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A Reanalysis of the Osteological and Cultural Remains from Ausmus Burial Cave, Claiborne County, Tennessee (3CE20)

Carole Elizabeth Tucker
University of Tennessee, Knoxville

To the Graduate Council:

I am submitting herewith a thesis written by Carole Elizabeth Tucker entitled "A Reanalysis of the Osteological and Cultural Remains from Ausmus Burial Cave, Claiborne County, Tennessee (3CE20)." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Anthropology.

P. S. Willey, Major Professor

We have read this thesis and recommend its acceptance:

Maria O. Smith, Charles H. Faulkner

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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A REANALYSIS OF THE OSTEOLOGICAL AND CULTURAL REMAINS FROM AUSMUS BURIAL CAVE, CLAIBORNE COUNTY, TENNESSEE (3CE20)

A Thesis
Presented for the
Master of Arts
Degree
The University of Tennessee, Knoxville

Carole Elizabeth Tucker

December 1989

to

my parents

Eldridge L. Tucker

and

Delphine F. Tucker

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ABSTRACT

Few excavations or analyses of remains from burial caves have been published. Those that are reported are frequently cited without considering context of the original excavations and analyses. This consideration is important, because previously collected data would be interpreted differently using modern approaches.

This study is a reanalysis of Ausmus Burial Cave (3CE20), Claiborne County, Tennessee. The site was excavated in the 1930's, and the authors' methodology, conclusion, and conjectures reflect this time. Their hypothesis was that the skeletons represented intruders in the area, they were killed in battle, and their bodies were dropped unceremoniously in the pit cave.

This reanalysis: (1) describes the data more completely and from current perspectives, (2) responds to questions concerning human interment in pit caves, and (3) includes additional skeletal material, discovered in 1975.

It is concluded that at least 25 Late Woodland/Early Mississippian individuals were recovered from 3CE20. They represent both genders and all age groups, except fetal. There is no

statistical difference in age distribution between 3CE20 and other Norris Basin sites of the same time period. The same results are found when 3CE20 individuals are compared to the Late Woodland Hamilton component individuals of Hiwassee Island (42MG31, 46MG31, 47MG31, 73MG31, 78MG31).

Statistically significant differences in gender exist between 3CE20 and a 50:50 ratio. However, this result may be spurious.

The paleopathological analysis reveals that several pathologies were undetected in the original report or were misdiagnosed. These findings are significant and place serious doubt upon the original interpretation.

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CHAPTER I

INTRODUCTION

The archaeological remains from Ausmus Burial Cave (3CE20), Claiborne County, Tennessee, were excavated during the 1934-1935 field season under the direction of William S. Webb. Human skeletal remains and several cultural artifacts were recovered in the original excavation. They were reported in An Archaeological Survey of the Norris Basin in Eastern Tennessee (Webb 1938). This report described all the Norris Basin investigations and proposed interpretations of the excavated materials.

In 1975, the present landowner, Mr. David H. Rogers, reported that several more skeletons had been recovered by a friend and family member. The landowner contacted Mr. Nick Fielder at the Division of Archaeology in Nashville, Tennessee. Fielder visited the site and confirmed that the cave was 3CE20 and he brought the newly recovered human and faunal remains to the University of Tennessee for storage. A few human skeletal remains were also recovered by the author in 1988.

From 1986 through 1989, nine graduate students in anthropology, including the author, were part of the Collections Improvement Project

(NSF-BNS-8606641). This project was formed to review, age, and sex the skeletal remains housed at McClung Museum, University of Tennessee. While reviewing the skeletal remains from 3CE20, a pathology was noted and identified as craniostenosis. The author became interested in this anomaly, and this led to further research concerning the pathology and the site itself. It was noted that this particular pathology was incorrectly identified in the original report; the individuals exhibiting this pathology were identified only as being dolichocephalic or long-headed--the pathology itself was not noted (Funkhouser 1938).

Based on the average cranial index, the sample from 3CE20 was classified as dolichocephalic. Although this index is now considered only descriptive, it was used in the past to classify groups of people (Brothwell 1981). The average cranial index for 3CE20 was 79.99, which classifies the site into a mesocephalic range. This classification led to the conjecture that these individuals were a group of Iroquoian invaders, killed in battle, and their bodies thrown unceremoniously into a pit (Webb 1938). However, the misdiagnosis, places some doubt on this interpretation.

Because Webb (1938) is routinely cited as reporting one of a few burial cave sites (e.g., Clark 1978; Walthall and DeJarnette 1974; Willey and Crothers 1986; Willey et al. 1988) and because his interpretations are in doubt, the remains need to be critically re-evaluated using current technology and knowledge. Therefore, it is obvious that this reanalysis was necessary.

This study reanalyzes the osteological and cultural remains from Ausmus Burial Cave. The purposes for this reanalysis are threefold--first, it describes the data from a current perspective and will make the data and interpretations more congruous with contemporary standards. Second, this reanalysis studies prehistoric human interment in pit caves. Third, the recently recovered material, discovered after the original report was published, is described. This research is significant because "virtually no scientifically documented, detailed excavation or analysis of the remains from a burial cave has ever been published" (Willey et al. 1988:69).

CHAPTER II

CONTEXT OF WEBB'S WORK

Introduction

Critical to a re-evaluation of Webb's interpretations is an assessment of the analytical procedures of 50 years ago. This is an important point to consider when using data and interpretations from earlier studies to support interpretations of similar data.

The Classificatory-Historical Period

In American archaeology, the time when Webb and his associates excavated, analyzed, and interpreted remains from 3CE20 is referred to as the Classificatory-Historical Period (Willey and Sabloff 1974). This period was mostly concerned with culture chronology or the "time-ordering of events" (Willey and Sabloff 1974:88). The primary method of achieving chronological control was with stratigraphic excavation. After this method became standard, the principle of seriation was introduced. Typology and classification, which had been introduced earlier during the Classificatory-Descriptive Period, were used with these new procedures ultimately to establish cultural-historical syntheses. Typology, however, was not limited to cultural remains, but it was also used to categorize skeletal remains. The well-entrenched belief was that there were distinct physical types, which could be discerned using metrics such as the cranial index. The abandonment of the notion of racial types and the associated typological framework is the hallmark of physical anthropology in the latter half of the 20th century.

A similar development in archaeology during this period was culture classification. In the Eastern United States, the Midwestern or McKern Classification System (1939) was popular to organize the data recovered by the federal relief programs.

> "Trait lists" were created that measured cultural similarity in terms of presence or absence of artifact types, cultural manifestations (e.g., burial practices), and other variables (e.g., site location) (Hensley-Martin 1986:5).

The archaeologists who followed this system attempted to improve the methods of analysis by identifying culture types through these traits lists. By following this method, no general syntheses of the descriptive material was generated.

Webb's Theoretical Orientation

William S. Webb published some of the most important works in the eastern United States. He follows the approach typical of the Classificatory-Historical Period by creating trait lists and, through these lists, syntheses of culture. However, apart from the approach being outdated, he has been criticized for several shortcomings by Taylor (1967). These include: (1) he failed to include all the data, (2) he used presence/absence trait lists which he did not quantify or associate with any of the traits of a particular occupational level, and (3) he abandoned his earlier interest in the prehistoric peoples themselves. Taylor (1967) illustrates these points with examples from several of Webb's works. In The Adena People (Webb and Snow 1945), Webb fails to treat in detail many categories of cultural phenomena such as: "detail[s] of houses and house life, foods other than vegetal, textiles and clothing..." (Taylor 1967:74). Basically, he presents the past lifeways of prehistoric peoples with only vague generalities. He includes a presence/absence trait list. Taylor criticizes this list because it does not quantify or associate any of the traits with a particular occupational level. In relation to burial customs, Taylor (1967:74) comments:

> Neither is the list applicable to studies of customs: for one thing, there is no way to identify the sex of burials except rarely and incidentally, and thus to learn what materials were buried with adults of what sex. There is some indication that children and infants were accompanied more often than adults with cultural objects (Webb and Haag, 1939, p.13; Webb and DeJarnette, 1942m e.g., sites Lu[067], pp. 186ff, site Ct[027], pp. 239ff), but this investigation has not been pursured, apparently because Webb is more interested in the typology of adult burial and its stratigraphic and comparative significance than in the totality of the burial customs of the...people.

Hensley-Martin (1986) also notes problems with Webb's reports in her thesis concerning a reanalysis of the lithic industry from the Read Shell Midden (15Bt10). This site was originally analyzed and published by Webb (1950), and various problems made the data incompatible with today's techniques and methodologies. Hensley-Martin (1986:3) states:

> [T]he artifact analysis carried out by Webb and his associates was brief, but more importantly there was no explicit discussion as to how artifacts were assigned to categories, nor why these categories were important in understanding the prehistory of the locale.

While reviewing the original report on Ausmus Burial Cave, this author found comparable problems. Archaeologically, Webb, Funkhouser, and their associates outline specific procedures for excavating mound sites, however, they made no attempt to explain how 3CE20 was surveyed or excavated--not even a map of the cave site is included in the original site report. This information would have established where the remains were located. Webb and his associates state that their excavation began 15 feet from the entrance, because "test pits sunk beyond that point failed to show anything other than a hard-clay deposit" (Webb 1938:179). Again, no coordinates are given to reveal where the test pits were dug. The cultural material was described much as Taylor (1967) criticized. Instead of analyzing the remains, Webb merely identifies the materials without any mention of size or scale of the materials. This is typical of his post-Midwestern-Classification reports (e.g., Webb 1939; Webb and DeJarnette 1942).

In the physical anthropological section of the original report, Funkhouser lists the cranial measurements from 3CE20, as well as all the long bone lengths. Typical of the time period, he uses the cranial measurements to categorize individuals by their cranial index, and he compares these data with another sample from the Mississippi Valley. From a comparison of these indices, the long bone lengths and the type of burial, Funkhouser concluded that "the skeletons of Site No. 20 [3CE20] represent a group of invaders, possibly killed in battle, and their bodies thrown unceremoniously into a pit" (Funkhouser 1938:244). These conclusions are based on the reliability of the physical type the index was measuring. Of course, the typological approach is no longer a viable interpretive framework (e.g., Brothwell 1981; Washburn 1963). But since this site is referenced in recent literature, (Clark 1978; Walthall and DeJarnette 1974; Willey and Crothers 1986; Willey et al. 1988), it is important to retest the intruder hypothesis using more objective criteria.

CHAPTER III

CAVES IN THE MIDSOUTH

Cultural and osteological materials in caves indicate the use of caves and further our knowledge of past lifeways (e.g., Bailey 1918; Barr 1972; Clark 1978; Crothers 1987; Faulkner, ed. 1986; Haskins 1986; Jones 1876; Moneymaker 1929; Robbins et al. 1981; Shetrone 1928; Walthall and DeJarnette 1974; Watson 1969; Watson, ed. 1974; Webb 1938; Webb and Wilder 1951; Willey et al. 1988; Willey and Crothers 1986).

Watson (1986) identifies four archaeological functions of cave sites. These are: footprint caves, prehistoric mine and quarry caves, ceremonial caves, and mortuary pits and caves. Footprint caves are those that were explored by prehistoric people as indicated by footprints in the mud and torch remains on the walls, such as in Jaguar Cave, Tennessee (Robbins et al. 1981). Prehistoric mine and quarry caves were used for lithic resources. The Mammoth Cave system in Kentucky (Watson 1969; Watson, ed. 1974), and Big Bone Cave in Tennessee (Crothers 1987) are examples of mine and quarry caves. Ceremonial caves, such as Mud Glyph Cave (Faulkner, ed. 1986), were used by prehistoric people for ritual purposes. Mortuary pits and caves were used to inter the dead and include horizontal as well as vertical caves (e.g., Bailey 1918; Clark 1978; Jones 1876; Walthall and DeJarnette 1974; Oakley 1971; Webb 1938). Cave burials usually are not associated with any occupational debris and the dead are interred deep within the cavern or dropped into pits.

Two areas in the Midsouth where caves were used most extensively as funerary chambers are the Middle Woodland Copena burial caves centered in northern Alabama (Walthall and DeJarnette 1974) and the late prehistoric pit caves of southwest Virginia (Clark 1978; Willey and Crothers 1986; Willey et al. 1988).

