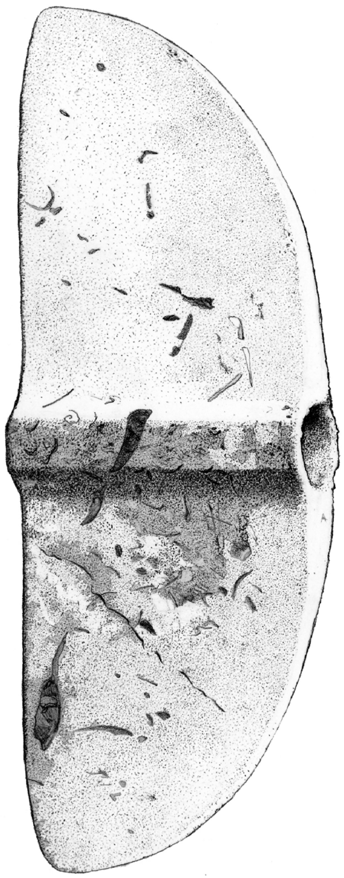
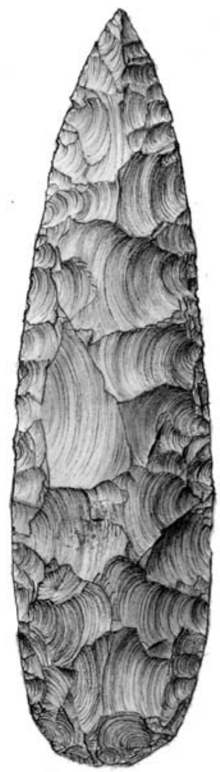
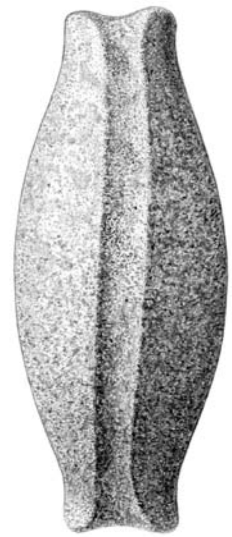
Archaeology and Bioarchaeology of the Buckeye Knoll Site (41VT98), Victoria County, Texas







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Archaeology and Bioarchaeology of the Buckeye Knoll Site (41VT98), Victoria County, Texas

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Cover Illustrations

Drawings of Selected Mortuary Artifacts Recovered from Buckeye Knoll:
(Left) Limestone, Semi-Lunar, Winged Bannerstone, Burial 74;
(Center) Chert Biface, Burial 1-B;
(Right) Quartzite Grooved Stone, Burial 6.

Chapter 11

Stable Isotope and DNA Analyses

Robert J. Hard
Noreen Tuross

Analytical Methods and Results
(Noreen Tuross)

Stable carbon and nitrogen isotopic measurements were made on collagen purified from the tooth samples of eight individuals. In addition, seven radiocarbon dates were obtained, and five DNA extractions and preliminary PCR reactions were done. The teeth were derived from Burials 5, 6, 8, 23, 27, 55, 71, and 74. All but one of these are ascribed to the Early Archaic cemetery component. The single exception, Burial 23, is a Late Archaic burial. A summary of the work performed is shown in Table 11-1.

Radiocarbon Ages of the Individuals

Collagen was extracted from tooth roots utilizing the decalcifying agent EDTA, washing with sodium hydroxide followed by a gelatinization process and filtering through sintered glass. The collagen had a slight yellow color and was indistinguishable from modern collagen in carbon and nitrogen content (see next section).

With the limited available data, three distinct and noncontemporaneous populations interred human remains at Buckeye Knoll. The large cluster of dates centers around 5600 years B.P. (uncalibrated). One individual is significantly older than the majority grouping, at 7570 ± 55 yrs B.P. (uncalibrated), while another single individual dates to 2120 ± 30 yrs B.P. Correcting these radiocarbon dates to allow for the observed variation in past ^{14}C amounts was done with the OxCal program. The results are shown in Figure 11-1.

Stable Isotope Analyses

Stable isotope analyses d^{13}C and d^{15}N were performed in duplicate on the seven specified individual tooth collagens. The data are shown in Table 11-2. When these data are viewed as a function of the uncorrected age of the sample, interesting patterns are observed (Figures 11-2 and 11-3).

The heavy isotope of nitrogen is enriched in the samples as a function of age. This statement must be accompanied by two caveats. First, the trend in Figure 11-2 is controlled by two samples: the youngest and the oldest. Second, tooth type has been considered. Even with these considerations, the change of almost $3^0/_{00}$ in d^{15}N is substantial and, if confirmed with additional samples, these data would indicate a major shift in human diets or an alteration in the underlying nitrogen isotopic values in plants due to environmental change—or both. These important preliminary conclusions should be further refined with additional analyses.

The carbon isotopic values are quite scattered, but all observed values could be derived from a diet rich in estuarine fauna and/or terrestrial fauna with access to C-4 plants. The range of carbon isotopic values is surprising, as is the depletion of the most recent individual. Again, this preliminary data suggests diet and/or environmental change through the age of the Buckeye Knoll deposit. (Editor's note: These observations are further considered in the discussion by Robert Hard in the next section of this chapter, as well as in a summary discussion in Chapter 15.)

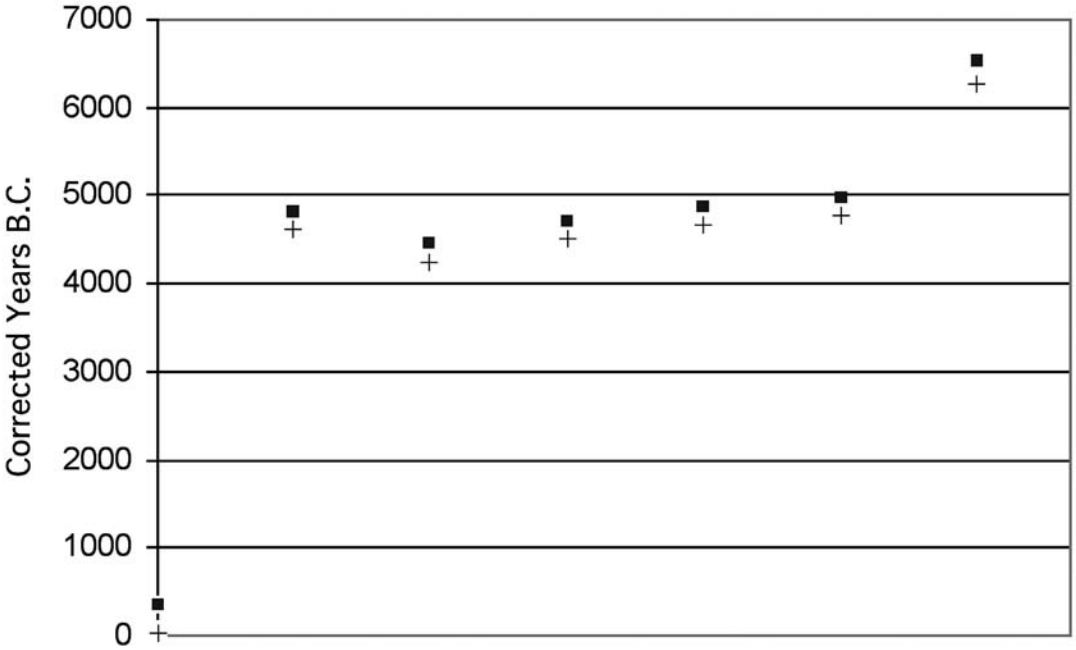


Figure 11-1. The lower (pluses) and upper (squares) limits of the corrected radiocarbon ages in years B.C. at the 95.4 percent confidence level.

DNA Analysis

Preliminary DNA analyses of five tooth extracts yielded no amplification products of the 9bp deletion regions of the mitochondrial genome. The extracts (Kolman and Tuross 2000) were tested for polymerase inhibition, and slight inhibition was observed in all samples. A second extraction based on a recently published technique (Rohland et al. 2004) was processed and amplification showed some promise for analytical success. Given the high input of labor and expense that full analysis would have entailed, however, it was decided by the project sponsor (U.S. Army Corps of Engineers, Galveston District) not to proceed. Janelle S. Stokes, archaeologist with the Galveston District, offered the following explanation for this decision:

> *During sampling for the presence of preserved DNA, initial results on human bone fragments indicated that there was no replicatible DNA in the VT98 materials. Another technique was then applied that indicated additional, intensive analysis might be productive if a full DNA analysis was performed. However, further information provided by the consultant (Noreen Tuross, Harvard University) made it clear that several lengthy and costly steps would be needed to determine if this was actually the case. It was impossible to reliably*

Table 11.1. Summary of Analytical Procedures Performed on Human Tooth Samples from Buckeye Knoll.

Sample ID	Procedures		
	$\delta^{13}C$ and $\delta^{15}N$	AMS Date	DNA Preparation
41VT98S5B74	x	x	x
41VT98S3B27	x	x	x
41VT98S1B6	x	x	x
41VT98S10B71	x	x	x
41VT98S15B23	x	x	x
41VT98S6B5	x	x	—
41VTS7B55	x	x	—
41VT98S2B8	x	—	—

Table 11-2. Stable Carbon and Stable Nitrogen Values for Human Tooth Samples from Buckeye Knoll.

Sample ID	$\delta^{13}C$	$\delta^{15}N$	C/N
41VT98S5B74	-15.8	10.9	2.8
	-15.9	10.9	2.8
41VT98S3B27	-16.2	12.5	2.8
	-16.2	12.6	2.8
41VT98S1B6	-16.3	11.5	2.8
	-16.2	11.5	2.8
41VT98S10B71	-15.6	11.2	2.8
	-15.7	11.1	2.8
41VT98S15B23	-18.1	9.7	2.7
	-18.5	9.7	2.7
41VT98S6B5	-13.6	11.8	2.8
	-13.8	11.8	2.8
41VTS7B55	-17.8	11.2	2.8
	-17.4	11.1	2.7
41VT98S2B8	-13.6	11.5	2.8
	-13.6	11.6	2.8

estimate how long the full DNA analysis would take or how much it would cost, because in most cases, samples such as those from VT98 are contaminated with modern DNA, and thus would require cloning and amplification of thousands of PCA reactions in order to isolate a prehistoric American Indian DNA sequence.

