ensure our interpretation was based on in situ preservation and not negatively affected by handling and transport.

Preservation bias must be accounted for to avoid the pitfall of making observations on a limited sample and extrapolating these results to a population level interpretation (Wood et al. 1992). The preservation coding scale created by Matternes et al. (2012) for Avondale, a nineteenth century African-American cemetery in Georgia, was employed to characterize the Eastern State Hospital burial sample (Table 4-1). This method allows for recording of poor preservation at a greater resolution than that outlined by Behrensmeyer (1978).

Table 4-1. Skeletal preservation codes (Matternes et al. 2012:183).

Score	Condition	Characteristics
1	Pristine	-Bone is in perfect condition -Periosteum is undamaged -100 percent recoverable
2	Near Pristine	-No more than 1 cortical break is present -Periosteal flaking may be present -No earth pressure warping -About 100 percent recovered
3	Settled	-Cortex is firm but broken into 2-4 pieces -Very slight surface erosion present -Some earth pressure warping may be present -Very slight loss of trabeculae -90-100 percent recovered
4	Eroded	-Cortex is cracked or broken in several places -Surface erosion or pitting present -Less than 50 percent of trabeculae is missing -10-25 percent of bone is not recoverable
5	Decomposed	-Cortex is shattered into square or rectangular pieces -Marked surface erosion and pitting present -More than 50 percent of trabeculae is missing -25-50 percent of bone is not recoverable
6	Severely Decomposed	-Cortex is shattered and incomplete -Severe longitudinal pitting is present -Trabeculae is missing -50-90 percent of bone is not recoverable
7	Disintegrated (Ghost)	-Only a light scatter of small decomposed fragments is present -Skeletal outline faintly visible. Individual bones may not be distinguishable -Over 90 percent of bone is not recoverable
8	Stain/Not Present	-Bones have completely disintegrated -No evidence of human or animal removal of these bones -Organic stain present
0	Disturbed	-Archaeological evidence indicates that the bones have been removed by human or animal activities

Within the Eastern State Hospital Cemetery, skeletal preservation ranged from nearly pristine (Code 2) to the stain not being present (Code 8) (Table 4-2). About one-third were coded as decomposed (Code 5), with most of the remaining burials having codes of 3, 4 or 6. Relative to the Avondale Cemetery, the remains were in a better state of preservation. At Eastern State Hospital, 86.4 percent of the remains had codes ranging from 3.0 to 6.9 compared to only 37.0 percent of the Avondale sample. At the latter slightly more than half had codes of 7 or 8.

Table 4-2. Eastern State Hospital skeletal preservation.

Preservation	Females		Males		Indeterminate		Total	
	Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
2 (2.5-2.9)	3	5.7	3	3.7		0.0	6	3.9
3 (3.0-3.9)	5	9.4	17	20.7	2	10.5	24	15.6
4 (4.0-4.9)	11	20.8	23	28.0		0.0	34	22.1
5 (5.0-5.9)	17	32.1	25	30.5	5	26.3	47	30.5
6 (6.0-6.9)	14	26.4	10	12.2	4	21.1	28	18.2
7 (7.0-7.9)	3	5.7	4	4.9	4	21.1	11	7.1
8 (8.0)		0.0		0.0	4	21.1	4	2.6
Total	53	100.0	82	100.0	19	100.0	154	100.0

Within the Eastern State Hospital Cemetery samples, male skeletal remains were, to some degree, better preserved than female skeletal remains, with 52.4 percent of the former having codes of 2, 3 or 4, compared to only 35.9 percent of females. This is not surprising, as previous research has demonstrated sex-related differences in skeletal preservation (Walker 1995). For instance, Walker (1995) found a somewhat similar pattern in the Saint Bride historic cemetery skeletal sample from London, where significantly fewer pubic bones well-preserved enough for sex-estimation were identified for females over the age of 44 years than for males of the same age. These results suggest that the bones of older females are especially prone to preservation issues and, as a group, are likely under-enumerated in the bioarchaeological record.

DEMOGRAPHIC PROFILE

Accurate demographic profiles for a skeletal sample are essential for understanding age and gender-based differences in activity, injuries, disease, diet, and death. While preservation of skeletal elements varied greatly both between and within burials, an attempt was made to obtain accurate age and sex estimations for 180 individuals (Burials 12B, 36C, 36E, 52D [remains identified in the field did not survive transporting to laboratory]), and 68D did not contain any skeletal remains and Burial 39B was a sealed coffin that was not opened and therefore not analyzed). Each individual was also assessed for taphonomic changes, dental health (see Chapter Five), pathological conditions, nonmetric variation, stature, and traumatic injuries following basic bioarchaeological methods (e.g., Buikstra and Ubelaker 1994; Larsen 1997; Ubelaker 1989).

The biological sex of each individual was estimated using nonmetric morphological attributes of the skull and pelvis (Acsádi and Nemeskéri 1970; Buikstra and Ubelaker 1994; Phenice 1969; Rogers 2005). Although male skulls tend to be more robust overall, variation exists between populations and can change over an individual's lifetime (Meindl et al. 1985; Walker 2008). Specific features of the skull assessed, include the prominence of the brow ridges and the sharpness of the supraorbital margins on the frontal bone; the contour and robusticity of the nuchal crest on the occipital bone; the length and width of the mastoid processes on the temporal bone; and the projection of the mental eminence of the mandible. Morphological sexual dimorphism of the pelvic

bones tends to be more reliable than any other skeletal element because the female pelvis must be able to accommodate the head of an infant during childbirth. Pelvic features examined were the presence or absence of a ventral arch ridge on the ventral aspect of the pubic bone; presence or absence of a ridge on the medial aspect of the ischiopubic ramus just interior to the pubic symphysis; the expression of a preauricular sulcus on the ilium, the size and shape of the greater sciatic notch; and subpubic concavity (Phenice 1969; Buikstra and Ubelaker 1994). For an experienced osteologist, morphological analysis of the pelvis can reach 95 percent accuracy (Bruzek 2002; Phenice 1969; Ubelaker and Volk 2002). Individuals were identified as Male, Probable Male, Female, Probable Female, or Indeterminate following Buikstra and Ubelaker (1994).

Adult age-at-death for the Eastern State Hospital skeletal sample was assessed using standard bioarchaeological methods focusing on age-related morphological changes observed on the pubic symphysis (Brooks and Suchey 1990; Suchey et al. 1988; Suchey and Katz 1998; Todd 1920, 1921), auricular surface (Buckberry and Chamberlain 2002; Lovejoy et al. 1985; Meindl and Lovejoy 1989), and closure of cranial sutures (Meindl and Lovejoy 1985). Methods used to estimate juvenile age-at-death, include epiphyseal closure (Buikstra and Ubelaker 1994; Scheuer and Black 2000) and dental development and eruption (Moorrees et al. 1963; Ubelaker 1987, 1989).

Calibrated Expert Inference (CEI) also was employed by Svenje Weise, a visiting researcher from the Max Planck Institute for Demographic Research in Rostock, in order to attain more accurate adult age-at-death estimates, especially among older individuals in the sample. CEI utilizes first impressions of osteological age of an individual based on traditional criteria as well as new traits from the skull, teeth, thorax, pelvis, and long bones, based on the researcher's calibration to reference samples, coupled with statistical methods to produce a 95 percent confidence interval (Weise 2009).

Broad age categories are reported for all remains excavated in 2005 and 2011 (Table 4-3). In order to facilitate comparisons with other historic cemeteries, the age categories are based on Buikstra and Ubelaker (1994) and include Adolescent (12-19 years), Young Adult (20-34 years), Middle Adult (35-49 years), and Older Adult (50+ years). Specific age ranges were derived from CEI for all of the burials excavated in 2011, except for the commingled remains (26A, 39A, 63A, 66A, 67A, 68A) (Table 4-4).

Table 4-3. Demographic profile.

Age Category	Female	Probable Female	All Female		Indeterminate		Male	Probable Male	All Male		Total	Perc
	N=	N=	Total	Perc	Total	Perc	N=	N=	Total	Perc		
Juvenile	0	0	0	0.0	5	16.1	3	1	4	4.5	9	5.0
Young Adult	18	4	22	36.1	4	12.9	23	3	26	29.5	52	28.9
Middle Adult	9	2	11	18.0	0	0.0	17	0	17	19.3	28	15.6
Older Adult	17	0	17	27.9	0	0.0	25	5	30	34.1	47	26.1
Adult ^a	6	5	11	18.0	22	71.0	7	4	11	12.5	44	24.4
Total	50	11	61	100.0	31	100.0	75	13	88	100.0	180	100.0

^a Adult is defined as 20 years of age or older

Between 1839 and 1861, 1,633 individuals were admitted to Eastern State Hospital and 681 deaths, an average of 30 per year, were reported (White 1984: 201). For the current skeletal analyses, individuals estimated to be “probable male” and “probable female” are subsumed under the “male” and “female” categories, respectively. The Eastern State Hospital skeletal sample consists of nine juveniles and 171 adults. Among those individuals for whom sex could be estimated, 59.1 percent (n=88) were considered to be male and 40.9 percent (n=61) were estimated to be female. Given that the Eastern State Hospital skeletal sample does not represent a “typical community,” but a patient population, the differences observed between male and female frequencies are not surprising. Hospital records between 1824 and 1869 show that females comprised 36.7 percent of the hospital population, whereas males made up 63.3 percent (White 1984:203), which does not differ significantly from the demographic results from the skeletal sample (chi square $X^2=1.253$; $P=0.283$).

Table 4-4. Age-at-death estimated using CEI.

5-Year Age Ranges	Female	Probable Female	Indeterminate	Probable Male	Male	Total	Percent
10-14	0	0	2	0	0	2	1.4
15-19	0	0	3	1	3	7	4.9
20-24	7	0	2	1	8	18	12.7
25-29	9	1	1	1	8	20	14.1
30-34	2	2	0	1	7	12	8.5
35-39	4	1	0	0	1	6	4.2
40-44	2	1	2	0	5	10	7.0
45-49	4	0	0	0	10	14	9.9
50-54	4	0	0	2	7	13	9.2
55-59	5	0	0	1	7	13	9.2
60-64	3	0	0	0	4	7	4.9
65-69	2	0	0	0	2	4	2.8
70-74	0	0	0	0	2	2	1.4
75-79	0	0	0	0	1	1	0.7
Adult ^a	1	4	3	3	2	13	9.1
Total	43	9	13	10	67	142	100.0

^a Adult is defined as 20 years of age or older
^b Does **NOT** includes burials from the 2005 excavation **NOR** commingled burials from the 2011 excavation (26A, 39A, 63A, 66A, 67A, 68A)

STATURE

Stature estimation is useful in determining the developmental health of a population, as adult stature serves as a general proxy for nutritional fluctuations, morbidity, and physical labor demands during growth and development (Stegman 1991:261). However, it must be kept in mind that stature is also affected by standard of living, and social and economic factors serve to complicate any direct correlation between stature and biology (Atler 2004:277). Differences in adult stature are tied to “heredity, nutrition, illness, socioeconomic status, and psychological well-being” (Bogin 1999:239). This suggests that stature is a result of multivariate processes that must be accounted for in subsequent interpretations. Stature estimates are typically derived using

population and sex specific regression equations when this information is available (Trotter and Gleser 1952, 1958), but estimation of stature can still be made using more generalized equations for populations of unknown sex and ancestry.

Due to the poor preservation of the skeletal remains, stature could only be estimated for about one-third of the sample. Stature estimation was calculated from a standard regression formulae of long bone lengths for the unknown group estimation function using 95 percent prediction intervals in the computer program FORDISC 3.0 (Jantz and Ousley 2005). The nineteenth century formulae were chosen to account for secular trends, although the division at A.D. 1900 has been shown to be arbitrary rather than a true threshold (see Albanese et al. 2012). While using the unknown group function may result in a slightly larger prediction interval for each individual, it prevents the miscalculation of stature based on mischaracterization of skeletal remains (Feldesman and Fountain 1996). Moreover, classification of skeletal material into ancestry categories is rife with errors, bias, and loaded terminology associated with race, diminishing its utility for scientific research.

At Eastern State Hospital, stature estimates were derived for 56 individuals, with sex determined for all but two (Figure 4-1; Table 4-5). When compared to other mid-nineteenth century cemeteries in Kentucky and surrounding states, the skeletal sample from Eastern State Hospital appears to be of similar stature (Table 4-6). In fact, the average Eastern State Hospital male height of 170.2 cm is comparable to that 171.0 cm of soldiers in 1850 (Steckel 1995) (Table 4-5).

Table 4-5. Descriptive statistics for stature by sex.

Sex	Min	Max	Mean	Median	St. Dev.
Male	157.9	182.2	170.2	170.3	6.4
Female	144.9	176.9	161.5	160.5	8.4
Total	144.9	182.2	167.6	168.6	8.0

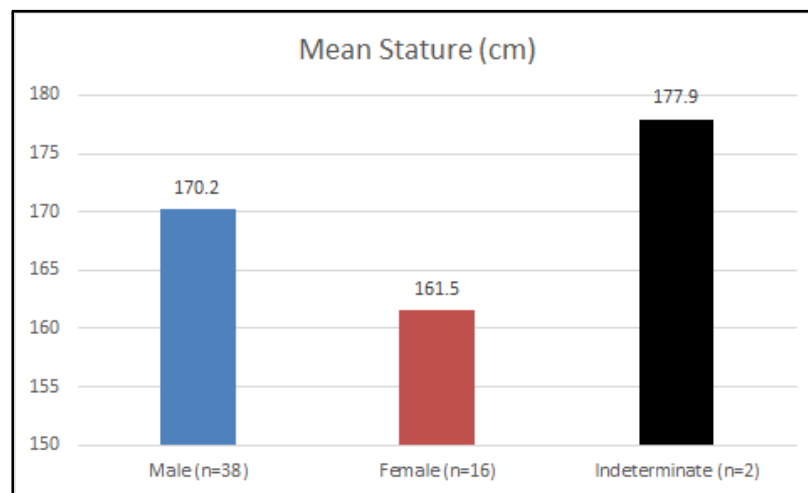


Figure 4-1. Average stature by sex.

Table 4-6. Comparative stature of other sites in surrounding area.

Site	Male Stature	S.D.	Female Stature	S.D.	Source
ESH (KY)	170.2 (n=38)	6.4	161.5 (n=16)	8.4	Current Study
Horse Park (KY)	169.6 (n=13)	7.4	163.7 (n=6)	7.1	Pollack et al. (2011)
Frankfort (KY)	174.0 (n=67)	6.6	165.3 (n=52)	6.6	Killoran and Favert (2009)
Avondale (GA)	169.0 (n=7)		159.0 (n=4)		Matternes et al. (2012)
Voegtly (PA)	170.0 (n=32)	5.1	160.2(n=14)	3.8	Ubelaker and Jones (2003)
Highland Park (NY)	172.6 (n=84)	5.5	160.0 (n=59)	6.0	Steegman (1991)
US Average (1850)	171.0	-	-	-	Steckel (1995)

PATHOLOGY

Although evidence of disease can be observed in the skeleton, not all pathology leaves evidence in the bone. Acute illnesses may cause death before bones are affected, and mental illness often affects the neurological system and soft tissues. What can be extrapolated is an overall assessment of skeletal health, which can help in constructing the life history of each individual. Paleopathological analyses of the Eastern State Hospital skeletal sample can provide insight into the activities and environmental factors that shaped the overall health of the patients. The varying degrees of skeletal health observed speak to diet, physical activity, and susceptibility of an individual to different pathologic conditions.

Methods

Due to variation in data collection techniques, the 11 individuals recovered from the cemetery in 2005 were not included in this analysis. A full paleopathological analysis was conducted for each of the remaining individual skeletons excavated in 2011. When identified, pathologies were described in detail according to *Standards* (Buikstra and Ubelaker 1994) and photographed. All data were entered in the freeware computer program Osteoware© available from the Smithsonian Institution (<https://osteoware.si.edu>).

Each bone was inventoried and analyzed to determine if any pathologies were present. Pathological conditions manifest in the bone in one or more of the following five basic expressions: 1) abnormal bone formation, 2) abnormal bone destruction, 3) abnormal bone density, 4) abnormal size, and 5) abnormal shape (Ortner 2003:45, 2011). The specific expressions of these indicators provide information about the causal disease or disorder. As many conditions result in overlapping indicators evident in the skeleton, carefully analyzing and documenting the expression, stage of healing, and distribution of lesions throughout the skeleton can help in establishing a differential diagnosis. Diseases or disorders observed in the Eastern State Hospital sample, include metabolic disorders, congenital conditions or anomalies, arthropathies, activity-related conditions, trauma, and infection (Appendix A-2).

Metabolic Disorders

Metabolic disorders (Table 4-7), often caused by a nutritional imbalance of some sort, interfere with the normal metabolism of bone (Ortner 2003). The skeletal manifestations of these conditions are caused by disruptions in the formation and remodeling of bone. Such diseases, include osteoporosis, cranial hyperostosis, porotic hyperostosis and cribra orbitalia as well as hyperostosis calvaria interna.

Table 4-7. Individual Cases of Metabolic Disorders.

Burial	Description
16A (<i>Adult; indeterminate sex</i>)	Thickening of cranial vault bones, particularly on frontal and parietal, as well as coarsening of the fibular trabeculae; possible case of Paget's disease.
27 (<i>Adult; male</i>)	Inactive cribra orbitalia present in left orbit.
29A (<i>male; 22-27</i>)	Inactive cribra orbitalia in left orbit.
33 (<i>male; 53-63</i>)	Diffuse bone loss and vertebral body compression possibly from osteoporosis
34 (<i>Juvenile; 14-16</i>)	Inactive cribra orbitalia in orbits
44A (<i>male; 43-55</i>)	Inactive cribra orbitalia in left orbit
51B (<i>male; 22-27</i>)	Inactive cribra orbitalia in the orbits
54 (<i>female; 43-50</i>)	Hyperostosis calvaria interna (frontal)
56B (<i>female; 53-68</i>)	Hyperostosis calvaria interna (temporals)
59J (<i>male; 23-33</i>)	Inactive porotic hyperostosis on occipital bone
60E (<i>male; 27-37</i>)	Hyperostosis calvaria interna (frontal)
64A (<i>male; 22-37</i>)	Inactive porotic hyperostosis on frontal bone and cribra orbitalia on left orbit
64B (<i>female; 37-53</i>)	Inactive cribra orbitalia on both orbits
66B (<i>male; 50-65</i>)	Inactive cribra orbitalia on left orbit
66D (<i>male; 50-65</i>)	Hyperostosis calvaria interna (right temporal)
67D (<i>male; 45-55</i>)	Hyperostosis calvaria interna (frontal)
68F (<i>female; 40-70</i>)	Inactive cribra orbitalia on left orbit

Although a number of causes are possible, osteoporosis is often associated with age-related bone loss (Brickley and Ives 2008). While difficult to identify in archaeological contexts without radiographic evidence, subsequent fractures in bone can aid in diagnosis. At least one individual, an older adult male (Burial 33), exhibited diffuse bone loss and vertebral body compression that could be the result of osteoporosis (Table 4-7). Cranial hyperostosis is evident in an adult of indeterminate sex (Burial 16A) (Table 4-7). Though the skeletal remains are poorly preserved; diploë expansion of this person's frontal and parietal bone fragments, which resulted in thicker vault bones, and trabecular coarsening in a fibula fragment are consistent with later stage Paget's disease. Although viral infection is hypothesized to be the cause, the etiology of this disease is not known (Ortner 2003:435).

Porotic hyperostosis and cribra orbitalia are characterized by porosity throughout the external table of the cranial vault and roof of the eye orbits, respectively (Ortner 2003). The porous lesions characteristic of these conditions are caused by an expansion of the diploë, or trabecular bone within the marrow cavities, causing porous destruction of the outer table of bone. These lesions are considered non-specific in nature. While iron-deficiency anemia during childhood (Stuart-Macadam 1985) is often put forth as the cause of these porous lesions, a critique of this hypothesis by Walker et al. (2009) argued that megaloblastic anemia induced by vitamin B₁₂ deficiency during infancy or childhood

provides a more probable etiology (c.f., McIlvaine 2013; Oxenham and Cavill 2010). In addition to anemia, cribra orbitalia also has been attributed to a vitamin C deficiency (Armelagos et al. 2014; Ortner 2003; Ortner and Erikson 1997; Walker et al. 2009). Infants and children are particularly susceptible to nutrient deficiencies, especially if resource availability is restricted. Nutrient deficits during infancy and early childhood are often caused by maternal stress during pregnancy or breastfeeding, delayed weaning during periods of scarce resources, or the introduction of nutrient-poor weaning foods (Piperata 2007; Sellen 2007; Walker et al. 2009). For instance, high starch and corn-based diets can exacerbate other biological stressors because the availability of nutrients, such as iron, vitamin B₁₂, and vitamin C, is poor (Steinbock 1976:244-248). Furthermore, enzymes in corn are known to inhibit the absorption of iron, and to a lesser extent, calcium, magnesium, and zinc (El-Najjar et al. 1976; Forbes et al. 1984; Lallo et al. 1977). Unsanitary conditions can further exacerbate nutritional stress by introducing parasitic infections, which can result in intestinal bleeding and diarrhea, further inhibiting nutrient absorption. Parasitic diseases can also further deplete the body of these vital nutrients (Balarajan et al. 2011; Pærregaard et al. 1990; Walker et al. 2009). A study of intra-population variation in anemia prevalence among living populations by Piperata et al. (2014) demonstrates the complex nature of anemia. The authors argue for a careful consideration of the many overlapping, and often interrelated, cultural and biological risk factors that could contribute to an individual's susceptibility to anemia (or other conditions).

If porotic hyperostosis is caused by vitamin B₁₂ deficiency, as Walker et al. (2009) argue, it is important to consider the long-term impact of this deficit on a child's developing central nervous system. In addition, Vitamin B₁₂ deficiency during infancy has been associated with cognitive impairments later in life (Graham et al. 1992). Symptoms in adults, which can manifest well before the deficiency shows up in blood tests, include agitated behavior, depression, paranoia, and violence (Berry et al. 2003; Hector and Burton 1988; Walker et al. 2009; Zucker et al. 1981).

While porotic hyperostosis and cribra orbitalia predominantly occur in infants and children under the age of five (Stuart-Macadam 1985), the remodeled lesions are often still visible in adults. Within the Eastern State Hospital sample, 10 individuals exhibited evidence of inactive porous lesions in the cranial vault and eye orbits (Table 4-7). Porotic hyperostosis of the cranial vault was recorded for two males (Burials 59J and 64A) and cribra orbitalia was present in the orbits of six males, two females, and one juvenile of indeterminate sex (Burials 27, 29A, 34, 44A, 51B, 64A, 64B, 66B, and 68F) (Table 4-7). One individual (Burial 64A; a young adult male) exhibited both porotic hyperostosis and cribra orbitalia. These results suggest that at least some individuals survived periods of stress early in life (before the age of five), likely due to nutritional deficiencies or parasitic infection. Dental analyses (see Chapter Five) suggest that the period of weaning (between two and four years of age) was a particularly stressful period for many of the individuals in the Eastern State Hospital sample, as is evident from the almost ubiquitous presence of enamel hypoplasias.

Five individuals (Burials 54 and 56B older adult females; Burial 60E a younger adult male; and Burials 66D and 67D older adult males) exhibited possible cases of hyperostosis calvaria interna, a genetic disorder characterized by the formation of bone on the internal surface of the cranial vault (Borra et al. 2013; May et al. 2011; Peruo 1964; Schmidt and Freyschmidt 1993; Waterval et al. 2009) (Table 4-7). This condition has been associated with diabetes and hormonal changes, especially those common during menopause in females. Individuals with hyperostosis calvaria interna often do not present clinical symptoms. Headaches, neurological deficits, blindness, and deafness have all been associated with the disorder, which may have led some individuals to seek treatment at Eastern State Hospital.

Congenital Disorders and Anomalies

One individual (Burial 60D, a young adult male) exhibited complete bilateral joint fusion of two of the wrist bones (triquetrals and lunates). Usually asymptomatic, this is often a bilateral congenital anomaly that does not affect the function of the wrist, but appears to have occurred during development (Lotter et al. 2010). Another individual (Burial 30, a young adult male) suffered from spina bifida in the second cervical vertebra of the neck where the posterior synchondrosis or spinous processes never fused. Spina bifida is a congenital condition resulting in the incomplete fusion of the posterior neural arch in any of the vertebra (Aufderheide and Rodríguez-Martín 1998). An individual may show no symptoms; however, this condition has occasionally been associated with cognitive deficits (Vinck et al. 2010).

Button osteomas are small, smooth, bony growths on the external surface of the cranium (Eshed et al. 2002). Despite their name, button osteomas are not tumors, but are thought to be caused by the over production of bone during cranial growth (Eshed et al. 2002:229). They are relatively common in the clinical and archaeological record, but do not appear to be age- or sex-dependent, and are generally asymptomatic, only occasionally affecting the individual if it obstructs their breathing, vision, or hearing (Bulloughs 1997). Button osteomas were observed in four individuals (Burials 23, 53B, 56B, and 60C), two males and two females, two middle adults and two older adults. The small size and location of these growths in the Eastern State Hospital sample would not have caused impairments to the affected individuals' breathing, hearing, or vision.

Traumatic Injuries

Evidence of traumatic injury to the skeleton may include partial to complete bone fractures, joint dislocations, indicators of nerve or blood supply disruption, abnormal change in bone shape, or ossification of muscle tissue (myostis ossificans) (Ortner 2003:119). The risk of traumatic injury is largely dependent upon both biological and cultural factors, such as occupation, age, gender, and health (Angel 1974; Jurmain and Bellifemine 1997; Lovejoy and Heiple 1981; Roberts and Manchester 1995:73-79). Careful attention to the degree of healing and other pathologies associated with the fracture (i.e., infection, necrotic bone, improperly healed fracture, joint fusion, or myositis ossificans) can indicate the timing and context of the injury. It is important,

however, to note that differentiating between intentional violence and accidental trauma is often not possible (Ortner 2003). Evidence of traumatic injury was documented for 16 individuals (Burials 19F, 24A, 25, 26B, 28, 29A, 29B, 32, 34, 38D, 53B, 56B, 59B, 62, 66C, and 67D) (Table 4-8). Many of the traumatic injuries observed have unknown etiologies, but could have resulted from labor or activity-related accidents.

Table 4-8. Individual Cases of Trauma.

Burial	Description
19F (<i>male; 40-50</i>)	Healed fracture right cuboid (ankle).
24A (<i>female; 28-53</i>)	Traumatic injury left and right hips, possibly due to bilateral hip dislocation.
25 (<i>male; 20-24</i>)	Healed depression fracture left ankle bone.
26B (<i>male; 23-27</i>)	Healed fracture left humeral midshaft resulting in slight angulation and myositis ossificans, likely caused by traumatic injury.
28 (<i>male; 25-33</i>)	Healed fracture of left 5 th foot bone.
29A (<i>male; 22-27</i>)	Possible dislocation of the right shoulder, with subsequent arthritis.
29B (<i>female; 33-43</i>)	Healed fracture of nasal bone.
32 (<i>male; 28-38</i>)	Healed fracture of right radius.
34 (<i>Juvenile; 14-16</i>)	Simple fracture on left acetabulum along border of lunate surface. Atrophied lower left limb bones and entire left arm bones. Also flattened, angular facet on left femoral head, possibly associated with polio.
38D (<i>female; 18-60</i>)	Possible fracture of right calcaneus and talus.
53B (<i>male; 47-63</i>)	Myositis ossificans of left shoulder caused by dislocation.
56B (<i>female; 53-68</i>)	Complete fracture of right ulna with fusion of distal radius or ulna.
59B (<i>male; 38-48</i>)	Healed comminuted fracture of right distal tibia (ankle).
62 (<i>female; 19-24</i>)	Misshapen left femoral head, fovea capitis. Fracture or dislocation left femur.
66C (<i>male; 25-33</i>)	Healed fracture of right distal fibula (ankle).
67D (<i>male; 45-55</i>)	Large traumatic myositis ossificans on right femoral diaphysis (lateral).

Five individuals show skeletal injuries that are consistent with dislocations or muscle trauma. For instance, Burial 29A (younger adult male) and 53B (older adult male) show skeletal changes to the right and left shoulder joints (respectively), arthritis, as well as traumatic myositis ossificans that are often associated with traumatic dislocations. Shoulder dislocations could result from a direct blow to the shoulder (such as during high impact sports activities), a fall on an outstretched hand, or seizures (Kelly 1954; Nordquist and Petersson 1995). There was one case of traumatic myositis ossificans to the lateral aspect of the femoral midshaft, which suggests that Burial 67D (older adult male) suffered from an injury, such as a contusion, to the large quadriceps muscle of the thigh.

Both the right and left hip joints of Burial 24A (middle adult female) and the left hip of Burial 62 (younger adult female) show skeletal changes that are consistent with possible subluxations (partial dislocation) or complete dislocations. A great deal of force is required to dislocate an otherwise healthy hip and the risk for these types of injuries increases with age, especially among women. However, hip dislocation in women can be caused by a fall from a height or even the process of giving birth (Galloway 1999; Salter and Harris 1963). Burial 34 (a juvenile) has possible pelvic fractures or hip dislocations; however, due to the probable effect of an underlying pathology, this individual's injury will be discussed under the section on infection.

One individual, Burial 29B (middle adult female), has a healed fracture to the distal nasal bones. While it is impossible to determine the exact etiology based on the skeletal remains alone, the most common cause of nasal fractures today is violence (Erdmann et al. 2008). The fragile bones of the nose could also easily fracture during a fall or other accidents. This individual also has Schmorl's nodes, which can occur due to axial loading during a fall or may result from heavy lifting.

Healed arm fractures were noted for three individuals. Burial 26B (younger adult male) has a fracture of the left humerus at approximately the midshaft resulting in slight angulation of the bone. Falls are among the most common cause of these types of fractures, either due to direct impact of the bone or perhaps due to holding on to something as one falls. However, activities during youth, such as extreme strain of the arm muscles (e.g., pitching), are also known to cause such injuries (Epps 1984; Ogawa and Yoshida 1998; Wedel and Galloway 2013). Burial 32 (younger adult male) has a rather classic Colles' fracture of the distal radius (wrist/forearm). Such fractures are usually caused by falling forward onto an outstretched hand (Wedel and Galloway 2013). This individual also has a well-healed upper left rib fracture towards the vertebral end of the bone, as well as multiple Schmorl's nodes. This type of rib fracture is often attributed to a fall or a direct blow to the chest (Wedel and Galloway 2013). Burial 56B (older adult female) has a midshaft fracture of the right ulna (forearm). Although there is some taphonomic damage to the bone, it appears as though the radius may also have fractured and fused to the ulna, or perhaps the ulna was not properly set. This fracture could have been caused by a fall (similar to the Colles' fracture of the radius) or, perhaps, a blow from a blunt object. Defensive wounds to the ulnar midshaft, called 'parry fractures,' occur as the arm is raised to shield the body from an attack (Anderson 1984; Wedel and Galloway 2013).

The remaining fractures are all associated with lower leg bones, ankle, and foot bones. Burials 59B (middle adult male) and 66C (younger adult male) both have healed fractures to the distal tibia and distal fibula, respectively. Both of these fractures are consistent with twisting the ankle, or twisting the leg while the foot is firmly planted on the ground (Wedel and Galloway 2013). The fractures in Burials 19F (middle adult female), 38D (adult female), 25 (young adult male) and 28 (also a young adult male) are located on the small bones within the foot called tarsals and metatarsals. These injuries are likely caused by falls from a considerable height, stress fractures from excessive walking or running, dropping heavy objects onto the foot, or forceful and excessive movement of the ankle or foot (Wedel and Galloway 2013).

The traumatic fractures and dislocations documented within this mortuary sample are relatively common, but all are consistent with injuries that individuals may have sustained during farm labor or work programs before or during their stay at Eastern State Hospital. The traumatic injuries observed are all mostly (if not completely) healed, suggesting that many of the wounds may have occurred prior to their arrival at Eastern State Hospital.

Activity-Related Conditions

Morphological modifications of bone due to habitual stress can indicate possible work-related activities. Such ‘markers of occupational stress,’ were associated with 30 individuals and consist of shape alterations and exaggerated muscle attachments sites. These activities affected a broad range of elements, including the clavicle, vertebrae, humeri, patellae, femora, tibiae, fibulae, tarsals, and metatarsals. Arthritic changes to bone also can reflect habitual activity; however, arthritis will be discussed separately below.

Markers of occupational stress, visible as morphological alterations or anatomical variation, were observed for 20 individuals (Burials 18C, 19B, 19G, 23, 24B, 25, 28, 29A, 29C, 30, 33, 37B, 37C, 41, 55B, 56B, 63A, 66G, 67A, and 67B). These distinctive shape alterations can indicate particular types of activities that may have been conducted throughout an individual’s lifetime. For example, a skeletal anomaly in the knee joint, referred to as Messeri’s patella, is identified by an impression on the margin of the patella (kneecap) associated with repetitive flexion of the knee (Capasso et al. 1998; Messeri 1961). This anomaly has been associated with frequent squatting, which would have been a common patient work activity at Eastern State Hospital. Such work likely included carpentry (i.e., building new editions to the hospital), gardening, and greenhouse work. Evidence for these types of activities was associated with a middle adult male and a young adult male (Burials 23 and 25, respectively). Both individuals displayed flexion facets on the distal tibiae, which are formed by repetitive squatting or similar dorsiflexion in the ankle (Victor 2010). Skeletal anomalies of the femoral neck and head associated with repeated hip flexion or extension (e.g., Allen’s fossa and Poirier’s facet) (Capasso et al. 1998; Finnegan and Faust 1974; Villotte and Knüsel 2009) were associated with three males and one female (Burials 19G, 24B, 29A, and 37B). These osseous changes in the bones likely reflect the occupational conditions of hospital residents prior to or, perhaps, during their stay at Eastern State Hospital (e.g., agricultural or manual labor).

The formation of pitting or spicules of bone (called enthesophytes) at muscle attachment sites often reflect activity patterns during life (Benjamin et al. 2006; Rogers et al. 1997; Weiss 2007). These conditions, often visible as exaggerated muscle attachments or ossified connective tissue, are usually caused by repeated activities, possibly related to an individual’s occupation. There were a number of occupational skeletal markers observed in the Eastern State Hospital skeletal sample. Pronounced enthesophyte formation is noted for 13 individuals (10 males and three females; Burials 19F, 20B, 26B, 28, 29C, 29D, 56B, 60D, 60E, 63F, 66D, 66F, and 67C). The presence of exaggerated muscle attachment sites suggests that these individuals engaged in strenuous activities throughout their lives. Such activity could have included agricultural work or manual labor within the hospital itself. For example, a middle adult female (Burial 20B) and a young adult male (Burial 60D) exhibited enthesophytes on the humerus and clavicles (or in the shoulder), suggesting they performed regular lifting or repetitive movement of the arm (Capasso et al. 1998:118,122). Others, such as an older adult female (Burial 56B) and a middle adult male (Burial 60E), displayed enthesophytes throughout the leg bones (including the tibiae and linea aspera of Burial 60E’s femora) that likely resulted from

repetitive bending or kneeling (Capasso et al. 1998:94). There were also several males (Burials 26B, 56B, 63F, 66D, and 67C) and one female (Burial 20B) with enthesophyte formation on the finger bones, which is sometimes associated with gripping objects and individuals who work regularly with their hands (Capasso et al. 1998; Ortner 2003).

ARTHROPATHIES

Arthritis (Degenerative Joint Disease)

Osteoarthritis, the most common joint disease today, is a non-inflammatory, chronic, and progressive condition caused by the loss of joint cartilage (Aufderheide and Rodríguez-Martín 1998:93; Rogers and Waldron 1995). Subsequent bone-on-bone contact results in lesions on the joint surfaces. Osteoarthritic changes may include lipping or bone formation around the margin of the joint surface, porosity and bone formation on the articular surface, eburnation, and eventually joint fusion. Such changes are usually age-progressive (80 percent of the time), and are often influenced by genetics, activity, body weight, or other pathological conditions (Aufderheide and Rodríguez-Martín 1998:93; Weiss and Jurmain 2007). Within the Eastern State Hospital skeletal sample, 73 individuals exhibited some evidence of osteoarthritis. The identified cases, however, represent only those remains with joint surfaces present. Thus, it is quite possible that, to varying degrees, all of the adults interred in the Eastern State Hospital Cemetery suffered from this joint disease.

Vertebral Pathology

In this analysis, osteophytosis, Schmorl's nodes, and diffuse idiopathic skeletal hyperostosis (DISH) were classified as vertebral pathologies. Arthritic changes to the spine are often characterized by the formation of osteophytes, or spicules of bone, around the vertebral bodies (or centra) caused by the degeneration of the intervertebral disk and subsequent irritation from bone-on-bone contact. The spicules on the adjacent centra can eventually grow together causing fusion between vertebrae, which is called ankylosis (Aufderheide and Rodríguez-Martín 1998:96). Overall, it is generally understood that almost all older adult spines show evidence of osteoarthritis at death (Ortner 2003; Resnick 2002). Within the Eastern State Hospital sample, 22 individuals exhibited evidence of osteophyte formation (Burials 15C, 18C, 20B, 23, 28, 29A, 29C, 29D, 30, 31B, 32, 33, 34, 37F, 43A, 46B, 48, 60D, 63D, 64A, 67A, 67A3, and 67C). Of these individuals, two also exhibited vertebral fusion (31B and 18C). Burial 31B was a young adult male who exhibited fusion of the cervical vertebrae.

Burial 18C exhibited fusion of multiple vertebrae consistent with diffuse idiopathic skeletal hyperostosis (DISH). While not considered a true arthropathy, DISH is evident by the ossification of the anterior longitudinal spinal ligament causing the fusion (or ankylosis) of multiple vertebrae (Aufderheide and Rodríguez-Martín 1998; Ortner 2003; Waldron 2009). This condition is also often associated with excessive bone production at other joint margins, including this individual's right elbow and hip. This

older adult male also exhibited severe osteophyte formation on thoracic vertebrae 6-11, and ankylosis between T6 and T7, T9 and T10, as well as a possible eye infection. The etiology is unknown, however, DISH occurs most often in older males and is associated in modern populations with obesity, Type II diabetes, and other metabolic disorders (Waldron 2009).

Herniation of the intervertebral disks results in protrusion of the disk into the centra surfaces, leaving characteristic depressions called Schmorl's nodes (Weiss 2005). This herniation (sometimes called 'slipped disk') may result from repeated activity (e.g., heavy lifting or farming) or traumatic injury (e.g., axial loading from a fall). Within the Eastern State Hospital skeletal sample, 21 (14.8 percent) individuals (Burials 20B, 23, 28, 29A, 29B, 29C, 29D, 30, 31B, 32, 33, 34, 37F, 38A, 43A, 46B, 60D, 63D, 64A, 67A1-7, and 67C) exhibited at least one Schmorl's node, suggesting that many of these individuals engaged in "back breaking" work throughout their lives.

SPECIFIC AND NON-SPECIFIC INFECTION

Within the Eastern State skeletal sample, 32 individuals (21 males, eight females, and three individuals of indeterminate sex) displayed evidence of specific and non-specific infection (Table 4-9). Of these, three were juveniles, 10 were young adults, four were middle-aged adults, 13 were older adults, and two were adults of indeterminate age. For the purposes of this study, periostitis and osteomyelitis were classified as non-specific bone infections. However, it is important to note that although periostitis may be indicative of infection, it can also be caused by a variety of insults to the bone. Specific infections discussed here are polio, sinusitis, and syphilis. (Infections resulting from trauma are discussed in another section.)

Non-Specific Indicators of Infection

Most cases of infection are nonspecific in nature, meaning that a specific diagnosis is not possible. The majority of infections noted in the Eastern State Hospital skeletal sample were visible as periostitis, osteomyelitis, or lytic (destructive) bone lesions. Inflammation is a common response to bone infection (although it can occur due to other circumstances, such as trauma or tumors). Periostitis is the deposition of new bone (or woven bone) on the external surface of the bone (Ortner 2003). Osteomyelitis is the result of infection within the medullary (or marrow) cavity of bone and is most commonly caused by *Staphylococcus aureus* or *Streptococcus* (Ortner 2003:181). A diagnosis of osteomyelitis is only made when cloacae, or characteristic openings in bone caused by drainage canals, are visible in association with periosteal bone formation (Ortner 2003:199). Periostitis is usually localized and often less severe, whereas osteomyelitis can spread easier through the circulatory system (Larsen 1997:84). Active (or unhealed) infection is differentiated from healing/healed infection based on the presence of new (woven bone deposition) or remodeled sclerotic bone (smooth texture) that has been incorporated into underlying bone (Ortner 2003). Woven bone has an irregular, variable,

Table 4-9. Individual Cases of Infection.

Burial	Evidence of Infection
16A (<i>adult indet sex</i>)	Osteomyelitis left and right tibiae
18C (<i>male 65-85</i>)	Lesion right orbit (possibly trachoma or other infection)
20B (<i>female 47-63</i>)	Woven bone deposition pleural aspect of left rib, possibly due to respiratory infection
24B (<i>male 24-28</i>)	Healed osteomyelitis of left humerus
26B (<i>male 23-27</i>)	Active periostitis on femora and tibiae; Abscess of second premolar
32 (<i>male 28-38</i>)	Sclerotic periostitis of right tibia, left rib (dorsal)
34 (<i>juvenile 14-16</i>)	Atrophy of left lower and upper limb elements (all except ankle/foot bones); Angularity on left sciatic notch and femoral head (possibly result of Polio); Active periostitis of right tibia and fibula diaphysis
37C (<i>male 63-78</i>)	Sclerotic periostitis throughout left tibia diaphysis (possible Treponematosi)
38A (<i>male 65-80</i>)	Sclerotic periostitis on anterior crest of left tibia
50C (<i>male 25-40</i>)	Healed and active periostitis both femora and right fibula
51A (<i>male 20-35</i>)	Woven and sclerotic bone deposition on internal surfaces of frontal and occipital bones
52A (<i>male 43-58</i>)	Periostitis of endocranial surface of left and right temporal bones, left fibula
55C (<i>female 45-65</i>)	Healed periostitis of left femur
55D (<i>male 17-20</i>)	Diffuse porosity of the left and right maxillae, above alveolar process (similar to scorbutic porosity); Abscess in maxilla affected left sinus; Healed sinusitis
56A (<i>juvenile 17-19</i>)	Healed and active periostitis on right tibia
56B (<i>female 53-68</i>)	Woven bone deposition on internal surface of right temporal (also HCI of left temporal). Atrophy of left humerus; Sclerotic periostitis of left and right fibulae tibiae, sclerotic deposition in right maxillary sinus (healed sinusitis)
57A (<i>male 19-23</i>)	Active periostitis of maxilla and mandible; Active systemic infection (woven deposition) of left and right shoulders, hips, ribs (possible respiratory infection), clavicle, tibiae, and femora
57B (<i>male 35-55</i>)	Woven and sclerotic bone deposition on in right frontal and maxillary sinus (healed and active sinusitis) and right alveolar bone of maxilla
59C (<i>female 55-75</i>)	Sclerotic bone deposition on alveolar bone of maxilla
59E (<i>female 30-111</i>)	Abnormal bone formation left occipital and temporal bone in form of plaque (internal)
59F (<i>male 55-75</i>)	Sclerotic bone deposition on alveolar bone of left maxilla
59J (<i>male 23-33</i>)	Periostitis (active and sclerotic) of left and right tibia and femora
60B (<i>female 53-68</i>)	Active and healing periostitis of left femur
60E (<i>male 27-37</i>)	Sclerotic bone on right posterior maxilla
62 (<i>female 19-24</i>)	Systemic infection of both tibia, right fibula, and left clavicle (possible Treponematosi)
63B (<i>male 35-50</i>)	Sclerotic bone formation on mandible (in place of right M1) and endocranial surface of occipital bone
64A (<i>male 22-37</i>)	Systemic infection (active and healing periostitis) of mandible, both radii and ulnae, pelvis, right metacarpal, left fibula, both femora and tibiae (possible Treponematosi); Also porotic hyperostosis and cribra orbitalia
64B (<i>female 37-53</i>)	Bone formation on hard palate of right maxilla; Systemic infection (sclerotic bone deposition) of maxilla, mandible, left MC2, and unidentified left metacarpal, ilium, both femora, both tibiae, and both fibulae; cribra orbitalia both orbits
66A (<i>commingled highly fragmentary an MNI=4</i>)	Periostitis of left patella (posterior surface), right tibia, left tibia
66D (<i>male 50-65</i>)	Sclerotic bone deposition on pleural aspect of right rib (respiratory infection); Healing periostitis of right and left hip and leg bones (acetabula, left ischium, left patella, left tibia, and both fibulae)
66E (<i>male 30-40</i>)	Healed periostitis of left radius
66G (<i>male 45-60</i>)	Inactive focal lytic lesion present on internal surface of right parietal bone
67C (<i>male 53-68</i>)	Healing or healed periostitis of left temporal bone (adjacent to TMJ) and both tibiae and left fibula

and porous appearance but becomes smoother as it transitions to sclerotic. Periostitis and osteomyelitis are both nonspecific indicators of infection, meaning that the specific causal pathogens are not known. However, healed or unhealed periostitis localized on the

pleural aspect of the ribs, for example, can suggest that an individual either survived a respiratory infection, or suffered from such an infection at the time of death.

Within the Eastern State Hospital skeletal sample, 31 individuals exhibited evidence of periostitis (Burials 16A, 20B, 24B, 26B, 32, 34, 37C, 38A, 50C, 51A, 52A, 55C, 55D, 56A, 56B, 57A, 57B, 59C, 59E, 59F, 59J, 60B, 60E, 62, 63B, 64A, 64B, 66A, 66D, 66E, and 67C) (Table 4-9). The periostitic lesions present range from active to healed, and from localized to systemic. For example, Burials 57A, 59J, 62 and 64B exhibit evidence for systemic infection at the time of death in the form of active and healed periostitis throughout the body. Others exhibited evidence of periosteal reactions in the sinus cavities of the maxillary and frontal bones suggesting sinusitis (Burials 55D, 56B, and 57B) or on the ribs suggesting respiratory infection (Burials 20B and 66D). A number of individuals also showed evidence for inflammation or infection on the internal surface of the cranium, possibly due to infectious disease. Of the 31 individuals with periostitis, at least two displayed evidence of osteomyelitis (Burials 16A and 24B).

Burial 18C (a male older adult), who as previously noted suffered from a variety of ailments, also has an inactive lytic lesion in the right eye orbit. This lesion could have resulted from a chronic or recurring eye infection, such as trachoma, which can cause blindness if left untreated (Webb 1990). As previously mentioned, this individual also shows evidence of diffuse idiopathic skeletal hyperostosis (DISH), which, along with some types of eye disease, has been associated with diabetes (Khandekar and Mohammed 2005).

Evidence of infection does not always indicate cause of death. Furthermore, death caused by acute illness often does not show evidence in the skeleton, as the individual would have to live long enough for bone to react. Not all cases of bone loss or deposition are due to the same type of infection. Very few diseases leave definitive evidence in the skeleton; however, a differential diagnosis based on several factors (e.g., the age and sex of the individual, type, and location and distribution of the lesions) can help narrow down the possibilities.

Specific Infection

Possible Case of Poliomyelitis

Burial 34, a juvenile (approximately 14-16 years of age), shows skeletal manifestations that are consistent with poliomyelitis, or polio. This individual exhibits extreme atrophy of the left leg and left arm. Multiple vertebrae also have Schmorl's nodes, likely due to disuse osteoporosis. The attachment sites for the muscles associated with flexion of the elbow are particularly pronounced in the affected arm (although also evident to a lesser degree in the right forearm) suggesting that this individual's arm may have been fixed in the flexed position (arm bent). The right distal tibia has a squatting facet suggesting hyper dorsiflexion of the ankle (flexing the foot upward or squatting), possibly due to compensation for the shorter left leg. Shape changes to the hip joints (acetabulum of the pelvis and femoral head) show evidence for possible subluxation, or

partial dislocation. The acetabular margin of the left hip also has a small healing fracture, which is not uncommon among individuals who have unbalanced and weakened hip muscles (Jones 1962). Further shape changes to the pelvis (wider greater sciatic notch of the left ilia) suggest that this individual spent a great deal of time sitting. The lack of atrophy in the right arm and leg bones suggests that this individual was not completely paralyzed. Considering the notable long bone length discrepancies (18 mm difference in humeral lengths, 4 mm difference in humeral midshaft diameters, and 8 mm difference in femoral midshaft diameters), it is likely that the onset of the condition began well before the bones completed growth.

While a number of other causes are possible (e.g., cerebral palsy), the mosaic, patchy distribution of affected muscles and bones, as well as possible osteoporosis of the spine due to prolonged immobility, are more suggestive of polio (Aufderheide and Rodríguez-Martín 1998:212; Ortner and Putschar 1985:325-326; Waldron 2009:109). Polio is a viral infection, most often spread through fecal-oral transmission. The first reported polio outbreaks in the United States occurred in 1891 in Louisiana and 1894 in Vermont (Oshinsky 2005; Trevelyan et al. 2005); however it is likely that many isolated cases went unrecognized. Multiple epidemics were reported from regions throughout the country, including Kentucky, by the early 1900s. Few bioarchaeological cases of polio have been documented, especially in the New World; however, a possible case has been identified in an individual from a nineteenth century cemetery in southwest Mississippi (Thompson 2012).

Possible Cases of Syphilis

Venereal syphilis is a specific disease caused by the bacterial spirochete *Treponema pallidum* subspecies *pallidum*. Late-stage syphilis is frequently characterized by debilitating and often lethal circulatory and neurological symptoms (Aufderheide and Rodríguez-Martín 1998; Roberts and Manchester 2005:209). These neurological symptoms were given the medical term ‘general paralysis of the insane,’ or ‘general paresis,’ and included progressive dementia, paralysis, and seizures. An 1877 report from a New York City asylum states that out of 1600 ‘insanity’ cases treated over a two-and-a-half year period, 205 (12.8 percent) were diagnosed with general paresis (MacDonald 1877). Similarly, one out of nine patients admitted to U.S. mental hospitals with psychoses in 1922 were afflicted with the disorder (Brown et al. 1970:125). According to reports from the Eastern State Hospital between 1824 and 1869, twelve individuals were admitted with a diagnosis of ‘paralyse generale’ or general paresis (White 1984:208).

In the late stage of the infection (occurring years, even decades after infection), distinctive skeletal manifestations can be pathognomonic for the disease (Hackett 1976; Powell and Cook 2005). There are three other very similar treponemal diseases (yaws, pinta, and endemic syphilis) that can sometimes confuse a diagnosis; however, venereal syphilis is the most likely to exist in Kentucky during the nineteenth century. Though syphilis often results in nonspecific periostitis throughout the postcranial bones, skeletal lesions diagnostic of venereal syphilis, include distinctive cavitating lesions and subsequent sclerotic scarring in the cranial vault; destructive lesions of the nasopalatal

bones; and bone deposition on the anterior aspect of the tibiae giving the bone a bowed appearance (saber shin).

While no individuals present all of the diagnostic skeletal reactions, at least three (Burials 37C, 62, and 64A) show postcranial lesions consistent with syphilis (e.g., extensive periostitis and “saber shin”) and are, therefore, considered *possible* cases. There were no cases of cranial lesions (often considered more diagnostic of syphilis) in the Eastern State Hospital sample, but it is estimated that 20.0 percent or fewer individuals with syphilis will show any evidence in the bone (Resnick and Niwayama 1995:2496). Because the later stage of syphilis can begin decades after initial infection, it is quite likely that any patients suffering from syphilis contracted the disease well before entering the hospital.

PATHOLOGY BY AGE AND SEX

In order to provide a more accurate assessment of pathology based on age and sex categories, commingled burials were excluded from all further comparisons. Statistical analyses (chi square test and Fisher’s exact test) were employed to determine whether differences in the frequencies of pathological conditions (Table 4-10) were significant (p-value set at .05 level) or likely just a product of chance.

Table 4-10. Frequencies of paleopathological conditions by age and sex.

Pathological Conditions	Juvenile	Young Adult		Middle Adult			Older Adult			Total			
	n/N %	n/N %		n/N %			n/N %			n/N %			
	Total	F	M	Total	F	M	Total	F	M	Total	F	M	Total
Arthritis	1/9 11.1	7/21 33.0	14/26 53.8	21/50 42.0	7/12 58.3	10/16 62.5	17/30 56.7	9/14 64.3	20/26 76.9	29/40 72.5	25/52 48.1	45/77 58.4	70/142 49.3
Vertebral arthritis	2/9 22.2	0/21 0.0	9/26 34.6	10/50 20.0	0/12 0.0	2/16 12.5	2/30 6.7	2/14 14.3	5/26 19.2	7/40 17.5	2/52 3.8	17/77 22.1	21/142 14.8
Schmorl's nodes	2/9 22.2	0/21 0.0	8/26 30.1	9/50 18.0	2/12 16.7	2/16 12.5	4/30 13.3	1/14 7.1	4/26 15.4	5/40 12.5	3/52 5.8	15/77 19.5	20/142 14.1
Occupation stress	0/9 0.0	1/21 4.8	5/26 19.2	6/50 12.0	2/12 16.7	3/16 18.8	5/30 16.7	1/14 7.1	6/26 23.1	7/40 17.5	4/52 7.7	14/77 18.2	18/142 12.7
Trauma	1/9 11.1	1/21 4.8	6/26 23.1	7/50 14.0	2/12 16.7	2/16 12.5	4/30 13.3	1/14 7.1	2/26 7.7	3/40 7.5	5/52 9.6	10/77 13.0	16/142 11.3
Porotic hyperostosis	0/9 0.0	0/21 0	2/26 7.7	2/50 4.0	0/12 0.0	0/16 0.0	0/30 0.0	0/14 0.0	0/26 0.0	0/40 0.0	0/52 0.0	2/77 26.0	2/142 1.4
Cribriform orbitalia	1/9 11.1	0/21 0.0	3/26 11.5	3/50 6.0	1/12 8.3	1/16 6.2	2/30 0	1/14 7.1	1/26 3.8	2/40 5.0	2/52 3.8	6/77 7.8	9/142 6.3
Periostitis	3/9 33.3	1/21 4.8	9/26 34.6	10/50 20.0	1/12 8.2	3/16 18.8	4/30 13.3	5/14 35.7	6/26 23.1	11/40 27.5	8/52 15.4	19/77 24.7	30/142 21.1

Juvenile ≤ 19 years of age; Young Adult = 20-34; Middle Adult = 35-49; Older Adult ≥ 50
 F = Female; M= Male
 n = number individuals affected; N = number of individuals analyzed; % = percent affected

Arthritis and bone infections were the most common conditions observed for the Eastern State Hospital Cemetery skeletal sample (Figures 4-2 and 4-3). These types of infections are often idiopathic, meaning that the cause is unknown. A number of factors can affect joint deterioration, including genetics, obesity, occupational stress, physical trauma, infectious disease, metabolic or vascular disorders, and neuropathy (Aufderheide and Rodríguez-Martín 1998:93). Though arthritis alone is considered a rather poor

indicator of activity, as age appears to be the most influential factor (Weiss and Jurmain 2007), other variables, such as age, sex, and presence of other pathological conditions as well as the type, severity, and distribution of lesions, can all aid in the interpretation of arthropathy data.

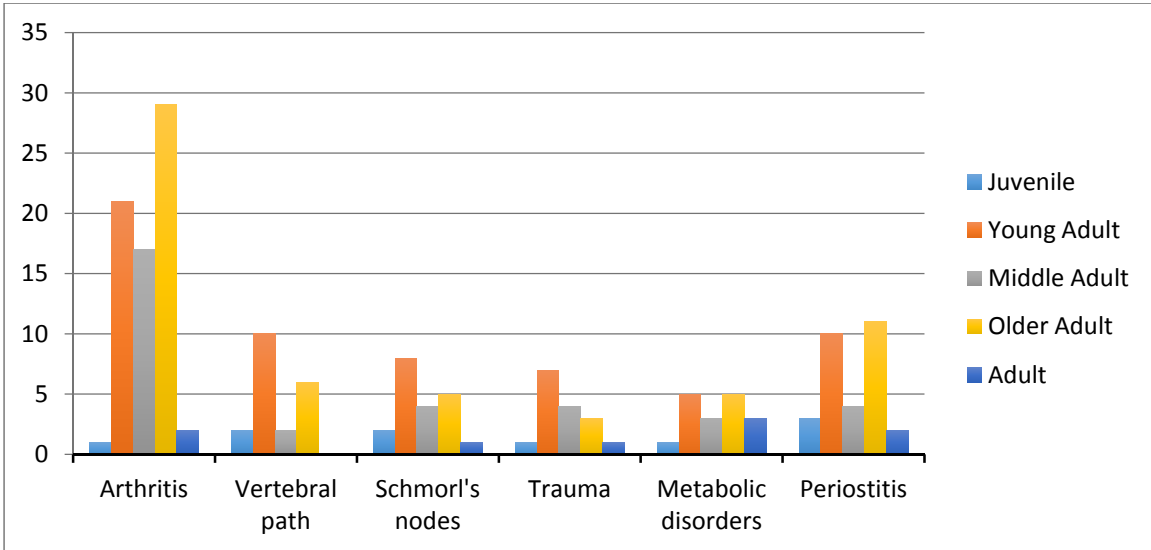


Figure 4-2. Percentage of Eastern State Hospital sample (n=142) displaying pathologies by age (excludes 2005 sample).

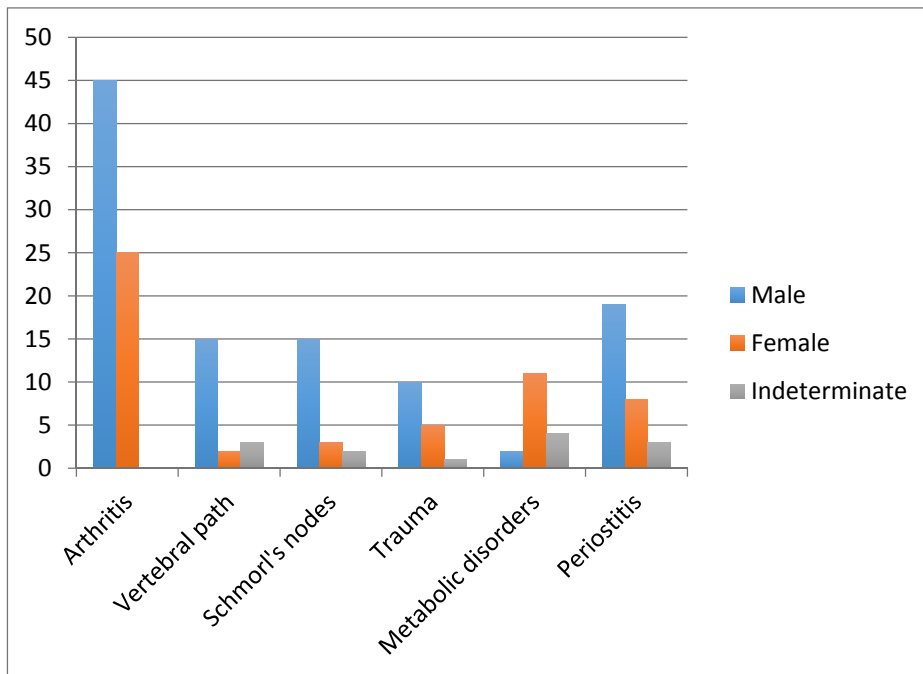


Figure 4-3. Percentage of Eastern State Hospital sample (n=142) displaying pathologies by sex (excludes 2005 sample).

Almost fifty percent of the individuals (49.3 percent; 70/142) in the Eastern State Hospital skeletal sample exhibited lesions in the bone consistent with arthritis, with frequency and distribution throughout the body varying by age and sex. This ailment was most evident in older adults (72.5 percent; 29/40; 20 males and nine females) followed by middle adults (57.0 percent; 17/30; 10 males and seven females) and young adults (42.0 percent; 21/50; 14 males and seven females). The frequency of arthritis increased significantly with age ($X^2=8.39$; $P < 0.015$), which is not unexpected since it is an age-progressive disease. Frequencies of arthritis did not differ significantly between males (58.4 percent; 45/77) and females (48.1 percent; 25/52). Vertebral pathologies associated with osteoarthritis (including osteophytosis, but not DISH or Schmorl's nodes) were present in 20 individuals (14.1 percent; 20/142) and occurred throughout each age range. Vertebral pathologies affected young adults (20 percent; 10/50; nine males and one individual of indeterminate sex), middle adults (6.7 percent; 2/30; both male), and older adults (15 percent; 6/40; four males and two females). Frequencies of vertebral pathologies were significantly greater among males (19.5 percent; 15/77) than females (3.8 percent; 2/52) (*Fisher's exact*, $P=0.0148$).

Schmorl's nodes are usually considered better indicators of activity than arthritis, especially for those activities that involve mechanical loading of the spine (Weiss 2005). Schmorl's nodes were associated with 20 individuals (14.1 percent; 20/142), including juveniles (22.2 percent; 2/9), females (5.8 percent; 3/52; two middle and one older adult) and males (19.5 percent; 15/77; one juvenile, eight younger adults, two middle adults and four older adults). The frequency of Schmorl's nodes is significantly greater among males than females (*Fisher's exact*, $P=0.037$). The presence of these lesions in the Eastern State Hospital skeletal sample suggests that at least some individuals engaged in activities that were strenuous on the spine.

Overall, 32 individuals (22.5 percent) showed skeletal evidence for infection in the form of bone deposition and/or bone loss, three of which were juvenile (Burials 34, 55D, and 56A). There were no statistically significant differences among the frequencies of infection for young, middle, and older adults. Thirty individuals displayed evidence for active, healing, or healed periostitis (21.1 percent; 30/142). Of these 30 cases, there were 19 males (24.7 percent; 19/77), eight females (15.4 percent; 8/52), and three individuals of indeterminate sex (two of which were juveniles). Periostitis affected all age groups, including juveniles (33.3 percent; 3/9), young adults (20 percent; 10/50), middle adults (13.3 percent; 4/30), and older adults (27.5 percent; 11/40).

Porosity in the eye orbits consistent with cribra orbitalia, likely due to infection and/or nutritional deficiencies such as vitamin C or vitamin D₁₂, was noted for nine individuals (6.3 percent; 9/142). This included one juvenile of indeterminate sex (Burial 34), three young adults (6.0 percent; 3/50; all males), two middle adults (6.7 percent; 2/30; one male and one female), two older adults (5.0 percent; 2/40; one male and one female), and six males (7.8 percent; 6/77), two females (3.8 percent; 2/52) and one individual of indeterminate sex (7.7 percent; 1/13) whose age could not be determined. Porosity on the external table of the cranial vault, consistent with porotic hyperostosis, was observed with two individuals (1.4 percent; 2/142), both young adult males. One of

the young adult males (Burial 64A) exhibited porosity consistent with both cribra orbitalia and porotic hyperostosis. Although the majority of porotic hyperostosis and cribra orbitalia were observed in adults, these conditions are often caused by anemia related to nutritional deficiencies and/or infectious disease in childhood (generally before the age of five years). These results suggest that at least some of the residents at Eastern State Hospital survived bouts of anemia early in life, likely due to dietary deficiency (e.g. vitamin B₁₂ or C) or possibly parasitic infections.

Markers of occupational stress were observed in 28 individuals (19.7 percent; 28/142: young adults [18.0 percent; 9/50], middle adults [23.3 percent; 7/30], and older adults [30 percent; 12/40]). They include exaggerated muscle attachment sites as well as conditions or anomalies that are associated with heavy or repetitive strain to the muscles and bones. The frequency of occupational stress markers was significantly greater (Fisher's exact $P=0.0287$) among males (28.6 percent; 22/77) than females (11.5 percent; 6/52). However, many conditions associated with physical activity, especially musculoskeletal markers, are correlated with larger body size (Weiss 2003), which likely influenced the observed sex differences.

Slightly more than ten percent of the Eastern State Hospital sample showed evidence for traumatic injury (11.2 percent; 16/142: young adults [14.0 percent; 7/50], middle adults [13.3 percent; 4/30], older adults [7.5 percent; 3/40], one adult of indeterminate age, and a juvenile). Of these, ten were male (13.0 percent; 10/77), five were female (9.6 percent 5/52), and one was a juvenile of indeterminate sex (Burial 34, likely a result of underlying pathology). While there were no significant differences in the frequency of traumatic injuries between males and females, there are a few possible gender-related patterns in the distribution of trauma throughout the skeleton and the types of activities that may have caused the injuries.

SUMMARY

Bone infections and arthritis were the most common pathologies in the Eastern State Hospital skeletal sample. Both males and females suffered from the same variety of ailments. The only statistically significant differences were noted for skeletal markers of occupational stress, Schmorl's nodes, and other vertebral pathologies indicative of arthritis, which were more common among males. Several individuals experienced multiple pathologies (e.g., arthritis in addition to infection) during the course of their lives.

The work program at Eastern State Hospital involved considerable labor requirements for males, including gardening and farming as well as specific projects, such as the construction of a road and building renovations (White 1984:109-110). Female labor primarily consisted of domestic chores, such as washing, sewing, and ironing. Furthermore, many individuals may have grown up or lived in rural areas where farming and other types of manual labor were common. Others may have lived in urban areas where they worked in factories, as laborers, and servants.

The presence of Schmorl's nodes (14.8 percent) suggests that many individuals engaged in regular activities that placed particular strain on the vertebral column or increased their risk of acute trauma to the spine (Weiss 2005). These lesions occurred significantly more often among males than females. Because Schmorl's nodes occur more commonly in younger individuals (especially in the 2nd and 3rd decades of life) due to weakness of the vertebral centra (Chandraraj et al. 1998), injuries observed among older individuals may have occurred prior to their stay at Eastern State Hospital. Observed markers of occupational stress lend further support to the idea that some of the Eastern State Hospital residents endured considerable workloads throughout their lives. These markers, which include distinct morphological changes or exaggerated muscle attachment sites, were significantly more common among males than females. However, many of these conditions, especially exaggerated muscle attachments, are associated with larger body size (Weiss 2003), which could explain some of the observed sex-related differences. Distinctive morphological variations (e.g., Messeri's patella, Allen's fossa and Poirier's facet of the femora, and flexion facets of the distal tibiae) were noted among several individuals, many of which are associated with particular types of activities, such as repetitive squatting or bending of the knees and hips (Capasso et al. 1998).

While the frequencies of traumatic injuries among males and females did not differ significantly, the types of trauma observed did vary somewhat by sex. Males tended to have more injuries related to heavy lifting or falls (e.g., long bone fractures, shoulder dislocations, and ankle fractures). Two female individuals suffered from possible hip trauma, which could have been caused by falls or, perhaps, underlying pathological conditions. Injuries commonly associated with interpersonal violence were noted for two females (a nasal fracture and an ulna fracture consistent with a defensive wound). It is important to note that these two possible cases of interpersonal violence could have resulted from a number of other nonviolent accidents, such as a fall. Furthermore, intentional violence could have contributed to some of the other documented male or female injuries.

Infectious disease was observed among males and females of all ages. Evidence of infection ranged from active at the time of death to well-healed. Within the Eastern State Hospital sample, 21.8 percent of the individuals exhibited evidence of periostitis. Skeletal changes observed included those associated with respiratory infection, sinusitis, a chronic eye infection, numerous localized infections, and systemic infection. Although not resulting in any definitive diagnoses, one individual shows skeletal evidence consistent with polio and at least three individuals present possible cases of late stage syphilis. The onset of any of these infections could have begun before individuals entered the hospital, or been contracted once admitted. The presence of an active infection does not necessarily mean that that particular infection was fatal, only that they had an infection at the time of death.

Many diseases that could have resulted in death would not have left evidence in the bones, as would be the case for those who died from any of the infectious diseases common at the time, including cholera, which was reported to have swept through the

hospital in 1849 and 1850. According to an 1860 Census Mortality Schedule for Adair County in south central Kentucky (United States Census Bureau 1860), the most frequent causes of death were infectious diseases, such as typhoid fever, tuberculosis, scarlet fever, and pneumonia. Gastrointestinal illnesses were also common.

The presence of inactive porotic lesions of the eye orbits (cribra orbitalia) and cranial vaults (porotic hyperostosis) suggests that several individuals (7.0 percent) endured periods of nutritional stress during infancy or early childhood, possibly due to vitamin deficiency (e.g., vitamin B₁₂, and vitamin C) or parasitic infection. These incidences likely correspond to the transition from breast milk to poor quality solid foods during weaning. Parasitic infections and bouts of diarrhea, which are common among infants and children from overcrowded or unsanitary living conditions (Fischer Walker and Black 2007), could have caused or further exacerbated any dietary deficiencies. Dental analyses from the Eastern State Hospital sample support these results, as 97 percent of the teeth analyzed present evidence for stress during childhood in the form of enamel hypoplasias (see Chapter Five). The peak age for development of these enamel defects was 3.1-3.5 years of age, which is consistent with weaning stress reported for other nineteenth century skeletal samples (Goodman 1988; King 2006).

ARCHAEOLOGICAL SITE COMPARISONS

The comparisons presented in this section are based on the frequencies of pathological conditions (number of individuals affected/total number of adults in the population), which does not account for differential preservation of skeletal material. For instance, samples with poorly preserved cranial bones are not likely to show evidence for porotic hyperostosis or cribra orbitalia. Furthermore, the definitions and diagnostic criteria utilized for different types of pathologies are not always explicitly stated and may vary between studies (e.g., some researchers include Schmorl's nodes with trauma, while others may list them separately). It is also important to note that individuals and populations differ based on their susceptibility to disease or risk of death (Vaupel et al. 1979; Wood et al. 1992). Some individuals may be particularly healthy and therefore able to survive a period of nutritional stress or infection, leaving evidence of a healed lesion in the skeleton (e.g., periostitis). Other individuals who contract the same illness, but whose immune systems are weaker, may die before the disease manifests in the bone. Given these considerations, the following discussion is meant to present a broad comparison of the types of pathological conditions associated with different skeletal samples. The comparative samples selected consist of family, community, or neighborhood cemeteries, as well as several institutional samples.

Rural and Community Cemeteries

The Old Frankfort Cemetery (n=242; 98 infants, children, and juveniles, 144 adults [71 males, 54 females, 20 indeterminate]) (early 1800s to ca. 1860), was an integrated urban burial ground located approximately fifty kilometers to the northwest of Lexington (Pollack et al. 2009). Individuals interred within this cemetery were enslaved

and freed African Americans, and working class European-Americans (Favret 2005). Almost eight percent of the adults suffered fractures or dislocations associated with trauma (Killoran and Favret 2009). Infections in the form of abnormal bone formation and bone loss was present, as were skeletal indicators of malnutrition. The most common pathology reported for the Old Frankfort Cemetery was osteoarthritis, especially along the spine (Pollack et al. 2009). Of particular note is the high frequency of Schmorl's nodes in this population (approximately 48 percent of adults), which suggests that many individuals engaged in activities that placed considerable stress on the vertebral column (Killoran and Favre 2009).

The Horse Park Cemetery (n=34; 14 infants, children and juveniles, 23 adults [15 males, seven females, one indeterminate]) (ca. 1800-1860), located in a rural area about fifteen km north of Lexington, contained the skeletal remains of 34 individuals, believed to be members of a European-American family that owned the property and enslaved African Americans (Pollack et al. 2011). Skeletal evidence for nutritional stress, included bowing in the long bones due to vitamin D deficiencies and cranial lesions associated with anemia or parasitic infection. There appears to be a relatively high percentage (14.3 percent) of traumatic injuries, including two particularly convincing cases of interpersonal violence (Pollack et al. 2011). Activity-related conditions were observed in the form of arthritic joints, elevated vertebral rings, and large muscle attachments. In addition, Schmorl's nodes were noted for just one individual (2.9 percent). The suite of conditions observed in the Horse Park sample was attributed to the physical demands of life on a working farm.

The Voegtly Cemetery sample (n=544; 370 infants, children, and juveniles, 174 adults [95 males, 76 females, and three indeterminate]) (1830-1861) primarily consisted of European-American church members from the Pittsburgh area. Within this sample, there were several cases of arthritis and Schmorl's nodes as well as non-traumatic bone lesions, which suggest chronic infection, as well as cribra orbitalia, an indication of malnutrition earlier in life (Ubelaker et al. 2003). Not surprisingly, the skeletal sample suggests that infectious disease, nutritional deficiencies and activity-related stress affected some of the individuals interred in the Voegtly Cemetery. The frequencies of these skeletal indicators of stress were relatively low (Ubelaker et al. 2003:43) and only 2.2 percent of the sample exhibited evidence of trauma (Ubelaker et al. 2003:31).

To the south, the Avondale Burial Place cemetery yielded a predominately African-American sample (n=101; 40 infants, children, and juveniles, 26 adults [16 males, 10 females, and 21 indeterminate]) that was primarily drawn from the community of Avondale, which is located just outside of Macon, Georgia (Matternes et al. 2012). While the cemetery was in use from ca. 1820 to 1950, over 90 percent of the individuals were likely interred prior to 1900 (Matternes et al. 2012:413). The most frequent type of stress indicators documented for this skeletal sample were labor-related skeletal manifestations, including osteoarthritis, ossified connective tissue, and vertebral pathologies (Schmorl's nodes were noted for only 3.0 percent of the individuals) (Matternes et al. 2012). The researchers attribute these work activity-related conditions to the hard labor required of southern tenant farmers. Several other types of pathological

conditions were observed as well, including nonspecific infection, possible cases of syphilis, skeletal indicators of nutritional stress (e.g., cribra orbitalia and rickets), and traumatic injury.

Although varying in sample size, within all five cemetery samples males outnumber females, with males accounting for slightly more than fifty-six percent of the burials at the Old Frankfort and Voegtly cemeteries, 59.1 percent of the Eastern State Hospital sample, 61.5 percent of the Avondale sample, and 68.2 percent of the Horse Park sample. Being an institutional cemetery, the Eastern State Hospital skeletal sample is distinguished from the other cemeteries by a general absence of infants and children. Within these nineteenth century burial samples, males and females appeared to have engaged in heavy labor, experienced varying degrees of malnutrition, and developed similar ailments throughout their lives.

Institutional Cemeteries

The Insane Asylum Cemetery in Stockton, California (1851-1854), represents a contemporary sample (39 adults; 31 males, five females, three indeterminate), from an institutional context (Collins 2009). Within this burial sample, a relatively high percentage of individuals exhibited evidence for periostitis (over forty-five percent) and traumatic injury (over seventeen percent). There were similarly high frequencies of osteoarthritis. Skeletal evidence for nutritional stress and infectious disease was documented for this sample as well, with 5.1 percent of individuals showing evidence of cribra orbitalia.

The Colorado State Insane Asylum skeletal collection (n=166; 107 males, 35 females, and 24 indeterminate) (1879-1899) represents a somewhat later institutional sample. Relative to the Stockton asylum it contains a much higher percentage of traumatic injuries, with 69.0 percent of the individuals exhibiting evidence of trauma (Leavitt-Reynolds 2011). This sample also contained a high percentage (42.7) of individuals with Schmorl's nodes. These results may reflect frontier life in the American West during the late nineteenth century.

Although not as extreme, two institutional skeletal collections from New York also exhibit high percentages of skeletal trauma. Within the Albany Almshouse (n=40 adults) (1890-1900) and Oneida Asylum (n=100 adults) (1860-1895) samples about one third of the individuals suffered traumatic injuries (Collins 2009; Phillips 2001a, 2001b). The Oneida Asylum sample also contained a high percentage (45.5) of individuals who had Schmorl's nodes. In comparison, only 9.5 percent of the Albany Almshouse sample exhibited this vertebral pathology. Phillips (2003) found that Schmorl's nodes tend to occur in considerably higher frequencies (close to 40 percent of adult individuals) in some institutional contexts (e.g., military, slavery, and mental institutions), with frequencies of less than 25 percent occurring among the general population samples. While the Colorado State Insane Asylum and Oneida Asylum samples conform to this expectation, the frequency of Schmorl's nodes in the Albany Almshouse and Eastern State Hospital (14.8 percent) samples are more similar to that of non-institutional

contexts. The Albany Almshouse served a very different purpose than the other institutions included in the comparison sample (Phillips 2003). It was often a last resort for those seeking shelter and food while they attempted to secure work, or as a place for poor terminally ill individuals, lacking family or other resources, to spend their final days. Many long-term institutions, such as prisons or asylums, implemented labor therapy that in many cases appears to have implemented more rigorous labor requirements than the general population. The Albany Almshouse residents were likely more representative of the general population.

The low percentage of Schmorl's nodes in the Eastern State Hospital skeletal sample is likely due to the poor preservation of the remains. Another possibility is that fewer individuals in the Eastern State Hospital sample were capable of performing activities that would place considerable strain on the spine due to the severity of their conditions. Alternatively, many of those interred in this cemetery may have come from higher socioeconomic backgrounds and did not have to undertake as much physical labor.

What all of the institutional samples share in common is that they are dominated by adults. The higher percentage of females interred within the Eastern State Hospital cemetery serves to distinguish it from the Insane Asylum Cemetery and the Colorado Insane Asylum samples. It does, however, share with the former a relatively low percentage of individuals with traumatic injuries, which are much higher among the other institutional samples. Relative to the Insane Asylum Cemetery, the Eastern State Hospital sample also had a much lower incidence (21.8 percent) of periostitis, but within both cemeteries, about five percent of the individuals showed evidence of cribra orbitalia.

CONCLUSIONS

The Eastern State Hospital skeletal sample appears to be representative of the hospital population as a whole. Demographically, the higher number of males represented in the skeletal sample is consistent with the patient population sex distribution reported in the historic records. The bioarchaeological data indicates that individuals interred in the Eastern State Hospital Cemetery suffered maladies common among pre-antibiotic nineteenth century agricultural societies where malnutrition, poor sanitation, and infectious disease were common.

Instances of porotic hyperostosis and cribra orbitalia indicate that some individuals suffered from nutritional deficiencies earlier in their lives, likely caused by the synergistic effects of infection and low nutrient, high starch corn or potato-based diets. Individuals in the Eastern State sample displayed both healed and active lesions at time of death, meaning that they suffered from various stages of infection prior to or during their stay at the hospital. These deficiencies coupled with poor sanitation often made people susceptible to infectious diseases, such as respiratory infections and sinusitis. One person also suffered from a chronic eye infection, another exhibited pathologies consistent with polio, and three may have suffered from late stage syphilis. The onset of any of these infections could have begun before these individuals entered

the hospital, or been contracted once admitted. In addition, many diseases, such as Cholera, that resulted in death at the hospital would not have left evidence in the bones.