The pit caves of southwest Virginia are very similar to the Copena cave complex because mortuary artifacts accompanied both types of caves (Willey et al. 1988). However, there is one major difference. All of the Virginia caves have a vertical entrance. Generally, these caves are small with a vertical entrance between 8 and 200 feet (Clark 1978). The remains appear to have been dropped in the cave from the surface (Willey and Crothers 1986). Ausmus Burial Cave resembles the pit caves in the southwest Virginia area, rather than the Copena cave complex (Willey and Crothers 1988).

CHAPTER IV

CONTEXT OF AUSMUS BURIAL CAVE

Introduction

Archaeological Work in the Norris Basin

A major objective of the Tennessee Valley Authority, created in 1933, was the construction of dams on the Tennessee River and its tributaries for flood control and generating hydroelectric power. It was apparent that with this construction many valuable archaeological sites would be flooded and lost.

A reservoir was proposed for the Norris Basin. Therefore, it was deemed necessary to survey it. Archaelogical work began in 1934 under the direction of William S. Webb. Eight field party supervisors were chosen with T.M.N. Lewis as district supervisor, and the University of Tennessee was selected to store the excavated material and records. Labor was provided by the Works Progress Administration, the Civil Works Administration, and the Federal Emergency Relief Administration (Webb 1938; Chapman 1988). They excavated 23 prehistoric sites (Webb 1938:2).

Construction began on Norris Dam in 1933. It is located on the Clinch River, about 80 miles above the point where the Tennessee River flows into the Clinch River and 7 miles below where the Powell River flows into the Clinch River (Webb 1938:2-3). This dam created Norris Lake by flooding the Clinch River for 72 miles and the Powell River for 56 miles (Webb 1938). Webb reports that:

> the area thus flooded, under the 1,020-foot contour following the Clinch River and its tributaries, constitutes the Norris Basin. This basin lies in Anderson, Campbell, Union, and Claiborne Counties, Tenn. (Webb 1938:3).

Ausmus Cave Location

Ausmus Burial Cave (3CE20) is located on the David H. Rogers farm, formerly the John H. Ausmus farm, in Claiborne County, Tennessee (see Figure 1). Webb states that:

> [T]he farm is on the south side of [old] Tennessee Highway No. 63, from La Follette to Middlesboro, and some 16 miles northeast of La Follette. The site is on the southside of Davis Creek in a large northward bend of this creek. Within this bend there is a plateau sloping gently to the creek in all directions (1938:83).

The Ausmus Farm Mounds (3CE10) were located on the highest portion of the plateau. However, excavation of the mounds and continued plowing of the land for the past 50 years, have left little trace of the mounds. With help from the present landowner, the

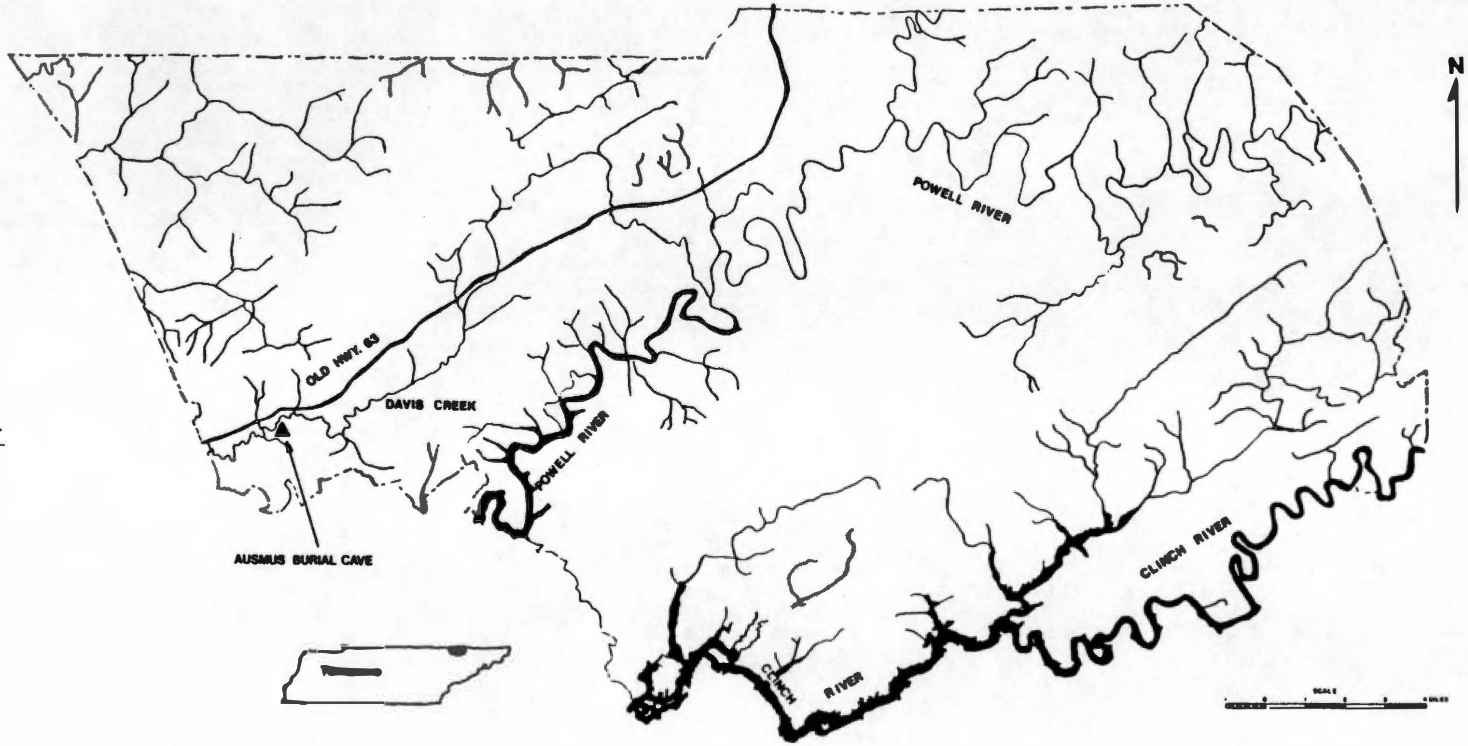

Figure 1. Location of Ausmus Burial Cave, Claiborne County, Tennessee.

remains of the mounds were located by the author, and as Webb (1938) reports, the cave is 0.5 miles south of this area. This description (Figure 1) locates the cavern in the Well Spring Quadrangle (TVA-USGS, Well Spring, Tenn., Well Spring Quadrangle, Revised 1980) at latitude 36o 25' 84" and longitude 83o 54' 50".

Claiborne County lies in East Tennessee which is divided into two physiographic provinces: the Appalachian Mountains and the Appalachian Valley Province (Fenneman 1938; Moneymaker 1948). 3CE20 is located at the northwest edge of the Appalachian Valley Province that extends from Virginia to Alabama (Barr 1972; Webb 1938).

Environment

The Appalachian Valley Province increases in altitude from less than 500 feet in Alabama, to nearly 900 feet near Chattanooga to 2,000 feet at the border of Tennessee and Virginia. It reaches its highest peak, 2,600-2,700 feet, between the New and Tennessee rivers (Webb 1938).

Major streams of the province include the Powell and Clinch rivers, that flow into the Tennessee River. The streams decrease from an elevation of

900-1,100 feet at the border of the valley "to 780 feet at Blacks Ford on the Clinch" (Webb 1938: 4). Along these streams, the valleys stand at an altitude of 900-1,100 feet. The ridges protrude 100-500 feet above the valleys.

Geologically, the Appalachian Valley Province can be characterized by "unaltered but highly deformed sedimentary rocks" (Moneymaker 1941:76). The formations were developed by the end of the Paleozoic era, 225-280 million years ago and include calcareous rocks such as: limestone, dolomite, as well as shales, sandstones and arenaceous shales (Fenneman 1938; Moneymaker 1941). Tangential pressure, originating in the southeast, disturbed the horizontal position of the formations and produced the folds, "which are almost universally overturned with faults occurring on the northwest side of the anticline" (Webb 1938:4).

The ridges and valleys were formed by diastrophic and erosional events, which included flooding by marine waters (Webb 1938). This pattern of flooding helped to develop the various sedimentary layers from which the formations were made.

The Appalachian Mountain chain was formed by the end of the Paleozoic (Fenneman 1938; Webb 1938).

Webb (1938:4) states that:

> Differential erosion has produced the present long ridges and valleys, the ridges being maintained by the more resistant strata, while the valleys are developed on the weaker shales and limestones.

Ausmus Burial Cave is "a small limestone cavern which appears to have originated with a surface sinkhole" (Webb 1938:179). Features commonly called "sinkholes" in Tennessee are also known as "dolines" in geologic terms. Dolines are characteristic of a karst area, which is a certain topography produced by a "solution of a limestone terrain" (Barr 1972:27). Barr states:

> Dolines are funnel-shaped depressions in the surface, the bottoms of which are believed to communicate with subterranean drainage systems through solutionally enlarged vertical joints" (1972:27).

Ausmus Burial Cave indicates is a doline with a penetrable cavern. Caves in the Appalachian Valley Province are characterized by their development in the folded and faulted Ordovician and Carboniferous (Mississippian) limestones (Barr 1972; Trudgill 1985). These types of limestones allow the formation of caves because "the rock itself is nearly impermeable and water is focused along joints, that is to say, the rock is pervious rather than porous" (Trudgill 1985:71). Therefore, caves are formed "as integrated flow networks of water-filled passages in a pervious and soluble bedrock" (Trudgill 1985:71). Initially, during the developmental stage, surface streams exist in valleys and the water table may exist in the interfluve areas (Trudgill 1985). As development proceeds, streams are diverted underground by open fissures, joints, and bedding planes (Trudgill 1985). Moneymaker (1941) revealed through his study that there were many small subriver cavities in the Appalachian Valley Province.

The Appalachian Valley physiographic province is also classified phytogeographically as part of the Oak-Chestnut Forest region (Braun 1950; Shelford 1963). Braun states:

> this region is the center of development of the Oak-Chestnut association, a climax in which chestnut, red oak, chestnut oak, and tulip tree are the most frequent dominants, and of the white oak physiographic climax (1950:35).

There are some inclusions of mixed mesophytic forests due to the region's mountainous characteristics.

Climatically, the region is marked by fluctuating temperatures and high humidity. Precipitation varies from 42 inches to 60 inches depending on the section of the region (Fribourg et al. 1973:5).

Description of Ausmus Burial Cave and Excavation

Ausmus Burial Cave (see Figure 2 and Figure 3) was first investigated by archaeological field crews led by field supervisors, Wendell C. Walker and Charles G. Wilder, during the 1934-1935 field season. The excavated materials from this site and other sites from the Tennessee region are stored in McClung Museum at the University of Tennessee.

The cavern drops 7 feet vertically and then extends horizontally in a westerly direction. Walker and Wilder's exploration of the cave ceased approximately 50 feet from the cave entrance because the passage became very narrow (Webb 1938). This description is similar to the description of the present day cave (see Figure 4).

The crew began testing the site by removing rocks, wood, and soil of the entrance talus slope, that had washed through the cave opening. After these materials were removed, it became apparent that there were human skeleton remains (see Figure 5). Excavation began 15 feet from the cave entrance. Test pits beyond this point revealed only a hard-clay deposit.

The skeletal remains of adult males, females, and children were lying in a mass. Skeletal material

Figure 2. Ausmus Burial Cave, 1938. Courtesy of the McClung Museum collection.

Figure 3. Ausmus Burial Cave, 1988.