In the end, the Galveston District determined that full DNA analysis would not be performed since: (1) additional funds needed to complete the analysis would be at least several hundred thousand dollars; (2) there was no certainty that funds would be available to complete additional analyses; (3) substantial additional expenditures in this range would not be possible because the overall project cost was nearing the total Congressionally authorized limit, and (4) the treatment plan stipulated that the DNA analysis could be constrained by cost [Janelle Stokes, personal communication 2008].

Data from Buckeye Knoll: Contextual Interpretations
(Robert J. Hard)

Stable ^{13}C and ^{15}N isotopic analyses are particularly well suited to the study of the adaptations at Buckeye Knoll, as this approach can provide data regarding the role of freshwater, marine and terrestrial aspects of the paleodiet that other techniques cannot. Noreen Tuross of Harvard University processed eight human tooth collagen samples from the site (see previous section in this chapter); seven of these dated to the Early Archaic period cemetery component and one dated to the Late Archaic period. This report considers these results within the context of stable isotope ecology of the Texas coastal plain.

Stable carbon and nitrogen isotope studies of ancient skeletal remains have become widely used techniques for the reconstruction of paleodiet (e.g. DeNiro and Epstein 1978, 1981: Katzenberg 2000; Schoeninger and DeNiro 1984; van der Merwe and Vogel 1978; Vogel and van der Merwe 1977). Huebner (1991, 1994) and his colleagues (Huebner and Boutton 1992, 1994; Huebner and Comuzzie 1992; Huebner et al. 1996) were the first to use stable isotope analyses in south Texas. Since then, stable isotopic work has been conducted in a variety of research contexts in the state (Alvarez 2005; Bement 1994; Bousman et al. 1990; Bousman and Quigg 2005; Cargill 1996, Cargill and Hard 1999; Eling et al. 1993; Hard 2002; Hard et al. 1996; Norr 2002; Pertulla 1996, 2001; Skinner et al. 1980; Terneny 2005; Turpin 1988). Recently, Hard and Katzenberg (2007) conducted a stable isotope study of a series of mortuary sites across the Texas coastal plain and this report will include a comparison of the Buckeye Knoll results with that study.

Ideally, such research should include consideration of the stable isotope ecology of the plants and animals in the ancient human food web. If this is not possible, reference to relevant studies can aid in the interpretation of the human data. Biologists have ex-

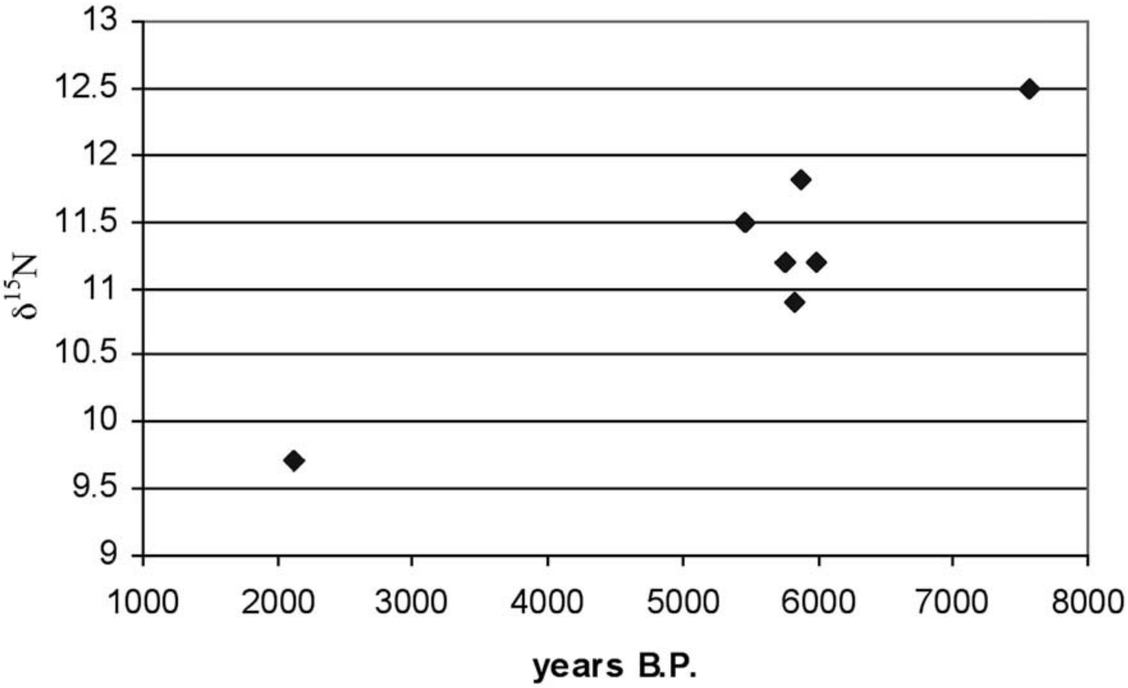


Figure 11-2. Graph showing the relationship between stable nitrogen values and sample ages.

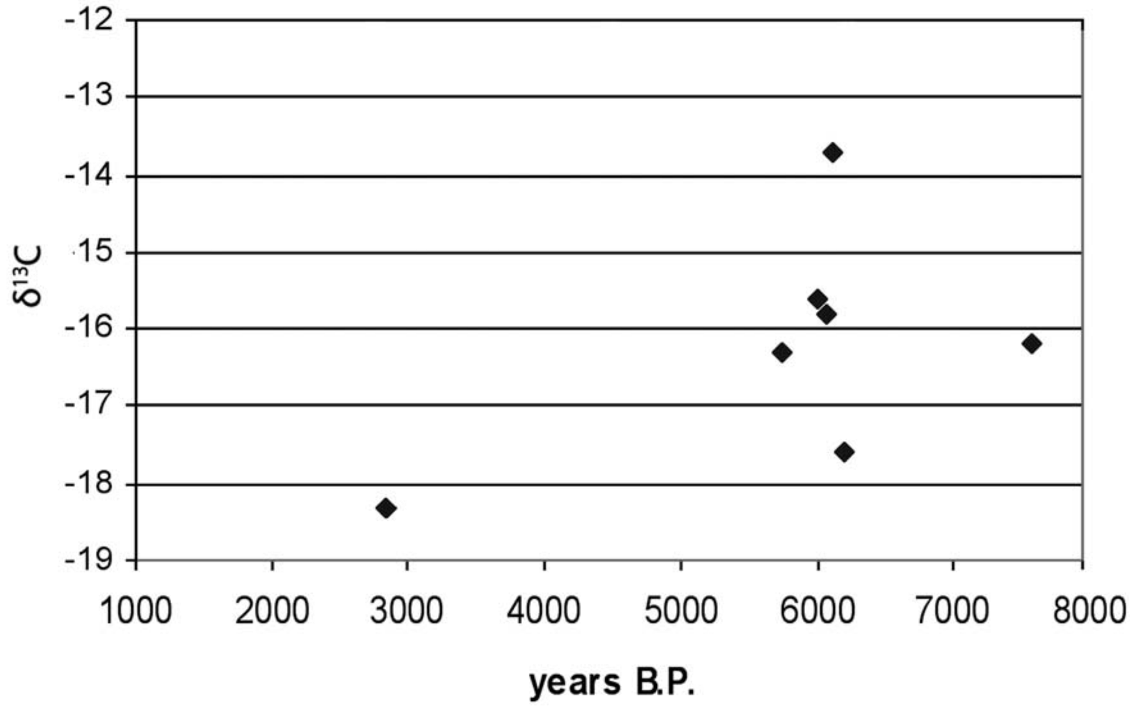


Figure 11-3. Graph showing the relationship between stable carbon values and sample ages.

amined the stable isotope ecology of Texas Gulf Coast marine and freshwater ecosystems (e.g., Fry et al. 1984; Jepsen 1999; Winemiller et al. 2006). Hard and Katzenberg (2007) conducted stable isotope analyses of animal taxa from archaeological sites on the Texas coastal plain.

Since excellent reviews of stable isotope methods and applications are readily accessible, only a synopsis of the principles of human dietary isotope studies is provided here (e.g. Ambrose 1993; Katzenberg and Harrison 1997; Schoeninger and Moore 1992; Schwarcz and Schoeninger 1991). The stable isotopes ^{13}C and ^{15}N have different reaction rates, known as fractionations, than their lighter, more common cousins ^{12}C and ^{14}N. With fractionations, the ratios between the scarce, heavier isotope and the lighter, abundant isotope change (e.g. ^{13}C to ^{12}C) as carbon and nitrogen move from the environment through plants and their consumers. Some groups of plants and animals incorporate heavy isotopes into their tissues at different rates. These ratios are recorded in living tissue, including human and animal bone found on archaeological sites. Laboratory analysis of bone or teeth measures the ratios of ^{13}C to ^{12}C and ^{15}N to ^{14}N and these ratios are compared to the ratios in laboratory standard materials. These ratios of the sample relative to the standard are symbolized with the "б" (delta) sign and are measured in permille (‰) or parts per thousand. The ratios, as they are recorded in human bone and teeth, allow identification of some food groups that tend to have somewhat unique isotopic ratios. As discussed below, some of the identifiable food groups include: terrestrial C_3 plants, terrestrial C_3 animals, terrestrial C_4 plants (including maize), C_4 plant grazers (e.g. bison), freshwater fish and marine (or estuarine) fish.