Though there were no significant differences in the frequencies of traumatic injuries between males and females, the types of injuries sustained did vary somewhat by sex. Males in the Eastern State Hospital sample exhibited injuries more often related to heavy lifting or falls (e.g., long bone fractures, shoulder dislocations, and ankle fractures). In comparison, three of the five female trauma cases involved injuries frequently caused by falls (e.g., hip dislocations and an ankle fracture) and the only two individuals presenting injuries most commonly associated with interpersonal violence (a broken nose and a fracture arm bone consistent with a defensive wound) were female.

Males, and to a lesser extent, females engaged in arduous labor-related activities throughout their lives. This is reflected by the presence of Schmorl's nodes and other vertebral pathologies, as well as exaggerated muscle attachments. In part, this is a result of patients growing up or living in rural areas where both men and women were involved in agricultural labor, or in urban areas where they engaged in a great deal of physical work in factories as day laborers or as servants. Once they were admitted to the hospital, they may have continued to have undertaken a great deal of physical labor as part of the hospital's patient work program. The types of jobs they were engaged in are consistent with mechanical loading activities and repetitive movement like those that would be expected with farm, factory, or servant labor.

Although containing different population samples, the human remains from central Kentucky Eastern State Hospital, Old Frankfort Cemetery, and the Horse Park Cemetery display similar types of pathological manifestations. Those interred within these three cemeteries engaged in a great deal of physical labor during the course of their lives, experienced varying degrees of malnutrition, and developed similar ailments throughout their lives. In comparison to other institutional samples, the residents of Eastern State Hospital had fewer traumatic injuries and work related Schmorl's nodes. This speaks to the resources available to the Eastern State Hospital staff and its structure as an operating institution.

CHAPTER FIVE: DENTAL ANALYSIS

By
Mindi Wetzel

INTRODUCTION

A minimum of 175 individuals were recovered in 2011 from Eastern State Hospital. Of these, 142 individuals retained some form of oral hard tissue for observation. Some individuals retained only alveolar maxillary or mandibular bone, examination of which showed pre-mortem tooth loss in several cases. All individuals with dentition present possessed permanent dentition, though one individual retained a deciduous canine (the permanent canine was fully formed and impacted within the maxillary alveolar bone) and one retained deciduous molars, indicating an age at death of around 12 years old.

An additional 11 individuals were recovered from the site in 2006 (Favret 2006). Since these remains had been reinterred prior to the analysis of the 2011 sample, they could not be examined as part of this study. Information presented in the 2006 report is referenced for comparative purposes, but the focus of this chapter is the larger 2011 sample.

The dental analyses were performed between May of 2011 and June of 2013, where attributes were recorded according to *Standards for Data Collection from Human Skeletal Remains* (Buikstra et al. 1994). Visual recording forms were completed for each individual, showing the presence or absence of teeth, and the location and size of carious lesions and abscesses. In the case of missing teeth, whether the absence was ante- or post-mortem was recorded when possible. Wear, carious lesions and their locations, abscesses, supernumerary teeth, and the presence of calculus also was recorded. Morphological traits recorded are summarized in Table 5-1. Dental metrics included the bucco-lingual, mesio-distal, and crown height measurements of each tooth type (where possible) for each individual. Per *Standards*, the left tooth was measured; the right antimere was used when the left was not available. Enamel hypoplasias also were recorded and measured. Attributes pertaining to demography and the overall health status of the Eastern State Hospital sample also are discussed.

Dental morphology and metrics of human teeth are used for anthropological studies to assess age at death, differences between males and females, biological affiliation, nutritional stress, disease, and even cultural beliefs as in the case of intentional dental mutilation. In the case of archaeological skeletal collections, dentition is especially useful as they are often the most well-preserved elements. Nonmetric traits that are often used to determine biological affiliation, include the Carabelli's Trait (identified first by Austrian Georg Carabelli in 1842) and shovel shaped incisors (Edgar 2005; Hillson 1996; Scott and Turner 1997). Though more than 100 different morphological dental traits have been identified and studied in the human dentition, pragmatically, researchers typically focus on one or two traits within a population (Scott and Turner 1997:25).

Table 5-1. Morphological Traits Recorded for the Eastern State Hospital Sample.

Trait	Teeth Scored
Hutchinson's Teeth	URI1, UL11
Winging	URI2, URI1, UL11, UL12
Shovel-Shaped Incisor	URI2, URI1, UL11, UL12
Double Shovel-Shaped Incisor	URI2, URI1, UL11, UL12
Peg-Shaped Incisor	URI2, UL12
Bushman Canine	URC, ULC
Distal Accessory Ridge	URC, ULC
Premolar Root Number	URP2, URP1, ULP1, ULP2, LRP1, LLP1
Enamel Extensions	URM3, URM2, URM1, ULM1, ULM2, ULM3
Carabelli's Trait	URM3, URM2, URM1, ULM1, ULM2, ULM3
Hypocone	URM3, URM2, URM1, ULM1, ULM2, ULM3
Metaconule	URM3, URM2, URM1, ULM1, ULM2, ULM3
Tome's Root	LRP1, LLP1
Cusp Groove Pattern	LRM3, LRM2, LRM1, LLM1, LLM2, LLM3
Cusp Number	LRM3, LRM2, LRM1, LLM1, LLM2, LLM3
Protostylid	LRM3, LRM2, LRM1, LLM1, LLM2, LLM3
Cusp 5	LRM3, LRM2, LRM1, LLM1, LLM2, LLM3
Cusp 6	LRM3, LRM2, LRM1, LLM1, LLM2, LLM3
Cusp 7	LRM3, LRM2, LRM1, LLM1, LLM2, LLM3
Molar Root Number	LRM3, LRM2, LRM1, LLM1, LLM2, LLM3

Over the decades of dental research, many researchers have attempted to standardize observations in order to facilitate comparison amongst and between populations. Hrdlicka (1920) developed a graded scale with which to define trait expression though it was Dahlberg (1945, 1949, 1963) who developed the first series of plaster casts. Today, the casts developed by Turner et al. (1991) at Arizona State University are the most commonly used and recommended by *Standards*.

DEMOGRAPHICS

Metric and non-metric traits of human dentition are used to infer sex, age at death, and ancestry. These traits taken alone are not meant to be the sole identifiers of the demography of a population, but are quite useful if used in conjunction with detailed skeletal analyses.

ANCESTRY

Despite research showing the high variability of Carabelli's Trait and Shovel-Shaped Incisors across populations (Correia 2000; Hawkey and Turner 1998; King et al. 2010), these two traits remain among the most commonly used to determine ancestry. Nevertheless, noting the presence or absence of these traits recorded within archaeological populations remains applicable.

Within the Eastern State Hospital sample, 113 individuals retained at least one or more maxillary molars observable for Carabelli's Trait (Figure 5-1). Forty-one

individuals (36.3 percent) were recorded as having no expression of the trait, 33 (29.2 percent) as having a slight expression (a line or pit), and 39 (34.5 percent) as possessing a cusp (Table 5-2). Individuals retaining maxillary incisors observable for shoveling numbered only 42, with 16 individuals (38.1 percent) showing no expression of the trait, 17 (40.5 percent) having a slight curvature of the marginal ridges (scores of 1 or 2), and nine (21.4 percent) having more pronounced marginal ridges enclosing a fossa on the lingual surface (Table 5-2). Forty-one individuals retained both maxillary molars and incisors observable for both Carabelli's Trait and shovel shaped incisors (Table 5-3).

Table 5-2. Summary of Carabelli's Trait and Shovel Shaped Incisors.

Carabelli's Trait	No. of Individuals	Shovel shaped	No. of Individuals
2011 Sample			
absent	41	absent	16
line or pit	33	score of 1 to 2	17
cusps	39	score of 3 to 5	9
2006 Sample			
absent	0	absent	5
line or pit	0	score of 1 to 2	0
cusps	7	score of 3 to 5	1



Figure 5-1. Carabelli's Trait on upper left maxillary molar (Burial 57A).

Table 5-3. Individuals retaining both maxillary molars and incisors observable for Carabelli's Trait and Shovel-Shaped Incisors.

Burial	Carabelli's Trait	Shovel Shaped Incisors
14B	absent	absent
16B	cuspid	absent
18A	absent	2
18B	absent	1
18E	absent	absent
19C	cuspid	4
19D	line or pit	absent
19G	cuspid	5
20A	cuspid	absent
25	cuspid	absent
26B	cuspid	4
28	cuspid	absent
29D	cuspid	absent
30	absent	4
31B	absent	2
32	absent	2
34	cuspid	absent
35	cuspid	1
36B	absent	2
37A	cuspid	1
38B	absent	3
39A	absent	2
39F	cuspid	absent
43B	cuspid	3
44B	cuspid	1
46A	line or pit	absent
47A	cuspid	absent
47B	absent	4
51B	cuspid	2
53A	cuspid	1
55D	line or pit	1
56A	line or pit	absent
59A	line or pit	4
59I	line or pit	1
59J	cuspid	1
60D	absent	1
66A S1	cuspid	1
66A S2	line or pit	absent
66C	absent	absent
67C	line or pit	2
67D	line or pit	absent

Several researchers have suggested that combinations of other traits can be more effective in predicting ancestry. For instance, Edgar (2005) recorded 29 morphological traits on a sample consisting of known African American and European ancestry. Of these, eight were found to have statistically significant differences between the two groups. Edgar then created probability tables (with both logistic regression and Bayes' Theorem) for use in determining ancestry of unknown individuals. The method was then

tested using casts from the Ohio State University (OSU) dental cast collection. This resulted in a 90 percent accurate assignment of ancestry (Edgar 2005).

Table 5-4 shows a selection of data recorded from the Eastern State Hospital dental collection compared to Edgar’s (2005) logistic regression probability tables. These individuals were chosen based on low wear scores on lower first and second molars. In this table, column AA gives the percent probability the individual is of African American ancestry and column EA gives the percent probability the individual is European American. Of the 52 individuals included in this analysis, 24 have an 83.0 percent probability of being of European American ancestry (Table 5-4). Most of the remaining individuals have a 55.0 percent probability of being African American or more likely of a mixed racial affinity.

Table 5-4. Ancestry Probability based on M5 and M7.

Burial	M5 LM2	M7 LM1	AA (%)	EA (%)	Burial	M5 LM2	M7 LM1	AA (%)	EA (%)
12	0	0	17	83	39F	0	0	17	83
14A	1	0	55	45	43	0	0	17	83
15D	1	0	55	45	43A	0	0	17	83
17	1	0	55	45	44B	1	0	55	45
18A	0	0	17	83	47A	1	0	55	45
18B	1	0	55	45	51A	1	0	55	45
18D	0	0	17	83	51C	0	0	17	83
18E	0	0	17	83	53A	0	0	17	83
19C	0	0	17	83	55A	0	0	17	83
19D	0	0	17	83	55B	0	0	17	83
20A	1	0	55	45	55D	0	0	17	83
21	0	1	49	51	56A	1	0	55	45
23	1	0	55	45	59G	1	0	55	45
24B	0	0	17	83	59I	1	0	55	45
25	1	0	55	45	59J	0	0	55	45
26A Cranium A	1	0	55	45	60D	1	0	17	83
27	1	0	55	45	60E	0	0	55	45
29A	0	0	17	83	63B	1	0	55	45
29C	0	0	17	83	64B	1	0	17	83
31B	1	0	55	45	66C	0	0	17	83
32	1	0	55	45	66E	0	0	55	45
34	1	0	55	45	66F	1	0	17	83
36B	0	0	17	83	66H	0	0	55	45
36D	1	0	55	45	67B	1	0	55	45
37D	0	0	17	83	68G	1	0	55	45
38B	1	0	55	45	68I	0	0	17	83

SEX

The Canine Distal Accessory Ridge (DAR) has been suggested to show sexual dimorphism. This ridge, when present, is located on the lingual crown between the medial lingual ridge and the distal marginal ridge. The trait is recorded according to size, with “0” representing no expression of the trait and “4” indicating a large, pronounced

ridge (Buikstra and Ubelaker 1994). Males consistently show higher frequencies and larger ridges than do women (Joseph et al. 2013; Scott 1977). Unfortunately, the location of the DAR (along with Bushman’s Canine) on the lingual surface of the canine leads to the trait being erased with minimal wear. Only 16 individuals in the Eastern State Hospital were observable for the DAR (Table 5-5).

Table 5-5. Distal Accessory Ridge Scores.

Burial	DAR Score
18B	0
19C	0
19G	0
28	0
34	2
35	1
43B	2
44B	4
53A	2
55B	4
55D	1
56A	2
66A S1	0
66C	3
66F	1
67A	0

Metric measurements are also used to estimate sex (Bidmos et al. 2010; Joseph et al. 2013; Karaman 2006; Rai and Anand 2007). The mesiodistal and buccolingual distances are measured, then robusticity calculated for each tooth type. Another method involves measuring the diagonal length of the tooth crown. The student’s t-test is then performed to determine statistically significant differences between the robusticity of known males versus that of known females ($p < 0.05$). For the Eastern State Hospital sample, robusticity calculations were based on only those determined to be “Definite Male” or “Definite Female” according to the skeletal analyses. The percentage of sexual dimorphism was calculated as well, with the lower canine and the lower third molar revealing the greatest difference between the males and females. These values were then compared to the individuals whose sex was indeterminate. Only 12 individuals retained dentition measurable and usable to calculate robusticity and attempt to assign possible sex. As can be seen in Table 5-6, the results are largely inconclusive for most individuals, though Burial 68I appears to most likely be a female based on the dental metrics.

DENTAL HEALTH

Attrition

Dental attrition, or wear, is the loss of tooth enamel or dentin typically caused by the contact between opposing maxillary and mandibular teeth (Hillson 1996). Wear typically begins on the occlusal surfaces through normal chewing and swallowing movements, though other forms of wear are caused by parafunctional activity, such as

bruxism (grinding of the teeth). A parafunctional habit is the habitual exercise of a body part in a way that is other than the most common use of that body part (McHarris 1979; Schiffman et al. 1992). The term is most commonly used by dentists, orthodontists, or maxillofacial specialists to refer to parafunctional uses of the mouth, tongue and jaw. Oral parafunctional habits may include bruxism (tooth-clenching or grinding), tongue tension, mouth breathing, and any other habitual use of the mouth unrelated to eating, drinking, or speaking.

Table 5-6. Probabilities of Indeterminate Sex Based on Dental Metrics.

Burial #	LC	LM3	probability individual is male	probability individual is female	LC	probability this tooth is male	probability this tooth is female	LM3	probability this tooth is male	probability this tooth is female
17			0.7%	0.8%						
26A	57.47		48.4%	73.40%	57.47	71.9%	98.4%			
34	58.18	124.92	82.9%	92.80%	58.18	75.4%	98.8%	124.92	85.3%	100.0%
35	46.69		28.3%	51.2%	46.69	15.4%	56.8%			
39A			30.4%	41.1%						
49			27.4%	52.0%						
56A	59.67	121.55	65.5%	84.7%	59.68	81.8%	99.4%	121.55	78.8%	100.0%
59I	57.61	117.11	81.8%	96.0%	57.61	72.6%	98.4%	117.11	68.3%	100.0%
67A			60.1%	78.3%						
68B		125.52	76.2%	94.2%				125.52	86.3%	100.0%
68E			15.9%	47.8%						
68I		94.35	26.7%	59.9%				94.35	11.7%	92.5%

Bruxism is typically a subconscious activity and is classified by researchers as a habitual behavior. Causes of bruxism are varied, and have been documented as being caused by allergic reactions, digestive ailments, trauma, stress, and anxiety. Bruxism can lead to abnormal wear patterns of the occlusal surfaces of the teeth, abfractions and fractures, and in severe cases, bruxism can cause alveolar bone loss, which can then lead to loss of teeth. In studies of living patients, pathological tooth wear is associated with bruxism, which appears in turn to be influenced by psychomotor factors (Kaushik et al. 2009; Lurie et al. 2007; Widgorowicz-Makowerowa et al. 1979). Stress and personality traits are suggested as variables that initiate, predispose, and perpetuate bruxism (Litonjua et al. 2003).

Normal, functional habits, such as chewing, are not the main cause of the wearing away of enamel and dentin, especially of the anterior teeth. Parafunctional habits are more destructive for several reasons. While teeth rarely come into contact during normal chewing, grinding of teeth may occur 1–4 hours in a 24 hour period, most often during sleep. The amount of pressure placed on teeth during functional habits is 20–80 psi (0.14–0.55 MPa), but the pressure can be much higher (ranging from 300 to 3000 psi [2.07 to 20.7 MPa]) (Lurie et al. 2007) during parafunctional habits (Hillson 1996). The direction of forces during functional habits is applied vertically along the long axis of

teeth, which is the least harmful to the periodontal membranes and ligaments that hold the teeth in their place. Collagenous fibers (called Sharpey's fibers, principal gingival fibers, alveolar crest fibers of the periodontal ligament [PDL], horizontal fibers of the PDL, and oblique fibers of the PDL) extend from the cementum into the periosteum of the alveolar bone. These fibers serve as "shock absorbers" for normal functional habits. Stresses applied to these fibers caused by parafunctional habits lead to breakage and loosening of the teeth as these are directed horizontally. Normally, the temporomandibular joint (TMJ) acts as a class III lever, which helps to restrict the amount of force generated. Class I or class II levers may be created during bruxism, which generates more force from the same amount of muscle activity and subsequently delivers more force to the teeth.

This parafunctional, lateral motion causes the canines and incisors of the opposing arches to move against each other laterally (with a side-to-side action by the medial pterygoid muscles that lie medial to the temporomandibular joints (TMJ), and abrade the tooth structure leading to the wearing down of the incisal edges of the teeth. People with bruxism may also grind their posterior teeth, which wears down the cusps of the occlusal surfaces of the molars. Most (but not all) bruxism includes clenching force provided by masseter and temporalis muscle groups; but some bruxers clench and grind front teeth only, which involves neither masseter nor temporalis muscle groups. Teeth hollowed by previous decay (caries) or dental drilling may collapse from bruxism's cyclic pressures. With prolonged bruxism, TMJ dysfunction (as well as headaches and myofascial pain) may develop. Enamel wears away and/or fractures, leading to increased decay rates and the extreme forces applied by the grinding leads to recession of the gums and alveolar bone.

The anomalous wear to anterior teeth documented by Cybulski (1994), Dumond (1977), Irish and Turner (1987), Larsen (1985), and Lukacs and Pastor (1988) were interpreted to be caused by circular notches on the occlusal surfaces of the anterior teeth, due to holding a clay pipe with the teeth; to the use of the teeth in processing of food; or the chewing of hides and sinews during meat processing. What these suggestions have in common is a relatively smooth, but anomalous, wear facet on the occlusal or labial surfaces of the anterior teeth.

As noted previously, normal, functional habits, such as chewing, are not the main cause of the wearing away or breaking of enamel, especially of the anterior teeth. During analyses of the Eastern State Hospital sample, parafunctional wear patterns were observed in dentition of several individuals, primarily on their anterior dentition (Figure 5-2). Of the 137 individuals with at least one tooth observable for this characteristic, 43 (31.4 percent) exhibit parafunctional wear in the form of chipped and spalled enamel. Often, this would be observed on an opposing tooth/teeth (maxillary to mandibular) in the arcade (Figure 5-3), but in some cases it did not. An example of the latter is shown in Figure 5-4 and Figure 5-5. Unfortunately, preservation of the sample as a whole was quite poor and comparisons between maxillary and mandibular teeth was not possible in many cases. Wear scores on the chipped teeth ranged from very minimal to severe, suggesting the chipping is independent from wear.

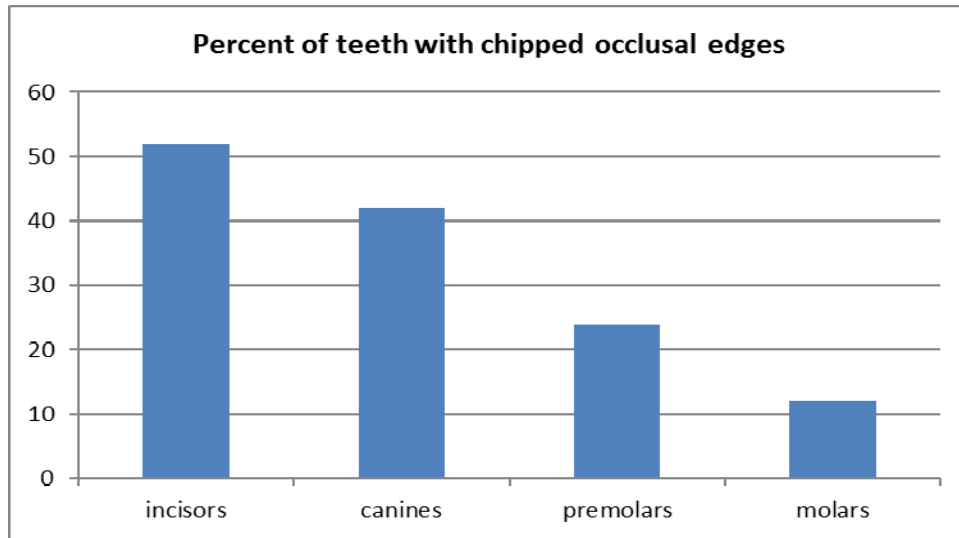


Figure 5-2. Percent of teeth with chipped occlusal surfaces due to parafunctional activity.



Figure 5-3. Parafunctional wear and chipped enamel evident on anterior dentition of Burial 60D, a 20-24 year old male.

Average wear scores for all teeth were recorded according to Scott (1979) for molars and Smith (1984) for incisors, canines, and premolars. For the group as a whole, the average molar wear score was 7.19; the average premolar wear score was 2.82, the average canine wear score was 3.73, and the average incisor wear score was 3.75. With the exception of the molar wear score, these values are quite similar to those observed in the Old Frankfort Cemetery sample (King 2006), where premolar, canine, and incisal



Figure 5-4. Burial 44B (20-25 year old male) showing chipped occlusal edges of ULI1, LLI2, and ULC with no corresponding parafunctional evidence on the opposing tooth.

wear averaged 2.61, 3.13, and 3.29, respectively. Molar wear observed in the Old Frankfort Cemetery was slightly higher at 9.42, though still remaining within the realm of low to moderate wear. The average wear score by tooth type for those teeth that show parafunctional chipping and spalling is presented in Figure 5-6. For each tooth type, the average scores denote that a moderate level of enamel has been removed, exposing a moderate amount of dentin. With respect to incisors and canines the dentin exposure no longer resembles a line. For premolars dentin exposure is on at least one cusp, and for

molars dentin exposure is minimal. The cause of the enamel chipping and spalling unclear. Perhaps the teeth were used as tools, though it cannot be ruled out that it was caused by parafunctional bruxism due to anxiety, stress, mental illness, or medication. It is interesting to note that, other than molar wear (which is slightly higher) the average wear scores for those with chipped teeth are very similar to the average wear scores for the sample as a whole.



Figure 5-5. Burial 60E (27-37 year old male) showing parafunctional wear on lingual surfaces of maxillary teeth.

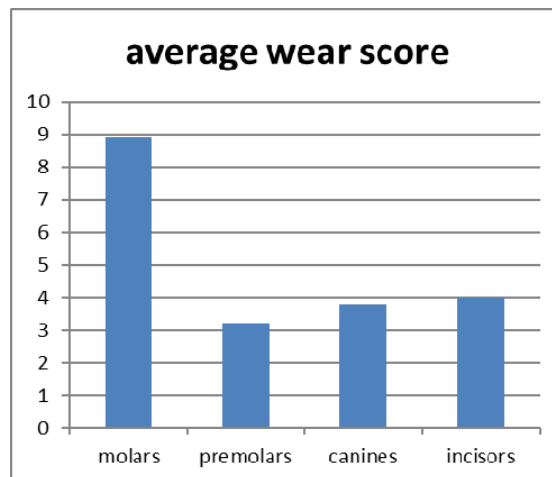


Figure 5-6. Average wear score by tooth type for individuals with chipped teeth.

One individual (Burial 60E) exhibits parafunctional wear patterns, in the form of extremely heavy sloped wear on the lingual crowns of maxillary premolars, canines, and incisors, that does not correspond to wear on the mandibular teeth (Figure 5-5). The wear is very smooth, polished and rounded, and uniformly sloped from the cement-enamel junction (CEJ) to the incisal edges across the lingual surfaces. The wear is not sharp and angular as seen in tooth-to-tooth wear and no chipping was noted. Also, the dentin exposed is a dark brown color, though the enamel and roots show no unusual coloring. Possibly a soft material (perhaps leather) may have been inserted into the mouth, then pulled with pressure applied to upper lingual crowns to cause these smooth, polished, rounded, uniform wear patterns of the maxillary anterior teeth.

Caries

Dental caries are the destruction of enamel and dentin resulting from the production of acid by bacteria in the mouth. The acid decalcifies mineralized tooth structures, and if left untreated, leads to a cavity in the tooth. Caries require four factors to be present in order for decay to occur: a susceptible tooth; the presence of microorganisms; a suitable environment in which the microorganisms can survive and multiply; and time (Spolsky et al. 1983). Tooth decay is a slow, chronic process and it takes an average of about 18 months for the process to develop into outright clinical caries (Parfitt 1956 in Spolsky et al. 1983). Molars are typically the most vulnerable to develop caries due to their more complex anatomy. The National Center for Health Statistics (NCHS) conducts periodic surveys of nutrition and health. A series conducted between 1967 and 1981 reveals that virtually no one escapes dental caries. Their results show that only 1.3 percent of their survey participants had a full set of 32 permanent teeth and no fillings. Fifty-five percent of the adult sample had 18 or more decayed-missing-or-filled teeth (DMFT) (Spolsky et al. 1983). In archaeological samples, a high proportion of caries is typically associated with a diet high in carbohydrates and sugars, as opposed to the diet consumed by hunter-gatherers.

In the Eastern State Hospital sample, 138 individuals retained at least one or more teeth observable for the presence of carious lesions (Figure 5-7). Of these, only 16 (11.6 percent) individuals had no presence of caries prior to death. A total of 2,144 carious lesions was recorded within the Eastern State Hospital skeletal sample, though 742 of these are root surface caries, many of which had not developed into cavernous lesions that had significantly eroded the tooth enamel or dentin. Nevertheless, the presence of these lesions indicates poor dental health and at least some exposure of the root below the cement-enamel junction, which is a sign of periodontal disease (Hillson 1996). In addition, 83 crowns had large carious lesions that had eroded at least half of the enamel crown (Figure 5-8), and 347 teeth had been lost pre-mortem (i.e., the tooth was missing completely though the alveolar socket was present and showed signs of resorption) (Figure 5.9). Of the 2,611 teeth available for observation of carious lesions, 1,462 (56.0 percent) had at least one carious lesion. Assuming that the teeth lost pre-mortem were due to caries (n=322), this number increases to 61.0 percent. However, this is tenuous as not all individuals retained alveolar bone in order to make the assessment that the

tooth/teeth had been lost pre-mortem. Powell (1985) states that the majority of pre-mortem tooth loss in modern populations is caused by severe caries.

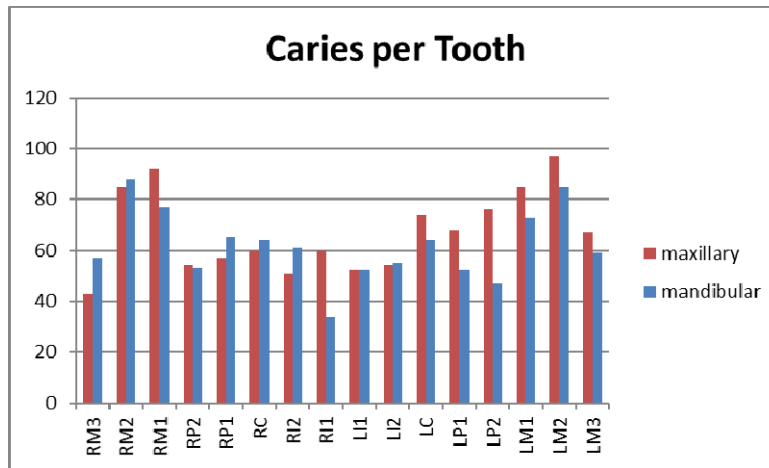


Figure 5-7. Caries by tooth type.

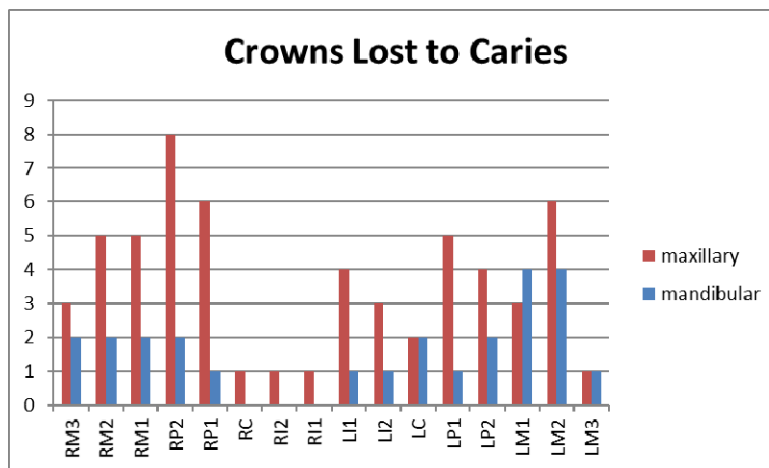


Figure 5-8. Crowns lost to carious lesions by tooth type.

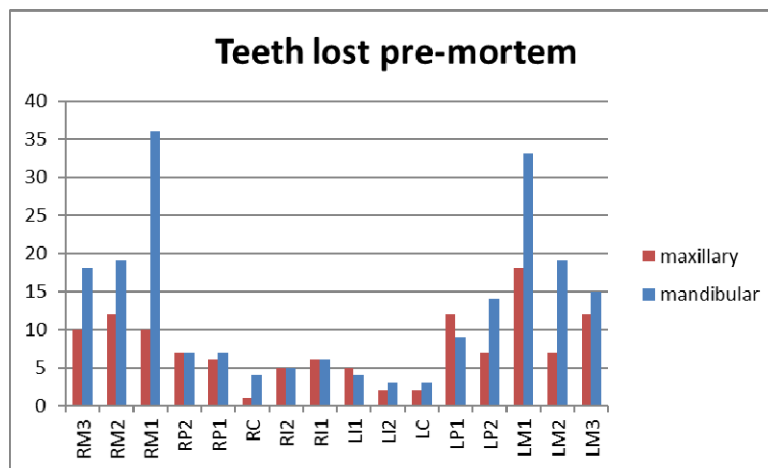


Figure 5-9. Teeth lost pre-mortem by tooth type.

Also noted were eight individuals with either gold or grey metal amalgam fillings (Table 5-7). Gold fillings with archaeological samples are apparently quite rare. Little et al. (1992) report an “unprecedented” amount of gold fillings at the Weir Family Cemetery in Manassas, Virginia. Of the 197 teeth they examined, 35 had carious lesions; 19 (54.3 percent) of which had gold fillings. Their study included a review of over 6,000 teeth from other historic cemeteries dating from 1814 to 1927 where only a single tooth (one at the Oneida County Poorhouse) had a gold filling (Little et al. 1992). Little et al. (1992; see also Strezewski 2003) suggested that only the wealthy could afford dental care, including fillings. Within the Eastern State Hospital sample, seven individuals had gold and one had amalgam fillings (Table 5-7), with two individuals possessing both gold and amalgam fillings. It is interesting to note that three of these individuals were recovered within the grave shaft that contained Burials 51A, 51B, and 51C. All individuals with dental work were males.

Table 5-7. Gold and Amalgam Fillings.

Burial No.	Amalgam	Gold
15A	2	0
20A	0	1
39C	0	2
46A	0	6
51A	0	2
51B	0	4
51C	3	1
63B	2	6

Abscesses

Abscesses result following the necrosis of the dental pulp cavity, which then drains irritants and bacteria through the root canal into the tooth socket (Figure 5-10). In acute cases, there typically is no immediate alveolar bone resorption, though in chronic abscesses the extended period of drainage causes a reaction in the periodontal tissues adjacent to the apical foramen and bone resorption. The presence or absence of abscesses was recorded according to *Standards* for the Eastern State Hospital sample. Hillson (1996) suggests caution in the identification of periapical abscesses because the thin plate of cortical bone overlying tooth sockets may break away in a burial—mimicking the presence of a fistula. In the Eastern State Hospital sample, most abscesses identified retained at least one tooth with a large carious lesion(s) present in the associated alveolar socket.

Calculus

Calculus is mineralized plaque—essentially mucus, bacteria, food, etc.—that adheres to the surface of the teeth. Heavy calculus buildup is typically found near the salivary duct openings near the mandibular incisors and maxillary molars. The bacteria in calculus leads to inflammation of the periodontal tissues, and can lead to weakened attachments between the periodontal ligaments and the tooth, and significant alveolar bone loss (Hillson 1996). Heavy plaque and calculus is typically associated with poor

oral hygiene or consumption of a diet high in carbohydrates and sugar. While comparisons of calculus deposits between population samples can give a general idea of overall dental hygiene, these comparisons should be made with caution, as different environmental conditions (e.g., soil type and acidity) can lead to variable calculus preservation (Boyadjian et al. 2007). Calculus was recorded for the Eastern State Hospital sample according to *Standards* as slight, moderate, or considerable. Within this sample, only 19.0 percent had no calculus present. Of the remaining dentition, 48.0 percent had slight, 29.0 percent moderate, and 6.0 percent considerable calculus (Figure 5.11). These percentages differ somewhat from those observed at the Old Frankfort Cemetery, where 31.0 percent showed slight buildup, 37.0 percent showed moderate, and 13.0 percent had considerable calculus present.

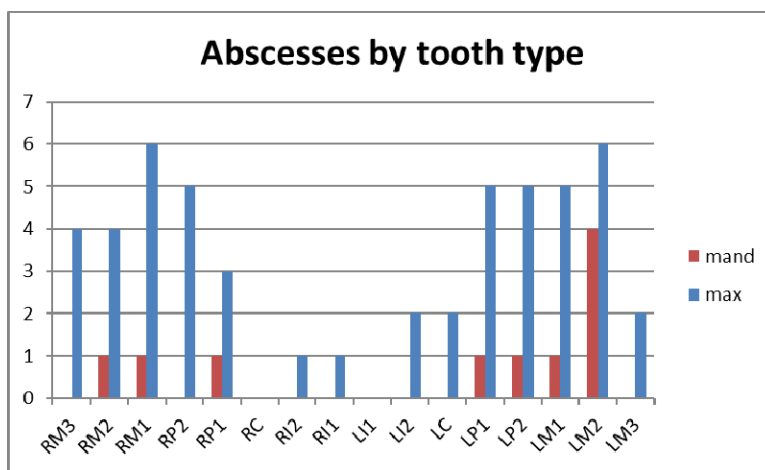


Figure 5-10. Abscesses by tooth type.



Figure 5-11. Heavy calculus on Burial 29D mandibular molars.

Enamel Hypoplasias

Enamel hypoplasias are visible defects in tooth enamel that have been associated with malnutrition, disease, and childhood stress. Their presence or absence has been used to assess the nutritional state of a population (Chavez and Martinez 1982; El-Najjar et al. 1978; Goodman et al. 1980; Goodman and Rose 1990, 1991; Goodman et al. 1989; Solomons and Keusch 1981). The defects are the result of a temporary disturbance in amelogenesis that results in deficiencies in the amount or thickness of enamel deposited during the stress episode. These visible markers can manifest as single or multiple pits, narrow or wide troughs, or areas of entirely missing enamel. They are quantitative defects as opposed to enamel opacities, which are qualitative defects. Opacities involve changes in color and opacity of enamel—not its amount or thickness (Federation Dentaire International 1982). As enamel does not remodel once it is formed, enamel hypoplasias are relatively permanent markers left on the tooth crown that can be measured and used to interpret the general health of a population. Though enamel hypoplasias cannot be attributed to a specific pathological condition or nutritional deficiency, they can be used as an indicator of developmental disturbances caused by some sort of metabolic stress. The locations of these defects can then be measured to obtain a relatively accurate estimate of the age of the individual at the time of the stress. Due to the regular and ring-like deposition, and the permanent non-regenerative nature of human enamel, measurements of enamel hypoplasias can be placed into regression equations to calculate the age of the individual at the time of the disturbance (Goodman and Rose 1990).

Previous research of enamel hypoplasias indicates that the maxillary and mandibular incisors, and canines are the most frequently hypoplastic, and further, that if defects are manifest on the posterior teeth, they are typically concurrent with those present on the anterior (Goodman et al. 1980; Goodman and Armelagos 1985; Goodman et al. 1989; Goodman and Rose 1991; Hodges 1987; Hutchinson and Larsen 1988; Lanphear 1990; Van Gerven et al. 1990). It is also suggested that only teeth with *Standards* wear scores of “2” or lower be included in statistical analyses, as more wear could have removed hypoplasias near the tooth crown (Buikstra and Ubelaker 1994).

Though all teeth were examined for enamel hypoplasias and their presence or absence was recorded, only the maxillary and mandibular incisors and canines with wear scores of “2” or lower were included in the statistical analyses of the Eastern State Hospital sample. Hypoplasias were scored on the labial surface of each tooth by use of digital sliding calipers to the nearest 0.01 mm. Defects were recorded according to *Standards* as linear horizontal grooves, linear vertical grooves, linear horizontal pits, non-linear arrays of pits, and single pits. Color was recorded as well. All defects recorded are considered as a single class of defect in the statistical analyses.

The calculation for the age at onset of enamel hypoplasias for the Eastern State Hospital sample was based on the method presented by Goodman and Rose (1990); modified from Swardstedt (1966), using the developmental sequence of Massler et al. (1941). In this method, the age of onset of enamel hypoplasias is calculated using regression equations incorporating the maximum crown height and the ages of enamel

formation based on Massler et al. (1941) (Table 5-8). This regression analysis assumes enamel formation occurs at a constant velocity, as recommended by Goodman and Rose (1990, 1991). The following regression equation was employed:

$$\text{Age at formation} = \frac{\text{age at crown completion} - \text{years of formation}}{\text{Of defect crown height}} \times \text{defect height from CEJ}$$

Table 5-8. Permanent Tooth Crown Formation Times (Massler et al. 1941).

Tooth	Year formation begins	Year formation ends	Years of formation
Maxillary			
C	0.0	6.0	6.0
I2	1.0	4.5	3.5
I1	0.0	4.5	4.5
Mandibular			
C	0.5	6.5	6.0
I2	0.0	4.0	4.0
I1	0.0	4.0	4.0

Of the 142 individuals with oral hard tissues present, 135 retained one or more measurable teeth with 131 of these individuals retaining observable enamel that could be measured for hypoplasias. Of these, only four individuals were observed to have no hypoplasias, though two of these retained only one tooth and wear scores were “3” or higher. In addition, in several cases crown height, wear, or poor preservation made it impossible to determine if enamel hypoplasias were present.

Within the Eastern State Hospital sample, only 34 individuals retained maxillary or mandibular canines and incisors with wear scores of “2” or lower for use in the calculation of age at onset of hypoplasias. Of these, only one individual had no enamel hypoplasias present. The 34 individuals were further subdivided into groups by sex based upon the skeletal analyses (Table 5-9 and 5-10; Figures 5-12 and 5-13).

Table 5-9. Sex categories based on Skeletal Analyses.

Females		Males		Indeterminate	
Burial #	Sex	Burial #	Sex	Burial #	Sex
15D	MLF	15A	MLM	17	INDET
16B	MLF	27	MLM	34	
18A	MLF	28	DM	35	
18B	MLF	30	DM	56A	
19C	MLF	32	DM		
20B	DF	37A	MLM		
24A	DF	55D	MLM		
36F	MLF	57A	MLM		
38B	MLF	63B	MLM		
43B	MLF	64A	DM		
53A	MLF	66B	MLM		
55B	PF	66C	MLM		
59A	MLF	68H	PM		
59D	MLF				
60B	DF				
62	MLF				

Table 5-10. Comparison of Enamel Hypoplasias by Sex.

	UI1			UI2			UC			LI1			LI2			LC		
	# teeth	# EH recorded	Average # defects/tooth	# teeth	# EH recorded	Average # defects/tooth	# teeth	# EH recorded	Average # defects/tooth	# teeth	# EH recorded	Average # defects/tooth	# teeth	# EH recorded	Average # defects/tooth	# teeth	# EH recorded	Average # defects/tooth
Females	4	15	0.9	6	19	1.1	9	37	2.2	8	28	1.7	8	39	2.3	10	51	3.0
Males	1	1	0.1	7	46	3.5	8	35	2.7	2	7	0.5	4	17	1.3	3	20	1.5
Indeterminate	2	11	2.8	0	0	0	2	15	3.8	2	4	1.0	1	4	1.0	2	14	3.5

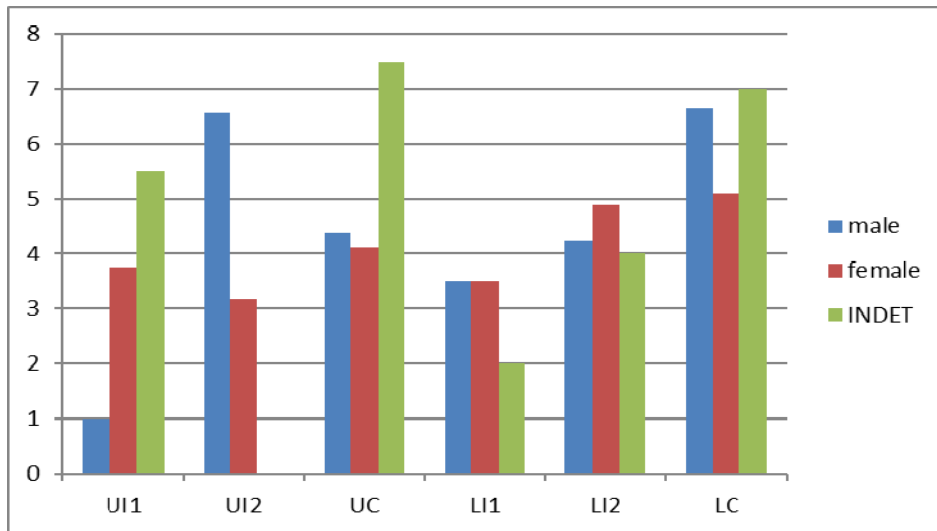


Figure 5-12. Average number of enamel hypoplasias per tooth type.

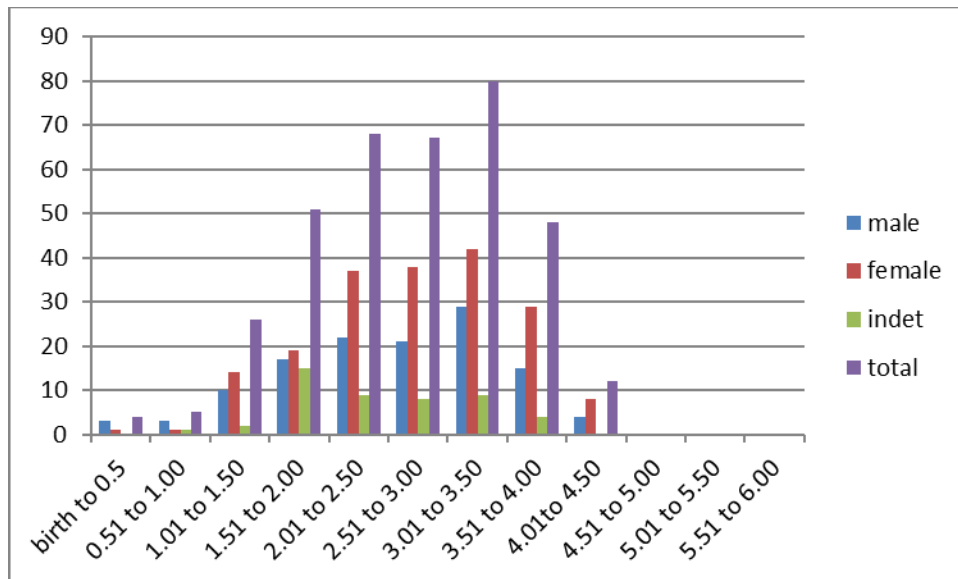


Figure 5-13. Cumulative number of hypoplasias per tooth type according to age at onset for the Eastern State Hospital sample.

Though the sample is small due to poor preservation, high wear on the anterior dentition and loss of enamel due to caries, within the Eastern State Hospital sample the onset of hypoplasias peaked at 3.01 to 3.50 years of age (Figure 5-3). These results are consistent with other nineteenth century samples (Buchner et al. 1999; Goodman 1988; King 2006). It is generally accepted that a peak of hypoplasia occurrence between approximately 2 and 4 years of age is associated with the stresses of weaning. Although weaning is typically a gradual shift from breast feeding to solid foods, it is considered to be the most dramatic nutritional transition of childhood and likely has a strong influence on the presence of hypoplastic defects.

DISCUSSION

The Eastern State Hospital dental analyses are suggestive of a population with very poor oral health. Caries and calculus affected over eighty percent of the sample, fifty percent of the sample had lost one or more teeth prior to death, and nearly thirty percent had one or more abscess (Table 5-). Males and females were nearly equally affected by dental diseases, except with respect to abscesses where 43.2 percent of males had one or more abscesses compared to only 25.0 percent of females. In addition, 97.0 percent of the sample had one or more enamel hypoplasias. Of note was the presence of fillings in the teeth of eight individuals. Such dental work is unusual in mid-nineteenth century samples and speaks to the wealth of these individuals prior to their admittance to the hospital, or suggests that the hospital employed a dentist.

Table 5-11. Dental Health of the Eastern State Hospital Sample.

	Caries	Calculus	Pre-mortem tooth loss	Abscesses
2011 Sample				
Females	91.7%	91.7%	58.3%	25.0%
Males	100.0%	88.9%	57.1%	43.2%
Summary	88.4%	81.9%	49.3%	28.1%
2006 Sample				
Females	100.0%	nd	nd	16.7%
Males	40.0%	nd	nd	20.0%
Summary	73.0%	nd	nd	28.6%*
*The 2006 examination reported 2 of 11 individuals as having one or more abscess present (18.2 percent), four of the 11 individuals were recorded as having 25.0 percent or less alveolar bone present. Alveolar bone must be present in order to record abscesses and if this is taken into consideration, the number of individuals observable for the presence of abscesses is reduced to 7—placing the percent affected at 28.6 percent.				

Within central Kentucky, interments from the Horse Park Cemetery (ca. 1800 to 1860) (Pollack et al. 2011) and Old Frankfort Cemetery (ca. 1810 to 1860) (King 2006; Pollack et al. 2009) are comparable to those documented at Eastern State Hospital. The 23 individuals examined from the Horse Park Cemetery were adults/adolescents of European American or African American descent. Although the percentage of individuals exhibiting one or more carious lesion was not reported, “almost all had one or more carious lesion” (Killoran and Dabbs 2011:56). Within this sample, 56.5 percent of

the individuals were observed to have lost at least one or more teeth prior to death, which is just slightly higher than the 49.3 percent observed for the Eastern State Hospital sample. On the other hand, only 13.0 percent had one or more abscess compared to 28.1 percent of the individuals in the Eastern State Hospital sample, and only two individuals were observed to have enamel hypoplasias. At the Horse Park Cemetery, the high frequency of pre-mortem tooth loss was attributed to a high caries rate and a diet of carious foods (Killoran and Dabbs 2011). In addition, a high grit diet would have resulted in the moderate to severe wear observed for six individuals in the Horse Park sample. Comparative parafunctional attrition and calculus data are not available for the Horse Park sample.

Results from the Old Frankfort Cemetery are similar to that of Eastern State Hospital—high caries rates (67.7 percent having at least one tooth with one or more carious lesion) and pre-mortem tooth loss (48.5 percent having lost one or more teeth prior to death). Though, again, abscess rates at Eastern State Hospital are higher (28.0 percent compared to 18.5 percent at the Old Frankfort Cemetery). On the other hand, the Old Frankfort Cemetery sample had a much higher percentage of individuals with moderate or severe calculus buildup (37.0 and 13.0 percent, respectively, compared to 29.0 and 6.0 percent, respectively, at Eastern State Hospital). In addition, while almost half of the individuals in the Eastern State Hospital sample had low calculus scores, only a third of those interred at the Old Frankfort Cemetery scored low for this condition. The percent of individuals with no calculus within each sample, was relatively similar (17.0 percent at Eastern State Hospital and 19.0 percent at the Old Frankfort Cemetery).

The observed inter-cemetery occurrences of calculus buildup may be attributable to preservation conditions, which were much better at the Old Frankfort Cemetery relative the Eastern State Hospital Cemetery, rather than different diets and oral hygiene practices. If, however, they are attributable to diet, it is possible though that the foods consumed by those interred at the Old Frankfort Cemetery contained larger amounts of carbohydrates (Brown 1975) and protein—both of which are conducive to calculus build up (Scott and Poulson 2012), while the individuals at the Eastern State Hospital may have been fed a more abrasive diet, which is associated with lower calculus accumulation (Mays 1998:152). If the latter were the case, lower calculus scores would be assumed to be accompanied by higher wear scores, which was not the case. Average wear scores for both samples are within the low to moderate range for each tooth type. Overall wear patterns for both samples are essentially typical of historic populations that consumed soft, grit-free foods, with the exception of the parafunctional wear observed in the Eastern State Hospital sample. Thus, it is more likely the observed inter-cemetery variation in calculus buildup is a result of differential preservation conditions rather than different diets. The chipping and spalling of primarily anterior teeth was not observed within the Old Frankfort Cemetery sample. The percentage of the populations that were affected by linear enamel hypoplasias is also similar, indicating both groups were exposed to chronic malnutrition and disease.

Interregional Comparison

In general, caries, calculus, tooth loss, and abscess rates within the Eastern State Hospital sample are higher than has been documented for nineteenth century cemetery in other regions. For instance, Little et al. (1992) compared 12 nineteenth century skeletal samples and found that caries rates ranged from 4.6 to 25.5 percent of teeth affected; with the highest percentage being found on teeth from a European American, rural, poor sample from the Oneida County Poorhouse in upstate New York (Little et al. 1992:408).

Other research has shown similar results. Sutter (1995) compared percentages of caries, pre-mortem tooth loss, and diseased/missing teeth indexes from several nineteenth century cemeteries in the United States and England, including the Highland Park Cemetery and Monroe County Almshouse in upstate New York (Higgins and Sirianni 1995; Higgins et al. 2002); pre-1850 interments from Ashton-under-Lyne Graveyard (British I) (Moore and Corbett 1975); post-1850 Ashton-under-Lyne Cemetery interments (Corbett and Moore 1976); the South Carolina Plantation Cemetery (Rathbun 1987); and the remains of Civil War Soldiers (Sledzik and Moore-Jansen 1990). Caries rates, percent of the sample affected by calculus, and pre-mortem tooth loss observed in the Eastern State Hospital sample is more than double those recorded for the Highland Park Cemetery/Monroe County Almshouse (Higgins et al. 2002). In addition, abscesses were much more prevalent with Eastern State Hospital sample relative to the Highland Park Cemetery/Monroe County Almshouse sample (Figure 5-). Relative to the other samples included in Sutter's study, caries rates, total number of abscesses, pre-mortem tooth loss, and presence of calculus also are much higher in the Eastern State Hospital sample.

Data reported from other nineteenth century cemeteries, such as the Ridley Graveyard in Tennessee; the Eddy and Becky Wight Cemeteries in Texas; a potter's field in Cincinnati, Ohio; and Cedar Grove in Arkansas are comparable as well, though all but the potter's field date to second half of the nineteenth century (and in two cases, into the early to mid-twentieth century) (Buchner et al. 1999; Mainfort and Davidson 2006; Murray and Perzigian 1995; Rose 1985). The Ridley Graveyard and Cedar Grove Cemetery were African American burial grounds used from ca. 1885 to 1940 and 1890 to 1927, respectively (Buchner et al. 1999; Rose 1985). Eddy and Becky Wight were two small, rural late nineteenth century European American cemeteries (Mainfort and Davidson 2006). The potter's field sample is from a public burying ground dating from around 1818 to 1837 that was located in downtown Cincinnati (Murray and Perzigian 1995). Again, the percent of the Eastern State Hospital sample affected by caries and abscesses is higher than was documented at these cemeteries, though the Cedar Grove sample exhibited a higher percentage of individuals who experienced pre-mortem tooth loss (Figure 5-14).

In each of the above referenced studies, the caries rates, calculus, and pre-mortem tooth loss was attributed to diets high in carbohydrates and sugars (Corbett and Moore 1976; Rathbun 1987; Sledzik and Moore-Jansen 1991). Though high caries and pre-mortem tooth loss rates at Eastern State Hospital also can be attributed to diet, the Eastern

State Hospital sample has a much higher rate of abscesses in comparison to each. It is highly unlikely that the foods consumed by the residents at Eastern State Hospital were so vastly different than what those interred in other nineteenth century cemeteries ate, that it resulted in more abscesses. Thus, it appears some other factor(s) may have been at play.

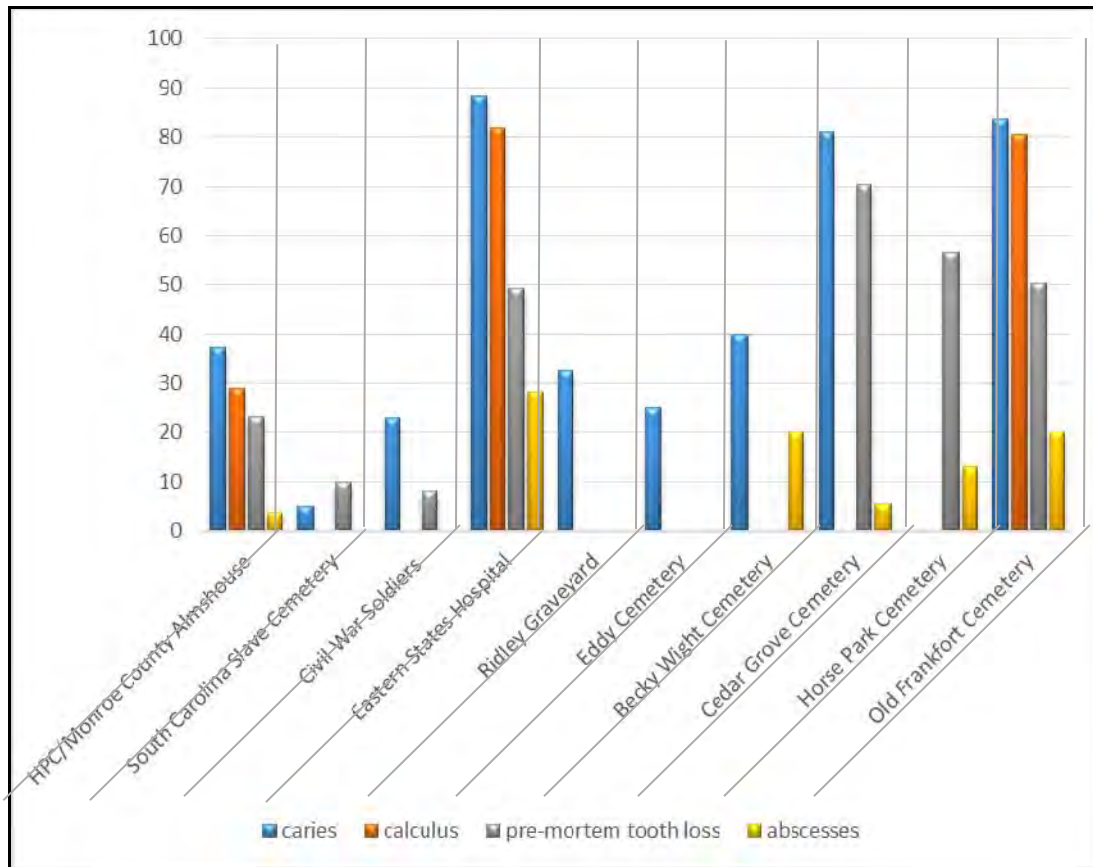


Figure 5-14. Comparison of Eastern State Hospital to other nineteenth century populations.

Calomel and Mercury Poisoning

A sample that has caries rates similar to that of the Eastern State Hospital sample was recovered from the Cross Cemetery in Springfield, Illinois. This cemetery was in use by the Cross family and close relatives from approximately 1829 to 1849 (Larsen et al. 1995). Of the 29 graves excavated, 11 were adults; (six females and five males) with a mean age at death of 32.1. Limited economic means were indicated by the simple burials and the result of the skeletal analyses suggested they lived physically demanding lives. Relative to the Eastern State Hospital sample, based on δC^{13} (-11.3‰ to -14.1‰ [n=8], -16.2‰ [n=1], -19.4‰ [n=1]) values a much higher percentage of Cross Cemetery burial sample (80.0 percent compared to 25.3 percent) consumed a high corn-based diet (Larsen et al. 1995).

Though abscess data is not available for the Cross Family Cemetery sample, as with the Eastern State Hospital sample, the Cross family cemetery adults have a high caries rate (19.6 percent) as well as a high rate of pre-mortem tooth loss (25.6 percent) (Figure 5-15). In Addition, parafunctional habits are indicated by step fractures on the anterior teeth of 27.2 percent of the sample (comparable to 31.4 percent of the Eastern State Hospital sample). And another similar abnormal wear pattern was observed on two older males who “exhibit considerably greater wear on the maxillary anterior teeth than on the mandibular anterior teeth” (Larsen et al. 1995:150). This abnormal wear pattern appears similar to that observed for Burial 60E (see Figure 5-5). Larsen et al. (1995:150) suggested this anomalous wear could have been caused by the use of the anterior maxillary teeth as tools, perhaps “to grip or pull leather on a frequent basis.” It is unclear what type of activity caused the chipping and spalling of enamel on the anterior dentition of the Cross Cemetery sample, though Larsen et al. (1995:150) state that “the pattern is highly suggestive of use of the front teeth in activities resulting in severe trauma.”

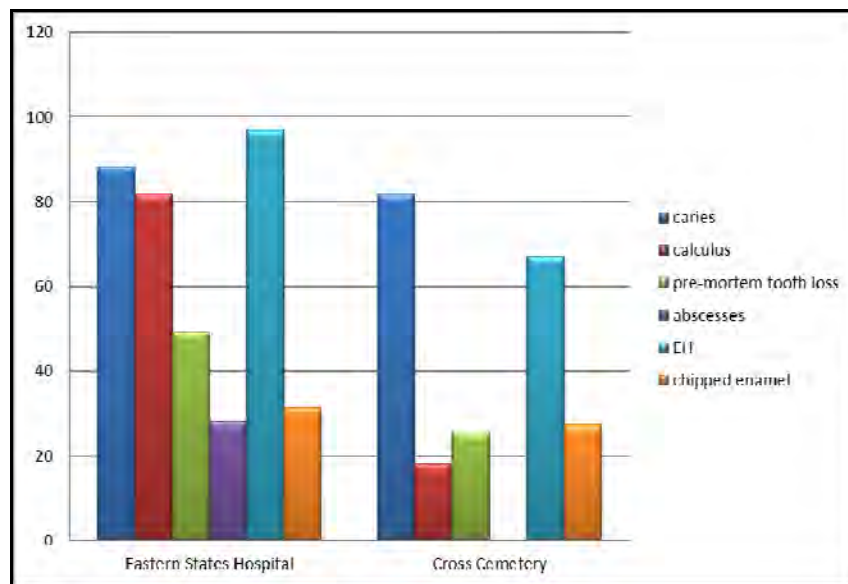


Figure 5-15. Comparison of the Cross Cemetery and Eastern State Hospital samples.

What aspects of the Cross family’s lifestyle could possibly have led to high caries, pre-mortem tooth loss, and anomalous wear patterns on the anterior teeth, similar to that documented at Eastern State Hospital? The enamel hypoplasia data from the Cross Cemetery shows a similar peak at occurrence, though lower in frequency than that of Eastern State Hospital. Cribra Orbitalia was observed in 18.0 percent of the adults (these lesions were noted on 6.3 percent of the Eastern State Hospital sample, see Chapter Four), though in each case the lesions were well-healed, indicating the episodes of anemia had occurred much earlier than when the individuals died. So again, what could these hard working pioneers have in common with the residents of a mental institution?

Larsen et al. (1995) provide some possible insight in their research into the health and lifeways of Illinois pioneers. During the 1830s, Sagamon County experienced some

of its heaviest settlement despite severe climactic events, such as the “Winter of the Deep Snow” when three feet of snow fell in December of 1830—resulting in a great number of people dying due to exposure and starvation. This was followed by paralyzing cold, tornados, hail and wind storms, oppressive heat, and rain causing further deaths and destruction of crops of wheat and corn (Larsen et al. 1995:143). However, most deaths on the Illinois frontier were attributed to diseases (e.g., pneumonia, tuberculosis, and intestinal disorders). Typhoid fever was common in the late summer and fall. Then in 1832, Asiatic cholera entered the area. This was followed by cholera outbreaks in 1849 and 1850. (The same epidemics also had a devastating effect on Eastern State Hospital.) Archival research revealed that the Cross family solicited the services of Dr. George Ambrose for one of their children on several occasions in 1848 and that Margaret Cross was treated again in mid-February of 1849. By the next month, Alvin Cross became severely ill and died. Examination of fragments of gravestones, revealed that Alvin Cross and two of his daughters (Lavinia Cross Williams and Mary Ann Cross Mitchel) were interred at the cemetery. Mary Ann Cross died in 1846, and Lavinia and Alvin passed in 1849 (Craig and Larsen 1993).

Though it is unclear as to what illnesses Dr. Ambrose was summoned to treat, the cholera epidemics of 1849 and 1850 could very well have been the reason. During the nineteenth century, physicians practiced “heroic” or “orthodox” medicine; employing the use of mineral medicines to purge the body of what ailed it. By 1844, “the most common method of treatment at the time was a combination of bleeding, calomel (mercurous chloride), and mineral medicines” (Coulter 1982:59). Mitchell (1850:22) quoted a fellow physician as saying, “Bile to cause, and calomel to cure, everything.” The method became known as Benjamin Rush’s “Heroic Dose” of medicine.

Although many physicians disagreed with Rush and considered the methods of bleeding and purging to be quite barbaric, Rush and his students believed these methods to be the best and most helpful measures to cure sickness. He also believed that it was not problematic if a patient did not salivate (known to be an indication of mercury poisoning) and that one could continue to administer the calomel until salivation occurred (Coulter 1982). He considered calomel to be indispensable for any and all ailments. The doses of calomel during Rush’s time were at least 6-10 grains, the equivalent to 389-650 milligrams of mercury. The Environmental Protection Agency’s current safe limits of mercury are two parts per billion of drinking water and one part methylmercury per million of seafood, and suggests a reference dose of 0.1 microgram per kilogram of body weight per day as acceptable exposure that is “likely to be without an appreciable risk of deleterious effects during a lifetime” (Environmental Protection Agency 2013). By today’s standards, those given calomel during Rush’s time were exposed to around 4,000 times this amount. Even after Rush’s death in the early 1800s, calomel was given in even higher doses than he had prescribed and remained a popular treatment for many ailments, such as cholera and syphilis, throughout the early to mid-nineteenth century.

A popular medicine known as “Blue Mass Pills,” were given freely as an antidepressant in the 1800s. A 2010 study by the Royal Society of Chemistry analyzed pills that were found in a mid-Victorian medicine chest that is part of the Park Pharmacy

Trust collection housed at a Devon Museum (Royal Society of Chemistry 2010). Results showed that mercury comprised an astonishing 33.6 ± 0.3 percent of each the pill. Though the use of calomel on syphilis patients did appear to help, the treatment only masked the physical lesions caused by the disease. Towards the end of the nineteenth century and into the twentieth, thousands of people were institutionalized with the mental illness that accompanies the tertiary stage of syphilis, despite, or perhaps because of, treatment with calomel.

The etiology of how calomel and mercury poisoning affects the oral cavity remains unclear. Historic accounts claim that calomel caused caries of the jaw, tooth loss, and oral pain (Scudder 1870, cited in Coulter 1982:72-73). In *Coulter's Divided Legacy, Volume III* he notes:

Calomel was well known to cause deterioration of the teeth, and Higginson [1861 *citation not known italics added*] states: "Perhaps the most universal symptom of this physical decay was the condition of America's teeth; one seldom talked to a dentist, it was affirmed, who did not despair of the republic." It is probably true that the toothlessness of many Americans was due to the doses of calomel they received from infancy, and this medication was doubtless responsible also for many of the other ills described. Even after small doses for a longer period of time—say, six months—the gums would be swollen, eating painful, and teeth loose, if they had not already fallen out.

It was not until after the Civil War that excess salivation was widely recognized as a sign of mercurial poisoning. Some patients were able to recover from their illnesses or poisoning, though many lost teeth, oral-facial muscle, or alveolar bone in the process.

John M. Scudder, a prominent practitioner of eclectic medicine in the mid-nineteenth century, described some of the effects he observed in patients who continued to receive "heroic" doses of calomel even after the onset of swollen gums and salivation. Scudder (as cited by Rothstein 1972:51) states:

The mouth feels unusually hot, and is sometimes sensible of a coppery or metallic taste; the gums are swollen, red, and tender; ulcers make their appearance and spread in all directions; the saliva is thick and stringy, and has that peculiar, offensive odor characteristic of mercurial disease; the tongue is swollen and stiff, and there is some fever, with derangement of the secretions. The disease progressing, it destroys every part that it touches, until the lips, the cheeks, and even the bones have been eaten away before death comes to the sufferer's relief.

And further that:

..when a person has taken a toxic dose of calomel, not only do the teeth then become loose, rot, and fall out, but the jaw bones begin to disintegrate in flakes and layers. Parts of the mouth, tongue and palate

could also rot away, and in this state one existed for the rest of one's life—provided one actually survived both the disease and the therapy (Rothstein 1972:51).

A photograph on display at the National Museum of Civil War Medicine in Frederick, Maryland shows the horrific effect of calomel/mercury poisoning on Mr. Carlton Burgan, a Union soldier (Figure 5-16). The photograph dates to 1862, when Mr. Burgan was 18 years old, after he was treated with calomel for pneumonia (Eggleston 2012).



Figure 5-16. Loss of maxillary alveolar bone and teeth attributed to calomel poisoning. Photo courtesy of the National Museum of Civil War Medicine.

Eastern State Hospital is known to have employed Benjamin Rush's "Heroic Dose" of Medicine in the early to mid-nineteenth century (White 1984), and as previously noted the Cross family solicited the services of Dr. George Ambrose during a large cholera epidemic. Though Dr. Ambrose's medical practices will never be known, perhaps this is the connection (however loose) between the two burial samples: members of both may have been subjected to medical treatment that likely consisted of ingestion of calomel. Though the etiology of how calomel and mercury poisoning affects the oral cavity remains unclear, perhaps the high percentage of individuals with caries, pre-mortem tooth loss, and anomalous wear in the Cross Cemetery and the Eastern State Hospital samples, and the high rate of abscesses in the Eastern State Hospital sample (Figure 5-), are related to these medical practices. The "caries of the jaw" described by

Coulter (1982) and Scudder (1870) could well be describing abscesses and loss of alveolar bone (and teeth) due to calomel treatments.

The anomalous wear on the anterior teeth of both samples also is intriguing, though the cause(s) remain unclear. No other archaeological samples exhibiting this anomalous fracturing of the anterior teeth was found during the literature review. Perhaps examination of samples similar to Eastern State Hospital for this specific attribute will shed more light on the matter.

SUMMARY

The dental analyses is suggestive of a burial sample that had very poor oral health. Caries and calculus affected over eighty percent of the sample; more than fifty percent had lost one or more teeth prior to death; almost thirty percent had one or more abscess, and nearly everyone had one or more enamel hypoplasia. Males and females were equally affected by dental diseases, except in the case of abscesses where males tend to have more relative to females. The association of fillings with eight individuals is unusual for a mid-nineteenth century sample and may speak to the wealth of some individuals prior to their admittance to the hospital. It also could indicate that the hospital employed a dentist, or perhaps dental students trained on some of the patients. Since three of the individual with fillings died at about the same time, one can not help but wonder if the dental students practiced on cadavers.

Dental attrition in the sample initially appears typical of a nineteenth century population consuming soft, grit-free foods, however, parafunctional activity is indicated by the association of chipped and spalled enamel (primarily on the anterior teeth) with more than thirty percent of the individuals interred with the Eastern State Hospital Cemetery. It is unclear what action or activity caused this atypical pattern. Perhaps the teeth were used as tools, though other causes may have been medication, anxiety, stress, or mental illness.

In comparison to other archaeological cemetery samples, with the possible exception of the Cross Family Cemetery, the Eastern State Hospital sample stands apart with its high percentage of individuals with abscesses and parafunctional wear patterns. Currently, parafunctional wear is not included in *Standards* as an attribute to be recorded and may be overlooked in many archaeological samples. It is unclear at this point what caused the high abscess and parafunctional wear rates in the Eastern State Hospital sample, though the administration of calomel to the patients is a potential culprit. Additional research into the effects of calomel and the etiology of anterior tooth chipping is much needed, and may shed additional light on the lives of those interred in the Eastern State Hospital Cemetery.

CHAPTER SIX ISOTOPIC ANALYSIS

By
Emily Rinker
and
Christopher Romanek

INTRODUCTION

Carbon and nitrogen isotope ratios extracted from bone collagen were obtained from select Eastern State Hospital burials to assess dietary variation within the skeletal sample and provide opportunities to compare the diets of residents at the hospital to contemporaneous samples. Of the 180 individuals in the analyzed sample, isotopic data was obtained for 83 individuals. For the remaining individuals, the skeletal remains were in such poor condition that reliable isotopic data could not be obtained, or broken bones with exposed collagen or collagen that had been saturated with water or soil could not be sampled. Though these conditions resulted in carbon and nitrogen isotope ratios not being obtained for slightly more than fifty percent of the skeletal sample, the resulting data set is still a representative sample of the Eastern State burial population.

Analysis of carbon isotope ratios can provide clues as to the dietary history of an individual based on the carbon signatures from plant food sources consumed over an individual's lifetime (Owsley and Ubelaker 2003; Turner et al. 2005). Likewise, bone collagen nitrogen isotope analysis can distinguish between diets consisting of primarily of terrestrial or marine animal food sources (Schoeninger et al. 1983:1381). Therefore, carbon and nitrogen isotope ratios can be used to examine different diets, which can speak to residential origin or socioeconomic status based on access to food sources in prehistoric or historic populations. In a bioarchaeological context, dietary analyses can provide unique insights into past lifeways, social and economic variability, and the ways in which social identity can affect health. However, isotopic data does not provide direct or comprehensive evidence of individual perceptions of group or individual identity, as many other factors can affect subsistence practices at both the individual and group levels. Isotope analysis is most informative when utilized in conjunction with other techniques, such as mortuary and skeletal analysis, to ensure that interpretations are unique to their specific contexts and communities (Epperson 2004).

CARBON ISOTOPE RATIOS

By measuring carbon isotope ($\delta^{13}\text{C}$) ratios in bone, it is possible to make inferences regarding the kinds of foods that were being consumed at different points in an individual's life. Carbon dioxide in the atmosphere and ocean water is transferred to living things, including humans, following its depletion of ^{13}C between the ocean and the atmosphere. C_3 and C_4 plants use different photosynthetic pathways, which is why their ^{13}C concentrations differ in human bone. The level of ^{13}C concentration in bone can

indicate whether an individual consumed more C₄ plant sources (e.g., maize, sorghum, millet, and sugarcane) or C₃ plant sources (e.g., wheat, barley, and quinoa) (Schoeninger and Moore 1992).

C₃ plants have $\delta^{13}\text{C}$ from -35.0 to -22.0‰ with a mean of -26.5‰ (O’Leary 1981). Potential C₃ edible plants, include wheat, rice, root crops, legumes, vegetables, nuts, honey, and a variety of fruits. Most of these plants are found in temperate regions like Kentucky and the interior of the southeastern United States (Ambrose 1993; Buikstra and Cook 1980). C₄ plants discriminate less against $\delta^{13}\text{C}$ than C₃ plants, thus producing a higher and more enriched $\delta^{13}\text{C}$, ranging from a -15.0 to -10.0‰ with a mean of 12.5‰ (Buikstra and Cook 1980; O’Leary 1981). Potential C₄ plants, include sorghum, millet, maize, and sugar cane (Ambrose 1993). These plants are usually found in dry, hot, and sunny climates; however, maize can be found in less arid environments and still maintain the same isotopic signature (Ambrose 1993). C₃ and C₄ plants are essentially opposites in that they thrive in distinctly different environments (i.e., tropical vs. temperate, mid-latitude summer and winter rainfall zones, low vs. high altitudes). Plants with $\delta^{13}\text{C}$ values ranging from -22.0 and -15.0‰ are food sources that lie between the parameters of C₃ and C₄ foods. Intermediate plant sources possess crassulean-acid metabolism (CAM) photosynthetic pathways (Ambrose and Norr 1993). CAM plants include pineapple, cacti, and orchids, which grow in far more arid climates and would not be accessible to most individuals in the southeastern United States. Therefore, this range of $\delta^{13}\text{C}$ is likely the product of an extremely varied diet.

Carbon-stable isotope ratios obtained on human remains thus represent a compilation of an individual’s diet. A high carbon isotope ratio would be suggestive of a diet high in C₄ plants, and a low ratio a diet high in C₃ plants. A diet consisting of a variety of C₃ and C₄ plants, would be suggestive of a more diverse diet; one that included both kinds of plants. A more diverse diet could reflect a higher economic or social status, but also could serve as an indicator of residential mobility patterns (Ambrose 1993; Buikstra and Cook 1980). The set of $\delta^{13}\text{C}$ values obtained from the Eastern State Hospital sample (Tables 6-1 and 6-2), ranges from -22.6 to -11.5‰, with a mean of 16.2‰ and a standard deviation of 2.0‰. The wide range of $\delta^{13}\text{C}$ values observed in this sample suggests that those interred in the Eastern State Cemetery subsisted on varying degrees of C₄ plants. Some individuals appear to have consumed large amounts of these types of plants, while others had more diverse diets. Their diets would have deemphasized C₄ plants in favor of other crops and proteins. Some individuals appear to have eaten little or no corn-based products. For this analysis, each individual was assigned to one of the following groups: high C₄ plant consumption, mix of C₄ and C₃ plants, and high C₃ plant use.

Some of the dental pathologies observed in the Eastern State Hospital burial sample may be due to a heavy reliance on corn-based products (see Chapter 5). But since many of those individuals who consumed little or no corn-based products also had a large number of caries, the consumption of other foods also may have been contributing factors. Perhaps these individuals consumed foods high in refined sugar, such as molasses, a common and inexpensive ingredient in the southeastern United States.

Table 6-1. $\delta^{13}\text{C}$ ranges of corn consumption.

$\delta^{13}\text{C}$ Range (‰)	Corn Consumption	Total	Percent
-11.50 to -14.99	High consumption	21	25.3
-15.00 to -17.99	Mixed/diverse	43	51.8
-18.00 and less	No consumption	19	22.9

Sex

A comparison of $\delta^{13}\text{C}$ values by sex identified some variation in the consumption of corn based products). Male $\delta^{13}\text{C}$ values range from -11.5 to -19.4‰ with a mean of -15.9‰ (median=-15.9‰) and a standard deviation of 1.8‰. Female $\delta^{13}\text{C}$ values range from -13.9 to -22.6‰ with a mean of -16.9‰ (median=-16.5‰) and a standard deviation of 2.4‰. The average $\delta^{13}\text{C}$ values for males and females are similar, though the values for females are suggestive of somewhat less of a reliance on corn-based products.

Both groups include individuals who consumed large amounts of corn-based products (n=21), those who ate more mixed diets (n=43), and those who consumed little or no corn based products at all (n=19) (Table 6-2). Thus slightly more than fifty percent of those interred within the Eastern State Hospital Cemetery consumed a mixed diet. When plant found consumption by sex was examined, differences were noted in the amounts of C_4 and C_3 plants that were consumed by males and females (Table 6-2). For instances, a higher percentage of males relative to females consumed large amounts of C_4 plants. In comparison, a much higher percentage of females relative to males appear to have consumed primarily C_3 plant foods. In general, the data suggests that males at Eastern State Hospital exhibited a greater tendency to have subsisted on a mixed or corn-based diet over the course of their lives, with females having less of a reliance on corn-based products.

Table 6-2. $\delta^{13}\text{C}$ ratios by Sex Category.

Age Groups	Range	High C_4		Mixed		High C_3		Total	
		Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Male	-11.5‰ to -19.4‰	15	30.0	28	54.9	8	15.7	51	100.0
Female	-13.9‰ to -22.6‰	5	19.2	11	42.3	10	38.5	26	100.0
Indeterminate	-13.5‰ to -18.4‰	1	16.7	4	66.7	1	16.7	6	100.0
Total	-11.5‰ to -22.6‰	21	25.3	43	51.8	19	22.9	83	100.0

Age

Individuals in all age ranges appeared to have consumed diets that contained large amounts of corn-based products, a mixed diet of C_3 and C_4 food sources, or had a heavily reliance on old world grains and potatoes (Tables 6-3 and 6-4). Variation, however, was noted in the amount of corn-based products consumed among the different age groups. For instance, only one old adult consumed a large amount of C_4 plants, with 60.0 percent of the old adults having a mixed diet, and 25.0 percent having consumed

Table 6-3. $\delta^{13}\text{C}$ ratios within the Eastern State burial sample (in descending order).

Burial Number	Sex Estimate	Age Estimate	$\Delta^{13}\text{C}$
<i>High C₄ Plant Diet (-14.99 to -10.00‰) N=21: Males=15 Females=5 Indeterminate =1</i>			
41	Male	Old Adult	-11.5
19D	Male	Old Adult	-12.2
68G	Male	Middle Adult	-12.4
67B	Male	Middle Adult	-13.4
34	Indeterminate	Juvenile/Subadult	-13.5
47B	Female	Middle Adult	-13.9
18D	Male	Old Adult	-14.0
59J	Male	Young Adult	-14.0
55A	Male	Middle Adult	-14.1
37F	Male	Young Adult	-14.1
31B	Male	Young Adult	-14.2
19B	Male	Young Adult	-14.3
30	Male	Young Adult	-14.3
19E	Female	Middle Adult	-14.3
66E	Male	Middle Adult	-14.5
55B	Female	Young Adult	-14.6
20A	Male	Young Adult	-14.7
67D	Male	Middle Adult	-14.8
43A	Male	Juvenile/Subadult	-14.9
53C	Female	Young Adult	-14.9
40	Female	Middle Adult	-14.9
<i>Mixed C₄ and C₃ Plant Diet (-17.99 and -15.00‰) N=43: Males=28 Females=11 Indeterminate =4</i>			
52C	Female	Old Adult	-15.0
54	Female	Middle Adult	-15.0
22	Female	Young Adult	-15.0
24A	Female	Middle Adult	-15.1
44B	Male	Young Adult	-15.1
29C	Male	Middle Adult	-15.1
52A	Male	Middle Adult	-15.1
50C	Male	Middle Adult	-15.1
29B	Female	Middle Adult	-15.1
26B	Male	Young Adult	-15.3
31A	Female	Middle Adult	-15.3
16A	Indeterminate	Adult	-15.4
64B	Male	Middle Adult	-15.4
19A	Female	Old Adult	-15.5
53D	Indeterminate	Adult	-15.6
19F	Male	Middle Adult	-15.6
15B	Female	Young Adult	-15.6
29A	Male	Young Adult	-15.8
38A	Male	Old Adult	-15.9
15A	Male	Young Adult	-15.9
24B	Male	Young Adult	-16.0
66B	Male	Old Adult	-16.2
25	Male	Young Adult	-16.3
66D	Male	Old Adult	-16.4
23	Male	Middle Adult	-16.4
50A	Male	Middle Adult	-16.4
29D	Female	Old Adult	-16.5
51B	Male	Young Adult	-16.5
13	Male	Young Adult	-16.6
46A	Male	Old Adult	-16.6
53B	Male	Old Adult	-16.6
14B	Female	Young Adult	-16.6
51C	Male	Old Adult	-16.7

Table 6-3. Continued.