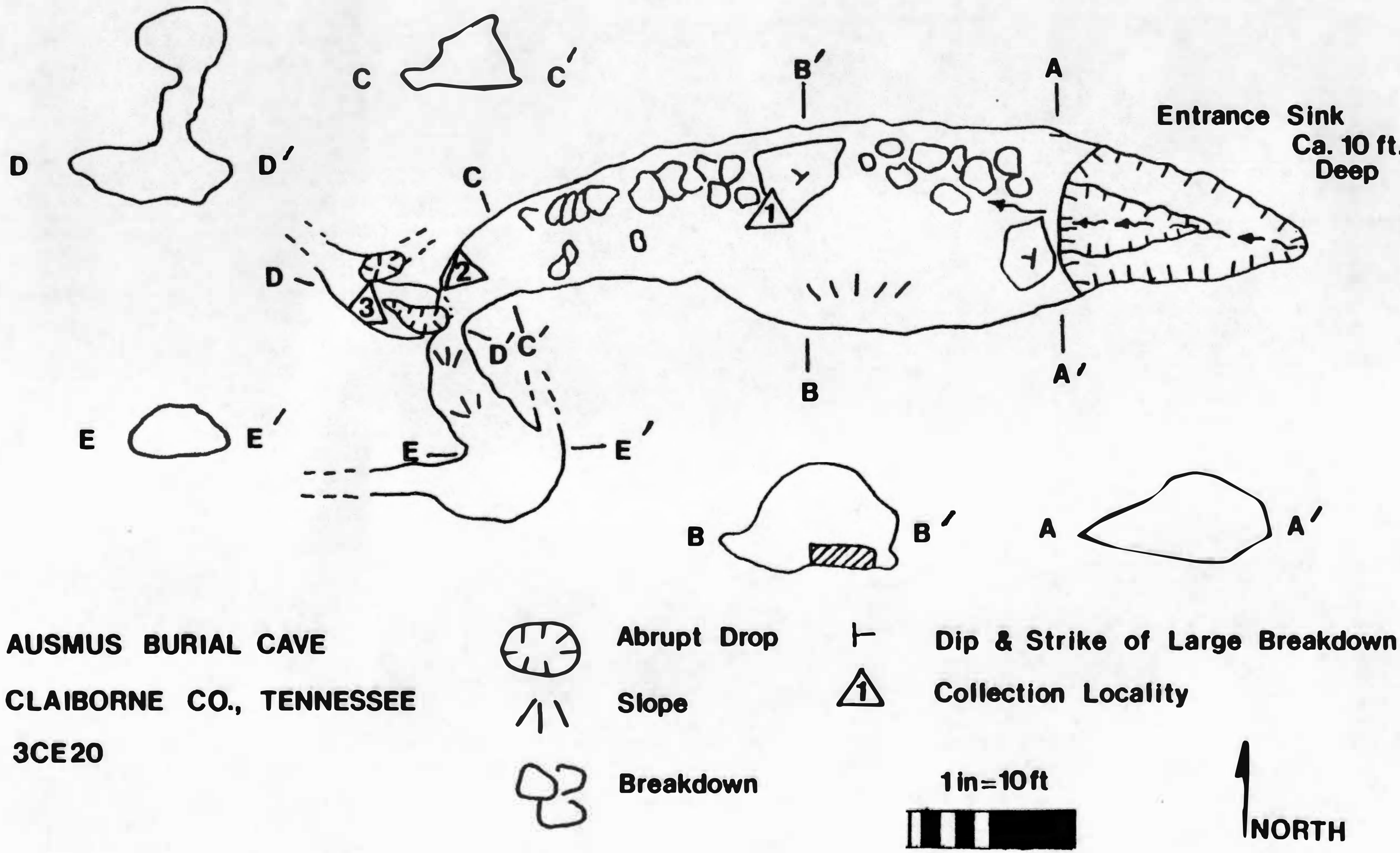

Figure 4. Map of Ausmus Burial Cave.

Figure 5. Skeletal Remains in Ausmus Burial Cave, 1938 (from Webb 1938).

was encountered to a depth of 4 feet. The remains were on the left-hand side of the cave looking toward the entrance. This distribution can be explained because the slope of the cave is from the right to the left side. Therefore, "if the bodies had been tossed in from above all would have rolled toward the left wall of the cave" (Webb 1938:180). This assumption by Webb concerning the tossed bodies will be discussed later.

No skeleton was in complete anatomical order. Yet, it was likely, according to Webb (1938:180), that the corpses had been deposited in the cave rather than bundle reburials or as a secondary burial. This conclusion was based on the occasional discovery of partial post-crania in anatomical order. The skulls were found farther down the slope than the post-cranial remains. This observation led Webb (1938:180) to believe that the bodies were presumably cast into the cave head first, because, "under such conditions, skulls, when detached, would roll to the lowest part of the cavern floor". However, this is mere conjecture. Several reasons can be given to explain why the skulls were found in the lowest part of the cave. For example, as water enters the cave it could have washed the skulls to the lowest section of the cave.

Additional skeletal remains were discovered in 1975. The present landowner, Mr. David H. Rogers, reported that several more skeletons had been recovered by a friend and family member. As stated earlier, the newly recovered human and faunal remains were brought to the University of Tennessee for storage. Scattered human skeletal remains were also recovered by the author in 1988.

CHAPTER V

CULTURAL REMAINS

Introduction

A total of 16 aboriginal artifacts was found in association with the skeletal remains from Ausmus Burial Cave. Although nine of the actual specimens are no longer available for observation and analysis (Chapman 1989, personal communication), a photograph (Webb 1938: Plate 122b) included in the original report was utilized for a general description. There was no scale provided in the photograph to determine the actual size of these artifacts.

The artifacts will be discussed to date the site. This can be problematic because the cave has been reported to have been looted before Webb's excavation (Rogers 1988, personal communication). However, because there are no other remains to identify the time period, the artifacts must be employed.

Descriptions

Modified Bone Shafts

Webb (1938) reported one bone implement with the remains. This implement is 83mm long and 4mm at its widest point. It was possibly made from a bird bone (Chapman 1989, personal communication). It resembles a "kanuga" or a scratcher made from sharp splinters of turkey leg bones. Hudson (1976) reports that similar implements were used to scratch individuals, and they were sharp enough to draw blood. This was part of their ritualistic behavior before participating in recreational activities. The implement is not diagnostic of any particular time period (Chapman 1989, personal communication).

A second bone implement, however, was found among the remains from the 1975 collection. This implement is 60.5mm in length and 16mm at its widest point. The fragmented bone is burned and polished. Longitudinal striations are observed along the length of the bone. Because of its fragmentary nature, its function could not be identified, although uses for modified bone shafts include awls and scrapers.

Discoidals

Two discoidals, one smaller than the other, were found. The larger discoidal is 57mm in diameter and 21.5mm thick. It is made from quartzite. The other discoidal is 27.5mm in diameter and 10mm thick. It is made from limestone. Normally, discoidals were made from pottery, shell, or stone (Lewis and Kneberg 1946). Pottery discoidals were used much like the stone discoidals in the game of "chungke" (Lewis and Kneberg 1946). The shell discoidals were used as ornaments, but could have other uses which can be determined from their context. (Lewis and Kneberg 1946). The size and material of these disks indicate that they were possibly game pieces used in "chungke" (Chapman 1989, personal communication). However, it should be noted that the larger discoidal labeled as an artifact from the cave site, does not resemble the large discoidal in the photograph. Either this artifact was mislabeled or the photographed discoidal was not actually from this site.

Beads

Twelve beads are in the original photograph. There are three large beads and nine small beads. These were found associated with a child's skeleton.

Because the subadult and the beads are assumed to be associated, they will be regarded as a single unit in this study. No other details were given in the original report to identify which of the five subadult skeletons were associated with the beads.

The three larger beads measure 48.5mm, 36mm, and 31mm in length. The larger beads are identified as Olive shells (Parmalee 1989, personal communication). The smaller beads were identified by Webb (1938) as olivella-beads. For purposes of this study, it is assumed that this identification is correct. Olivellas are small marine shells. They are usually around 2 to 6.5cm in length. Several thousand beads have been reported found with a single individual (Lewis and Kneberg 1946). Lewis and Kneberg commented:

> The manner in which these beads lay over the torsos of burials suggests that they had been sewn onto garments....All such instances were confined to child or infant burials (1946:128).

This suggests that the subadult may have been interred clothed.

Conclusions

The artifacts place 3CE20 in the Late Woodland, possibly transitional into the Early Mississippian

(A.D.700-1300). Worked bone is rarely found in a Late Woodland site; it is more frequent in the Mississippian time period (Lewis and Kneberg 1946). Discoidals are characteristic of the Mississippian, but a few have been recovered from Late Woodland sites (Faulkner 1985, personal communication). Olivella-beads are found frequently in Late Woodland sites and are virtually non-existent in Mississippian sites (Lewis and Kneberg 1946).

The olivella-beads are probably the most reliable artifacts to establish a date for the site. There is some doubt that the skeletal remains, the modified bone implements, and the discoidals were associated.

The Ausmus Farm Mounds (3CE10) are only 0.5 miles from 3CE20, and they date from the Late Mississippian (Webb 1938; Chapman 1988), similar to the Dallas component of Hiwassee Island. The discoidals may have fallen into the cave during a game of "chungke" at this much later date. The apparent association with the burials may have been spurious. Doubt is increased when it is considered that discoidals are hardly ever found with burials.

Adair comments:

> The hurling stones they use at present [Creek Indians ca. 1768] were time immemorial rubbed smooth on the rocks, and with prodigious labour; they are kept with the strictest religious care, from one generation to another, and are exempted from being buried with the dead. They belong to the town where they are used, and are carefully preserved (1930:431 cited in Lewis and Kneberg 1946:122).

However, it should be noted that the discoidals pictured are smaller than the hurling stones which Adair and Lewis and Kneberg mention in their reports (Faulkner 1989, personal communication).

Therefore, the olivella beads are the most reliable indicators of a time period. This being the case, a Late Woodland time period can be suggested. However, giving the other artifacts benefit of the doubt, the site will be considered Late Woodland/Early Mississippian.

CHAPTER VI

CONDITION OF THE HUMAN SKELETAL REMAINS

The preservation of the Ausmus Cave skeletons are generally good, however, there are some exceptions. A few elements exhibit root marking, travertine coating, surface area flaking, and burning.

One skull, Burial 32-8, exhibits endocranial root marking. This indicates that plant roots were in contact with some of the bones at one time, although the author did not find any evidence of roots in the cave in 1988.

One skull, Burial 32-9, exhibits travertine coating. This coating is most likely from "exposure to calcium carbonate-saturated water for long periods" (Willey et al. 1988:58). This is fairly common for remains from caverns.

Poor preservation, in the form of surface area flaking, is more noticeable on the remains donated in 1975, than on the other remains. This suggests that these elements were subjected to alternate wetting and drying (Willey et al. 1988:58).

Forty-two elements (4.9% of all specimens) show burning.

Baby (1954:2) classified burned bones in three different catagories:

1. Completely incinerated. Fragments range from light to blue-gray to buff and show deep "cracking," diagonal transverse fracturing, and warping.
2. Incomplete incineration (smoked). Fragments are blackened through the incomplete combustion of organic material present in the bone. Frequently, bits of charred periosteum are found adhering to the outer surface.
3. Nonincinerated or "normal bone." These fragments were not affected by the heat, but show some smoking along the edges.

The burned remains from 3CE20 classified according to Baby (1954) (see Table 1).

The only burned bone Funkhouser notes is the occipital region of Skull 32-14. Five other elements from the 1938 collection exhibited some degree of burning, however the largest sample of burned bones (36 elements-86% of all burned specimens) was recovered in 1975.

Funkhouser described the burned area of Skull 32-14 as being badly burned and he could not determine if the burning took place before interment or more recently. Binford (1972) described the difference between burning fresh and dry bone. He states that dry bone exhibits longitudinal fractures, angular cracking, and no warping. Fresh bones tend to exhibit deep transverse fractures, curvature, and warping. From these descriptions, it is concluded

Table 1. Ausmus Burial Cave Burned Bone.

Bone	Number	Degree
Skull	2	3
Parietal fragments	2	3
Occipital fragments	2	3
Humerus fragments	5	3
Femur fragments	8	3
Fibula fragment	1	3
Clavicular fragment	1	3
Vertebrae	2	1
Innominate fragments	2	3
Patella	1	3
Hand Phalange	1	3
Calcaneous	1	3
Talus	1	3
Indeterminate	13	3
Total	42	

that the burning of Skull 32-14 took place after the bone was dry, and was not part of the interment process.