In bone and teeth, both the collagen and apatite compounds can be analyzed. In this study only tooth collagen was analyzed so apatite will not be discussed further. Ingested protein contains the essential amino acids that build the collagen carbon molecules; therefore collagen $\delta^{13}C$ values usually reflect the protein component of the diet (Schwarcz 2000). Collagen ^{13}C fractionates so that it is estimated to be 5‰ greater than the $\delta^{13}C$ value of the dietary protein source, assuming protein intake is adequate (Katzenberg 2000; Schwarcz 2000; van der Merwe and Vogel 1978). Therefore, if human $\delta^{13}C$ collagen measured -20‰, the ingested dietary protein would be -25‰.

Three groups of plants with different photosynthetic pathways fractionate $\delta^{13}C$ at varying rates. Most trees, shrubs and forbs belong to the C_3 group and have a global mean $\delta^{13}C$ value of about -27‰ (O'Leary 1988:334). Warm-season grasses and some forbs belong to the C_4 group, as does maize, and these plants have a mean $\delta^{13}C$ value of -13.1‰ (O'Leary 1988:334). Maize consumers can be distinguished from non-maize consumers, assuming there are no other significant C_4 or CAM (Crasslucean Acid Metabolism) plants in the diet. Bison that graze on C_4 grasses have more positive values than do deer that feed on C_3 plants. CAM plants, including arid-land succulents such as agave and cacti, can fluctuate between C_3-like and C_4-like values. Prickly pear, the principal CAM plant on the south Texas coastal plain, has C_4-like values (Boutton et al. 1998). Flesh tends to be 2‰ less than collagen, so for example, deer bone collagen with a $\delta^{13}C$ value of -19‰ indicates that deer meat is -21‰.

Nitrogen isotope ratios ($^{15}N/^{14}N$) are potentially more complex, since trophic level, temperature, nitrogen source, and plant and animal physiology can affect collagen nitrogen isotope ratios (e.g. Ambrose 1991; Minagawa and Wada 1984). The $\delta^{15}N$ value of atmospheric nitrogen (N_2), the primary standard, delineates the arbitrary zero point of the nitrogen isotope scale ($\delta^{15}N$=0‰). For each trophic-level increase from plants to herbivores to carnivores in both terrestrial and aquatic environments there is a 3 to 4‰ gain in ^{15}N values (Ambrose 1991; Minagawa and Wada 1984; Schoeninger and DeNiro 1984). Drought-tolerant herbivores can have more elevated ^{15}N values (Ambrose 1993; Sealy et al. 1987). Unlike $\delta^{13}C$ values, the б^{15}N values of flesh and collagen are the same.

The basic principles outlined above apply to aquatic environments, but there are some important differences. Basal carbon sources in aquatic ecosystems may have different $\delta^{13}C$ values than atmospheric carbon; particularly in marine ecosystems where dissolved inorganic carbon is the primary source (Katzenberg 2000; Pate 1994). Freshwater plants obtain carbon, not only from atmospheric CO_2 but from the water and associated sources with more variable $\delta^{13}C$ values than terrestrial C_3 plants (Jepson 1999; Katzenberg 2000). A foodweb study of Brazos River isotope ecology found the $\delta^{13}C$ values of freshwater plants range from -18‰ to -25‰ (Jepsen 1999).

In Texas estuarine settings, seagrass meadows are common in shallow water (<2 m) and have C_4 values, while in offshore environments, algae, with values intermediate between C_3 and C_4 plants, dominate the base of the foodweb (Fry and Parker 1979). Fish from seagrass meadows in some Texas shallow bays yield mean $\delta^{13}C$ flesh values from -8.3 to -15.5‰ (mean -12.1‰) while offshore fish have more negative values, -14.8 to -19.2‰ (mean -17.5‰) (Fry and Parker 1979:502). The role of seagrass versus algae as the basal producer for any particular Texas estuarine environment or fish species can vary. Texas saltmarsh fish (including several species of ancient economic value) yield more negative flesh values, from -13 to -20‰ (Winemiller et al. 2006). The lifecycle of some species involves movement from offshore to nearshore settings, exposing them to both seagrass- and algae-dominated niches. Humans feeding on nearshore fish from seagrass environments may have elevated $\delta^{13}C$ values that overlap with the values resulting from a diet of C_4 plants, while fish from algae-dominated settings should have $\delta^{13}C$ values that are intermediate between that of C_3 and C_4 plants. However, a marine diet should have distinctive elevated $\delta^{15}N$ values.

A Texas saltmarsh yielded ^{15}N values from aquatic plants that ranged from 0.7 to 6.5‰, generally higher than the range of most terrestrial plants (Winemiller et al. 2006). Marine and freshwater fish tend to have elevated $\delta^{15}N$ values reflecting more trophic levels (e.g. aquatic plants, zooplankton and invertebrates, fish, piscivorous fish) than in most terrestrial herbivore species.

Methods

As noted, CEI submitted teeth from eight individuals to Noreen Tuross for $\delta^{13}C$ and $\delta^{15}N$ analyses, ^{14}C dating, and DNA screening. Using a stable mass spectrometer, analyses of $\delta^{13}C$ and $\delta^{15}N$ were performed on pairs of duplicate samples for the eight teeth (see Table 11-2). The difference between the measurements is negligible, indicating high measurement consistency. The ratio of elemental carbon to nitrogen was measured and the values are 2.7 to 2.8 for all samples, thus indicating the carbon and nitrogen in the collagen are well preserved (see Table 11-2). Table 11-3 lists these samples again, along with the results of the associated radiocarbon dates. The "OC" dates are from the tooth collagen Tuross extracted. The "Beta" dates are from bone collagen from that particular burial.

Results

Table 11-3 reports the paired values and the mean of each pair. The mean $\delta^{13}C$ value of the seven Early Archaic period samples is -15.6‰ and the mean $\delta^{15}N$ value is 11.51‰. The $\delta^{13}C$ values are more variable, ranging from -13.7‰ to -17.6‰, while the $\delta^{15}N$ values range from 10.9‰ to 12.55‰. The single Late Archaic period sample (Burial 23) reflects a notable decline in both ^{13}C and ^{15}N values, with values of -18.3‰ and 9.7‰. All values are plotted in Figure 11-4**,** including the mean and standard deviation of the $\delta^{13}C$ and $\delta^{15}N$ values. The Early Archaic period samples have both elevated ^{13}C and ^{15}N values and the ^{15}N value suggests a substantial reliance on aquatic species. The ^{13}C value suggests freshwater resources dominate over marine species, but marine (or estuarine) resources are isotopically visible (see below). The two individuals with -13‰ to -14‰ $\delta^{13}C$ values (Burials 5 and 8) indicate they had a different diet, one that includes notably more estuarine C_4 resources than the other five Early Archaic period individuals. The single Late Archaic value (Burial 23) suggests a decline in use of aquatic species, particularly in marine resources since there is a decline in both $\delta^{15}N$ and $\delta^{13}C$ values, a trend that can be accounted for if C_3 plant resources were replacing lost estuarine resources.

Discussion and Conclusions

Comparative data allow the stable isotope study for Buckeye Knoll to be placed within the context of human isotopic ecology of the Texas coastal plain. Hard and Katzenberg (2007) measured $\delta^{13}C$ and $\delta^{15}N$ collagen values for 168 faunal samples from 29 taxa from three prehistoric and four historic sites on the Texas coastal plain. Figure 11-5 summarizes the data for 75 of these faunal samples including the four faunal categories (bison, terrestrial mammals, riverine fish, and estuarine fish) that are representative of the most important human dietary items, plus the three plant categories (C_3 plants, C_4 plants and CAM plants) that are isotopically recognizable. The points on Figure 11-5 are the mean collagen values and the error bars represent ± values at a 90-percent confidence interval, with outliers removed. Further details are found in Hard and Katzenberg (2007). The Buckeye Knoll Early Archaic mean value (with its 90-percent confidence level error bars) and the single Buckeye Knoll Late Archaic collagen value (again with 90-percent confidence bars) are also plotted on Figure 11-5.

The C_3 and C_4 plant values were derived from the herbivore collagen values from Hard and Katzenberg (2007). CAM plant values, primarily prickly pear in this region, were derived from Boutton et al. (1998:Table 1) and Boutton (personal communication 2006). C_3 terrestrial mammals represent collagen from white-tail deer, cottontail rabbit, opossum, and raccoon, all of which feed on C_3 plants or their consumers (n=17). This group has negative $\delta^{13}C$ values and intermediate $\delta^{15}N$ collagen values. The riverine fish group repre-

Table 11-3. Stable Isotope and AMS-Derived Chronometric Data Obtained on Samples of Human Tooth Collagen from Buckeye Knoll.

Period	Burial No.	^{13}C pairs	^{13}C	^{15}N pairs	^{15}N	C/N pairs	2-Sigma Cal. (yrs. B.P.)	C14 Lab No.
Early Archaic	74	-15.8/-15.9	-15.85	10.9/10.9	10.90	2.8/2.8	6670-6580	OC-44622
	27	-16.2/-16.2	-16.20	12.5/12.6	12.55	2.8/2.8	6640-6410	Beta- 157424
	6	-16.3/-16.2	-16.25	11.5/11.5	11.50	2.8/2.8	6300-6220	OC-44624
	71	-15.6/-15.7	-15.65	11.2/11.1	11.15	2.8/2.8	6610-6500	OC-44625
	5	-13.6/-13.8	-13.70	11.8/11.8	11.80	2.8/2.8	6730-6650	OC-44627
	55	-17.8/-17.4	-17.60	11.2/11.1	11.15	2.8/2.7	6860-6770	OC-44628
	8	-13.6/-13.6	-13.60	11.5/11.6	11.55	2.8/2.8	6430-6290	Beta-157422
	Mean	—	-15.60	—	11.6	—	—	—
	Std. Dev.	—	1.44	—	0.55	—	—	—
Late Archaic	23	-18.1/-18.5	-18.30	9.7/9.7	9.70	2.7	2130-2050	OC-44626