Burial Number	Sex Estimate	Age Estimate	$\Delta^{13}\text{c}$
18C	Male	Old Adult	-16.7
57A	Male	Young Adult	-16.9
19G	Female	Middle Adult	-16.9
44A	Male	Middle Adult	-17.1
48	Male	Middle Adult	-17.2
33	Male	Old Adult	-17.3
51A	Male	Young Adult	-17.4
56A	Indeterminate	Juvenile/Subadult	-17.5
37B	Male	Old Adult	-17.7
46B	Indeterminate	Young Adult	-17.8
<i>High C3 Plant Diet (-23.00 and -18.00‰) N=19; Males=8 Females=10 Indeterminate=1</i>			
15D	Female	Young Adult	-18.0
27	Male	Adult	-18.3
32	Male	Young Adult	-18.3
18B	Female	Young Adult	-18.3
43B	Female	Young Adult	-18.4
63E	Female	Old Adult	-18.4
35	Indeterminate	Juvenile/Subadult	-18.4
63F	Male	Old Adult	-18.6
42	Male	Young Adult	-18.8
39C	Male	Middle Adult	-18.9
18A	Female	Young Adult	-18.9
60D	Male	Young Adult	-19.0
15C	Male	Old Adult	-19.1
20B	Female	Old Adult	-19.1
63C	Female	Young Adult	-19.3
28	Male	Young Adult	-19.4
60B	Female	Old Adult	-20.8
60A	Female	Middle Adult	-21.0
19C	Female	Young Adult	-22.6

Table 6-4. $\delta^{13}\text{C}$ ratios by Age Category.

Age Groups	Range	High C4		Mixed		High C3		Total	
		Freq	Perc	Freq	Perc	Freq	Perc	Freq	Perc
Juveniles & Subadults	-13.5‰ to -18.4‰	2	50.0	1	25.0	1	25.0	4	100.0
Young Adults	-14.0‰ to -22.6‰	8	25.0	14	43.8	10	31.3	32	100.0
Middle Adults	-13.9‰ to -18.3‰	8	33.3	14	58.3	2	8.3	24	100.0
Old Adults	-13.4‰ to -15.6‰	3	15.0	12	60.0	5	25.0	20	100.0
Adults	-12.2‰ to -19.1‰	0	0.0	2	66.7	1	33.3	3	100.0
Total	-11.5‰ to -22.6‰	21	25.3	43	51.8	19	22.9	83	100.0

primarily C₃ plants (Tables 6-3 and 6-4). In comparison, when combined, the middle-aged adult group exhibited a very different pattern. Within this combined group, 33.3 percent consumed a large amount of C₄ plants and 58.3 percent had a diverse diet. Only two middle aged adults (8.3 percent) were found to have consumed primarily C₃ plants. This data suggests that a higher number of older adults grew up outside the central Kentucky region relative to middle-aged adults. The juvenile/subadult and young adult age groups appear to vary in plant consumption. Juveniles/subadults consumed both C₃ and C₄ plants. Young adults subsisted primarily on mixed diets, but a few also had a heavy reliance on either C₃ or C₄ foods.

NITROGEN ISOTOPE RATIOS

Nitrogen isotope ratios ($\delta^{15}\text{N}$) serve as integrators, rather than simple dietary tracers, to provide an overall picture of the dietary sources of nitrogen. Dietary nitrogen found in humans comes from a variety of sources that possess different nitrogen isotope ratios (Robinson 2001). Higher levels of ^{15}N can potentially reflect a mixed diet of terrestrial foods and fish. The latter tend to have higher levels of ^{15}N than terrestrial animals “because they live in ecosystems with lower rates of nitrogen fixation, or because the preferred food species are often high level predators at a high trophic level themselves” (Katzenberg 1989; Schoeninger and Schurr 1998; Schurr 2009). Plants usually have $\delta^{15}\text{N}$ ranging between -2.8 and 6.4‰ (Schurr 2009; Virginia and Delwiche 1982). Legumes, for example, are part of a symbiotic relationship with nitrogen-fixing bacteria. Therefore, they obtain certain amounts of nitrogen directly from the atmosphere, producing $\delta^{15}\text{N}$ values closer to zero. Nitrogen values greater than 6.4‰ would thus reflect the consumption of foods with higher trophic levels and a diet that contained some meat. The higher the $\delta^{15}\text{N}$ value, the more meat an individual would have consumed during the course of their life (Schurr 2009). The resulting set of $\delta^{15}\text{N}$ values from the Eastern State Hospital sample ranges from 7.7 to 16.2‰, with a mean of 10.2‰ and a standard deviation of 1.1‰ (Table 6-5). These values point to variation in the amount of meat consumed by those interred within the Eastern State Hospital Cemetery. Such variation may reflect differing socioeconomic statuses, or rural vs urban residential patterns.

Sex

A comparison of $\delta^{15}\text{N}$ values by sex identified little in the way of variation by gender in the consumption of meat. Male $\delta^{15}\text{N}$ values range from 8.6 to 16.2‰, with a mean of 10.4‰ and a standard deviation of 1.2‰. Female $\delta^{15}\text{N}$ values ranges from 7.7 to 11.8‰, with a mean of 9.8‰ and a standard deviation of 1.1‰ (Figure 6-1). Though the male range is somewhat greater than the female range, it is greatly influence by an outlier (16.2‰). When this outlier is removed, the male $\delta^{15}\text{N}$ values range from 8.6 to 12.3‰, and the mean is reduced to 10.2‰, resulting in values that are very similar to those of the females.

The $\delta^{15}\text{N}$ outlier (16.2‰) is a male (Burial 39C) 45-57 years of age. In addition to a high $\delta^{15}\text{N}$ value, this individual's $\delta^{13}\text{C}$ is -18.9‰. This indicates he had a high meat, non-corn based diet. As previously noted, the latter value suggests this individual immigrated to the Bluegrass region later in life.

Age

As with the examination of the data by sex, $\delta^{15}\text{N}$ age comparisons did not document much in the way of intra-cemetery variation. Juveniles and subadults range from 9.0 to 10.4‰; young adults range from 8.4 to 11.4‰; young/middle adults range from 8.0 to 11.8‰; middle adults range from 9.9 to 10.7‰; middle/old adults range from

9.1 to 16.2‰; and old adults range from 7.7 to 11.8‰. Overall, no substantial differences in nitrogen values could be identified by age group (Figure 6-2).

Table 6-5. $\delta^{15}\text{N}$ ratios within the Eastern State burial sample (in ascending order).

Burial Number	Sex Estimate	Age Estimate	$\Delta^{15}\text{n}$
15D	Female	Young Adult	7.7
60B	Female	Old Adult	7.7
60A	Female	Middle Adult	8.0
63C	Female	Young Adult	8.4
44B	Male	Young Adult	8.6
19C	Female	Young Adult	8.9
57A	Male	Young Adult	9.0
43A	Male	Juvenile/Subadult	9.0
28	Male	Young Adult	9.0
29C	Male	Middle Adult	9.1
48	Male	Middle Adult	9.1
40	Female	Middle Adult	9.2
43B	Female	Young Adult	9.2
44A	Male	Middle Adult	9.3
63E	Female	Old Adult	9.3
24A	Female	Middle Adult	9.5
41	Male	Old Adult	9.5
64B	Male	Middle Adult	9.5
15B	Female	Young Adult	9.5
50C	Male	Middle Adult	9.6
18C	Male	Old Adult	9.6
19D	Male	Old Adult	9.7
52A	Male	Middle Adult	9.7
20B	Female	Old Adult	9.7
47B	Female	Middle Adult	9.8
31A	Female	Middle Adult	9.9
19F	Male	Middle Adult	9.9
68G	Male	Middle Adult	10.0
66E	Male	Middle Adult	10.0
55B	Female	Young Adult	10.0
22	Female	Young Adult	10.0
24B	Male	Young Adult	10.0
25	Male	Young Adult	10.0
50A	Male	Middle Adult	10.0
35	Indeterminate	Juvenile/Subadult	10.1
67D	Male	Middle Adult	10.1
51C	Male	Old Adult	10.2
34	Indeterminate	Juvenile/Subadult	10.3
19A	Female	Old Adult	10.3
63F	Male	Old Adult	10.3
18A	Female	Young Adult	10.3
33	Male	Old Adult	10.3
38A	Male	Old Adult	10.7
59J	Male	Young Adult	10.4
19E	Female	Middle Adult	10.4
29B	Female	Middle Adult	10.4
29A	Male	Young Adult	10.4
46A	Male	Old Adult	10.4
56A	Indeterminate	Juvenile/Subadult	10.4
29D	Female	Old Adult	10.4

Table 6-5. Continued.

Burial Number	Sex Estimate	Age Estimate	$\Delta^{15}\text{n}$
18D	Male	Old Adult	10.5
55A	Male	Middle Adult	10.5
31B	Male	Young Adult	10.5
19B	Male	Young Adult	10.5
18B	Female	Young Adult	10.5
26B	Male	Young Adult	10.6
53B	Male	Old Adult	10.6
32	Male	Young Adult	10.6
67B	Male	Middle Adult	10.7
23	Male	Middle Adult	10.7
42	Male	Young Adult	10.8
52C	Female	Old Adult	10.8
54	Female	Middle Adult	10.8
51A	Male	Young Adult	10.8
51B	Male	Young Adult	10.9
46B	Indeterminate	Young Adult	10.9
37F	Male	Young Adult	11.1
20A	Male	Young Adult	11.1
53D	Indeterminate	Adult	11.1
15C	Male	Old Adult	11.1
30	Male	Young Adult	11.2
66D	Male	Old Adult	11.2
53C	Female	Young Adult	11.3
16A	Indeterminate	Adult	11.3
15A	Male	Young Adult	11.4
66B	Male	Old Adult	11.4
14B	Female	Young Adult	11.4
19G	Female	Middle Adult	11.8
37B	Male	Old Adult	11.8
27	Male	Adult	12.3
39C	Male	Middle Adult	16.2

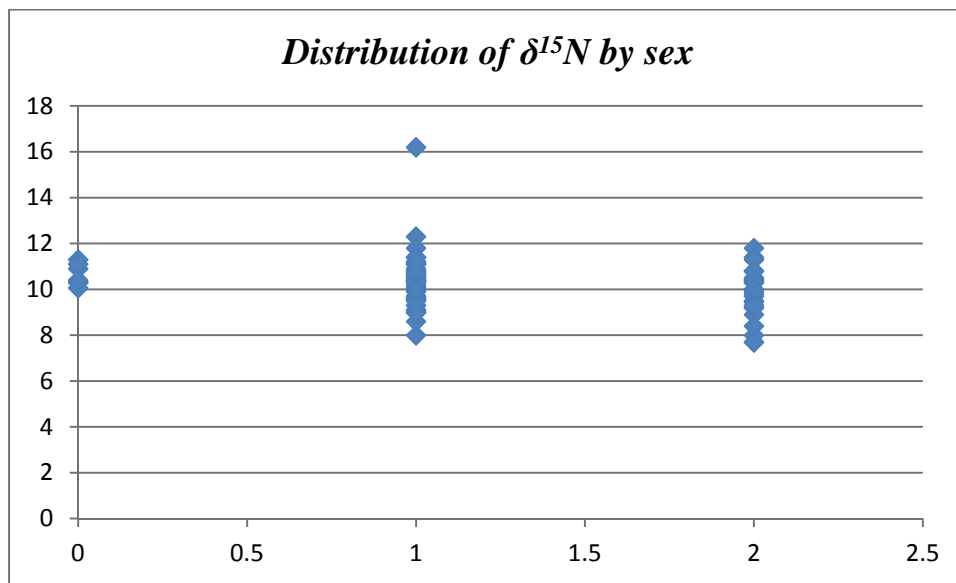


Figure 6-1. Distribution of $\delta^{15}\text{N}$ by sex (0=Indeterminate; 1=Male; 2=Female).

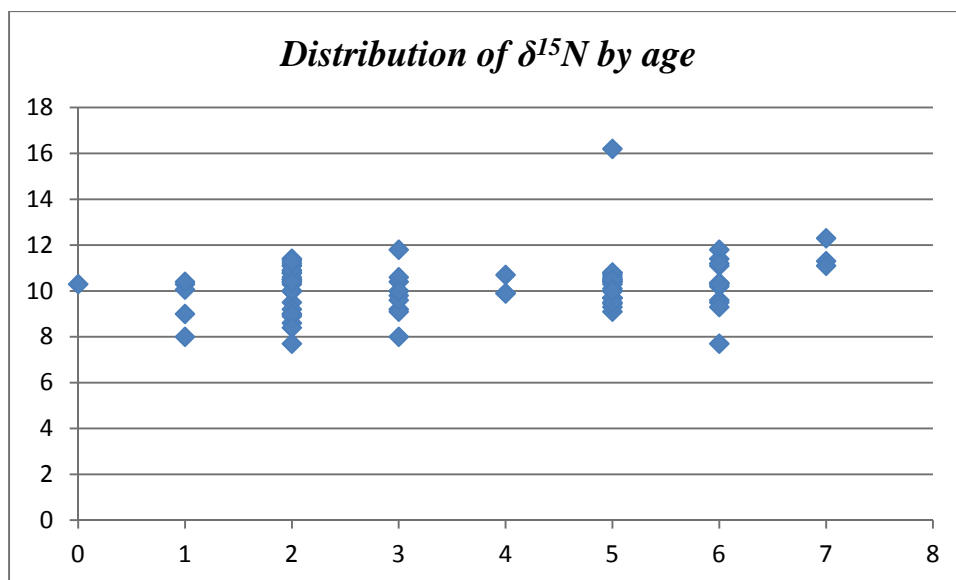


Figure 6-2. Distribution of $\delta^{15}\text{N}$ by age (0=indeterminate, 1=juvenile/subadult, 2=young adult, 3=young/middle adult, 4=middle adult, 5=middle/old adult, 6=old adult, 7=adult).

ARCHAEOLOGICAL CEMETERY COMPARISONS

The 83 individuals in the Eastern State Hospital burial population that yielded isotopic data offer interesting insights into nineteenth century residential mobility and socio-economic variability within central Kentucky. In comparison to other central Kentucky cemeteries, the Eastern State Hospital burial population contained a much higher percentage of individuals who consumed little or no C_4 plants (Table 6-6). In fact, among the other three Kentucky cemeteries it was compared to, only the Old Frankfort Cemetery in Franklin County contained individuals who appear to have consumed little in the way of C_4 plants. The stable carbon isotope data from Eastern State Hospital suggests that one in five individuals grew up in a region where they consumed primarily old world grains and perhaps potatoes. It also contained a higher percentage of individuals who consumed a combination of corn-based productions and old world grains, which suggests that during the course of their lives those interred within this cemetery may have been better off than those interred in contemporary neighborhood or rural cemeteries, such as the Old Frankfort and Horse Park cemeteries.

Slightly more than eighty-four percent of the Old Frankfort Cemetery's burial population exhibited evidence of a corn-based diet, which included corn-fed animals and their products, and refined sugars. The Old Frankfort Cemetery population yielded a mean $\delta^{13}\text{C}$ value of -13.3‰ , substantially higher than the -16.2‰ obtained for the Eastern State Hospital population (Table 6-6). Very high $\delta^{13}\text{C}$ values at the Old Frankfort Cemetery suggests a heavy reliance on a corn-based diet. A lack of diversity in diet can cause deficiencies in Vitamin D, Vitamin C, and protein. Within the Old Frankfort population, on average African Americans appear to have consumed more corn based products than European Americans, -12.8 and -14.1‰ , respectively. Somewhat lower

$\delta^{13}\text{C}$ values for poor and lower middle class European Americans suggests that they had a more diverse diet, one that included more old world crops, such as wheat and barley, and potatoes than enslaved and freed African Americans (Schurr 2009). As with Eastern State Hospital, the few individuals interred within the Old Frankfort Cemetery who did not consume any corn-based products likely migrated to Kentucky from other regions.

Table 6-6. $\delta^{13}\text{C}$ ranges and means between regional cemetery samples.

Cemetery	Low	Mean	High	Range
Eastern State Hospital (n=83)	-22.6‰	-16.2‰	-11.5‰	11.1‰
Old Frankfort (n=119)	-20.5‰	-13.3‰	-9.2‰	11.3‰
Vardeman (n=34)	-15.9‰	-13.1‰	-9.0‰	6.9‰
Horse Park (n=29)	-17.1‰	-14.2‰	-10.7‰	6.4‰

At the Old Frankfort Cemetery, nitrogen isotope ratios ranged from 8.5 to 14.3‰, with a mean of 10.9‰ (Table 6-6). These values are similar to the range documented at the Eastern State Hospital Cemetery. Many of the infants and young children in the Old Frankfort Cemetery population exhibited lower than expected $\delta^{15}\text{N}$ values, suggesting that they were weaned at a very young age (Schurr 2009).

Table 6-7. $\delta^{15}\text{N}$ ranges and means between regional cemetery samples (18 years or older).

Cemetery	Low	Mean	High	S.D.
Eastern State Hospital (n=83)	7.7‰	10.2‰	16.2‰	1.1‰
Old Frankfort (n=119)	8.5‰	10.9‰	14.3‰	0.9‰
Vardeman (n=34)	9.4‰	11.0‰	15.1‰	0.8‰
Horse Park (n=29)	8.8‰	11.0‰	13.5‰	0.9‰

Within the Horse Park Cemetery (Fayette County) population, $\delta^{13}\text{C}$ values ranged from -10.7 to -17.0‰, with a mean of 14.2‰ (Table 6-6). As with the Old Frankfort cemetery these values points to a heavy reliance on C_4 plants. At the Horse Park Cemetery, a slightly higher percentage of the population consumed a more diverse diet than those associated with the Old Frankfort Cemetery, but still a much lower percentage than documented at Eastern State Hospital (Table 6-6). The $\delta^{15}\text{N}$ values obtained from this cemetery population ranged from 8.8 to 13.5‰, with a mean of 11.0‰ (Table 6-7).

The Vardeman Cemetery in Lincoln County, Kentucky was used from the mid-nineteenth century into the twentieth century. As such, the early years of this cemetery's use overlaps with the Eastern State Hospital cemetery. Those interred in this cemetery had $\delta^{13}\text{C}$ values that ranged from -15.9 to -9.0‰, with a mean of -13.0‰ (Table 6-6). These values suggest that almost everyone interred in this cemetery consumed large amounts of C_4 plants or corn-based products (Table 6-5). The $\delta^{15}\text{N}$ values obtained from this cemetery population ranged from 9.4 to 15.1‰, with a mean of 11.0‰ (Table 6-7).

SUMMARY

Of the individuals in the Eastern State Hospital sample that yielded carbon isotope data, about one quarter subsisted on diets high in corn products and slightly more than half consumed a diverse diet, one that included both C₃ and C₄ plants. The remaining individuals (16.7 percent) consumed little in the way of C₄ plants. Within this burial sample, relative to females more males had a high corn-based diet. On the other hand, a much higher percentage of females consumed no C₄ plants over the course of their lives. Some of the variation observed in the consumption of C₃ and C₄ plants among those interred in the Eastern State Hospital may be tied to socioeconomic status, with upper middle class and wealthy individuals having a more diverse diet than the poor. It also may indicate that prior to being admitted to the hospital, many of the individuals interred in Eastern State Hospital Cemetery lived in areas where local populations were less dependent on corn-based products or had recently emigrated to the United States from Europe where people consumed potatoes and old world grain crops.

When compared to other central Kentucky cemeteries the Eastern State Hospital sample exhibits a great deal more variation in plant food consumption. Those interred within contemporary urban neighborhood or rural family cemeteries appear to have relied much more heavily on corn-based products than those interred within the Eastern State Hospital Cemetery. If the Eastern State Hospital diversity reflects the composition of an institutional population, it is possible that those interred in neighborhood and rural cemeteries had similar socioeconomic backgrounds and lived most of their lives in the central Kentucky region.

The δ^{15} Nitrogen values for the Eastern State Hospital burial sample point to a mixed diet of terrestrial foods and fish. These individuals also probably consumed a fair amount of plants, which accounts for many of the intermediate δ^{15} N values. The Eastern State Hospital values are similar to those documented at contemporary urban neighborhood and rural family cemeteries. Given the variation observed in the carbon isotopic data, the overall nitrogen similarity both within and between cemeteries was somewhat surprising, and it is possible that with additional samples it may be possible to identify patterns in the data.

numbers are somewhat deceiving as the number of deaths at Eastern State Hospital spiked in 1849 and 1850, a direct result of cholera outbreaks, which hit Lexington and the hospital particularly hard. Hospital records indicate that during that two year period there were 190 patient deaths (White 1984:201). The death rate also was unusually high in 1856 when 65 individuals died at the asylum, either from cholera or some other dysentery-like disease (White 1984:62). When the three worst years are removed, the death rate declines to 20 persons per year, with a low of nine deaths and a high of 34 deaths; yearly rates that are similar to those documented during the cemetery's initial decade of use.

Table 7-1. Eastern State Hospital admissions and Deaths (1839-1861)*.

Year	Admit	Died	Year	Admit	Died
1839	86	35	1854	40	23
1840	65	35	1855	74	25
1841	72	28	1856	74	65
1842	61	22	1857	100	25
1843	74	15	1858	57	20
1844	78	8	1859	45	9
1845	100	10	1860	50	10
1846	90	27	1861	48	18
1847	86	23	Subtotal	823	453
1848	98	25	Mean	63.3	34.8
Subtotal	810	228	<i>Minus 1849, 1850, 1856 (cholera epidemics)</i>		
Mean	81	22.8	Subtotal	534	198
1849	96	98	Mean	53.4	19.8
1850	119	92			
1851	33	34	Grand Total	1633	681
1852	38	13	Mean	71	29.6
1853	49	21	*From White 1984 (compiled from Annual Reports)		

The medical treatment of the day may have contributed to the large number of hospital patients who died of cholera. Medical science at the time mistakenly attributed the disease to marsh miasmata (decaying vegetation in a swampy area) and thought that it was transmitted through the air (White 1984:67). As noted by White (1984:67), the cure for cholera was deadly: based on traditional purgation, including emetics, bloodletting, rubefacients, and purgatives (40-50 grams of calomel and 1-2 grams of opium). The repeated use of calomel also results in dental deterioration, which negatively affects the overall health of an individual (see Chapter Five). These treatments as well as poor sanitary conditions undoubtedly contributed to the large number of individuals who died during cholera epidemics as well as those who died of dysentery, another major medical problem at the hospital. It was not until 1856 that it was discovered that the sewer, in its course to a natural sink, passed directly over the stream that supplied all of the water consumed at the hospital (1869 Annual Report, as cited by White 1984).

The placement of up to 10 individuals within a single grave shaft (Figure 7-2) reflects the response of the hospital staff to a large number of individuals dying at the same time. As the cholera epidemics intensified, or other dysentery-like diseases led to multiple deaths, there may have been an effort on the part of the hospital staff to bury people as quickly as possible, with mass graves being the most expedient way to accomplish this in a short amount of time.

Eastern State Hospital would not have been the only institution or municipality whose mortuary practices would have been impacted by a cholera epidemic (Duban 2012). The sheer volume of deaths certainly would have put a strain on institutional and community mortuary practices, especially religious services. At Eastern State Hospital, however, there appears to be little difference in how those who died before, during, or after an epidemic were treated relative to coffin style/construction, how the dead were dressed before they were placed in the coffin, or how the body was arranged in the coffin. The primary difference was whether they were placed in an individual or mass grave.

MORTUARY PATTERNS

Coffin and Grave Type

Almost everyone was interred in a hexagonal wooden coffin, though a few were interred in a rectangular wooden coffin and one individual was buried in an iron coffin. Late machine-cut nails were used to construct the coffins and the box that held the iron coffin. Screws also were used in the building of about twenty percent of the coffins. Late machine-cut nails increase in popularity after 1830, and by the 1840s are the dominant nail type used in construction activities. Most of the coffin nails were 6d-8d pennyweight nails, and the overall consistency of the nails used to construct the coffins suggests that they were manufactured on-site or were obtained from a single supplier. The one metal coffin is a Fisk metallic burial case, which was manufactured sometime between 1848 and 1854. The absence of more ornate coffins, with fancy handles, thumbscrews and face plates, is consistent with a cemetery that ceased to be used after 1861.

The cemetery contains a mix of single (62 individuals) and mass graves (n=28, containing 97 individuals) (Figures 7-3 and 7-4). Single interments occur by themselves (n=31) or are stacked (n=31). In three instances (Grave Shafts 31, 56, and 57), stacking consisted of a single grave placed over an earlier interment. More intensive stacking was documented in four areas (Grave Shafts 37, 38, 39, and 59). In these areas, from four to 10 individual graves had been placed one on top of another, effectively obliterating the initial grave shaft.

In addition to the intact interments, the remains of 27 commingled individuals were recovered. Their remains were primarily associated with fill from four grave shafts (63, 66, 67, and 68) located in the northwestern section of the cemetery (Figure 7-3)

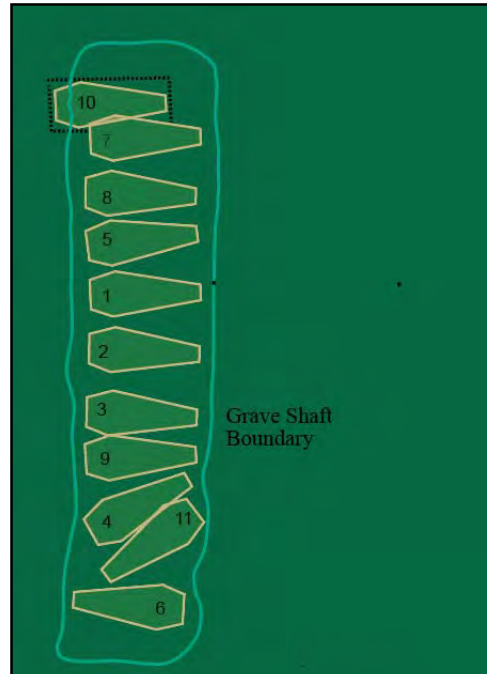


Figure 7-2. A mass grave documented in 2005. It overlaid an earlier single interment (Burial 10).

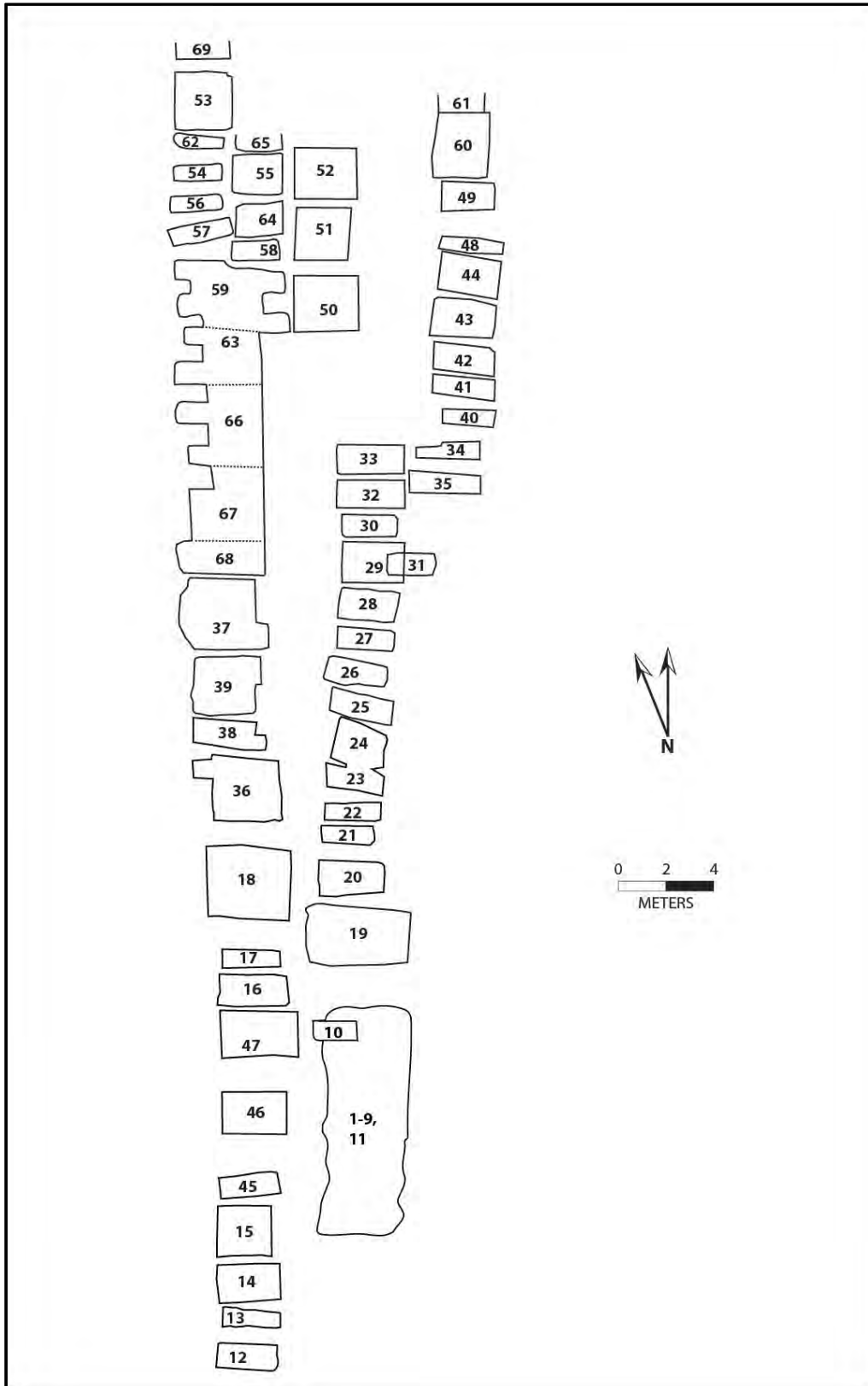


Figure 7-3: Single and Mass Grave Shafts (Shafts 61, 65, and 69 not excavated).

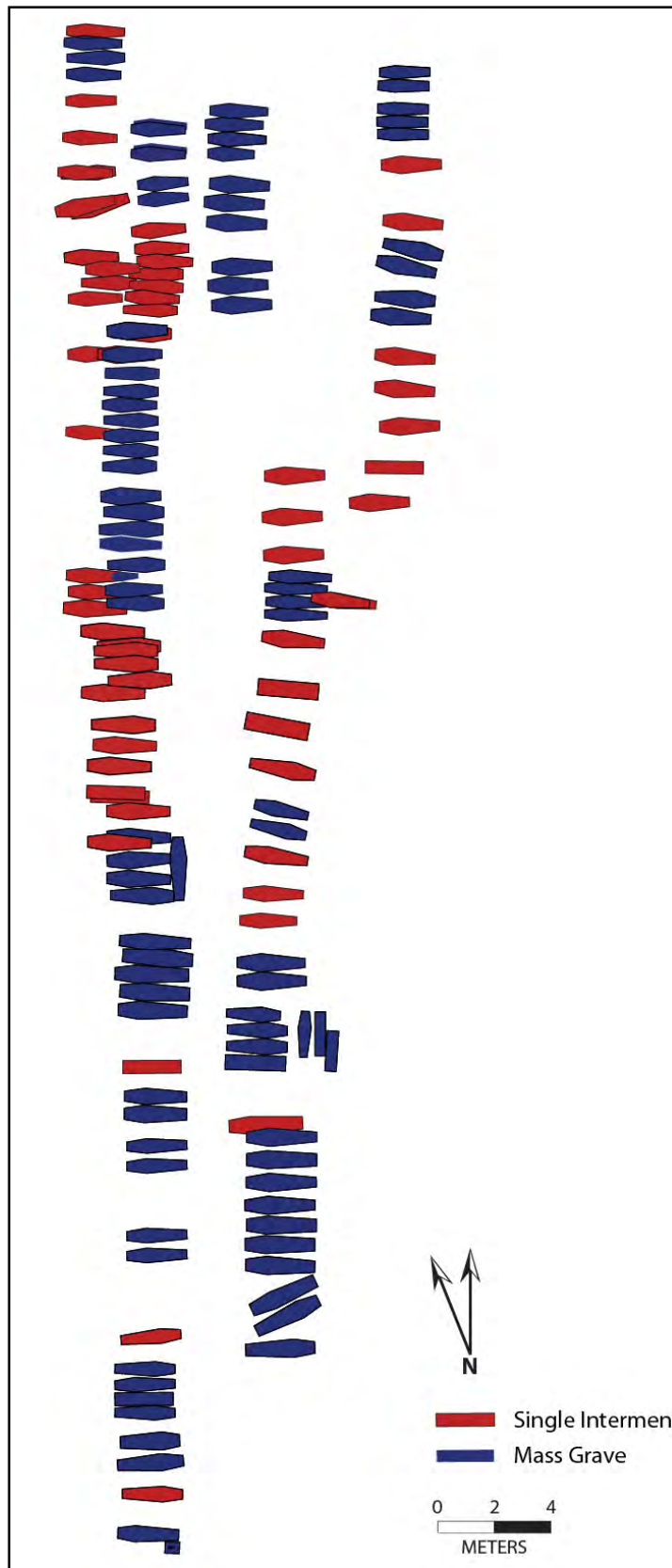


Figure 7-4. Distribution of single interments and mass graves.

Many of the earlier individual interments were completely destroyed and commingled, during the excavation of the grave shafts for multiple interments. The digging of these shafts truncated an additional seven earlier single interments. Some commingling of human remains occurred during the excavation of a grave shaft (39) for the interment of the Fisk casket, and the commingled remains associated with Grave Shaft 26 may represent individuals who were interred in the cemetery after their bodies were examined by doctors at the Transylvania Medical School. Other individuals were disturbed as the result of the repeated stacking of burials (Grave Shafts 37, 38, 53 and 59), and a few graves (Grave Shafts 37 and 40) were disturbed by the digging of a privy or trenches for utility lines.

Within the cemetery, individual burials are aligned in five somewhat irregular rows (Figure 7-4). Based on the fact that individual interments in the most westerly row were truncated by later mass graves or disturbed as a result of grave stacking, some of the single graves associated with this row may represent the earliest interments in the cemetery. Some single interments, such as Burial 36A and two single stacked graves (Burials 31A and 31B), however, postdate an earlier mass grave (Burials 36B-E, and Burials 29A-D, respectively), so not all later interments were associated with a mass grave. Unlike the more regular spacing seen in the placement of single interments, mass graves tend to be located much closer to each other, with little more than 10 to 15 cm separating some of the shafts (Figure 7-3).

Coffin Orientation

Of the 159 coffins documented within the cemetery, 152 contained individuals whose remains were preserved well enough to determine the direction in which their head had been placed. The remaining seven coffins represent disturbed burials or the human remains were too poorly preserved to determine orientation. Slightly less than three-quarters (74.8 percent) of the coffins contained individuals who were buried with their head to the northwest and almost one-quarter (22.5 percent) were oriented with their head facing the southeast. Both male and female burials follow similar patterns with most being oriented with their head to the northwest, though a higher percentage of males relative to females were oriented with their head to the southeast (Table 7-2). Since hexagonal coffins are wider at the elbows and taper towards the feet, alternating them head to toe would allow for more coffins to be placed within a single grave shaft (Figure 7-4).

Table 7-2. Coffin orientation by sex.

Orientation	Male		Female		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Northwest	59	72.0	43	79.6	102	75.0
Southeast	23	28.0	8	14.8	31	22.8
Southwest	-		1	1.9	1	0.7
Northeast	-		2	3.7	2	1.5
Total	82	100.0	54	100.0	136	100.0

When coffin orientation was evaluated for just single interments, there was a stronger preference for graves to be oriented towards the northwest. Yet, even 10.0 percent of single interments were oriented to the southeast. Thus, a southeast orientation cannot solely be about fitting more coffins within a grave shaft, and thus could reflect individual preferences.

Of the individuals who did not face the northwest or southeast, two faced the northeast, and one was oriented to the southwest. All were associated with mass graves. Thus, the orientation of their coffins appears to reflect an attempt to fit more coffins in a single grave shaft (Burial 19) rather than a cultural preference for body placement.

Cemetery research in central Kentucky has documented a mid-nineteenth century practice of orienting graves with the head to the northwest rather than to the west, as a locale tradition (Bybee 2009b; Favret 2008; Pollack et al. 2011). At the Ward Hall (Bybee 2009b) and Horse Park (Pollack et al. 2011) cemeteries this pattern was restricted to African American graves. This also may have been the case at the Terrell Cemetery, but the placement of a woman and two children along the edge of the cemetery and orienting their grave shafts in a different direction may simply represent an attempt to signal that they were not part of the family (Favret 2008). A similar northwest orientation was noted for African American graves at the Goodwyn Cemetery in South Carolina (Trinkley et al. 2011). At the Eastern State Hospital Cemetery a northwest-southeast orientation appears to have been the common practice regardless of biological affiliation or ethnic background.

Arm Placement

Arm placement at Eastern State Hospital exhibited a great deal of variation, with arms and hands variously placed on the chest, pelvis, or at the side of the body (Figure 7-6). Of the 159 primary interments, arm placement could be determined for 132 burials. The most common pattern consisted of placing both forearms across the chest (28.0 percent), followed by their placement on or across the pelvis (15.2 percent), along the side of the body (10.6 percent), towards the same shoulder (2.3 percent), and towards the opposite shoulder (2.3 percent) (Figure 7-5).

For the remaining interments (41.7 percent), the left and right forearms were not placed in the same position (Figure 7-6). An arm placement associated with 8.3 percent of the burials consisted of placing the left forearm across the chest and the lower right arm the pelvis (Figure 7-6a). Another common arm placement consisted of folding either the left or right forearm towards the same (15.2 percent) or opposite shoulder (6.1 percent), with the other forearm usually placed across the chest or pelvis (Figure 7-6d-f).

In general, Eastern State Hospital burials exhibited the same types of arm placements as has been documented at other Kentucky cemeteries, but some differences were noted. For instance, within both the Eastern State Hospital and Old Frankfort cemeteries, a similar percentage of forearms arms were folded across the chest (about thirty percent) or placed along the side of the body (about ten percent). Where they differ

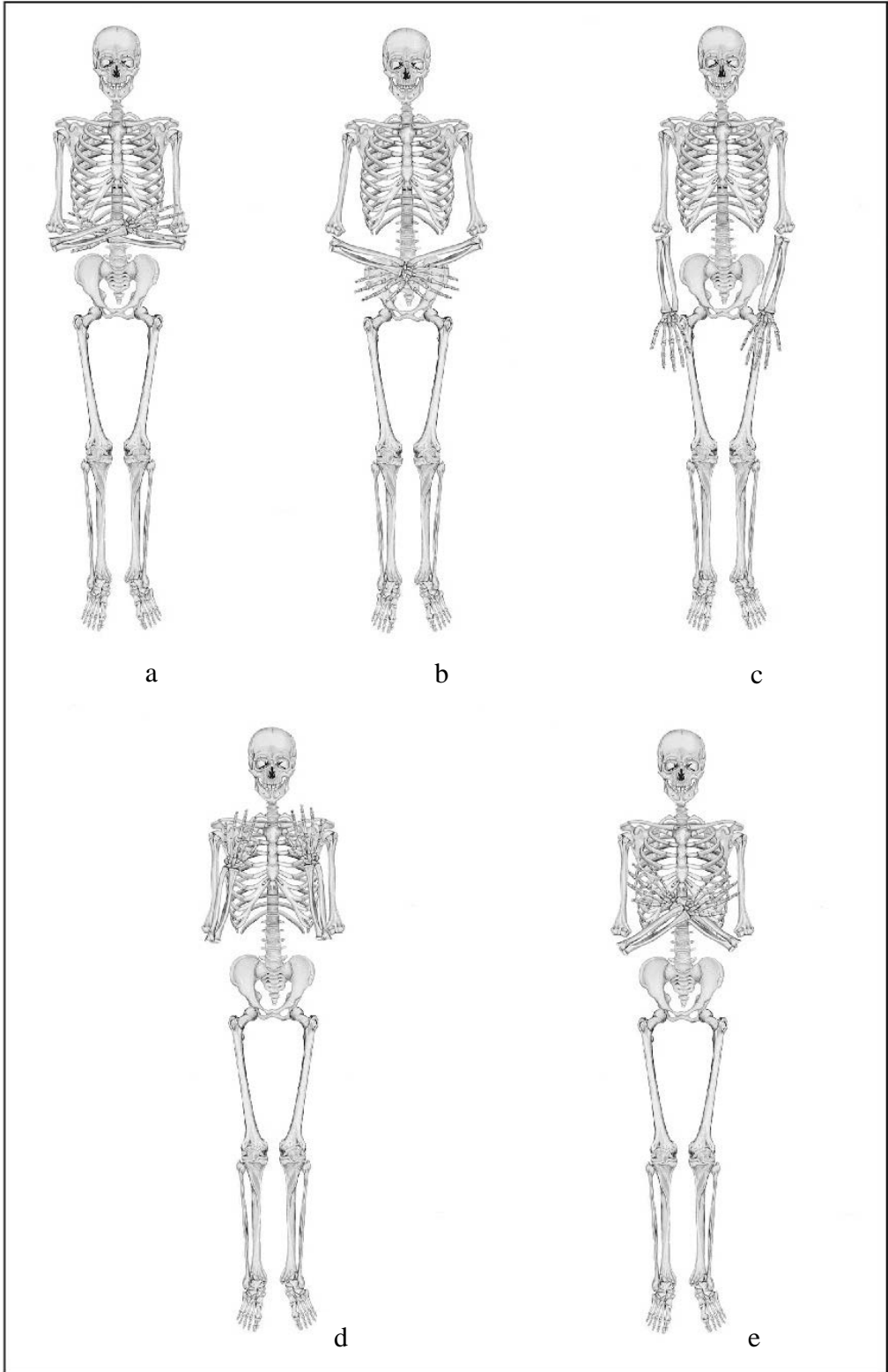


Figure 7-5. Five Primary Forearm Placements: a, folded across chest; b, across pelvis, c, along side; d, folded same shoulder; e, folded opposite shoulder.

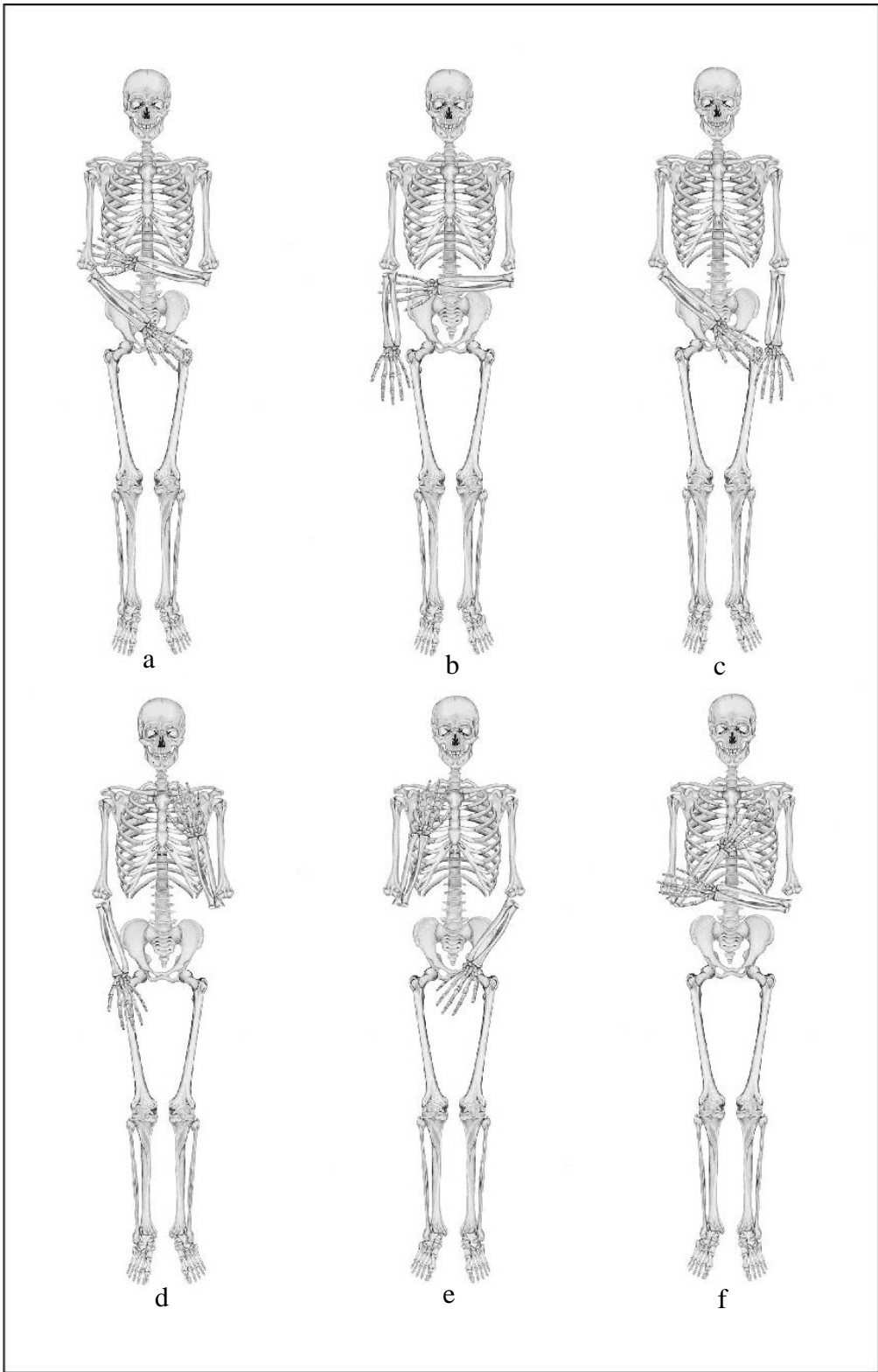


Figure 7-6. Arm placement combinations: a, left arm chest, right arm pelvis; b, left arm chest, right arm side; c, left arm side, right arm pelvis; d, left arm same shoulder, right arm side; e, left arm pelvis, right arm same shoulder; f, left arm chest, right arm opposite shoulder.

is with respect to the placement of the forearms across the pelvis, which was associated with 48.0 percent of the graves at the Old Frankfort Cemetery but only 15.2 of the Eastern State Hospital burials.

But what really distinguished Eastern State Hospital arm placement from that observed at the Old Frankfort Cemetery was 1) a combination of different arm treatments, and 2) the folding of the forearm towards the same or opposite shoulder (Figures 7-5 and 7-6). Within the Eastern State Hospital cemetery, about forty percent of the graves exhibited a combination of arm placements compared to only seven percent of the graves at the Old Frankfort Cemetery. Likewise, while thirty percent of the burials at Eastern State Hospital exhibited the folding of at least one lower arm toward the same or opposite shoulder, there were only four instances of this mortuary practice documented among the 242 burials at the Old Frankfort Cemetery (Pollack and Killoran 2008).

Elsewhere in the central Kentucky region the folding of one or both forearms towards the same shoulder has been documented at the State Monument in Kentucky, where it was observed in association with two of the three investigated 1840s Mexican War veteran graves (Stottman and Pollack 2005). On the other hand, this mortuary practice was not documented at the Horse Park or Terrell family cemeteries (Favret 2008; Pollack et al. 2009).

Given the contemporaneity of the Eastern State Hospital and Old Frankfort cemeteries, and the size of the burial samples recovered, the observed differences in arm placement are not attributable to sample size. Nor does it appear to reflect diachronic trends in the treatment of the dead. Rather, it may reflect differences in how the dead were laid out prior to interment in a neighborhood burial ground relative to an institution cemetery. At the Old Frankfort Cemetery religious, cultural, and family traditions may have dictated how a person's arms should be situated within a coffin. These traditions may not have been as rigorously enforced by the hospital staff who laid the dead in coffins, or they may not have known the patients cultural or religious traditions. The practice of placing one or both hands by the same or opposite shoulders, however, may have come to symbolize rest in peace, and may represent an effort on the part of the hospital staff to treat the dead with respect.

Binding of Legs

When most individuals were placed in their coffin, the narrowness of the lower end of the hexagonal coffin determined how far apart the lower legs and feet could be. For eight individuals, however, their knees had been drawn together to the point that they were almost touching and in several cases their feet had been crossed. It is quite possible that the lower legs of these individuals had been bound prior to placing them in a coffin.

In addition to those individuals whose legs had been bound, several individuals may have been too tall for the coffin they were to be placed in. This resulted in their legs and feet being placed diagonally towards the coffin's lower right hand corner (Figure 7-9).

Clothing and Personal Objects

The vast majority of the personal items found at the cemetery are clothing related buttons, hook and eye fasteners, and buckles. These objects would have been associated with shirts or shifts, dresses, pants, skirts, undergarments (including corsets), jackets, vests, hospital garments, and possibly suspenders. The most common buttons were five-hole bone and four-hole porcelain Prosser buttons. Five-hole bone buttons were found with about one-fifth (n=30) of the burials, with 70.0 percent of these individuals being males (slightly more than five buttons per person) (see Figures 7-13, 7-14, and 7-15). Fewer five-hole buttons were found with females (average of 2.3 per person) (Figure 7-8).

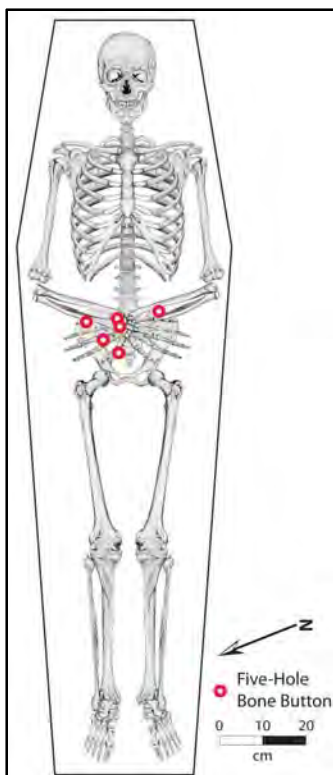


Figure 7-7. Burial 15A, a 22-32 year old female. (Buttons were found below arms and hands.)

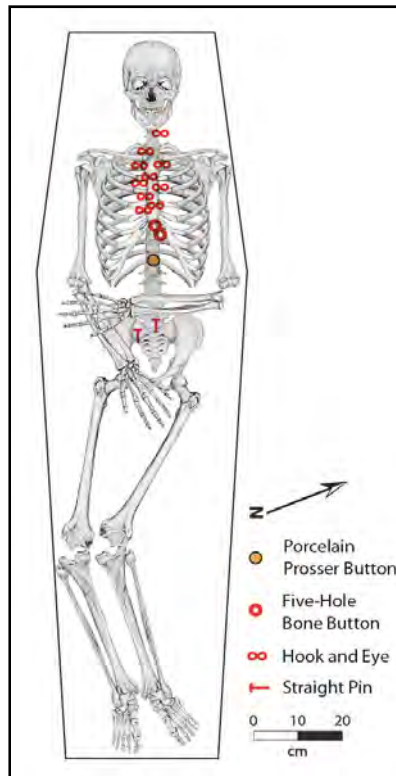


Figure 7-8. Burial 18B, 18-21 year old female, who was too tall for her coffin.

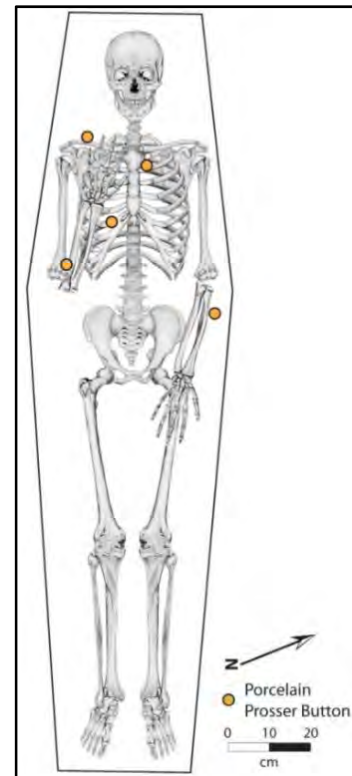


Figure 7-9. Burial 66E, 30-40 year old male. Note Prosser button distribution.

When found with males, these types of buttons tend to be of the medium and large varieties, and were primarily associated with the pelvic area. A similar button distribution was noted with one female (Figure 7-8). The association of these buttons with the pelvic area is suggestive of drop down pants fly closures or suspender attachments. Five-hole buttons found with other females tend to be of the small variety, and in three of the seven female burials were found directly below a concentration of hook and eye fasteners (Figure 7-8). In these instances, the buttons may represent undergarments.

Prosser buttons, which increased in popularity after 1840, also were associated with about one-fifth (n=28) of the burials (Figures 7-8, 7-9, 7-10, and 7-12), but only co-occur with five-hole bone buttons on four occasions (Figures 7-8). They co-occur somewhat more frequently with four-hole bone buttons (Figure 7-10), but were never found with one-hole bone buttons. Single Prosser buttons are associated with seven females and five males, but when multiple Prosser buttons are present they are almost always with males (12 vs 2 female burials) (Figures 7-9 and 7-12). When found near the neck area, the presence of just one Prosser button probably represents a closure for a women's dress or shift, or a pull-over men's shirt. A few single Prosser buttons were found near the left or right shoulder. These buttons may have been associated with hospital garments. Multiple Prosser buttons may be associated with shirts and jackets (Figure 7-12). Some, however, exhibited unique distributions. For instance, the distribution of Prosser buttons associated with Burial 66E (Figure 7-9) is suggestive of a garment that had ornamental buttons (Severa 1995).

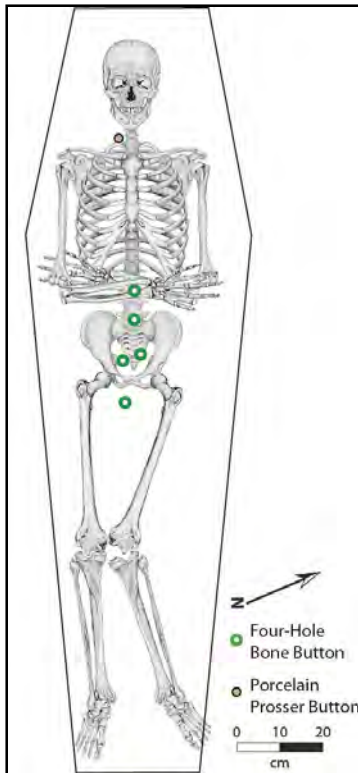


Figure 7-10. Burial 34, a 14-16 year old juvenile who may have suffered from polio.

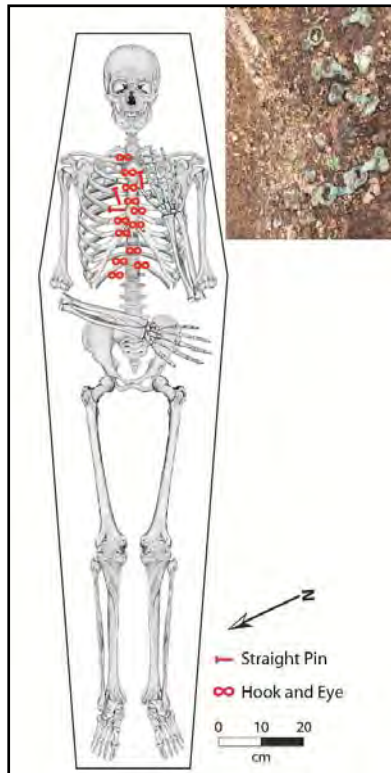


Figure 7-11. Burials 13, 18-28 year old male.

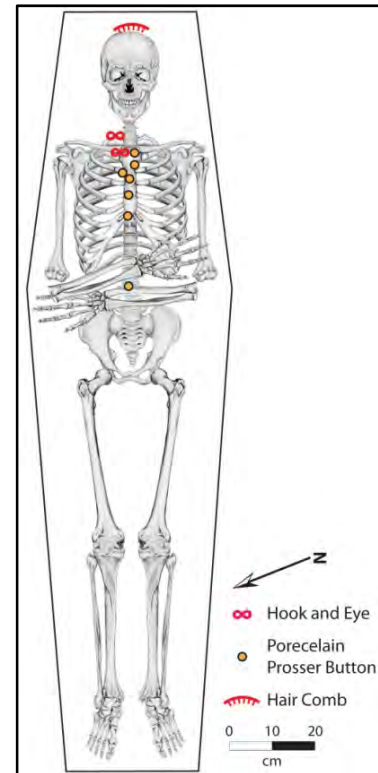


Figure 7-12. Burial 63F, a 53-68 year old male.

Four-hole bone buttons were associated with 13 burials (five female, seven male, and one indeterminate juvenile) (Figure 7-10). Single occurrences are primarily associated with males (n=6 vs two females) (Figure 7-15), while multiple occurrences tend to be associated with females (three vs one male). These types of buttons tend to be found with other fasteners, and were often located in the vicinity of the pelvic or chest area. Coin and dome buttons were associated with just five adult burials (three males,

one female, and one indeterminate). The former were primarily found in the vicinity of the pelvis and probably were associated with drop-down fly plants. The dome buttons were probably associated with coats (Figure 7-13).

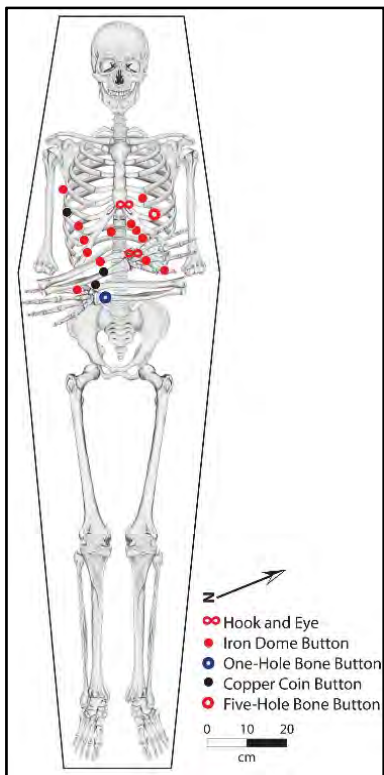


Figure 7-13. Burial 23, 28-53 year old male.

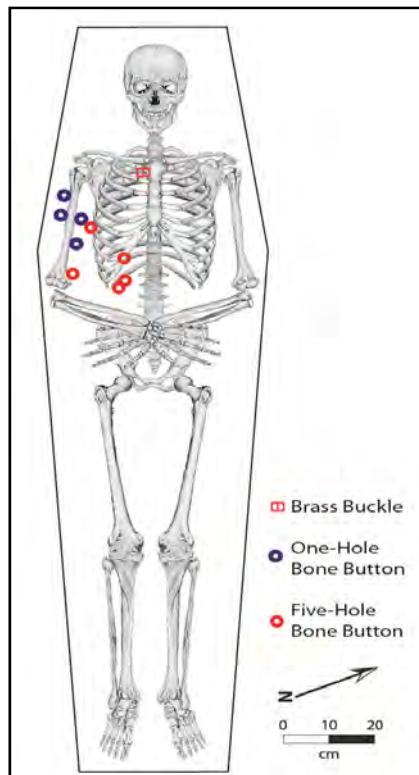


Figure 7-14. Burial 44B, a 20-25 year old male.

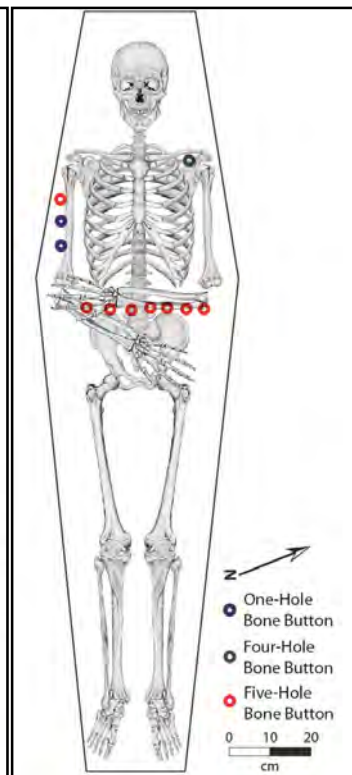


Figure 7-15. Burial 20A, a 23-26 year old male.

Relative to other archaeologically investigated cemeteries in central Kentucky and elsewhere, hooks and eyes are much more common at Eastern State Hospital, being associated with 20 burials (Figures 7-8, 7-11, and 7-12). Surprisingly, none were recovered from the contemporary Old Frankfort or Horse Park cemeteries. They are, however, present at the contemporary Voegtly Cemetery in Pittsburgh, which was a church cemetery from 1833-1861 (Ubelaker and Jones 2003). At this cemetery they are associated with 3.0 percent of the burials, about fifty percent being infants or very young children. They are quite common at the somewhat later Alameda-Stone Cemetery (1860-1880) in Tucson, where they are associated with about fifteen percent of the burials (Goldstein et al. 2012:198). Within this cemetery, they were primarily associated with females.

As at the Alameda-Stone Cemetery, hook and eye closures were associated with one in seven burials (13.0 percent) within the Eastern State Hospital sample. Slightly more than two-thirds were adult females, and the remainder were males. When associated with women, large numbers of these types of fasteners tend to extend from the neck towards the pelvis (Figure 7-8), being primarily located along the anterior aspect of the body, but in some cases being found behind the spine. These hook and eye closures

were probably associated with dresses. In other instances, small numbers of hook and eye fasteners may have been associated with blouses or capes.

When found with males, hook and eye fasteners also tend to be found within the vicinity of the chest. In two instances (Burials 13 and 21), they extended down the chest in a manner similar to that observed for females (Figure 7-11). This could indicate that these individuals were buried wearing a dress. In another instance (Burial 63D), a concentration of hook and eye fasteners was associated with the pelvic area. The distribution of these fasteners is suggestive of a pants fly closure.

The presence of two hook and eye fasteners near the neck of Burial 63F could indicate that he was buried wearing a cape or “pelerine” (a cape/collar that usually ran to the elbows) (Figure 7-12). Such garments were often fastened with a hook and eye at the neck (Severa 1995:48). This 63-68 year old man had a series of Prosser buttons that extended from the neck down towards the chest. These buttons may have been associated with a shirt, but could represent a more elaborate garment. This individual also was one of only two found with a hair comb; together this, along with the hook and eye fasteners at the neck, strengthens the interpretation that he was laid out in a more elaborate and ornamental outfit compared to the typical male interred within the Eastern State Cemetery (Figure 7-12). The lack of buttons indicative of pants also is interesting; could he have been wearing a dress?

In most archaeological contexts, pins are often thought to be associated with shrouds. Within the Eastern State Hospital cemetery, pins were the only artifact associated with four burials (two females and two indeterminate). For the remaining 12 individuals (nine females and three males), there were eight instances (six females and two males) where pins were found in association with hook and eye fasteners. Pins associated with these burials were usually found in or just above the chest or pelvic area, suggesting that rather than being associated with shrouds they were used to pin clothing (Figures 7-8 and 7-11). A similar hook/eye and pin relationship was noted at the Michigan City Old Graveyard (Strezewski 2003:31).

A few burials deserve special mention because of the unique or unusual distribution of clothing related objects associated with these individuals. For instance, Burial 23, a 38-53 year old adult was buried wearing a vest and double-breasted jacket (Figure 7-13). It is quite possible that he and several other hospital residents, especially those who came from more prosperous families, were allowed to wear their own clothing.

An unusual button distribution pattern was associated with Burial 20A (a 23-26 year old male) (Figure 7-14) and Burial 44B (a 20-25 year old male) (Figure 7-15). Both exhibit a combination of one-hole and five-hole buttons situated along the right humerus. In addition to these buttons, a line of five-hole bone buttons found across the hip region of Burial 20A may represent pants fly closures, and a four-hole button at the left shoulder may have been associated with a shirt or hospital garment. The association of one-hole buttons with the right humerus of both individuals, which was not replicated among the other burials, may represent a specialized restraining garment. The cluster of five-hole

buttons found in the lower right abdomen of Burial 44B and a buckle between his shoulder blades also may have been associated with this restraining garment.

Burial 20A's teeth exhibit evidence of grinding and uneven wear patterns (also has a gold filling), and Burial 44B's dentition exhibits a great deal of chipping and spalling of the enamel (see Figure 5-4). Though what caused the grinding, chipping and spalling is not known, it may be a result of parafunctional bruxism due to anxiety, stress, mental illness, or medication. Perhaps these conditions are what led to these two individuals being required to wear a restraining garment.

In addition to Burial 63F, a hair comb was found with a 53-68 year old female (Burial 60B). The only other non-clothing related objects interred with the dead were a necklace found with a 47-63 year old female (Burial 50B), a ring associated with an 18-23 year old female (Burial 18A), and a coin found with a 45-57 year old male (Burial 39C).

Most of the clothing and other personal objects tend to exhibit gender related distributional patterns. The association of pants with females and dresses with males, not to mention the hair comb with Burial 63F, may reflect personal choices that deviated from the norm. At the Old Frankfort Cemetery, several women were buried wearing pants, and a similar pattern was noted at the Alameda-Stone Cemetery in Tucson (Goldstein et al. 2012:198). At neither cemetery was there any evidence of men wearing women's clothing or being buried with non-clothing related artifacts normally associated with women.

POPULATION CHARACTERISTICS

Demographics

Including the commingled remains, a minimum of 186 individuals (this includes five empty coffins due to preservation/disturbance and an unopened metal coffin) were interred in the portion of the Eastern State Hospital cemetery investigated in 2005 and 2011. If a third of the cemetery has yet to be investigated then there may have been as many as 300 individuals interred within this cemetery. This represents almost half (44.0 percent) of those who died at the hospital between 1839 and 1861. For the remaining individuals, their family or relatives may have claimed their body and either interred them at the Lexington Cemetery, an urban cemetery in a nearby town, or in a rural family cemetery. Thus, those interred within the cemetery may represent patients who did not have family and friends in the Lexington area, or whose loved ones could not afford to bury them in another cemetery.

The burial sample recovered from the Eastern State Hospital Cemetery differs from that of family or neighborhood cemetery in that it contains only nine juveniles, perhaps one infant (a small box without any remains), and no children (Table 7-3). Given the high infant mortality rates of the nineteenth century, infants and children can

account for over thirty percent of a cemetery's burial population. For instance, at the Old Frankfort Cemetery, they comprise 36.3 percent of the individuals recovered from this neighborhood burial ground (Table 7-4) (Pollack et al. 2009; see also Favret 2005). When the distribution of juveniles, young adults, middle-aged adults, and older adults is examined, the Eastern State Hospital population contains a much higher percentage of young adults (38.8 vs 29.2 percent) and a lower percentage of older adults (31.1 to 41.6 percent) relative to the Old Frankfort Cemetery. These percentages suggest that young adults admitted to the hospital had a slightly greater chance of dying before their thirty-fifth birthday than those living in the vicinity of the Old Frankfort Cemetery.

Table 7-3. Demographic Profile.

Age Category	Female		Indeterminate		Male		Total	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Juvenile	0	0.0	5	16.1	4	4.5	9	5.0
Young Adult	22	36.1	4	12.9	26	29.5	52	28.9
Middle Adult	11	18.0	0	0.0	17	19.3	28	15.6
Older Adult	17	27.9	0	0.0	30	34.1	47	26.1
Adult	11	18.0	22	71.0	11	12.5	44	24.4
Total	61	100.0	31	100.0	88	100.0	180*	100.0
Percent Minus Indeterminate		40.9				59.1		

*Does not include coffins that lack remains or the metal coffin that was not opened.

Table 7-4. Life Table for Eastern State Hospital and Old Frankfort Cemetery.

5-Year Age Ranges	Eastern State		Old Frankfort		Old Frankfort Minus infants and Children	
	Freq	Percent	Freq	Percent	Freq	Percent
<i>Infants/children</i>						
0-1			29	13.5		
1-4			42	19.5		
5-9			7	3.3		
<i>Juveniles/adolescent</i>						
10-14	2	1.6	6	2.8	6	12.4
15-19	7	5.4	17	7.9	17	5.1
<i>Young Adult</i>						
20-24	18	14.0	7	3.3	7	8.0
25-29	20	15.5	11	5.1	11	9.5
30-34	12	9.3	13	6.0	13	11.7
<i>Middle Adult</i>						
35-39	6	4.7	16	7.4	16	7.3
40-44	10	7.8	10	4.7	10	5.8
45-49	14	10.9	8	3.7	8	6.6
<i>Older Adult</i>						
50-54	13	10.1	9	4.2	9	8.8
55-59	13	10.1	12	5.6	12	20.4
60-79	14	10.9	28	13.0	28	12.4
Total	129		215	100.0	137	100.0

The higher number of males relative to females in the Eastern State Hospital Cemetery is consistent with historical records for the 1840s and 1850s, during which time more males were admitted to the hospital than females. Within the Eastern State Hospital Cemetery sample, males account for 59.1 percent and females encompassed 40.9 percent of the interments. In comparison, males accounted for 55.0 percent and females 45.0 percent of the Old Frankfort burial population.

Since Eastern State Hospital served the state of Kentucky and the surrounding region, it is likely that many patients were brought to this facility from other geographic areas. This diversity is reflected in a list of those who died at the hospital during the Cholera epidemic during the summer of 1849 (Brinegar 2006a). The 51 people who died are reported to have come from 30 of Kentucky's then 101 counties and Louisville, and as far away as Alabama and North Carolina. Not surprisingly, counties represented are primarily those located in the vicinity of Lexington, with northern and south-central counties also being well -represented. Livingston is the most western county represented, and none of the patients who died during the summer of 1849 were from eastern Kentucky counties.

Stature

Females at Eastern State Hospital on average stood 161.5 cm (5'4") in height and males averaged 170.2 cm (5'7") in height. Although the individuals at Eastern State Hospital may have experienced very different activities and been in varying stages of health, they were of similar stature as individuals interred in other mid-nineteenth century cemeteries in Kentucky and elsewhere.

Pathology

Within the Eastern State Hospital, males and females experienced the same types of ailments. Within this population, arthritis and bone infections were the most common conditions identified. Several individuals, particularly males, also showed evidence of labor-related activities, which is not surprising as many of the individuals likely engaged in physical labor either before they entered the hospital or during their stay. The incidence of vertebral pathology, especially Schmorl's nodes, which are labor-related manifestations, provides additional support to the notion that many of these individuals engaged in continuous physical labor throughout their lives.

Cranial lesions documented within the Eastern State Hospital population indicate that some individuals likely suffered from nutritional stress earlier in their lives, possibly caused by vitamin deficiencies (i.e. iron, vitamin D, and vitamin C), parasitic infections, and high corn or potato-based diets. Many individuals displayed both healed and active lesions consistent with infectious disease at the time of death, meaning that they suffered from various stages of infection throughout their lives.

Trauma was not as high as expected, especially relative to other institutional cemeteries that have been investigated archaeologically. Though trauma was not very

common, some differences were noted by gender. Males tended to have more injuries common in physical activity or falls. These fractures, shoulder dislocations, as well as enlarged or ossified muscle attachment sites likely reflect arduous labor-related activity over a long period of time. Injuries commonly associated with violence were noted for two females (a nasal fracture and an ulna fracture consistent with a defensive wound). These wounds also could have resulted from accidental injuries. Another two female individuals suffered from possible hip injuries, which could have been caused by falls or, perhaps, underlying pathological conditions.

One individual, a juvenile (approximately 14-16 years of age), shows skeletal manifestations and trauma that are consistent with polio (Figure 7-10). This individual exhibits extreme atrophy of the long bones of the left leg and left arm, and had suffered a broken left hip. This individual's arm may have been fixed in the flexed position (arm bent). The right lower ankle has a squatting facet pointing to repeated flexion of the foot upward or squatting, possibly due to compensation for a shorter left leg. Shape changes to the hip joints (acetabulum of the pelvis and femoral head) show evidence of a possible partial dislocation, and suggests that this individual spent a great deal of time sitting. The lack of atrophy in the right arm and leg bones indicates that this individual was not completely paralyzed. The healed nature of the fracture suggests they lived for some time after the injury.

In comparison to the contemporary Old Frankfort and Horse Park cemeteries, the Eastern State Hospital population displayed similar pathological manifestations. Within these cemeteries, men and women appeared to have engaged in heavy labor, experienced varying degrees of malnutrition, and developed similar ailments throughout their lives.

Autopsy Evidence

Two individuals exhibited evidence of having undergone an autopsy, as indicated by the bisected cranium on each, including false start kerf marks near the orbits where the hand saw skipped out of the groove. No post-cranial evidence is present to suggest a complete autopsy was conducted.

Another individual (Burial 19A, a 47-63 year old female) was conspicuously missing her skull. There was nothing to indicate that this burial had been disturbed by later interments, and no evidence to suggest that the cranium had been removed by grave robbers. Rather, her skull appears to have been removed, perhaps by a doctor, before she was placed in her coffin. Her remains were too poorly preserved to determine if cut marks were present on the cervical vertebrae.

The disarticulated remains found in the fill above Burial 26B, a 23-27 year old male, may represent individuals placed in the cemetery after they had been examined by doctors/medical students at nearby Transylvania University. All of the remains were recovered from the fill of a single interment and there is no evidence to suggest that digging of the grave shaft for Burial 26B resulted in the disturbance of earlier graves.

This small concentration of bones contained the partial remains of four individuals, and included three skulls and four mandibles.

Dental Health

Individuals interred in the Eastern State Hospital Cemetery tended to have very poor oral health, with caries and calculus affecting more than eighty percent of the mortuary sample. In addition, fifty percent had lost one or more teeth prior to death, and nearly thirty percent had one or more abscesses. Males and females were nearly equally affected by dental diseases except in the case of abscesses where males had almost twice as many as females. In general, abscess rates at this cemetery were much higher than at other mid-nineteenth century cemeteries. It is possible that the nineteenth century use of calomel to treat various ailments may have resulted in mercury poisoning and subsequent tooth deterioration.

The high incidences of hypoplasias in the Eastern State Hospital sample reflects environmental and nutritional stress, and exposure to disease during the early years for almost everyone interred in this cemetery. This data is consistent with the previously mentioned cranial lesions associated with vitamin D or iron deficiencies. Nutritional stress reflected in the teeth is in part related to weaning, but also is suggestive of a diet abundant in carbohydrates and sugar.

Unusually high incidences of chipped and spalled enamel was noted within the Eastern State Hospital burial sample. It may have been caused by teeth grinding or gnashing, or jaw clenching. Bruxism was also present as evident by sloping and polished wear patterns observed on the teeth of several individuals. This could have been caused by using the teeth during certain work activities, such as leather work, which would involve repeated pulling and pressure. However, this could also be a result of soft materials being inserted into the mouth to control seizures.

Within the Eastern State Hospital sample, eight individuals had fillings, which is suggestive of dental work either before they entered the hospital or during their stay. Of these eight individuals, seven had gold fillings and one an amalgam filling. In the mid-nineteenth century, only the wealthy could afford dental care, and not surprisingly, gold fillings are relatively rare in archaeological samples (Houdek et al. 2000:98; Little et al. 1992; Strezewski 2003:41). The presence of eight individuals with fillings within the Eastern State Hospital sample could thus reflect their socioeconomic status. Or it could reflect experimentation by the Transylvania Dental School.

That three of the eight individuals were associated with Grave Shaft 51 is quite intriguing. Two were young adult males in the 20-35 year old range, and the other could only be classified as an adult male. Clothing related objects were only found with one of the graves and each exhibited a different arm placement. Since all were found in the same grave shaft, they presumably died at the same time. One can not help but wonder if complications associated with this dental work contributed to their death, or perhaps dental students were practicing on cadavers.

DIET

Stable carbon isotope data not only provides important information on diet, but can be used to gain insights into nineteenth century residential mobility and socioeconomic variability within central Kentucky. Of the individuals in the Eastern State Hospital sample that yielded carbon isotope data, about one quarter subsisted on diets high in corn products and slightly more than half consumed a diverse diet, one that included both C₃ and C₄ plants. The remaining individuals (16.7 percent) consumed little in the way of C₄ plants. Within this burial sample, more males relative to females had a high corn based diet. On the other hand, a much higher percentage of females consumed no C₄ plants over the course of their lives. Some of the variation observed in the consumption of C₃ and C₄ plants among those interred in the Eastern State Hospital may be tied to socioeconomic status, with upper middle class and wealthy individuals having a more diverse diet than the poor.

In comparison to other central Kentucky cemeteries, the Eastern State Hospital burial population contained more individuals who consumed little or no C₄ plants. In fact, the Eastern State Hospital data suggests that at least ten years before they were admitted to the hospital, one in five individuals lived in a region where they primarily consumed old world grains and perhaps potatoes. It also contained a higher percentage of individuals who consumed a combination of corn-based products and old world grains, suggesting that during the course of their lives, many of those interred within this cemetery may have been better off than those interred in the Old Frankfort, Horse Park, and Vardeman cemeteries.

When compared to other central Kentucky cemeteries, the Eastern State Hospital sample exhibits considerably more variation in plant food consumption. Those interred within contemporary urban neighborhood or rural family cemeteries appear to have relied much more heavily on corn-based products than those interred within the Eastern State Hospital Cemetery. If the Eastern State Hospital diversity reflects the composition of an institutional population, it is possible that those interred within neighborhood and rural cemeteries had similar socioeconomic backgrounds and lived most of their lives in the central Kentucky region.

COMMINGLING/LACK OF CONNECTEDNESS

During the investigation of the Eastern State Hospital, six concentrations of commingled remains, representing a minimum of 27 individuals, were documented. Of these, five were the indirect result of the excavation of mass graves. In addition to the commingling of the remains of 23 individuals, the mass graves truncated seven earlier single interments and completely disturbed an additional six graves. The sixth concentration represented the remains of four individuals placed over a single interment. It was previously suggested that the latter may represent remains placed in the cemetery after they had been examined by doctors at Transylvania University. Together, these activities impacted at least 36 individuals.