CHAPTER VII

PALEODEMOGRAPHY OF AUSMUS BURIAL CAVE

Human Skeletal Remains

The skeletal assemblage from Ausmus Burial Cave includes the remains recovered during the original 1938 excavation, the remains donated to the University of Tennessee in 1975, (which included some non-human skeletal remains discussed in Appendix A), and the remains which were surface collected by the author in 1988. Upon examining the materials from 1938 and reviewing the list of measurable long bones (Webb 1938:243), it was concluded that 61 long bones were no longer present in the sample. Attempts to locate the remains were to no avail. These attempts not only included searching McClung Museum, but also corresponding with the University of Kentucky, where the remains had been housed.

A total number of elements was obtained by carefully sorting and siding each bone element and then listing the elements. All fragmentary, as well as complete bones were analyzed to obtain an accurate count (Table 2).

Table 2. Individuals and Elements from Ausmus Burial Cave.

Individual	Elements Present
32-2	Calotte+, face, teeth
32-3	Calotte+, face, mandible, teeth
32-4	Calotte+, left and right zygomatic, left maxilla, mandible, teeth
32-5	Frontal, left and right parietals, left and right temporals, occipital, right zygomatic, right maxilla, mandible, teeth
32-6	Right frontal, complete right parietal, partial left parietal, partial left and right temporals, occipital
32-7	Calotte+, partial right parietal, partial right temporal, partial occipital, teeth
32-8	Frontal, left and right parietals, left and right temporals, fragmented occipital
32-9	Calotte
32-10	Calotte+, frontal, left and right parietals, left and right temporals, occipital, complete face
32-11	Frontal, two parietal fragments
32-12	Calotte+, face, mandible, teeth
32-13	Calotte+, face, mandible, teeth
32-14	Calotte+, face, mandible, partial occipital, teeth
32-15	Frontal, left and right parietals
32-16A	Mandible, teeth
32-16B	Mandible, teeth
32-16C	Mandible, teeth
32-16D	Mandible, teeth
32-16E	Mandible, teeth

Table 2 (continued)

Individual	Elements Present
32-17	Miscellaneous post-crania (combined with burial 25 see Table 6)
18	Calotte+, face, partial maxilla, tooth
19	Calotte+, face
20A	Frontal
20B	Calotte+, frontal, left and right parietals, two burned vertebrae fragments
21	Two occipital fragments, burned parietal fragment, burned long bone fragment, right maxilla, teeth
22	Calotte+, left maxilla, teeth
23	Calotte+, partial face, partial right parietal, partial frontal, maxilla, teeth
24A	Frontal
24B	Mandible, teeth
24C	Mandible, burned parietal fragment, teeth
25	Miscellaneous post-crania (combined with burial 32-17--see Table 6)

Preliminary sorting began by separating adult from subadult bones. Like elements were grouped together and fragmented elements were glued together facilitating the determination of total elements.

The disarticulation of the skeletal remains made it impossible to separate the individual skeletons. However, several crania and some post-crania are in fair to excellent condition and completeness to obtain several measurements, and morphological assessments. The remains were scored following a method developed by Dr. Maria O. Smith (see Table 3).

Demographic Methods

To explain events in past societies, it is necessary to study the demographic aspects of past populations (Owsley and Bass 1979). Paleodemography, or prehistoric demography, allows an investigator to study "information relating to a past human populations's mortality, longevity, fertility, and total population size" (Boyd 1984:57).

Because the skeletal remains are disarticulated, only simple demographic techniques could be utilized. Similar to the approach used by Willey, et al. (1988), it was important to consider the population structure of the Ausmus Burial Cave material. This

Table 3. Scoring Methods.

<u>Subjective Scoring System for Completeness</u>

1. GOOD
   - bone is essentially complete
   - long bones possess both ends
   - any breaks are clean, and repairable
   - what damge there is, is not more than chipping or flaking of the outer table
   - no major features are missing or obscured

2. FAIR
   - one or other end may be missing
   - breaks present, bone may be in several pieces but may not be complete when reconstructed
   - no major pieces missing
   - large area(s) of outer table may be missing from areas of bone
   - details and some features may be obscured

3. POOR
   - bones in pieces, will not reconstruct
   - major elements missing
   - many fragments unidentifiable

<u>Subjective Scoring System for Fragility</u>

1. GOOD
   - outer table intact
   - will withstand handling

2. FAIR
   - outer table friable, it peels, or crumbles
   - withstands gentle handling
   - details and some features obscured or eroded

3. POOR
   - outer table gone
   - crumbles when touched; friable
   - external features very blurred and eroded
   - piece should wear a sign that says "be careful!"

Adapted after : Maria O. Smith, unpublished scoring methods, September, 1986.

was accomplished by determining the minimum number, age, and sex of the individuals. Next, the individuals from 3CE20 were compared with other sites in the Tennessee region to determine if segments of the population were under- or over-represented.

This simple demographic method was chosen rather than the life table approach (Ascadi and Nemeskeri 1970). To determine accurate demographic information from skeletal populations using a life table, there are several factors to be considered. First, it is necessary to have a large sample and then several prerequisites must be met. Ubelaker (1974:5) states that the prerequisites are:

(1) a knowledge of the completeness of the sample;
(2) information about the archaeological associations of the skeletons;
(3) a determination of the length of time the sample represents;
(4) an adequate assessment of sex and age at death;
(5) a proper selection of demographic methodology

Unfortunately, the skeletal remains from Ausmus Burial Cave do not meet the above requirements. With the obvious problems of commingling, small sample size (25 individuals total), compounded with the lack of information concerning the archaeological associations, life table analyses should not be attempted.

Following the method of Willey et al. (1988), a ratio of the number of observed elements is contrasted with the number of expected elements if all the elements of the total number of individuals are present. "For these calculations, left and right sides are combined" (Willey et al. 1988:2). For example, if the total number of individuals is 25, the sample would be expected to contain 50 left and right humeri. But if only 10 humeri were observed in the sample, it could be concluded that only 20% of the total number of humeri were present. Some elements were excluded from this calculation because the total number expected could not be determined.

Minimum Numbers

There are several methods which could be used to obtain a count of total remains (Chaplin 1971). The minimum numbers method was utilized because it is a direct measure of the number of individuals involved (Chaplin 1971:70). No assumptions are used concerning preservation or arbitrary quantities. This method is based on separating the adult and subadult material, "counting the most frequent adult element, and contrasting subadult ages" (Willey, et al. 1988:62).

Aging Techniques

Subadult age estimation was from epiphyseal closure of the long bones, dental eruption, and long bone lengths. Estimation of age by epiphyseal closure is based on methods presented by Krogman (1978). Dental eruption followed the chart by Ubelaker (1989). Long bone lengths were compared to long bone length standards (Ubelaker 1989).

Adult age estimation was based on cranial suture closure according to McKern and Stewart (1957:28-30) and Todd and Lyon (1924:345, 351, 357). Although this is not a reliable aging technique (Ubelaker 1989), it was utilized in conjunction with dental eruption (specifically, third molar eruption) to provide as accurate an age as possible. Post-cranial remains were considered to be adult if the epiphyses were fused (Stewart 1954; Flecker 1932/1933, cited in Krogman 1978).

Sexing Techniques

Sex estimation of the subadults was not attempted. Sex estimation of the adults was based on visual morphological traits of the crania. The post-cranial remains were not considered in this estimation because they could not be associated with any of the crania. The cranial traits included: size of brow ridge (Bass 1971:72), orbital margin morphology (Keen 1950:69-70), shape of chin (Bass 1971:73), and size of mastoid processes (Bass 1971:74).

Age Intervals

The sample was classifed into four age groups, similar to the age groups devised by Lewis and Kneberg (1946). Adults are individuals aged 18 years or older, adolescents are aged 12-17 years, children are considered 3-11 years, and infants are 0.5-2 years. Perinatal deaths were not included as an age interval because this group was not represented in the Hiwassee Island (Lewis and Kneberg 1946) or the Ausmus Burial Cave samples.

Comparative Sample

Webb and Funkhouser believed that the individuals from 3CE20 were different from others in the Norris Basin region. Therefore, to examine whether the 3CE20 age distribution was different from that of other sites in this time period, a comparative sample was formed. Due to the small sample sizes, burials from three Norris Basin sites were pooled. These sites were chosen because: (1) they had a similar geographic location, (2) they had a similar time period, and (3) they were not cave sites. These sites are Taylor Farm Mound (3AN16), Crawford Farm Mounds (6AN21), and Freel Farm Mound (7AN22).

Taylor Farm Mound (3AN16) was in Anderson County, three and one-half miles west of Clinton, Tennessee. The mound is circular, about 30 feet in diameter and 10 feet high. It is on a bluff overlooking the Clinch River (Webb 1938). Constructed as a burial mound, interments were encountered at all levels. However, preservation of these individuals was poor. Nine individuals were utilized.

Crawford Farm Mounds (6AN21) were in Anderson County, Tennessee, near Scarboro. They are a quarter mile north of the Clinch River and opposite Copper

Ridge in a cultivated field (Webb 1938). The larger of the two mounds had been disturbed by local residents, who dug a trench almost to the center of Mound 1.

Webb (1938:180) states:

> Mound No. 1 was 45 feet in diameter and Mound No. 2 was about 35 feet in diameter. The centers of these mounds were about 60 feet apart, Mound No. 2 being southwest of Mound No. 1.

Mound 1 contained 23 burials and Mound 2 contained 19 burials. It appears that the burials from Mound 1 were discarded due to poor preservation and only the 19 individuals from Mound 2 are still available. For purposes of this study, nine individuals were utilized.

Freel Farm Mound (7AN22) was also located near Scarboro, Anderson County, Tennessee. The site is 1,200 feet from the Clinch River in the bottom of a valley (Webb 1938). While the field surrounding the mound was cultivated, the mound itself remained undisturbed. The mound was circular in shape, forty feet in diameter, and eight feet high. Seventeen burials were found, but only 14 individuals could be utilized.

It should be noted that these three sites had only 32 individuals with age determinations. Therefore, another sample was utilized to confirm these results. The Hamilton component of Hiwassee Island was the logical choice because (1) it was a large site, (2) it was located in the East Tennessee region, and (3) it included a Late Woodland component (A.D. 500-1000 A.D.).

Hiwassee Island was located seven miles south of Dayton, Meigs County, Tennessee. It was on the left bank of the Tennessee River at the confluence of the Hiwassee River. The burials from the Hamilton component at Hiwassee Island were classified by their cultural affliations such as point and pottery types. They were buried in cemetery mounds in a flexed or extended position. The 173 skeletons recovered from this component were in a poor state of preservation (Lewis and Kneberg 1946). See Figure 6 and Table 4 for site locations.

The age identification of the 32 pooled individuals was conducted by the Collections Improvement Project members at McClung Museum. The data was accessed through the computer data base. The ages of the Hamilton component remains are reported in Hiwassee Island (Lewis and Kneberg 1946) and were utilized for the comparative sample as they appeared in the report (see Table 5 and Table 6).

To test whether a sex was under- or over-represented, a 50:50 ratio was used.