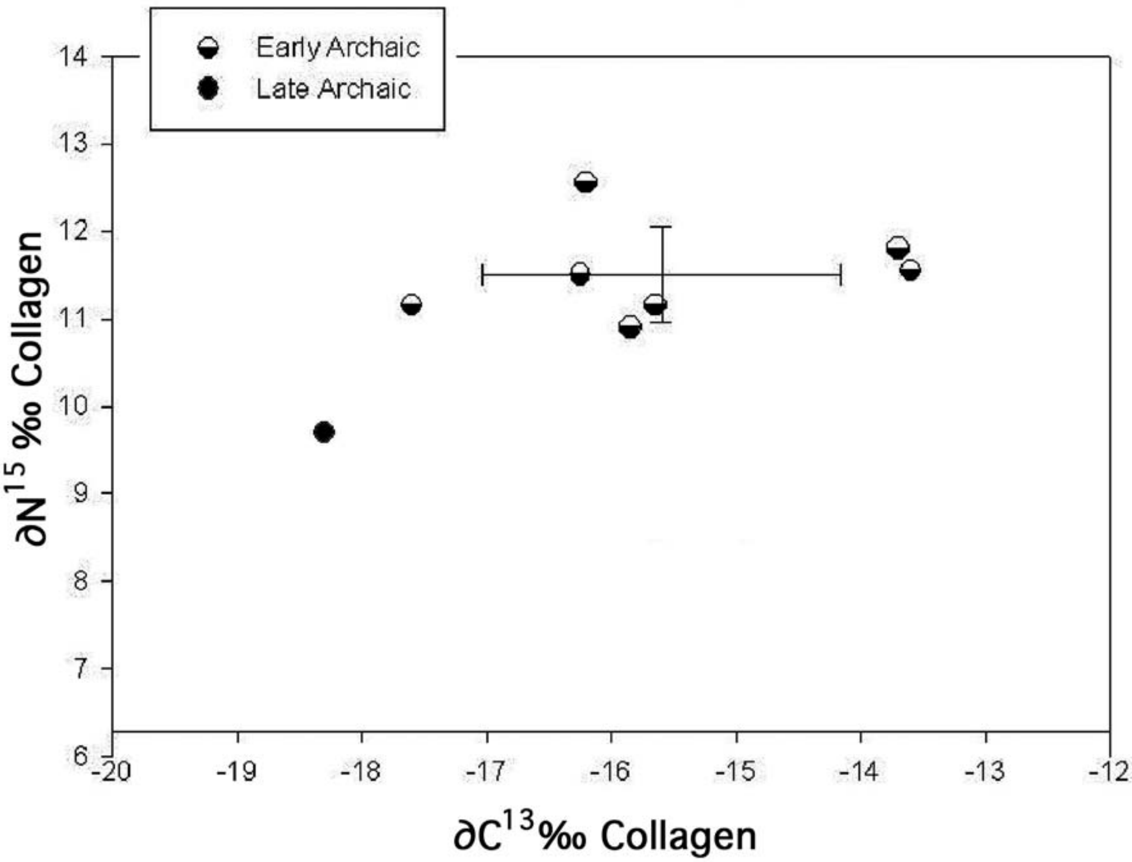


Figure 11-4. Graphic plotting of stable isotope values for the Early Archaic and Late Archaic burials from Buckeye Knoll.

sents freshwater species that include bowfin, catfish, flathead catfish, and gar (*n*=37), all with elevated $\delta^{15}N$ values since fish tend to feed at higher trophic levels and have more diverse $\delta^{15}N$ sources than terrestrial species. Such fish also tend to have depleted $\delta^{13}C$ values that are similar to terrestrial plant C_3 values.

The marine fish category (*n*=16) represents drum, freshwater drum and gar (the latter two live in both freshwater and estuarine environments and can tolerate saline waters); the samples in this study yielded marine values and were so classified (Hard and Katzenberg 2007). This sample yielded mean flesh $\delta^{13}C$ values of -12.01‰ (std dev = 2.7‰) and mean $\delta^{15}N$ flesh values of 9.0‰ (std dev = 2.1‰). Estuarine species linked to C_4 seagrasses tend to have values similar to these. However, fish in estuarine settings can have more negative $\delta^{13}C$ values than this archaeofaunal sample if they are from foodwebs controlled by filamentous algae and C_3 plants rather than seagrass meadows (Fry 2006:120-131; Fry and Parker 1979). For example, Winemiller et al. (2006) found that Matagorda Bay mullet, black drum, red drum, sea trout, gar and sea catfish, all important estuarine resources in ancient times, had mean $\delta^{13}C$ values on the order of 6‰ more negative than the mean values in our study. Once these modern values are corrected for changes due to fossil fuel inputs, the difference remains about 4‰ to 5‰ more negative. The most likely explanation is that the archaeofaunal samples represent foodwebs dominated by C_4 seagrass meadows since the modern samples are from algael foodwebs (Winemiller et al. 2006).

The modern fish samples also yielded mean $\delta^{15}N$ values about 3‰ more positive than archaeological fish samples, even though some species were the same (Winemiller et al. 2006; Hard and Katzenberg 2007). This difference may be due to modern pollution and/or variability in estuarine plant $\delta^{15}N$ values (Fry 2006; Pate 1994). In addition, estuarine gastropods and mollusks can also have widely varying isotopic values (Fry 2006:126; Winemiller et al. 2006). These issues

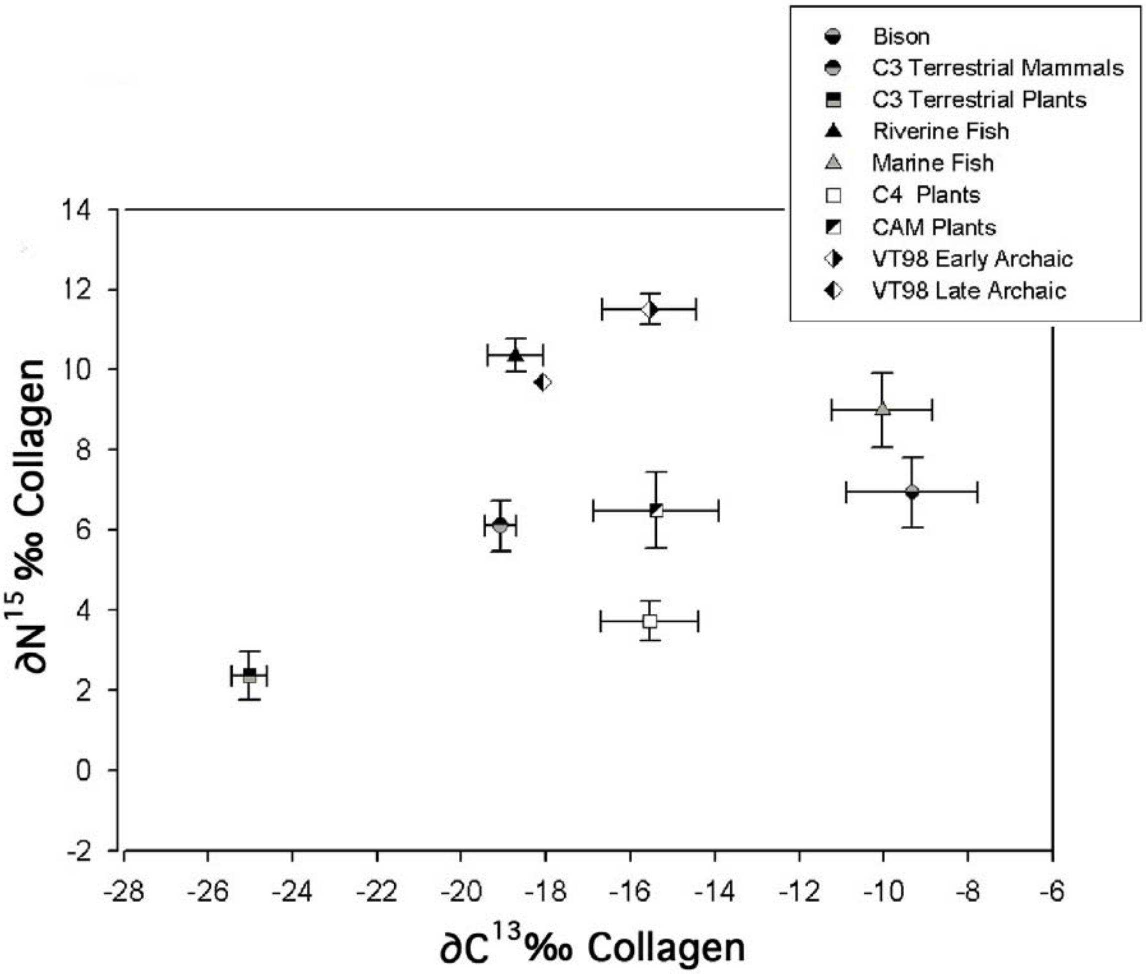


Figure 11-5. Human and animal collagen and plant isotopic values for Buckeye Knoll.

make estimating estuarine dietary inputs difficult and suggest more archaeological fauna samples of estuarine resources need to be examined.

Bison (*n*=5), due to their status as grazers in an environment where C_4 grasses dominate, have elevated $\delta^{13}C$ values and relatively low $\delta^{15}N$values. Figure 11-5 gives a rough idea of the isotopic relationships between potential food sources and collagen values from Buckeye Knoll. It is clear these elevated values suggest substantial inputs of freshwater fish.

The Figure 11-5 collagen values should be corrected for fractionation in order to better estimate diet. Animal $\delta^{13}C$ flesh values are 2‰ more negative than collagen values, but $\delta^{15}N$ flesh values are assumed to be equal to the $\delta^{15}N$ collagen (Ambrose 2000:Table 12.2; Newsome et al. 2004:1106; Schwarcz and Schoeninger 1991:301; Tieszen 1994:273). Figure 11-5 plots these calculated flesh values of the animal groups.