The commingled remains were primarily located in the northwestern portion of the cemetery, in an area that was initially used for single interments. In addition to the mass graves, this was the predominate area where the stacking of single graves was documented. Elsewhere in the cemetery, mass graves were located in close proximity to one another but did not result in the disturbance of earlier single interments. And in these areas, they were rarely placed over an earlier grave.

The finding of concentrations of commingled remains was rather surprising, as the cemetery was in use for only 20 years. If much of the commingling took place during epidemics, then many of the earlier interments would have been in the ground less than 10 years, before their graves were disturbed. Thus, it is quite likely that prior to (and during) the digging of the mass grave shafts, hospital staff were aware of the fact that they were disturbing earlier graves. Certainly, the presence of mass graves throughout the cemetery points to the need to inter large numbers of individuals quickly, perhaps due to the cholera epidemics of the mid-nineteenth century. But why place these graves over and through earlier interments?

A lack of connectedness between the dead and the living may have contributed to the commingling of human remains, regardless of the socioeconomic status or religious affiliation of the deceased. Neither the hospital staff nor the administration appear to have had a vested interest in the cemetery itself, and most importantly a familial relationship with those interred within the cemetery. This is not only reflected in the commingling of the remains, but by the repurposing of the cemetery shortly after the final individual was interred. After the cemetery was converted to a female pleasure garden, its location was quickly lost to history.

In the early to mid-nineteenth century, prior to the beautification of death movement, attitudes toward the dead were more pragmatic. This was particularly evident in urban areas where space was limited. For instance, in southern Europe, particularly in Italy where graves were reused, after a short period of time the remains of those who had been previously interred in a grave were collected and placed into a loculo or ossuary (Goody and Poppi 1994). The reverence for the dead in this region stemmed mainly from the Christian idea of resurrection and the need to pray for the deceased soul's entrance into heaven (Goody and Poppi 1994:171). Relatives still cared for the relocated remains, but they just did so at another location. The remains of those for which there were no longer relatives residing nearby were initially placed in a common charnel house and then transferred to an ossuary. Elsewhere in England, burial space could be bought and resold, depending on one's financial situation and mobility. As noted by Strange (2003:147-148), "for those who interred the dead in what was, essentially, a second-hand burial space, access to the rites of mourning associated with private burial outweighed the lack of exclusive grave ownership." There was also a strong desire on the part of families to have a 'decent' funeral. This was in part grounded in "a desire to care for the corpse, to claim an identity for the dead and to negotiate grief through familiar customs of mourning" (Strange 2003:147).

During the nineteenth century, puritans favored equality in graves resulting in less elaborate stones and sparse grave treatments (Goody and Poppi 1994:169). The goal was to bury the dead and families were not as concerned with maintaining burial grounds (Goody and Poppi 1994:171-73). The enlightenment also contributed to this as people became more secular and trusting in science, and the institutions of the state exercised more control over the ownership of the body for individuals under their stewardship (Goody and Poppi 1994; Rugg 2000:269; Strange 2003:144). In a similar vein, in the Greek Orthodox Church, members believe that the soul is released from the body when decomposition leaves bones devoid of flesh. The remnant skeletal elements no longer represent the individual, but represent the collective bones of ancestors (Fox and Marklein 2013:195). This goes along with the Protestant reformations rejection of Catholic ideas of purgatory, whereby the actions of the living could save the souls of the dead (Goody and Poppi 1994:167). “Given this view, there was little point in going to the cemetery in order to help one’s relatives” (Goody and Poppi 1994:168). Thus, from this perspective, once the soul had been released and flesh had left the body, what remained may not have been considered to still be a person.

If these notions were commonplace in the central Kentucky region during the nineteenth century, hospital staff may have been more concerned with offering patients a proper burial than they were with the long-term care of earlier graves. It also may have been why they collected the disturbed remains and placed them back in the grave shaft at the conclusion of the mortuary event. In addition, simple markers may have been used to identify grave locations and hospital staff may have been more concerned with maintaining the cemetery grounds than protecting individual graves. They may have even considered the incorporation of the cemetery within a pleasure garden as a proper way to honor the dead.

CONCLUSIONS

At death, the residents of Eastern State Hospital appear to have been treated in a manner similar to those interred in other mid-nineteenth century urban neighborhood and rural cemeteries. The deceased were carefully laid to rest in hexagonal wooden coffins with their arms placed in the appropriate position pursuant to family, cultural, or religious traditions. Men were buried wearing shirts, jackets and pants, and women wearing dresses and shifts. As was the norm of the time, non-clothing related objects, such as hair combs and necklaces, were found with just a few individuals.

The Eastern State Hospital mortuary sample was comprised of a diverse group of individuals. They came from various social and economic backgrounds, and were brought to the hospital from counties throughout the state. In many ways their lives parallel those of the general communities that they resided in, as most undertook a considerable amount of hard labor before and after they entered the hospital. On the other hand, most consumed a more diverse diet than cemetery populations associated with urban neighborhood and rural cemeteries in central Kentucky. Some evidence of physical anomalies is evident in the burial population in the form of bruxism and teeth

grinding and poor dental health due to medical treatments. The presence of restraining garments, and the binding of legs and arms also may reflect some of the mental disorders from which patients suffered.

The bioarchaeological data indicates that individuals interred in the Eastern State Hospital Cemetery suffered maladies common among pre-antibiotic nineteenth century agricultural societies where malnutrition, poor sanitation, and infectious disease were common. Instances of enamel hypoplasia, porotic hyperostosis, and cribra orbitalia indicate many individuals suffered from nutritional deficiencies during their early years, likely caused by the synergistic effects of infection and low nutrient, high corn or potato-based diets. These deficiencies coupled with poor sanitation often made people susceptible to infectious diseases, such as respiratory infections and sinusitis. The onset of any of these infections could have begun before these individuals entered the hospital, or been contracted once admitted.

The presence of mass graves points to the need to bury people quickly, perhaps due to the cholera epidemics of the mid-nineteenth century. As patient deaths peaked during disease outbreaks, staff may have attempted to inter the dead as quickly as possible in an effort to separate the dead and diseased from the living, and stem the tide of mortality. These efforts ultimately resulted in the disturbance and commingling of earlier single interments, which from an early twenty-first century perspective is difficult to comprehend. It is suggested that a disconnect between the living and those interred within the cemetery coupled with nineteenth century mortuary customs that viewed the proper treatment of the dead as more important than the long-term preservation of the cemetery led to the commingling of human remains.

Certainly the social and economic status of those interred within this burial ground contributed to the cemetery being lost to history. Patients buried in this cemetery were mentally ill or had behavioral issues that led to them being admitted to the hospital, where they ultimately died. Many also may not have had relatives or family living in the Lexington area to arrange for the upkeep of the graves. After the area containing the cemetery was converted into a pleasure garden, any connection between those interred beneath the surface and the living would have quickly faded from the hospital staff's corporate memory. With no one maintaining the cemetery grounds, it quickly became "out of sight, out of mind" and was forgotten until it was rediscovered in 2005. This report has hopefully shed some light on those who lived and died at Eastern State Hospital in the mid-nineteenth century.

REFERENCES CITED

- Acsádi, G. and J. Nemeskéri
1970 *History of Human Life Span and Mortality*. Hungarian Academic Society, Budapest.
- Adams-Graf, John
2000 Nomenclature and Summary Table for Button Analysis. In *Never Anything so Solemn: an Archaeological, Biological, and Historical Investigation of the Nineteenth Century Grafton Cemetery*, edited by Jane E. Buikstra, Jodie A. O’Gorman, and Cynthia Sutton, pp. 182-196. Kampsville Studies in Archaeology and History No. 3. Kampsville, Illinois.
- Albanese, John, Stephanie E. Osley, and Andrew Tuck
2012 Do Century-Specific Equations Provide Better Estimates of Stature? A Test of the 19-20th Century Boundary for the Stature Estimation Feature in Fordisc 3.0. *Forensic Science International (Online)* 219(1):2861-2863.
- Allen, Dan Summer IV
2002 *Applied Archaeology: Relocation of the Mason Cemetery (40GL88), A Multi-Family Burial Ground in Giles County, Tennessee*. Duvall and Associates, Franklin, Tennessee.
- Ambrose, Stanley H.
1993 Isotopic Analysis of Paleodiets: Methodological and Interpretive Considerations. In *Investigations of Ancient Human Tissue: Chemical Analyses in Anthropology*, edited by Mary K. Sandford, pp. 59-130. Gordon and Breach Science Publishers, Langhorne, Pennsylvania.
- Ambrose, Stanley H. and Lynette Norr
1993 Experimental Evidence for the Relationship of the Carbon Isotope Ratios of Whole Diet and Dietary Protein to those of Bone Collagen and Carbonate. In *Prehistoric Human Bone: Archaeology at the Molecular Level*, edited by J. B. Lambert and G. Grupe, pp. 1-37. Springer-Verlag, Berlin.
- Anderson, L. D.
1984 Fractures of the shafts of the radius and ulna. In *Fractures in Adults*, edited by C. A. Rockwood and D. P. Green, pp. 511-558. Philadelphia, JB Lippincott.
- Angel, J.
1974 Patterns of fractures from Neolithic to Modern times. *Anthropologiai Közlemények* 18:9-18.
- Annual Report
1832 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
1842 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
1843 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.

- 1845 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1846 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1853 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1859 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1863 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1868 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1869 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1879 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1888 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1889 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1898 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1894 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1896 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1898 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1899 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1903 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.
- 1913 *Annual Report of Eastern State Lunatic Asylum.* Kentucky Documents, Library and Archives, Frankfort.

- 1925 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
- Armelagos G. J., K. Sirak, T. Werkema, B. L. Turner
 2014 Analysis of nutritional disease in prehistory: The search for scurvy in antiquity and today. *International Journal of Paleopathology* 5:9-17.
- Atler, George
 2004 Height, Frailty, and the Standard of Living: Modelling the Effects of Diet and Disease on Declining Mortality and Increasing Height. *Population Studies* 58(3):265-279.
- Aufderheide A. C., and C. Rodríguez-Martín
 1998 *The Cambridge Encyclopedia of Human Paleopathology*. Cambridge University Press, Cambridge.
- Bachman, Mary
 1998 *Collector's Guide to Hair Combs: Identification and Values*. Collector Books, Paducah, Kentucky.
- Balarajan Y, U., Ramakrishnan, E. Özaltın, A. H. Shankar, S. V. Subramanian
 2011 Anaemia in low-income and middle-income countries. *Lancet* 378:2123–2135.
- Behrensmeyer, A. K.
 1978 Taphonomic and Ecological Information from Bone Weathering. *Paleobiology* 4:150-162.
- Bell, Edward
 1990 The Historical Archaeology of Mortuary Behavior: Coffin Hardware From Uxbridge, Massachusetts. *Historical Archaeology* 24(3):54-78.
- 1994 *Vestiges of Mortality and Remembrance: A Bibliography on The Historical Archaeology of Cemeteries*. Scarecrow Press, Metuchen, New Jersey.
- Benjamin, M., H. Toumi, J. R. Ralphs, G. Bydder, T. M. Best, and S. Milz.
 2006 Where tendons and ligaments meet bone: Attachment sites ('entheses') in relation to exercise and/or mechanical loading. *Journal of Anatomy* 208:471-490.
- Berry N., R. Sagar, and B. M. Tripathi
 2003 Catatonia and other psychiatric symptoms with vitamin B12 deficiency. *Acta Psychiatrica Scandinavica* 108:156–159.
- Bidmos, M. A., V. E. Gibbon, and G. Strkalj
 2010 Recent Advances in Sex Identification of Human Skeletal Remains in South Africa. *South African Journal of Science* 106(11/12).
- Bogin, Barry
 1999 *Patterns of Human Growth*, Second edition. Cambridge Studies in Biological and Evolutionary Anthropology (Book 23). Cambridge University Press, Cambridge.

- Borra, V. M., J. J. Waterval, R. J. Stokroos, J. J. Manni, and W. Van Hul
 2013 Localization of the gene for hyperostosis cranialis interna to chromosome 8p21 with analysis of three candidate genes. *Calcified Tissue International* 93:93-100.
- Boyjadjian, Celia H. C., Sabine Eggers and Karl J. Reinhard
 2007 Dental Wash: A Problematic Method for Extracting Microfossils from Teeth. *Journal of Archaeological Science* 34:1622-1628.
- Brickley, M., and R. Ives
 2008 *The Bioarchaeology of Metabolic Bone Disease*. Academic Press, Amsterdam.
- Brinegar, Pam
 2006a 1833 and 1849 Cholera Deaths at Eastern State Hospital, Lexington, Kentucky. The Kentucky Atlas of August 24, 1849, as reprinted in the Lexington Leader, Lexington, Kentucky, 25 August 1901, p. 10 cols. 1-4. http://kykinfolk.com/esh/cholera_deaths.htm. Accessed July 13, 2014.
- 2006b The Cemetery at Eastern State Hospital, Lexington, Kentucky. <http://www.rootsweb.ancestry.com/~kyfayett/esh/>. Access August 9, 2014.
- Brooks, S. and J. M. Suchey
 1990 Skeletal Age Determination Based on the Os Pubis: A Comparison of the Acsadi-Nemeskeri and Suchey-Brooks Methods. *Human Evolution* 5(3):227-238.
- Brown, Albert T.
 1975 The Role of Dietary Carbohydrates in Plaque Formation and Oral Disease. *Nutrition Reviews* 33(12):353-361.
- Brown, W. J., J. F. Donohue, N. W. Axnick, J. H. Blount, N. Ewen, and O. Jones
 1970 *Syphilis and other venereal diseases*. Cambridge University Press, Cambridge.
- Bruzek, J.
 2002 A Method for Visual Determination of Sex, Using the Human Hip Bone. *American Journal of Physical Anthropology* 117:157-168.
- Buchner, Andrew C., Emanuel Breitburg, Charles Williams, and Elizabeth A. Williams
 1999 *At Rest, Again: The Ridley Graveyard (40WM208) Archaeological Relocation Project, Williamson County, Tennessee*. Panamerican Consultants. Memphis.
- Buckberry, J. L., and A. T. Chamberlain
 2002 Age Estimation from the Auricular Surface of the Ilium: A Revised Method. *American Journal of Physical Anthropology* 119:231-9.
- Buikstra, Jane E., and Della C. Cook
 1980 Paleopathology: An American Account. *Annual Review of Anthropology* 9:433-470.
- Buikstra, Jane E., and Douglas Ubelaker
 1994 *Standards for Data Collection from Human Skeletal Remains*. Research Series No. 44. Arkansas Archaeological Survey, Fayetteville.

- Bulloughs, Peter
1997 *Orthopaedic Pathology*. Third Edition. Times Mirror International Publishers Limited, London.
- Bybee, Alexandra
2009a Mortuary Archaeology. In *The Archaeology of Kentucky: An Update*, edited by David Pollack, pp. 1050-1055. Kentucky Heritage Council, Frankfort.
2009b *Bioarchaeological Investigations of an African-American Cemetery (15Sc292) at the Ward Hall Development Property, Georgetown, Scott County, Kentucky*. Cultural Resource Analysts, Lexington.
- Capasso, L., K. A. R. Kennedy, and C. A. Wilczack,
1998 *Atlas of Occupational Markers on Human Remains*. Edigrafital, Teramo, Italy.
- Carabelli, G.
1842 *Anatomie des Mundes*. Braumiller und Seidel, Wien, Germany
- Chandraraj S., C. A. Briggs, and K. Opeskin
1998 Disc Herniations in the Young and End-Plate Vascularity. *Clinical Anatomy* 11:171-176.
- Chavez, Adolfo, and Celia Martinez
1982 *Growing up in a Developing Community*. Instituto Nacional de la Nutricion, Mexico, D. F.
- Cincinnati Enquirer
1870 The Son of Henry Clay: Thirty-Eight Years of Hopeless Insanity Ended by Death in an Asylum, newspaper article, May 17, 1870.
- Coachbuilt
n.d. Website on history of Coachbuilt, including origins in Fisk metallic burial cases, see http://www.coachbuilt.com/bui/c/crane_breed/crane_breed.htm. Last accessed January 2014.
- Coleman, Winston J.
1951 *Last days, death, and funeral of Henry Clay, with some remarks on the Clay monument in the Lexington Cemetery*. Winburn Press, Lexington.
- Collins, E.
2009 An Osteological and mortuary analysis of the Insane Asylum of California Cemetery, 1851-1854. Thesis, California State University, Chico.
- Cooke, John E.
1833 Susan Yandell to David Wendel, 7 June 1833; "Remarks on Cholera as it appeared in Lexington, June 1833," *Transylvania Journal of Medicine* 6:313; *Lexington Observer and Kentucky Reporter*, 8 June 1833.
- Corbett, M. E., and W. J. Moore
1976 Distribution of Dental Caries in Ancient British Populations: IV The 19th Century. *Caries Research* 10:401-414.

Correia, A., and C. Pina

2000 Tubercle of Carabelli: A Review. *Dental Anthropology Journal* 15:18-21.

Coulter, Harris Livermore

1982 *Divided Legacy Volume III: Science and Ethics in American Medicine 1800-1914: The Conflict between Homeopathy and the American Medical Association*. North Atlantic Books. Berkley, California. Online edition. www.books.google.com. Accessed between January 2012 and August 2013.

Craig, Joseph, and Clark Spencer Larsen

1993 *Life and Death on the Illinois Prairie: Archaeological and Osteological Investigations at the Cross Cemetery, Springfield, Illinois*. Roosevelt National Life Insurance Company Springfield, Illinois.

Cybulski, J. S.

1994 Culture Change, Demographic History, and Health and Disease on the Northwest Coast. In *In the Wake of Contact: Biological Responses to Conquest*, edited by C. S. Larsen and G. R. Milner, pp. 75-85. Wiley-Liss, New York.

D. G. Beers & Co.

1877 *Atlas of Bourbon, Clark, Fayette, Jessamine and Woodford Counties, Kentucky*. D.G.Beers & Co., Philadelphia.

Dahlberg, Albert A.

1945 The Changing Dentition of Man. *Journal of the American Dental Association*. 6:676-690.

1949 The Dentition of the American Indian. In *Papers on the Physical Anthropology of the American Indian*, edited by W. S. Laughlin, pp. 138-176. Viking Fund, New York.

1963 Analysis of American Indian Dentition. In *Dental Anthropology, Symposia for the Study of Human Biology*, Vol. V, edited by D. R. Brothwell, pp. 149-177. Pergamon Press, Oxford.

Daly, Walter J.

2008 The Black Cholera comes to the Central Valley of America in the 19th Century - 1832, 1849, and later. In *Transactions of the American Clinical And Climatological Association* 119:143-153.

Davidson, James M.

2000 The Development of Freedman's Cemetery. In *Freedman's Cemetery: A Legacy of A Pioneer Black Community in Dallas, Texas*, edited by Duane E. Peter, Marsha Prior, Melissa M. Green, and Victoria G. Clow, editors, pp. 233-407. Special Publication No. 6. Geo Marine. Report No. 21. Texas Department of Transportation, Environmental Affairs Division, Archeology Studies Program, Austin.

2006 Material Culture, Chronology, and Socioeconomics. In *Two Historic Cemeteries in Crawford County, Arkansas*, edited by Robert C. Mainfort, Jr. and James M. Davidson, pp. 97-218. Arkansas Archaeological Survey Research Series No. 62. Fayetteville, Arkansas.

- des Fontaines, J.
1990 Wedgwood Whiteware. *Proceedings of the Wedgwood Society* 13:1-8.
- Duban, Rachel
2012 A Grave Situation: Burial Practices Disturbed During Cholera Epidemic. In *Cholera: Hamilton's Forgotten Epidemic*, edited by D. Ann Herring, Heather T. Battles, Diedre Beintema, Ayla Mykytey, and Thomas Siek, pp. 136-145. Anthropology Publications, Paper 6. Department of Anthropology, McMaster University, Hamilton, Ontario.
- Dumond, D. E.
1977 *The Eskimos and Aleuts*, Ancient Peoples and Places, Thames & Hudson, London.
- Edgar, Heather J. H.
2005 Prediction of Race Using Characteristics of Dental Morphology. *Journal of Forensic Science* 50(2):1-5.
- Eggleston, Lori
2012 *Guardian of the Artifacts*. Online. Internet. http://guardianoftheartifacts.blogspot.com/2012_02_01_archive.html. Blog of the National Museum of Civil War Medicine. Frederick, Maryland. Accessed March 7, 2012.
- Ehrgott & Krebs Lith.
1871 Birdseye View of Lexington, Kentucky. Ehrgott & Krebs Lith., Cincinnati.
- El-Najjar, M. Y., D. J. Ryan, C. G. Turner, and B. Lozoff
1976 The etiology of porotic hyperostosis among the prehistoric and historic Anasazi Indians of Southwestern United States. *American Journal of Physical Anthropology* 44:477-488.
- El-Najjar, M. Y., M.V. DeSanti and L. Ozebek
1978 Prevalence and possible etiology of dental enamel hypoplasia. *American Journal of Physical Anthropology* 48:185-192.
- Environmental Protection Agency
2013 Agency for Toxic Substances and Disease Registry. Toxic Substances-Mercury. www.atsdr.cdc.gov. Accessed March June 24, 2013.
- Epperson, T. W.
2004 Critical Race Theory and the Archaeology of the African Diaspora. *Historical Archaeology* 38(1):101-108.
- Epps, C. H.
1984 Fractures of the shaft of the humerus. In *Fractures in Adults*, edited by C. A. Rockwood and D. P. Green, pp. 653-674. Second edition, J. B. Lippincott, Philadelphia:
- Erdmann, D, K. E. Follmar, M. DeBruijn, A. D. Bruno, S. Jung, D. Edelman, S. Mukundan, and J. R. Marcus
2008 A retrospective analysis of facial fracture etiologies. *Annals of Plastic Surgery* 60:398-403.

- Eshed, V., B. Latimer, C. M. Greenwald, L. M. Jellema, B. M. Rothschild, S. Wish-Baratz, and I. Hershkovitz
 2002 Button Osteoma: Its Etiology and Pathophysiology. *American Journal of Physical Anthropology* 118:217–230.
- Favret, Amy C.
 2005 *The Bioarchaeology of Children's Health in Antebellum Kentucky: The Old Frankfort Cemetery*. Unpublished master's thesis, Department of Anthropology, Ball State University, Muncie, Indiana.
 2006 *Archaeological Investigations of Unmarked Graves at Eastern State Hospital Lexington, Fayette County, Kentucky*. Report No. 119. Kentucky Archaeological Survey, Lexington.
 2008 *Archaeological Investigations at Terrill Cemetery (15Ma424), Madison County, Kentucky*. Report No. 149. Kentucky Archaeological Survey, Lexington.
- Federation Dentaire International
 1982 An Epidemiological index of Developmental Defects of Dental Enamel (DDE Index). *International Dentition Journal* 32:159-167.
- Feldesman, Marc R., and Robert L. Fountain
 1996 "Race" Specificity and the Femur/Stature Ratio. *American Journal of Physical Anthropology* 100:207-224.
- Finnegan, M., and M. A. Faust
 1974 Variants of the Femur. *Research Report 14: Bibliography of Human and Non-human, Non-Metric Variation*. Paper 3.
- Fischer Walker C., and R. Black
 2007 Micronutrients and Diarrheal Disease. *Clinical Infectious Diseases* 45: S73-77.
- Forbes, R. M., H. M. Parker, J. W. Erdman, Jr.
 1984 Effects of dietary phytate, calcium and magnesium levels on zinc bioavailability to rats. *The Journal of nutrition* 114:1421–1425
- Fox, Sherry C. and Kathryn Marklein
 2013 Primary and Secondary Burials with Commingled Remains from Archaeological Contexts in Cyprus, Greece, and Turkey. In *Commingled and Disarticulated Human Remains: Working Toward Improved Theory, Method, and Data* edited by Anna J. Osterholtz, Kathryn M. Baustian, Debra L. Martin, pp. 193-212. Springer, New York.
- Francaviglia, Richard V.
 1971 The Cemetery as an Evolving Cultural Landscape. *Annals of the Association of American Geographers* 61(3):501-509
- Galloway, Allison
 1999 Principles for Interpretation of Blunt Force Trauma. In *Broken Bones: Anthropological Analysis of Blunt Force Trauma*, edited by Allison Galloway, pp. 35-255. Charles C. Thomas, Springfield.

- Garrow, Patrick H.
1987 A Preliminary Seriation of Coffin Hardware Forms in Nineteenth and Twentieth Century Georgia. *Early Georgia* 15(1/2):19-45.
- Goldstein, Lynne, Kristin J. Sewell, Michael P. Heilen, and Joseph T. Hefner
2012 Mortuary Synthesis. In *Uncovering Identity in Mortuary Analysis: Community – Sensitive Methods for Identifying Group Affiliation in Historic Cemeteries*, edited by Michael P. Heilen, pp. 185-226. Left Coast Press, Walnut Creek, California.
- Goodman, Alan H.
1988 The Chronology of Enamel Hypoplasias in an Industrial Population: A Reappraisal of Sarnat and Shour (1941, 1942). *Human Biology* 60(5):781-791.
- Goodman, Alan H., and George J. Armelagos
1985 The Chronological Distribution of Enamel Hypoplasia in Human Permanent Incisor and Canine Teeth. *Archives of Oral Biology* 30(6):503-507.
- Goodman, Alan H., George J. Armelegos, and Jerome C. Rose
1980 Enamel hypoplasias as indicators of stress in three prehistoric populations from Illinois. *Human Biology* 52:515-528.
- Goodman, Alan H., and Jerome C. Rose
1990 Assessment of Systemic Physiological Perturbations from Dental Enamel Hypoplasias and Associated Histological Structures. *Yearbook of Physical Anthropology* 35:59-110.
- 1991 Dental Enamel Hypoplasias as Indicators of Nutritional Stress. In *Advances in Dental Anthropology*, edited by M. Kelly and C. Larsen, pp. 279-295. Wiley-Liss, New York.
- Goodman, Alan H., D. L. Martin, A. Perry, C. Martinez, D. Chavez, and K. Dobney
1989 The Effect of Nutritional Supplementation on Permanent Tooth Development and Morphology. *American Journal of Physical Anthropology* 78:129-130.
- Goody, Jack, and Cesare Poppi
1994 Flowers and Bones: Approaches to the Dead in Anglo-American and Italian Cemeteries. *Comparative Studies in Society and History*, 36(1):146-175.
- Gordon, Claire C., and Jane E. Buikstra
1981 Soil pH, Bone Preservation, and Sampling Bias at Mortuary Sites. *American Antiquity* 46:566-571.
- Graham, S. M., O. M. Arvela, and G. A. Wise
1992 Long-term neurologic consequences of nutritional vitamin B12 deficiency in infants. *Journal of Pediatrics* 121:710-714.
- Grauer, Anne L.
1995 *Bodies of Evidence: Reconstructing History through Skeletal Analysis*. Wiley-Liss, New York.
- Habenstein, R. W., and W. M. Lamers
1955 *The History of American Funeral Directing*. National Funeral Directors Association, Milwaukee.

Hackett, C.

1976 Diagnostic criteria of syphilis, yaws and treponarid (treponaematoses) and of some other diseases in dry bones. In *Sitzungsberichte der Heidelberger Akademie der Wissenschaften Mathematisch-naturwissenschaftliche Klasse*. Abhandlung 4. Springer-Verlag, Berlin.

Hawkey, D. E., and C. O. Turner II

1998 Carabelli's Trait and Forensic Anthropology: Whose Teeth are These? In *Human Dental Development, Morphology, and Pathology: A Tribute to Albert A. Dahlberg*, edited by J. R. Lukacs, pp. 41-50. Department of Anthropology, University of Oregon, Eugene.

Hector, M., and J. Burton

1988 What are the Psychiatric Manifestations of Vitamin B₁₂ Deficiency? *Journal of the American Geriatrics Society* 36:1105-1112.

Higgins, Roseanne L., Michael R. Haines, Lorena Walsch, and Joyce E. Sirianni

2002 The Poor in the Mid-Nineteenth Century Northeastern United States: Evidence from the Monroe County Almshouse, Rochester, New York. In *The Backbone of History: Health and Nutrition in the Western Hemisphere*, edited by R. H. Steckel and J. C. Rose, pp. 162-184. Cambridge University Press, Cambridge.

Higgins, Roseanne L., and Joyce E. Sirianni

1995 An Assessment of Health and Mortality of Nineteenth Century Rochester, New York Using Historic Records and the Highland Park Skeletal Collection in *Bodies of Evidence*, edited by Anne L. Grauer, pp. 121-136. Wiley-Liss, York.

Hillson, Simon

1996 *Dental Anthropology*. Cambridge University Press. Cambridge.

Hodges, Denise C.

1987 Prehistoric Health and Agricultural Intensification in the Valley of Oaxaca, Mexico. *American Journal of Physical Anthropology* 72:211.

Houdek, D., J. E. Buikstra, and C. Stojanowski

2000 Osteological Analysis. In *Never Anything So Solemn: An Archaeological, Biological, and Historical Investigation of the Nineteenth-Century Grafton Cemetery*, edited by J. E. Buikstra, J. A. O'Gorman, C. Sutton, pp. 91-114. Kampsville Studies in Archaeology and History No. 3. Kampsville, Illinois.

Hrdlicka, Ales

1920 Shovel Shaped Teeth. *American Journal of Physical Anthropology* 3:29-465.

Hughes, Elizabeth, and Marion Lester

1981 *The Big Book of Buttons*. New Leaf Publishers, Maine.

Hutchinson, Dale L., and Clark S. Larsen

1988 Determination of Stress Episode Duration from Linear Enamel Hypoplasias: A Case Study from St. Catherine's Island, Georgia. *Human Biology* 60:93-110.

- Hyson, John M., Joseph W. A. Whitehorne, and John T. Greenwood
 2009 *A History of Dentistry in the US Army to World War II*. United States Department of the Army. Office of the Surgeon General, Borden Institute.
- Irish, J. D., and C. O. Turner II
 1987 More Lingual Surface Attrition of the Maxillary Anterior Teeth in American Indians—Prehistoric Panamanians. *American Journal of Physical Anthropology*, 73(2):209-213.
- Jaffe, H. L.
 1972 *Metabolic, Degenerative, and Inflammatory Diseases of Bones and Joints*. Lea and Febinger, Philadelphia.
- Jantz, R. L., and S. D. Ousley
 2005 *FORDISC 3: Computerized Forensic Discriminant Functions*. University of Tennessee, Knoxville.
- Jones, G. B.
 1962 Paralytic dislocation of the hip. *Journal of Bone and Joint Surgery* 44B:573-587.
- Jones, W. Unite
 1924 *The Button Industry*. Sir Isaac Pitman and Sons, London.
- Jelliffe, D. B., and E. F. P. Jelliffie
 1971 Linear Enamel Hypoplasias of Deciduous Incisor Teeth in Malnourished Children. *American Journal of Clinical Nutrition* 24:893.
- Joseph, Anna P., R. K. Harish, P. K. Rajeesh Mohammed, and R. B. Vinod Kumar
 2013 How Reliable is Sex Differentiation from Teeth Measurements. *Oral & Maxillofacial Pathology Journal* 4(1):289-292.
- Journal of the House of Representatives
 1824 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
- Journal of the Senate
 1821 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
- 1823 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
- 1824 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
- 1825 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
- 1826 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.

- 1828 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
- 1829 *Annual Report of Eastern State Lunatic Asylum*. Kentucky Documents, Library and Archives, Frankfort.
- Jurmain R., and V. Bellifemine
 1997 Patterns of cranial trauma in a prehistoric population from central California. *International Journal of Osteoarchaeology* 7:34-50.
- Karaman, Feryal
 2006 Use of Diagonal Teeth Measurements in Predicting Gender in a Turkish Population. *Journal of Forensic Sciences* 51(3):630-635.
- Karlkins, Karlis
 1985 *Glass Beads*. Studies in Archaeology, Architecture, and History, Parks Canada, Ottawa.
- Katzenberg, M. A.
 1989 Stable isotope analysis of archaeological and faunal remains from southern Ontario. *Journal of Archaeological Science* 16:319-329.
- Kaushik, S. K., R. Madan, A. Gambhir, and T. Prasanth
 2009 Aviation stress and dental attrition. *Indian Journal of Aerospace Medicine*, 53(1):6-10.
- Kelly, J. P.
 1954 Fractures complicating electroconvulsive therapy and chronic epilepsy. *Journal of Bone and Joint Surgery-British Volume* 36: 70-79
- Kentuckiana Digital Library
 2014 View of Lunatic Asylum of Kentucky Kentuckiana Digital Library, (<http://name.kdl.kyvl.org/KUK-SLIDE-1576>). Accessed August 9, 2014.
- Kentucky Gazette
 1817 The hospital committee. *Kentucky Gazette*. June 28, 1817, page 4, column 6.
- 1818 The first class of a lottery. *Kentucky Gazette*. October 9, 1818, page 4, column 6.
- Kentucky Reporter
 1816a An act for founding and establishing a public hospital in Fayette County. *Kentucky Reporter*. April 17, 1816, page 3, column 4.
- 1816b Fayette Hospital. *Kentucky Reporter*. April 17, 1816, page 3, column 4.
- 1816c To the people of Kentucky. *Kentucky Reporter*. April 17, 1816, page 3, column 4.
- 1816d Theatre. *Kentucky Reporter*. December 11, 1816, page 3, column 5.
- Khandekar, R., and A. J. Mohammed
 2005 Visual disabilities among diabetics in Oman. *Saudi Medical Journal* 26:836-841.

Killoran, Peter, and Gretchen Dabbs

2011 Chapter Six: Human Skeletal Remains. In *Archaeological Investigations of the Horse Park Cemetery (15FA315) Fayette County, Kentucky*, by David Pollack, Peter Killoran, and Kim McBride, pp. 41-58. Report No. 204. Kentucky Archaeological Survey, Lexington.

Killoran, Peter, and Amy Favret

2009 Human Osteology and Cemetery Demographics. In *The Archaeological Investigation of the Old Frankfort Cemetery, Frankfort, Kentucky*. On file, Kentucky Archaeological Survey, Lexington.

King, Melinda J.

2006 Analysis of Enamel Hypoplasias in the Old Frankfort Cemetery: Comparisons between Adult Male and Female and Juvenile Prevalence and Age at Onset of Defects. In *Current Research in Kentucky: Volume Nine*, edited by Nicole V. Mills, Richard V. Williamson and Richard Davis, pp. 87-102. Kentucky Heritage Council, Frankfort.

King, Nigel M., Jennie S. J. Tai, and H. M Wong

2010 Morphological and Numerical Characteristics of the Southern Chinese Dentitions. Part II: Traits in the Permanent Dentition. *The Open Anthropology Journal* 3:71-84.

Kirkbride, Thomas S.

1880 On the Construction, Organization, and General Arrangements of Hospitals for the Insane. Transcription from www.kirkbridebuildings.com. First published 1854. J. B. Lippincott & Co., Philadelphia

Kowalsky, Arnold A., and Dorothy E. Kowalsky

1999 *Encyclopedia of Marks on American, English, and European Earthenware, Ironstone, Stoneware, 1780-1980: Makers, Marks, and Patterns in Blue and White, Historic Blue, Flow Blue, Mulberry, Romantic Transferware, Tea Leaf, and White Ironstone*. Schiffer Publishing, Atglen, Pennsylvania.

Lallo, J. W., G. J. Armelagos, and R. P. Mensforth

1977 The Role of Diet, Disease, and Physiology in the Origin of Porotic Hyperostosis. *Human Biology* 49:471-483.

Lancaster, Clay

1952 Major Thomas Lewinski: Emigre Architect in Kentucky. *Journal of the Society of Architectural Historians* 11(4):13-20.

1978 Vestiges of the Venerable City. Lexington-Fayette County Historic Commission, Lexington. Kentucky Digital Library (http://kdl.kyvl.org/catalog/xt7qrf5kbv70_260_1) accessed August 8, 2014.

1991 *Antebellum Architecture of Kentucky*. University Press of Kentucky, Lexington.

Lanphear, Kim M.

1990 Frequency and Distribution of Enamel Hypoplasias in a Historic Skeletal Sample. *American Journal of Physical Anthropology* 81:35-43.

- Larsen, Clark Spencer
 1985 Dental Modifications and Tooth Use in the Western Great Basin. *American Journal of Physical Anthropology* 67:393-402.
- 1997 *Bioarchaeology, Interpreting Behavior from the Human Skeleton*. University Press, Cambridge.
- Larsen, Clark Spencer, Joseph Craig, Leslie E. Sering, Margaret J. Schoeninger, Katherine F. Russell, Dale L. Hutchinson, and Matthew A. Williamson
 1995 Cross Homestead: Life and Death on the Midwestern Frontier. In *Bodies of Evidence*, edited by A. Grauer, pp. 139-159. Wiley-Liss, New York.
- Leavitt-Reynolds, A. A.
 2011 A biocultural examination of trauma from the Colorado State Insane Asylum skeletal collection, 1879-1899. Unpublished Master's Thesis, Department of Anthropology, Colorado State University, Fort Collins.
- Legislative Documents
 1867 Legislative Documents. Kentucky Documents, Library and Archives, Frankfort.
- Lexington Transcript
 1888 Eastern Kentucky Lunatic Asylum. *Lexington Transcript*. January 14, 1888, page 1, column 2.
- Lindbergh, Jennie
 1999 Buttoning Down Archaeology. *Australian Historical Archaeology* 17:50-57.
- Litonjua, L. A., S. Andreana, P. J. Bush, and R. E. Cohen
 2003 Tooth wear: attrition, erosion, and abrasion. *Quintessence International* 34(6):435-446.
- Little, Barbara J., Kim M. Lanphear, and Douglas W. Owsley
 1992 Mortuary Display in a Nineteenth-Century Anglo-American Cemetery in Manassas, Virginia. *American Antiquity* 57(3):397-418.
- Lossing, Benson John
 1878 *History of American Industries and Arts*. Porter and Coates, Philadelphia.
- Lotter, O., S. Stahl, O. Luz, M. Pfau, and H.E. Schaller
 2010 Bilateral paradoxically symptomatic luno-triquetral coalition: a case report. *Eplasty* 10:47.
- Loughlin, Michael L., and M. Jay Stottman
 2010 *An Archaeological Survey of Eastern State Hospital (15Fa289) Lexington, Fayette County, Kentucky*. Report No. 185. Kentucky Archaeological Survey, Lexington.
- Lounsbury, Carl R.
 1994 *An Illustrated Glossary of Early Southern Architecture & Landscape*. Oxford University Press, New York.

- Lovejoy, C. O., and K. Heiple
 1981 The analysis of fractures in skeletal populations with an example from Libben site, Ottawa County, Ohio. *American Journal of Physical Anthropology* 55:529-541.
- Lovejoy, C. O., R. S. Meindl, T. R. Pryzbeck, and R. P. Mensforth
 1985 Chronological metamorphosis of the auricular surface of the ilium: a new method for the determination of adult skeletal age at death. *American Journal of Physical Anthropology* 68(1):15-28.
- Lubar, Steven
 1987 Culture and Technological Design in the Nineteenth-Century Pin Industry: John Howe and the Howe Manufacturing Company. *Technology and Culture* 28(2):253-282.
- Lukasc, John R., and Robert F. Pastor
 1988 Activity-Induced Patterns of Dental Abrasion in Prehistoric Pakistan: Evidence from Mehrgarh and Harappa. *American Journal of Physical Anthropology* 76(3):377-398.
- Lurie, Orit, Yehuda Zadik, Schmucl Ein, Ricardo Tarrasch, Gil Raviv, and Liav Goldstein.
 2007 Bruxism in Military Pilots and Non-Pilots: Tooth Wear and Psychological Stress. *Aviation, Space, and Environmental Medicine* 78(2):137-139.
- Luscomb, Sally C.
 1967 *The Collector's Encyclopedia of Buttons*. Crown Publishers, New York.
- Mabelitini, Brian
 2008 Coffin/Casket Hardware, Personal Artifacts, and Non-Mortuary Related Artifacts. In *Archeological Investigations at Terrill Cemetery (15MA424), Madison County, Kentucky*, edited by Amy C. Favret, pp. 5-7. Report No. 149. Kentucky Archaeological Survey, Lexington.
- MacDonald, A. E.
 1877 General Paresis. *American Journal of Insanity*. April 1877:451-482
- Mainfort, Robert C. Jr., and James M. Davidson
 2006 *Two Historic Cemeteries in Crawford County, Arkansas*. Arkansas Archaeological Survey Research Series No. 62. Fayetteville, Arkansas.
- Massler, M., I. Schour, and H. G. Ponche
 1941 Developmental Pattern of the Child as Reflected in the Classification Pattern of the Teeth. *American Journal of Diseases of Children* 62:33-67.
- Matt and Mapother
 1855 Map of Lexington, Fayette County, Kentucky. Haag and Sons Engraving, Lexington.
- Matternes, Hugh B., Valerie Davis, Julie Coco, Staci Richey, and Sarah Lowry
 2012 *Hold Your Light on Canaan's Shore: A Historical and Archaeological Investigation of the Avondale Burial Place (9B1164)*. Volume 1: Report of Investigation. Technical Report 2097. New South Associates, Stone Mountain, Georgia.

- May, H., N. Peled, G. Dar, J. Abbas, and I. HersHKovitz
 2011 Hyperostosis frontalis interna: What does it tell us about our health? *American Journal of Human Biology* 23:392-397.
- Mays, Simon
 1998 *The Archaeology of Human Bones*. Routledge, London.
- McHorris, W. H.
 1979 Occlusion with Particular Emphasis on the Functional and Parafunctional Role of Anterior Teeth. *Journal of Clinical Orthodontia* 13:684.
- McIlvaine, B. K.
 2013 Implications for reappraising the iron-deficiency anemia hypothesis. *International Journal of Osteoarchaeology* DOI: 10.1002/oa.2383.
- Medical Officers of Asylums and Hospitals for the Insane
 1854 *The Asylum Journal*. Online Edition. www.books.google.com. Accessed July 28, 2013.
- Meindl, R. S., and C. O. Lovejoy
 1985 Ectocranial Suture Closure: A revised method for the determination of skeletal age at death based on the lateral-anterior sutures. *American Journal of Physical Anthropology* 68:57-66.
- 1989 Age changes in the pelvis: implications for paleodemography. In: *Age Markers in the Human Skeleton*, edited by M. Y. Iscan, pp. 137-168. Charles C. Thomas, Springfield, Illinois.
- Meindl, R. S., C. O. Lovejoy, R. M. Mensforth, and L. D. Carlos
 1985 Accuracy and Direction of Error in Sexing of the Skeleton: Implications for Paleodemography. *American journal of Physical Anthropology* 68:29-45.
- Messeri, P.
 1961 Morfologia della rotula nei neolitici della Liguria. *Archivio per l'Antropologia e la Etnologia* 91:1-11.
- Middleton, Strobridge & Co.
 1861 Plan of the Pleasure Grounds & Farm of the Eastern Lunatic [SIC] Asylum, Lexington, Kentucky. Middleton, Strobridge & Co., Cincinnati.
- Miller, Sarah E.
 2005 Coffin/Casket Case Hardware, Personal Artifacts, and Nonmortuary Related Artifacts. In *Archaeological Investigations at the State Monument, Frankfort, Kentucky* by M. Jay Stottman, and David Pollack, pp. 31-44. Report No. 104. Kentucky Archaeological Survey, Lexington.
- 2006 Cultural Materials Recovered. In *Archaeological Investigations of Unmarked Graves at Eastern State Hospital*, by Amy Favret, pp. 11-19. Report No. 119. Kentucky Archaeological Survey, Lexington.
- 2007 Preliminary Analysis of Artifacts from the Old Frankfort Cemetery (15Fr154). In *Current Archaeological Research in Kentucky: Volume Nine*, edited by E. Nicole Williams,

- Richard V. Williamson, and Richard D. Davis, pp. 61-85. Kentucky Heritage Council, Frankfort.
- Mitchell, John Kearsley
 1850 *Impediments to the Study of Medicine: A Lecture, Introductory to the Course of Practice of Medicine*. T. K. and P. G. Collins, Philadelphia, Pennsylvania. Online edition. www.books.google.com. Accessed between January 2012 and August 2013.
- Moir, R. W.
 1987 Socioeconomic and Chronometric Patterning of Window Glass. *Historic Buildings, Material Culture, and People of the Prairie Margin*, edited by David H. Journey and Randall W. Moir, pp. 73-81. Richland Creek Technical Series Volume V. Southern Methodist University, Dallas.
- Moore, W. J., and M. E. Corbett
 1975 Distribution of Dental Caries in Ancient British Populations. Iii. The 17th Century. *Caries Research* 9(2):163-175.
- Moorrees, C. F., E. A. Fanning, and E. E. Hunt, Jr.
 1963 Age Variation of Formation Stages for Ten Permanent Teeth. *Journal of Dental Research* 42:1490-502.
- Murray, Elizabeth A., and Anthony J. Perzigian
 1995 A Glimpse of Early Nineteenth Century Cincinnati as Viewed from Potter's Field: An Exercise in Problem Solving. In *Bodies of Evidence*, edited by A. Grauer, pp. 173-184. Wiley-Liss, New York.
- Nelson, Lee H.
 1968 Nail Chronology as an Aid to Dating Old Buildings. *History News* 19(2):25-27.
- Nordquist, A., and C. J. Petersson
 1995 Incidence and causes of shoulder girdle injuries in an urban population. *Journal of Shoulder and Elbow Surgery* 4:107-112
- Observer and Reporter
 1869 Eastern Kentucky Lunatic Asylum. *Observer and Reporter*. April 10, 1869, page 3, column 2.
- Ogawa, K., and A. Yoshida
 1998 Throwing fracture of the humeral shaft: An analysis of 90 patients. *American Journal of Sports Medicine* 26:242.
- O'Leary, M. H.
 1981 Carbon isotope fractionation in plants. *Phytochemistry* 20(4):553-567.
- O'Malley, Nancy
 2006 Historical Background. In *Archaeological Investigations of Unmarked Graves at Eastern State Hospital Lexington, Fayette County, Kentucky*, by Amy Favret, pp. 4-9. Report No. 119. Kentucky Archaeological Survey, Lexington.

- Ortner, Donald J.
 2003 *Identification of Pathological Conditions in Human Skeletal Remains*. Second Edition. Academic Press, San Diego.
- 2011 Human skeletal paleopathology. *International Journal of Paleopathology* 1:4-11.
- Ortner, Donald J., and M. F. Ericksen
 1997 Bone changes in the human skull probably resulting from scurvy in infancy and childhood. *International Journal of Paleopathology* 7:212-220.
- Ortner, Donald J., and W. G. J. Putschar
 1985 *Identification of Pathological Conditions in Human Skeletal Remains*. Smithsonian Institution Press, Washington, D.C.
- Oshinsky, D. M.
 2005 *Polio: An American Story*. Oxford: Oxford University Press.
- Owsley, D. H., and D. W. Ubelaker
 2003 Isotopic evidence for diet in the seventeenth-century colonial Chesapeake. *American Antiquity* 68(1):129-139.
- Oxenham, M. F., and I. Cavill
 2010 Porotic hyperostosis and cribra orbitalia: the erythropoietic response to iron-deficiency anaemia. *Anthropological Science* 118:199-200.
- Pærregaard, A., K. Hjelt, and P. A. Krasilnikoff
 1990 Vitamin B12 and folic acid absorption and hematological status in children with postenteritis enteropathy. *Journal of Pediatric Gastroenterological Nutrition* 11:351-355.
- Parfitt, G. J.
 1956 The speed of development of the carious activity. *British Dental Journal* 100:204-207.
- Parler, Mary
 1962 *Folk Beliefs from Arkansas, Volume VII: Death and Funeral Customs*. University of Arkansas, Fayetteville, Arkansas.
- Perou, M. L.
 1964 *Cranial Hyperostosis*. C.C. Thomas, Springfield,
- Perrin, William Henry, editor
 1882 *History of Fayette County Kentucky*. O. L. Baskin & Co., Chicago.
- Phenice, T.
 1969 A Newly Developed Visual Method of Sexing in the Os Pubis. *American Journal of Physical Anthropology* 30:297-301.
- Phillips, Shawn M.
 2001a County institutions as crucibles of social judgment: Bioarchaeological evidence of the consequences of disease and social stigma. *Northeast Anthropology* 61:27-47.

- 2001b *Inmate Life in the Oneida County Asylum, 1860–1895: A Biocultural Study of the Skeletal and Documentary Records*. Unpublished Ph.D. dissertation, Department of Anthropology, University at Albany, State University of New York, Albany.
- 2003 Worked to the bone: the biomechanical consequences of ‘labor therapy’ at a nineteenth century asylum. In *Human Biologists in the Archives: Demography, Health, Nutrition and Genetics in Historical Populations* edited by D. Ann Herring and Alan C. Swedlund, pp. 96-129. Cambridge University Press, Cambridge.
- Piperata, B. A.
2007 Nutritional status of Ribeirinhos in Brazil and the nutrition transition. *American Journal of Physical Anthropology* 133:868–878.
- Piperata, B. A., M. Hubbe, and K. K. Schmeer
2014 Intra-population variation in anemia status and its relationship to economic status and self-perceived health in the Mexican Family Life Survey: Implications for bioarchaeology. *American Journal of Physical Anthropology*. doi: 10.1002/ajpa.22543
- Pollack, David, A. Gwynn Henderson, and Peter E. Killoran
2009 *Frankfort’s Forgotten Cemetery*. Education Series No. 10. Kentucky Archaeological Survey, Lexington.
- Pollack, David, and Peter E. Killoran
2008 Mortuary Patterns. In *The Archaeological Investigation of the Old Frankfort Cemetery, Frankfort, Kentucky*. On file, Kentucky Archaeological Survey, Lexington.
- Pollack, David, Peter Killoran, and Kim McBride
2011 *Archaeological Investigations of the Horse Park Cemetery (15FA315) Fayette County, Kentucky*. Report No. 204. Kentucky Archaeological Survey, Lexington.
- Powell, Mary Lucas
1985 The Analysis of Dental Wear and Caries for Dietary Reconstruction. In *The Analysis of Prehistoric Diets*, edited by R. I. Gilbert, Jr. and J. H. Mielke, pp. 307-338. Academic Press, Orlando, Florida.
- Powell, Mary Lucas, and Della C. Cook, editors
2005 *The Myth of Syphilis: The Natural History of Treponematoses in North America*. University Press of Florida, Gainesville.
- Price, Cynthia R.
1979 *19th century Ceramics in the Eastern Ozark Border Region*. Monograph Series 1. Center for Archaeological Research, Southwest Missouri State University, Springfield.
- Pyle, G. F.
1969 The diffusion of cholera in the United States in the nineteenth century. *Geographical Analysis* 1(1):59-75.
- Rai, B., and S. Anand
2007 Gender determination by diagonal distances of teeth. *The Internet Journal of Biological Anthropology* Vol. 1.

- Ranck, George
1884 *Guide to Lexington, Kentucky*. Transylvania Printing Company, Lexington.
- Rathbun, T. A.
1987 Health and Disease at a South Carolina Plantation: 1840-1870. *American Journal of Physical Anthropology* 70:239-254.
- Remini, Robert V.
1991 *Henry Clay: Statesman for the Union*. W. W. Norton and Company, New York.
- Resnick, Donald L.
2002 Degenerative disease of the spine. In *Diagnosis of bone and joint disorders, Volume 2*, edited by Donald L. Resnick, pp. 1382-1485. W. B. Saunders, London
- Resnick, Donald L., and G. Niwayama
1995 Osteomyelitis, septic arthritis, and soft tissue infection: mechanisms and situations. In *Diagnosis of bone and joint disorders, Volume 2*, edited by Donald L. Resnick, pp. 2448-2558. W. B. Saunders, London
- Roberts Charlotte, and Keith Manchester
2005 *The Archaeology of Disease*. Cornell University Press, Ithaca.
- Robinson, D.
2001 $\delta^{15}\text{N}$ as an integrator of the nitrogen cycle. *Trends in Ecology and Human Evolution* 16:153-162.
- Rogers, J., L. Shepstone, and P. Dieppe
1997 Bone Formers: Osteophyte and Enthesophyte Formation are Positively Associated. Extended Reports. *Annals of Rheumatic Disease* 56:85-90.
- Rogers J. and T. Waldron
1995 *A Field Guide to Joint Disease in Archaeology*. John Wiley, New York.
- Rogers, T. L.
2005 Determining the sex of human remains through cranial morphology. *Journal of Forensic Sciences* 50:1-8.
- Rose, Jerome C. (editor)
1985 *Gone to a Better Land. A Biohistory of a Rural Black Cemetery in the Post-Reconstruction South*. Research Series No. 25. Arkansas Archaeological Survey Fayetteville.
- Rothstein, William
1972 *American Physicians in the Nineteenth Century: from Sects to Science*. The Johns Hopkins University Press, Baltimore.
- Rotman, Deborah, John Adams-Graf, Kathryn Jakes, Marjorie Schroeder, and Christina Fulton.
2000 The Material Culture of Mortuary Behavior: Artifacts from the Grafton Cemetery. In *Never Anything so Solemn: an Archaeological, Biological, and Historical Investigation of the Nineteenth Century Grafton Cemetery*, edited by Jane E. Buikstra, Jodie A.

- O’Gorman, and Cynthia Sutton, pp. 60-90. *Studies in Archaeology and History* No. 3. Kampsville, Illinois.
- Royal Society of Chemistry
2010 UK lab reveals shocking mercury level in Lincoln's blue pills [Press release]. Retrieved from: <http://www.rsc.org/AboutUs/News/PressReleases/2010/BluePillsMercury.asp>.
- Rugg, Julie
2000 Defining the place of burial: What makes a cemetery a cemetery? *Mortality* 5(3):259-275
- Russell, Aaron E.
1997 Material Culture and African-American Spirituality at the Hermitage. In *Historical Archaeology* 31(2):63-80.
- Salter, R. B., and W. R. Harris
1963 Injuries involving the epiphyseal plate. *Journal of Bone and Joint Surgery [Am]* 45: 587-622.
- Saunders, S. R., and M. A. Katzenberg
2000 *Biological Anthropology of the Human Skeleton*. New York: Wiley-Liss.
- Scheuer, L., and S.M. Black
2000 *Developmental Juvenile Osteology*. Academic Press, San Diego.
- Schiffman, Dr. Eric L., J. R. Friction, and D. Haley
1992 The Relationship of Occlusion, Parafunctional Habits and Recent Life Events to Mandibular Dysfunction in a Non-patient Population. *Journal of Oral Rehabilitation* 19(3):201-223.
- Schmidt H., and J. Freyschmidt
1993 *Borderlands of normal and early pathologic findings in skeletal radiography*. Fourth Edition, Thieme Medical Publishers, New York.
- Schoeninger, M. J., M. T. DeNiro, and H. Tauber
1983 Stable nitrogen isotope ratios of bone collagen reflect marine and terrestrial components of prehistoric human diet. *Science* 220(4604):1381-1383.
- Schoeninger, M. J., and K. Moore
1992 Bone Stable Isotope Studies in Archaeology. *Journal of World Prehistory* 6(2):247-295.
- Schoeninger, M. J., and M. R. Schurr
1998 Human subsistence at Moundville: The stable isotope data. In *Archaeology of the Moundville Chiefdom*, edited by J. Vernon James Knight and V. P. Steponaitis, pp. 120-132. Smithsonian Institution Press, Washington, D.C.
- Schurr, Mark R.
2009 Stable Isotope Perspectives on Diet. In *The Archaeological Investigation of the Old Frankfort Cemetery, Frankfort, Kentucky*. On file, Kentucky Archaeological Survey, Lexington.

- Scott, Eugene C.
1979 Dental Wear Scoring Technique. *American Journal of Physical Anthropology* 51:213-218.
- Scott, Richard G.
1977 Classification, sex dimorphism, association, and population variation of the Canine Distal Accessory Ridge. *Human Biology* 49(3):453.
- Scott, Richard G., and Simon R. Poulson
2012 Stable Carbon and Nitrogen Isotopes of Human Dental Calculus: A Potentially New Non-Destructive Proxy for Paleodietary Analysis. *Journal of Archaeological Science* 39:1388-1393.
- Scott, Richard G., and Christy G. Turner II
1997 *The Anthropology of Modern Human Teeth: Dental Morphology and its Variation in Recent Human Populations*. Cambridge University Press, Cambridge.
- Scudder, John M.
1870 *The Eclectic Practice of Medicine*. Cincinnati Medical Publishing Company, Cincinnati.
- Sellen, D. W.
2007 Evolution of infant and child feeding: implications for contemporary public policy. *Annual Review of Nutrition* 27:123-148.
- Severa, J. L.
1995 *Dressed for the Photographer: Ordinary Americans and Fashion, 1840-1900*. Kent State University Press, Kent, Ohio.
- Sledzik, Paul S., and Peer H. Moore-Jansen
1991 Dental Disease in 19th Century Military Skeletal Samples. In *Advances in Dental Anthropology*, edited by Marc A. Kelley and Clark S. Larsen, pp. 218-223. Wiley-Liss, New York.
- Smith, B. H.
1984 Patterns of molar wear on hunter-gatherers and agriculturalists. *American Journal of Physical Anthropology* 63:39-56.
- Solomons, Noel W., and Gerald T. Keusch
1981 Nutritional Implications of Parasitic Infections. *Nutritional Review* 39:149-160.
- Souder, Mary Attie
1922 *Notions*. The Ronald Press Company, New York.
- Spolsky, Vladimir W., Caren J. Kamberg, Kathleen N. Lohr, and Bonnie G. Feldman
1983 *Measurement of Dental Health Status*. Rand Corporation, Santa Monica, California.
- Sprague, Roderick
2002 China or Prosser Button Identification and Dating. *Historical Archaeology* 36(2):111-127.

- Steckel, Richard H.
1995 Stature and the Standard of Living. *Journal of Economic Literature* 33(4):1903-1940.
- Steegman, A. Theodore
1991 Stature in an Early Mid-19th Century Poorhouse Population: Highland Park, Rochester, New York. *American Journal of Physical Anthropology* 85:261-268.
- Steinbock, R. T.
1976 *Paleopathological Diagnosis and Interpretation*. Charles C. Thomas, Springfield, Illinois.
- Stottman, M. Jay
2009 *Archaeological Investigations at the Western Cemetery Site (15Jf35) Louisville, Jefferson County, Kentucky*. Report No. 178. Kentucky Archaeological Survey, Lexington.
2012 Summary Report of Archaeological Investigations of the Pope Cemetery. On file, Kentucky Archaeological Survey, Lexington.
2014 *The Archaeology of the Late Nineteenth Century Staff Quarters and Greenhouses at Eastern State Hospital (15FA289), Lexington, Fayette County, Kentucky*. Research Report No. 12. Kentucky Archaeological Survey, Lexington
- Stottman, M. Jay, and David Pollack
2005 *Archaeological Investigations at the State Monument, Frankfort, Kentucky*. Report No. 104. Kentucky Archaeological Survey, Lexington.
- Strange, Julie-Marie
2003 'Tho' lost to sight, to memory dear': pragmatism, sentimentality and working-class attitudes toward the grave, c. 1875-1914. *Mortality* 8(2):144-159.
- Strezewski, Michael
2003 *Ellen We Miss thee at Home: Archaeological Investigations at the Michigan City Old Graveyard (12Le348), La Porte County, Indiana*. Archaeological Survey, Indiana University Purdue University at Fort Wayne, Fort Wayne.
- Stuart-Macadam, P.
1985 Porotic Hyperostosis: Representative of a Childhood Condition. *American Journal of Physical Anthropology* 66:391-398.
- Suchey, J. M., and D. Katz
1998 Applications of pubic age determination in a forensic setting. In *Forensic Osteology: advances in the identification of human remains*, edited by K. Reichs, pp. 204-236. Charles C. Thomas, Springfield.
- Suchey, J. M., S. T. Brooks, and D. M. Katz
1988 *Instructions for use of the Suchey-Brooks system for age determination for the female os pubis. Instructional materials accompanying female pubic symphyseal models of the Suchey-Brooks system*. France Casting, Fort Collins, Colorado.

Sutter, Richard C.

1995. Dental Pathologies among Inmates of the Monroe County Poorhouse. In *Bodies of Evidence: Reconstructing History through Skeletal Analysis*, edited by Anne L. Grauer, pp.185-196. Wiley-Liss, New York:

Swardstedt, Torsten

- 1966 *Odontological Aspects of a Medieval Population from the Province of Jamtland/Mid-Sweden*. Tiden Barnangen, AB, Stockholm.

The Leader

- 1894 The Plans. *The Leader*. May 1, 1894, page 1, columns 5-6.
- 1905 Asylum to be surrounded by new iron fence. *The Leader*. January 1, 1905, Section A2, page 6, column 5.

Theobald, Samuel

- 1829 Some Account of the Lunatic Asylum of Kentucky. *Transylvania Journal of Medicine and the Associate Sciences*. November 1829:500.
- 1830 Some Account of the Lunatic Asylum of Kentucky. *Transylvania Journal of Medicine and the Associate Sciences*. February 1830:79.

Thompson A. R.

- 2012 Differential diagnosis of limb length discrepancy in a 19th Century Burial from Southwest Mississippi. *International Journal of Osteoarchaeology* 24(4):517-530.

Todd, T. W.

- 1920 Age changes in the pubic bone. I: The male white pubis. *American Journal of Physical Anthropology* 3(3)285-334.
- 1921 Age changes in the pubic bone. II: The pubis of the male Negro-White hybrid, III: The pubis of the White female. IV: The pubis of the female Negro-White hybrid. *American Journal of Physical Anthropology* 4 (1):1-70.

Tomes, Nancy

- 1994 *The Art of Asylum-Keeping: Thomas Story Kirkbride and the Origins of American Psychiatry*. University of Pennsylvania Press, Philadelphia.

Trevelyan B., M. Smallman-Raynor, and A. D. Cliff

- 2005 The Spatial Dynamics of Poliomyelitis in the United States: From Epidemic Emergence to Vaccine-Induced Retreat, 1910–1971. *Annals of the Association of American Geographers* 95:269-293.

Trinkley, Michael, Debi Hacker, and Nicole Southerland

- 2011 *Identification of Graves and Mapping of the Goodwyn Cemetery, Richland Co., South Carolina*. Chicora Research Contribution 539. Chicora Foundation, Columbia, South Carolina.

Trotter, Mildred, and Goldine C. Gleser

- 1952 Estimation of Stature from Long Bones of American Whites and Negroes. *American Journal of Physical Anthropology* 10:463-514.

- 1958 A Re-evaluation of Estimation of Stature Based on Measurements of Stature Taken During Life and of Long Bones after Death. *American Journal of Physical Anthropology* 16:76-123.
- Tucker, B. D.
2002 *Culinary Confusion: Using Osteological and Stable Isotopic Evidence to Reconstruct Paleodiet for the Ocmulgee/Blackshear Cordmarked People of South Central Georgia*. Unpublished Master's thesis, Department of Geography, George State University, Atlanta.
- Turner, B. L.
2008 *The Servants of Machu Picchu: Life Histories and Population Dynamics in Late Horizon Peru*. Unpublished Ph.D. dissertation, Department of Anthropology, Emory University, Atlanta.
- Turner, B. L., J. D. Kingston, and J. T. Milanich
2005 Isotopic evidence of immigration linked to status during the Weeden Island and Suwannee Valley periods in North Florida. *Southeastern Archaeology* 24(2):121-136.
- Turner, B. L., G. D. Kamenov, J. D. Kingston, G. J. Armelagos
2009 Insights into Immigration and Social Class at Machu Picchu, Peru Based on Oxygen, Strontium, and Lead Isotopic Analysis. *Journal of Archaeological Science* 36:317-332.
- Turner, C. G. II, C. R. Nichol, and G. R. Scott
1991 Scoring Procedures for Key Morphological Traits of the Permanent Dentition: The Arizona State University Dental Anthropology System. In *Advances in Dental Anthropology*, edited by Marc A. Kelly and Clark S. Larsen, pp. 13-31. Wiley & Sons, New York.
- Ubelaker, Douglas H.
1987 Estimating age at death from immature human skeletons: an overview. *Journal of Forensic Sciences* 32(5):1254-63.
- 1989 *Human Skeletal Remains: Excavation, Analysis, Interpretation*, Second edition. Aldine Publishing Company, Chicago.
- Ubelaker, Douglas H., and Erica B. Jones (editors)
2003 *Human Remains from Voegtly Cemetery, Pittsburgh, Pennsylvania*. Smithsonian Contributions to Knowledge No. 46. Smithsonian Institution Press, Washington, D. C.
- Ubelaker, Douglas H. and C. G. Volk
2002 A test of the phenice method for the estimation of sex. *Journal of Forensic Sciences* 47(1):19-24.
- U. S. Census Bureau
1860 *Federal Census Mortality Schedule: Adair County, Kentucky*. Retrieved July 21, 2014, from <http://kykinfolk.com/adair/Census/1860AdairKyMortality.xls>
- Van Gerven, Dennis, Rosemary Beck, and James Hummert
1990 Patterns of Enamel Hypoplasias in Two Medieval Populations from Nubia's Batn el Hajar. *American Journal of Physical Anthropology* 82:413-420.

- Vaupel J. W., K. G. Manton, and E. Stallard
 1979 The impact of heterogeneity in individual frailty on the dynamics of mortality. *Demography* 16:439–454.
- Victor, Jan M. K.
 2010 Biomechanics of the Knee and Alignment. In *The Knee: A Comprehensive Review*, edited by Giles R. Scuderi and Alfred J. Tria, pp. 27-68. World Scientific Publishing Company, Singapore.
- Villotte, S., and C. Knüsel
 2009 Some remarks about femoroacetabular impingement and osseous non-metric variations of the proximal femur. *Bulletins et Mémoires de la Société d'Anthropologie de Paris* 21:95-98
- Vinck A., M. W. G. Nijhuis-van der Sanden, N. J. A. Roeleveld, R. A. Mullaart, J. J. Rotteveel, and B. A. M. Maassen.
 2010 Motor profile and cognitive functioning in children with spina bifida. *European Journal of Paediatric Neurology* 14:86-92.
- Virginia, R. A., and C. C. Delwiche
 1982 Natural ¹⁵N Abundance of Presumed N₂-Fixing and Non-N₂-Fixing Plants from Selected Ecosystems. *Oecologia* 54:317-325.
- Waldron, T.
 2009 *Paleopathology*. Cambridge University Press, Cambridge.
- Walker, Phillip L.
 1995 Problems of preservation and sexism in sexing: some lessons from historical collections for paleodemographers. In *Grave reflections: portraying the past through cemetery studies*, edited by Saunders and Herring, pp. 31-47. Canadian Scholars' Press, Toronto
- 2008 Sexing skulls using discriminant function analysis of visually assessed traits. *American Journal of Physical Anthropology* 136(1):39-50.
- Walker Phillip L., R. R. Bathurst, R. Richman, T. Gjerdrum, and V. A. Andrushko
 2009 The cause of porotic hyperostosis and cribra orbitalia: a reappraisal of the iron-deficiency-anemia hypothesis. *American Journal of Physical Anthropology* 139:109–125.
- Walker, Phillip L., John R. Johnson, and Patricia M. Lambert
 1988 Age and Sex Biases in the Preservation of Human Skeletal Remains. *American Journal of Physical Anthropology* 76:183-188.
- Waterval, J. J., R. J. Stokroos, N. J. C. Bauer, R. B. J. De Bondt, and J. J. Manni
 2009 Phenotypic manifestations and management of hyperostosis cranialis interna, a hereditary bone dysplasia affecting the calvaria and the skull base. *American Journal of Medical Genetics, Part A*. 152A: 547-555.
- Webb, Stephen G.
 1990 Prehistoric Eye Disease (Trachoma?) in Australian Aborigines. *American Journal of Physical Anthropology* 81:91-100.

- Wedel, V. L., and A. Galloway
 2013 *Broken Bones: Anthropological Analysis of Blunt Force Trauma*, Second Edition. Charles C. Thomas Publisher, Springfield.
- Weise, Svenja
 2009 *The Medieval Cemetery S:t Jörgen in Malmö: A Paleodemographic Analysis*. Unpublished Ph.D. dissertation, Anthropological Department, University of Southern Denmark.
- Weiss, E.
 2003 Understanding muscle markers: aggregation and construct validity. *American Journal of Physical Anthropology* 121:230–240.
 2005 Schmorl's Nodes: A Preliminary Investigation. *Paleopathology Newsletter* 132:6-10.
 2007 Muscle Markers Revisited: Activity Pattern Reconstruction with Controls in a Central California Amerind Population. *American Journal of Physical Anthropology* 133:931-940.
- Weiss, E., and R. Jurmain
 2007 Osteoarthritis Revisited: A Contemporary Review of Aetiology. *International Journal of Osteoarchaeology* 17:437-450
- White, Carolyn L.
 2005 *American Artifacts of Personal Adornment 1680-1820: A Guide of Identification and Interpretation*. AltaMira Press, Oxford, England.
- White, Christopher
 n.d. Observations on the Development of Wood Screws in North America. Museum of Fine Arts, Boston. http://cool.conservation-us.org/coolaic/sg/wag/Am_Wood_Screws.pdf
- White, Ronald F.
 1984 *A Dialogue on Madness: Eastern State Lunatic Asylum and Mental Health Policies in Kentucky, 1824-1883*. Unpublished Ph.D. Dissertation, History Department, University of Kentucky, Lexington.
- Widgorowicz-Makowerowa N., C. Grodzki, H. Panek, T. Maslanka, K. Plonka, and A. Palacha
 1979 Epidemiologic studies on prevalence and etiology of functional disturbances of the masticatory system. *Journal of Prosthetic Dentistry* 41(1):76-82.
- Wood, J. W., George R. Milner, H. C. Harpending, and K. M. Weiss
 1992 The osteological paradox: problems of inferring prehistoric health from skeletal samples. *Current Anthropology* 33(4):343-370.
- Yandall, Lunsford P.
 1833 Smasmodic Cholera, as it appeared in the city of Lexington. Transylvania University, Lexington.
- Yanni, Carla
 2007 *The Architecture of Madness: Insane Asylums in the United States*. University of Minnesota Press, Minneapolis.
- Zucker, D. K., R. Livingston, R. Nakra, and P. J. Clayton
 1981 B₁₂ deficiency and psychiatric disorders: case report and literature review. *Biological Psychiatry* 16:197–205.

APPENDIX ONE: BURIAL DESCRIPTIONS

GRAVE SHAFT 12

This grave shaft measured 2.18 x 0.75 m and contained the remains of two individuals, one oriented to the northwest. The other burial appears to have been a small rectangular box that may have contained the remains of an infant or small child.

Burial 12A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the west. There were 12 complete nails and 68 nail fragments found with this burial and with the associated Burial 12B. All nails were combined in the field during excavation. Of the complete nails, eight had a pennyweight of 7d and four a pennyweight of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult of indeterminate sex who was 18-28 years old when he or she died. Both lower arms were placed across the chest.

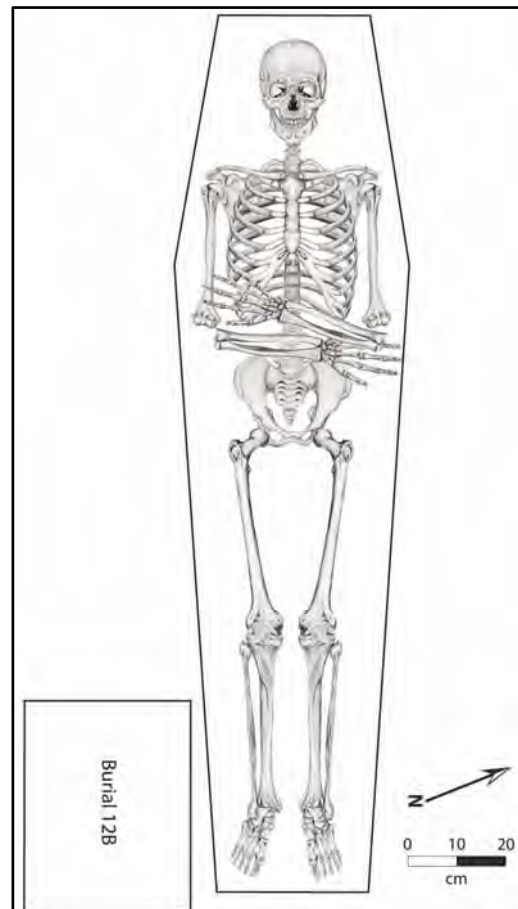
No pathologies were noted.

No isotopic data are available for this individual.

The teeth were poorly preserved, however the majority of intact teeth contained at least one carious lesion.

Clothing, Shrouds, and Personal Artifacts

None



Burial 12B

Coffin/Casket Remains and Hardware

This burial is represented by a rectangular coffin outline near the legs of burial 12A. This coffin measured 45 cm long and 35 cm wide, but orientation could not be determined due to lack of preserved remains. Coffin hardware consisted of 20 complete nails and nail fragments (see Burial 12A for pennyweights).

Human Skeletal and Dental Remains

This individual is represented solely by a grave shaft outline with no human remains preserved. Based on the size of the coffin outline, this burial may have been that of an infant. No additional observations can be made concerning this burial.

Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 13

This grave shaft measured 2.05 x 0.75 m and contained the remains of one individual.

Burial 13

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 194 cm in length and 48 cm in width, with the head oriented to the southeast. Twelve complete nails and 42 nail fragments were recovered from this burial. Of the complete nails, 9 had a 7d pennyweight 7 and three a 9d pennyweight.

Human Skeletal and Dental Remains

This individual is estimated to be a young possibly male adult who was 18-28 years old when he died. The lower left arm had been folded towards the same shoulder and the lower right arm had been placed across the pelvis. The remains were too fragmentary to derive a stature estimate.

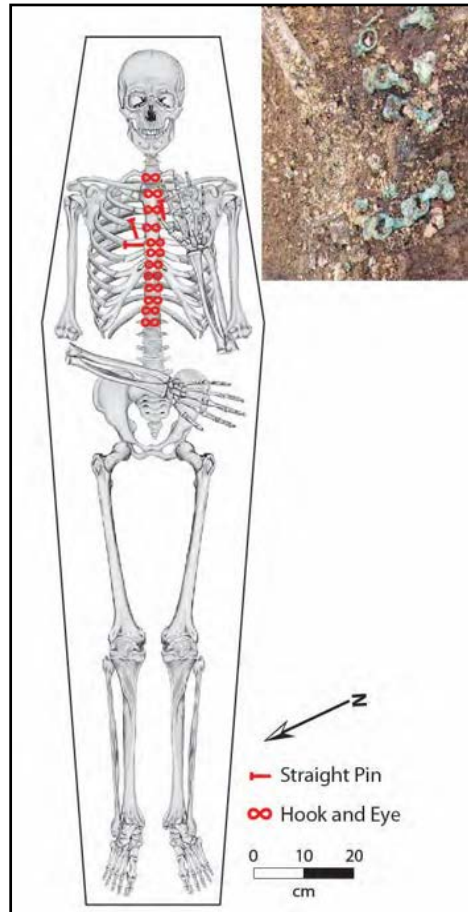
This individual suffered from arthritis on the atlas vertebra (C1), which adjoins the head and neck.

This individual yielded a $\Delta^{13}\text{C}$ value of -16.6, suggesting a diverse diet of mixed C_3 plants and corn-based products.

The teeth are very poorly preserved, but this individual appears to have had a minimal number of caries and moderate to heavy dental wear. Additionally, the upper right canine never erupted and remained in its crypt.

Clothing, Shrouds, and Personal Artifacts

Clothing related items consisted of 10 complete hook and eye pairs as well as hook and eye fragments. These fasteners were located on the front of the torso extending from the neck towards the pelvis. Three straight pins were found in the vicinity of the hook and eye fasteners.



GRAVE SHAFT 14

This grave shaft measured 2.48 x 1.44 m and contained the remains of two individuals, lying side by side oriented southeast.

Burial 14A

Coffin/Casket Remains and Hardware

This individual was buried in a coffin of indeterminate shape that measured 200 cm long and 35 cm wide, with the head oriented to the southeast. Coffin hardware consisted of two complete nails and six nail fragments. Both of the complete nails had a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult possibly female who was 20-30 years old when she died. The remains are too fragmentary to derive a stature estimate. Both lower arms were placed across the pelvis.

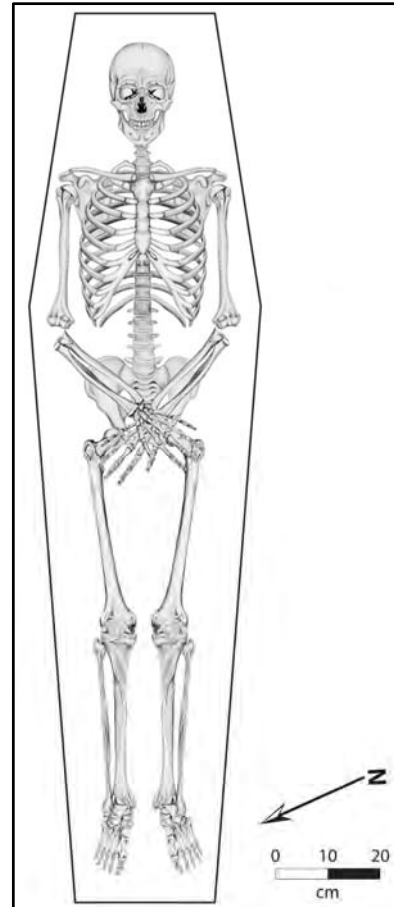
Due to the incomplete and fragmentary condition of the skeleton in addition to taphonomic damage, no pathologies could be observed.

No isotope data are available for this individual.

The teeth were poorly preserved, but the majority of those intact contained at least one carious lesion. The pattern of carious lesions is indicative of periodontal disease.

Clothing, Shrouds, and Personal Artifacts

None



Burial 14B

Coffin/Casket Remains and Hardware

This individual was buried in a coffin of indeterminate shape measuring 190 cm long and 30 cm wide, with the head oriented to the southeast. Their legs were placed towards the left side of the coffin, suggesting that this individual was slightly taller than the length of the coffin. Of the 46 coffin nails found with this burial, two were complete (pennyweight 8d) nails and 44 were nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 24-30 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest

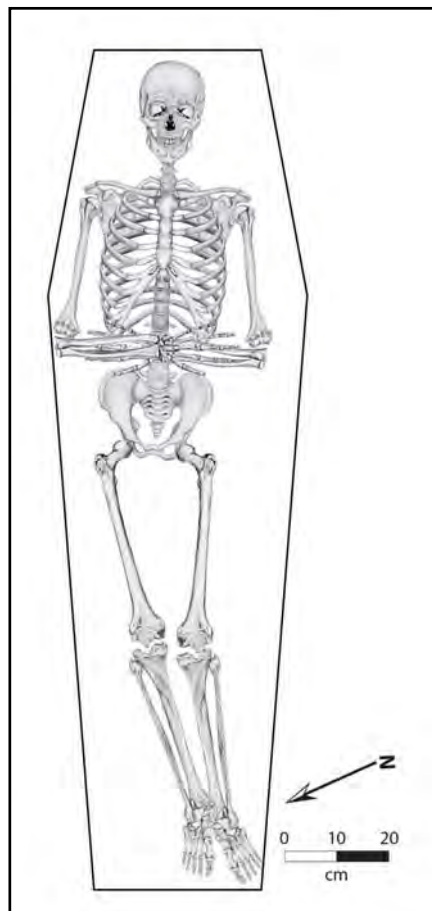
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -16.6 and $\Delta^{15}\text{N}$ values of 11.4, suggesting a diverse diet consisting of mixed C_3 pathway plants with some corn-based products and a moderate amount of meat.