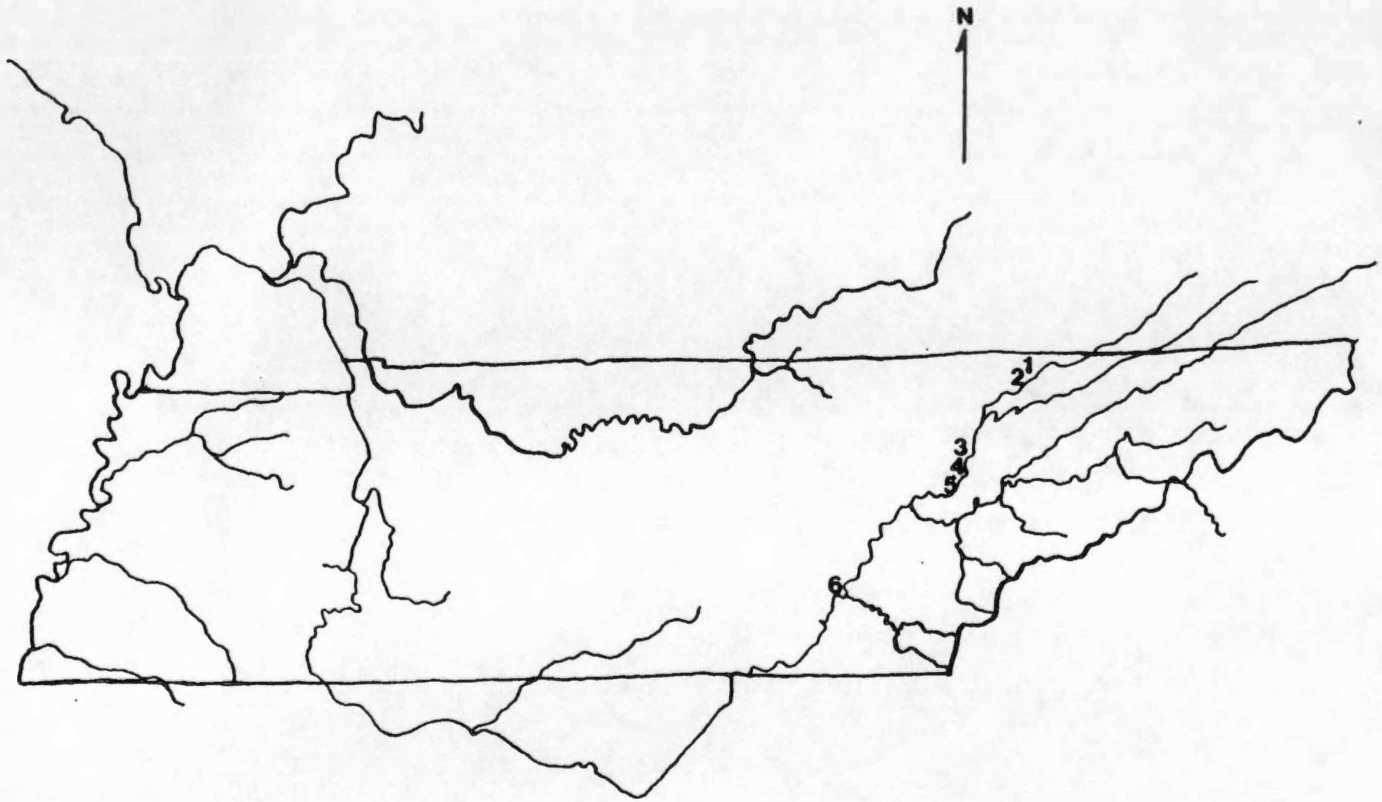

Figure 6. Location of Chosen Sites in Tennessee.
Sites indicated by map number are
identified in Table 4.

Table 4. Location of Sites. Map numbers refer to Figure 6.

Map #	Site Name
1	Ausmus Farm Mounds
2	Ausmus Burial Cave
3	Taylor Farm Mound
4	Crawford Farm Mounds
5	Freel Farm Mound
6	Hiwassee Island

Table 5. Age and Gender of Individuals from 3CE20 and Comparative Samples: 3AN16, 6AN21, and 7AN22.

Site	Burial	Age	Gender
Ausmus Burial Cave 3CE20 (1938)	32-2	Adult	Male
	32-3	Adult	Male
	32-4	Adult	Male
	32-5	Adult	?
	32-6	Adult	Male
	32-7	Adult	Female
	32-8	Adult	?
	32-9	Adult	Female
	32-10	Adult	Male
	32-11	Adult	?
	32-12	Adult	Female
	32-13	Adult	Male
	32-14	Adult	Male
	32-15	Adult	?
	32-16A	Juvenile	?
	32-17B	Child	?
(1975)	18	Adult	Male
	19	Adult	Male
	20A	Infant	?
	20B	Adult	Male
	21	?	?
	22	Adult	Male
	23	Adult	Female
	24A	Infant	?
	25	Child	?
Taylor Farm Mound (3An16)	1	Adult	?
	2	Adult	?
	3	Adult	Male
	4A	Adult	Female
	4B	?	?
	5	?	?
	6	?	?
	7	Adult	?
	8	?	?
	9	?	?
	10	?	?
	11	Adult	?
	12	Adult	Female
	13	?	?
	14	Adult	Male
	15	Adult	Female

Table 5 (continued)

Site	Burial	Age	Gender
Crawford Farm Mounds (6An21)	1	Adult	Male
	2	Adult	?
	3	?	?
	4	Adolescent	?
	5	Adult	?
	6	Adult	?
	7	?	?
	8	?	?
	9	?	?
	10	?	?
	11	?	?
	12	Adult	?
	13	?	?
	14	?	?
	15	Adult	?
	16	?	?
	17	Adult	?
	18	Adult	?
	19	?	?
Freel Farm Mound (7AN22)	1	Adolescent	?
	2+3A	Adult	?
	2+3B	Adult	?
	4	Adult	?
	5	?	?
	6+7	?	?
	8	Juvenile	?
	9	?	?
	10	Adult	?
	11	Adult	?
	12	Adult	?
	13	Adult	Male
	14A	Adult	?
	14C	Child	?
	15	Adult	?
	16	Adult	?
	17	Adult	Male

Table 6. Demography of Hamilton Component Individuals from Hiwassee Island.

Age	Male	Female	?	Number
Infants	-	-	17	17
Children	-	-	22	22
Adolescents	-	-	5	5
Adults	52	19	58	129
Total				173

Statistical Methods

A summary of the statistical techniques utilized in the analysis of the demographic data follows.

Kolmogorov-Smirnov Two-Sample Test. This test was chosen as the most appropriate statistical method for determining whether a particular age group is under- or over-represented. It is also an appropriate test because it applicable to two samples with ordinal data (Thomas 1976). The data from this study conform to these requirements.

First, as in all statistical tests, the null hypothsis is stated that no difference exists between the two samples. Next, the cumulative proportion of individuals in each age interval was calculated for each sample. The Kolmogorov-Smirnov two-sample test compares the differences between the cumulative proportion of each age group. The largest observed difference between the age groups from the two samples is compared to the Kolmogorov-Smirnov critical value table (Thomas 1976: Table A.8(b), p. 505). If the difference is less than the critical value, the null hypothesis is accepted. However, if the difference equals or exceeds the critical value, the null hypothesis is rejected and the alternate hypothesis is accepted. The critical values of the statistic at the 0.05 level can be calculated:

$$1.36\sqrt{\frac{n_1 + n_2}{n_1 n_2}}$$

For statistical comparison, the Ausmus Burial Cave age distribution was tested against the pooled Norris Basin sites using the 0.05 level of significance. Then, to compare the Ausmus Burial Cave sample with the larger region, it was tested against the Hamilton component of Hiwassee Island. It was expected that there would be no difference between the cave site and the other Norris Basin sites, as well as no difference between the cave site and Hiwassee Island.

Binomial Probability. This test was chosen as the most appropriate statistical method for determining whether one sex is under- or over-represented. It requires a simple distribution involving two event classes A and A' (e.g., male and female). "Either event A occurs (a successful outcome) or A does not occur (the outcome is a failure)" (Thomas 1976:142). The probability of event A is p, the probability of failure is denoted by q. The quantity of (p+q) must always equal unity

(Thomas 1976). The data from this study conform to this requirement.

The formula for this experiment is:

$$P(X=4) = C_{(n,r)} q^{(n-r)} p^{r}$$

where C = a numerical coefficient (X!/((n-r)!n!)

p = probabilty of success

q = 1 - p

X = total number of sample

n = number of males represented

r = number of females represented

The null hypothesis for this test is that there is no difference in the sexes represented in the samples. To compensate for gender bias in comparative sites, a 50:50 ratio is used as the comparative sample, with a level of significance at 0.05. Therefore, if P(X=4) is less than 0.05 (the level of significance), the null hypothesis will be rejected. On the other hand, if P(X=4) is greater than 0.05 the null hypothesis will be accepted.

Results

Human Skeletal Elements

A total of 851 human elements (see Table 7) were identified from Ausmus Burial Cave. Almost all elements of the human skeleton are represented. Element counts ranged from 89 metatarsals to 0 hamates. Some of the greatest frequencies of adult bones were hands and feet elements contrasted with some of the long bones which were much lower in frequency (see Table 8).

Minimum Numbers and Age

At least 25 individuals were recovered from Ausmus Burial Cave. This is based on the minimum numbers method of quantifying skeletal remains. The most frequent adult element is the right talus; there are 20 adult right tali. Five subadults are present: one adolescent, two children, and two infants.

The adolescent is represented by a mandible with two permanent mandibular premolars and four mandibular molars erupted. With all permanent second mandibular molars erupted, and the third mandibular molars in the crypt, the age is probably around 12 years.

Table 7. Minimum Number of Elements from Ausmus Burial Cave.

Bone	Left	Indeterminate or Unpaired Bones	Right
Long Bones:			
Humerus	3	6	2
Radius	4	1	4
Ulna	4	-	3
Femur	5	6	5
Tibia	4	1	3
Fibula	3	-	5
Irregular Bones:			
Clavicle	9	-	4
Scapula	6	-	2
Gladiolus		-	
Manubrium		3	
Innominate	4	3	9
Patella	11	-	6
Vertebrae:			
Cervical:			
1		3	
2		8	
3-7		15	
Thoracic:			
1-9		20	
10		1	
11		-	
12		3	
10-11		2	
10-11-12		-	
Lumbar:			
1-5		5	
Indeterminate Vertebrae		4	
Sacrum		2	
Hand Bones:			
Carpals:			
Navicular	2	-	1
Lunate	-	-	2
Triquetral	1	-	-
Pisiform	-	1	-
Greater Multangular	1	-	-
Lesser Mulatangular	-	-	1
Capitate	2	-	-
Hamate	-	-	-

Table 7 (continued)

Bone	Left	Indeterminate or Unpaired Bones	Right
Metacarpals:			
1	8	-	7
2	6	-	11
3	4	-	7
4	6	-	6
5	4	-	8
Indeterminate		1	
Phalanges:			
Proximal 1-5		74	
Middle		9	
Distal 1-5		2	
Foot Bones:			
Tarsals:			
Calcaneous	6	-	6
Talus	18	-	20
Cuboid	3	-	2
Navicular	7	-	4
Cuneiforms:			
1	2	-	2
2	-	-	-
3	-	-	1
Metatarsals:			
1	9	-	16
2	5	-	10
3	8	-	8
4	8	-	7
5	10	-	7
Indeterminate		1	
(Indeterminate Metacarpals or Metatarsals--8)			
Phalanges:			
Proximal:			
1		6	
2-5		15	
Middle		-	
Distal		-	
Ribs:			
1	7	-	4
2-12		31	
Post-cranial Fragments		30	

Table 7 (continued)

Bone	Left	Indeterminate or Unpaired Bones	Right
Skulls		19	
Mandibles		16	
Misc. Crania:			
Temporal		3	
Occipital		3	
Parietal		2	
Maxilla		1	
Frontal		2	
Indeterminate		4	
Teeth		198	

Table 8. Contrast Between Ausmus Burial Cave Specimens Observed and Those Expected.

Element	Number observed	Number expected*	Percent of expected observed
Talus	38	50	76.0
Cranium	19	25	76.0
Mandible	16	25	64.0
Metatarsals	89	250	35.6
Patella	17	50	34.0
Femur	16	50	32.0
Innominate	16	50	32.0
Metacarpals	68	250	27.2
Clavicle	13	50	26.0
Calcaneous	12	50	24.0
Humerus	11	50	22.0
Foot Navicular	11	50	22.0
Radius	9	50	18.0
Tibia	8	50	16.0
Fibula	8	50	16.0
Scapula	8	50	16.0
Cervical	26	175	14.8
Ulna	7	50	14.0
Hand Phalanges	85	700	12.1
Manubrium	3	25	12.0
Cuboid	5	50	10.0
Thoracic	26	300	8.7
Sacrum	2	25	8.0
Cuneiform-1	4	50	8.0
Ribs	42	600	7.0
Hand Navicular	3	50	6.0
Lumbar	5	125	4.0
Lunate	2	50	4.0
Capitate	2	50	4.0
Foot Phalanges	21	700	3.0

Table 8 (continued)

Element	Number observed	Number expected	Percent of Expected observed
Triquetral	1	50	2.0
Cuneiform-3	1	50	2.0
Greater Multangular	1	50	2.0
Lesser Multangular	1	50	2.0
Pisiform	1	50	2.0
Teeth	198**		
Unidentified	57**		
Total	851		

* Number expected is based on complete recovery of all elements of 24 individuals
** These elements are excluded from further calculations

The two children are represented by long bones. A complete right ulna, with unfused epiphyses, measured 170mm in length. This size is characteristic of an individual 6.5-7.5 years of age. Similarly, a left radius, with unfused epiphyses, measured 113.5 mm in length, characteristic of a child between the ages of 2.5-3.5 years.