The isotope value of the human diet is estimated to be 3 to 6‰ less than the $\delta^{13}C$ collagen value due to fractionation during collagen production; in this study 5‰ is used (Ambrose 1993; DeNiro and Epstein 1978; Katzenberg et al. 2000; Newsome 2004:1105; Schwarcz 2000; Vogel 1978). The diet is estimated to be 3‰ less than the $\delta^{15}N$ value of collagen due to trophic fractionation effects (e.g. Ambrose 1993, 2000; Newsome 2004:1105). Collagen $\delta^{13}C$ values, under most conditions, tend to be controlled by protein intake rather than whole diet (Ambrose 1993). Therefore, the Early Archaic period component of Buckeye Knoll, with a mean $\delta^{13}C$ collagen value of -15.6‰, indicates these individuals consumed protein with a lifetime average of $\delta^{13}C$ value of -20.6‰ (-15.6‰ –

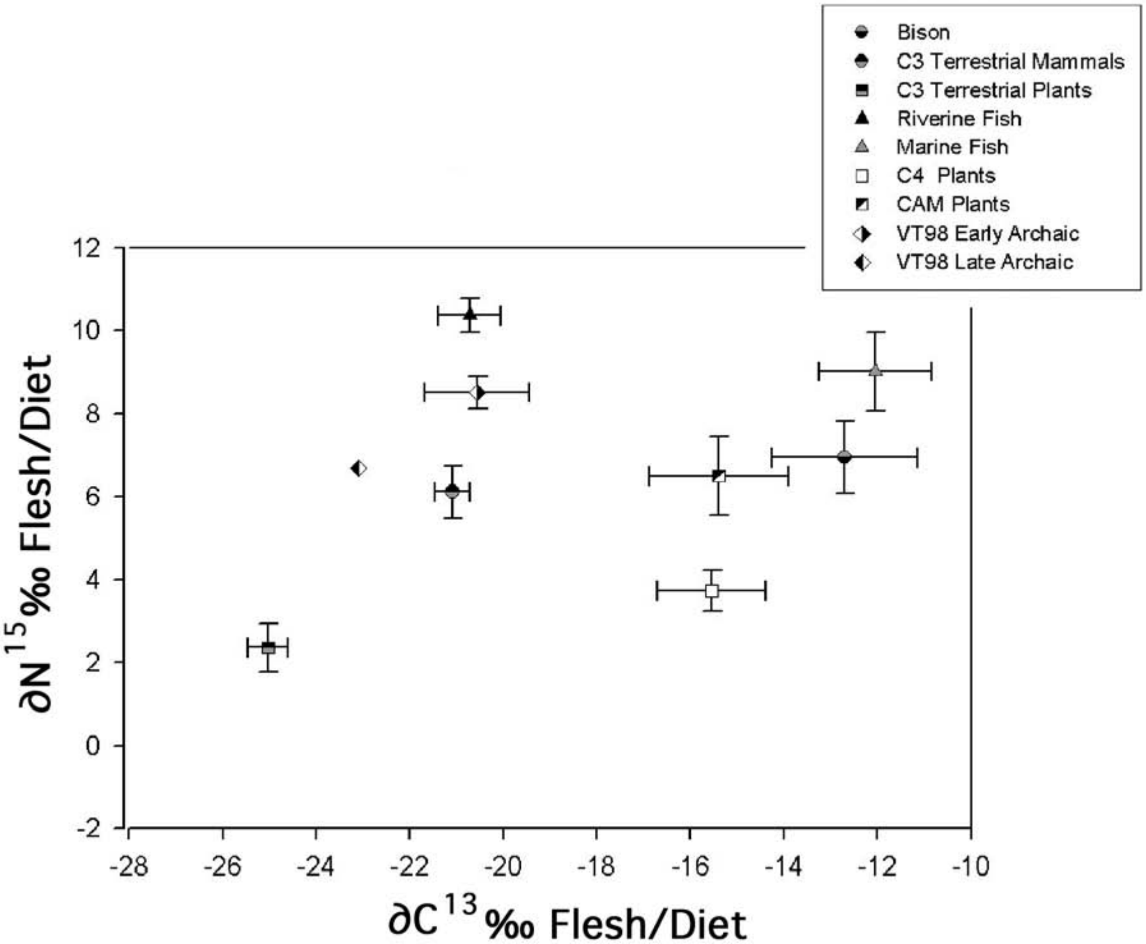


Figure 11-6. Plotting of stable isotope values for major plant and animal resources.

5.0‰). The $\delta^{15}N$ value of 11.6‰ indicates a diet with an average $\delta^{15}N$ value of 8.6‰ (11.6‰ – 3‰). Figure 11-5 displays the resource flesh values and the human dietary values for the Buckeye Knoll individuals.

Figure 11-6 now allows a clearer image of diet at Buckeye Knoll. If the Buckeye Knoll values were centered on any particular resource it would suggest that 100 percent of the diet was from that resource. The Early Archaic component, with a $\delta^{13}C$ dietary protein value of -20.6‰ is consistent with protein sources from both C_3 terrestrial animals and freshwater resources. The $\delta^{15}N$ value falls between that of those two groups suggesting that terrestrial animals and freshwater resources are contributing substantially to the diet. One diet scenario that would account for the Buckeye Knoll values is a diet that is a mix of only freshwater and terrestrial animals. However, this is highly unlikely given the available plant resources and the human need for carbohydrates (e.g. Speth and Spielmann 1983). A more likely scenario is that, along with substantial freshwater resources and some terrestrial animals, the Early Archaic populations were also using C_3 plant resources. However, a diet of freshwater fish, terrestrial animals and C_3 plants would yield $\delta^{13}C$ and $\delta^{15}N$ values lower than the Buckeye Knoll values. However, if marine resources were added then the elevated isotopic values of such resources would offset the negative values of C_3 plants, thus accounting for the measured isotopic values of the Early Archaic component. The most likely diet that accounts for the Early Archaic isotope values is one that is dominated by freshwater resources, but with terrestrial animals, estuarine resources, and C_3 plants each contributing to the diet. It is difficult to make a more explicit estimate of dietary source contributions, particularly with the uncertainty of estuarine source values. None to only slight levels of bison, CAM or C_4 plants were likely being used in the Early Archaic period.

The $\delta^{13}C$ value of the dietary protein from the single Late Archaic individual is -23.1‰ and the dietary $\delta^{15}N$ is 6.7‰, representing a decline in both values compared with that of the Early Archaic period. Notice on Figure 11-5, the Late Archaic data point represents a clear increase in C_3 plant resources and a drop in aquatic resource use. Marine resource use notably declined and freshwater resource use declined somewhat but still remained important. This individual's diet was made up of substantial levels of freshwater resources, C_3 plant resources, and C_3 terrestrial animal resources, with marine resources playing a negligible role or being completely absent. Given that this is only a single individual, it is unknown if this is typical of the Late Archaic period for the area.

Comparisons with Other Sites

Hard and Katzenberg (2007) included analysis of nine prehistoric cemeteries in three ecological zones: the Coastal Zone, the Riverine-Savanna Zone and the Inland Zone (Figure 11-7). The Coastal Zone covers a strip of land about 50 km wide extending from the shoreline inland It includes the coastline, bays, estuaries, and river mouths. Extending westward from the western boundary of the Coastal Zone, to about 200 ft amsl, is the Riverine-Savanna Zone. The land in this zone is flat to gently rolling and the rivers are sinuous, with wide floodplains, swamps, sloughs, and oxbow lakes where freshwater aquatic resources are abundant. The Riverine-Savanna Zone measures about 30-70 km east-west but extends an additional 30-100 km farther inland following the 200-ft contour along the low-lying floodplains. This zone is attractive to spawning fish in the spring and forms resource-rich zones that Hall (1998, 2000) describes as "natural catfish farms." The Inland Zone extends west from the Riverine-Savanna Zone to the edge of Edwards Plateau. This flat to hilly land rises from the 200-ft contour to about 1,000 ft in the vicinity of San Antonio.

Human bone samples from three prehistoric Coastal Zone cemeteries were included in the study: Cayo del Oso (41NU2), Mitchell Ridge (41GV66), and Harris County Boys School Cemetery (41HR80). All are largely Late Archaic to Late Prehistoric in age. The five mortuary sites from the Riverine-Savanna Zone are Morhiss (41VT1), Ernest Witte (41AU36), Bowser (41FB3), Crestmont (41WH39), and Loma Sandia (41LK28). The one site in the Inland Zone was Olmos Dam (41BX1). Bone preservation at Loma Sandia was poor, so valid results were obtained for only one sample from this site, although 37 samples from the locale were processed.

Figure 11-8 shows the dietary values (collagen corrected for fractionation, see above) for the sites in the Texas coastal plain study, as well as the Buckeye Knoll data. Three prehistoric cemeteries in the Riverine-Savanna Zone, Ernest Witte (AU36), Bowser (FB3) and Crestmont (WH39), overlap with mean $\delta^{13}C$ dietary values ranging from -23.9‰ to -24.1‰. The $\delta^{15}N$ dietary values are sharply elevated and range from 7.6‰ to 8.1‰. These values represent substantial dependence on freshwater resources with C_3 plant and animal resources present as well. In contrast to the Early Archaic period diet at Buckeye Knoll, marine resource use does not appear to be isotopically visible in these Riverine-Savanna sites during the Middle and Late Archaic periods.

The Morhiss site (VT1) population represents multiple periods, as existing site data do not allow the burials to be sorted temporally. In Figure 11-8, the Morhiss data plot between the Early Archaic Buckeye Knoll data and the Late Archaic Buckeye Knoll individual. The Morhiss site has a mean $\delta^{13}C$ value that is more positive than the other three Riverine-Savanna sites, suggesting that some of the Morhiss population, like the Early Archaic Buckeye Knoll population, may have been utilizing some of the marine resources that were available 38 km to the south.