The dentition shows evidence of two periapical abscesses in the maxilla and one in the mandible, as well as periodontal disease in the mandible. There is also evidence of an extra-numary socket on the mandible for an additional central incisor.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 15

This grave shaft measured 2.45 x 2.02 m and contained the remains of four individuals lying side by side, two oriented northwest and two oriented southeast.

Burial 15A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 50 cm in width, with the head oriented to the southeast. Coffin hardware consisted of seven complete nails and 47 nail fragments. Of the complete nails, two had a pennyweight of 6d, four a pennyweight of 4d, and one a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 22-32 years old when he died. The remains are too fragmentary to derive a stature estimate. Both lower arms were placed across the pelvis.

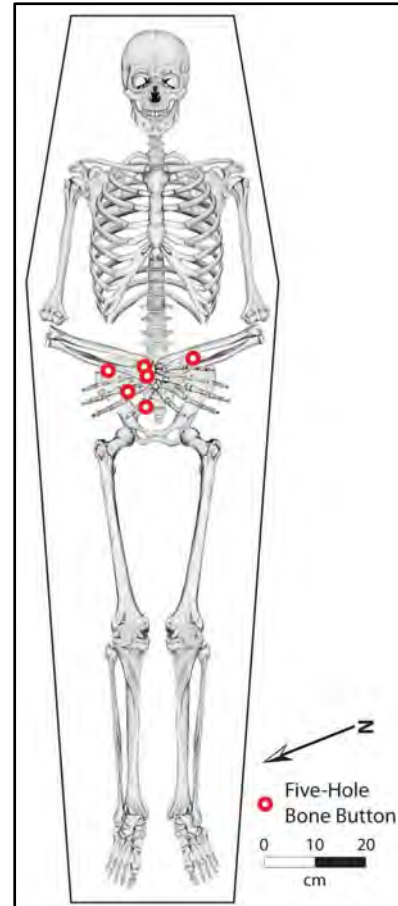
This individual suffered from arthritis in the right knee.

This individual yielded $\Delta^{13}\text{C}$ values of -15.9 and $\Delta^{15}\text{N}$ values of 11.4, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition was poorly preserved with only brittle and loose teeth present. No maxilla is present, but the mandible shows extreme resorption of alveolar bone on both sides, as well as two periapical abscesses. There are carious lesions on several of the teeth, two of which contain gray metal amalgam fillings. This level of tooth decay and loss is abnormal for the age and dietary content of this individual.

Clothing, Shrouds, and Personal Artifacts

There were six five-hole bone buttons associated with this individual. All were located in the vicinity of the pelvis (though shown in the illustration above the arms, all of the buttons were found below the arms and hands).



Burial 15B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of five complete and nine nail fragments. Of the complete nails, two had a pennyweight of 6d, one a pennyweight of 7d, and two a pennyweight of 9d.

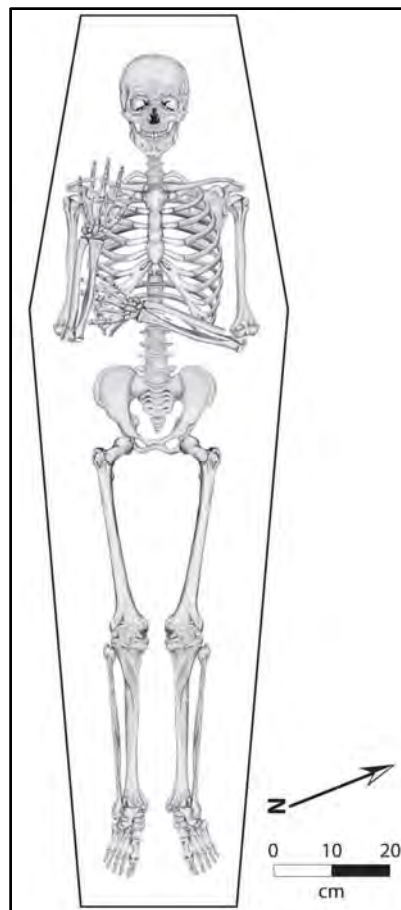
Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 18-25 years old when she died. The remains are too fragmentary to derive a stature estimate. The lower left arm was placed across the chest, and the lower right arm folded towards the same shoulder.

No pathologies noted.

This individual yielded $\Delta^{13}\text{C}$ values of -15.6 and $\Delta^{15}\text{N}$ values of 9.5, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows light wear and few carious lesions, although the caries in the mandibular teeth appear to have developed where enamel was weakened from enamel hypoplasias.



Clothing, Shrouds, and Personal Artifacts

None

Burial 15C

Coffin/Casket Remains and Hardware

This individual was buried in a rectangular shaped coffin measuring 190 cm in length and 35 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven complete nails, 48 nail fragments, and a screw. Of the complete nails, three had a pennyweight of 7d, one of 8d, and three of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 53-68 years old when he died. The remains are too fragmentary to derive a stature estimate. Both lower arms were placed across the pelvis.

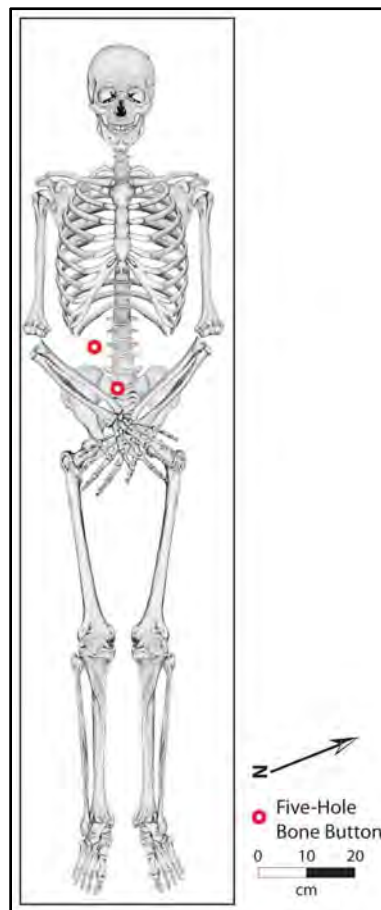
This individual suffered from arthritic degeneration of most of the lumbar and thoracic vertebrae, resulting in the fusion of at least five thoracic vertebrae (ankylosis) from under the anterior longitudinal ligament during life. This condition was possibly a result of diffuse idiopathic skeletal hyperostosis (DISH). Both shoulders show arthritic lipping on the articular surface of the scapula, but there is no corresponding activity present on the humeral heads.

This individual yielded $\Delta^{13}\text{C}$ values of -19.1 and $\Delta^{15}\text{N}$ values of 11.1, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

There is evidence of bone loss in the mandible indicative of periodontal disease, and the lower left third molar may have been congenitally absent. At least 3 teeth were lost before death, and an abscess is present on a maxillary molar socket.

Clothing, Shrouds, and Personal Artifacts

One straight pin was associated with the burial but its location is not known. In addition, two five-hole bone buttons were found in the vicinity of the pelvis. Both were probably associated with pants closures.



Burial 15D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 45 cm in width, with the head oriented to the southeast. Coffin hardware consisted of 17 complete nails, 64 nail fragments, and a screw. Of the complete nails, eight had a pennyweight of 6d, one of 8d, and eight of 9d.

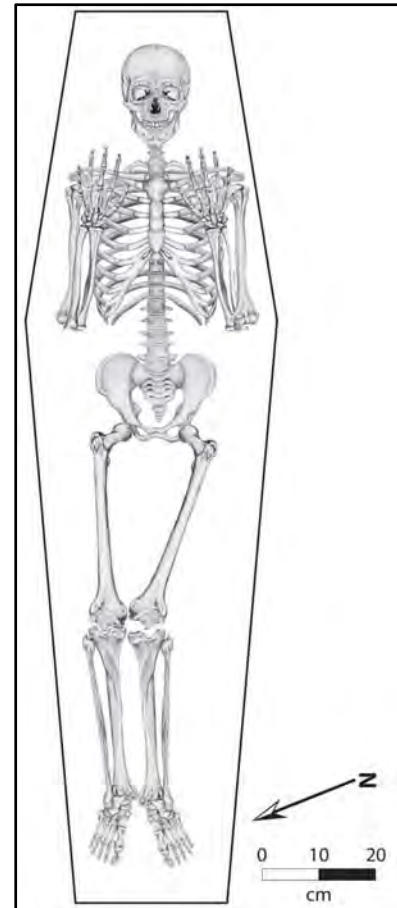
Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 20-30 years old when she died. The remains are too fragmentary to derive a stature estimate. Each lower arm was folded towards the same shoulder.

No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -18 and $\Delta^{15}\text{N}$ values of 7.7, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a minimal amount of meat.

The dentition shows evidence of bone loss around the right maxillary molars indicative of periodontal disease, and a small periapical abscess is present at the right first molar.



Clothing, Shrouds, and Personal Artifacts

A single straight pin was associated with this burial, but its location relative to the skeletal remains is not known. There were also 18 pieces of plainweave 1/1 possibly wool fabric found with from this burial.

GRAVE SHAFT 16

This grave shaft measured 2.49 x 1.46 m and contained the remains of two individuals lying side by side, both oriented northwest.

Burial 16A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of six complete and 18 nail fragments. All of the complete nails had a pennyweight of 7d. Two of the nails were crossed likely as a result of deterioration of a coffin corner joint.

Human Skeletal and Dental Remains

This individual is estimated to be an adult of indeterminate sex. The remains are too fragmentary to derive a stature estimate. Both arms were placed with the hands across the pelvis.

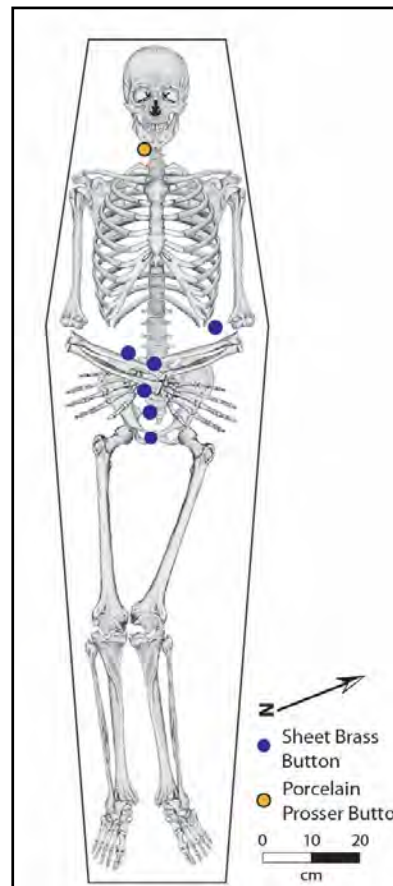
Pathologies present include abnormal bone formation along the exterior shaft as well as inside the medullary cavity of both the left and right tibia, which is consistent with osteomyelitis. In addition, there is evidence of thickening of the diploë of the cranial bones, particularly on the frontal and parietal, possibly a manifestation of Paget's disease.

This individual yielded $\Delta^{13}\text{C}$ values of -15.4 and $\Delta^{15}\text{N}$ values of 11.3, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, as well as a moderate amount of meat.

The dentition is represented by seven loose teeth, of which five contain at least one carious lesion.

Clothing, Shrouds, and Personal Artifacts

One Prosser button was associated with the neck area, and six two-piece sheet brass buttons were found in the vicinity of the pelvic area. The former may represent a pull-over shirt and latter a pants fly (though shown in the illustration above the arms, all of the buttons were found below the arms and hands). Five fragments of plainweave 1/1 wool fabric that were originally covering the brass buttons were found with this individual.



Burial 16B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware consists of two complete and 27 nail fragments. Both complete nails had a pennyweight of 7d and were crossed likely as a result of deterioration of a coffin corner joint.

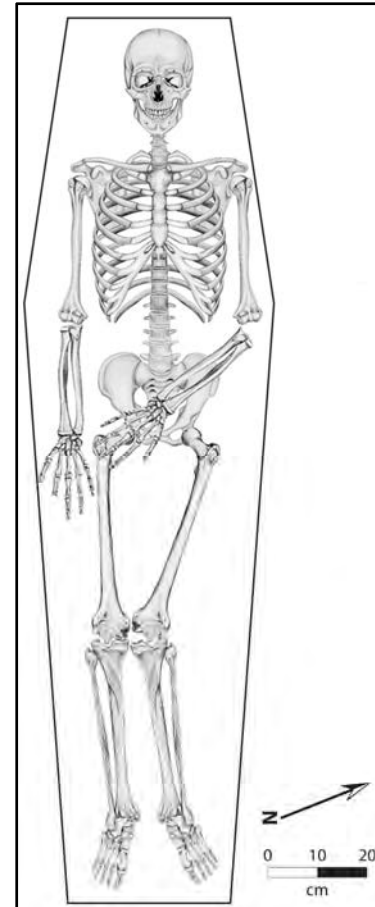
Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 20-30 years old when she died. The remains are too fragmentary to derive a stature estimate. The lower left arm was placed across the pelvis and the right arm was placed along the side of the body.

No pathologies noted.

No isotopic data are available for this burial.

The dentition was poorly preserved and very brittle. There is evidence of horizontal bone loss in both the maxilla and mandible, and the entire left side of the mandible shows complete resorption from pre-mortem tooth loss. Additionally, there is heavy calculus deposited on maxillary molars.



Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 17

This grave shaft measures approximately 2.1 x 0.8 m with irregular boundaries. The grave shaft contained the remains of a single individual oriented northwest.

Burial 17

Coffin/Casket Remains and Hardware

This individual was buried in a coffin measuring 184 cm in length and of indeterminate width, with the head oriented to the northwest. Coffin hardware consisted of three complete and 17 nail fragments. Of the complete nails, one had a pennyweight of 4d and two a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult of indeterminate sex who was 18-28 years old when he or she died. The remains were too fragmentary to derive a stature estimate and both arms were too poorly preserved to determine their placement (arm placement in figure is for illustrative purposes only).

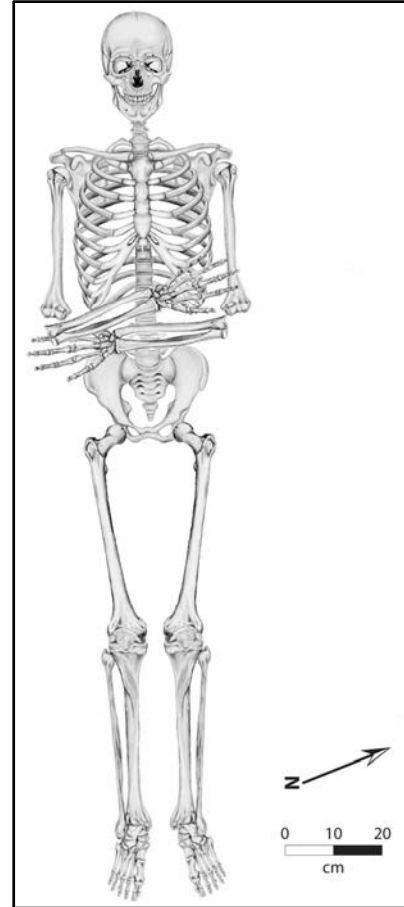
No pathologies were noted.

No isotopic data are available for this individual.

The dentition is poorly preserved but shows that the upper right first molar has a large caries that has eroded away half of the occlusal surface. Additionally a polished facet on the lower right first incisor indicates the individual had an overbite.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 18

This grave shaft measured 3.5 x 3.1 m and contained the remains of five individuals lying side by side. Of these burials, four were oriented northwest and one was oriented southeast.

Burial 18A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 186 cm in length and only 26 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven complete (pennyweight 7d) nails and 26 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 18-23 years old when she died. The remains are too fragmentary to derive a stature estimate. The lower left arm was placed across the chest and the lower the right arm was folded towards the same side shoulder. The lower legs had been crossed (bound?)

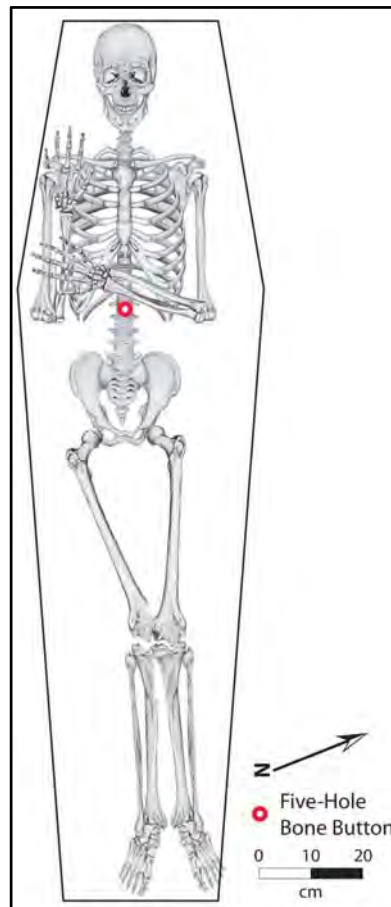
The left triquetral bone in the wrist is considerably larger than the right, and exhibited slight arthritic lipping on the articular surface with the pisiform, another bone in the wrist.

This individual yielded $\Delta^{13}\text{C}$ values of -18.9 and $\Delta^{15}\text{N}$ values of 10.3, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

The dentition is in good condition with only one tooth missing, potentially lost pre-mortem. There is one abscess at the maxillary right third molar, as well as horizontal bone loss indicative of periodontal disease in both the upper and lower arcade. The lower left first incisor is congenitally absent, and there are few carious lesions and minimal dental wear.

Clothing, Shrouds, and Personal Artifacts

A single five-hole bone button was located in the abdomen and a copper/brass wedding ring also was associated with this individual.



Burial 18B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 163 cm in length and 18 cm in width, with the head oriented to the northwest. Coffin hardware consisted of five complete (one a pennyweight of 5d and four a pennyweight of 7d) nails and 28 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 18-21 years old when she died. The remains are too fragmentary to derive a stature estimate. The left arm was positioned with the hand across the chest, while the right arm was positioned with the hand across the pelvis.

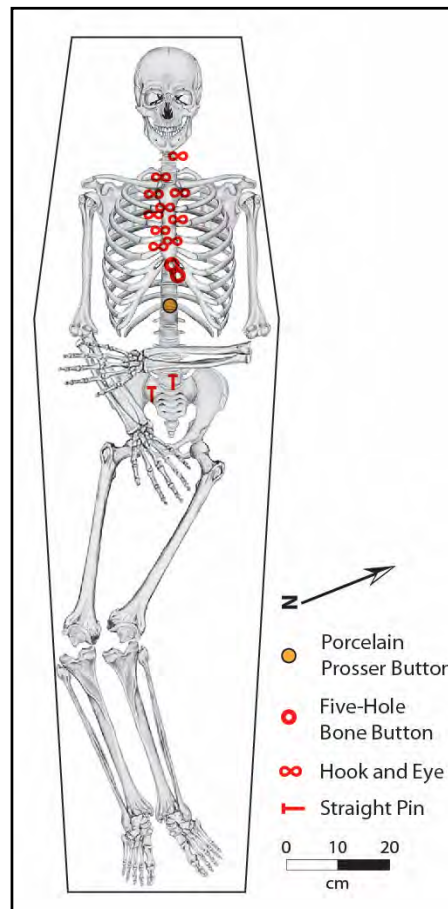
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -18.3 and $\Delta^{15}\text{N}$ values of 10.5, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

The dentition shows moderate horizontal bone loss and pitting suggesting periodontal disease in the maxilla and mandible. The lower right third molar is congenitally absent, which could possibly have caused the large gap between the lower right second premolar and first molar. Caries are noted throughout the dental arcade.

Clothing, Shrouds, and Personal Artifacts

Two straight pins were found in the pelvic area. Clothing related objects consisted of hook and eye fasteners, and buttons. The 10 hooks and eight eyes extend from the neck towards the pelvis. A single Prosser button and two five-hole bone buttons were found just below the hook and eye fasteners. The hook and eye fasteners may have been associated with a dress, and the buttons undergarments. There were two pseudomorphs associated with the reverse of a hook and eye. Both correspond to a fine plainweave fabric.



Burial 18C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 188 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware is represented by eight complete nails, 22 nail fragments, and one screw. Of the complete nails, five had a pennyweight of 6d and three a pennyweight of 7d.

Human Skeletal and Dental Remains

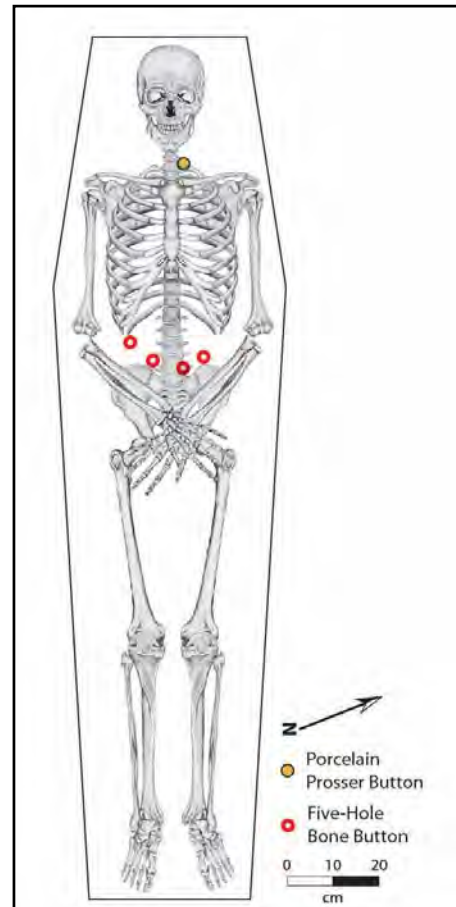
This individual is estimated to be an older adult male who was 65-85 years old when he died and who stood 173.7 ± 8.8 cm (68.4 ± 3.5 "") tall. Both arms were placed with the hands across the pelvis.

Pathology included bone loss on the right orbital roof, which did not appear active at the time of death. Arthritis is present throughout the temporal bone, the ribs, both shoulders, both elbows, both knees, both hands, and extensively throughout the cervical and thoracic vertebrae, resulting in the probable fusion of several thoracic vertebrae (ankylosis) under the anterior longitudinal ligament during life. This condition was possibly a result of diffuse idiopathic skeletal hyperostosis (DISH), the production of new bone into the anterior longitudinal ligament of the spine with ossification of extra-spinal entheses and ligaments (Waldron 2009). Additionally the insertion points for the triceps brachii have ossified.

This individual yielded $\Delta^{13}\text{C}$ values of -16.7 and $\Delta^{15}\text{N}$ values of 9.6, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat. The dentition shows evidence of heavy caries with several teeth having lost their entire crown. There is very heavy plaque present on teeth throughout the arcade, and 10 teeth were lost prior to death. A periapical abscess is present at the upper right second molar, and horizontal bone loss is evident throughout the maxilla and mandible. Steep angular wear is present on the upper canines only.

Clothing, Shrouds, and Personal Artifacts

One Prosser button was recovered from the neck area of this burial, and four five-hole bone buttons were found in the pelvic area. The Prosser button represents a pull-over shirt and the bone buttons pants closures.



Burial 18D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 187 cm in length and 38 cm in width, with the head oriented to the southeast. Coffin hardware is represented by five complete pennyweight 8d nails and 28 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 40-70 years old when he died. The remains are too fragmentary to derive a stature estimate. The lower left arm was folded towards the same side shoulder and the lower right arm had been placed across the chest. The left and right hands were bent and the lower legs were crossed. The positioning of the hands is suggestive of deformities and the legs of having been bound.

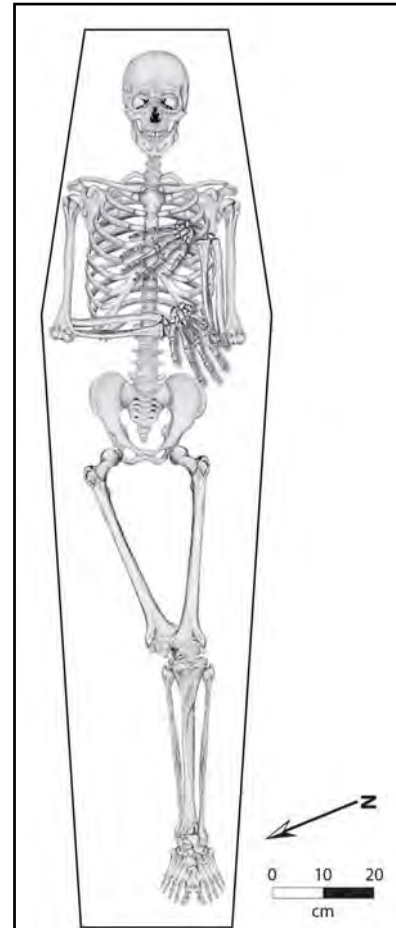
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -14 and $\Delta^{15}\text{N}$ values of 10.5, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is fairly well preserved and shows evidence of vertical and horizontal bone loss throughout the entire arcade, specifically on the anterior teeth. Dental wear is moderate throughout with very heavy patterned wear on the anterior teeth, suggesting this individual clenched and ground their teeth together extensively. All maxillary anterior teeth are chipped as well.

Clothing, Shrouds, and Personal Artifacts

None



Burial 18E

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 190 cm in length and 58 cm in width, with the head oriented to the northwest. Coffin hardware consisted of four (pennyweight 8d) complete nails.

Human Skeletal and Dental Remains

This individual is estimated to be an adult male who was 30-70 years old when he died. The remains are too fragmentary to derive a stature estimate. The lower left arm had placed across the chest and the lower right arm across the pelvis.

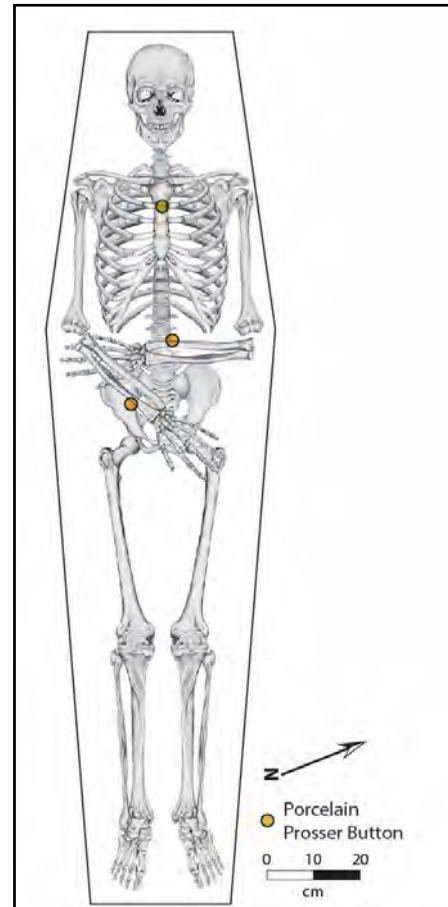
No pathologies were noted for this individual.

No isotopic data are available for this burial.

The dentition shows evidence of horizontal and vertical bone loss fairly uniform across the entire arcade, with the greatest prominence on the left side. There is a large abscess at the upper left second molar.

Clothing, Shrouds, and Personal Artifacts

There were three Prosser buttons associated with this burial, located at atop the sternum and at each wrist. They probably were associated with a pull-over shirt.



GRAVE SHAFT 19

This grave shaft measured 3.5 x 2.16 m and contained the remains of seven individuals. Of these, two were oriented to the northeast, three to the northwest, and one to the southeast. The burials in this shaft were packed tightly next to one another.

Burial 19A

Coffin/Casket Remains and Hardware

This individual was buried in a rectangular shaped coffin measuring 170 cm in length and 55 cm wide, with the head oriented to the southwest. This is the only burial excavated at the site that was oriented this way. Coffin hardware consisted of 19 complete nails, 38 nail fragments, and a screw. Of the complete nails, one had a pennyweight of 3d, one of 4d, two of 5d, two of 6d, 12 of 8d, and one of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult female who was 47-63 years old when she died and stood 155 ± 8.8 cm (61 ± 3.5 "") tall. The lower left arm was placed across the chest and the lower right arm was folded towards the same side shoulder.

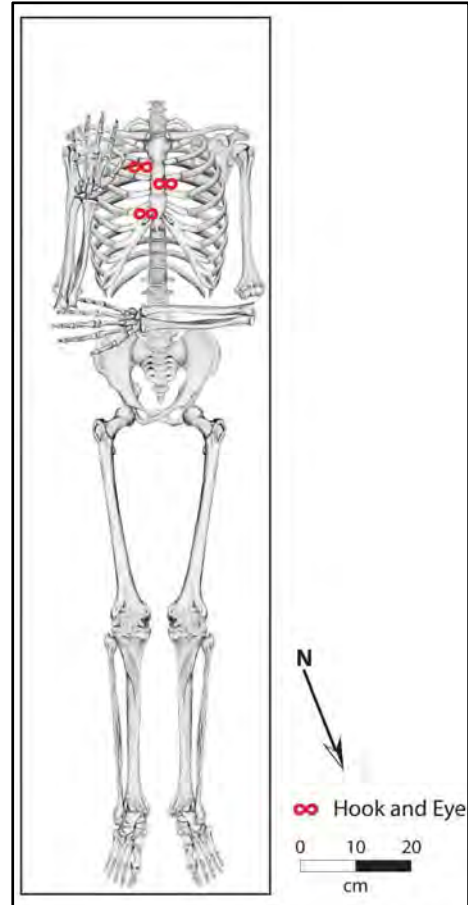
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -15.5 and $\Delta^{15}\text{N}$ values of 10.3, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

There were three hooks and one eye recovered from the upper torso area of this burial. They may have been associated with a dress or possibly a cape.



Burial 19B

Coffin/Casket Remains and Hardware

This individual was buried in a rectangular shaped coffin measuring approximately 175 cm in length and approximately 35 cm in width, with the head oriented to the southeast. Coffin hardware consisted of 12 complete nails, 22 nail fragments, and a screw. Of the complete nails, six had a pennyweight 6d, three of 7d, and three of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 23-28 years old when he died and stood 174.2 ± 8.8 cm (68.6 ± 3.5 "") tall. The lower left arm was placed across the chest and the lower right arm across the pelvis.

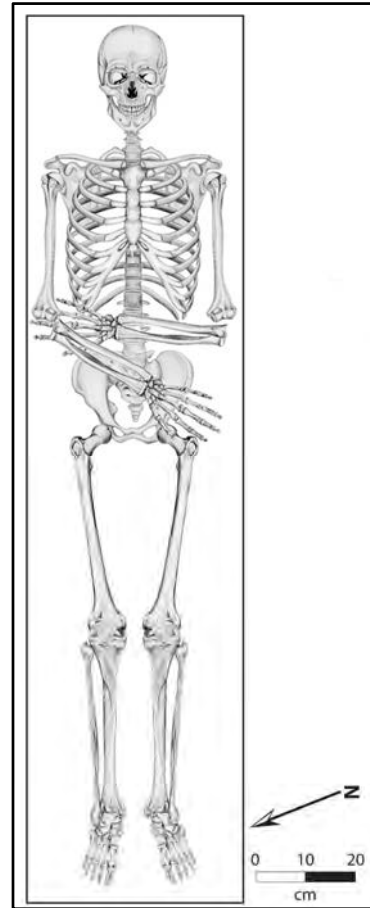
This individual had a unifocal area of bone loss on the head of the right first metatarsal that appeared to be healing when they died. No other pathologies were present.

This individual yielded $\Delta^{13}\text{C}$ values of -14.3 and $\Delta^{15}\text{N}$ values of 10.5, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None



Burial 19C

Coffin/Casket Remains and Hardware

This individual was buried in a rectangular shaped coffin 156 cm in length and 29 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two complete (9d pennyweight) nails and 28 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 22-26 years old when she died. The remains are too fragmentary to derive a stature estimate. Both arms were placed at the side of the body.

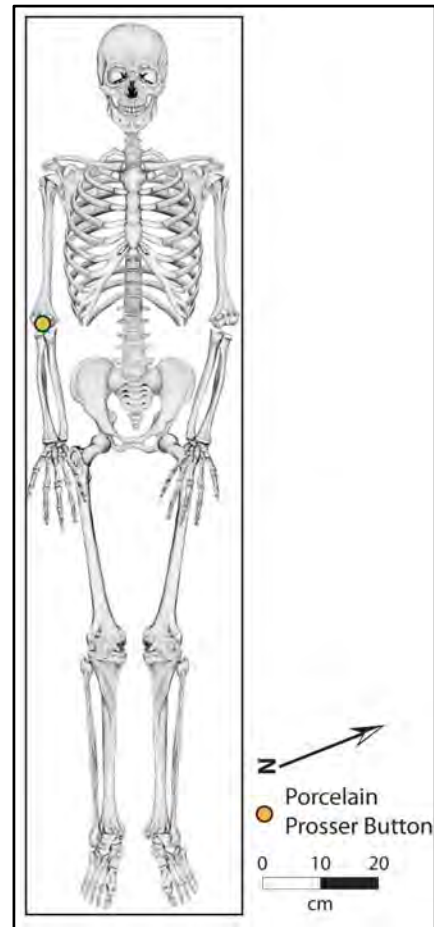
No pathologies were noted for this individual.

This individual yielded $\Delta^{13}\text{C}$ values of -22.6 and $\Delta^{15}\text{N}$ values of 8.9, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

The dentition shows that the third molars are not fully erupted yet, and the upper right third molar is erupted out through the buccal surface of the maxilla. The upper second incisors are shovel shaped, and there is a large Carabelli's Trait on the upper first molars. Caries rate is minimal.

Clothing, Shrouds, and Personal Artifacts

A single Prosser button was recovered from near the right elbow. It may have been associated with a shirt.



Burial 19D

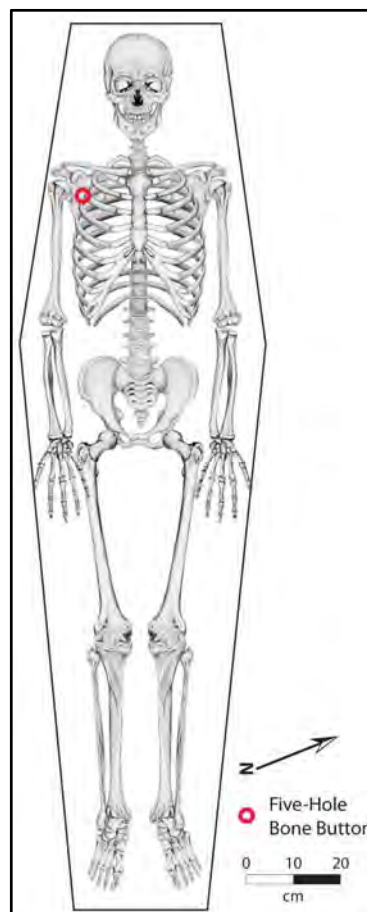
Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 189 cm in length and 38 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 10 complete nails and 23 nail fragments. Of the complete nails, one had a pennyweight of 4d, three of 7d, and six of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 40-60 years old when he died. The remains are too fragmentary to derive a stature estimate. Both arms were placed at the side of the body.

This individual exhibited laminal spurs on three thoracic vertebrae, which are likely non-metric traits rather than pathological and are found in individuals of all ages. This individual also suffered from arthritis in the glenoid fossa of the right shoulder; the associated humeral head as well as both elements on the left side were too damaged to observe any arthritic activity. This individual also had arthritic lipping in the right ankle, specifically along surfaces of the talus corresponding to articulation with the distal fibula and proximal navicular.



This individual yielded $\Delta^{13}\text{C}$ values of -12.2 and $\Delta^{15}\text{N}$ values of 9.7, suggesting a diet consisting of very minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows evidence of minimal caries rate and moderate horizontal bone loss throughout the maxilla and mandible. The teeth exhibit moderate wear exposing some dentin on posterior teeth in particular. There is dark brown staining on the occlusal and buccal surfaces of most molars, and the majority of upper teeth and some lower teeth exhibit chipping of the occlusal surface.

Clothing, Shrouds, and Personal Artifacts

A five-hole bone button was found in the vicinity of the right shoulder. It may have been associated with a hospital garment.

Burial 19E

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 176 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven complete nails and 35 nail fragments. Of the complete nails, three had a pennyweight of 4d, one of 6d, and three of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 38-53 years old when she died and stood 155 ± 9.3 cm (61 ± 3.7 "") tall. The lower left arm was placed across the pelvis and the lower right arm had been folded toward the same shoulder.

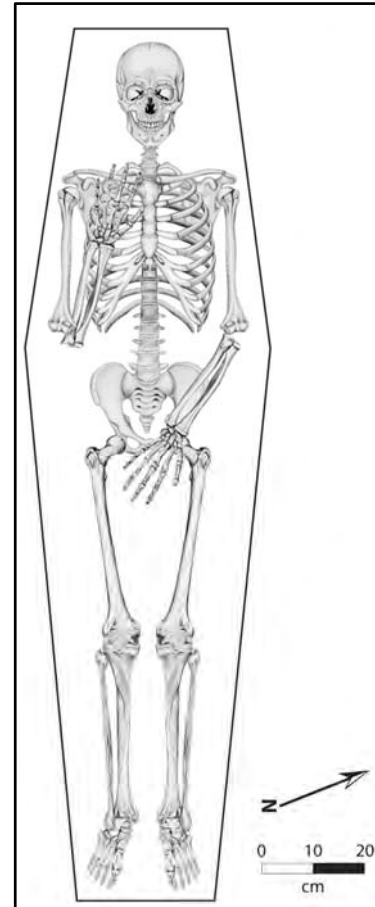
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -14.3 and $\Delta^{15}\text{N}$ values of 10.4, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows evidence of significant horizontal bone loss in both the maxilla and mandible, with several caries in maxillary teeth having been caused by heavy calculus. The mandible shows evidence of severe tooth loss, with the three remaining teeth being loose.

Clothing, Shrouds, and Personal Artifacts

None



Burial 19F

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal coffin measuring 184 cm in length and 34 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 44 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle adult male who was 40-50 years old when he died and stood 166 ± 8.2 cm (65.3 ± 3.2 "") tall. Both arms were placed at the side of the body.

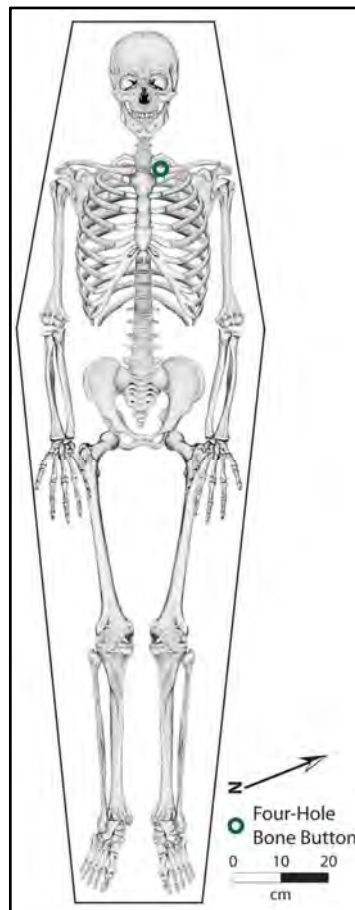
This individual has abnormal bone formation present on the olecranon process of the right ulna. This enthesophyte formation, also called Woodcutter's lesion, is likely the result of stress on the joint during repeated flexion and extension of the elbow (Capasso et al. 1998:78). This individual also had an area of unifocal bone loss on two bones of the right ankle, the calcaneus and cuboid, on corresponding articular surfaces. Both areas of bone loss appear to be smooth and healing when the individual died. There is also evidence for a healed fracture of the right cuboid (ankle bone).

This individual yielded $\Delta^{13}\text{C}$ values of -15.6 and $\Delta^{15}\text{N}$ values of 9.9, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows signs of pre-mortem tooth and bone loss throughout the arcade, with several remaining teeth loose in their sockets and only holding on by root tips. Caries rate is high, partially caused by heavy calculus buildup. Dental wear is moderate.

Clothing, Shrouds, and Personal Artifacts

A four-hole bone button was found near the left clavicle. It may have been a closure for a pull-over shirt.



Burial 19G

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 170 cm in length and 40 cm in width, with the head oriented to the southeast. Coffin hardware consisted of five complete nails, 26 nail fragments, and a screw. Of the complete nails, one had a pennyweight of 7d and four a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle adult female who was 33-45 years old when she died and stood 162.4 ± 7.8 cm (63.9 ± 3.1 "") tall. The lower left arm had been placed across the chest, and the lower right arm towards the opposite shoulder.

This individual had abnormal bone formation on the left humerus, in the form of a sharp ridge along the deltoid tuberosity extending from just about midshaft to the greater tubercle and is likely an exaggerated muscle attachment. Additionally, both femora have areas of porosity on the anterior portion of the femoral neck adjacent to the head consistent with cribra femoralis (also known as Allen's fossa). A Poirier's facet also appears on the left femoral head.

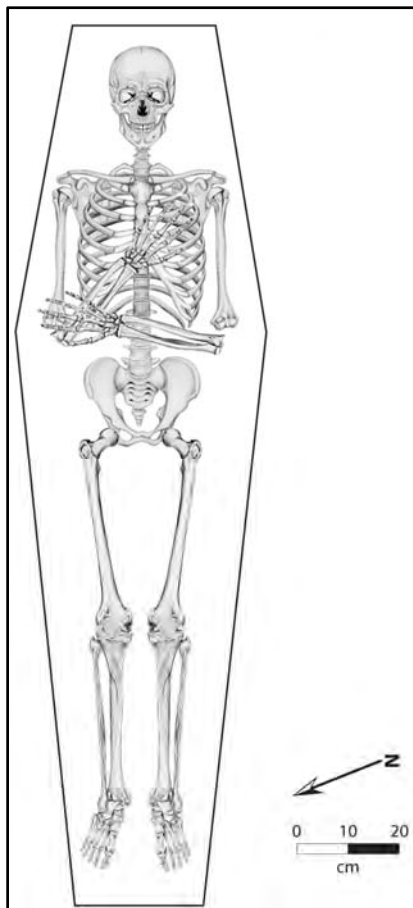
Capasso et al. (1998:91) point out that the majority of the individuals within a population exhibit these facets and that regular locomotion may be sufficient to create them, however, repeated hyperextension of the hip (e.g. downhill running) could influence its expression. This individual also suffered from arthritic lipping in both knees, located along the intercondylar notches on both femora.

This individual yielded $\Delta^{13}\text{C}$ values of -16.9 and $\Delta^{15}\text{N}$ values of 11.8, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows evidence of significant horizontal bone loss throughout the arcade, and two teeth lost pre-mortem. Dental wear is minimal and caries rate is moderate, with heavy calculus present. The teeth are all very small in size.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 20

This grave shaft measured 2.52 x 1.40 m and contained the remains of two individuals lying side by side facing northwest.

Burial 20A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 192 cm in length and 52 cm in width, with the head oriented to the northwest. Coffin hardware consisted of five complete nails, 38 nail fragments, and a screw. Of the complete nails, 4 had a pennyweight of 7d and one a pennyweight of 10d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 23-26 years old when he died and stood 177.1 ± 7.9 cm (69.7 ± 3.1 "') tall. The left arm was placed across the chest, while the right arm was placed with the hand across the pelvis.

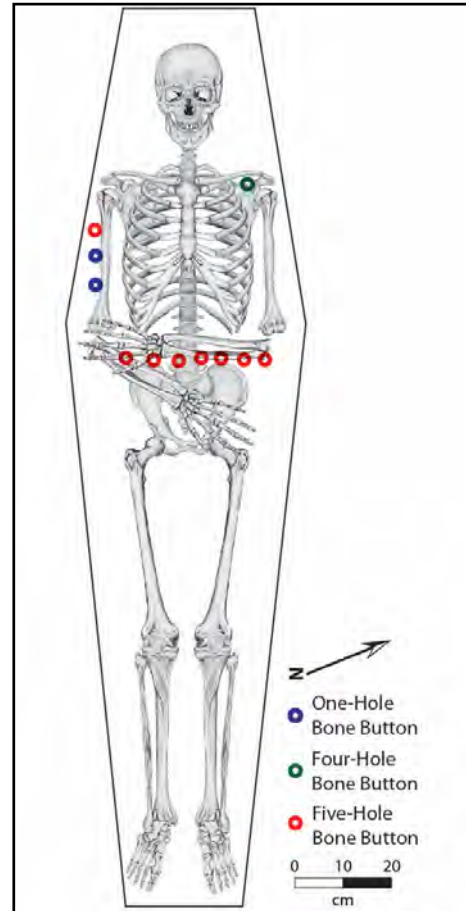
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -14.7 and $\Delta^{15}\text{N}$ values of 11.1, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows that the third molars have not fully erupted yet and there is little evidence of caries, calculus, or dental wear. The upper left first molar has a small gold filling on the occlusal surface, and there is a large Carabelli's Trait on the upper molars. Additionally, there is evidence of parafunctional wear on the right anterior teeth, suggesting that this individual ground their incisors and canines together.

Clothing, Shrouds, and Personal Artifacts

Two one-hole and one five-hole bone button were found directly adjacent to the right arm. A four-hole bone button was found near the left shoulder, and seven five-hole bone buttons were found in the pelvic area (all were located below the arms). The two one-hole and one of the five-hole buttons may have been from a restraining garment, and the other five-hole buttons represent pants closures or suspender attachments. The four-hole bone button may have been associated with a hospital garment.



Burial 20B

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin measuring 185 cm in length and 55 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 47-63 years old when they died and stood 165.1 ± 7.9 cm (65 ± 3.1 "") tall. The lower left arm was placed across the chest, and the lower right arm the pelvis.

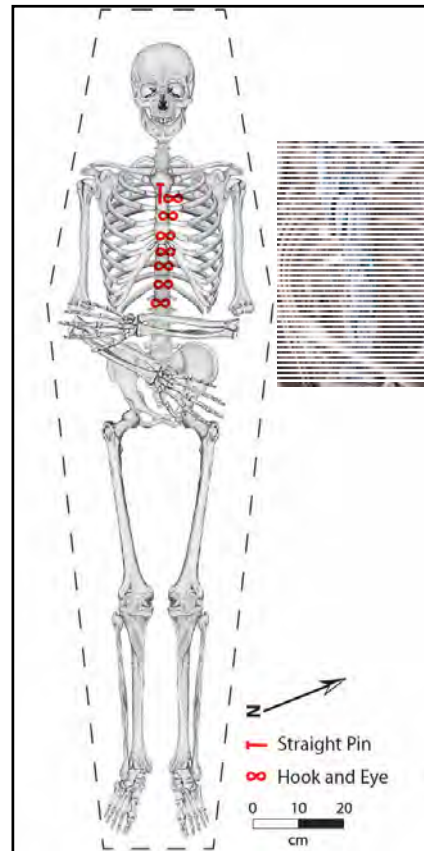
Pathology includes woven bone deposition on an unidentified left rib, as well as Schmorl's nodes on several thoracic and lumbar vertebrae as a result of herniated discs typically caused by axial loading to the vertebral column. This individual also had abnormal bone formation (enthesophytes) on the right humerus and phalanges of the left and right hand. Additionally, arthritic activity is present on most articular surfaces present including the left glenoid fossa, right ulna, left carpals, left patella, both femora and tibiae, and most elements of the ankles and feet.

This individual yielded $\Delta^{13}\text{C}$ values of -19.1 and $\Delta^{15}\text{N}$ values of 9.7, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

The dentition shows that all mandibular molars were lost pre-mortem with heavy caries likely the cause. Heavy calculus is present throughout the mandible and dental wear is minimal. There are bulbous, bony growths at the apex of the lower left canine. The maxilla shows severely porous, pitted, and inflamed alveolar bone around the upper right molars, and the upper right canine appears to be fully formed but not erupted.

Clothing, Shrouds, and Personal Artifacts

A single straight pin was recovered from above the sternum. At least five hooks and five eyes were found in a line extending down the chest from just below the pin. The hook and eye closures were probably associated with a dress. A single plainweave 1/1 possibly cotton fabric fragment possibly from a shirt, and 13 pseudomorphs of a similar fabric were associated with the hooks and eyes.



GRAVE SHAFT 21

This grave shaft measured 2.01 x 0.72 m and contained the remains of a single individual oriented to the northwest.

Burial 21

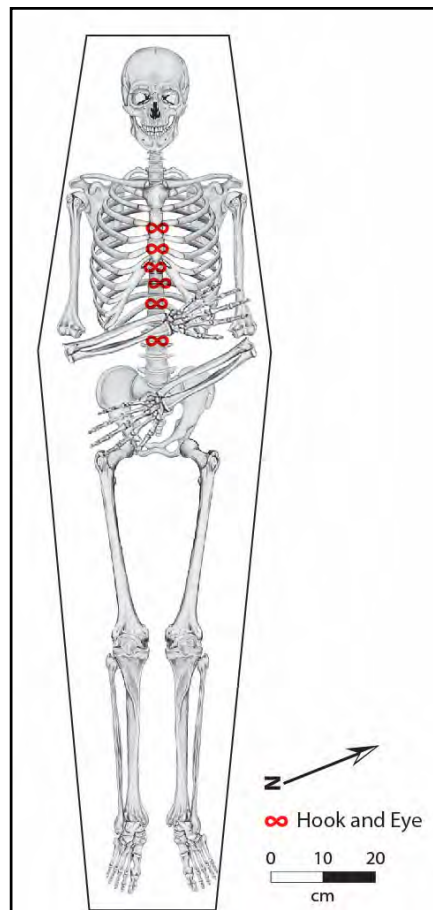
Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of nine complete nails and 19 nail fragments. Of the complete nails, five had a pennyweight of 4d and four a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a juvenile male who was 17-19 years old when he died. The remains are too fragmentary to derive a stature estimate. The lower left arm had been placed across the pelvis, and the lower right arm across the chest.

Despite the young age of this individual, they suffered from arthritic lipping on most bones of the wrists and ankles, as well as the articular surfaces of the C3 and C4 vertebrae.



This individual yielded no $\Delta^{13}\text{C}$ values, but $\Delta^{15}\text{N}$ values of 8.0 suggest a diet that included a minimal amount of meat.

The dentition shows that the third molars have not fully formed or erupted yet, and there is little to no wear on the premolars and molars. The anterior teeth show heavy wear and polishing with some chipping, indicating an overbite and grinding of the anterior teeth during life. Refitting the dentition suggests a cross bite that caused teeth to grind together at a slight offset. Dental age suggests this individual is approximately 15 years old.

Clothing, Shrouds, and Personal Artifacts

A series of hook (n=5) and eye (n=2) closures, and several hook and eye fragments were found extending from the sternum towards the pelvis. These closures may have been associated with a jacket or possibly a dress. A single plainweave 1/1 fabric fragment was found in association with the hooks and eyes.

GRAVE SHAFT 22

This grave shaft measured 2.2 x 0.7 m and contained the remains of a single individual oriented to the northwest.

Burial 22

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 175 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 10 complete nails and 22 nail fragments. Of the complete nails, six had a pennyweight of 4d and four a pennyweight of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 24-32 years old when she died and stood 165.5 ± 7.8 cm (65.2 ± 3.1 "") tall. The lower left arm was folded towards the same shoulder with the hand bent awkwardly downward. The lower right arm was placed across the pelvis.

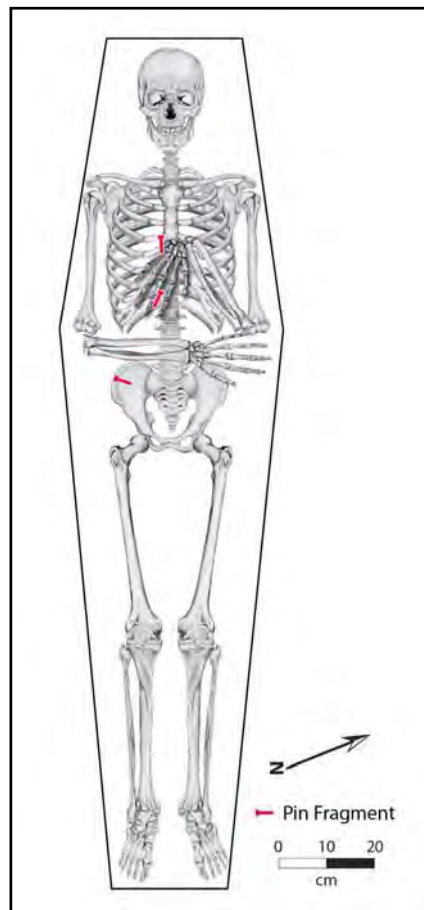
This individual shows some signs of arthritic activity in the left and right shoulder on the humeral heads only, and on both distal femora along articulation points with both the patellae and tibiae.

This individual yielded $\Delta^{13}\text{C}$ values of -15.0 and $\Delta^{15}\text{N}$ values of 10.0, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows mandibular first molars were lost pre-mortem and there is heavy calculus buildup on the anterior teeth with corresponding horizontal bone loss. The maxilla shows horizontal bone loss throughout with moderate calculus and heavy caries rate. There is also black staining on the upper right teeth of unknown origin.

Clothing, Shrouds, and Personal Artifacts

Of the three straight pins associated with this burial, two were found in the torso area and one with the right pelvis. They may have been used to pin a shroud.



GRAVE SHAFT 23

This grave shaft measured 2.35 x 1.15 m and contained the remains of a single individual oriented to the northwest.

Burial 23

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 187 cm in length and 51 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two complete nails (pennyweight 8d) and 13 nail fragments.

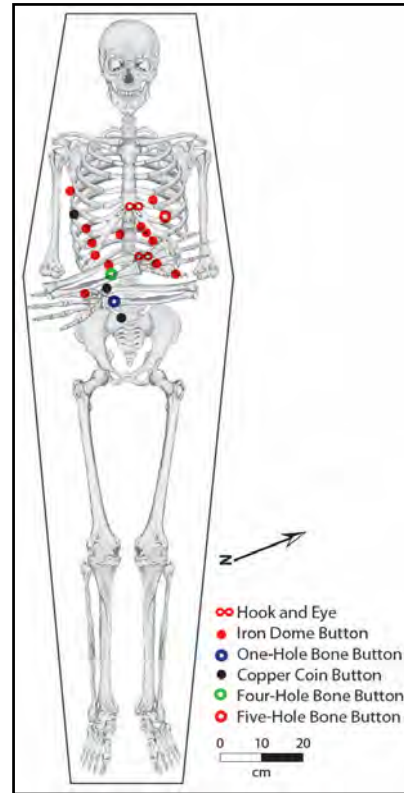
Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 38-53 years old when he died and stood 175.4 ± 7.9 cm (69.1 ± 3.1 "") tall. Both lower arms were placed across the chest. This individual had several pathologies throughout the skeleton. Both patellae show characteristics of Messeri's Patella, caused by continued stress associated with squatting or chronic flexion of the knee. There is also arthritic lipping present on the distal femora where the patellae articulate, as well as along the condyles where the tibiae articulate. This individual also had two small button osteomas present on the left frontal bone, which are benign growths on the cranial vault. There are also Schmorl's nodes on both superior and inferior surfaces of six thoracic vertebrae, characteristic of herniated disks associated with heavy lifting. Two left ribs and three right ribs exhibit arthritic sharp ridge lipping around the tubercles, but thoracic vertebrae were too damaged to find any associated arthritic activity there. One cervical vertebra has elevated ring osteophyte formation present on the centrum, possibly caused by repetitive extension of the neck during activity.

This individual yielded $\Delta^{13}\text{C}$ values of -16.4 and $\Delta^{15}\text{N}$ values of 10.7, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat. The dentition shows some horizontal bone loss throughout the arcade, but very noticeable and severe vertical bone loss throughout the entire arcade that exposed much of the roots of the teeth. Calculus is minimal and caries rate is low, while dental wear is very heavy and resulted in polished occlusal edges. The dental wear is likely the reason for the severe bone loss.

Clothing, Shrouds, and Personal Artifacts

There were two hooks, two eyes, and several hook and eye fragments associated with the torso area of this burial. A variety of buttons were also found with this individual. They consisted of a one-hole bone button, a five-hole bone button, three metal coin or stamp buttons, and 13 metal dome buttons. The latter were most likely part of a jacket, which might have been double-breasted. The coin buttons could represent elaboration of the jacket or a vest. Several of the metal buttons were fabric covered. Fabrics identified consisted of plainweave 4/4 fragments and twill weave 2/1 jacket fragments, 1/1 possibly cotton fragments associated with a shirt, and 2/1 pseudomorphs that were likely from a necklace or bracelet.



GRAVE SHAFT 24

This grave shaft measured 2.1 x 1.5 m and contained the remains of two individuals lying side by side, one oriented to the northwest and the other to the southeast.

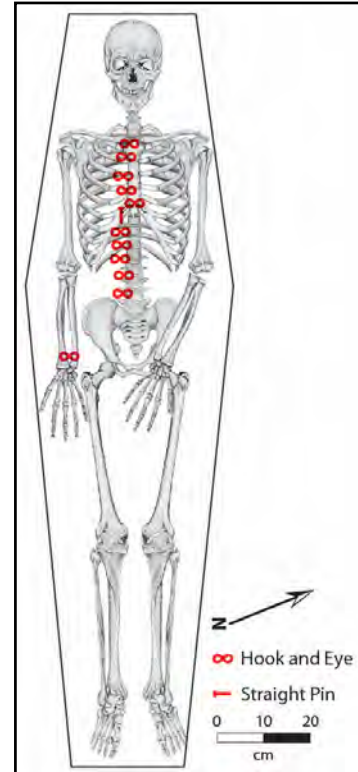
Burial 24A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 182 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 10 complete nails and 25 nail fragments. Of the complete nails, six have a pennyweight of 6d, three of 8d, and one of 20d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 38-53 years old when she died and stood 160.4 ± 7.9 cm (63.2 ± 3.1 "") tall. The lower left arm was placed across the pelvis and right arm along at the side of the body.



Pathologies include arthritis in the hips, knees, ankles, and wrists, with lipping occurring on most articular surfaces in all joints mentioned. Additionally, two lumbar vertebrae have arthritic lipping around the articular surfaces with associated bone formation. Finally, there is sclerotic bone deposition on the non-articular aspect of the left acetabulum and on both articular and non-articular aspects of the right acetabulum, likely resulting from trauma to the hip joint. The foramen located alongside the lunate surface is substantially enlarged on both sides, possibly from increased blood and nutrient flow to the damaged area. There is corresponding sclerotic deposition inside the fovea capitis on each femoral head, possibly from bilateral hip dislocation (subluxation), with associated traumatic bone deposition. Other indicators of this include a shift in the medial border of the left auricular surface towards the sacrum, as well as an enlarged or possibly accessory iliac tuberosity on the right ilium medial to the auricular surface.

This individual yielded $\Delta^{13}\text{C}$ values of -15.1 and $\Delta^{15}\text{N}$ values of 9.5, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat. The dentition shows evidence of severe horizontal bone loss across the entire arcade, with the maxilla appearing almost paper thin and porous. At least six teeth were lost pre-mortem possibly as a result of heavy calculus buildup and corresponding heavy caries. The maxilla shows three abscesses at the left first molar and right second molar, and dental wear is minimal throughout the arcade except for slightly elevated wear on the anterior teeth.

Clothing, Shrouds, and Personal Artifacts

Of the hook and eye fasteners associated with this individual, one was found near the right wrist. The remaining 10 hooks, five eyes, and hook and eye fragments were found along the back of the spine extending from the just below the neck towards the pelvis. The hook and eye closures were probably associated with a dress. A straight pin found in the vicinity of the hooks and eyes may have been used to pin clothing.

Burial 24B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 50 cm in width, with the head oriented to the southeast. Coffin Hardware consisted of four complete nails and eight nail fragments. All of the complete nails had a pennyweight of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 24-28 years old when he died and stood 175.5 ± 7.2 cm (69.1 ± 2.8 "") tall. Both arms were placed at the side of the body.

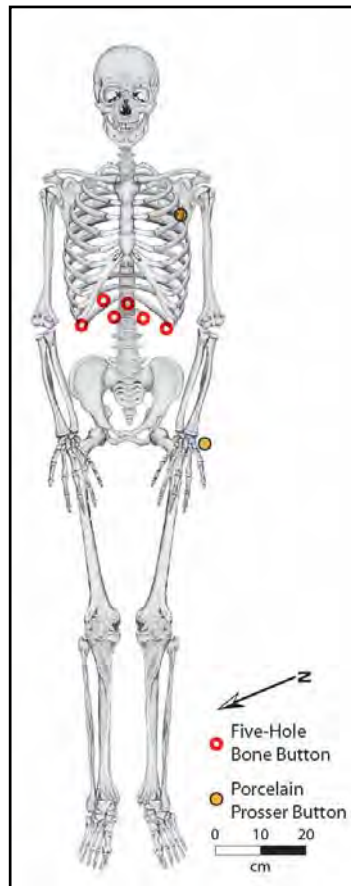
This individual had arthritis in both knees, as well as surface osteophyte formation on the right distal femur, and arthritic activity in the right first metacarpal including spicule formation. The left femoral neck exhibits bone loss consistent with Allen's fossa. The right femoral head exhibits a Poirier's facet, which has been suggested to be caused by pressure exerted by the iliopsoas muscle during repeated hyperextension of the hip (Capasso et al. 1998:104). Additionally, there is an area of multifocal bone loss present on the left humerus that appears to be a remnant cloaca, evidence for osteomyelitis, that was no longer active at time of death.

This individual yielded $\Delta^{13}\text{C}$ values of -16 and $\Delta^{15}\text{N}$ values of 10, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows extreme horizontal bone loss evident in the maxilla and three teeth lost pre-mortem. Some evidence of caries present including cavernous lesion in the upper right first molar destroying the entire crown and most of the root. There is also evidence of two abscesses in the maxilla. The mandible shows dark brown/black staining on the left teeth, particularly the molars. These teeth are also unevenly and heavily worn, with some chipping of occlusal surfaces of the molars, premolars, and canines.

Clothing, Shrouds, and Personal Artifacts

Two Prosser buttons were recovered from the right side of the torso; one from near the left wrist and one from near the right shoulder. A series of eight five-hole bone buttons were found just above the pelvis. The Prosser buttons may be associated with a shirt. The bone buttons were associated with pants closures or suspender attachments.



GRAVE SHAFT 25

This grave shaft measured 2.13 x 0.86 m and contained the remains of a single individual oriented to the northwest.

Burial 25

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 195 cm in length and 50 cm in width. Coffin hardware consisted of six complete (one pennyweight of 8d and five a pennyweight of 9d) nails.

Human Skeletal and Dental Remains

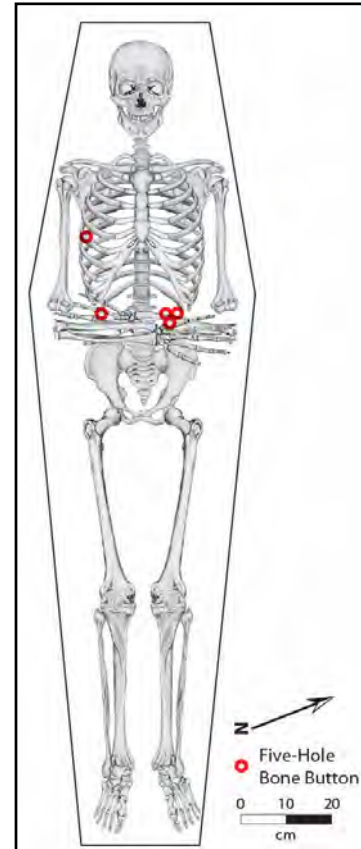
This individual is estimated to be a young adult male who was 20-24 years old when he died and stood 170.3 ± 7.8 cm (67 ± 3.1 "") tall. Both lower arms were placed across the chest.

Pathologies include Messeri's Patella on both sides and flexion facets on both left and right distal tibiae (squatting facets). Capasso et al. (1998:121, 127) suggest these markers are a result of repetitive flexion of the knee and ankle such as during repetitive squatting. Additionally, the left femur has an area of porosity on the anterior portion of the femoral neck adjacent to the head consistent with cribra femoralis (also known as Allen's fossa). Some researchers have speculated that these lesions are caused by habitual squatting (Mann and Hunt 2005). There is arthritic activity present only in the knees, with lipping present on both distal femora. The left distal humerus has an area of coalesced porosity on the capitulum, where the radius articulates, but no other pathology is present on either bone. Finally, the left navicular shows evidence of a well healed depression fracture.

This individual yielded $\Delta^{13}\text{C}$ values of -16.3 and $\Delta^{15}\text{N}$ values of 10.0, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat. The dentition shows that alveolar bone was relatively healthy with only vertical bone loss present on anterior teeth due to patterned wear. The anterior teeth are heavily worn with dentin exposed from an apparent overbite. Three third molars and the upper left second premolar are congenitally absent.

Clothing, Shrouds, and Personal Artifacts

Of the five-hole bone buttons associated with this individual, four were found just above the pelvic area. They may have been associated with pants. The fourth was found along the left side of the rib cage, and may have been associated with a shirt pocket. Copper staining was observed on some of the vertebrae, but the cause of the staining could not be determined.



GRAVE SHAFT 26

This grave shaft measured 2.54 x 1.24 m and contained the remains of one intact burial oriented to the northwest overlain by the commingled remains of at least four individuals.

Burial 26A (Comingled)

Human Skeletal and Dental Remains

Burial 26A was a commingled set of remains representing a minimum of four individuals. There were three crania present, in varying degrees of preservation, and four mandibles. The intact left humerus shows evidence of large and pronounced muscle attachment. Age and sex estimates were only possible for the crania and pelvic fragments containing a greater sciatic notch. Results suggest there were two male and one probable female crania, as well as one male, one female, and one ambiguous greater sciatic notch. All were adults. No pathologies were noted.

No isotopic data are available for these commingled remains.

The multiple dentition fragments suggest that the individuals represented here in general had horizontal bone loss with subsequent root surface caries, and mostly moderate to heavy dental wear. One maxilla and mandible pair show parafunctional wear patterning suggesting that individual habitually rubbing or grinding their teeth.

Burial 26B

Coffin/Casket Remains and Hardware

This individual was buried in a rectangular shaped coffin measuring 190 cm in length and 55 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 10 complete nails and 34 nail fragments. Of the complete nails, one had a pennyweight of 7d, three of 8d, and six of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 23-27 years old when he died and stood 159.9 ± 10.1 cm ($62.9 \pm 4''$) tall. The left arm was placed with the hand across the chest, while the right arm was placed with the hand across the pelvis.

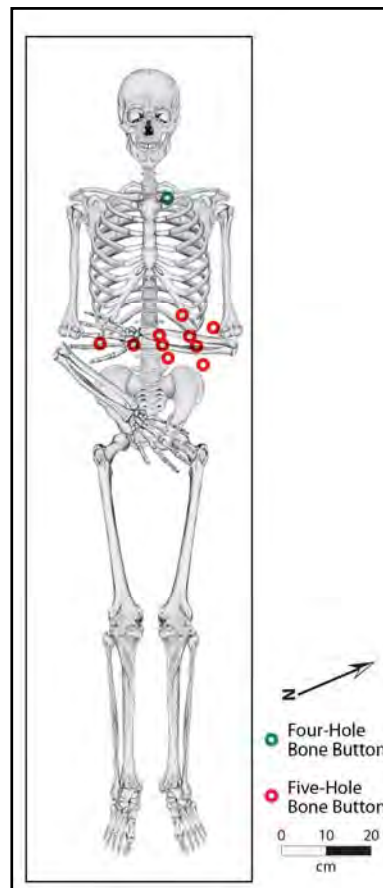
Pathologies include abnormal bone formation on the left humerus, including enthesophytes on both the proximal and distal portions as well as woven bone deposition on the midshaft. The left humerus is also considerably bowed, particularly along the proximal half of the shaft, consistent with a well healed fracture. Woven bone is also present on the left and right tibiae as well as both femora. A mixture of woven and sclerotic bone is present on the anterior aspect of the right maxilla, located above the second premolar. Additionally, there is enthesophyte formation on several phalanges in both hands, corresponding to connective tissue attachment sites. Finally, there is arthritic activity in both shoulders as evinced by lipping on both glenoid fossae.

This individual yielded $\Delta^{13}\text{C}$ values of -15.3 and $\Delta^{15}\text{N}$ values of 10.6, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows heavy caries rate throughout the entire arcade, with several teeth either lost or consumed by cavernous lesions. Heavy calculus buildup is also present likely causing the root surface lesions. All anterior teeth show evidence of occlusal edge chipping, and there is some horizontal bone loss in the maxilla.

Clothing, Shrouds, and Personal Artifacts

A four-hole bone button located near the neck may have been associated with a pull-over shirt. The 10 five-hole bone buttons found above the pelvis were probably pants fly closures or suspender fasteners (though shown in the illustration above the arms, all of the buttons were found below the arms and hands).



GRAVE SHAFT 27

This grave shaft measured 2.56 x 1.05 m and contained the remains of a single individual.

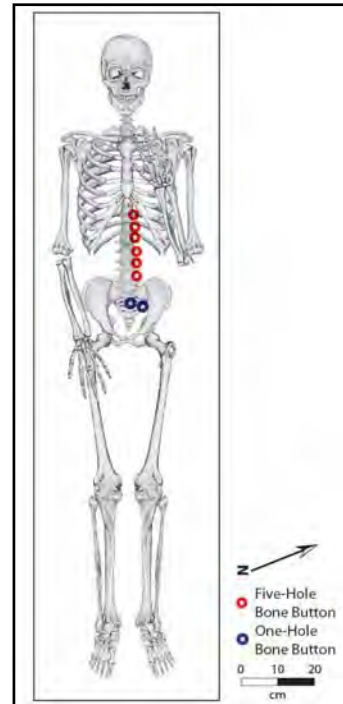
Burial 27

Coffin/Casket Remains and Hardware

This individual was buried in a rectangular shaped coffin measuring 190 cm in length and 48 cm in width, with the head oriented to the northwest. Coffin hardware consisted of nine complete nails and 41 nail fragments. Of the complete nails, two had a pennyweight of 4d and seven a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an adult probable male who stood 157.9 ± 9.3 cm (62.1 ± 3.7 "") tall. The lower left arm had been folded towards the same shoulder and the right arm had been placed at the side of the body.



This individual appears to have an area of healed porosity present in the left orbit, also known as cribra orbitalia. Cribra orbitalia is thought to be caused by vitamin deficiency (e.g. vitamin B₁₂ or vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009).

This individual yielded $\Delta^{13}\text{C}$ values of -18.3 and $\Delta^{15}\text{N}$ values of 12.3, suggesting a diet consisting entirely of C₃ plants with no corn-based products, and a significant amount of meat.

The dentition shows bone loss is minimal in the mandible but more extensive in the maxilla. There appears to have been an abscess at the upper right second incisor, as well as abscesses at the upper left second incisor and left first premolar. Caries are present to a greater degree in the maxilla. There is parafunctional dental wear in the anterior teeth indicating a cross bite grinding pattern, with additional evidence of bruxism on these teeth as well.

Clothing, Shrouds, and Personal Artifacts

Of the eight bone buttons associated with this burial, two were one-hole buttons found in the vicinity of the sacrum. The rest were five-hole buttons that extended towards the head along the back of the spine.

GRAVE SHAFT 28

This grave shaft measured 2.2 x 1.13 m and contained the remains of a single individual oriented northwest.

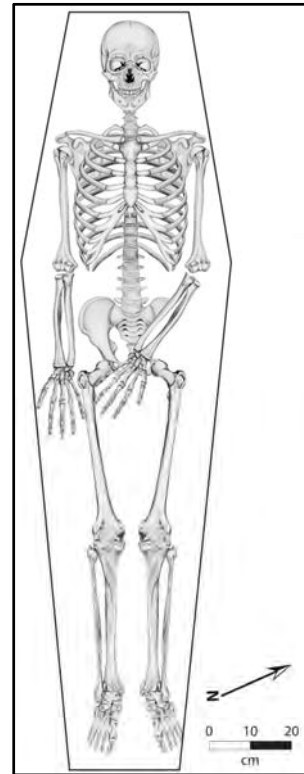
Burial 28

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 184 cm in length and 50 cm in width. Coffin hardware consisted of three nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 25-33 years old when he died and stood 176.9 ± 8.2 cm (69.7 ± 3.2 "") tall. The lower left arm was placed across the pelvis, and the right arm along the side of the body.



Pathology includes arthritis in the temporomandibular joint (TMJ), likely causing pain during chewing. There are also five vertebrae containing Schmorl's nodes of marked expression on both superior and inferior surfaces of the centra, resulting most likely from herniated disks. The vertebrae are likely lumbar based on curvature and size of the centra. Two bones exhibit bone loss, unifocal on the right navicular and multifocal on the distal right tibia. There is bowing present in the left fifth metatarsal (MT5), possibly resulting from a well-healed fracture. Finally, both left and right femora exhibit bone formation (enthesopathy) along the linea aspera, the most prominent muscle attachment site on the posterior aspect of the femur, and may reflect repeated flexion and extension (Capasso et al. 1998:118).

This individual yielded $\Delta^{13}\text{C}$ values of -19.4 and $\Delta^{15}\text{N}$ values of 9.0, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

The dentition shows minor horizontal and vertical bone loss in the mandible and heavier bone loss in the maxilla, all corresponding to areas of tooth decay and loss. Three teeth were lost pre-mortem, with moderate caries throughout the arcade. The tooth loss appears to have been due to calculus buildup, and dental wear is moderate. The upper and lower right second incisors are both rotated 90 degrees within the socket, resulting in perpendicular orientation and crowding of the remaining teeth around them.

Clothing, Shrouds, and Personal Artifacts

A single five-hole bone button was found with this individual, however its location is not known.

GRAVE SHAFT 29

This grave shaft measured 2.5 x 1.9 m and contained the remains of four individuals lying side by side, all oriented to the northwest. Electrical conduits ran directly above the grave shaft but did not intrude into the burials themselves.

Burial 29A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 195 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 13 complete (pennyweight 7d) nails, 28 nail fragments, and a screw.

Human Skeletal and Dental Remains

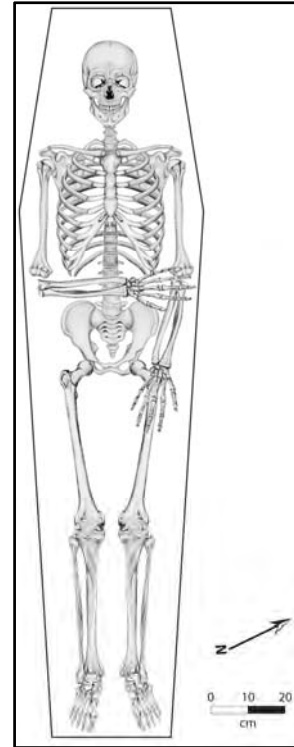
This individual is estimated to be a young adult male who was 22-27 years old when he died and stood 175.7 ± 7.8 cm (69.2 ± 3.1 "') tall. The left arm was placed at the side of the body, and the lower right arm across the chest.

Pathologies include bone loss on both calcanei (appears congenital) as well as arthritic activity on all joint surfaces in both upper and lower limbs, left clavicle, ribs and associated thoracic vertebrae, as well as eburnation on a right wrist bone (trapezium). There is also evidence for a possible dislocation of the right shoulder. Three thoracic and one lumbar vertebrae exhibit marked expression Schmorl's nodes on the superior and inferior surfaces. There is inactive porosity in the left orbit consistent with cribra orbitalia, possibly due to vitamin deficiency (e.g., vitamin B₁₂, and vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009). Bone deposition was noted on the right humeral head. A facet consistent with Allen's fossa was present on the right femoral neck. This individual yielded $\Delta^{13}\text{C}$ values of -15.8 and $\Delta^{15}\text{N}$ values of 10.4, suggesting a diverse diet consisting of mixed C₃ plants and corn-based products, and a moderate amount of meat.

The dentition shows some horizontal bone loss in the mandible, and evidence of six maxillary teeth lost pre-mortem. There is heavy dental wear on all mandibular teeth and parafunctional wear present the lower right canine, which has been worn at an angle and chipped along the occlusal edge. Many other teeth have chipped as well, suggesting heavy bruxism. The upper left canine is present within the palate, with only a small portion of the crown exposed and subsequently worn down to expose the dentin.

Clothing, Shrouds, and Personal Artifacts

None



Burial 29B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 175 cm in length and 42 cm in width, with the head oriented to the northwest. Coffin hardware consisted of eight complete nails and 12 nail fragments. Of the complete nails, five had a pennyweight of 6d, one a pennyweight of 7d, and two a pennyweight of 8d.

Human Skeletal and Dental Remains

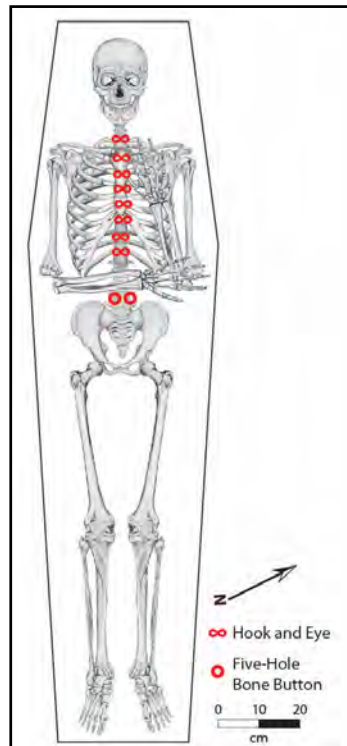
This individual is estimated to be a young-to-middle adult female who was 33-43 years old when she died and stood 164.4 ± 7.9 cm (64.7 ± 3.1 "") tall. The lower left arm was folded towards same shoulder, and the lower right arm was placed across the chest.

Pathologies include arthritic activity on all articular surfaces of the knees, the glenoid fossa of the right shoulder (which also had a large surface osteophyte in the center of the articular surface), as well as several left rib heads and associated thoracic vertebrae, both temporomandibular joints (TMJ), the atlas vertebra (C1) and the occipital condyles of the cranium. The left medial clavicle has a surface osteophyte present on the articular surface. Four thoracic and three lumbar vertebrae exhibit moderate expression Schmorl's nodes on both superior and inferior surfaces, suggesting herniated intervertebral disks. Finally, the nasal bones are angled outward from the face in a manner consistent with a well-healed fracture of the nasal bone.