The two infants are represented by frontal bones. One frontal bone is aged at 2 years, based on metopic suture closure and general size. The other frontal has an unfused metopic suture, characteristic of an infant less than 2 years.

To determine whether any age group is under- or over-represented, it is necessary to compare the data to other sites. Using the Kolmogorov-Smirnov two-sample test at a 0.05 level of significance, the test failed to show any significant difference (Table 9). This result suggests that the individuals were being deposited in the cave in the same fashion as those at other Norris Basin sites.

Because the Norris Basin sample is small, it was necessary to repeat the test using the Hamilton component of Hiwassee Island. Again, using the Kolmogrov-Smirnov two-sample test at a 0.05 level of significance, the test shows no significant difference (Table 10). This result also suggests

Table 9. Paleodemographic Comparison of the Ausmus Cave and Other Norris Basin Sites.

Age category	Ausmus Cave No.	%	Cum.%	Norris Basin No.	%	Cum.%	Difference Cum.%
Infants	2	0.083	0.083	0	0.000	0.000	0.083
Children	2	0.083	0.167	2	0.063	0.063	0.104*
Adolescents	1	0.042	0.208	2	0.063	0.125	0.083
Adults	20	0.800	1.000	28	0.0875	1.000	0.000
Total	25			32			

*Maxium difference is underlined

Critical level (0.05) is 0.367. Conclusion: no significant difference between age categories of the sites.

Table 10. Paleodemographic Comparison of the Ausmus Cave and Hiwassee Island.

Age category	Ausmus Cave No.	%	Cum.%	Hiwassee Island No.	%	Cum.%	Difference Cum.%
Infants	2	0.083	0.083	17	0.098	0.098	0.015
Children	2	0.083	0.167	22	0.127	0.225	0.058*
Adolescents	1	0.042	0.208	5	0.029	0.254	0.046
Adults	20	0.800	1.000	129	0.746	1.000	0.000
Total	25			173			

*Maximum difference is underlined

Critical level (0.05) is 0.296. Conclusion: no significant difference between age categories of the sites.

that individuals were being deposited in the cave regardless of age.

Sex

The morphological traits of the skull indicated 11 males, 4 females. To determine whether any sex is under- or over-represented, the Binomial Probability was applied to the data. When compared to a 50:50 ratio, at a 0.05 level of significance, the test resulted in a score of P = .0416. Because this is less than 0.05, the null hypothesis of no difference between the sexes is rejected. This result suggests that more males were being interred in this cave than females.

CHAPTER VIII

PALEOPATHOLOGY

Introduction

Paleopathology, the study of diseases which have left manifestations upon the remains of past populations, is an important tool for understanding the health and nutritional status of past populations, and it can shed some light on the antiquity of diseases and the effect of diseases on past human populations (Hohenthal and Brooks 1960; Ortner and Putschar 1985; Steinbock 1976). With respect to diseases that leave their mark on bone, "few...are accepted as being recognizable in the pathological specimens preserved in archaeological collections" (Hohenthal and Brooks 1960:64). When these maladies are observed in an archaeological collection, such as the specimens in the Ausmus Burial Cave collection, it becomes important to record and to describe the pathologies.

The following discussion will address the three major pathologies that Funkhouser either misdiagnosed or did not recognize. These pathologies are craniostenosis, treponemal infections, and perimortem trauma. Each will be discussed in terms of (1) background of the disease, (2) etiology, (3) paleopathology in present sample, and (4) results. Other pathologies will be described, but not in the detail of the diseases just mentioned previously.

Craniostenosis

Background

This abnormality, which has a distribution of only 1:20,000 live births (Bennett 1967), is more common in males than in females (5 males:1 female). This skeletal malformation was first described in 1851 by Virchow, who coined the term "craniostenosis" to describe skull changes that resulted from premature cranial suture closure. Hemple et al. (1961:342) state that Virchow realized

> that when premature fusion of two cranial bones occurs, normal growth is inhibited in a direction perpendicular to the obliterated line of suture and compensatory growth occurs in a direction parallel to the fused suture.

Simmons and Peyton (1947) report that Van Graefe in 1866, was the first to recognize that visual impairment occurred with craniostenosis. Following the publication of Van Graefe's paper, many similar cases were reported. However, at this time, there was a tendency to confuse craniostenosis with microcephaly or premature obliteration of the fontenelles and premature suture closure. These two anomalies were separated only after roentgenography was developed.

The late 1900's brought extensive literature to light concerning this malformation (e.g., Alami and Ouammou 1986; Cohen 1980; Graham 1979, 1981; Lucas et al. 1987; Moss 1975; Schomig-Spingler et al. 1986). Nevertheless, there is still controversy concerning the etiology of craniostenosis.

One reason for this controversy is the terminology used to describe the pathology. To simplify the terminology, Simmons and Peyton (1947:531-532) developed the following classification:

A. Complete, early, premature synostosis of the cranial sutures (oxycephaly, turrecephaly, turmschadel).

1. Oxycephaly without facial deformity.
2. Craniofacial dysostosis of Crouzon.
3. Acrocephalosyndactylism.
4. Delayed oxycephaly (onset after birth).

B. Incomplete early synostosis of the cranial sutures.

1. Scaphocephaly: premature closure of the sagittal suture.
2. Brachycephaly: premature closure of the coronal suture, or of the coronal and lambdoidal sutures.

3. Plagiocephaly: asymmetrical premature closure of the sutures.
4. Mixed.

C. Late premature synostosis of the cranial sutures after the skull has reached or nearly reached adult size so that no deformities and no symptoms result. (This is included only to show its relation to true craniostenosis and to make it clear that surgical treatment is not indicated. This process should not be considered pathologic).

There have been several reports of scaphocephalic skulls in the archaeological literature (e.g., Bennett 1967; Eiseley and Asling 1944; Hohenthal and Brooks 1960; Stewart 1972). Eiseley and Asling (1944) report a scaphacephalic skull found near Troy, Kansas. The specimen is described in great detail and the cranial measurements and indices, which are important indicators of scaphocephalic distortions, are listed. They also indicate several minor anomalies thought to be features of this disorder.

Eiseley and Asling (1944) describe:

> Notable in this respect are the deeply channeled cranial sinuses, the peculiar form of the mastoids [short and blunt], and the two curious bosses near obelion, which may represent displaced ossification centers (Eiseley and Asling 1944:254).

Hohenthal and Brooks (1960) follow the procedure provided by Eiseley and Asling in their report concerning a scaphocephalic skull found in

California. Hohenthal and Brooks found that while the skulls had similar traits overall, they differed in the minor anomalies. The California specimen had normal channeled cranial sinuses, long and heavy mastoids, and no bossing such as Eiseley and Asling describe.

The most noticable characteristic of this anomaly is the abnormal shape of the skull and noticing that at least one, if not more, cranial sutures are fused. The actual shape of the skull depends on which sutures are fused and the age of the individual at the time of the fusion. Several forms of this anomaly can occur depending on which sutures fuse. Because there are so many different forms of this pathology, there has been difficulty in achieving an understanding of craniostenosis. This disease can be defined three different ways. First, it can be either simple (only one suture involved) or compound (two or more sutures involved). Second, it can be primary (simple, with one suture involved, or compound, with two or more sutures involved, as previously explained), or secondary (suture closure brought on by another known disorder). Third, it can be either isolated (no other anomalies associatied with the suture closure) or syndromic (occurring with other primary defects) (Cohen 1980).

Etiology

There have been three different hypotheses to explain the etiology of craniostenosis. First, Virchow postulated that the premature suture closure caused the deformed cranial base (Cohen 1980:511). Next, Moss hypothesized the exact opposite. He believed that the anomaly occurred early in the embryonic stage of skull development causing a "dysostosis of the several bones of the cranial base" (Moss 1975:31). This, in turn, changed the location and the tensile forces within the principle dural fiber tracts that are located between the cranial base and the neurocranial capsule. This leads to premature suture closure. The third theory states that a primary defect in the mesenchymal blastema leads to both craniosynostosis and an abnormal cranial base (Park and Powers 1920).

Currently, Moss' theory is the most popular. However, due to the several ways of classifying the disease, "all three theories are probably correct; each may be implicated in some, but not all, cases of craniosynostosis" (Cohen 1980:512).

Remains from Ausmus Burial Cave

Funkhouser lists all the measurements that could be calculated for the skulls from 3CE20. Two of the six measurements needed for the calculation were used to determine a cranial index for each individual. These indices indicate that three skulls are dolichocephalic.

The skulls described as being dolichocephalic are skulls 32-4, 32-13, and 32-14. They were remeasured using the six cranial measurements that Eiseley and Asling (1944) felt were important indicators of scaphocephalic distortion. All measurements were taken using sliding and hinge calipers, as well as tape. Definitions of the measurements are presented in Appendix B. Two indices (cranial index and breadth-height index), which Eiseley and Asling utilized in their analysis, were calculated using the six measurements.

Two of the skulls were dolichocephalic, and these two skulls were pathological. Skull 32-14 was excluded from the sample when measurements revealed a mesocephalic skull. The pathologic skulls from 3CE20 are described following Eiseley and Asling (1944) and Hohenthal and Brooks (1960).

Skull 32-4 (Figure 7) is an adult male. The cranium and face are complete and in excellent condition. The mandible is fragmentary, but it is also in excellent condition. Parietal foramina are present; there was not any parietal bossing observed. Endocranial sutures are completely fused; the coronal suture is open. The cranial index of Skull 32-4 is narrow or dolichocrany. The breadth-height index is acrocrany or high skull (Bass 1971).

Skull 32-13 (Figure 7) is an adult male. Similar to Skull 32-4, the cranium and face are complete and excellent condition. No parietal foramina are observed; however, parietal bossing is observed. This skull exhibits a prominent superciliary eminence. The cranial index of Skull 32-13 is dolichocrany. The breadth-height index is acrocrany or high skull (Bass 1971).

The skulls from Ausmus Burial Cave can be classified as simple (Skull 32-4) and compound (Skull 32-13) cranoiostenosis. Further classification is inhibited because the skulls were disarticulated from the post-cranial remains and no other anomalies can be associated with them.

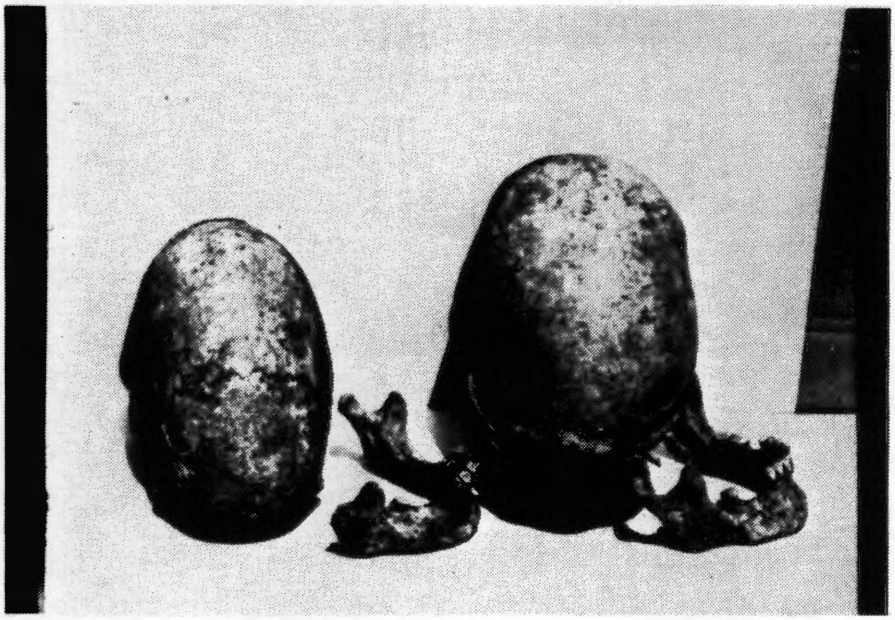

Figure 7. Craniostenosis, Skull 32-4-left, Skull 32-13-right. Courtesy of the McClung Museum collection.