Radiocarbon dating at Morhiss has identified three individuals belonging to the Early Archaic period, two to the Middle Archaic period and two to the Late Archaic period, and these are plotted on Figure 11-9 along with those of unknown temporal affiliation (Hard and Katzenberg 2007). The three Early Archaic Morhiss individuals and the one Middle Archaic Morhiss individual are similar to the Buckeye Knoll Early Archaic sample. The other Middle Archaic individual from Morhiss, plus one of the Late Archaic individuals from that site, cluster with the Buckeye Knoll Late Archaic individual. Most of the unknown affiliates from Morhiss fall in or near this late cluster. This cluster of Late Archaic and unknown period individuals indicates a decline in aquatic resource use. The contribution of marine resources declined to lower levels and may have been slight to none. Freshwater resource use declined from Early Archaic levels but remained an important part of the diet. Note that the single Late Archaic individual from Morhiss, on the far right of Figure 11-9, has a sharply elevated $\delta^{13}C$ value. This person likely came from a coastal environment as its $\delta^{13}C$ value is similar to individuals from the Cayo del Oso site (NU2).

On Figure 11-8, the three Coastal Zones sites—Cayo del Oso (NU2), Harris County Boys School

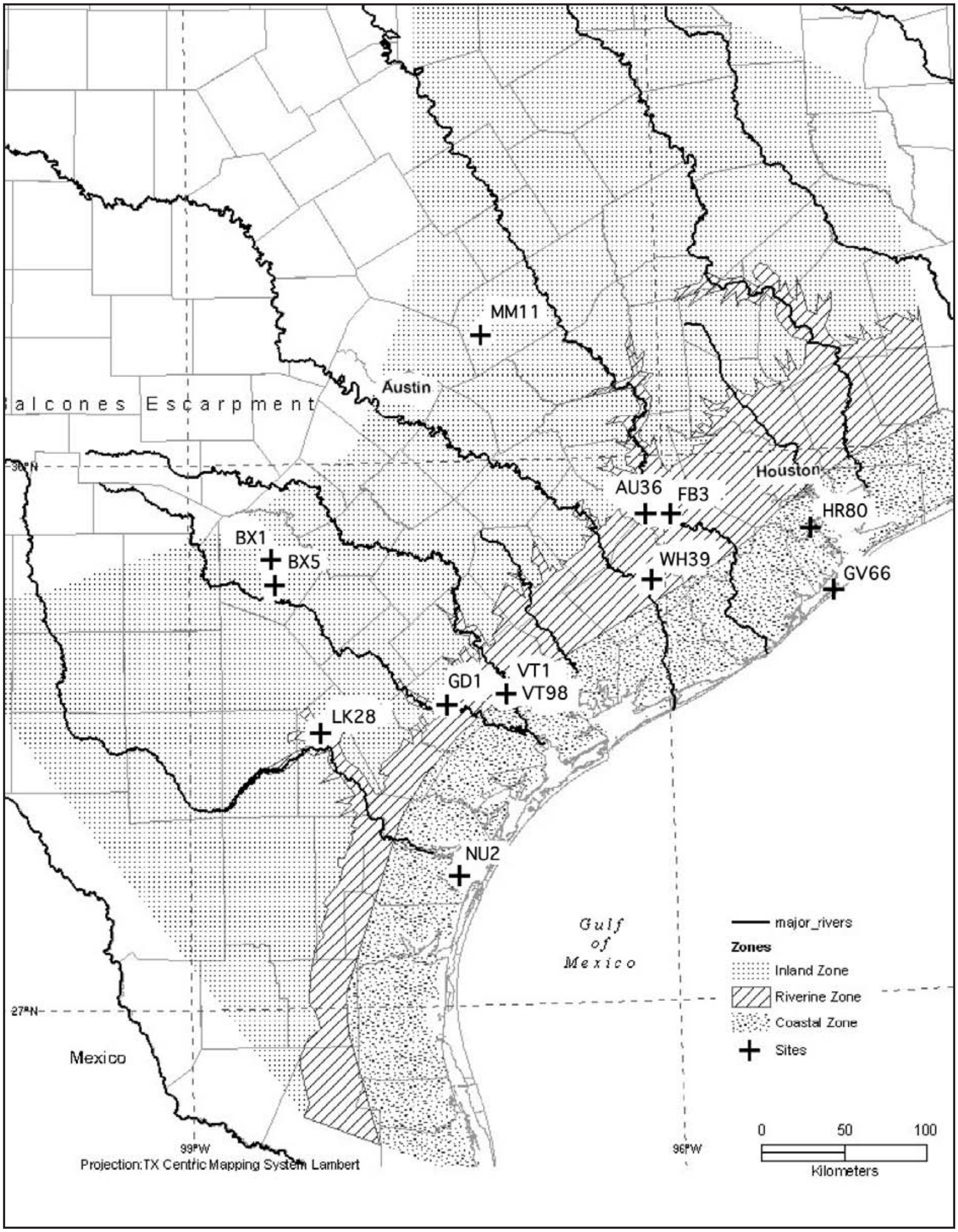


Figure 11-7. Map showing Coastal, Riverine, and Inland Resource Zones on the Texas coastal plain, plus locations of sites referenced in the text.

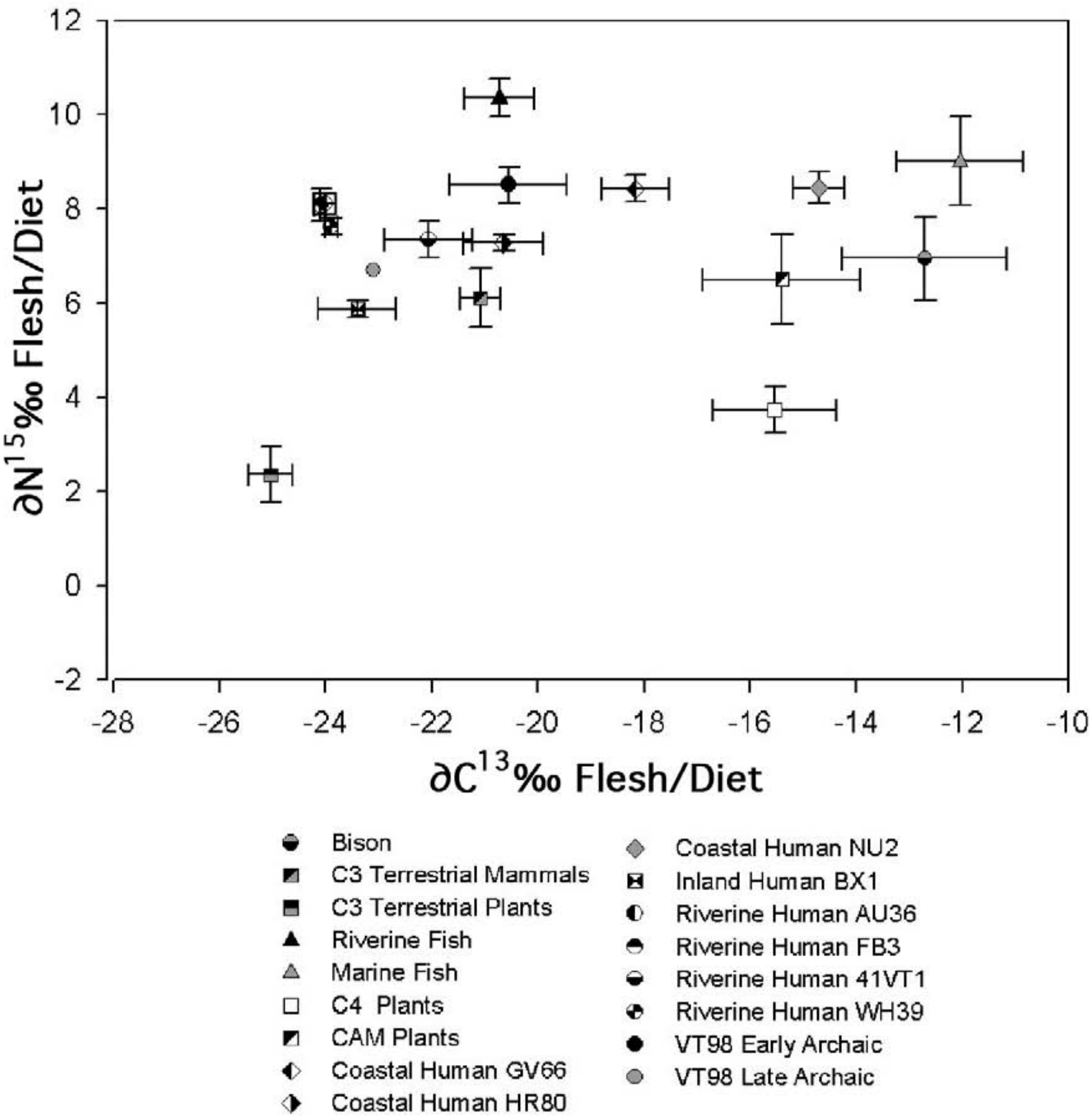


Figure 11-8. Stable isotope values from collagen (corrected for fractionation) from Buckeye Knoll and other sites on the Texas coastal plain.

(HR80), and Mitchell Ridge (GV66)—show elevated $\delta^{15}N$ values, but more variability in the $\delta^{13}C$ dietary values. The Cayo del Oso individuals are the most enriched, with mean $\delta^{13}C$ and $\delta^{15}N$ dietary values of -14.7‰ and 8.5‰, respectively, indicating a diet with a substantial contribution of marine resources and little to no use of freshwater resources. The Harris County Boys School and Mitchell Ridge individuals reflect various mixtures of marine and freshwater resources, combined with terrestrial resources. Improved baseline estuarine source data would allow a better resolution of this issue. The individuals from the single Inland Zone site, Olmos Dam (BX1), have lighter mean isotopic values that reflect a focus on inland, C_3 plant and animal resources, although minor use of freshwater aquatic resources likely occurred (see Figure 11-8).