This individual yielded $\Delta^{13}\text{C}$ values of -15.1 and $\Delta^{15}\text{N}$ values of 10.4, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat. The dentition shows extreme tooth loss, with 11 teeth lost pre-mortem with most alveolar bone completely resorbed. The remaining teeth have few caries but heavy calculus is present. All maxillary teeth show a very dark brown/black staining as well.

Clothing, Shrouds, and Personal Artifacts

A series of hooks (n=8), eyes (n=7), and hook and eye fragments were found extending from the neck towards the pelvis. They may have been associated with a dress as three fragments of a plainweave weft-faced fabric were found in association with these closures. The two five-hole bone buttons found beneath the lumbar vertebrae may have been associated with undergarments.



Burial 29C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 190 cm in length and 52 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven complete (7d pennyweight) nails, 58 nail fragments, and two screws.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 38-53 years old when he died and stood 182.2 ± 9.3 cm (71.7 ± 3.7 "') tall. Both lower arms were folded back towards the same shoulder.

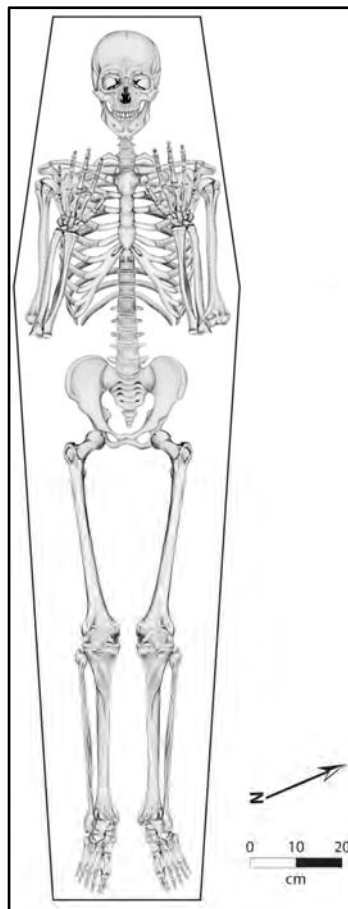
Pathology noted included abnormal bone development (enthesopathy) on the radii, ulnae, hand phalanges, and calcanei, suggesting repetitive activity. There is also a Schmorl's node on C7 and elevated ring osteophyte formation on lumbar vertebrae. The presence of occluded distal femoral and tibial medullary cavities is likely a result of significant infection that entered the bone. Additionally, there is evidence of arthritic activity in the jaw (TMJ), patellae, glenoid fossa/humerus, tarsals, and metatarsals. The expression of Messeri's Patella suggests repeated flexion of the knees.

This individual yielded $\Delta^{13}\text{C}$ values of -15.1 and $\Delta^{15}\text{N}$ values of 9.1, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows significant horizontal bone loss throughout the entire arcade with 4 teeth lost pre-mortem. There is heavy plaque buildup present on all maxillary teeth, causing root surface caries on all remaining teeth. Almost all the mandibular teeth show heavily worn crowns with dentin exposed in a central depression where the dentin has then started to dissolve/deteriorate once exposed.

Clothing, Shrouds, and Personal Artifacts

None



Burial 29D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 171 cm in length and 43 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 11 complete nails and 19 nail fragments. Of the complete nails, four have a pennyweight of 7d, three of 8d, and four of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 48-60 years old when she died and stood 174.7 ± 8 cm (68.8 ± 3.1 "") tall. The lower left arm was folded towards the same shoulder, and the lower right arm was placed across the chest.

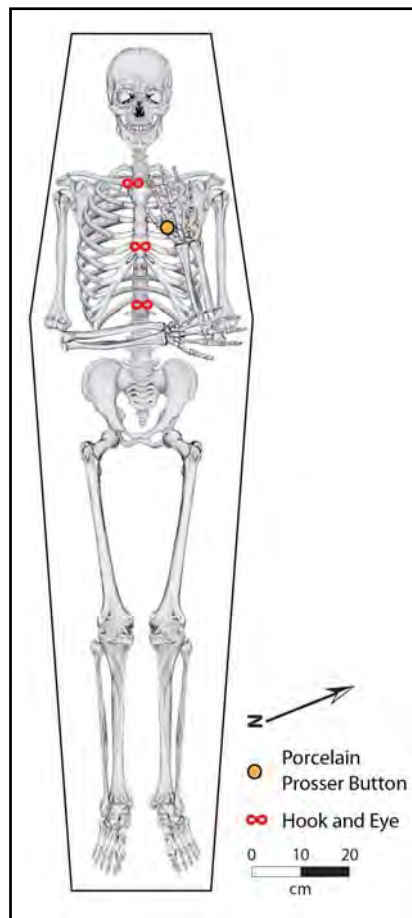
Pathology included two cervical Schmorl's nodes resulting from herniated intervertebral disks in the neck. There is also arthritic activity in the jaw (TMJ), wrists, ankles, and knees, and abnormal bone formation (enthesopathy) on the proximal and medial hand phalanges. There was also evidence of left tibial proximo-lateral condyle convexity, possibly caused by repeated squatting.

This individual yielded $\Delta^{13}\text{C}$ values of -16.5 and $\Delta^{15}\text{N}$ values of 10.4, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows extreme tooth loss, with only a single socket remaining on the mandible and the rest are fully resorbed. It appears there was an abscess at both lower canines, and the single tooth remaining has an overwhelming amount of plaque covering it. The remaining loose maxillary teeth are all covered in plaque as well, some up to 5mm in thickness. Dental wear is low because plaque is covering all surfaces.

Clothing, Shrouds, and Personal Artifacts

A single straight pin was found with the burial, but its location could not be determined. Three hooks and two eyes, and a Prosser button were found in association with this burial. The hook and eye closures were found at the neck and behind the spin. The Prosser button was this recovered from the torso area. The hook and eye closures may have been associated with a dress, and the Prosser button a pocket.



GRAVE SHAFT 30

This grave shaft measured 2.23 x 0.75 m and contained the remains of a single individual oriented northwest.

Burial 30

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin measuring 192 cm in length and 54 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 10 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 28-33 years old when he died and stood 176.2 ± 7.8 cm (69.4 ± 3.1 "") tall. Both arms were placed with the lower hands across the pelvis.

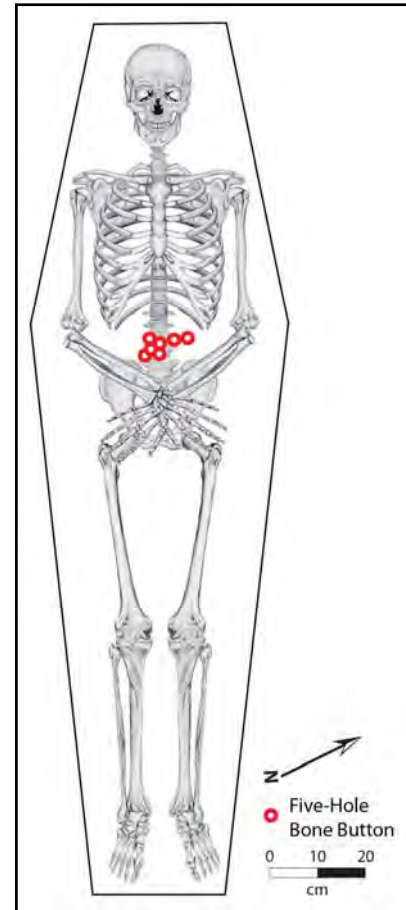
Pathology includes arthritic activity in the jaw (TMJ) and both knees, a lumbar Schmorl's node likely resulting from a herniated disk, and bone loss on the distal femora. Additionally, porosity consistent with cribra femoralis is present on both femoral necks, possibly due to habitual extension of the hips (Mann and Hunt 2005), as well as squatting facets on the distal tibiae. There is also evidence of spina bifida of the axis (C2), a congenital condition that often does not present with clinical symptoms in life.

This individual yielded $\Delta^{13}\text{C}$ values of -14.3 and $\Delta^{15}\text{N}$ values of 11.2, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows horizontal bone loss throughout the entire arcade, with only one tooth lost pre-mortem. A tiny pin-sized periapical abscess was forming at the lower left second premolar at death, and it appears that the third molars were erupting at angles except for the congenitally absent lower left. Severe hypoplasias are present on canines and incisors as well.

Clothing, Shrouds, and Personal Artifacts

There were seven five-hole bone buttons found just above the pelvic area. They appear to represent a drop down fly for a pair of pants.



GRAVE SHAFT 31

This grave shaft measured 2.2 x 0.73 m and contained the remains of two individuals oriented northwest. These burials were placed in a single, narrow shaft one above the other.

Burial 31A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 175 cm in length and approximately 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be an adult probable female standing approximately 172.7 ± 6.8 cm (68 ± 2.7 "") tall. The lower left arm was folded back towards the shoulder and the lower left arm was placed towards the opposite shoulder.

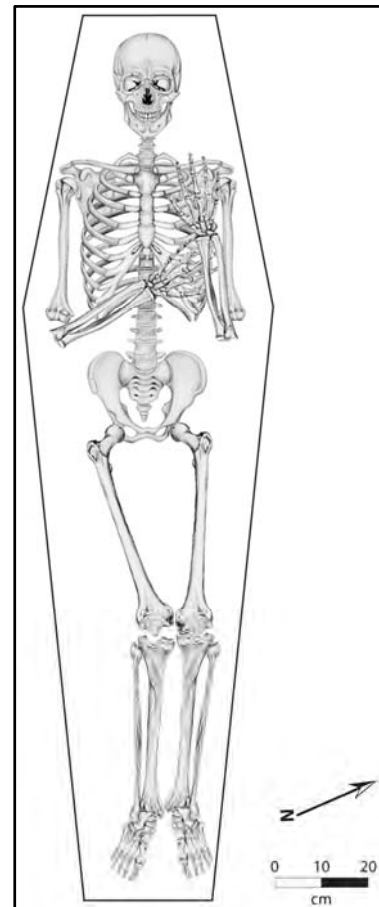
Pathology noted includes arthritic activity on all articular surfaces of the knees, ankles, wrists, ribs, and the atlas (C1) and axis (C2) vertebrae.

This individual yielded $\Delta^{13}\text{C}$ values of -15.3 and $\Delta^{15}\text{N}$ values of 9.9, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

A single eye from hook and eye fastener was found with this individual, but its location within the burial could not be determined.



Burial 31B

Coffin/Casket Remains and Hardware

This individual was buried in a coffin that appears to be hexagonal shaped, but the exact dimensions could not be determined. The head was oriented to the northwest. Coffin hardware consisted of eight complete nails and 10 nail fragments. Of the complete nails, six had a pennyweight of 7d, one a pennyweight of 8d, and one a pennyweight of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 28-34 years old when he died and stood 163 ± 7 cm (64.2 ± 2.7 "') tall. Both lower arms had been were placed across the pelvis.

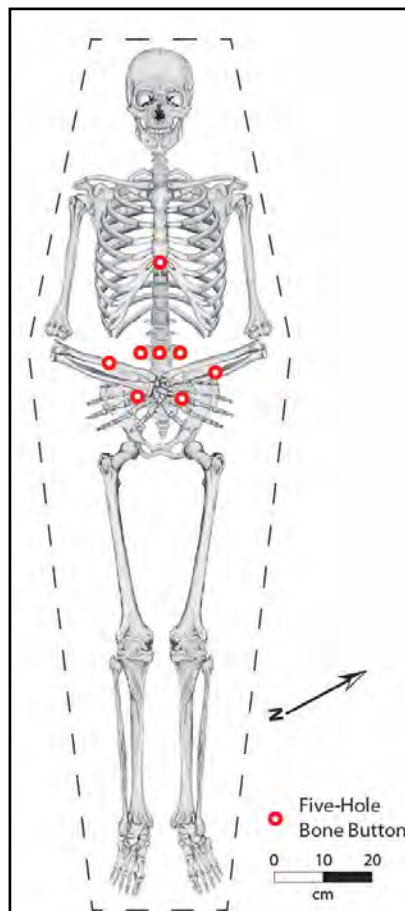
Pathology includes two cervical vertebrae with bifurcated posterior synchondroses. This is likely a congenital trait and would not have affected them adversely in life. Additionally there are two lumbar Schmorl's nodes, likely as a result of herniated intervertebral disks, and arthritic lipping on the articular surfaces of both knees and ankles.

This individual yielded $\Delta^{13}\text{C}$ values of -14.2 and $\Delta^{15}\text{N}$ values of 10.5, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows relatively healthy alveolar bone in the maxilla with more horizontal and vertical bone loss in the mandible in isolated areas. Moderate wear and calculus buildup are present along with associated root surface caries on many teeth. All teeth are present and in occlusion.

Clothing, Shrouds, and Personal Artifacts

Of the eight five-hole bone buttons associated with this individual, seven were found on or just above the pelvis, and were associated with a pants fly or suspender attachments (though shown in the illustration above the arms, all of the buttons were found below the arms and hands). Another five-hole bone button was found midway between the neck and the pelvis. Upon removal of the skeleton, three Prosser buttons were recovered from beneath the vertebrae. They along with the additional five-hole bone button may have been associated with a shirt.



GRAVE SHAFT 32

This grave shaft measured 2.6 x 0.9 m and contained the remains of a single individual oriented northwest.

Burial 32

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 190 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of eight complete (pennyweight 7d) nails and 23 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult male who was 28-38 years old when he died and stood 171 ± 7.9 cm (67.3 ± 3.1 "") tall. The lower left arm was placed across the chest, and the lower right arm across the pelvis.

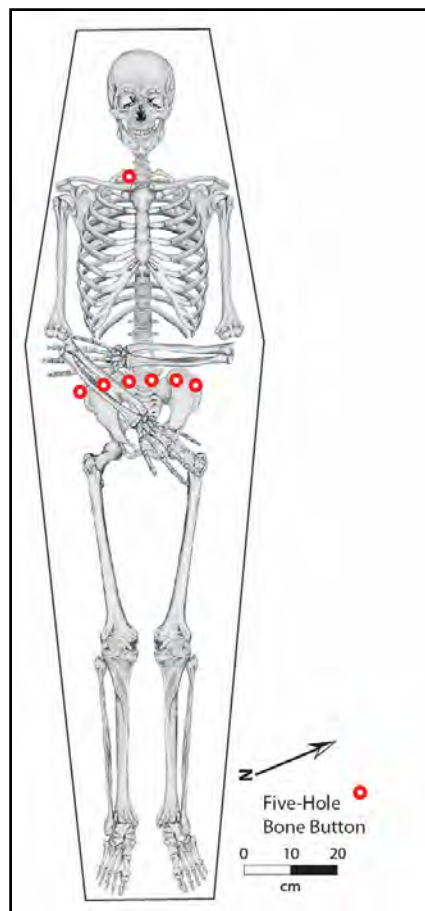
Pathologies include sclerotic bone deposition on the right tibia and an unidentified left rib, likely due to healed infection. There is also evidence for a healed fracture on the distal right radius (consistent with a Colles' fracture). There were Schmorl's nodes on three unidentified thoracic vertebrae indicating herniated intervertebral disks, and arthritis in both the occipital condyles at the base of the cranium.

This individual yielded $\Delta^{13}\text{C}$ values of -18.3 and $\Delta^{15}\text{N}$ values of 10.6, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

The dentition shows

Clothing, Shrouds, and Personal Artifacts

Of the eight five-hole bone buttons associated with this burial, one small five-hole button was located at the neck and seven medium to large buttons were found at the waist (under the arms). The former may have been associated with a pull-over shirt and the latter pants.



GRAVE SHAFT 33

This grave shaft measured 2.6 x 1.25 m and contained the remains of a single individual oriented northwest. The shaft showed the outline of a hexagonal coffin that was encased in a larger, wooden box and is located only 6 cm from Grave Shaft 32.

Burial 33

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 48 cm in width, with the head oriented to the northwest. Coffin hardware consists of six complete nails and 32 nail fragments. Of the complete nails, two have a pennyweight of 6d and four a pennyweight of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 53-63 years old when they died and stood 172.2 ± 8.3 cm (67.8 ± 3.3 "") tall. The lower left arm was placed at the side of the body, and the lower right arm across the pelvis.

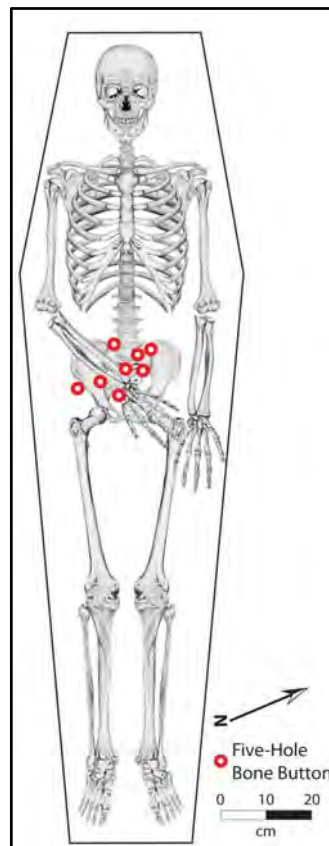
Pathology includes arthritic lipping throughout the vertebral column, glenoid fossae, humeri, radii, ulnae, carpals, femora, tibiae, patellae, tarsals, and metatarsals. Additionally, there is evidence of Schmorl's nodes on L4 and L5, suggesting herniated intervertebral disks, possibly caused by axial loading to the spine. There is also diffuse bone loss in cervical vertebrae, possibly due to a combination of advanced age and long-term physical activity.

This individual yielded $\Delta^{13}\text{C}$ values of -17.3 and $\Delta^{15}\text{N}$ values of 10.3, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition is very poorly preserved with no alveolar bone intact and only 7 maxillary teeth recovered. The upper left second incisor and canine have broken crowns resulting from this individual sustaining a blow to the left side of the face.

Clothing, Shrouds, and Personal Artifacts

A cluster of eight five-hole bone buttons was found in the pelvic area of this individual (though shown in the illustration above the arms, all of the buttons were found below the arms and hands). They would have been associated with a drop-down pants fly.



GRAVE SHAFT 34

This grave shaft measured 2.1 x 1.05 m and contained the remains of a single individual oriented northwest. The coffin was buried within a larger, rectangular box similar to Burial 33.

Burial 34

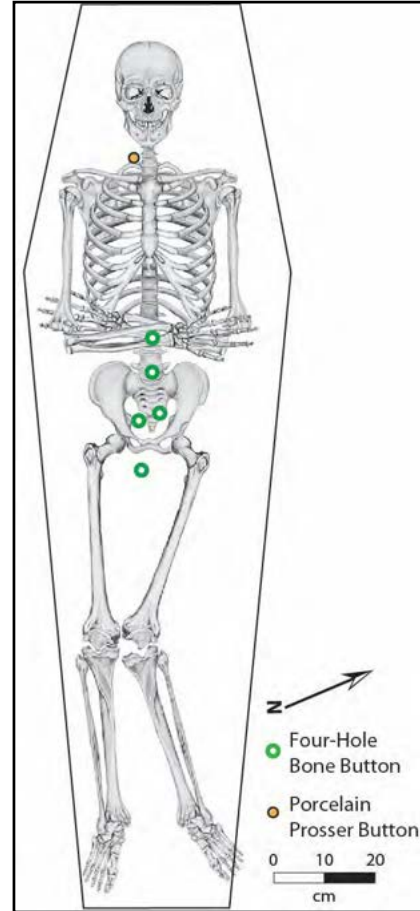
Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin Hardware consisted of 13 complete nails and 47 nail fragments. Of the complete nails, one had a pennyweight of 3d, five of 6d, five of 8d, and two of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a juvenile who was 14-16 years old when he or she died. No sex or stature estimation was made due to the immature age of the individual. Both lower arms were placed across the chest.

This individual shows skeletal manifestations that are consistent with poliomyelitis, or polio, including extreme atrophy of the left leg and left arm. The attachment sites for the muscles associated with flexion of the elbow are particularly pronounced in the affected arm (and to a much lesser degree in the right forearm) suggesting that this individual's arm may have been fixed in the flexed position (arm bent). The lack of atrophy in the right arm and leg bones suggests that this individual was not completely paralyzed. Considering the notable long bone length discrepancies (18 mm difference in humeral lengths, 4 mm difference in humeral midshaft diameters, and 8 mm difference in femoral midshaft diameters), it is likely that the onset of the condition began well before the bones completed growth. The right distal tibia has a squatting facet suggesting hyperdorsiflexion of the ankle (flexing the foot upward or squatting), possibly due to compensation for the shorter left leg. Shape changes to the hip joints (acetabulum of the pelvis and femoral head) show evidence for possible subluxation, or partial dislocation. The acetabular margin of the left hip also has a small healing fracture, which is not uncommon among individuals who have unbalanced and weakened hip muscles (Jones 1962). Further shape changes to the pelvis (wider greater sciatic notch of the left ilia) suggest that this individual spent a great deal of time sitting. Multiple vertebrae also have Schmorl's nodes, likely due to disuse osteoporosis. While a number of other causes are possible (e.g., cerebral palsy), the



mosaic, patchy distribution of affected muscles and bones, as well as possible osteoporosis of the spine due to prolonged immobility, are more suggestive of polio (Aufderheide and Rodríguez-Martín 1998:212; Ortner and Putschar 1985:325-326; Waldron 2009:109).

Additionally, there is evidence of active infection in the form of woven bone deposition on the diaphysis of the right tibia and fibula. There are also inactive porous lesions in the eye orbits consistent with cribra orbitalia, possibly due to vitamin deficiency (e.g., vitamin B₁₂ and vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009).

This individual yielded $\Delta^{13}\text{C}$ values of -13.5 and $\Delta^{15}\text{N}$ values of 10.3, suggesting a diet consisting of minimal C₃ plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows that all third molars were not fully developed or erupted yet at death. Alveolar bone is healthy throughout the arcade and there is little dental wear, although several anterior teeth exhibit marked chipping along occlusal edges. The lower right first incisor is the only tooth lost pre-mortem and there is a single cavernous carious lesion on the upper right second premolar. The upper first molars have large Carabelli's Trait expression, and slight parafunctional wear is present.

Clothing, Shrouds, and Personal Artifacts

The single Prosser button found near the neck area may have been associated with a pull-over shirt. Several four-hole bone (n=5) buttons were located on or in the vicinity of the pelvis. These buttons may represent the fly for a pair of pants.

GRAVE SHAFT 35

This grave shaft measured 2.0 x 0.86 m and contained the remains of a single individual oriented northwest.

Burial 35

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 160 cm in length and approximately 35 cm in width, with the head oriented to the northwest. Coffin hardware consisted of four complete nails and 34 nail fragments. Of the complete nails, one had a pennyweight of 6d and three a pennyweight of 8d.

Human Skeletal and Dental Remains

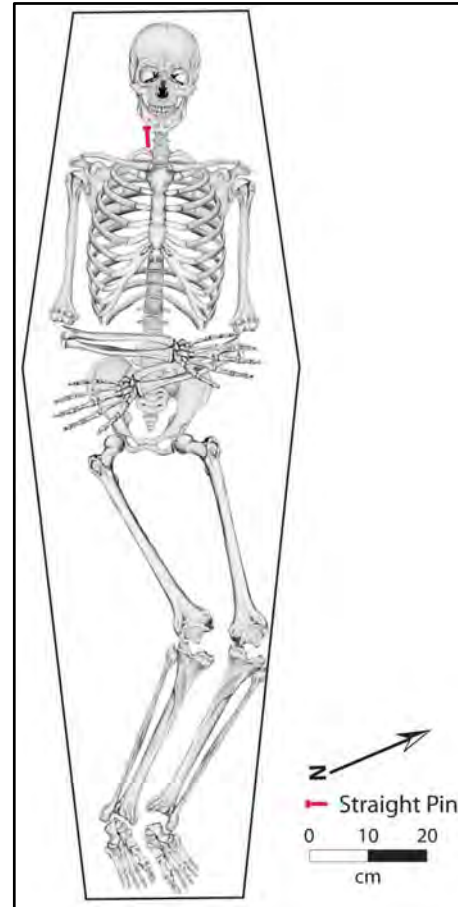
This individual is estimated to be a juvenile who was 12-14 years old when he or she died. No sex or stature estimation was made due to the immature age of the individual. The lower left arm was placed across the pelvis, and the lower right arm across the chest. The bending of both legs suggests this individual was not placed in the appropriate sized coffin.

No pathology was observed for this individual. This individual yielded $\Delta^{13}\text{C}$ values of -18.4 and $\Delta^{15}\text{N}$ values of 10.1, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

The dentition shows that all third molars have not fully developed or erupted yet at death and healthy alveolar bone throughout the arcade. Dental wear is minimal, with several molars having large carious lesions eroding almost the entire occlusal surface away. The upper first molars exhibit Carabelli's Trait and slight shovelings is present on the upper first incisors. Several teeth have occlusal edge chipping, and the entire crown of the upper right second molar appears to have been chipped off pre-mortem.

Clothing, Shrouds, and Personal Artifacts

A single straight pin was found beneath the cranium. It was probably associated with a burial shroud.



GRAVE SHAFT 36

This grave shaft measured 2.65 x 2.54 m and originally contained the remains of five (Burials 36B-F) individuals: two were oriented northwest, one was oriented southeast, and two were too deteriorated to determine orientation. Another burial (36A) postdates and intruded into the top of this shaft. The grave shaft for Burial 36A extended 0.7 m beyond the western edge of the Burials 36B-F grave shaft. The former was oriented northwest.

Burial 36A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 186 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of six complete nails and 41 nail fragments. Of the complete nails, three had a pennyweight of 6d, one of 7d, and two of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 48-63 years old when he died and stood 169.2 ± 10.1 cm ($66.6 \pm 4''$) tall. The left arm was placed at the side of the body, while the right arm was placed with the hand across the pelvis.

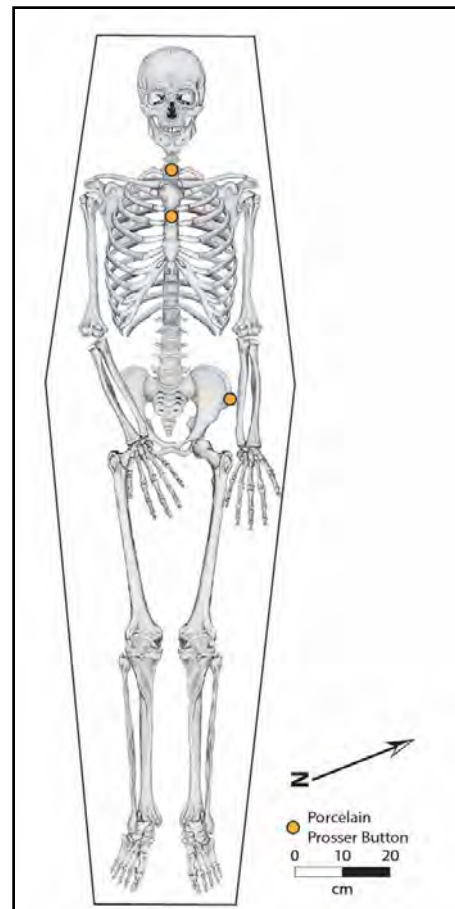
Pathology exhibited includes arthritic lipping on tarsals of both ankles, both distal tibiae, and elements of the left knee.

No isotopic data are available for this burial.

Dental evidence shows heavy tooth loss prior to death, with at least 6 mandibular teeth and 1 maxillary tooth lost and the sockets completely resorbed. There is also a very large Carabelli's Trait on both upper first molars.

Clothing, Shrouds, and Personal Artifacts

Of the three Prosser buttons associated with from this burial, two were located by the neck and the other by the left pelvis. They may have been associated with a shirt.



Burial 36B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 195 cm in length and approximately 55 cm in width, with the head oriented to the southeast. Coffin hardware consisted of 10 complete nails, 38 nail fragments, and two screws. Of the complete nails, seven had a pennyweight 6d and three a pennyweight of 7d.

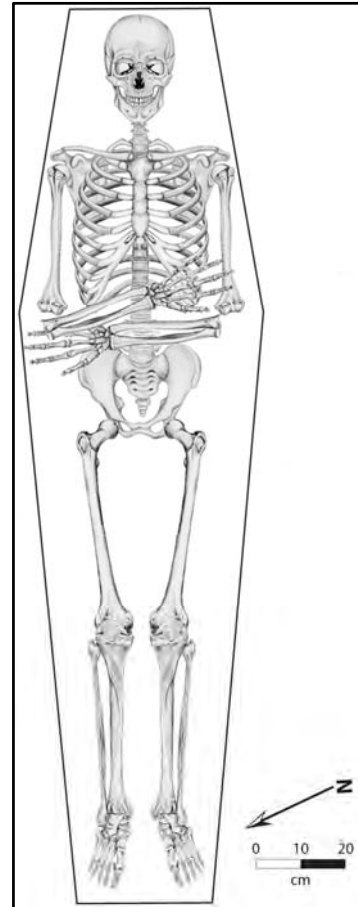
Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult probable male who was 25-40 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms had been placed

Pathologies include arthritic activity on the tarsals in both ankles as well as bone deposition in the medullary cavity of the left proximal tibia, likely the result of a of an infection within the bone.

No isotopic data are available for this individual.

The teeth are poorly preserved with many not recovered and virtually no alveolar bone remaining. The upper right third molar was not fully descended at death, and the upper left first molar was lost pre-mortem with complete alveolar resorption.



Clothing, Shrouds, and Personal Artifacts

None

Burial 36C

Coffin/Casket Remains and Hardware

This burial was identified in the field based on clusters of nails but no other information could be determined due to poor preservation. This burial is treated as an individual interment based on the assumption that these nails represent were associated with coffin. Of the 26 nails that were associated with this coffin, 10 were complete and 16 were nail fragments. Of the complete nails, seven had a pennyweight of 6d and three a pennyweight of 7d.

Human Skeletal and Dental Remains

None

Clothing, Shrouds, and Personal Artifacts

None

Burial 36D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 195 cm in length and 55 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 10 complete nails, 24 nail fragments, and a screw. Of the complete nails, five had a pennyweight of 6d, three of 8d, and two of 9d.

Human Skeletal and Dental Remains

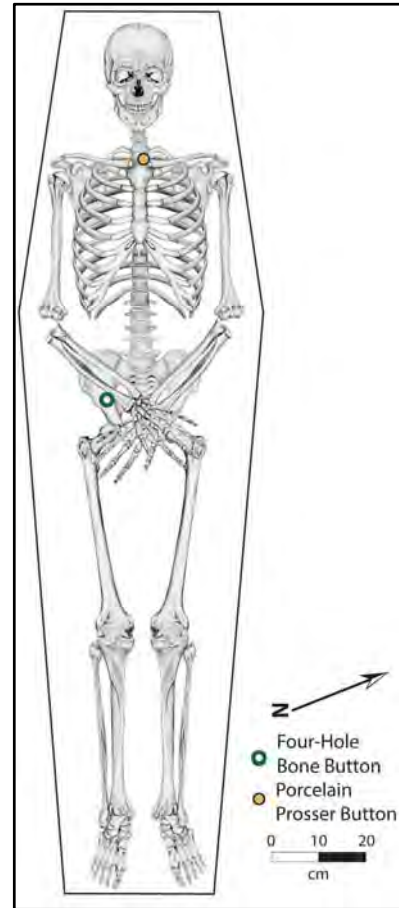
This individual is estimated to be an adult female who was 25-50 years old when she died. The remains are too fragmentary to derive a stature estimate. Both lower arms had been placed across the pelvis.

No pathology was observed. No isotope data are available for this individual.

Teeth are in very poor condition and very brittle. It appears that only the upper third molars were lost pre-mortem. Dental wear is light on lower molars possibly because they erupted with crowns facing slightly inward (lingual).

Clothing, Shrouds, and Personal Artifacts

A single Prosser button was recovered from the neck area, and a single four-hole button was located on the right pelvis. These buttons may have been associated with a shift.



Burial 36E

Coffin/Casket Remains and Hardware

This burial was identified in the field based on clusters of nails but no other information could be determined due to poor preservation. This burial is treated as an individual interment based on the assumption that these nails represent were associated with coffin. Of the 45 nails that were associated with this coffin, nine (6 pennyweight of 6d and three a pennyweight of 7d) are complete and 35 are fragments. Two screws also were associated with this coffin.

Human Skeletal and Dental Remains

None

Clothing, Shrouds, and Personal Artifacts

None

Burial 36F

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 165 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consists of a complete nail (pennyweight 6d), and 22 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be an adult female who was 30-50 years old when she died. The remains are too fragmentary to derive a stature estimate. Both lower arms had been placed across the chest.

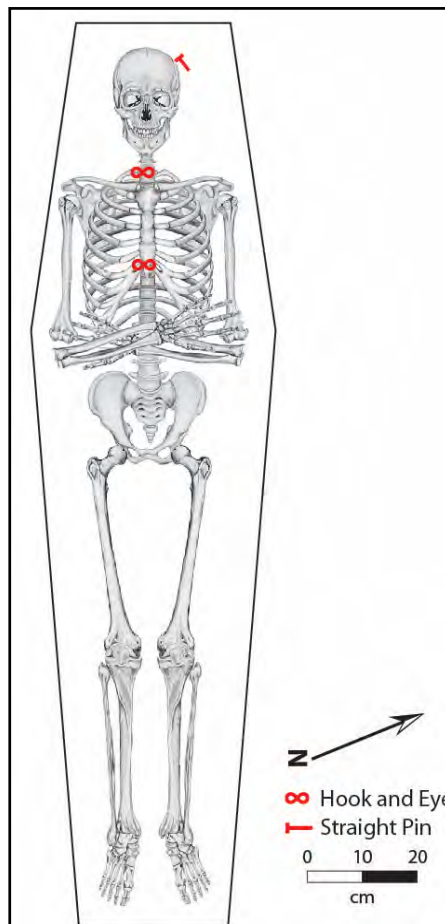
Pathology included arthritic lipping (sharp ridge) on the articular surface of the atlas (C1) where it meets the dens of the axis (C2).

No isotopic data are available for this individual.

The dentition shows evidence of heavy tooth loss prior to death, with four mandibular teeth and four maxillary teeth lost and showing almost complete resorption of all associated sockets.

Clothing, Shrouds, and Personal Artifacts

A single straight pin was recovered from side of the cranium of this burial. Four hooks and two eyes also were found. They were located near the neck and on the chest and may have been associated with a blouse.



GRAVE SHAFT 37

This grave shaft measured 3.3 x 2.35 m and contained the remains of six individuals. Of these, three were oriented southeast, two were oriented northwest, and the orientation of one grave could not be determined.

Burial 37A - Disturbed

Coffin/Casket Remains and Hardware

Coffin shape, dimensions, and head orientation were not possible for this individual, as their grave had been completely disturbed, most likely by the installation of an electric line.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 20-25 years old when he died. The remains are too fragmentary to derive a stature estimate or determine arm placement.

Overall this burial is in very poor condition and appears to have been disturbed. A left maxillary fragment and distal left humerus are all that remains of the upper body, with most of the lower body being unidentifiable fragments.

No pathology was noted. No isotopic data are available for this individual.

The dentition is represented only by the left maxilla, but those teeth that remain show little wear and minimal caries, and there is no bone loss or evidence of abscess in the alveolar bone suggesting good dental health at time of death.

Clothing, Shrouds, and Personal Artifacts

None

Burial 37B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the southeast. Coffin hardware consisted of six complete nails, 54 nail fragments, and two screws. Of the complete nails, two had a pennyweight of 6d and four a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 60-75 years old when he died and stood 170.3 ± 8.2 cm (67 ± 3.2 "") tall. Both arms had been placed at the side of the body.

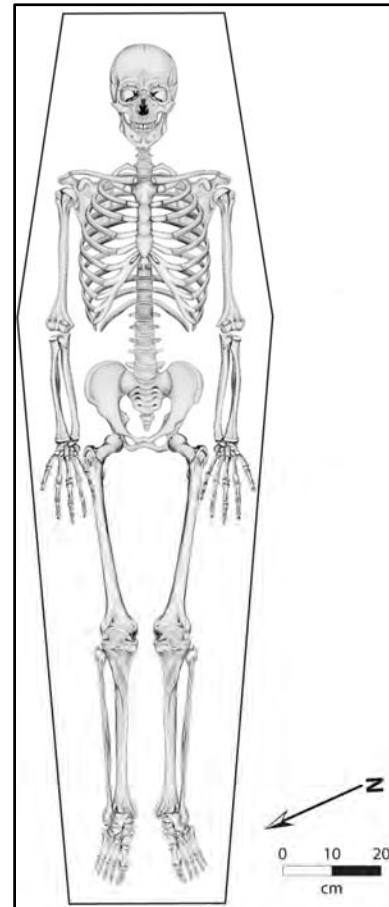
Pathology present includes arthritic lipping of the distal humeri, the left proximal ulna, distal femora, distal tibiae, and talus, as well as unifocal bone loss on the right proximal humerus. Additionally, the right femur has an area of porosity on the anterior portion of the femoral neck adjacent to the head consistent with cribra femoralis. A Poirier's facet also appears on both femoral heads. Capasso et al. (1998:104) point out that the majority of the individuals within a population exhibit these facets and that regular locomotion may be sufficient to create them, however, repeated hyperextension of the hip (e.g. downhill running) could influence its expression.

This individual yielded $\Delta^{13}\text{C}$ values of -17.7 and $\Delta^{15}\text{N}$ values of 11.8, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition is poorly preserved, however what remains shows evidence of tooth loss and bone resorption in two maxillary sockets and two mandibular sockets. Severe horizontal and vertical bone loss throughout the dental arcade indicates periodontal disease. Dental wear is very heavy, and all exposed dentin is stained dark brown to black on the occlusal surface, as are exposed roots. Chipped occlusal edges are also evident on the upper left canine and incisors.

Clothing, Shrouds, and Personal Artifacts

None



Burial 37C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 170 cm in length and 40 cm in width, with the head oriented to the southeast. Coffin hardware consisted of nine complete nails and 13 nail fragments. Of the complete nails, five had a pennyweight of 6d and four a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 63-78 years old when he died and stood 174.8 ± 10.1 cm ($68.8 \pm 4''$) tall. The lower left arm was placed across the pelvis. The lower right arm was missing and its placement could not be determined. The illustration shows the right arm placement stylized for visual purposes only.

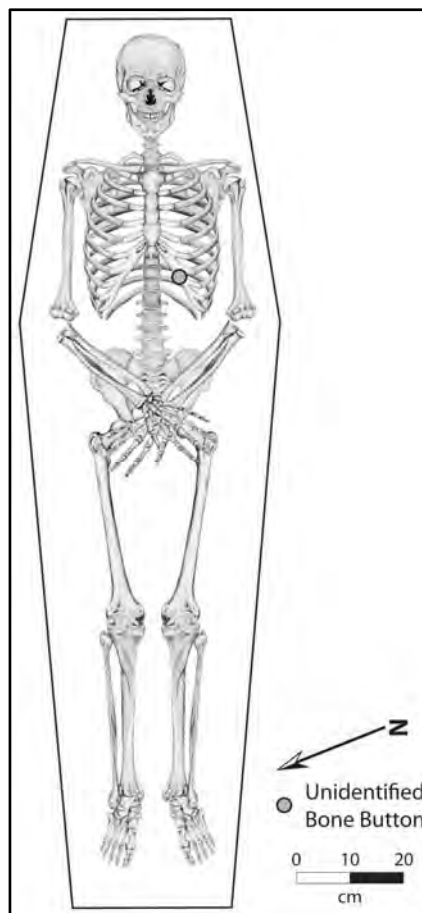
Pathology includes extensive sclerotic periostitis throughout left tibial diaphysis (possible case of Treponematosi) as well as arthritic lipping on the left distal humerus, distal femora, patellae, and tarsals. A Poirier's facet also appears on the right femoral head. Capasso et al. (1998:104) point out that the majority of the individuals within a population exhibit these facets and that regular locomotion may be sufficient to create them, however, repeated hyperextension of the hip (e.g. downhill running) could influence its expression. There is also sclerotic bone deposition on the left tibial diaphysis, possibly due to infection.

No isotopic data are available for this individual.

The dentition shows evidence of heavy tooth loss prior to death, with all mandibular molars and one premolar lost and sockets completely resorbed. The maxilla was not preserved and only one tooth was recovered, precluding further analysis.

Clothing, Shrouds, and Personal Artifacts

A single unidentified bone button was found within the left rib cage area.



Burial 37D - Disturbed

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin measuring 55 cm in width, with the head oriented to the southeast. No length measurement was possible due to poor preservation. Coffin hardware consisted of six complete nails and nine nail fragments. Of the complete nails, three had a pennyweight of 6d, one of 7d, and two of 8d. This burial appears to have been disturbed by Burials 37C and 37E.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult probable male who was 40-60 years old when he died. The remains are too fragmentary to derive a stature estimate. The left lower arm was placed across the chest. The lower right arm was missing and its placement could not be determined. The illustration shows the right arm placed across the chest for visual purposes only.

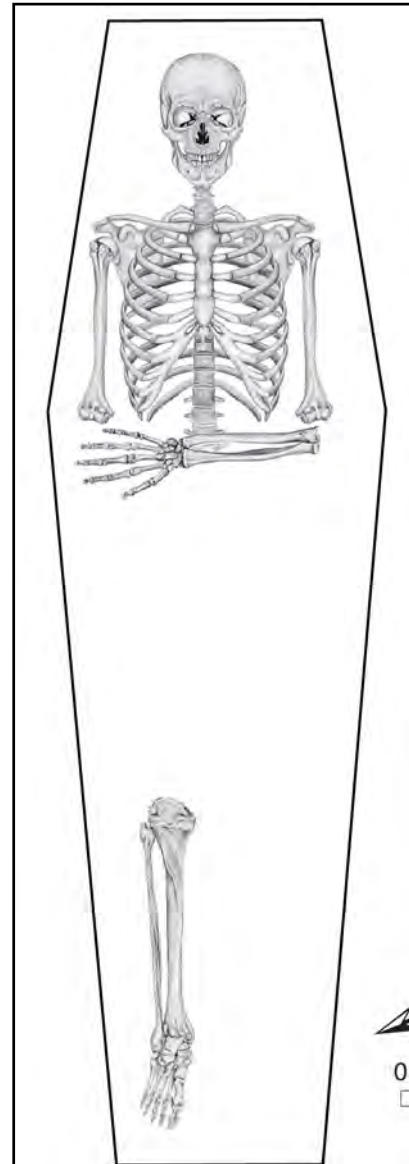
Overall this burial is in very poor condition, represented by less than 25% of the entire skeleton. No pathology was noted.

No isotopic data are available for this individual.

The dentition is also poorly preserved, with only a few mandibular teeth and a small fragment of alveolar bone representing the entire arcade. The teeth that are present show little wear and no evidence of caries.

Clothing, Shrouds, and Personal Artifacts

None



Burial 37E -Disturbed

Coffin/Casket Remains and Hardware

This individual was buried in a rectangular shaped coffin measuring 195 cm in length and approximately 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of a complete (pennyweight 8d) nail and 23 nail fragments. This burial appears to have been disturbed by Burial 37C.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult probable male who was 45-65 years old when he died. The remains are too poorly preserved to derive a stature estimate. Both arms are missing and placement cannot be determined (arm placement is for illustrative purposes).

No other information is available for this individual.

Clothing, Shrouds, and Personal Artifacts

None

Burial 37F

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 45 cm in width, with the head oriented to the northwest. No length measurement was possible due to poor preservation, disturbance of the legs during the placement of the electrical conduit. Coffin hardware consisted of two complete (pennyweight 8d) nails, and 16 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 22-28 years old when he died and stood 181 ± 8.2 cm (71.2 ± 3.2 "") tall. The lower left arm was placed across the pelvis, and the lower right arm across the chest.

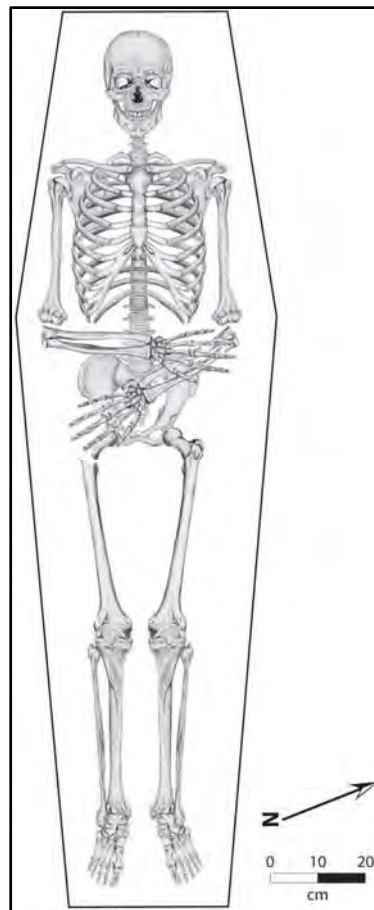
Pathology includes arthritic lipping of the distal femora and proximal left tibia as well as moderate expression Schmorl's nodes in three unidentified vertebrae. This vertebral pathology is indicative of intervertebral disk herniation, possibly due to forces exerted on the spine during axial loading.

This individual yielded $\Delta^{13}\text{C}$ values of -14.1 and $\Delta^{15}\text{N}$ values of 11.1, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is poorly preserved but indicates at least 4 mandibular teeth lost prior to death. The maxilla shows evidence of significant caries, an abscess and a periapical abscess at the upper right first and second molars, respectively, and significant horizontal and vertical bone loss especially around the left first molar. Dental wear is light, and the caries and abscesses seem at odds with the young age of this individual.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 38

This grave shaft measured 2.9 x 1.4 m and contained the remains of four individuals. It appears to be the result of several overlapping mortuary events, with disturbance of earlier burials by later additions. Three burials were oriented northwest, and one was too poorly preserved to determine orientation.

Burial 38A

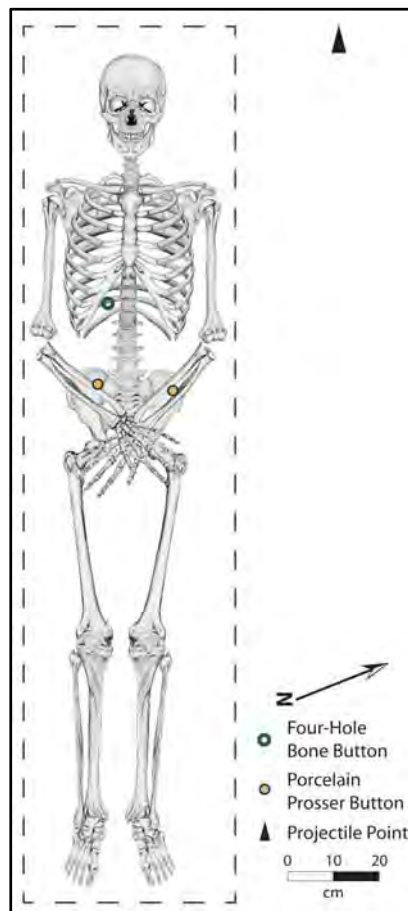
Coffin/Casket Remains and Hardware

This individual was buried in a possibly rectangular shaped coffin measuring 195 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of nine complete nails and 38 nail fragments. Of the complete nails, two had a pennyweight of 4d, three of 6d, and four of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 65-80 years old when he died and stood 175.2 ± 10 cm (69 ± 3.9 "') tall. Both lower arms were placed across the pelvis.

Pathology includes arthritic lipping of the humeri, ulnae, radii, carpals, femora, tibiae, and tarsals. Additionally, there is evidence of a Schmorl's node in an unidentified thoracic vertebra, likely from a intervertebral herniated disk likely due to force applied to the spine during axial loading. There is also sclerotic bone deposition on the left tibia, potentially from an infection.



This individual yielded $\Delta^{13}\text{C}$ values of -15.9 and $\Delta^{15}\text{N}$ values of 10.4, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

Clothing, Shrouds, and Personal Artifacts

There were two Prosser buttons found in the pelvic area and a four-hole bone button was associated with the lower right torso area. They were probably associated with a pull-over shirt. A prehistoric projectile point was also recovered from the shaft fill, although not associated with this burial intentionally.

Burial 38B - Disturbed

Coffin/Casket Remains and Hardware

This individual was buried in a possibly rectangular shaped coffin measuring approximately 175 cm in length and 35 cm in width, with the head oriented to the northwest. Coffin hardware consisted of eight complete (pennyweight 9d) nails, 25 nail fragments, and a screw. This burial appears to have been slightly disturbed by Burial 38A, which was placed almost directly on top of this individual.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 20-30 years old when she died. The remains are too fragmentary to derive a stature estimate. Both lower arms were placed across the pelvis.

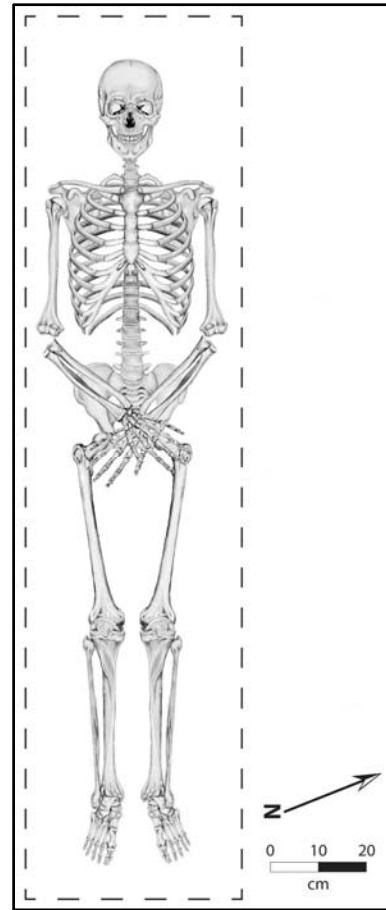
Overall this burial is in very poor condition with only approximately 10-15% of the burial present.

No pathology was noted. No isotopic data are available for this individual.

The dentition is poorly preserved, but there is evidence of at least 8 mandibular teeth being lost prior to death, with complete alveolar resorption. Only the lower left canine and first premolar remain in occlusion, and both have a large chunk of crown broken off that occurred prior to death as well based on the worn edges of the break. There is corresponding breakage and wear on the upper left first premolar as well. There are 10 maxillary teeth lost pre-mortem with complete alveolar resorption.

Clothing, Shrouds, and Personal Artifacts

None



Burial 38C - Disturbed

Coffin/Casket Remains and Hardware

Coffin shape, dimensions, and head orientation were not possible for this burial. No nails were recovered from this burial. This burial appears to have been completely disturbed by the other burials in this grave shaft.

Human Skeletal and Dental Remains

This individual is estimated to be an adult of indeterminate sex. Overall this burial is in very poor condition and is only represented by several small pelvis fragments (n=13), including ilium and <25% of one acetabulum. Cortical bone is mostly intact, but this is only about 2% of the skeleton present. No other data is available.

Clothing, Shrouds, and Personal Artifacts

None

Burial 38D

Coffin/Casket Remains and Hardware

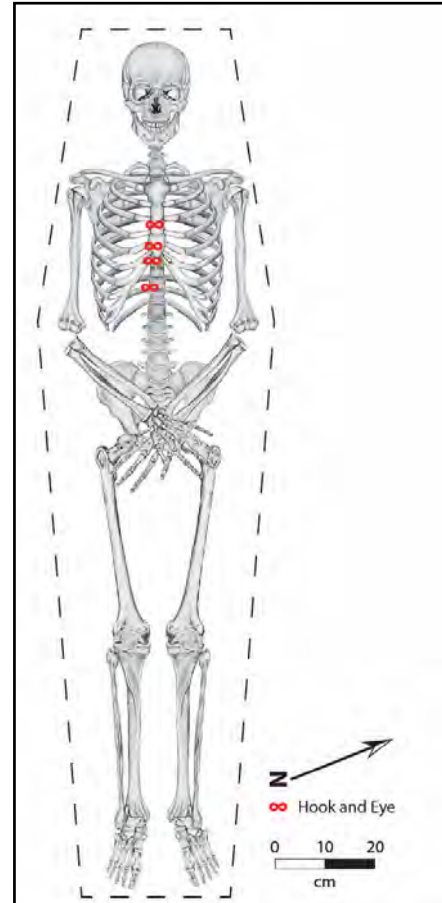
This individual was buried in a possibly hexagonal shaped coffin measuring approximately 180 cm in length and approximately 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of six complete nails and 11 nail fragments. Of the complete nails, five had a pennyweight of 6d and one a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be an adult probable female who was 18-60 years old when she died. The remains are too fragmentary to derive a stature estimate. Both lower arms had been across the pelvis. Overall this burial is in very poor condition with less than twenty percent of the skeletal material present.

Pathology includes a possible fracture in the right ankle (calcaneus and talus).

No isotopic data are available for this individual. No dental data are available for this individual.



Clothing, Shrouds, and Personal Artifacts

Four hooks and two eyes were found under the spine of this individual. Plainweave weft-faced wool fabric fragments (n=3) and plainweave possibly faced fabric (n=2) were associated with these fasteners, which may have been associated with a dress.

GRAVE SHAFT 39

This grave shaft measured 2.4 x 2.3 m and contained the remains of three intact burials, two disturbed burials, and at least four commingled individuals. Two of the burials were oriented northwest, and one was oriented southeast.

Burial 39A - Commingled

Human Skeletal and Dental Remains

The remains of a least four individuals were recovered from the fill of this grave shaft. Their graves were disturbed during the digging of a grave shaft for Burial 39B. Three crania are represented (based on temporal bones) but a total of four individuals are present here based on the presence of four right ulnae. No aging or sexing elements are intact. One tibia, two femora, and a radius and ulna all appear to belong to a single individual based on robusticity, suggestive perhaps of a male. No pathologies were noted in any elements.

No other data are available for this burial.

Clothing, Shrouds, and Personal Artifacts

None

Burial 39B

Coffin/Casket Remains and Hardware

This individual was buried in an iron casket measuring 192 cm in length and 60 cm in width, with the head oriented to the northwest. This casket had been placed in a wooden box. Of the 76 nails associated with this box, 21 were complete nails and 55 were nail fragments. Pennyweights represented, included 6d (n=1), 9d (n=4), and 10d (n=16).

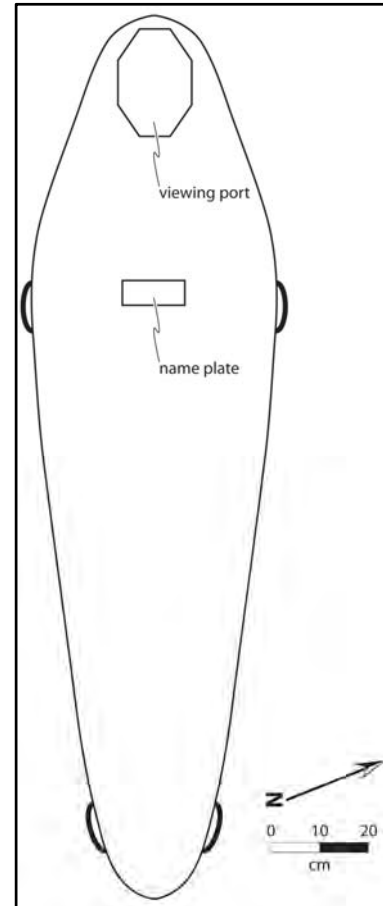
It was of the sarcophagus style, with molded lines to resemble draped fabric, and floral designs at the feet. Sarcophagus style Fisk coffins were manufactured between 1848 and 1854 (Allen 2002). It had eight handles along the sides, and a viewing window at the head. The case was in a good state of preservation. Since the coffin was not opened, no additional information was collected on the individual interred within it.

Human Skeletal and Dental Remains

This burial contains an iron coffin that was sealed and remains unopened. No analysis was conducted.

Clothing, Shrouds, and Personal Artifacts

None



Burial 39C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the southeast. Coffin hardware consisted of 13 complete nails, 21 nail fragments, and two screws. Of the complete nails, eight had a pennyweight of 6d, four of 8d, and one of 10d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 45-57 years old when he died. The remains are too fragmentary to derive a stature estimate. The left arm was placed at the side of the body, and the lower right arm was placed under the pelvis.

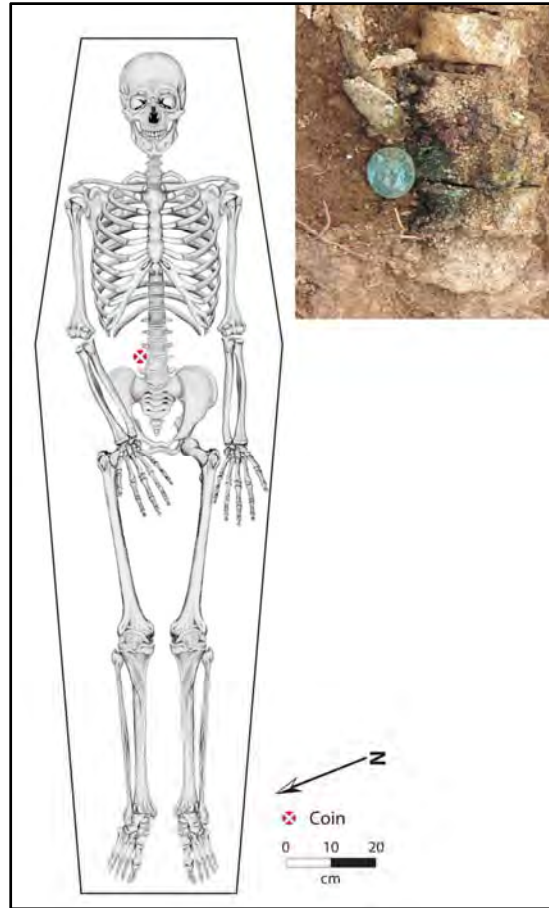
Pathology includes cervical and thoracic osteophyte formation, as well as arthritic lipping of the femora, tibiae, and tarsals.

This individual yielded $\Delta^{13}\text{C}$ values of -18.9 and $\Delta^{15}\text{N}$ values of 16.2, suggesting a diet consisting of entirely C_3 plants with no corn-based products, and a significant amount of meat.

The dentition is poorly preserved with only a single maxillary tooth still in occlusion, the upper left second premolar, which contained two gold fillings. The rest of the maxillary teeth were recovered loose. There is evidence of 6 mandibular teeth lost prior to death with complete alveolar bone resorption. There is only light dental wear on the maxillary teeth but wear on mandibular teeth is moderate to heavy.

Clothing, Shrouds, and Personal Artifacts

A single one cent 1844 coin was found near the lumbar vertebrae of this burial.



Burial 39D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 26 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be an adult female who was 30-70 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest. Overall this burial is in very poor condition, with only approximately 20-25% present.

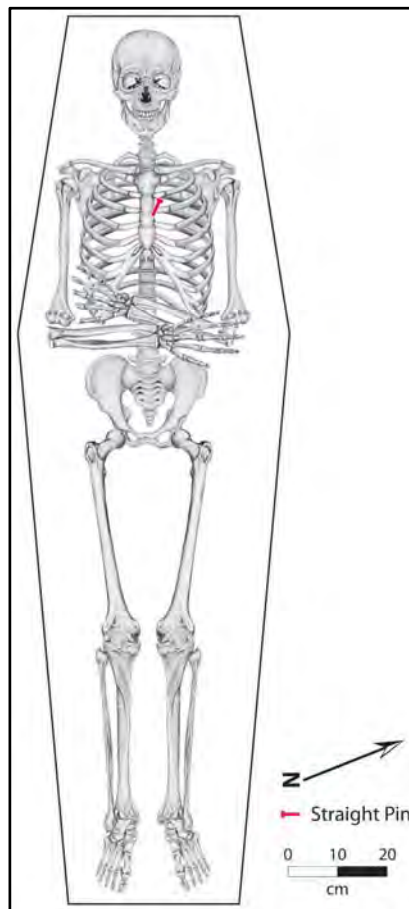
No pathology was noted.

No isotopic data are available for this individual.

The dentition is poorly preserved and represents two different individuals, both showing numerous caries and pre-mortem tooth loss with complete resorption, as well as several abscesses.

Clothing, Shrouds, and Personal Artifacts

A single straight pin was recovered from the chest of this individual. It likely was associated with a burial shroud.



Burial 39E - Disturbed

Coffin/Casket Remains and Hardware

Coffin shape, dimensions, and head orientation could not be determined for this burial. It appears that excavation of the grave shafts for Burials 39C and 39D impacted this individual, disturbing almost the entire grave. No coffin nails were directly associated with Burial 39E.

Human Skeletal and Dental Remains

This individual is estimated to be an adult probable male who was 25-50 years old when he died. The remains were too fragmentary to derive a stature estimate or to determine arm placement. Overall this burial is in poor condition with only the cranium and tibia fragments present.

No pathology was noted. Nor is isotopic or dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None

Burial 39F - Disturbed

Coffin/Casket Remains and Hardware

Coffin shape, dimensions, and head orientation were not possible for this burial. It appears that the placement of Burial 39C and possible Burials 39B and 39D impacted this individual, disturbing almost the entire grave. No coffin nails were directly associated with this burial

Human Skeletal and Dental Remains

This individual is estimated to be a young adult probable male who was 20-35 years old when they died. The remains were too fragmentary to derive a stature estimate or arm placement. This burial is in poor condition, having been disturbed by Burial 39C.

No pathology noted. Nor is isotopic data are available for this individual.

The dentition is in fair preservation, with most teeth present and showing minimal caries and only minimal to moderate wear. There is no sign of alveolar bone loss.

Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 40

This grave shaft measured 1.87 x 0.75 m and contained the remains of a single individual oriented northwest. A privy intruded upon this grave shaft and removed all traces of this individual's head.

Burial 40

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin measuring approximately 170 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 12 complete nails and seven nail fragments. Of the complete nails, two had a pennyweight of 4d, four of 6d, and six of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 28-36 years old when she died and stood 158.6 ± 6.8 cm (62.4 ± 2.7 "") tall. Both lower arms were placed across the chest.

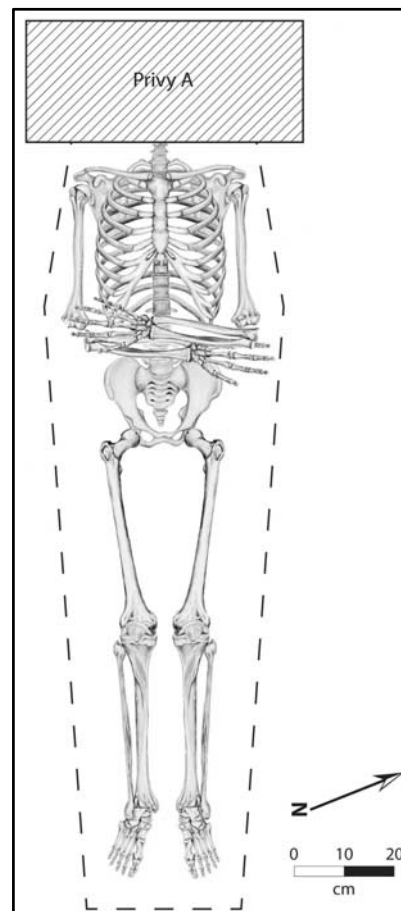
Pathology includes barely discernible arthritic lipping of the distal femora, patellae, distal tibiae, tarsals and metatarsals.

This individual yielded $\Delta^{13}\text{C}$ values of -14.9 and $\Delta^{15}\text{N}$ values of 9.2, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

A single tooth, the lower right canine, is all that was recovered of the dentition, precluding analysis.

Clothing, Shrouds, and Personal Artifacts

Several traces of copper or brass were documented as dark green stains in the right upper chest, inside the right arm, below the shoulder, and adjacent to the left foot. They may represent coffin hardware.



GRAVE SHAFT 41

This grave shaft measures 2.3 x 0.85 m and contains the remains of a single individual oriented northwest.

Burial 41

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin measuring 180 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of three complete (pennyweight of 6d) nails and 35 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 53-68 years old when he died and stood 176.1 ± 7.9 cm (69.3 ± 3.1 "") tall. The lower left arm was placed across the chest, and the lower right arm at the side of the body.

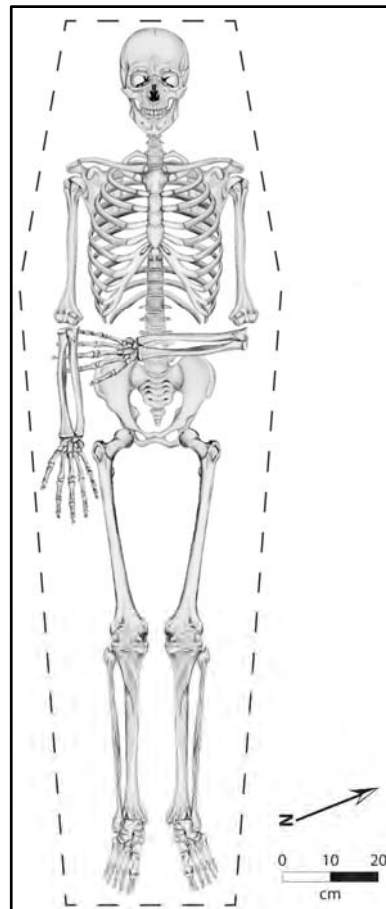
Pathology includes arthritic activity in the shoulders, wrists, knees, ankles, and vertebrae, as well as a Poirier's facet on the right femur. Capasso et al. (1998:104) point out that the majority of the individuals within a population exhibit these facets and that regular locomotion may be sufficient to create them, however, repeated hyperextension of the hip (e.g. downhill running) could influence its expression. Additionally, there is an area of bone loss on the right distal tibia at the medial malleolus.

This individual yielded $\Delta^{13}\text{C}$ values of -11.5 and $\Delta^{15}\text{N}$ values of 9.5, suggesting a diet consisting of almost no C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows extreme horizontal bone loss throughout the entire arcade, with the remaining teeth only having less than their apical one-third still in the socket. Heavy root surface caries are present due to plaque buildup and bone loss. Dental wear is heavy on the five remaining maxillary teeth, but not on the single remaining mandibular tooth

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 42

This grave shaft measured 2.31 x 1.15 m and contained the remains of a single individual oriented southeast.

Burial 42

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 192 cm in length and 50 cm in width, with the head oriented to the southeast. The coffin was placed within a larger rectangular box, resulting in a large number of nails and two outlines. Coffin and box hardware consisted of six complete nails and 43 nail fragments. Of the complete nails, one had a pennyweight of 6d and five a pennyweight of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 28-33 years old when he died and stood 164.9 ± 7.2 cm (64.9 ± 2.8 "") tall. Both arms were placed at the side of the body.

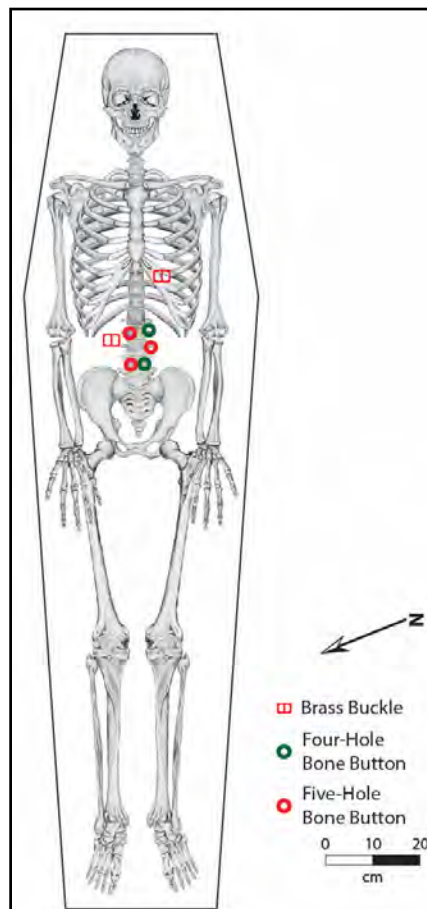
Pathology includes arthritic lipping on all visible joint surfaces of both knees and ankles.

This individual yielded $\Delta^{13}\text{C}$ values of -18.8 and $\Delta^{15}\text{N}$ values of 10.8, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

Both four-hole (n=2) and five-hole (n=3) buttons were found just above the pelvis of this individual. A brass buckle was found in association with the buttons. A second brass buckle was found in the upper right torso area. The buttons may represent pants closures. The buckles possibly represent a jacket or suspenders. A single plainweave possibly faced wool fragment, a twill weave 2/1 silk fragment, and a twill weave 2/2 wool fragment were recovered from between the upper buckle and coffin wood.



GRAVE SHAFT 43

This grave shaft measured 2.4 x 1.65 m and contained the remains of two individuals, one oriented northwest and the other oriented southeast.

Burial 43A

Coffin/Casket Remains and Hardware

This individual was buried in a coffin whose shape and dimensions could not be determined, however, the head was oriented to the northwest. Coffin hardware consisted of a complete (pennyweight 7d) nail and 19 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a juvenile male who was 17-18 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were across the chest.

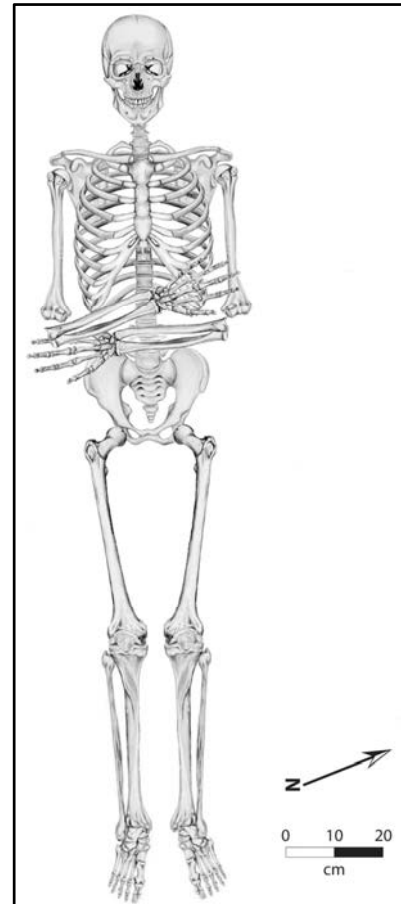
Pathology present includes evidence of Schmorl's nodes on five of the lower thoracic vertebrae, likely resulting from herniated intervertebral disks due to forces exerted on the spine during axial loading.

This individual yielded $\Delta^{13}\text{C}$ values of -14.9 and $\Delta^{15}\text{N}$ values of 9.0, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is well preserved for this individual, showing greater wear on the mandibular anterior teeth than the posterior teeth. The maxillary teeth show evidence of losing the left first molar pre-mortem with complete alveolar resorption, as well as 3 crowns completely lost to caries and a large abscess at the upper left second molar. Anterior teeth are heavily worn, corresponding to the wear seen in the mandibular anterior teeth, suggesting this individual ground their front teeth during life. Overall caries are very prevalent, affecting the majority of the teeth in the dental arcade.

Clothing, Shrouds, and Personal Artifacts

None



Burial 43B

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin measuring 165 cm in length and approximately 40 cm in width, with the head oriented to the southeast. Coffin hardware consisted of two complete (pennyweight 7d) nails and 15 nail fragments.

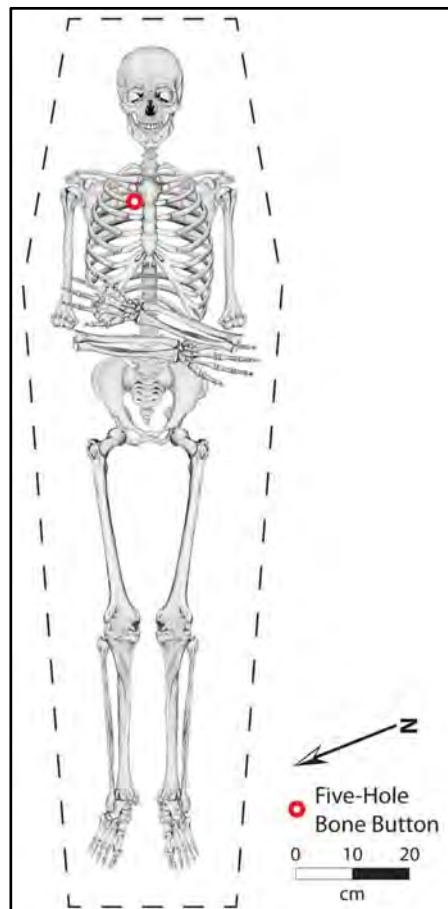
Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 25-33 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -18.4 and $\Delta^{15}\text{N}$ values of 9.2, suggesting a diet consisting entirely of C_3 plants with no corn-based products, and a moderate amount of meat.

The dentition shows evidence of poor oral health, with 3 mandibular teeth and 2 maxillary teeth lost prior to death with most showing heavy to complete alveolar bone resorption. There is heavy calculus present on the lower left second and third molar as well as on all maxillary teeth on the left side distal to the second premolar. Horizontal bone loss seen throughout the entire dental arcade is likely a result of the calculus and caries present, with only minimal wear on all teeth.



Clothing, Shrouds, and Personal Artifacts

A single bone 5-hole button was found near the neck of this individual. It may have been associated with a shift.

GRAVE SHAFT 44

This grave shaft measured 1.76 x 0.5 m and contained the remains of two individuals, both oriented to the northwest.

Burial 44A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 175 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consists of five complete nails, 22 nail fragments, and a screw. Of the complete nails, one had a pennyweight of 5d, three of 6d, and one of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 43-55 years old when he died. The remains were too fragmentary to derive a stature estimate. The lower left arm was folded towards the opposite shoulder, and the lower right arm was placed across the chest.

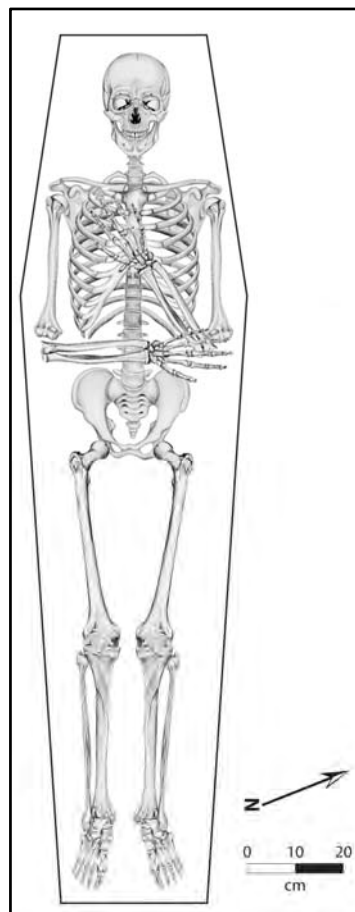
Pathologies included arthritic lipping in both patellae as well as inactive cribra orbitalia in the left orbit, possibly caused by vitamin deficiency (e.g. vitamin B₁₂, vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009).

This individual yielded $\Delta^{13}\text{C}$ values of -17.1 and $\Delta^{15}\text{N}$ values of 9.3, suggesting a diverse diet consisting of mixed C₃ plants and corn-based products, and a moderate amount of meat.

The dentition shows evidence of fairly poor oral health, with 3 mandibular molars lost prior to death and caries found throughout the dental arcade. Several caries manifested as cavernous lesions that destroyed the entire crown and part of the root, with smaller lesions along the root surface intersecting with the larger ones on some teeth. There is a single abscess at the upper left second premolar and first molar area as well.

Clothing, Shrouds, and Personal Artifacts

None



Burial 44B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 55 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven complete nails, 25 nail fragments, and a screw. Of the complete nails, three had a pennyweight of 6d, and four a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 20-25 years old when he died and stood 165.4 ± 8.3 cm (65.1 ± 3.3 "") tall. Both arms were placed with the hands across the pelvis.

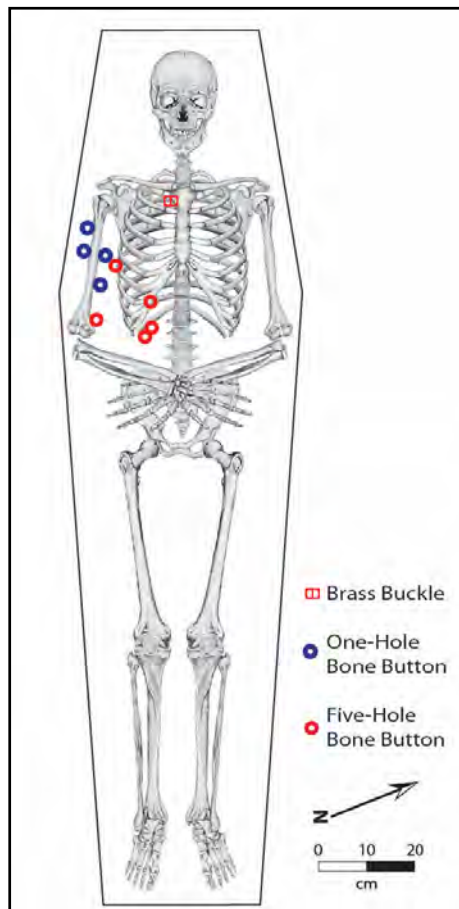
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -15.1 and $\Delta^{15}\text{N}$ values of 8.6, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition is in good shape with all teeth present at time of death. There is only minor evidence of root surface caries on some teeth, and wear is minimal. Several teeth show evidence of chipping in both the maxilla and mandible. This individual exhibits a number of interesting nonmetric characteristics including Carabelli's Trait, slightly peg-shaped to shovel-shaped upper second incisors.

Clothing, Shrouds, and Personal Artifacts

Four one-hole bone buttons and two five-hole bone-button were found along the right humerus of this individual, and several five-hole bone (n=4) buttons were associated with the right side of the torso. There was also a single brass buckle recovered from beneath the vertebrae and between the two scapulae. Together the buttons and the buckle are suggestive of a restraining garment.



GRAVE SHAFT 45

This grave shaft measured 2.32 x 0.84 m and contained the remains of a single individual oriented southeast.

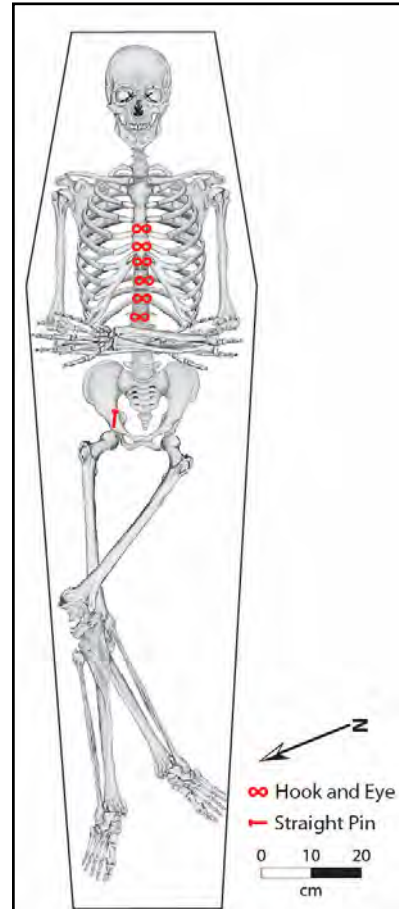
Burial 45

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 175 cm in length and 45 cm in width, with the head oriented to the southeast. Coffin hardware consisted of 18 complete nails and 24 nail fragments. Of the complete nails, two had a pennyweight of 5d, 10 a pennyweight of 6d, and six a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an adult female when she died. The remains are too fragmentary to derive a stature estimate. The arms were not preserved enough to determine placement (arm placement in figure is for illustrative purposes only). The legs may have been bound.