Treponemal Infections

Background

The origin of treponemal infections, which includes syphilis, has been debated more than any other disease. The first of three hypotheses is the Columbian hypothesis, which states that syphilis originated in the New World and was carried back to Europe by Columbus' crew in 1493. Because the European population had not been previously exposed to the disease, the disease spread rapidly.

The second hypothesis is the pre-Columbian hypothesis. This postulates that syphilis was present in Europe before Columbus' voyage, however, it was in a less virulent form or misdiagnosed as leprosy. The epidemic occurred when the diseases were recognized as separate entities--coincidentally, about the time of Columbus' return from the New World.

The third theory is the unitarian theory which states that syphilis evolved with human populations and was present in both the New and Old Worlds at the time of Columbus' discovery (Baker and Armelagos 1988).

Hudson (1968) believes that the four treponemal syndromes (yaws, pinta, endemic syphilis, and venereal syphilis are caused by a single disease, _Treponema pallidum._ Because the diseases are similar to each other, it is difficult to diagnose differentially the bone lesions (Baker and Armelagos 1988). Steinbock (1976) stresses that the differences in skeletal lesions are quantitative. He explains that yaws and endemic syphilis rarely affect the skull, whereas venereal syphilis does. Keeping this in mind, the syndromes can be tentatively diagnosed.

Prehistoric skeletal remains suggesting treponematosis have been identified throughout the southeastern United States. Jones (1876) identified syphilitic lesions from remains found in Tennessee. Syphilitic lesions were described affecting a skeleton excavated at Lighthouse Mound, in northeastern Florida (Baker and Armelagos 1988). Additionally, many other reports suggest treponemal infections in the prehistoric Southeast (e.g., Bullen 1972; Powell 1988; Ortner and Putschar 1985). These reports reveal that treponemal infections could have affected up to half of the population and that the infection "was undoubtedly present in the eastern half of the United States from Late Archaic times (as early as 3000 B.C.)" (Baker and Armelogos 1988:719).

However, to conclude that treponemal infections are pre-Columbian, it must be proven that the skeletal remains are both ancient and treponemal. Most of the remains that are reported to have possible treponemal infections do not have a provenience and cannot be proved to be pre-Columbian (Baker and Armelogos 1988). Therefore, the interpretations still remain controversal.

Etiology

In cranial syphilis, destruction begins on the external surface of the cranium by an extension of infection from the soft tissues of the pericranium. This destruction follows small blood vessels from the pericranium into the cranium.

> In the center of the lesion, the destruction produces a depression reaching down to the spongy part of the diploe. While the destructive process is going on in the cranial depression, a regenerative process takes place around the circumference laying down new bone which gradually becomes very sclerotic. When the gummy matter is finally resorbed, the stellate lesion characteristic of cranial syphilis remains (Steinbock 1976:129).

This stellate lesion is known by the term "caries sicca" (Ortner and Putschar 1985). Hackett (1976) added detail to the sequential events of caries sicca, making it a diagnostic feature on dry bone.

Remains from Ausmus Burial Cave

The lesions noted on Skull 32-14 (Figure 8) were originally identified as "old healed osteomyelitis of the frontal bone with five distinct pits and several smaller depressions" (Funkhouser 1938:249). These lesions became the focus of reanalysis when it was noted that osteomyelitis generally affects the long bones and rarely the cranium (Steinbock 1976).

Reanalysis of the skull revealed the following information. Skull 32-14 is an adult male. The cranium, face, and mandible are complete and are in excellent condition. Five stellate-shaped lesions and several smaller depressions were noted on the right side of the frontal. A few were noted on the left side of the frontal and also on the left temporal.

Similar lesions were on a skull from the 1975 collection. Skull 22 (Figure 9) is an adult male. The cranium consists of a calotte and the left half of the maxilla, and it is in excellent condition. This individual exhibits robust mastoid processes, blunt eye orbits, and a robust supra-orbital torus.

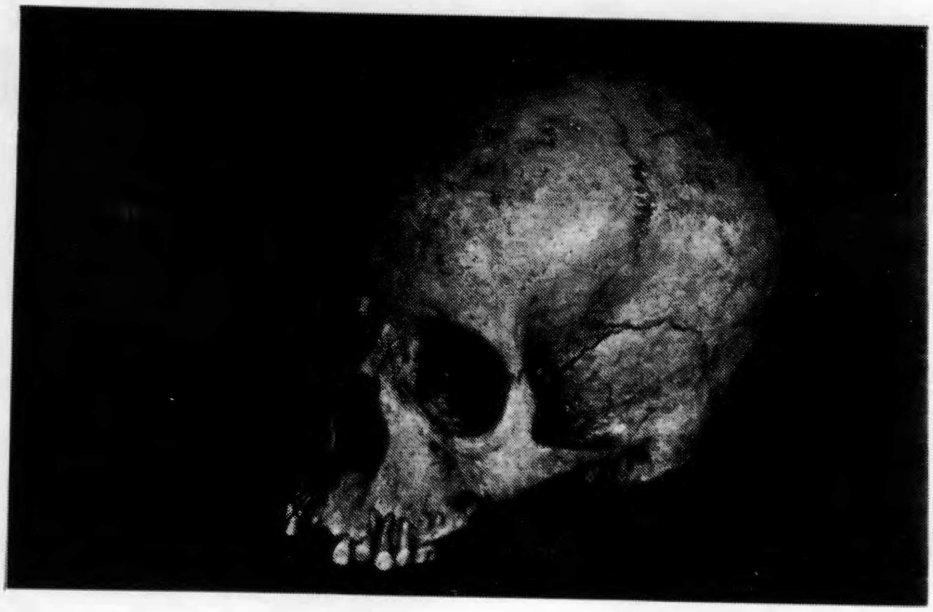

Figure 8. Possible Treponemal Infection, Skull 32-14.

Figure 9. Possible Treponemal Infection, Skull 22.

There are five stellate-shaped lesions on the frontal bone very similar to the lesions noted on Skull 32-14.

The stellate-shaped lesions support a tentative diagnosis of treponemal infection. These lesions, which are part of the caries sicca sequence, are the most diagnostic feature of cranial syphilis in dry bone (Baker and Armelogos 1988; Hackett 1976; Ortner and Putschar 1985).

One tibia from the sample exhibited slight bowing. This is indicative of syphilitic infections, however, it could not be concluded if the bowing was the result of an infection.

If concluded that the lesions, located on the crania, are the result of treponemal infections and the cave site is indeed a Late Woodland/Early Mississippian manifestation, this site becomes important evidence for the pre-Columbian theory of treponemal infections, but not necessarily syphilis.

Perimortem Trauma

Four individuals have perimortem holes in the frontal and parietal areas. These individuals are skulls 32-4, 32-13, 18, and 22. They are all adult males.

The perimortem trauma affecting Skull 32-4 (Figure 10) is a hole in the right parietal. It is located 67mm inferior and 6mm to the right of bregma. It is approximately 14mm wide and 25mm long. No internal beveling is noted.

The perimortem hole in Skull 32-13 is located on the frontal, 82mm inferior from bregma and 43mm superior from nasion, along the midline. It is approximately 27mm long and 34mm wide. No internal beveling is noted.

Skull 18 has two holes. The first is located on the right parietal. It is triangular in shape. Along the coronal suture, it is 39mm from bregma. Perpendicular from this point, the center of the hole is 11mm toward the back of the skull. It is approximately 17mm wide and 31mm long. The second hole is on the left temporal, 31mm long and 37mm wide. No internal beveling is noted with either hole.

The last skull with this lesion is Skull 22. This hole is located where the sagittal suture meets the lambdoidal suture on the right side of the occipital, inferior to the lambdoidal suture. It is 7mm long and 9mm wide. Again, no beveling is noted.

These holes are clean punches. No radiating fractures or depressions are associated with this

Figure 10. Example of Possible Perimortem Trauma, Skull 32-4.

trauma. To produce these fractures, the skulls were struck with an object at a very low velocity (Smith et al. 1987). They all appear to be perimortem holes. It is possible that this trauma is responsible for the individuals' deaths. Several causes can explain these holes, but the most obvious is being struck on the head with a bone spear or similar object (Galloway, personal communication). This follows Webb and Funkhouser's conclusion that the group was killed during a battle. However, no artifacts of this nature were found with the remains. Therefore, the results become conjectural.

Other Pathologies

Several other pathologies were noted on the skeletal remains. Most of these are common for prehistoric skeletal remains. Funkhouser (1938) noted this when he stated:

> Various types of [diseases] are frequently noted and are interesting only in that they indicate the pre-Columbian man was subject to many of the same diseases found in civilized man today, and it may be assumed that these osteological conditions were due to the same causes-trauma, pyrogenic infection, tuberculosis, and perhaps even syphilis (Funkhouser 1938:250).

Specifically, the other pathologies noted are the caries, button osteomas, arthritis, and periostitis. All of the pathologies found in this examination are listed in Table 11.

Caries

Dental caries are progressive demineralization and destruction of the tooth structure initiated by "local fermentation of retained food sugars by particular bacterial constituents of plaque" (Smith 1983:4). In this sample, 8 out of 25 individuals (32%), exhibit at least one carious lesion. Eleven teeth, out of a sample of 198 teeth, have 25 caries. The mean-cariosity-per-person score was calculated for this sample. This score is computed by dividing the number of individuals by the number of carious teeth (Smith 1983) (see Table 12). The Ausmus Burial Cave individuals possess an average of 1.00 carious lesion per person.

"Caries frequency is low among hunter-gatherers (approximately two to three lesions per mouth" (Ortner and Putschar 1985:439). This data agrees with the pattern of hunter-gatherer populations, which is typical of the Late Woodland/Early Mississippian time period.

Table 11. Other Pathologies Present on Individuals from Ausmus Burial Cave.

Individual	Pathology
32-4	Caries
32-5	Caries
32-16B	Caries
32-16C	Caries
32-16D	Caries
32-16E	Caries
19	Button osteomas
21	Caries
22	Caries
23	Caries
32-17, 25	Arthritis, periostitis

Table 12. Summary Data of Caries Location.

Location	I1	I2	C	P3	P4	M1	M2	M3
Maxilla								
Occlusal	0	0	0	1	1	1	2	0
Buccolingual	0	0	0	0	0	0		0
Mandible								
Occlusal	0	0	0	0	0	1	6	5
Buccolingual	0	0	0	0	0	2	3	2

Button Osteomas

The most common benign, neoplastic lesion is a button osteoma on the cranial vault (Ortner and Putschar 1985). It is usually located on the frontal and parietal bones. "It consists of mostly dense lamellar bone with vascular channels but practically without marrow spaces" (Ortner and Putschar 1985:368). This is represented by one individual in this sample.

Vertebral Osteophytosis

This arthritis is a common joint disease. It develops with aging and degeneration of articular cartilage. Following this degeneration, the interior disk compresses and protrudes against the anterior longitudinal ligament (Steinbock 1976). This pressure produces subperiosteal bone formation at the anterior margin of the vertebrae. This is represented by slight lipping on several of the vertebrae.

Periostitis

This inflammation is characterized by periosteal bone being formed over the surface of the bone. The surface is irregular with variable thickness. "The marked, uneven hypervascularity visible on dry bone in the form of smaller and larger pores in periosteal bone is often striking" (Ortner and Putschar 1985:129-130). By itself, this disease is uncommon. However, it is usually part of pathogenic changes of the underlying bone. Therefore, it becomes a common lesion in archaeological collections (Ortner and Putschar 1985). Several miscellaneous long bones from 3CE20 exhibit this lesion.

CHAPTER IX

DISCUSSION

This discussion will focus on the results of the demographic analysis, the paleopathological analysis, and possible implications of these results. These points are significant because of their relevance concerning how certain burial caves were utilized.

Demographic analysis revealed that there was an unusual distribution of osteological elements. Some of the greatest frequencies of adult bone were hands and feet elements contrasted with some of the long bones which were unexpectedly lower in frequency.