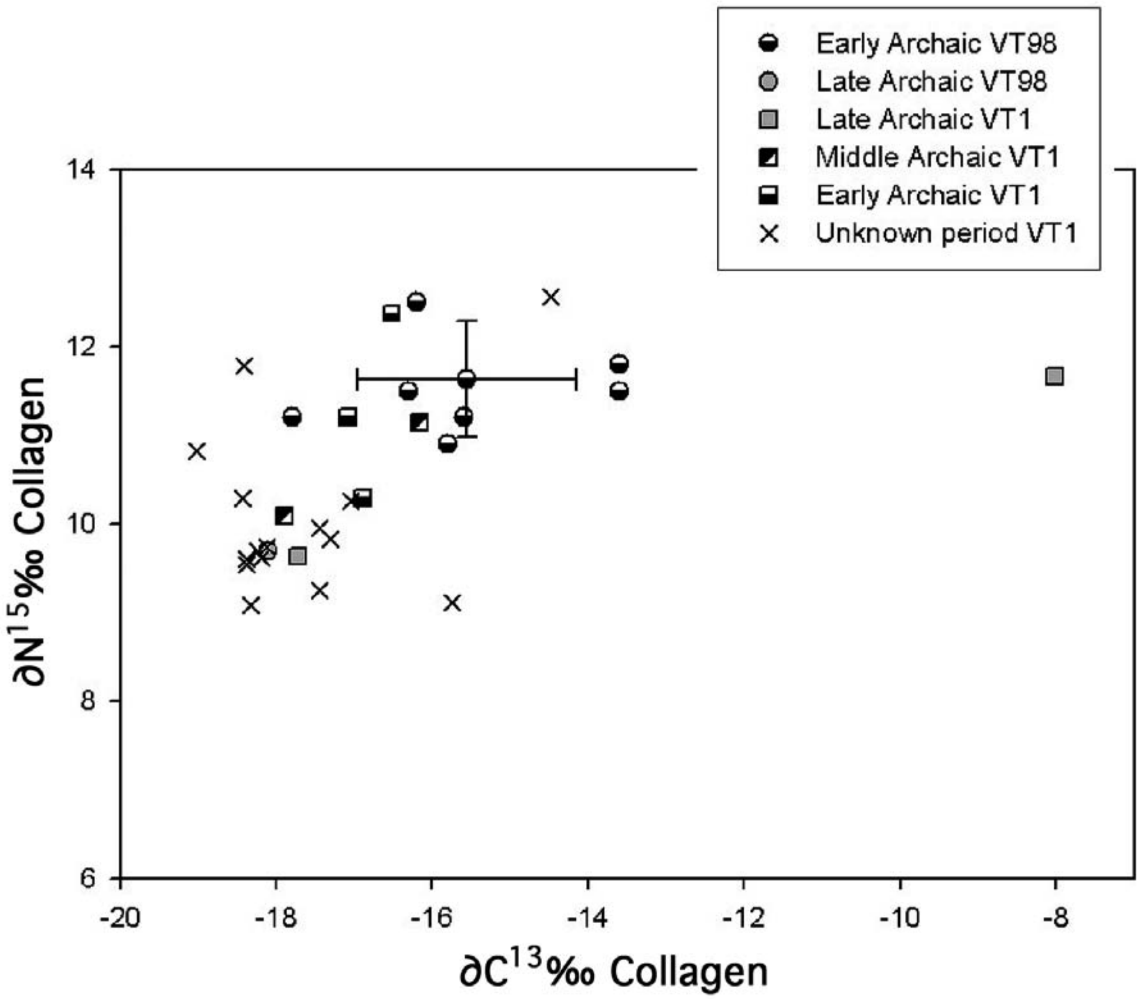


Figure 11-9. Plotting of the stable isotope data from Early, Middle, and Late Archaic burials from the Buckeye Knoll and Morhiss (41VT1) sites.

Conclusions

The Early Archaic individuals from Buckeye Knoll reflect a very early focus on freshwater aquatic resources combined with terrestrial C_3 plants, terrestrial C_3 animals and estuarine resources. This diverse pattern reflects a wider mix of resources and perhaps a greater level of mobility than the pattern that had emerged by the Middle Archaic period and continued into the Late Archaic period, in which hunters and gatherers in Riverine-Savanna settings (Morhiss, Ernest Witte, Crestmont, and Bowser) appear to have made little or no use of coastal resources, despite their proximity. The single Late Archaic individual from Buckeye Knoll is consistent with that pattern. Future work will need to consider the ramifications of these important cultural changes, as well improve baseline estuarine resource data.

Chapter 12

SKELETAL ANALYSIS

Glen H. Doran
Christopher Stojanowski

Introduction

The primary impetus for the bioarchaeological analysis of the Buckeye Knoll materials lies in the site's unique nature with respect to geography and antiquity (Doran et al. 2002). In the preparation of the treatment plan and proposal, details of the comparative potential were dealt with extensively. It is sufficient to say the Buckeye Knoll materials represent one of largest, if not the largest, collection of human skeletal material of this antiquity west of the Mississippi River. It must also be stated that the condition of the skeletal material leaves much to be desired due to the taphonomic challenges. Old material, particularly old material in open and often harsh soil contexts, like present at Buckeye Knoll, suffers. Even with these limitations, the data collected will be useful and provide a truly unique insight to some of the earliest occupants of the south Texas coastal margin. The Buckeye Knoll data file(s) have been provided to the Galveston District and Coastal Environments, Inc. (CEI), and will be available to future researchers.

The overall human bone preservation at Buckeye Knoll was poor, resulting in the majority of the remains being highly fragmented. During excavation, a consolidant was applied, when necessary, to facilitate removal from the ground. A mixture of polyvinyl acetate and acetone was sometimes applied to the exposed material, and the remains were removed, often with significant matrix adhering to the skeletal materials. The material was then wrapped in aluminum foil and stored in the Corpus Christi office of CEI until negotiations and plans were in place for Florida State University (FSU) to take possession of the materials for detailed inventory and analysis. These materials were transported to FSU by Doran and Joan Gardner (project conservator). Robert Ricklis brought a second set of materials that we were unable to transport in the initial acquisition of the material. All materials were transported by ground to FSU in large, plastic storage containers and were never out of sight of those responsible for transporting the materials.

Storage and analysis was performed in a facility leased specifically for the Buckeye Knoll project and no materials or other activities took place in the facility (referred to as the "Buckeye Knoll Lab") in Tallahassee, Florida. The physical location was immediately adjacent to the Department of Anthropology facilities at 1847 West Tennessee Street in Tallahassee. Staff members were hired to assist in the inventory of materials. Doran was responsible for the overall inventory of postcranial material performed in part by Dr. Rachel Wentz and Ph.D. candidate Colette Berbesque, who prepared the report on linear enamel hypoplasia (LEH) for the Buckeye Knoll materials.

The first step in the conservation of the material was to remove the remains from the aluminum foil. Each element was unwrapped and transferred to plastic storage bags. Upon unwrapping, many of the elements were seen to be highly fragmented. There were significant amounts of dirt within the foil wrappings.

Upon removal, the dirt was separated from the skeletal remains and stored in plastic bags. The bags were labeled with burial number and site information and stored in the same container as the skeletal material, as per the protocols agreed upon in the Treatment Plan.

During the course of unwrapping, it was noted that some of the remains had small spots of mold on their surfaces. Upon the advice of J. Gardner (previously a conservator with the Carnegie Museum, conservation consultant to the project, and currently conservator for National Park Service, Southeast Archeological Center—SEAC), drops of ethanol were placed directly onto the mold. The elements were left in open air for 24 hours to dry and the mold disappeared.

The next step was to free those skeletal elements consolidated within matrix blocks. Ethanol was applied to the blocks to loosen the consolidant, and the elements were removed using small wooden skewers to lift the dirt from around the bones. The remains were then air dried and placed in new, labeled plastic bags for storage. The associated dirt was bagged separately and retained with each burial, as per procedures outlined in the Treatment Plan. Once all bones were separated from matrix, analysis began.

Analysis

Each burial was inventoried following, as closely as possible, the procedures presented in the Standards for Osteological Data Collection (SOD manual; Buikstra and Ubelaker 1994). Due to the fragmented nature of the remains, the identification of many elements presented a considerable challenge. The elements identified were recorded on data inventory sheets while the unidentifiable elements were grouped according to type of element (e.g., "longbone"). As the elements were identified, pathologies were recorded. The identification of true pathologic lesions was also challenging due to extreme taphonomic damage.

This information is presented in a burial inventory on a burial-by-burial basis. The first section of the burial-by-burial inventories presents the metric information that could be collected with inferences, in some cases, on what the metrics provide in terms of age and or sex attribution. The metrics section is followed by a more in-depth, detailed discussion of each burial with discussion of the overall condition, inventory and specific features of each burial. This section addresses the issues associated with the number of individuals represented and identifications of sex, where possible. It should be noted that this inventory, and the inventory of dental material, were done independently and then cross validated. Where appropriate, the results of the dental inventory and metric analysis are also brought into the discussion. Items not associated with burials, often described as "floating," were also included in the inventory and were given numbers greater than 75 (the number of burials identified in the field, see Chapter 10) with provenience data according to the grid datum point at the southwest corner of the pertinent unit, the arbitrary level, and the stratigraphic zone (i.e., Unit S16 W18, Lev. 3, Zone 3, becomes 161833).

Once burial inventories were completed, cranial and postcranial metrics were recorded per standard measurements within the SOD manual. The fragmented nature of the material limited metric data collection. Taphonomic damage also prevented the assessment of cranial non-metrics. Stature estimates for a small number of individuals were calculated utilizing the most appropriate regression formulae for longbone and metacarpal dimensions.

Sex assessment was based on pelvic and cranial morphology, cranial and postcranial metrics, and dental metrics. Due to the fragmented nature of most elements, additional measurements from the talus, calcaneus, carpals, tarsals, and femoral neck and shaft were also collected. Abbreviations used in some tables and in the data files, as well as measurement procedures that are not described in the SOD manual (Buikstra and Ubelaker 1994), are presented in Addendum 12-1 (at the end of this chapter). Comparative measurements, and direct comparisons, were also taken from the skeletal collection from the Windover Site in east-central Florida (8BR246) to assist in assessments of age and sex. The usefulness of the Windover sample of Early Archaic skeletal materials derived mainly from its exceptionally good state of preservation.