No pathologies were present.

No isotopic data are available for this individual.

The dentition is represented by only 2 teeth, both left and right mandibular canines. These teeth both exhibit root surface caries indicating severe loss of alveolar bone prior to death exposing the roots. There are also large carious lesions along the cement-enamel junction (CEJ) of the both canines. Wear is very heavy on the right canine but only minimal on the left canine. No other observations are possible.

Clothing, Shrouds, and Personal Artifacts

A single straight pin was found in vicinity of the right pelvis. In addition, six hooks and five eyes were located along the back of spine. Five plainweave 1/1 pseudomorph fragments were found in association with the hook and eye fasteners. The hook and eye fasteners may have been associated with a dress.

GRAVE SHAFT 46

This grave shaft measured 2.2 x 1.05 m and contained the remains of two individuals lying side by side, both oriented northwest.

Burial 46A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 48 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 12 complete nails, 23 nail fragments, and three screws. Of the complete nails, six had a pennyweight of 6d, five of 7d, and one of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 45-65 years old when he died. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed across the chest, while the lower right arm was placed across the pelvis.

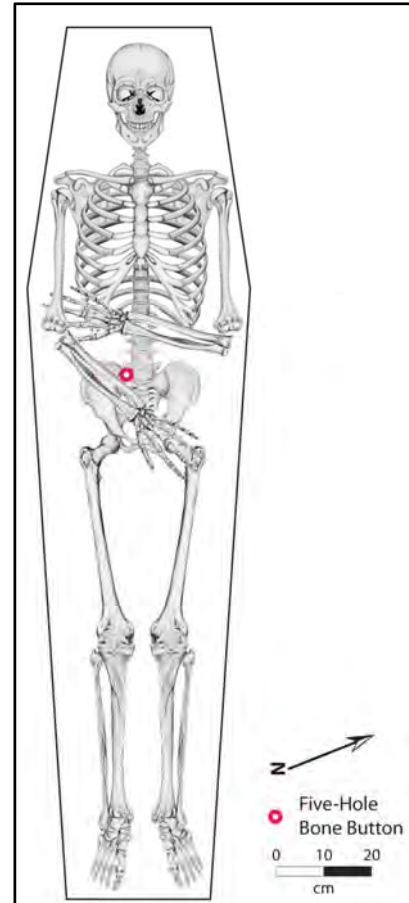
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -16.6 and $\Delta^{15}\text{N}$ values of 10.4, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows evidence of 3 teeth lost prior to death with complete alveolar bone resorption. There is some alveolar bone loss and root surface caries present along the anterior teeth caused by calculus deposits. This individual also had 6 gold fillings total, corresponding to the moderate to heavy caries rate seen in the dentition overall.

Clothing, Shrouds, and Personal Artifacts

A single five-hole bone button was located in the pelvic region of this individual. It may represent a pants closure.



Burial 46B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 48 cm in width, with the head oriented to the northwest. Coffin hardware consisted of nine complete nails, 33 nail fragments, and a screw. Of the complete nails, two had a pennyweight of 6d, five of 8d, and two of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult of indeterminate sex who was 24-30 years old when he or she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were folded towards the opposite shoulder.

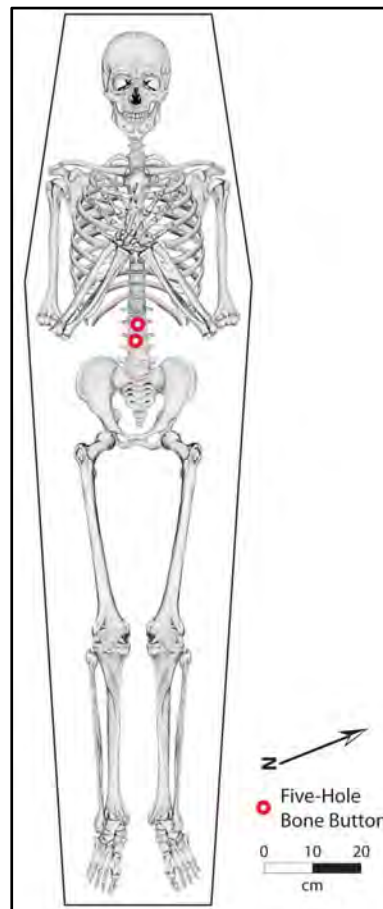
Pathology includes one marked expression Schmorl's node on an unidentified lumbar vertebra, likely as a result of a herniated intervertebral disk possibly due to forces exerted on the spine during axial loading.

This individual yielded $\Delta^{13}\text{C}$ values of -17.8 and $\Delta^{15}\text{N}$ values of 10.9, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition is in poor condition, but all teeth present show root surface caries that cover a significant portion of the tooth root. This suggests that this person suffered from significant alveolar bone loss prior to death.

Clothing, Shrouds, and Personal Artifacts

There were two five-hole bone buttons located along the spine just above the pelvis. They likely are from the fly of a pair of pants.



GRAVE SHAFT 47

This grave shaft measured 2.4 x 1.6 m and contained the remains of two individuals lying side by side, both oriented northwest. This shaft had room for another burial to the south of the two interments but this portion of the shaft was never used.

Burial 47A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin nails consisted of three complete (pennyweight 8d) nails and 18 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult probable female who was 25-45 years old when she died. The remains were too fragmentary to derive a stature estimate. Both arms were placed with the hands across the pelvis.

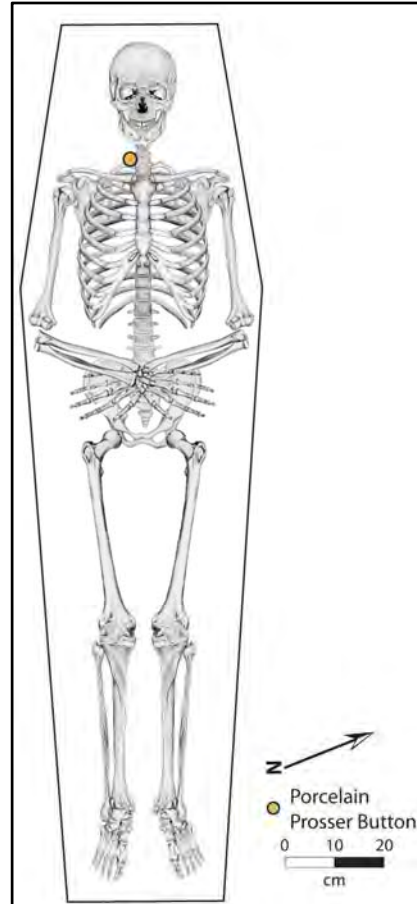
No pathologies were noted.

No isotopic data are available for this individual.

The dentition is very poorly preserved, with the maxilla represented by a small portion and the mandible missing entirely. All the teeth recovered were loose. Several of the upper anterior teeth show evidence of chipping along the occlusal surface edge prior to death, with corresponding chipping present on two loose mandibular teeth as well.

Clothing, Shrouds, and Personal Artifacts

A single Prosser button was found near the neck of this individual. It may have been associated with a shift.



Burial 47B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven complete nails and 34 nail fragments. Of the complete nails, one had a pennyweight of 4d, three of 6d, one of 8d, and two of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult probable female who was 20-40 years old when she died. The remains were too fragmentary to derive a stature estimate. The left arm was placed at the side of the body, while the lower right arm was folded towards the same shoulder.

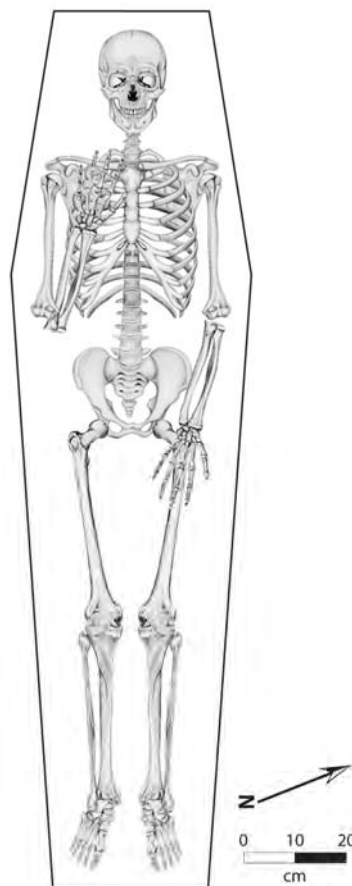
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -13.9 and $\Delta^{15}\text{N}$ values of 9.8, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is poorly preserved but shows evidence of at least four mandibular molars and two maxillary premolars being lost prior to death with complete alveolar bone resorption and the development of a narrow spiny ridge. Horizontal and vertical bone loss is prominent, exposing the roots of most of the teeth remaining.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 48

This grave shaft measured 1.76 x 0.5 m and contained the remains of a single individual oriented northwest.

Burial 48

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 58 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two complete (pennyweight 6d) nails, 21 nail fragments, and two screws.

Human Skeletal and Dental Remains

This individual is estimated to be a younger adult male who was 30-36 years old when he died and stood 162.7 ± 7.3 cm (64 ± 2.9 "") tall. The lower left arm was folded towards the opposite shoulder, and the right arm was placed at the side of the body.

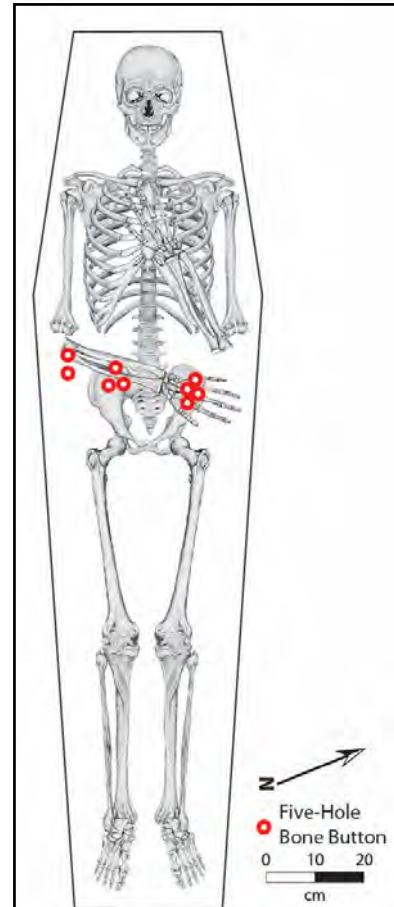
Pathologies included osteophyte formation on the anterior, superior and inferior portions of multiple cervical vertebrae (C3-C6).

This individual yielded $\Delta^{13}\text{C}$ values of -17.2 and $\Delta^{15}\text{N}$ values of 9.1, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

The nine five-hole bone buttons associated with this individual represent pants closures or suspender fasteners (though shown in the illustration above the arms, all of the buttons were found below the arms and hands).



GRAVE SHAFT 49

This grave shaft measured 2.16 x 0.81 m and contained the remains of a single individual oriented southeast.

Burial 49

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 125 cm in length and 30 cm in width, with the head oriented to the southeast. Coffin hardware consists of three complete nails, 24 nail fragments, and a screw. Of the complete nails, two had a pennyweight of 4d and one a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be a juvenile of indeterminate sex who was 10-14 years old when he or she died. Due to the immature nature of this individual no sex or stature estimate is possible. The placement of both arms could not be determined due to poor preservation (arm placement in figure is for illustrative purposes only).

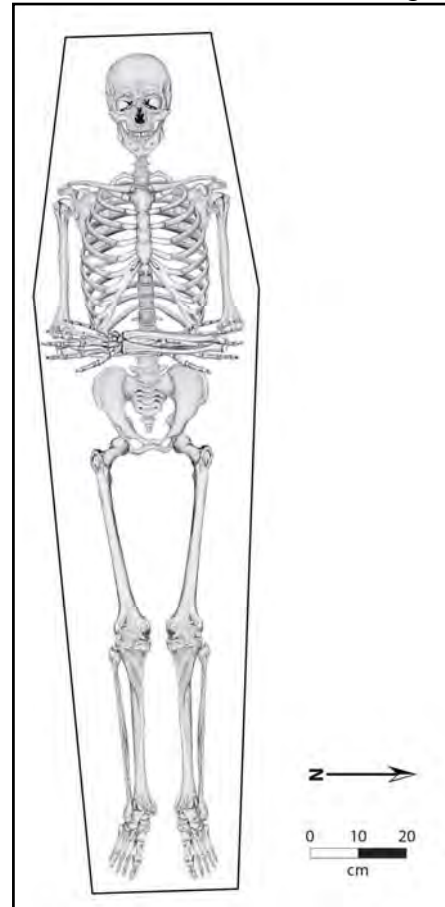
No pathologies were noted.

No isotopic data are available for this individual.

The dentition is poorly preserved, with only 7 total teeth recovered. There are large cavernous lesions on the occlusal surfaces of the lower first molars, and heavy calculus deposits on the upper left first molar. Dental age suggests this individual is 12 years old \pm 6 months.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 50

This grave shaft measured 2.2 x 2.64 m and contained the remains of three individuals lying side by side, all oriented northwest.

Burial 50A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware consists of six complete (pennyweight 8d) nails and 40 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 43-55 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

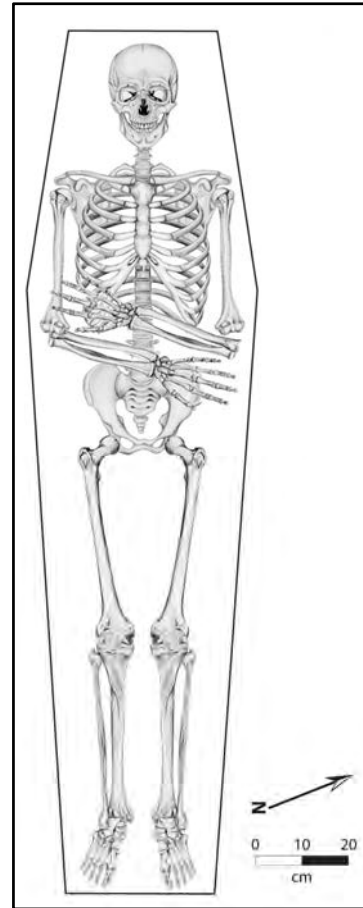
Pathology includes arthritic lipping on the metacarpals in the left hand only. An extra tibia shaft fragment was found with this burial.

This individual yielded $\Delta^{13}\text{C}$ values of -16.4 and $\Delta^{15}\text{N}$ values of 10.0, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None



Burial 50B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of four complete nails and 27 nail fragments. Of the complete nails, three had a pennyweight of 8d and one a pennyweight of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 47-63 years old when she died. The remains were too fragmentary to derive a stature estimate. Both arms were placed with the hands across the chest.

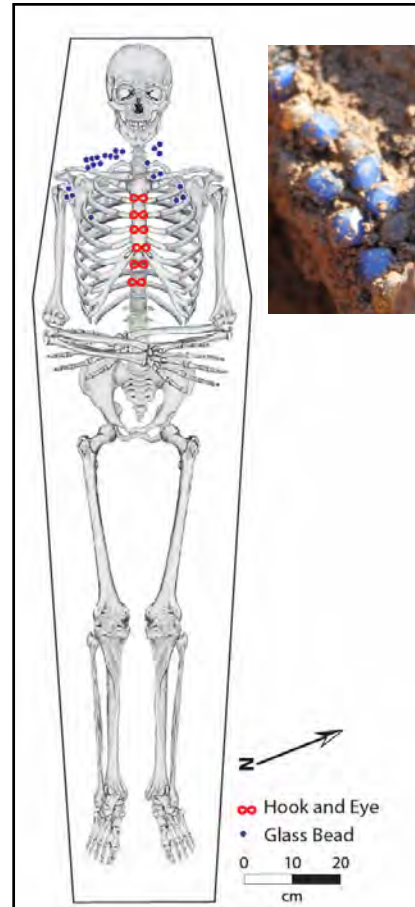
Pathology includes arthritic activity around the fovea capitis of both femoral heads.

No isotopic data are available for this individual.
No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

Clothing related objects associated with this burial consisted of eight hooks and five eyes located beneath the spine, and three five-hole bone buttons whose location is not known. The hooks and eye fasteners were probably associated with a dress and the bone buttons undergarments.

Personal objects associated with this burial consisted of 54 drawn glass beads. The beads were located around the neck and intermingled with the chest cavity.



Burial 50C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of six complete (pennyweight 8d) nails and 32 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult male who was 25-40 years old when he died. The remains were too fragmentary to derive a stature estimate. Both arms were placed with the hands across the chest.

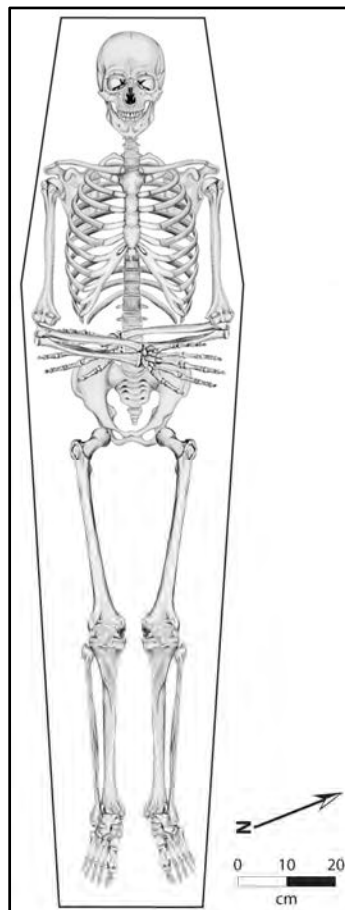
Pathologies include woven bone on the femora, woven and sclerotic bone on the right femur, and sclerotic bone on the right fibula. The bone deposition in the lower limbs is likely due to prolonged infection that was active at the time of death.

This individual yielded $\Delta^{13}\text{C}$ values of -15.1 and $\Delta^{15}\text{N}$ values of 9.6, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 51

This grave shaft measured 2.4 x 2.14 m and contained the remains of three individuals lying side by side, all oriented northwest.

Burial 51A

Coffin/Casket Remains and Hardware

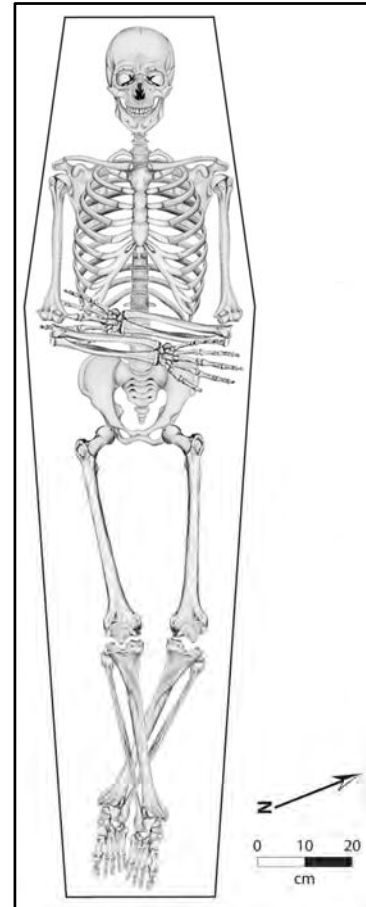
This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 50 cm in width, with the head oriented to the northwest. The coffin was then placed within a larger, rectangular box measuring 210 cm in length and 60 cm in width. Coffin hardware consisted of eight complete nails, 76 nail fragments, and three screws. Of the complete nails, one had a pennyweight of 7d, two a pennyweight of 9d, and five a pennyweight of 12d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 20-35 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

Pathology includes woven and sclerotic bone deposition found on the endocranial surface of the frontal and occipital bones, possibly due to infection.

This individual yielded $\Delta^{13}\text{C}$ values of -17.4 and $\Delta^{15}\text{N}$ values of 10.8, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.



The dentition is fragmentary but shows evidence of four teeth lost pre-mortem. The lower right canine was skewed in the socket, resulting in the crown facing inward somewhat, and the lower left second molar had slanted after the loss of the first molar. Dental wear is moderate but the caries rate is high, with several cavernous lesions. Three maxillary teeth also show occlusal edge chipping. There are two gold fillings, one each in the maxillary first molars. Additionally, diagonal scratches near a carious lesion on the buccal surface indicate that a hard, thin object was used to rub across the tooth surface.

Clothing, Shrouds, and Personal Artifacts

None

Burial 51B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 195 cm in length and 55 cm in width, with the head oriented to the northwest. The coffin was then placed in a larger, rectangular box measuring 210 cm in length and 60 cm in width. Coffin hardware consisted of 11 complete nails and 84 nail fragments. Of the complete nails, seven had a pennyweight of 6d and four a pennyweight of 12d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 22-27 years old when he died. The remains were too fragmentary to derive a stature estimate. The lower left arm was folded back towards the same shoulder and the lower right arm was placed across the chest.

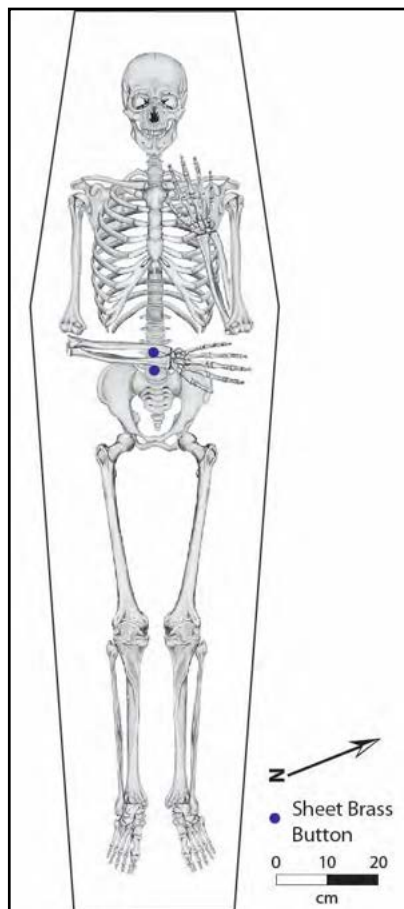
Pathology includes inactive cribra orbitalia of both eye orbits, possibly due to vitamin deficiency (e.g. vitamin B₁₂, vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009).

This individual yielded $\Delta^{13}\text{C}$ values of -16.5 and $\Delta^{15}\text{N}$ values of 10.9, suggesting a diverse diet consisting of mixed C₃ plants and corn-based products, and a moderate amount of meat.

The dentition shows evidence of six teeth lost pre-mortem with varying levels of socket resorption. Three mandibular teeth have gold fillings on the crown, with the filling on the right second premolar spanning the entire width of the interstitial crown. There is also a gold filling in the upper left second premolar. Evidence indicates the distal interstitial crown of this tooth and the mesial interstitial crown of the upper left first molar were sawn off, forming a v-shaped space between the teeth, to allow for filling of the carious lesion with gold.

Clothing, Shrouds, and Personal Artifacts

A couple of two-piece stamped sheet brass buttons were found just above the pelvis (though shown on top of arm they were actually found below the arm). They represent pants fly closures. Plainweave 1/1 fullered wool fabric fragments (n=8) were found in the vicinity of the head.



Burial 51C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 190 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 45 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be an adult male of indeterminate sex. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed across the chest, and the lower right arm across the pelvis.

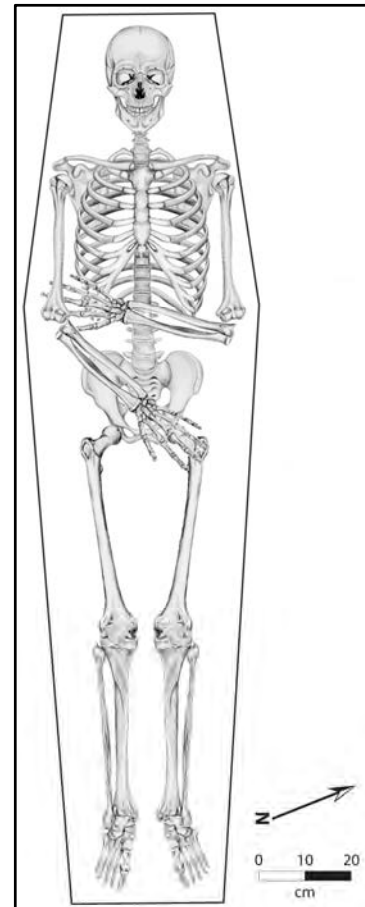
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -16.7 and $\Delta^{15}\text{N}$ values of 10.2, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition is poorly preserved, but shows evidence of two fillings in the mandible. The right first molar has a small gold filling on the occlusal surface, as well as a reddish metal filling on the distal interstitial crown. This filling connects to the mesial interstitial crown of the right second molar, which also has a reddish metal filling on the distal interstitial crown.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 52

This grave shaft measured 2.4 x 2.0 m and contained the remains of four individuals lying side by side, all oriented northwest.

Burial 52A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 192 cm in length and 46 cm in width, with the head oriented to the northwest. Coffin hardware consisted of a complete (pennyweight 6d) nail and five nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 43-58 years old when he died and stood 170.3 ± 10.3 cm (67 ± 4.1 "") tall. Both lower arms were placed across the pelvis.

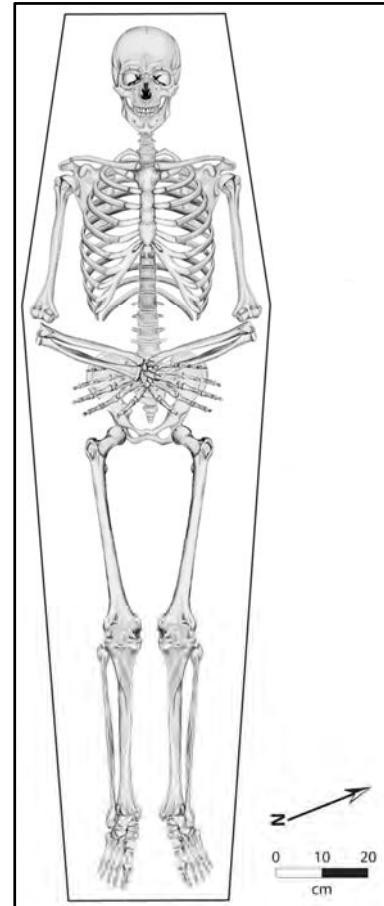
Pathologies include arthritic activity on the left and right tarsals, left and right metatarsals, as well as osteophyte formation on the vertebrae, arthritic activity on both acetabula and the intercondylar area of both femora. Additionally, there is evidence of porosity on a right phalanx, although the cause is unclear. Evidence of active and healed infection in the form of woven and sclerotic bone formation is noted for the endocranial surface of the temporal bone as well as the right fibula.

This individual yielded $\Delta^{13}\text{C}$ values of -15.1 and $\Delta^{15}\text{N}$ values of 9.7, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition shows evidence of minimal tooth loss, with only the lower right molars being lost pre-mortem with complete alveolar bone resorption. A single caries was noted that destroyed the entire crown of the lower left first molar. The maxillary teeth show evidence of heavy calculus present on the upper right molars, with slightly less calculus present on the left molars.

Clothing, Shrouds, and Personal Artifacts

None



Burial 52B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and approximately 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of a complete (pennyweight 7d) nail and five nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle adult female who was 35-50 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were folded towards the opposite shoulder.

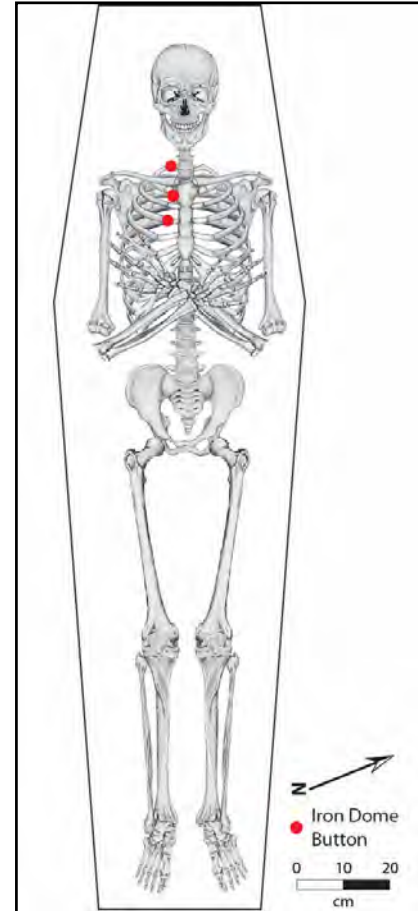
Pathology includes arthritic lipping on most articular surfaces in the knees and ankles, as well as along the fovea capitis on the left femoral head.

No isotopic data are available for this individual.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

Three iron dome buttons were recovered from upper torso extending down towards the pelvis. They may represent coat fasteners.



Burial 52C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 48 cm in width, with the head oriented to the northwest. Coffin hardware consists of four complete (pennyweight 8d) nails and 12 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 47-63 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

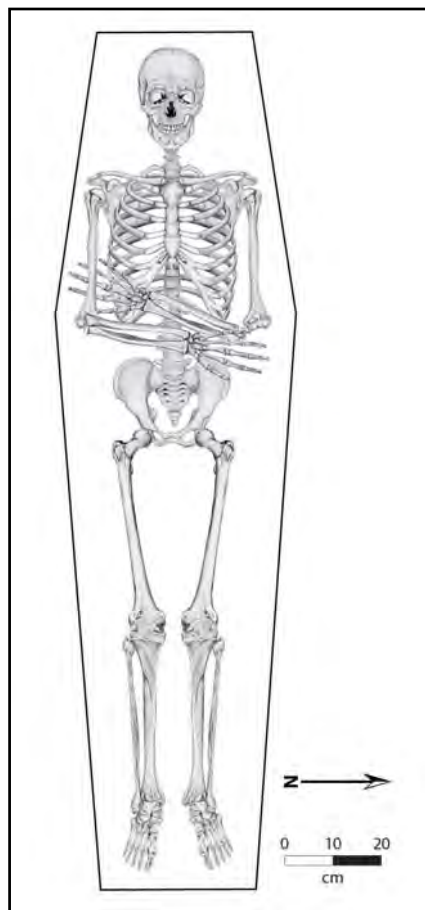
Pathologies include slight lipping found on the intercondylar notch of the right distal femur. The diploë of the skull appears slightly thickened, however, it may not necessarily be pathological.

This individual yielded $\Delta^{13}\text{C}$ values of -15.0 and $\Delta^{15}\text{N}$ values of 10.8, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is poorly preserved, with most teeth brittle and all alveolar bone is fragmentary. There is evidence pre-mortem tooth loss with varying degrees of alveolar resorption at each location. Several teeth have cavernous carious lesions in the crown, and almost all teeth present have root surface caries. There is heavy calculus development on the upper right second molar only.

Clothing, Shrouds, and Personal Artifacts

None



Burial 52D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal coffin with the head oriented to the northwest, however, due to poor preservation no dimensions were documented. Coffin hardware consists of four complete (pennyweight 8d) nails and nine nail fragments.

Human Skeletal and Dental Remains

This burial is represented by an organic stain in the soil. No skeletal material was preserved or retained, despite there being minor cranial fragments identified in the field. As such, no age, sex, or stature estimate is possible. The size of the area delineated by the coffin nails suggests this was a child burial.

No isotopic data are available for this individual.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 53

This grave shaft measured 3.1 x 2.4 m and contained the remains of three individuals lying side by side, and earlier truncated single interment. Of the four burials, three of which were oriented northwest and one was oriented southeast.

Burial 53A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 170 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consists of seven complete and nine nail fragments. Of the complete nails, one had a pennyweight of 5d, three of 6d, and three of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an adult probable female. The remains were too fragmentary to derive a stature estimate. The lower left arm was missing and its placement could not be determined. The lower right arm was placed with the hand across the pelvis.

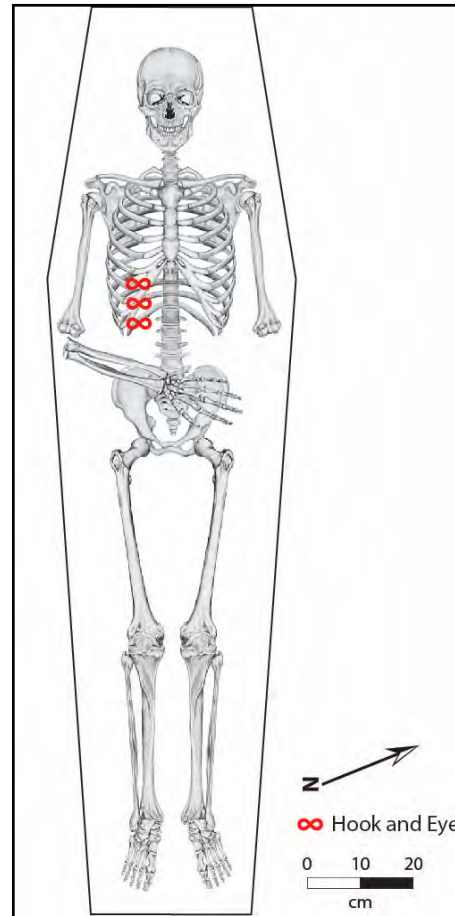
No pathologies were noted.

No isotopic data are available for this individual.

The dentition shows evidence of only one tooth lost pre-mortem. The upper right third molar is congenitally absent, and the deciduous upper right canine is still present and in occlusion with a large carious lesion. The permanent canine can be seen through a hole in the palate. The upper left canine is not fully descended. The upper and lower left third molars have not erupted completely. There is very little wear throughout the dental arcade, mainly on the anterior teeth. Of note the lower right second incisor is worn at an angle.

Clothing, Shrouds, and Personal Artifacts

A few hooks (n=4) and eyes (n=3) were found along the right side of the rib cage. Fabric associated with these fasteners consisted of seven plainweave possibly faced wool fabric fragments, one possibly plainweave possibly wool fragment, and one plainweave 1/1 fabric fragment.



Burial 53B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 185 cm in length and approximately 50 cm in width, with the head oriented to the southeast. Coffin hardware consisted of four complete nails and a pointed tip screw. Of the complete nails, two had a pennyweight of 6d, one of 7d and one of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 47-63 years old when he died and stood 167.3 ± 8.8 cm (65.9 ± 3.5 "") tall. The left arm was placed at the side of the body, and lower the right arm was placed across the pelvis.

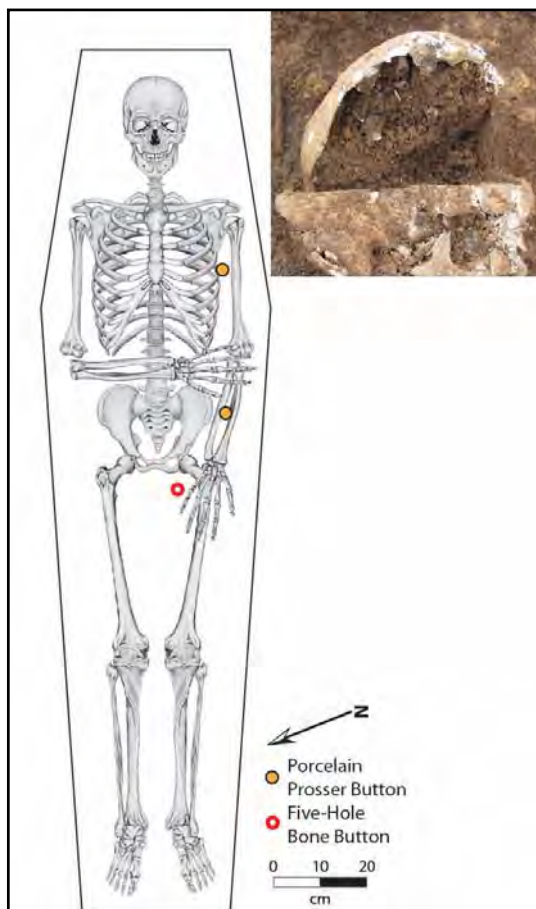
Pathologies include traumatic myositis ossificans on the left clavicle, possibly due to shoulder dislocation, as well as arthritic activity on the left humerus, left glenoid fossa, distal femoral epiphyses, and a button osteoma (small benign growth) on the right parietal bone. This person was autopsied after death, indicated by the bisected calvarium.

This individual yielded $\Delta^{13}\text{C}$ values of -16.6 and $\Delta^{15}\text{N}$ values of 10.6, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

Two Prosser buttons and a five-hole bone button were found along the left side of the body. An additional Prosser button and a four-hole bone button were found during the washing of the skeletal remains. One of the Prosser buttons was found along the side of the rib cage, and the other between the tibia and radius. The five-hole bone button was found adjacent to the left femur.



Burial 53C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 170 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of four complete (pennyweight 8d) nails, 35 nail fragments, and a screw.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 21-25 years old when she died. The remains are too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

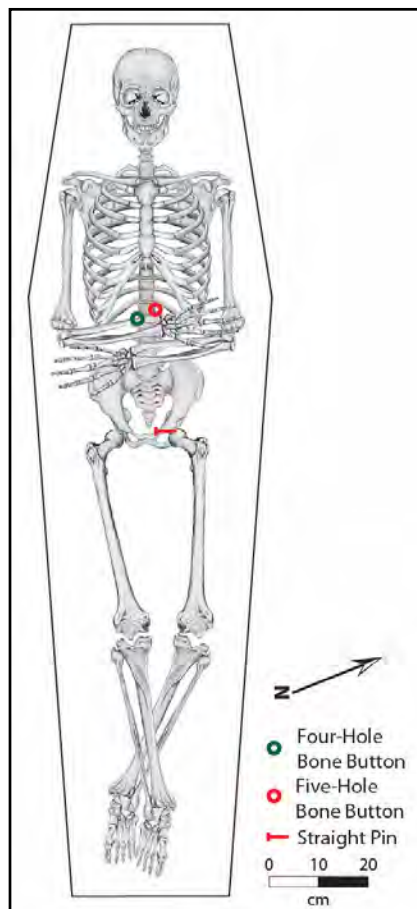
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -14.9 and $\Delta^{15}\text{N}$ values of 11.3, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is very poorly preserved with little alveolar bone remaining and all remaining teeth being brittle and mostly broken. Only one carious lesion was present on the lower left second incisor, but the state of preservation prevented further analysis.

Clothing, Shrouds, and Personal Artifacts

A single straight pin was recovered from the pelvic area. In addition, a single four-hole bone button and a five-hole bone button were found in back of the spine.



Burial 53D - Disturbed

This was a disturbed burial, with only the feet being articulated. This individual may have been disturbed during the digging of a mass grave for Burials 53A-C.

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 165 cm in length and approximately 30 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be an adult of indeterminate sex who was 25-60 years old when he or she died. The remains were too fragmentary to derive a stature estimate. Both arms were too poorly preserved to determine placement.

No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -15.6 and $\Delta^{15}\text{N}$ values of 11.1, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 54

This grave shaft measured 1.96 x 0.56 m and contained the remains of a single individual oriented northwest.

Burial 54

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 19 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 43-58 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

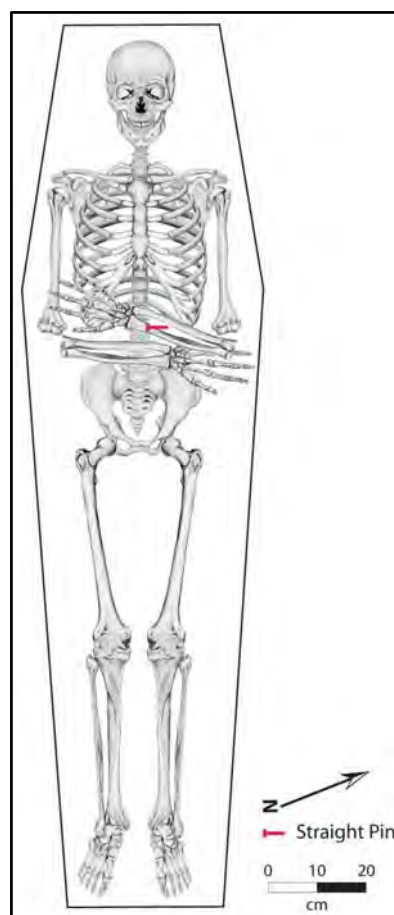
Pathologies include arthritic activity on several joint surfaces of the knees and feet, as well as the C1 (atlas) and C2 (axis) vertebrae of the upper neck. Additionally, there is evidence of bone deposition on the internal surface of the frontal bone consistent with hyperostosis frontalis (or calvaria) interna.

This individual yielded $\Delta^{13}\text{C}$ values of -15.0 and $\Delta^{15}\text{N}$ values of 10.8, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows evidence of extreme tooth loss prior to death, with at least 7 of the mandibular teeth lost and alveolar bone completely resorbed. Only a small maxillary fragment was recovered showing potential for complete maxillary tooth loss, but this cannot be stated definitively.

Clothing, Shrouds, and Personal Artifacts

A single straight pin was recovered from the lower torso area. It was probably associated with a burial shroud.



GRAVE SHAFT 55

This grave shaft measured 3.05 x 2.5 m and contained the remains of four individuals, all oriented northwest. It appears that two of these burials, Burials 55A and 55B, were placed side by side overtop of preexisting side by side burials. This placement was prior to decomposition of the existing coffins, as evidenced by partial skeletal slumping of the upper burials sometime after they were placed in the ground.

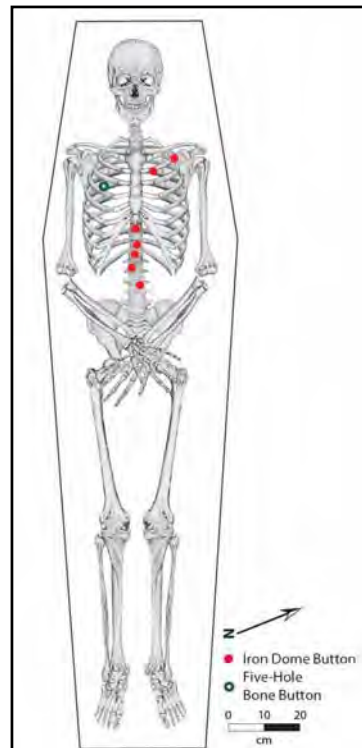
Burial 55A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 193 cm in length and 60 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two complete (pennyweight 6d) nails and 14 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 43-53 years old when he died and stood 178.8 ± 8.2 cm (70.4 ± 3.2 "") tall. Both lower arms were placed across the pelvis.



No pathologies were noted. This individual yielded $\Delta^{13}\text{C}$ values of -14.1 and $\Delta^{15}\text{N}$ values of 10.5, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is poorly preserved with most teeth brittle and easily broken. Three teeth were lost pre-mortem with varying levels of socket resorption. There are periapical abscesses on the upper right second premolar and third molar, and significant horizontal bone loss throughout the maxillary arcade, with a cavernous crater-like area of bone loss noted around the cemento-enamel junction (CEJ) of the upper right first premolar. Additionally, all teeth in the entire dental arcade have root surface caries. Dental wear ranges from minimal to extreme.

Clothing, Shrouds, and Personal Artifacts

Eight iron dome buttons were found extending from the right shoulder towards the pelvis, and a four-hole bone button was located near the left shoulder of this individual. The distribution of the metal buttons is suggestive of a coat. The bone button may have been associated with a pocket. The iron dome buttons were covered with a plainweave, possibly faced pseudomorph fabric. A brass buckle was found in association with the fabric fragments. It may have been part of a vest.

Burial 55B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 191 cm in length and 42 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 12 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult probable female who was 33-48 years old when she died. The remains were too fragmentary to derive a stature estimate. Both arms were placed with the hands across the chest.

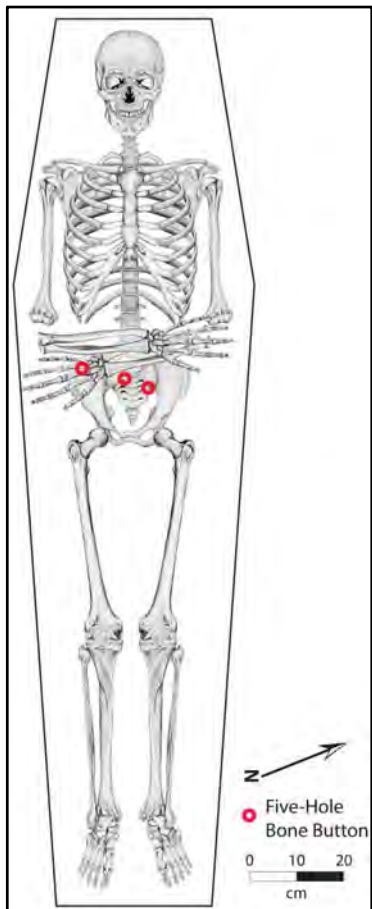
Pathologies include surface porosity on the articular surface of the right glenoid fossa and proximal epiphysis of the right humerus.

This individual yielded $\Delta^{13}\text{C}$ values of -14.6 and $\Delta^{15}\text{N}$ values of 10.0, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is poorly preserved, but all but one tooth are present and in occlusion. The upper and lower anterior teeth show evidence of minimal to heavy chipping of the occlusal edges, and wear is correspondingly heavier on these teeth compared to the posterior elements. Caries are minimal, and alveolar bone looks healthy, except for some vertical bone loss at the maxillary canines, which are out of alignment and pushed slightly forward as are those on the mandible.

Clothing, Shrouds, and Personal Artifacts

Three five-hole bone buttons were recovered from the pelvis area, possibly indicative of pants (though shown in the illustration above the arms, all of the buttons were found below the arms and hands).



Burial 55C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 48 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two complete (pennyweight 8d) nails and five nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 45-65 years old when she died. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed across the chest and the lower right arm the pelvis.

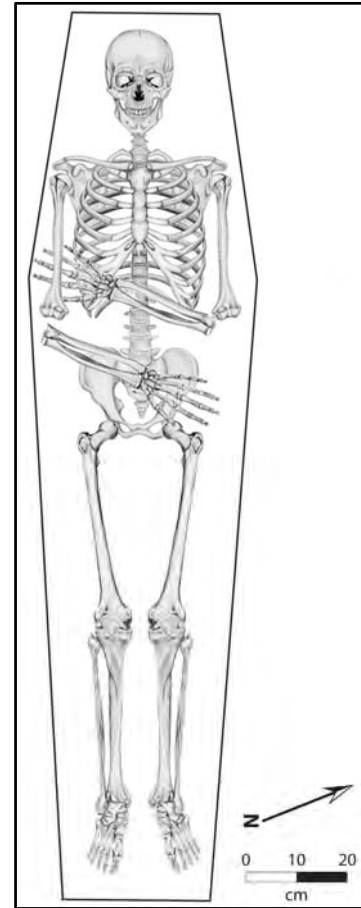
Pathologies include a healed periostitis on the proximal third of the left femur, likely due to infection.

No isotopic data are available for this individual.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None



Burial 55D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 172 cm in length and 36 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 19 nail fragments.

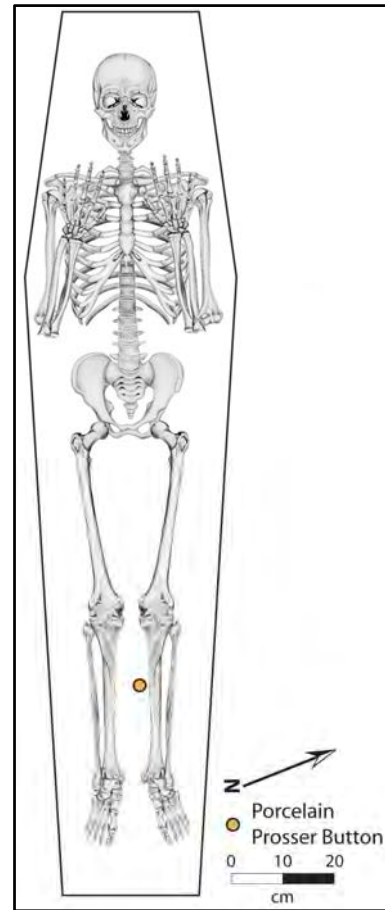
Human Skeletal and Dental Remains

This individual is estimated to be a juvenile male who was 17-20 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were folded towards the same shoulder.

Pathologies include diffuse porosity present in the on the anterior aspect of the left and right maxillae, just above the alveolar process, as well as woven bone on the anterior aspect of the maxilla as well as in the left maxillary sinus (healed sinusitis).

No isotopic data are available for this individual.

The dentition is well preserved in comparison with most of the rest of the skeleton, with all maxillary teeth present and in occlusion and only 4 mandibular teeth loose or missing. The upper third molars have not fully developed, although the crowns have descended. There are light root surface caries throughout the dental arcade, with minimal to no wear throughout but evidence of chipping is present on many teeth.



Clothing, Shrouds, and Personal Artifacts

A single Prosser button was recovered from near the left tibia.

GRAVE SHAFT 56

This grave shaft measured 1.8 x 0.8 m and contained the remains of two individuals, one oriented northwest and the other southeast. Burial 56A was buried directly atop an earlier single interments (Burial 56B), causing some disturbance of the lower burial.

Burial 56A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the southeast. Coffin hardware consisted of four complete nails and 38 nail fragments. Of the complete nails, one had a pennyweight of 7d and three a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a juvenile of indeterminate sex who was 17-19 years old when he or she died. Sex and stature could not be estimated for this individual due to the immature nature of the skeleton as well as the fragmentary nature of all material present. Both lower arms were placed across the chest.

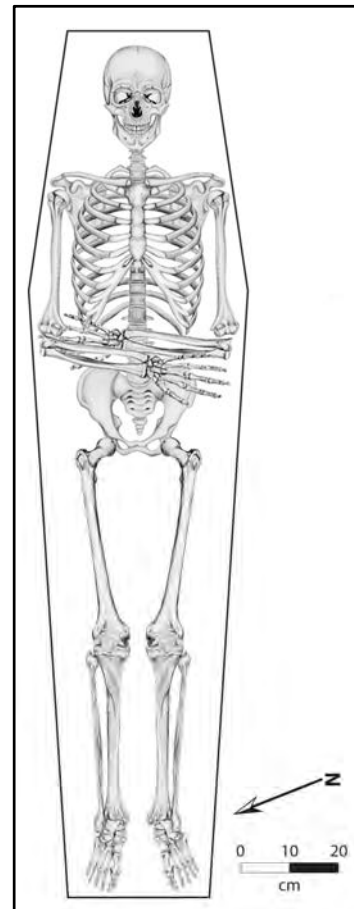
Pathologies include woven and sclerotic bone deposition found on the lateral aspect of the diaphysis of the right tibia, possibly due to prolonged infection that was still active at the time of death.

This individual yielded $\Delta^{13}\text{C}$ values of -17.5 and $\Delta^{15}\text{N}$ values of 10.4, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition is very poorly preserved, with the few remaining teeth being quite brittle. Caries are minimal, with moderate calculus development on most remaining teeth. The very tip of the apical third molar roots has not yet fully closed. Dental wear is minimal and there appears to be no alveolar bone loss at death.

Clothing, Shrouds, and Personal Artifacts

None



Burial 56B

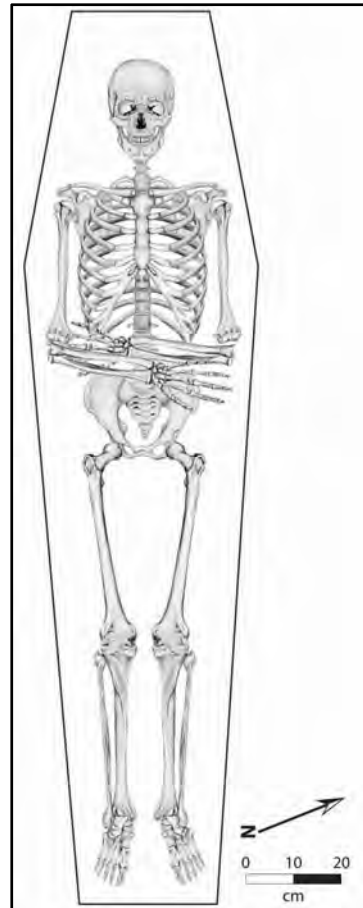
Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 60 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven complete nails and 24 nail fragments. Of the complete nails, six had a pennyweight 6d and one a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult female who was 53-68 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

Pathologies were somewhat extensive in this individual and include arthritic activity on most observable joint surfaces. There is evidence of extensive bone deposition throughout the body, including both fibulae, and right distal tibia/fibula as well as the endocranial surface of the left temporal bone. Sclerotic deposition in right maxillary sinus suggests healed sinusitis. There is also bone deposition on the endocranial surface of the left temporal bone consistent with hyperostosis calvaria interna. There are also button osteomas (benign bony growths) on the parietal bones. This individual also suffered from a healed midshaft fracture of the right ulna (forearm). Although there is some taphonomic damage to the bone, it appears as though the radius may also have fractured and fused to the ulna, and/or perhaps the ulna was not properly set. This fracture is consistent with a defensive wound (i.e. parry fracture), but could have been caused by a fall (Anderson 1984; Wedel and Galloway 2013).



No isotopic data are available for this individual.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 57

This grave shaft measured 1.8 x 0.53 m and contained the remains of two individuals, with Burial 57A being placed on top of an earlier single interments. Both were oriented with the head to the northwest.

Burial 57A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 175 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two complete nails and 20 nail fragments. One complete nail had a pennyweight of 6d and the other a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 19-23 years old when he died. The remains were too fragmentary to derive a stature estimate. The left arm was placed at the side of the body and the lower right arm across the chest.

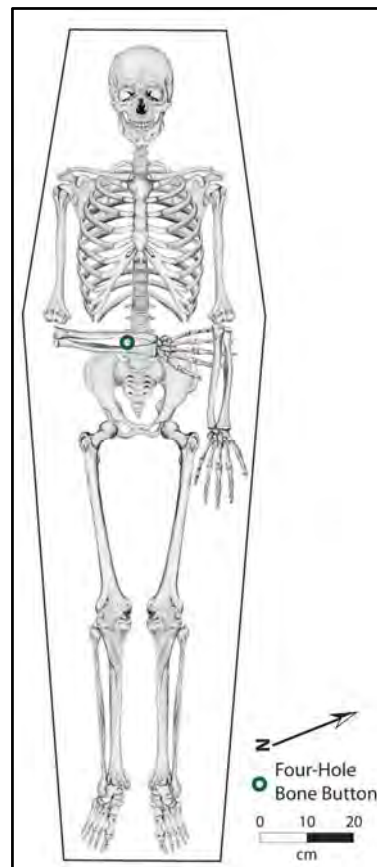
Pathologies include woven bone deposition consistent with active systemic infection. The affected bones include the right and left fibulae tibiae, scapulae, ilia, ribs (possibly due to respiratory infection), the right clavicle, maxillae, and mandible.

This individual yielded $\Delta^{13}\text{C}$ values of -16.9 and $\Delta^{15}\text{N}$ values of 9.0, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition is well preserved, with most of the mandible and maxilla still intact. All four third molars are congenitally absent. There is some horizontal bone loss due to moderate calculus buildup, as well as interstitial porosity throughout the arcade. There is only slight caries present between the upper left second premolar and first molar. Dental wear is minimal, but parafunctional wear is evident based on heavy chipping of the anterior teeth. The molars also exhibit a very large Carabelli's Trait.

Clothing, Shrouds, and Personal Artifacts

A four-hole bone button was found beneath the lower right arm, just above the pelvis. It may have been a pants closure.



Burial 57B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 178 cm in length and 46 cm in width, with the head oriented to the northwest. Coffin hardware consisted of four complete nails and 11 nail fragments. Of the complete nails, one had a pennyweight of 4d, one of 5d, and two of 6d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 35-55 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed towards the opposite shoulder. This person also was autopsied after death, indicated by the bisected calvarium.

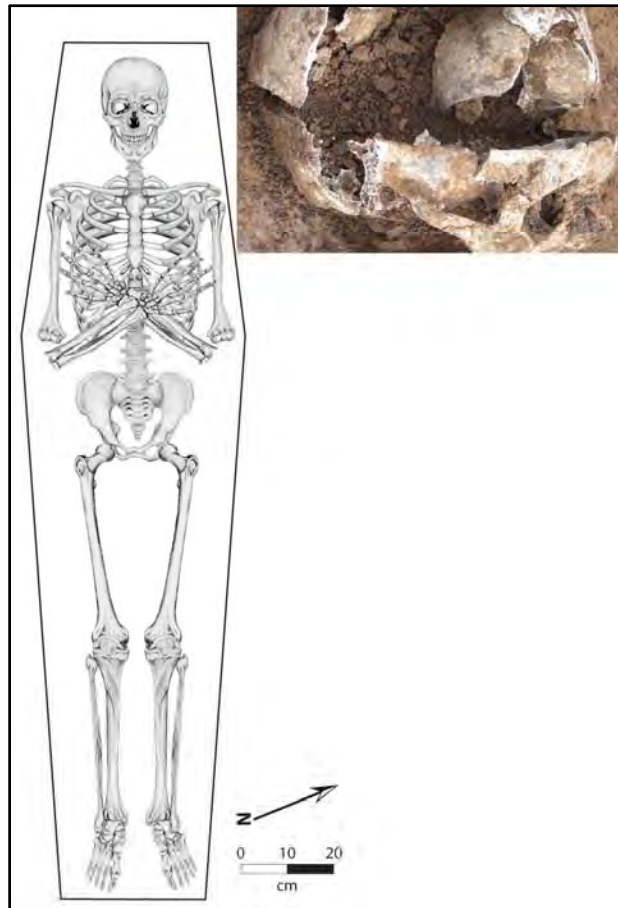
Pathology includes woven and sclerotic bone deposition in the sinus cavities of the right frontal and maxilla (prolonged, active sinusitis).

No isotopic data are available for this individual.

The dentition is poorly preserved, with alveolar bone and teeth brittle and broken. The upper right second premolar through third molar were all lost pre-mortem with varying levels of alveolar resorption, and there is a very large abscess at the upper right second and third molar loss sites spanning the width of the bone. There is minimal vertical bone loss along the upper anterior teeth. The upper left second and third molars were also lost pre-mortem and there is an abscess of the second molar root, though smaller than that found on the right. The mandible is very fragmented but evidence shows the lower right third molar and left first molar were lost pre-mortem with moderate resorption.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 58

This grave shaft measured 1.9 x 0.8 m and contained the remains of a single individual oriented northwest.

Burial 58

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 175 cm in length and approximately 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 15 nail fragments.

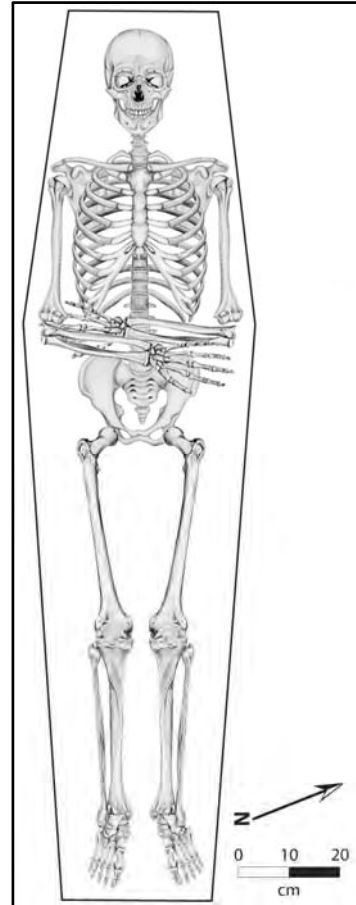
Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult probable male who was 40-65 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

No pathologies were noted.

No isotopic data are available for this individual.

The dentition is very poorly preserved, with only five loose teeth and small fragments of alveolar bone. Evidence suggests that four teeth were lost pre-mortem, and a large abscess at one of the tooth loss sites. There is significant horizontal bone loss at all the lower molar sites, and dental wear is minimal to moderate.



Clothing, Shrouds, and Personal Artifacts

There were three hooks and three eyes associated with this burial, but their location cannot be determined.

GRAVE SHAFT 59

This grave shaft measured 4.7 x 3.1 m and contained the remains of 10 stacked individual burials. Of these, eight were oriented northwest and two were oriented southeast. It appears that Burial 59C was the original burial in this locality, and its shaft was repeatedly expanded to incorporate additional single interments.

Burial 59A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 187 cm in length and approximately 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 12 complete nails, 44 nail fragments, and a screw. Of the complete nails, two had a pennyweight of 5d, six of 8d, and four of 9d.

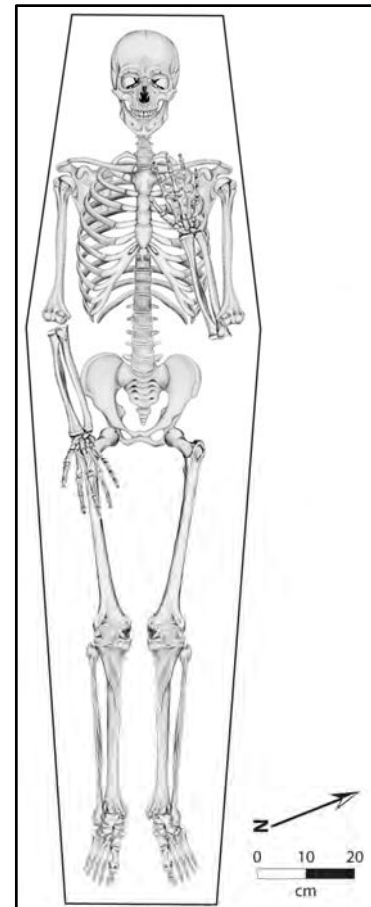
Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 25-35 years old when she died. The remains are too fragmentary to derive a stature estimate. The lower left arm was folded towards the same shoulder and the right arm was placed at the side of the body.

No pathologies were noted.

No isotopic data are available for this individual.

The dentition is poorly preserved, with teeth dry and brittle and alveolar bone somewhat fragmentary. All four third molars are congenitally absent. There is evidence of some horizontal bone loss across the maxilla. The upper right second incisor shows evidence of shoveling, and there is some dimpling on the mesial lingual cusp of the upper first molars.



Clothing, Shrouds, and Personal Artifacts

None

Burial 59B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 12 complete nails and 20 nail fragments. Of the complete nails, three had a pennyweight of 5d, six of 6d, and three of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle adult male who was 38-48 years old when he died and stood 161.4 ± 9.3 cm (63.5 ± 3.7 "") tall. Both arms were placed at the side of the body.

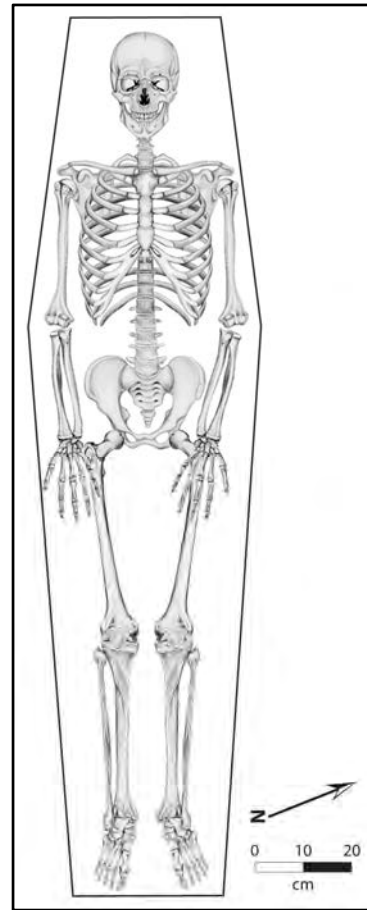
Pathologies include arthritic activity on most joint surfaces in the arms, legs, pelvis, as well as throughout most of the observable vertebrae. Additionally, there is evidence of a healed comminuted fracture of the right distal tibia (ankle).

No isotopic data are available for this individual.

The dentition shows evidence of severe horizontal bone loss throughout the entire arcade, with corresponding heavy tooth loss. The lower first molars were lost pre-mortem, causing the second and third molars to slant forward in their sockets to almost a horizontal position. There are large, transversal abscesses at the lower left first molar and upper right second and third molars, as well as a buccal abscess at the upper left first through third molar. Heavy caries throughout the dentition also suggests very poor oral health.

Clothing, Shrouds, and Personal Artifacts

None



Burial 59C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 170 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two complete (pennyweight 7d) and 22 nail fragments. Burial 59D post-dated and partially overlaid Burial 59C.

Human Skeletal and Dental Remains

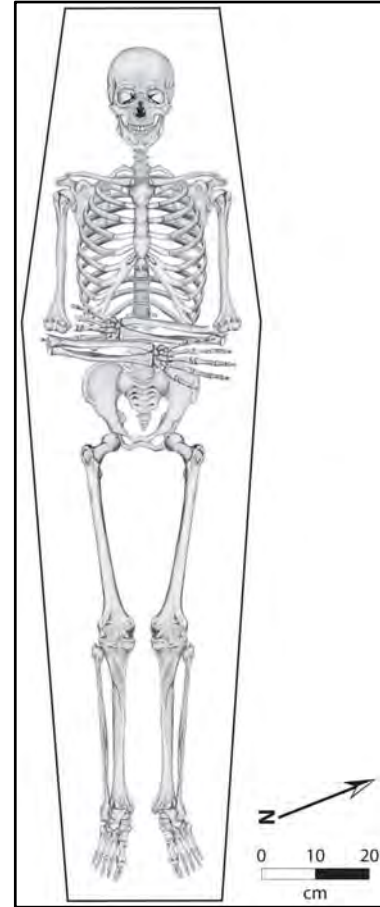
This individual is estimated to be an older adult female who was 55-75 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

Pathologies include sclerotic bone deposition on the alveolar bone of the maxilla. There is a small depression on the frontal bone that may be a healed lytic lesion or depression fracture, but difficult to determine because of considerable taphonomic damage to the bone.

No isotopic data are available for this individual. No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None



Burial 59D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 11 complete nails, 17 nail fragments, and one screw. Of the complete nails, nine had a pennyweight of 6d, one of 8d, and one of 9d. This individual had been placed over the lower right leg of 59C.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 20-24 years old when she died. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed across the chest, and the lower right arm towards the opposite shoulder.

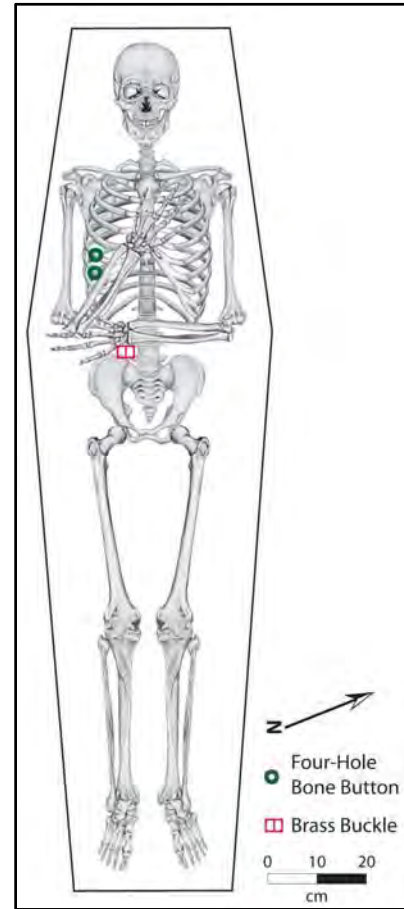
Pathologies include arthritic activity on the distal portion of the right radius and the left and right tarsals.

No isotopic data are available for this individual.

The dentition shows that the all four third molars were impacted, with occlusal surfaces slanted mesially. The lower right first molar was lost pre-mortem with complete alveolar resorption, but the remaining teeth show minimal wear and no caries. Alveolar bone appears to be healthy throughout the remaining dental arcade.

Clothing, Shrouds, and Personal Artifacts

Two four-hole bone buttons were found along the right side of the rib cage and a brass buckle was located just above the right pelvis.



Burial 59E

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of four complete (pennyweight 6d) nails and 25 nail fragments.

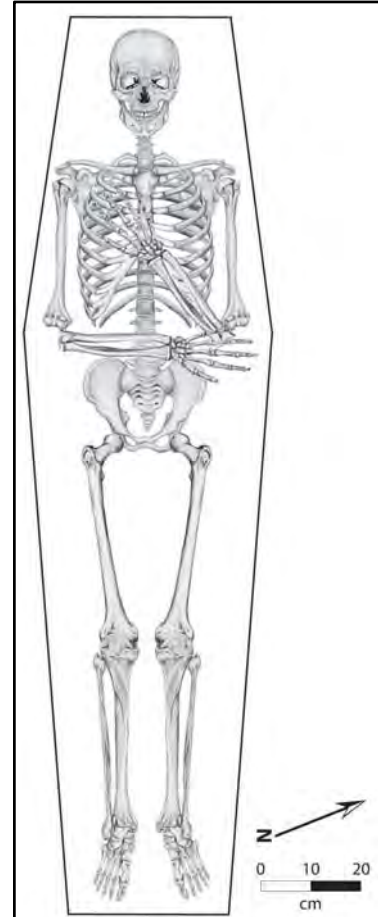
Human Skeletal and Dental Remains

This individual is estimated to be an adult probable female 30+ years old when she died. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed towards the opposite side shoulder and the lower right arm across the chest.

Pathologies noted include abnormal bone formation on the endocranial surface of the left occipital and left temporal bone in the form of plaque.

No isotopic data are available for this individual.

The dentition is in very poor preservation, with no teeth present and only a fragmented mandible. This individual may have been almost edentulous, with only a few anterior teeth still in the socket and occlusion and the rest in the process of complete resorption. There is severe horizontal bone loss and decreased bone density throughout the mandible, but post-mortem damage precludes further analysis.



Clothing, Shrouds, and Personal Artifacts

None

Burial 59F

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 184 cm in length and 41 cm in width, with the head oriented to the southeast. Coffin hardware consisted of three complete nails and 28 nail fragments. Of the complete nails, one had a pennyweight of 7d and two a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 55-75 years old when he died. The remains were too fragmentary to derive a stature estimate. Both arms were placed at the side of the body.

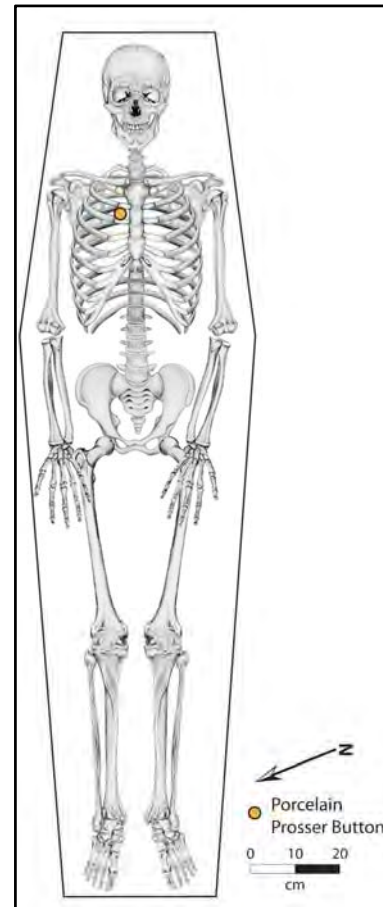
Pathologies include arthritic changes to the first cervical vertebra, both femoral heads (including eburnation on the right) and intercondylar notches, as well as the left and right acetabula (eburnation on the right). There is also sclerotic bone deposition on the alveolar bone of the left maxilla.

No isotopic data are available for this individual.

The dentition is poorly preserved, with alveolar bone and teeth dry and brittle. The maxilla shows that the upper left first molar was lost pre-mortem with complete alveolar resorption. The area has extreme vertical bone loss, with the second molar tilting forward and the third molar only partially rooted in the socket. The mandible shows that two molars were lost pre-mortem with moderate resorption, with associated vertical bone loss at these sites. Dental wear is extremely heavy, and caries rate is minimal and mainly at the root surface of teeth.

Clothing, Shrouds, and Personal Artifacts

A single Prosser button was located below the neck and near the sternum. It was probably associated with a pull-over shirt.



Burial 59G

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 30 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 35-55 years old when he died. The remains were too fragmentary to derive a stature estimate. The lower left arm was folded towards the opposite shoulder and the lower right arm was placed across the chest.

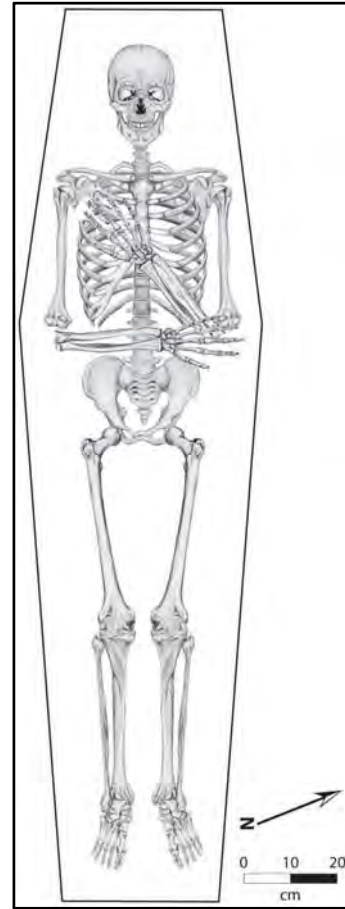
Pathologies include arthritic changes to the left hand, right proximal radius (elbow), and the right and left foot bones.

No isotopic data are available for this individual.

The dentition is poorly preserved, with both teeth and alveolar bone brittle and cracking. The maxilla shows evidence of significant horizontal bone loss around the third molars as well as extensive porosity throughout the palate. The mandible shows vertical and horizontal bone loss along the entire left side, with a spiny ridge of lipping along the buccal alveolar crest. Dental wear is moderate, as is caries rate. Calculus is moderate to heavy and appears to be the reason for the alveolar bone loss. Additionally, a parafunctional wear pattern was noted on the anterior teeth with many of the occlusal surfaces worn at an angle.

Clothing, Shrouds, and Personal Artifacts

None



Burial 59H

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 194 cm in length and 33 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 13 nail fragments. This burial was situated directly beneath Burial 59G.

Human Skeletal and Dental Remains

This individual is estimated to be an adult probable male. The remains were too fragmentary to derive a stature estimate. The lower left arm was folded towards the same side shoulder, and the right arm was placed across the chest.

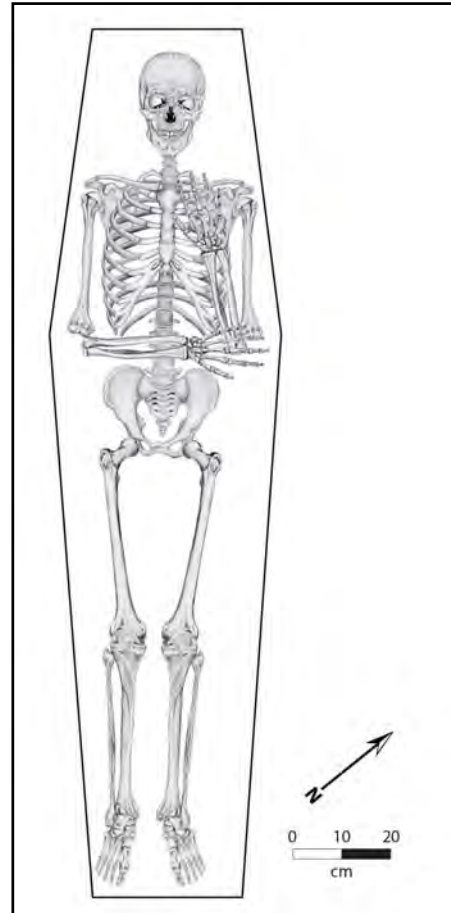
No pathologies were noted.

No isotopic data are available for this individual.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None



Burial 59I

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 168 cm in length and 44 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 21 complete (pennyweight 6d) nails and 21 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a juvenile of indeterminate sex who was 13-19 years old when he or she died. Sex and stature were not estimated due to the immature nature of the individual and the fragmentary state of the remains. Both lower arms were placed across the chest.

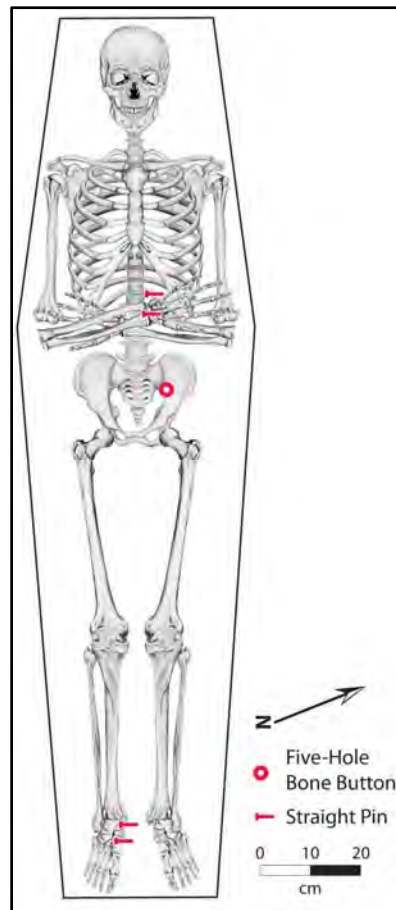
No pathologies were noted.

No isotopic data are available for this individual.

The dentition is entirely present, with the third molars not entirely developed or erupted yet. Alveolar bone throughout the arcade appears healthy with no bone loss or porosity, and no pre-mortem tooth loss. Dental wear is minimal to moderate, with some calculus and root surface caries present throughout. Dental age estimates this individual is 15 ± 6 months at death.

Clothing, Shrouds, and Personal Artifacts

A five-hole bone button was found on the left pelvis. There were also four straight pins found with this burial: two at the feet and two above the left arm. The pins were probably associated with a shroud.



Burial 59J

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 182 cm in length and 44 cm in width, with the head oriented to the southeast. Coffin hardware consisted of three complete nails, 25 nail fragments, and a screw. Of the complete nails, one had a pennyweight of 6d and two a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 23-33 years old when he died and stood 168.6 ± 11.5 cm (66.4 ± 4.5 "") tall. Both lower arms were placed across the chest.