Three reasons can be offered to explain these results. First the cave could have been looted for the larger skeletal elements. It is thought that the cave was looted for cultural elements before Webb's original excavation (Rogers 1988, personal communication), implying that the skeletal elements were looted also. If this reason is correct, there would be a low frequency of skulls present in the sample, because skulls are more frequently desired as "mantle pieces." Because the frequency of skulls is high, looting of the skeletal remains is not the only process involved.

The second reason is that animals could have entered the cave and disturbed the distribution of the elements; this is unlikely because no gnaw marks are found on the bones.

The third reason is because so many small elements are present, it supports Webb's belief that most individuals were primary burials rather than secondary burials (e.g. Willey et al. 1988). This is the most likely explanation for this distribution of elements.

The demographic age analysis revealed that individuals were being deposited in the cave regardless of age compared to other sites in the same time period. This is similar to the distribution of ages found in other caves (Willey and Crothers 1986; Willey et al. 1988).

The most surprising demographic result was that males were more frequent than females in Ausmus Burial Cave. The sex distribution in other caves has been equal (Willey and Crothers 1986; Willey et al. 1988). Several possible explanations can be offered to interpret these results. There could have been a number of sudden male deaths with a need for quick disposal, such as in warfare. There could have been a sex bias in the mortuary custom. Finally, the results from this statistical test could be spurious because of inexact sexing techniques.

The paleopathological analysis of these individuals revealed that Webb and Funkhouser either misdiagnosed or simply did not recognize several pathologies. This revelation is significant because their conclusions may have been different if they had diagnosed these pathologies correctly.

Of the three pathologies discussed in detail, craniostenosis is the most notable malformation. If it had been recognized as a pathology, Webb and his associates would have known why these two individuals exhibited dolichocephaly. Then, while calculating the average cranial index, these affected specimens should have been excluded. The other individuals were brachycephalic, similar to the other Norris Basin aborigines.

Without knowledge of an exact family history (to assess heredity and genetic syndromes) (Lucas 1987; Schomig-Spingler et al. 1986) or other possible disorders affecting other parts of the body (Cohen 1980), no one reason can be pin-pointed for the cause of craniostenosis in the individuals.

The treponemal infections are important because they were misdiagnosed as healed osteomyelitis (Funkhouser 1938). Osteomyelitis more commonly affects the post-crania, than the crania (Steinbock 1976). This suggests a treponemal infection, which has similar lesions and affects the crania. If the site can be dated to the Late Woodland/Early Mississippian time period, and if more evidence could be found to support this diagnosis, the individuals would support the pre-Columbian theory for how treponemal infections entered the New World. Nevertheless, because of the questionable time period and an exact diagnosis is virtually impossible without associated post-cranial remains, this site remains doubtful as a site to help confirm the pre-Columbian theory.

It could not be concluded how the perimortem trauma occurred. Warfare is certainly a possibility, and taking into consideration that more males were interred in the cave, it certainly supports Webb and Funkhouser's conclusion that the individuals were killed in battle. However, without more diagnostic artifacts and other signs of trauma on the remains, this remains conjecture.

A high percentage (20%) of the individuals from Ausmus Burial Cave exhibited at least one of the three unusual pathologies. Several reasons could account for this unusual occurrence including the burial pit was being used to inter "different" individuals. As noted earlier, craniostenosis can grossly deform the skull shape and frequently results in blindness. Treponemal infections could also result in visually disturbing individuals. Also, people dying of violent deaths may be perceived as "different" suggesting that the cave may have been used to inter separately individuals who were perhaps social outcasts, from the other members of the society.

This may be a viable hypothesis because mound burials seem to prevail during the Late Woodland and Early Mississippian time periods (Schroedl 1978). With present knowledge, burial caves are certainly not the most common mode of burial. When different modes of burial occur, it should not automatically imply a different time period or cultural group, but it could imply differentiation within certain cultural groups. Griffin (1930:2 cited in Hofman 1986:36) states:

> When different methods of burial are found...workers...attempt to correlate the different modes with different cultural groups....The idea seems to be that a given culture is to be identified by one form of burial and that in different cultures one is expected to find different methods of corpse disposal. This misconception must disappear as scientific investigation over this central area reveals the archaeological data in their true light.

Unlike the burial cave sites in southwest Virginia, Ausmus Burial Cave was not found adjacent to a village site from the same time period (Clark 1978). The village site near the site is the Ausmus Farm Mounds (3CE10), which was dated to the Late Mississippian Dallas culture (Lewis and Kneberg 1946:10). No direct association can be made.

Several problems with the site make it difficult to deduce much more information. These problems are (1) looting the cave before Webb's investigation, (2) disarticulation of the remains, (3) loss of some of the remains before reanalysis, (4) some of the site is not excavated, and (5) incomplete records of the excavation and location of skeletons. Overall, results of this analysis revealed that Ausmus Burial Cave was used exclusively as a burial cave. It can be implied but not verified conclusively, due to the problems with the context and rarity of cultural remains, that the use was restricted to a single culture.

CHAPTER X

SUMMARY AND CONCLUSIONS

This study reanalyzed the remains from Ausmus Burial Cave in terms of: (1) contemporary methods, (2) human interment in caves, and (3) describing additional data discovered since the the 1938 excavation. This is considered important when it is noted that the original 1938 analysis is being used as a reference for other modern studies.

Webb and Funkhouser's interpretation of the Ausmus Burial Cave skeletons was that the individuals were intruders, killed in warfare, and unceremoniously dropped in the cave. This conjecture was tested through analysis of the archaeological background, human osteological remains, artifacts, paleodemography and paleopathology.

Webb's original investigation was typical of research conducted in the 1930's. While his research is not necessarily wrong, several techniques and interpretations are available now that were not available to Webb and his associates. This new information can be used to correct interpretations.

The paleodemographic study indicated a minimum of 25 individuals from all age groups and from both genders. To test whether a certain age group was being deposited in the cave more than the other age groups, these individuals were compared to other Norris Basin sites using the Kolmogrov-Smirnov two-sample test. The Binomial Probability test was used to test whether one gender was preferentially buried over the other gender. These tests revealed there was no difference in age within the Norris Basin sites. The same results occurred when the data were compared with the individuals recovered from the Hamilton component of Hiwassee Island. On the other hand, males appeared to be preferentially buried in the cave. However, this result could be false due to inaccurate sexing techniques.

Paleopathological analysis proved to be the most informative concerning Webb and Funkhouser's conjecture. Because this conjecture is based in part on the shape of the crania, the skulls were remeasured and observed for pathologies. Concluding that two of the skulls exhibited craniostenosis and were skeletally malformed, these specimens were excluded from the sample. Recalculating the average cranial index revealed that the other individuals are brachycephalic, similar to the other Norris Basin aborigines. Statistical re-evaluation of the material does not support the hypothesis that the individuals were the Iroquoian intruders Webb (1938) and Funkhouser (1938) claim.

The skulls that indicate a treponemal infection were diagnosed by Webb and Funkhouser as healed osteomyelitis. According to Steinbock (1976), osteomyelitis rarely affects the cranium. Since no definitive date can be assigned to the site, the treponemal infections cannot be proved to be pre-Columbian.

The perimortem trauma is important because it supports Webb and Funkhouser's conjecture of warfare. The holes could have occurred by a blow with a sharp object with a low velocity. It is not concluded how the perimortem trauma did occur.

Ausmus Burial Cave, as most caves, had been looted before Webb's investigation (Rogers 1988). The few artifacts that were found in association with the remains, indicate the possibility that the child was interred clothed, based on olivella beads being used as clothing decoration. This places doubt upon the conjecture that the individuals were interred unceremoniously.

It can be concluded that the individuals were part of a primary burial and it is a possibility that the individuals were being segregated from the other members of society, because of being "different" (e.g., craniostenosis, treponemal infections and violent deaths). Of course, this does not explain the individuals not diagnosed with pathologies. However, maladies which do not affect the bone should not be excluded. Although this is conjectural and cannot be proven, support is found in the high frequencies of unusual skeletal traits.

To reiterate, this data base reveals that cave burial practices are different from other local modes of burial in the same time period. Therefore, the only conclusion that can be drawn is that the individuals from Ausmus Burial Cave are part of the Norris Basin group; they are not intruders in the area, at least not based on skull shape. Because it is not known conclusively whether the individuals were buried with grave goods that were later looted from the site, the individuals may not have been unceremoniously dropped in the cave. Finally, the cave and the remains do seem to conform more to the southwest Virginia pit burial caves than to the Copena burial caves. The major difference is that there is not a nearby village site contemporaneous with the cave. Future excavations could possibly reveal one.

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APPENDIXES

APPENDIX A

FAUNAL SKELETAL REMAINS

The majority of faunal remains were identified by Lynn M. Synder. Some miscellaneous remains were identified by Dr. Paul Parmalee.

Although there were no non-human remains recorded or observed in the 1938 collection, there were several animal bones included in the 1975 collection. Twenty-six non-human elements were analyzed from this collection. They are listed in Table A-1.

Synder (personal communication) reports that the animal remains are in excellent condition and are probably from a recent time period, especially the domestic chicken and pig. There are no cut-marks on the bones and no burning.

The elements identified as *Gallus gallus* (domestic chicken) compare in size to a large roasting hen. All of the elements identified as *Canis familiaris* (domestic dog) are probably from the same individual and compare in size to a beagle or other small dog. All of the *Canis* sp. elements are probably from the same individual and compare in size to a domestic dog, but a much larger animal such

Table A-1. Identified Vertebrate Faunal Materials from Ausmus Burial Cave, 3CE20 (40CE20)

Taxon (common name):	element (portion, comment)
Gallus gallus (domestic chicken):	pelvis (right), femur (left proximal)
Didelphis marsupialis (opossum):	cranium (temporal with left zygomatic), mandible (right with dentition), innominate (left), innominate (right)
Sylvilagus floridanus (eastern cottontail):	femur (left), femur (left), femur (right)
Canis cf. *familiaris* (domestic dog):	humerus (left), femur (right)
Canis sp. (dog, wolf, coyote):	occipital (right), occipital (left), rib (left), rib (left), rib (right), femur (left)
Mephitis mephitis (striped skunk):	humerus (right, proximal epiphysis unfused), innominate left acetabulum and ilium), femur (left diaphysis, epiphyses unfused)
Sus scrofa (domestic pig):	basioccipital (unfused, juvenile), temporal (right inferior with external meatus, juvenile), mandible (left with dentition)

a shepherd-sized dog. The Sus scrofa (domestic pig) elements are from a young animal (Synder, personal communication).

APPENDIX B

CRANIAL MEASUREMENT DEFINITIONS

Glabello-occipital length - "Greatest length, from the glabellar region, in the median sagittal plane" (Howells 1973:170).

Maximum width - "The greatest breadth of the cranium perpendicular to the median sagittal plane, avioding the supra-mastoid crest" (Giles and Elliot 1962:149).

Biasterionic width - "Direct measurement from one asterion (the common meeting point of the temporal, parietal, and occipital bones on either side) to the other" (Howells 1973:170).

Bistephanic breadth - "Breadth between the intersections, on either side, of the coronal suture and the inferior temporal line marking the of the temporal muscle (the stephanic points)" (Howells 1973:170).

Parietal Arc - "Surface distance from bregma to lambda" (Brothwell 1981:83).

Parietal Chord - "Minimum distance from bregma to lambda" (Brothwell 1981:83).

Cranial Index - "a numerical device for expressing the ratio of the breadth of the skull to the length (in percent)" (Bass 1971:63).

Cranial Breadth-Height Index - "expresses the ratio of height to breadth of a skull (in percent)" (Bass 1971:65).

VITA

Carole Elizabeth Tucker was born in Bulls Gap, Tennessee on March 25, 1964. She graduated from Morristown-Hamblen High School East in May 1982. She attended the University of Tennessee, Knoxville, and received the Bachelor of Arts degree in Anthropology, with honors, in June 1986.

She entered the graduate program at the University of Tennessee, Knoxville, in September 1986, and received the Master of Arts degree, with a major in Anthropology, in December 1989. During this time, she has been involved with skeletal analysis and curation, archaeological fieldwork, archaeological analysis, and data entry.

She is a member of the Tennessee Anthropological Association and the American Association for State and Local History.