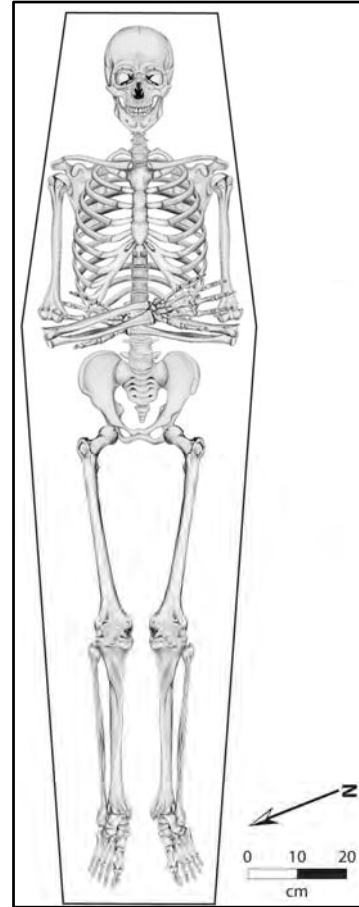
Pathologies include woven and sclerotic bone deposition on both femora and tibiae as well as porosity on the occipital bone consistent with inactive porotic hyperostosis, possibly due to vitamin deficiency (e.g. vitamin B₁₂) or parasitic infection during infancy or early childhood (Walker et al. 2009).

This individual yielded $\Delta^{13}\text{C}$ values of -14.0 and $\Delta^{15}\text{N}$ values of 10.4, suggesting a diet consisting of minimal C₃ plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is well preserved. The maxilla shows evidence of horizontal bone loss throughout, and the upper left second premolar was lost pre-mortem with complete alveolar resorption. The mandible shows pre-mortem loss of the lower right second molar with complete alveolar resorption. There is also a small amount of horizontal bone loss along the left side with a spiny ridge near the left molars. Some calculus is evident, and dental wear is minimal and caries rate is moderate.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 60

This grave shaft measured 3.35 x 2.06 m and contained the remains of five individuals lying side by side, all oriented northwest.

Burial 60A

Coffin/Casket Remains and Hardware

This individual was buried in a possibly rectangular shaped coffin measuring approximately 155 cm in length and approximately 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of a complete (pennyweight 6d) nail and 10 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be an adult female who was 25-45 years old when she died. The remains were too fragmentary to derive a stature estimate. The lower right arm was placed across the chest and the lower left arm across the pelvis.

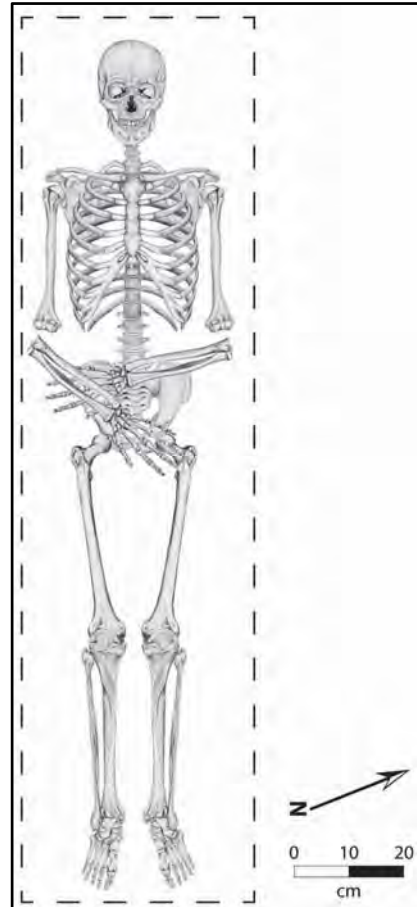
Pathologies include arthritic activity on the cervical vertebrae, both intercondylar notches of the distal femora (knees), and both ankles.

This individual yielded $\Delta^{13}\text{C}$ values of -21.0 and $\Delta^{15}\text{N}$ values of 8.0, suggesting a diet consisting of entirely C_3 plants and no corn-based products, and a minimal amount of meat.

The dentition shows evidence of 5 maxillary teeth lost pre-mortem, with significant vertical and horizontal bone loss throughout the arcade. The mandible shows evidence of 8 teeth lost pre-mortem, with significant horizontal and vertical bone loss as well. Dental wear is minimal, and caries rate is low on remaining teeth, but oral health appears to have been poor for an individual of this age.

Clothing, Shrouds, and Personal Artifacts

None



Burial 60B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 170 cm in length and 30 cm in width, with the head oriented to the northwest. Coffin hardware consisted of three complete nails and four nail fragments. Of the complete nails, two had a pennyweight of 6d and one a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult female who was 53-68 years old when she died. The remains were too fragmentary to derive a stature estimate. Each lower arm was folded towards the opposite shoulder.

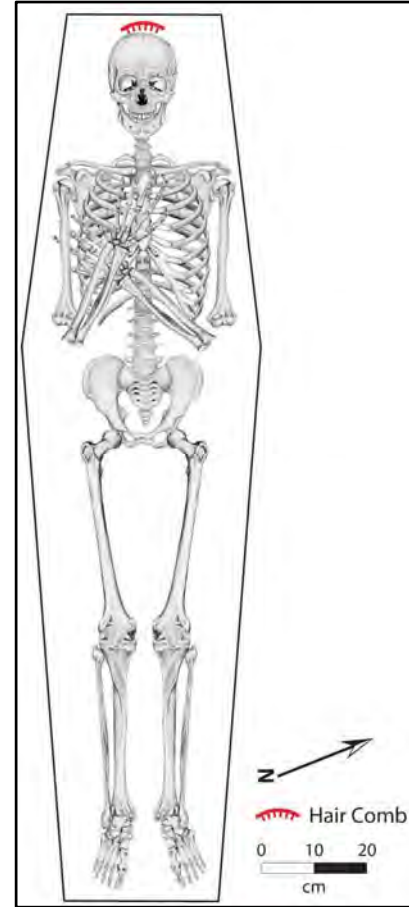
Pathologies include woven and sclerotic bone deposition on the proximal third of the left femur, as well as arthritic sharp lipping present on the centra of three of the cervical vertebrae.

This individual yielded $\Delta^{13}\text{C}$ values of -20.8 and $\Delta^{15}\text{N}$ values of 7.7, suggesting a diet consisting of entirely C_3 plants and no corn-based products, and a minimal amount of meat.

The dentition shows that the lower third molars were congenitally absent, and the upper third molars were likely also congenitally absent but post-mortem damage prevents a conclusive judgment. The remaining left molars were lost pre-mortem with complete alveolar resorption, and there is evidence of extensive horizontal and vertical bone loss throughout the arcade. There is heavy calculus and root surface caries present on almost all remaining teeth, as well as a moderate to large size abscess at the lower right molar area and a periapical abscess at the lower right second premolar as well. Dental wear is minimal to moderate and caries rate is high. The maxilla shows evidence of three anterior teeth lost pre-mortem with significant resorption, as well as heavy calculus and caries, and minimal wear.

Clothing, Shrouds, and Personal Artifacts

A single horn hair comb was found just above the cranium of this burial. It had a width of 114 mm and 22 teeth. The right side of the comb has two rivets in the upper right corner of the comb's body, suggesting fastening to another part that has not survived.



Burial 60C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 172 cm in length and 35 cm in width, with the head oriented to the northwest. Coffin hardware consisted of four complete nails and six nail fragments. Of the complete nails, three had a pennyweight of 4d and one a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 43-53 years old when she died and stood 156.9 ± 8.2 cm (61.8 ± 3.2 "") tall. The lower left arm was placed across the chest and the lower right arm along the side of the body.

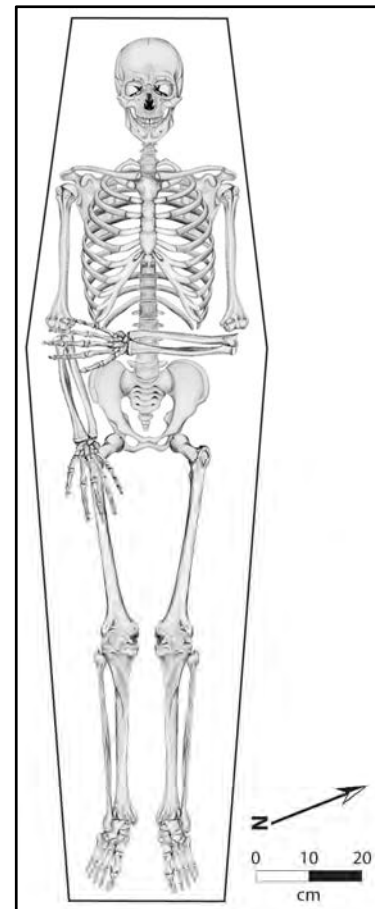
Pathologies include a button osteoma on the external surface of the right parietal bone as well as arthritic activity on the proximal ulnae (elbows), left carpals and metacarpals (hand and wrist bones), cervical and thoracic vertebrae, the proximal and distal articular surfaces of the right and left femora and tibiae (hips, knees and ankles), both patellae, and the right and left foot bones.

No isotopic data are available for this individual.

The dentition shows evidence that both lower third molars were lost pre-mortem, with heavy wear on remaining teeth. Calculus and horizontal bone loss are also evident. The maxilla shows that the left first molar was lost pre-mortem and a periapical abscess at the left canine. There is heavy wear and horizontal bone loss throughout the arcade.

Clothing, Shrouds, and Personal Artifacts

None



Burial 60D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 160 cm in length and 35 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 15 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 20-24 years old when he died and stood 161.7 ± 9.3 cm (63.7 ± 3.7 "") tall. The lower left arm was placed across the chest and the lower right across the pelvis.

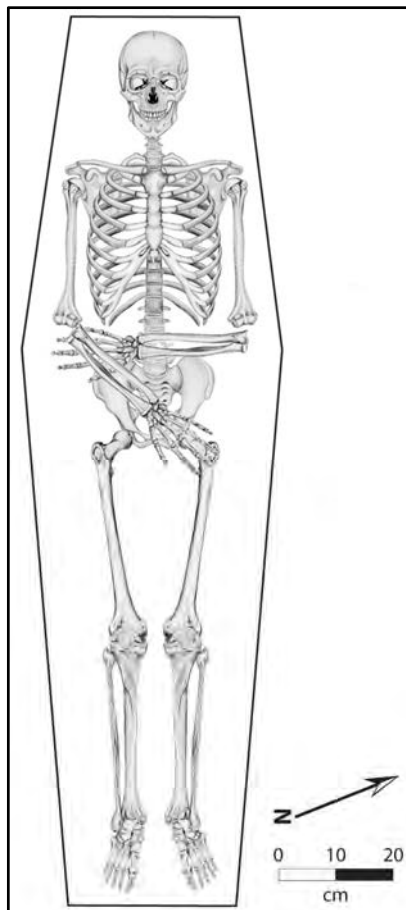
Pathologies include enthesophyte formation on the clavicles and humeri, as well as arthritic activity on the ulnae, lumbar vertebrae, and ribs. A Schmorl's node is present on an unidentified lumbar vertebra. Additionally, there is complete bilateral joint fusion of two of the wrist bones (triquetrals and lunates). Usually asymptomatic, this is often a bilateral congenital anomaly that does not affect the function of the wrist, but appears to have occurred during development (Lotter et al. 2010).

This individual yielded $\Delta^{13}\text{C}$ values of -19.0, suggesting a diet consisting entirely of C_3 plants and no corn-based products. No $\Delta^{15}\text{N}$ values were reported from the lab.

The dentition is intact with all teeth present and in occlusion. Alveolar bone looks healthy with minimal calculus and only a few root surface caries on lower anterior teeth where alveolar bone appears to have been lost due to bruxism. Dental wear is minimal to moderate with the heaviest wear located on the anterior teeth, indicating that this person clenched their teeth together at a slight angle and with an inward pulling motion. This resulted in parafunctional wear facets on the lingual side of the upper and lower anterior teeth, as well as occlusal surface chipping.

Clothing, Shrouds, and Personal Artifacts

None



Burial 60E

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin with the head oriented northwest, but due to poor preservation its dimensions could not be determined. Coffin hardware consisted of 11 nail fragments

Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult male who was 27-37 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the pelvis.

Pathologies include sclerotic bone deposition on the right maxilla as well as on the internal table of the left frontal bone consistent with hyperostosis calvaria (or frontalis) interna. Arthritic changes are present throughout the cervical vertebrae, the proximal right ulna (elbow), and the proximal and distal articular surfaces of both femora (knees and hips).

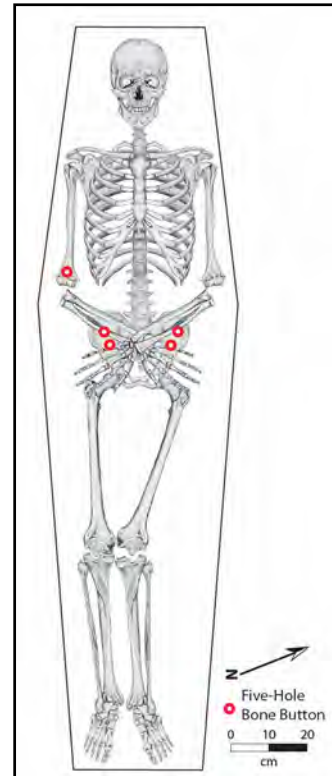
The presence of exaggerated muscle attachments of the femora (linea aspera) and tibiae (popliteal lines) suggest repetitive strain of the knees (e.g. squatting) (Capasso et al. 1998:118,122). There is also enthesophyte formation on the tibial tuberosities consistent with Osgood-Schlatter's disease, which is also often caused by repetitive flexion and extension of the knees (e.g. running and jumping) during adolescence (Capasso et al. 1998:123).

No isotopic data are available for this individual.

The dentition shows evidence of four mandibular teeth and two maxillary teeth lost pre-mortem, with signs of vertical and horizontal bone loss in both arcades. Dental wear is minimal to moderate on the mandible, however the maxillary premolars, canines, and incisors exhibit parafunctional wear that is not matched in the occluding lower teeth. This wear is smooth, polished, and rounded across the teeth and exposed the dentin that appears very dark brown while the enamel does not. This could possibly have been caused by a soft material (such as leather) being inserted into the mouth and then pulled upwards with pressure applied to the maxillary lingual crowns.

Clothing, Shrouds, and Personal Artifacts

Four of the five-hole bone buttons associated with this burial were located on the pelvis, with two found on the right side and two on the left. These buttons may have been associated with a drop down pants fly. Another five-hole bone button was found on the right humerus.



GRAVE SHAFT 62

This grave shaft measured 1.95 x 0.48 m and contained the remains of a single individual oriented northwest.

Burial 62

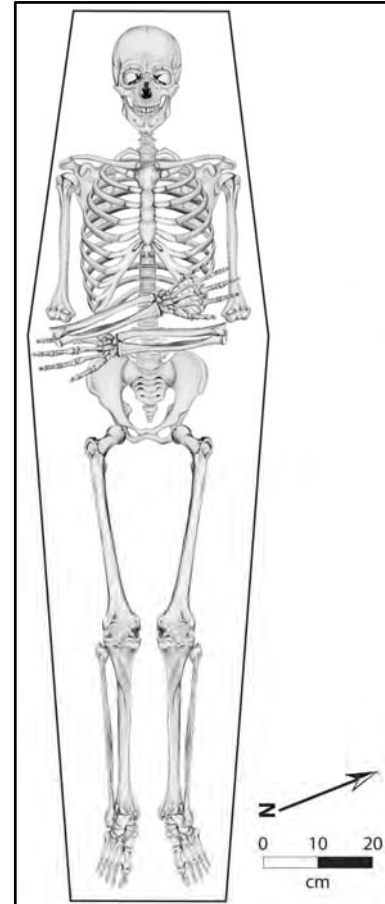
Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 195 cm in length and 48 cm in width, with the head oriented to the northwest. Coffin hardware consisted of nine nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 19-24 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

Pathologies include systemic infection (possible case of Treponematosi) in the form of woven and sclerotic bone deposition on both tibiae, the right fibula, left femur, left clavicle, and the endocranial surface of the left sphenoid. There is also evidence for arthritic changes to the left proximal femur and an unsided acetabular fragment (hip). The femoral head is also misshaped, possibly caused by a hip dislocation (perhaps due to traumatic injury or underlying condition). All of the observable foot bones also show bony changes consistent with arthritis.



No isotopic data are available for this individual.

The dentition is very poorly preserved, indicating at least one tooth lost pre-mortem and a cavernous abscess at the mandibular right first molar. Caries present on mandibular teeth but none are present on maxillary teeth. No other observations can be made due to preservation.

Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 63

This grave shaft measured 3.06 x 1.8 m and contained the remains of six individual burials and a commingled remains of at least five individuals. One single interment (Burial 63E), predated and was truncated by the grave shaft dug for the other five individuals who were lying side by side in a large grave shaft. Two of the burials were oriented southeast and four were oriented northwest.

Burial 63A (Commingled Remains)

Human Skeletal and Dental Remains

Burial 63A consisted of the commingled remains of at least five adult individuals that were recovered from the grave shaft fill above the intact burials. Elements represented included a skull, a scapula, a pelvic bone, two humeri, five left femora, a patella, four right tibiae, five left tibiae, two left fibulae, two right fibulae, and two hand bones. The bones displayed only light brown staining, if any.

The skull displays more black staining on parts of the external and endocranial surfaces. The cortical bone is intact, but displays some flaking, especially on one right femur. The majority of the remains are long bones, however, their epiphyses have all been compromised in the same manner.

Pathologies include arthritic activity on two femora, as well as a Poirer's facet on one femur.

No isotopic data are available for this burial.

The dentition that remains shows evidence of one pre-mortem tooth loss and widely varying wear.

Burial 63B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 186 cm in length and 40 cm in width, with the head oriented to the southeast. Coffin hardware consisted of five complete nails, 30 nail fragments, and a screw. Of the complete nails, two had a pennyweight 5d and three a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle adult male who was 35-50 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

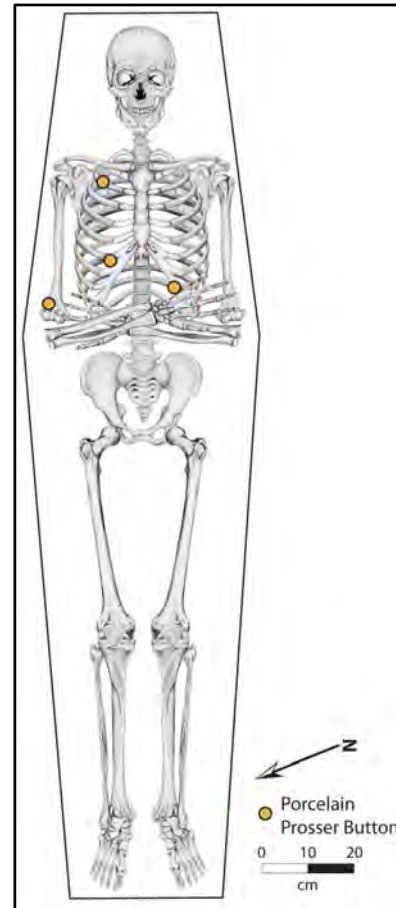
Pathologies include sclerotic bone formation on the mandible and the endocranial surface of the occipital bone. Arthritic activity is also present on the first cervical vertebra (atlas), both distal femora (knees), as well as the right and left tali, left calcaneus and left navicular bones of the ankles.

No isotopic data are available for this individual.

The dentition shows evidence of two teeth lost pre-mortem, with root surface caries and localized horizontal bone loss also present in both the maxilla and mandible. There are three gold fillings and one grey metal filling in the mandible, and one gold filling and one grey metal filling in the maxilla as well.

Clothing, Shrouds, and Personal Artifacts

Of the four Prosser buttons associated with this burial, one was located on the distal portion of the right humerus and one was located near the right shoulder. The other two were found in the lower torso area, one on the right side directly below the one near the right shoulder and the other on the left side. An area of green-stained sediment was noted near the feet. This stain may have been a coffin decorative element.



Burial 63C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 172 cm in length and 18 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 11 complete nails and 40 nail fragments. Of the complete nails, six had a pennyweight of 6d, two of 7d, and three of 8d. This individual had been placed directly over Burial 63D.

Human Skeletal and Dental Remains

This individual is estimated to be a young adult female who was 23-28 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the pelvis.

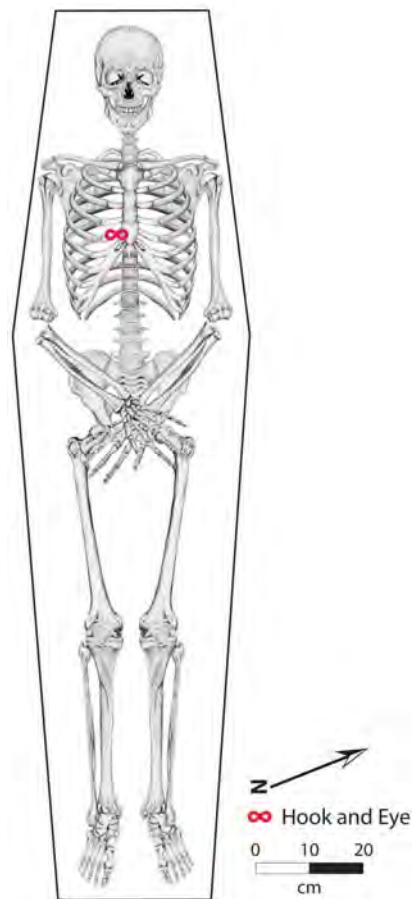
The only pathology noted was arthritic lipping on the distal right femur (knee).

This individual yielded $\Delta^{13}\text{C}$ values of -19.3 and $\Delta^{15}\text{N}$ values of 8.4, suggesting a diet consisting entirely of C_3 plants and no corn-based products, and a moderate amount of meat.

The dentition is in very poor condition with only a few teeth present and fragments of maxilla and mandible being brittle and friable. A single root surface caries is noted on the upper left first molar, and there is a potential abscess and horizontal bone loss at the lower left third molar, but preservation is too poor to tell definitively.

Clothing, Shrouds, and Personal Artifacts

A single hook and eye pair was found near the sternum. It may have been associated with a blouse.



Burial 63D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 186 cm in length and approximately 35 cm in width, with the head oriented to the northwest. Coffin hardware consisted of five complete nails and 23 nail fragments. Of the complete nails, three had a pennyweight 6d and two a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 40-60 years old when he died. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed across the pelvis and the right arm along the side of the body.

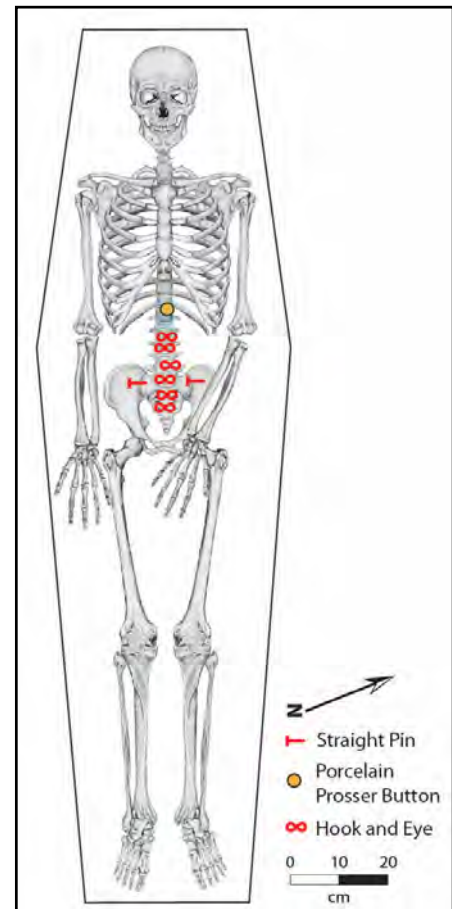
Pathologies include arthritic activity on the left glenoid fossa and proximal humerus (shoulder), the left fovea capitis of the femur (hip) as well as the right distal tibia, talus, and calcaneus of the ankle. Schmorl's nodes were also present on two thoracic vertebrae and one lumbar vertebra, likely resulting from herniated intervertebral disks due to forces exerted on the spine during axial loading.

No isotopic data are available for this individual.

The dentition is poorly preserved but shows evidence of root surface caries on all anterior teeth, likely due to vertical loss of buccal alveolar bone. There is evidence of at least five occlusal or interstitial caries in the mandible and 6 in the maxilla.

Clothing, Shrouds, and Personal Artifacts

A single Prosser button was found in the abdomen area just below the rib cage. A series of at least eight hooks and six eyes extended from the Prosser button towards the pelvis. Two straight pins also were found in the pelvic area. The button may have been associated with an undergarment, and the hook and eye fasteners a pants fly. The pins may have been used to pin clothing.



Burial 63E - Truncated

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin measuring 178 cm in length and approximately 40 cm in width, with the head oriented to the northwest. Coffin hardware consists of seven complete nails and 10 nail fragments. Of the complete nails, five had a pennyweight of 6d and two were pennyweight of 8d. This individual appears to have been placed directly over Burial 63F, and was truncated by Burials 63C and 63D.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult female who was 55-70 years old when she died. The remains were too fragmentary to derive a stature estimate. The left arm was along the side of the body and the lower right arm across the chest.

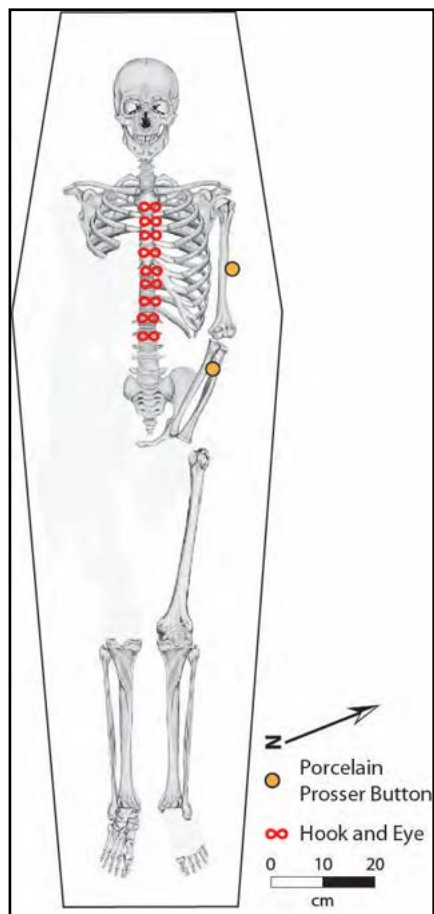
Pathologies include arthritic activity on the left and right acetabula and the left fovea capitis of the femur (hips), as well as the left and right tarsal bones of the ankles.

This individual yielded $\Delta^{13}\text{C}$ values of -18.4 and $\Delta^{15}\text{N}$ values of 9.3, suggesting a diet consisting entirely of C_3 plants and no corn-based products, and a moderate amount of meat.

The dentition is poorly preserved with all but two teeth recovered loose and in very brittle condition. At least two teeth were lost pre-mortem with alveolar resorption, and root surface caries are present on all remaining teeth.

Clothing, Shrouds, and Personal Artifacts

The 11 hooks and 10 eyes associated with this burial were located along the back of her spine. They were probably associated with a dress. Other clothing related items were the two Prosser buttons that were located along the arm.



Burial 63F

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 183 cm in length and 46 cm in width, with the head oriented to the southeast. Coffin hardware consisted of 43 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 53-68 years old when he died and stood 160.5 ± 7.4 cm (63.2 ± 2.9 "") tall. Both lower arms were placed across the chest.

Pathologies include arthritic activity on the left and right glenoid fossae and left humeral head (shoulders), the proximal left ulna (elbow), the left acetabulum (hip), and right distal femur at the intercondylar notch (knee). There is enthesophyte formation present on both right and left hand phalanges (fingers), which is often associated with regularly working with one's hands (e.g. gripping objects) (Capasso et al. 1998:94).

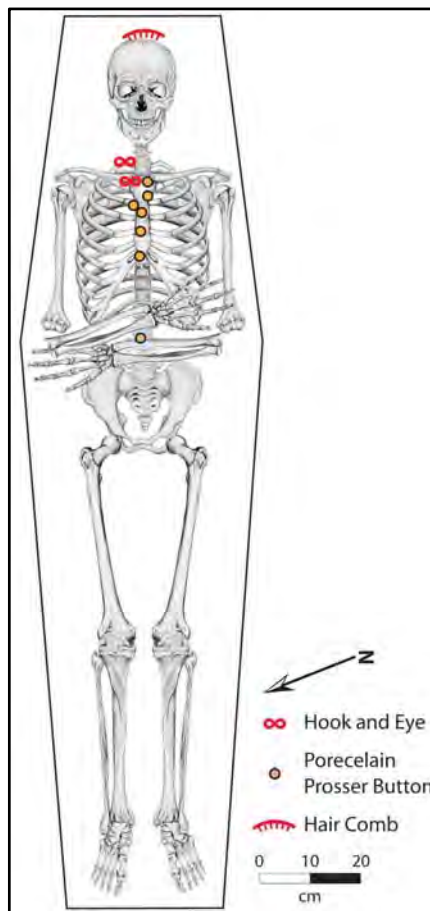
This individual yielded $\Delta^{13}\text{C}$ values of -18.6 and $\Delta^{15}\text{N}$ values of 10.3, suggesting a diet consisting entirely of C_3 plants and no corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

Clothing related items consisted of seven Prosser buttons, and two hooks. The Prosser buttons were found in a line extending from the neck towards the pelvis. The two hooks were found near the neck. The buttons and may have been associated with a shirt (or dress?) and the hook and eye fasteners a cape

A horn hair comb found in back of the cranium of this burial. It measured 70 mm in width and had at least 48 teeth.



Burial 63G - Truncated

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin with the head oriented to the northwest, but measurements were not possible due to truncation by later burials. Coffin hardware consisted of two complete (pennyweight 12d) nails and 22 nail fragments. This single interment was significantly impacted by Burials 63C and 63D, which effectively removed the entire lower body of this individual.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult female who was 55-80 years old when she died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

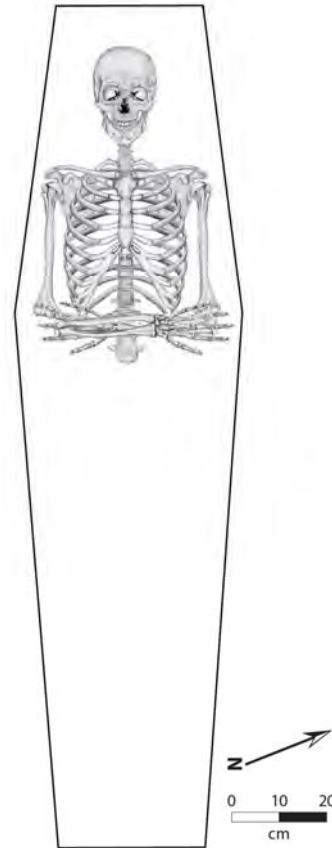
No pathologies were noted.

No isotopic data are available for this individual.

The dentition is in very poor condition, but alveolar bone shows evidence of horizontal bone loss and heavy caries in the maxilla, some of them cavernous lesions that destroyed the entire crown of the teeth in which they formed. Additionally, three periapical abscesses were present at death, and one tooth was lost pre-mortem. No data are available on the mandible.

Clothing, Shrouds, and Personal Artifacts

None



GRAVE SHAFT 64

This grave shaft measured 2.0 x 1.4 m and contained the remains of two individuals lying side by side, and oriented northwest.

Burial 64A

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 170 cm in length and approximately 40 cm in width, with the head oriented to the northwest. Coffin hardware consisted of seven complete nails, 16 nail fragments, and a screw. Of the complete nails, six had a pennyweight of 7d and one a pennyweight of 12d.

Human Skeletal and Dental Remains

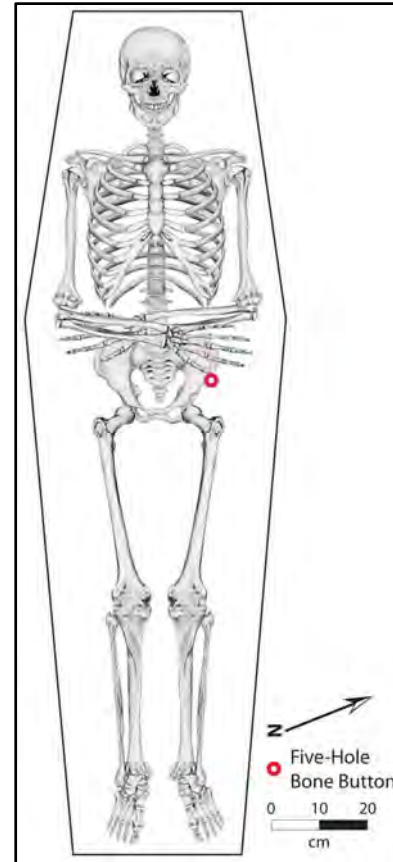
This individual is estimated to be a young-to-middle adult male who was 22-37 years old when he died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed with the hands across the chest.

Pathologies include active and healing infection throughout the skeleton in the form of woven and sclerotic bone deposition (possible case of Treponematosi). The affected bones include the mandible, radii and ulnae (forearm), pelvis, right metacarpal (hand), femora, tibiae and left fibula (leg). Schmorl's nodes were observed on multiple cervical vertebrae (including C2) of the neck, possibly due to herniated intervertebral disks. There is also porosity on the external table of the frontal bone and in the left eye orbit consistent with inactive porotic hyperostosis and cribra orbitalia, respectively. These porous lesions are likely due to vitamin deficiency (e.g. vitamin B₁₂, vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009).

No isotopic data are available for this individual. The dentition is in very good condition with all teeth present except the mandibular third molars, which are congenitally absent. The maxilla shows crowding and subsequent calculus around the left canine, alveolar bone loss, and root surface caries. Dental wear is minimal to moderate throughout the dental arcade.

Clothing, Shrouds, and Personal Artifacts

A five hole bone button was found beneath the left os coxa of this individual.



Burial 64B

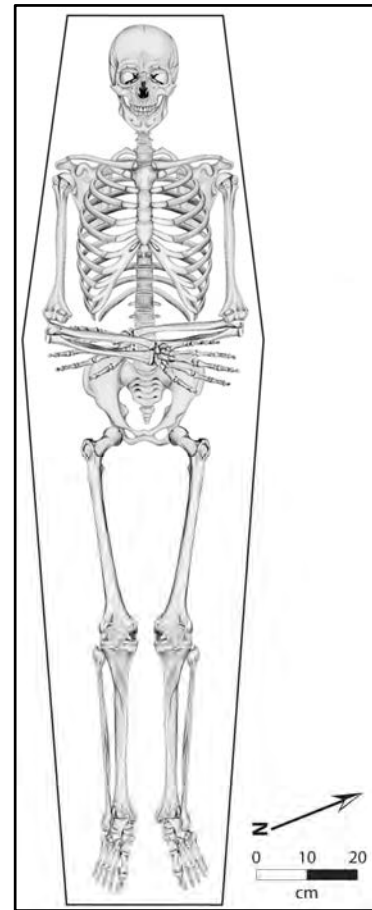
Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of three complete nails and 21 nail fragments. Of the complete nails, two had a pennyweight of 7d and one a pennyweight of 10d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult female who was 37-53 years old when they died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the chest.

Pathologies include extensive sclerotic bone formation throughout the skeleton, including the hard palate of the maxilla, the mandible, two left metacarpals (hand), an unisided ilium (pelvis), as well as both right and left femora, tibiae, and fibulae. Porosity associated with inactive cribra orbitalia was observed for both eye orbits, possibly due to vitamin deficiency (e.g. vitamin B₁₂, vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009). There is also evidence of arthritic activity on the first and second cervical vertebrae of the neck and the right proximal femur (hip).



This individual yielded $\Delta^{13}\text{C}$ values of -15.4 and $\Delta^{15}\text{N}$ values of 9.5, suggesting a diverse diet consisting of mixed C₃ plants and corn-based products, and a moderate amount of meat.

The dentition is in variable states of preservation depending upon the element. Horizontal and vertical bone loss is evident in the maxilla, resulting in root surface caries on many teeth. The right third molar has erupted at an angle towards the cheek, crowding the next tooth and causing it to lose one of its roots. One mandibular tooth has been lost pre-mortem and there is evidence of a periapical abscess, with only very localized alveolar bone loss throughout the jaw. Several of the teeth were chipped during life, with wear patterns indicating that this person ground their teeth back and forth resulting in flat and polished posterior teeth. Caries rate is minimal throughout the dental arcade.

Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 66

This grave shaft measured 3.0 x 2.0 m and contained the remains of seven intact burials (66B-G), one earlier truncated grave (Burial 66H) and the remains of at least four commingled individuals (Burial 66A). Of the intact burials, four were oriented southeast and three were oriented northwest.

Burial 66A (Commingled)

Human Skeletal and Dental Remains

The remains of a least four adult individuals were recovered from the fill of this grave shaft. The majority of the bones display medium to light brown staining. Of the two skulls recovered from the grave shaft fill, Skull 1 is significantly lighter in color (almost white) as a result of cortical bone flaking. This skull displays male cranial features, such as a pronounced nuchal crest, very large mastoid processes, smooth supraorbital margins, a pronounced glabella, and pronounced mental eminence.

Skull 2 displays cranial traits indicating it is probably male based on a pronounced nuchal crest and smooth supraorbital margins. No other features were available. Skull 2 displayed enough sutures to suggest that the individual was likely a middle-to-older adult because of complete closures.

Pathologies include bone deposition on a left patella as well as right and left tibiae. Arthritic activity was noted on a distal right femur (knee) and a left acetabulum (hip). These pathologies are not necessarily all located on bones from same individual.

No isotopic data are available for this burial.

The dentition mostly consists of maxillary fragments from both recovered crania. Skull 1 exhibits congenital third molar absence and two periapical abscesses, with some caries present. Skull 2 is in very poor shape, with only evidence of root surface caries and a large cavernous lesion present on the remaining teeth. There is also a large spall of enamel chipped off a single tooth, but preservation prevents further analysis.

Burial 66B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and approximately 35 cm in width, with the head oriented to the southeast. Coffin hardware consists of two complete nails and 13 nail fragments. Of the complete nails one has a pennyweight of 5d and one a pennyweight of 7d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 50-65 years old when he died. The remains were too fragmentary to derive a stature estimate. Both arms were placed at the side of the body.

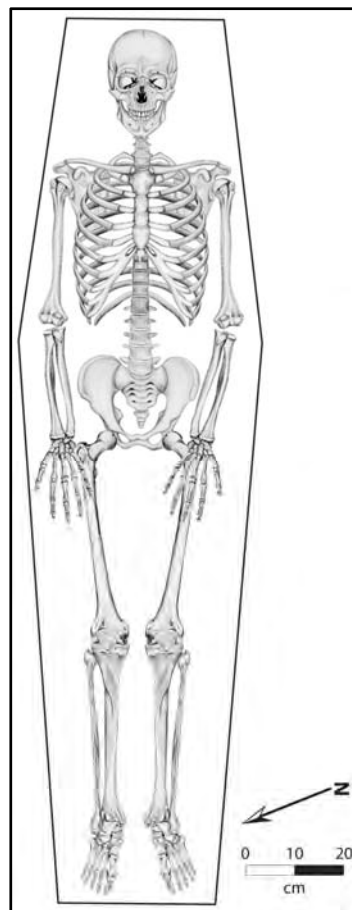
Pathologies include porosity in the left eye orbit consistent with inactive cribra orbitalia, possibly due to vitamin deficiency (e.g. vitamin B₁₂, vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009). Arthritic activity was observed on the right talus and calcaneus of the ankle, right 1st metatarsal of the foot, right 2nd metacarpal (hand) and both right and left carpals of the wrist.

This individual yielded $\Delta^{13}\text{C}$ values of -16.2 and $\Delta^{15}\text{N}$ values of 11.4, suggesting a diverse diet consisting of mixed C₃ plants and corn-based products, and a moderate amount of meat.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None



Burial 66C

Coffin/Casket Remains and Hardware

This individual was buried in a possibly rectangular shaped coffin measuring approximately 175 cm in length and approximately 50 cm in width, with the head oriented to the southeast. Coffin hardware consists of three complete (pennyweight 8d) nails, 27 nail fragments, and a screw.

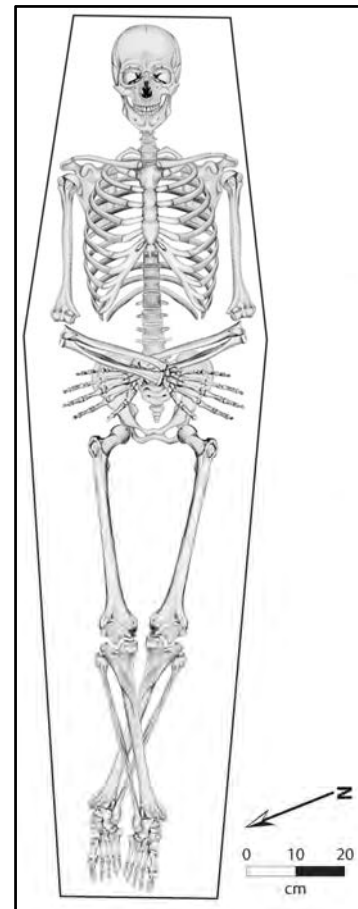
Human Skeletal and Dental Remains

This individual is estimated to be a young adult male who was 25-33 years old when they died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed across the pelvis.

Pathologies include a healed fracture of the distal right fibula (ankle). Arthritic changes were also observed on the proximal and distal joint surfaces of the right femur (hip and knee) as well as the right calcaneus and right metatarsals (MT1, MT3, MT4) of the foot.

No isotopic data are available for this individual.

The dentition is very poorly preserved. There is evidence of moderate to heavy caries throughout the maxilla and mandible, with localized horizontal and vertical bone loss present in the maxilla. There is some chipping of occlusal surfaces on the anterior teeth that occurred during life as well.



Clothing, Shrouds, and Personal Artifacts

None

Burial 66D

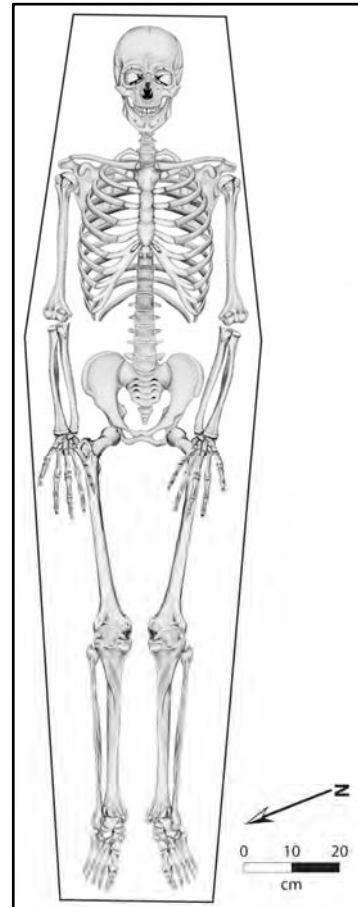
Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 190 cm in length and 50 cm in width, with the head oriented to the southeast. Coffin hardware consists of five complete nails and 42 nails fragments. Of the complete nails, two had a pennyweight of 6d and three a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male 50-65 years old when they died. The remains were too fragmentary to derive a stature estimate. Both arms were placed at the side of the body.

Pathologies include sclerotic bone deposition on the pleural aspect of a right rib (possible respiratory infection) and healing periostitis of right and left hip and leg bones (acetabula, left ischium, left patella, left tibia, and both fibulae). Bone formation consistent with hyperostosis calvaria interna was observed on the right temporal bone. Enthesophyte formation was present on right and left hand phalanges (fingers), which has been attributed to regularly working with one's hands (Capasso et al. 1998:94). Arthritic activity was present on the first and second cervical vertebrae, the proximal right radius and ulna (elbow), distal right ulna (wrist), left patella, and right and left tarsals and metatarsals of the feet.



This individual yielded $\Delta^{13}\text{C}$ values of -16.4 and $\Delta^{15}\text{N}$ values of 11.2, suggesting a diverse diet consisting of mixed C_3 plants and corn-based products, and a moderate amount of meat.

The dentition is poorly preserved, partly due to significant loss of bone density during life. Two maxillary teeth and six mandibular teeth lost pre-mortem with significant horizontal and vertical bone loss throughout the arcade. This bone loss resulted in the remaining teeth to be loose and only minimally rooted in their sockets still. Dental wear is very heavy, and calculus is present on all remaining teeth. Caries are present throughout the arcade as root surface or interstitial lesions.

Clothing, Shrouds, and Personal Artifacts

None

Burial 66E

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 180 cm in length and approximately 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of four complete nails and 32 nail fragments. Of the complete nails, two had a pennyweight of 6d and two a pennyweight of 8d.

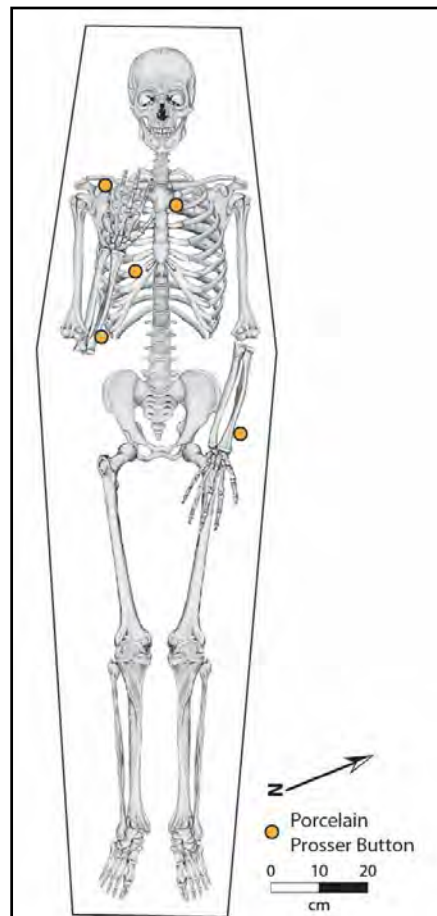
Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult male who was 30-40 years old when they died and stood 172.7 ± 8.2 cm (68 ± 3.2 "") tall. The left arm was placed at the side of the body, and the lower right arm was folded toward the same shoulder.

Pathologies include sclerotic bone deposition on the proximal diaphysis of the left radius (forearm bone) as well as arthritic activity on the second cervical vertebra, the right acetabulum and both femoral heads (hips), right and left distal femora, patellae, and the proximal right tibia (knees), and the distal right tibia and all observable tarsals (ankles).

This individual yielded $\Delta^{13}\text{C}$ values of -14.5 and $\Delta^{15}\text{N}$ values of 10.0, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition shows evidence of only a single tooth lost pre-mortem, but root surface caries throughout the entire arcade, which are likely a result of slight alveolar bone loss. Dental wear is minimal on posterior teeth and moderate on anterior teeth.



Clothing, Shrouds, and Personal Artifacts

Five Prosser buttons were found with this burial. One was found by the right shoulder and one by the right elbow. Another was found adjacent to the left hand. The other two were associated with the upper torso.

Burial 66F

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 200 cm in length and 55 cm in width, with the head oriented to the southeast. Coffin hardware consists of four complete nails and 30 nail fragments. Of the complete nails, one had a pennyweight of 6d and three a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult male who was 30-50 years old when they died. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed across the pelvis, and the right arm across the chest.

Pathologies include enthesophyte formation on a single right hand phalanx, sometimes attributed to regularly working with one's hands (Capasso et al. 1998:94), as well as arthritic activity on the cervical vertebrae of the neck, both proximal femoral heads (hips), and the distal right tibia (ankle).

No isotopic data are available for this individual.

The dentition shows significant evidence of pre-mortem chipping of many of the teeth on both sides. There is a supernumerary lower right first molar between the existing first molar and second premolar that is smaller than normal but exhibits similar morphology. The caries rate is fairly high with over half the teeth present exhibiting root surface lesions. Dental wear is especially heavy on the left side, corresponding to the chipped enamel, suggesting perhaps some abnormal chewing activity on this side.

Clothing, Shrouds, and Personal Artifacts

None

Burial 66G

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 178 cm in length and 44 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 33 nail fragments and a screw.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 45-60 years old when they died. The remains were too fragmentary to derive a stature estimate. Both arms were placed along the side of the body.

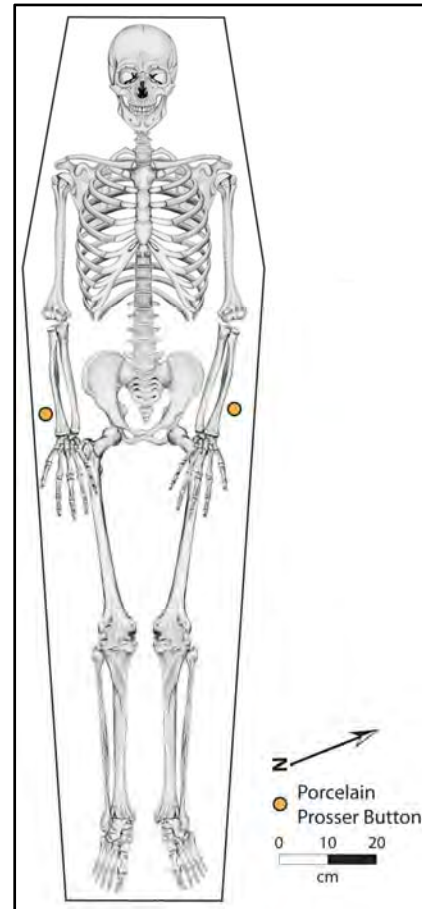
Pathologies include a focal lytic lesion present on the endocranial surface of the right parietal bone, as well as arthritic activity on the right proximal ulna (elbow), the right distal femur (knee), and both left and right tarsals (ankles).

No isotopic data are available for this individual.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

A single Prosser buttons were found at the left and right wrist of this burial, suggesting the presence of a cuffed shirt.



Burial 66H - Truncated

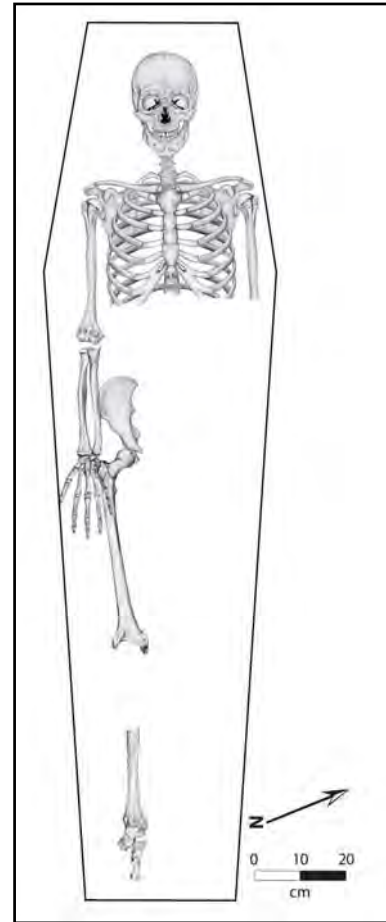
Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 190 cm in length and 45 cm in width, with the head oriented to the northwest. Coffin hardware consisted of two complete nails (a pennyweight of 5d and a pennyweight of 6d) and 26 nail fragments. This single interment predates and was disturbed by the placement of Burials 66B-G in a much larger mass grave.

Human Skeletal and Dental Remains

This individual is estimated to be a young-to-middle adult probable female who was 25-40 years old when they died. The remains were too fragmentary to derive a stature estimate. Both arms were placed at the side of the body.

Overall, this burial was in extremely poor condition, incomplete, and highly fragmentary. Medium brown and black staining was present on the majority of the skeleton and cortical bone was flaking heavily. The only elements represented were the cranium, left and right scapulae, left clavicle, left and right humeri, right hand, right pelvis, right femur, and right tibia. However, these were highly fragmentary and displayed significant taphonomic damage. No pathologies were noted.



No isotopic data are available for this individual.

The dentition is very poorly preserved with little alveolar bone remaining. What does remain indicates some vertical and horizontal bone loss in both the maxilla and mandible has occurred, resulting in mostly root surface caries. Overall dental wear and caries rate is minimal, with only a few isolated occlusal lesions present on preserved teeth.

Clothing, Shrouds, and Personal Artifacts

None

GRAVE SHAFT 67

This grave shaft measured 2.0 x 2.0 m and contained the remains of four intact graves (67B-E) and the commingled remains of at least six additional individuals (Burial 67A). The intact burials were lying side by side, two were oriented northwest and two were oriented southeast.

Burial 67A (Commingled)

Human Skeletal and Dental Remains

The remains of a least six individuals were recovered from the fill of this grave shaft. All elements were represented. Skulls that yielded features that could be used to estimate age and sex consisted of an adult female; a probable adult male that displayed exaggerated muscle attachments on the occipital and right parietal; a young adult; a probable adult female; an adult; and a possible adult female. These individual crania could not be grouped with other bone fragments with any degree of confidence.

Pathologies include Schmorl's nodes on multiple vertebrae, including two thoracic, one lumbar, and the first sacral vertebra. Arthritic activity was observed on a right humeral head.

No isotopic data are available for this burial.

Dental remains show evidence of varied oral health, with some individuals exhibiting high caries rates and abscesses and relatively healthy dentitions in others.

Burial 67B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 190 cm in length and 55 cm in width, with the head oriented to the northwest. Coffin hardware consisted of 39 nail fragments and a screw.

Human Skeletal and Dental Remains

This individual is estimated to be a middle adult male who was 37-45 years old when they died. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed across the pelvis and the lower right arm across the chest.

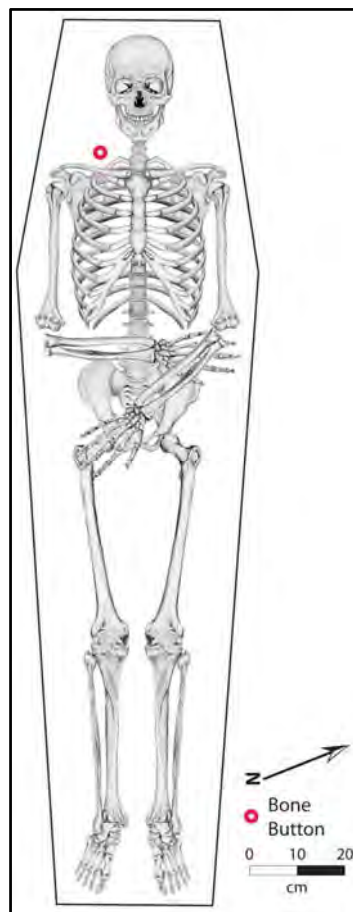
Pathologies include arthritic changes to multiple cervical vertebrae (including C2), most observable thoracic vertebrae, the proximal left ulna and radius (elbow), distal right radius (wrist), right and left metacarpals (hand), and the right and left proximal femora (hips). There is a small area of enthesophyte formation on the posterior aspect of the right proximal tibia, likely an exaggerated muscle attachment site.

This individual yielded $\Delta^{13}\text{C}$ values of -13.4 and $\Delta^{15}\text{N}$ values of 10.7, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is poorly preserved, especially the roots of the remaining teeth. The mandible shows minimal caries and moderate calculus, with moderate to heavy wear. The maxilla shows evidence of alveolar bone loss with most remaining teeth being loose in their sockets with roots exposed and containing root surface caries. There is a periapical abscess at the upper left first molar, and caries rate is moderate. Dental wear is moderate and there is only evidence of occlusal edge chipping on two maxillary teeth.

Clothing, Shrouds, and Personal Artifacts

A single bone button was found near the neck of this individual. Unfortunately it crumbled during removal, so no information is available on its size or number of holes. It may have been associated with a pull-over shirt.



Burial 67C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 50 cm in width, with the head oriented to the southeast. Coffin hardware consisted of six complete nails and 34 nail fragments. Of the complete nails, three had a pennyweight of 8d and three a pennyweight of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be an older adult male who was 53-68 years old when they died and stood 170 ± 8.2 cm (66.9 ± 3.2 "") tall. The left arm was across the pelvis, and the lower right arm towards the opposite shoulder.

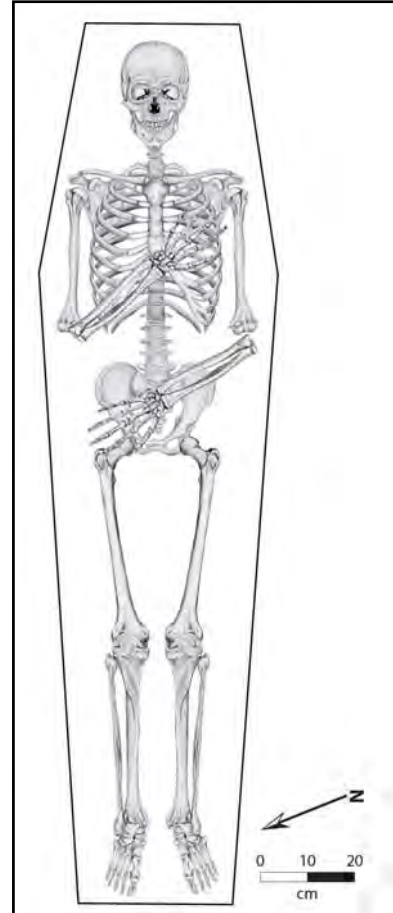
Pathologies include healing or healed periostitis of left temporal bone (adjacent to TMJ) both tibiae, and the left fibula. Schmorl's nodes are present on several unidentified thoracic and lumbar vertebrae, likely as a result of herniated intervertebral disks. Arthritic activity was observed on the left glenoid fossa (shoulder), proximal right ulna (elbow), distal right radius (wrist), left and right ribs, multiple cervical vertebra (including C2), the right acetabulum (hip), as well as most of the observable joint surfaces of the hands, wrists, knees, ankles, and feet. Lastly, there is enthesophyte formation on multiple hand phalanges, which has been attributed to regularly working with one's hands (Capasso et al. 1998:94).

No isotopic data are available for this individual.

The dentition shows evidence of 4 maxillary teeth lost pre-mortem with extensive alveolar bone loss throughout the arcade. The mandible shows that 2 teeth were lost pre-mortem and several massive caries. There are root surface caries on all teeth present in the dentition with moderate calculus evident. Dental wear is heavy on the anterior teeth and moderate on the posterior teeth, with only slight chipping present on the upper left incisors.

Clothing, Shrouds, and Personal Artifacts

None



Burial 67D

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 190 cm in length and approximately 45 cm in width, with the head oriented to the southeast. Coffin hardware consisted of two (pennyweight 8d) nails and 28 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 45-55 years old when they died. The remains were too fragmentary to derive a stature estimate. The lower left arm was across the chest and the lower right arm was placed towards the opposite shoulder.

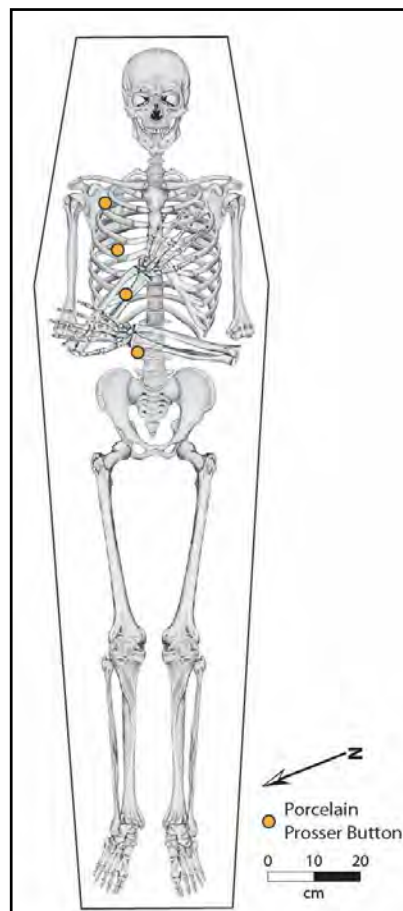
Pathologies include bone formation on the endocranial surface of the frontal bone consistent with hyperostosis calvaria (or frontalis) interna. There is also a large myostitis ossificans located on the lateral aspect of the right femoral midshaft, likely due to traumatic injury such as a blow to the thigh. Arthritic activity was observed on multiple cervical vertebrae (including C2), the left acetabulum and left femoral head (hip), right patella, right proximal tibia (knee), as well as the right distal tibia and right tarsals (ankle).

This individual yielded $\Delta^{13}\text{C}$ values of -14.8 and $\Delta^{15}\text{N}$ values of 10.1, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is very poorly preserved, limiting the data recovered. Root surface caries are present, and dental wear is moderate to heavy. Two teeth were lost pre-mortem in the mandible and there is some evidence of horizontal and vertical bone loss near the sites of tooth loss in the mandible.

Clothing, Shrouds, and Personal Artifacts

Several Prosser buttons were found this burial. They were found along the right side extending from the shoulder to the lower vertebrae. These buttons may have been associated with a side closing jacket.



Burial 67E

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 185 cm in length and 50 cm in width, with the head oriented to the northwest. Coffin hardware consisted of eight complete nails and 19 nail fragments. Of the complete nails, five have a pennyweight of 5d, two of 8d, and one of 9d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 35-55 years old when they died. The remains were too fragmentary to derive a stature estimate. Both lower arms were folded towards the same shoulder.

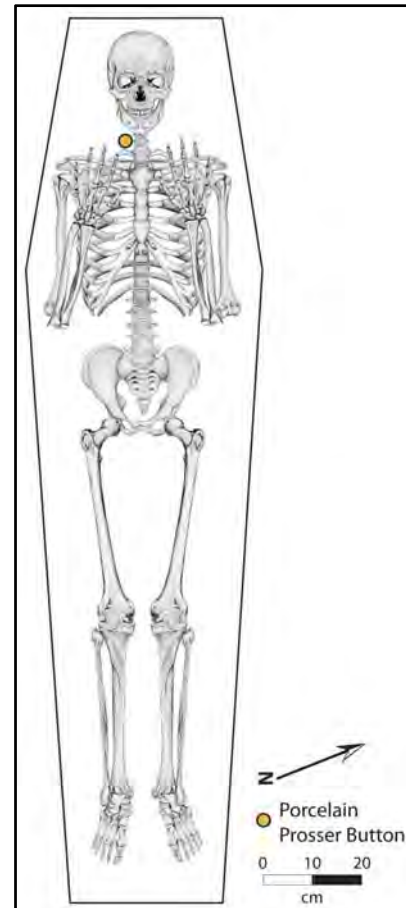
No pathologies were noted.

No isotopic data are available for this individual.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

A single Prosser button was found from near the neck of this individual. It may have been associated with a pull-over shirt.



GRAVE SHAFT 68

This grave shaft measured 3.0 x 1.6 m and contained the remains of eight intact burials (68B-J) and the commingled remains of at least four individuals (Burial 68a). Of the intact burials, four were single interments (Burials 68B-D and 68G) that predated the grave shaft dug for Burials 68E, 68F, 68H, and 68I. The latter were placed side by side in a large grave shaft. Five of the burials were oriented northwest, two were oriented southeast, and the orientation of one burial could not be determined.

Burial 68A (Commingled)

Human Skeletal and Dental Remains

The fill of this grave shaft contained the remains of at least four adult individuals. Elements represented were clavicles and scapulae, mandibles, teeth, cervical vertebrae, a hand phalange, radii, ulna, acetabulums, ilia, patellae, femora, and tibiae. Based on robusticity and gracility, it is estimated that there is at least one male and one female present.

No pathologies were noted.

No isotopic data are available.

Root surface caries and minimal wear were present on some of the recovered teeth.

Burial 68B

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring approximately 175 cm in length and approximately 35 cm in width, with the head oriented to the southeast. Coffin hardware consists of four complete nails and 23 nail fragments. Of the complete nails, one had a pennyweight of 7d and three a pennyweight 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle adult male who was 35-50 years old when they died. The remains were too fragmentary to derive a stature estimate. Both lower arms were placed towards the opposite shoulder.

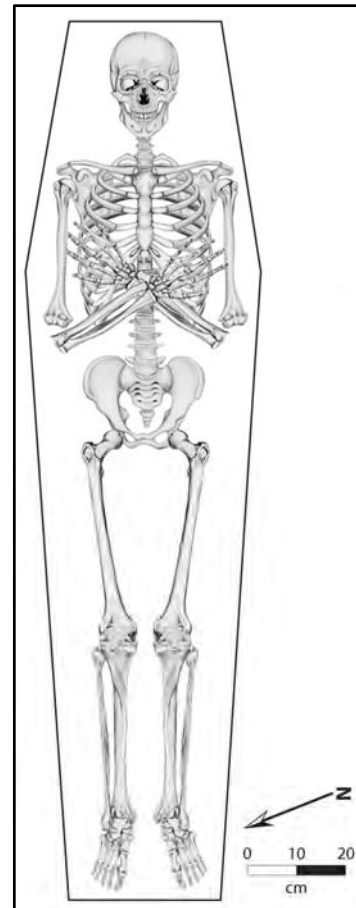
No pathologies were noted.

No isotopic data are available for this individual.

The dentition is very poorly preserved, with no real data discernible from the maxilla. The mandible shows that 3 molars were lost pre-mortem. Dental wear was moderate as was caries rate.

Clothing, Shrouds, and Personal Artifacts

None



Burial 68C

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 180 cm in length and 45 cm in width, with the head oriented to the northwest. A total of 8 complete nails and 68 nail fragments were recovered from this burial. Of the complete nails, 3 were pennyweight 8 and 5 were pennyweight 9. This burial appears to be intrusive upon the original burials placed to the west of 68C, but preservation is so poor that further evaluation is not possible.

Human Skeletal and Dental Remains

This individual is estimated to be an adult male. The remains were too fragmentary to derive a stature estimate. Both arms were missing and placement could not be determined. (Arm placement is for illustrative purposes only.)

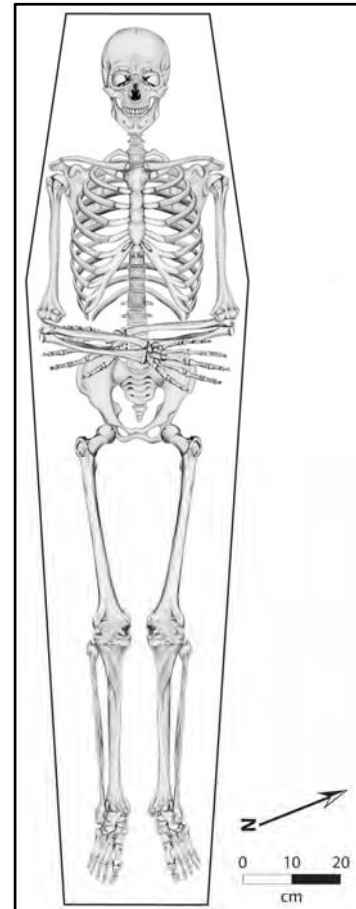
No pathologies were noted.

No isotopic data are available for this individual.

No dental data are available for this individual.

Clothing, Shrouds, and Personal Artifacts

None



Burial 68D

Coffin/Casket Remains and Hardware

Coffin shape, dimensions, and head orientation could not be determined.

Human Skeletal and Dental Remains

This burial is represented by a ring of coffin nails with no skeletal material preserved.

Clothing, Shrouds, and Personal Artifacts

None

Burial 68E - Truncated

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin with the head oriented to the west, however due to poor preservation no dimensions could be determined. Coffin hardware consist of complete (pennyweight 12d) nails and 26 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult of indeterminate sex who was 30-50 years old when they died. The remains were too fragmentary and truncated to derive a stature estimate or determine the placement of the arms.

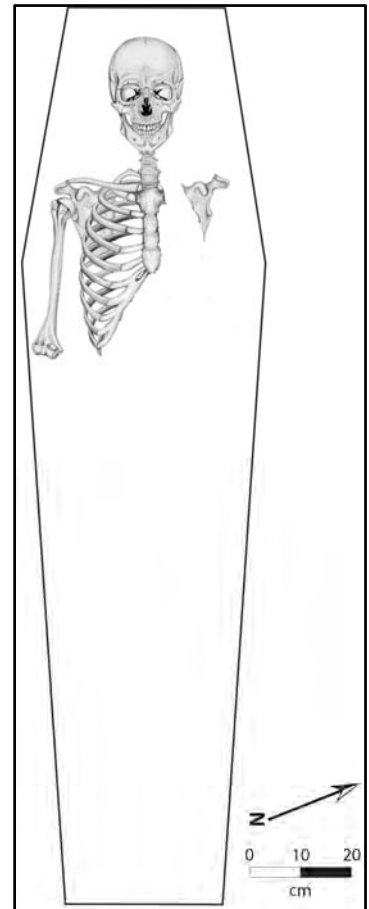
No pathologies were noted.

No isotopic data are available for this individual.

Only two loose teeth were recovered from this burial, both containing caries and moderate wear. No alveolar bone was preserved.

Clothing, Shrouds, and Personal Artifacts

None



Burial 68F - Truncated

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin with the head oriented to the west, however due to poor preservation no dimensions could be determined. Coffin hardware consisted of two complete (one pennyweight 8d and one pennyweight 12d) nails and 19 nail fragments.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult possibly male who was 40-70 years old when they died. The remains were too fragmentary and truncated to derive a stature estimate or arm placement.

Pathologies include porosity in the left eye orbit consistent with inactive cribra orbitalia, possibly due to vitamin deficiency (e.g. vitamin B₁₂, vitamin C) or parasitic infection during infancy or early childhood (Walker et al. 2009). Arthritic activity was observed on the right glenoid fossa (shoulder).

No isotopic data are available for this individual.

The dentition shows evidence of moderate to high caries rate, with multiple cavernous lesions and root surface caries throughout the arcade. Seven teeth were lost pre-mortem, and there were potentially two abscesses that healed prior to death on the maxilla. Dental wear was heavy on the anterior teeth and moderate on the posterior teeth.



Clothing, Shrouds, and Personal Artifacts

None

Burial 68G

Coffin/Casket Remains and Hardware

This individual was buried in a hexagonal shaped coffin measuring 190 cm in length and 50 cm in width, with the head oriented to the southeast. Coffin hardware consisted of four complete nails and 31 nail fragments. Of the complete nails, two had a pennyweight of 5d and two a pennyweight of 8d.

Human Skeletal and Dental Remains

This individual is estimated to be a middle-to-older adult male who was 43-53 years old when they died. The remains were too fragmentary to derive a stature estimate. The lower left arm was placed at the side of the body, and the lower right arm across the pelvis.

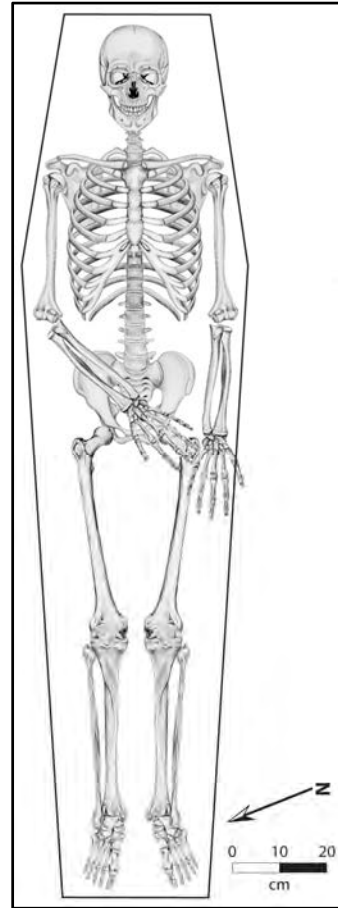
No pathologies were noted.

This individual yielded $\Delta^{13}\text{C}$ values of -12.4 and $\Delta^{15}\text{N}$ values of 10.0, suggesting a diet consisting of minimal C_3 plants and high consumption of corn-based products, and a moderate amount of meat.

The dentition is very poorly preserved, with only the left side of the dentition recovered. The alveolar bone appears healthy with no horizontal or vertical bone loss, and minimal calculus deposition present. Dental wear is moderate on anterior teeth and minimal on posterior teeth, with caries rate being moderate and mostly in the form of root surface caries.

Clothing, Shrouds, and Personal Artifacts

None



Burial 68H - Truncated

Coffin/Casket Remains and Hardware

This individual was buried in a possibly hexagonal shaped coffin with the head oriented west, however due to poor preservation no dimensions could be determined. Coffin hardware consisted of four complete (pennyweight 6d) nails and 10 nail fragments.

Human Skeletal and Dental Remains

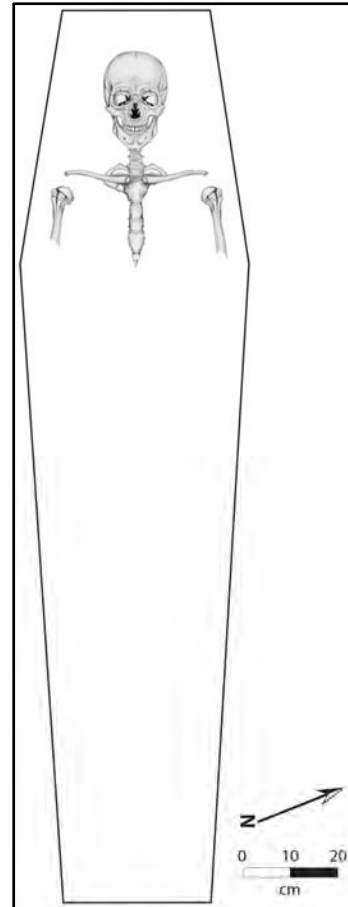
This individual is estimated to be a juvenile probable male who was 17-21 years old when they died. The remains were too fragmentary and truncated to derive a stature estimate or determine arm placement.

The only elements present are the skull, atlas (C1), an unidentified thoracic vertebra, and the right clavicle and fragments of the right arm.

No pathologies were noted.

No isotopic data are available for this individual.

The dentition is very poorly preserved. Caries rate appears to have been low, with only root surface caries present on some teeth. Dental wear was minimal throughout with moderate calculus deposition. Alveolar bone appears healthy and no apparent tooth loss or abscesses prior to death.



Clothing, Shrouds, and Personal Artifacts

None

Burial 68I -Truncated

Coffin/Casket Remains and Hardware

Coffin shape and dimensions could not be determined due to poor preservation. The head was oriented to the northwest. Coffin hardware consisted of five nail fragments.

Human Skeletal and Dental Remains

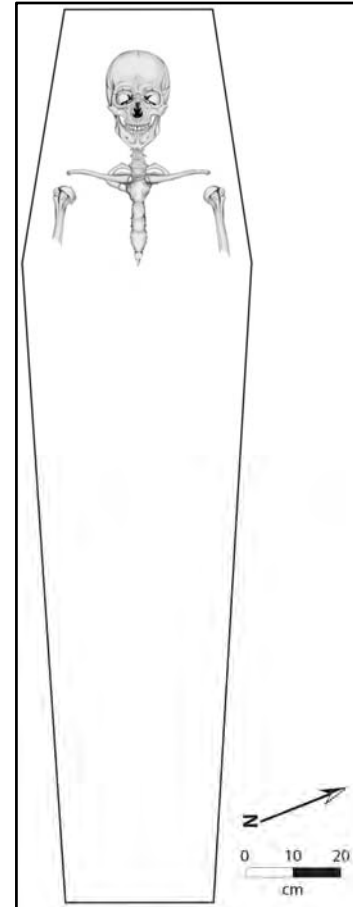
This individual is estimated to be an adult of indeterminate sex. The remains were too fragmentary to derive a stature estimate or determine arm placement.

The only elements represented were the skull, maxilla, mandible, and the right arm (which was mostly unidentified fragments).

No pathologies were noted.

No isotopic data are available for this individual.

The dentition is very poorly preserved, but caries rate appears to have been low with only root surface caries present. A single tooth was lost pre-mortem, but extensive damage makes this a tentative assessment. The upper right canine had not erupted yet at death, although it is unclear whether it is supernumerary or not. Dental wear appears to have been moderate to heavy, with moderate calculus buildup present.



Clothing, Shrouds, and Personal Artifacts

None

APPENDIX TWO:

Table A2-1. Pathology distribution by burial number.

Burial #	Arthritis	Vert. Path	Schmorl's Nodes	Periostitis	Possible Aneurysms	PH	CO	HCI	Trauma	Activity-MOS	Activity-MSM
12A											
12B											
13	x										
14A											
14B											
15A	x										
15B											
15C	x	x									
15D											
16A											
16B											
17											
18A	x										
18B											
18C	x	x								x	
18D											
18E											
19A											
19B										x	
19C											
19D	x										
19E											
19F	x								x		x
19G	x									x	
20A											
20B	x	x	x								x
21	x										
22	x										
23	x	x	x							x	
24A	x								x		
24B	x									x	
25	x								x	x	
26A											
26B	x			x					x		x
27							x				
28	x	x	x						x	x	x
29A	x	x	x				x		x	x	
29B	x		x						x		
29C	x	x	x							x	x
29D	x		x								x
30	x	x	x							x	
31A	x										
31B	x	x	x								
32	x	x	x	x					x		
33	x	x	x							x	

Burial #	Arthritis	Vert. Path	Schmorl's Nodes	Periostitis	Possible Asynhalis	PH	CO	HCI	Trauma	Activity-MOS	Activity-MSM
34		x	x	x			x		x		
35											
36A	x										
36B											
36C											
36D											
36E											
36F	x										
37A											
37B	x									x	
37C	x			x	x					x	
37D											
37E											
37F	x	x	x								
38A	x		x	x							
38B											
38C											
38D									x		
39A											
39B											
39C	x										
39D											
39E											
39F											
40	x										
41	x									x	
42	x										
43A		x	x								
43B											
44A	x						x				
44B											
45											
46A											
46B		x	x								
47A											
47B											
48		x									
49											
50A	x										
50B	x										
50C				x							
51A				x							
51B							x				
51C											
52A	x			x							
52B	x										
52C	x										
52D											
53A											

Burial #	Arthritis	Vert. Path	Schmorl's Nodes	Periostitis	Possible Spondylitis	PH	CO	HCI	Trauma	Activity-MOS	Activity-MSM
53B	x								x		
53C											
53D											
54	x							x			
55A											
55B										x	
55C				x							
55D				x							
56A				x							
56B	x			x				x	x	x	x
57A				x							
57B				x							
58											
59A											
59B	x								x		
59C				x							
59D	x										
59E											
59F	x			x							
59G	x										
59H											
59I											
59J				x		x					
60A	x										
60B	x			x							
60C	x										
60D	x	x	x								x
60E	x			x				x			x
62	x			x	x				x		
63A	x									x	
63B	x										
63C	x										
63D	x	x	x								
63E	x										
63F	x										x
63G											
64A		x	x	x	x	x	x				
64B	x			x			x				
66A	x			x							
66B	x						x				
66C	x								x		
66D	x			x				x			x
66E	x			x							
66F	x										x
66G	x									x	
66H											
67A	x	x	x							x	
67B	x									x	
67C	x	x	x	x							x

Burial #	Arthritis	Vert. Path	Schmorl's Nodes	Periostitis	Possible Spondylitis	PH	CO	HCl	Trauma	Activity-MOS	Activity-MSM
67D	x			x				x	x		
67E											
68A											
68B											
68C											
68D											
68E											
68F	x						x				
68G											
68H											
68I											