Age assessment was complicated by taphonomic damage to many element surfaces. When possible, auricular surfaces, pubic symphyses, and cranial suture closures were assessed. For juvenile remains, epiphysial union, dental eruption, emergence, and formation, and longbone size and morphology were utilized. The reality is that, with few exceptions, the dental attrition was far more useful because of preservation/taphonomic problems with the bone. Details of the attrition analysis are provided in the dental-analysis section.

As anticipated in the Treatment Plan (Ricklis and Doran 2003), the dentition provided the greatest amount of metric and non-metric data. Measures included crown height, mesiodistal and buccolingual dimensions, and cervical (neck) diameters taken at the cemento-enamel junction, also in the mesiodistal and buccolingual directions. Dental morphology was assessed based on the Arizona State University dental-scoring system. Dental pathology assessment included scoring for calculus, caries, hypercementosis, abscesses, premortem tooth loss and hypoplastic defects.

Skeletal materials designated for radiocarbon dating were packed separately from the individual burials but received the same curatorial treatment (with the exception of ethanol application) and analysis.

Photographic Documentation

Photographic documentation was undertaken using a Nikon Coolpix camera set on maximum-pixel resolution. Photos were taken of all crania, longbones, joint surfaces, taphonomic alterations and pathologies. The anterior and posterior of all longbones were photographed, as were intra- and extra-cranial surfaces. Fragmented remains were grouped according to burial number, and multiple photographs from different perspectives were taken. These images were stored on an external hard drive and backed up on multiple series of DVD disks. Teeth were photographed to include lingual, labial, and crown surfaces, enamel hypoplastic defects, carious lesions, and dental anomalies. Roots of subadult dentition were also photographed. Digital photography provides a cost-effective method of documenting the materials, and multiple shots of each element, element fragment cluster, tooth, etc., were often taken. In all, roughly 8,000 images are curated on the Buckeye Knoll hard drive at FSU and occupy roughly 30 gigabytes of space.

Comparative Considerations

A primary goal of this report is to provide basic comparative data for future researchers. Over the last decade, some information has been compiled which will provide a simple comparative framework, although this is not the primary goal of this report. The basic descriptions of the Texas comparative sites and other samples are provided in Addendum 12-2 to this chapter. In addition to the metric data extracted from a series of Texas reports, we also utilized comparative dental metrics that come largely from Stojanowski's (2001) doctoral dissertation and have been utilized in several recent publications, which provide additional references on the subsamples used (Stojanowski 2004, 2005). Postcranial metrics, largely humerus and femur shaft dimensions, were also drawn from sites presented in the Steckel et al. (2002) publication (Western Hemisphere database and the online database—http://global.sbs.ohio-state.edu/western_hemisphere_module.htm), Doran's (1975) Master's thesis on the longbones of Texas Indians, along with data from sites identified in the paleodemography section of the Windover monograph (Doran 2002b). Part of the difficulty of any large-scale comparison—although this was not the main goal of this project—is the compilation of chronologically and geographically appropriate comparative samples that contain an array of osteometric information. Other disciplines have established broad-based databases for everything from soil chemistry to metrics of other species, but such large human-centered databases are still ephemeral or, at best, in developmental stages, although they are long overdue and have much to recommend them.

Following the general burial inventory, there is a detailed dental inventory by Stojanowski (Chapter 13) describing, again on a burial-by-burial basis, the dental material from each of the burials. This includes a discussion of the methods of assessing age, particularly the procedures for assessing age vis-à-vis dental attrition. It also includes a discussion of the dental traits (non-metric) collected. Following these inventories there is a discussion of the comparative information, particularly for the postcranial and dental metric series.

Taphonomic and Methodological Overview

As already noted, the skeletal remains from Buckeye Knoll had suffered extensive taphonomic damage prior to excavation. Most elements were fragmented and had extremely degraded cortical surfaces. Of the total 780 identifiable elements, 410 were fragmented. The complete elements consisted primarily of bones of the hands and feet. There were no complete crania, although several had been partially reconstructed in CEI's Corpus Christi laboratory. Many elements were embedded in matrix following the application of consolidant during excavation. As the elements were removed from matrix, many were reduced to small fragments. This was especially the case with the crania.

As noted earlier, the surfaces of most elements were highly degraded. Many exhibited erosional "lesions," possibly caused by water or insect damage. Some lesions, many quite symmetric in shape, and often very nearly circular, completely perforated the cortical surfaces and often passed completely through the element. Some elements exhibited multiple lesions of this nature, giving the element a "worm-eaten" appearance. These types of lesions were present on cranial and postcranial remains. It is suspected that some of these lesions may be from burrowing insect larvae (large), which tunneled through the bone after normal bone durability and density was compromised by soil chemistry (i.e., once the bone was chemically softened, burrowing larvae from species such as cicadas tunneled through the now-softened bone). In some locations, similar distinct circular perforations might be caused by root invasion. However, no root remains were found in the perforations, and if they were caused by root activity it may have been several thousands years prior to excavation and the root detritus has long since decayed. Based on personal observations, many of these lesions were approximately the same size as mature cicada's larva, and the small ones may be from immature larvae (subterranean for most of their lives). Lesion diameter varied from less than 10 mm to as much as 20 mm. These were not just found on the older materials. Burial 25, for example, one of the best preserved in the collection from the Late Archaic interval, exhibited a number of these lesions (using the term here in a nonpathological sense). They can be quite frequent and their incidence on just the dorsal surface of the right femur will give some sense of this process. None of the lesions in this element completely penetrates the cortical surface, though in most elements they do. In Burial 25 they were approximately 5 to 9 mm in diameter, and circular to slightly elliptical in shape. To provide some sense of the frequency, there were two on the neck of the femur (dorsal surface only), and each was circular and approximately 1 cm in diameter. On the upper shaft/metaphysis just below the neck, there were seven such lesions; several appeared to be very recent (i.e., the bone was freshly exposed, and others were much older and showed no fresh bone exposure. All were roughly 1 cm in diameter. None was larger than 2 cm, and none was deeper than 5 to 7 mm Again, they did not penetrate the cortical surface. There was an additional shallower one of the same size, but less than 3 mm along the linea aspera in the region of the nutrient foramen, that also appeared recent. There were three more equally shallow ones of approximately the same diameters on the inferior metaphysis. In some cases, they were much larger, some as large as 3.5 cm that completely penetrated to the medullary cavity. One from Burial 58 (an unidentified [UID] longbone fragment) had scalloped edges and, from a descriptive standpoint, looked like a hole carved into the bone. The entire "lesion" was approximately 1.8 cm long and the cavity that penetrates the medullary cavity was 1.5 cm long and somewhat rectangular in shape. As noted earlier, these features appeared to be formed by some burrowing creature that, in some cases, began to burrow through the bone but then backed off, while in other cases the creature continued to excavate and completely penetrated the bone.

There was significant calcium-carbonate buildup on many elements, in some cases completely obliterating the external surface of the bone. Only a very small number of burials exhibited rodent-gnawing damage in the form of small striations on several longbones. No elements exhibited human modification (cuts, charring, etc.), although the condition of the bones would make it difficult to observe such modification unless it had been persistent and thus was relatively obvious. There were enough surfaces available for examination that it is felt had there been extensive or persistent human modification we would have seen them unless they were at trace levels. By all indications we feel these were primarily fleshed burials of both sexes and consisted of both adults and subadults. We also feel it is a reasonable presumption that the Buckeye Knoll sample constitutes a representative cross section of the community occupying this geographic area at this time period. Demographically, as with many archaeological samples, there is a problem of infant underenumeration.

Burial Inventory

Each burial will be presented individually, and each description includes burial metrics, an assessment of preservation, and a summary of bone pathology and skeletal biology. The metric data are limited, particularly for the postcranial component, and are presented as the first element of the burial-by-burial descriptions. Such data also are presented in table format (Addendum 12-3). Summary statistics for the various Buckeye Knoll dimensions are provided in Table 12-1.

The relative degree of preservation and an inventory of identified elements (more often element fragments) are presented. Much of the material was so fragmented that standard metrics were not collectable. In a number of cases, the fragments of the major longbones were identifiable by a direct element-to-element comparison with individuals from the Windover collection (Doran 2002a). In some cases, the comparisons allowed for what is felt to be a reasonable approximation of location (particularly midshafts) on element-to-element comparisons, and we identified and recorded those specific individuals from the Windover collection that provided the best analogs. Typically, a series of several dozen individuals of both sexes and different ages were used in this comparative step to derive as much information as possible from the Buck-

Table 12-1. Aggregate Postcranial Statistics for the Buckeye Knoll sample.

	N	MIN.	MAX.	MEDIAN	MEAN	SE	SD	Measurement *
MXLFEML	1	468	468	468	468.00			Maximum femur length
MXLFEMR	1	464	464	464	464.00			
BILFEML	1	472	472	472	472.00			Bicondylar femur length
BILFEMR	1	468	468	468	468.00			
MXDFEMHL	2	40.43	48.15	44.29	44.29	3.86	5.46	Maximum dia. Femur head
MXDFEMHR	5	40.55	48.07	46.42	44.83	1.40	3.14	
FMSAPL	13	21.12	32.99	26.24	26.47	0.99	3.56	Femur midshaft ap
FMSAPR	7	21.76	33.19	28.37	28.35	1.55	4.09	
FMSMLL	13	20.76	27.34	24.66	24.50	0.55	1.97	Femur midshaft ml
FMSMLR	7	23.82	27.03	25.24	25.49	0.47	1.25	
LENTIBL	1	360	360	360	360.00			Max. tibia length
LENTIBR	1	382	382	382	382.00			
PATMXHL	5	31.12	42.57	36.09	37.26	2.10	4.69	Patella height
PATMXHR	8	35.27	41.61	37.68	37.88	0.87	2.47	
PATMXBL	7	33.06	44.58	38.97	39.28	1.51	4.01	Patella breadth
PATMXBR	9	32.97	41.48	37.24	37.40	0.88	2.64	
MAXHUML	1	300	300	300	300.00			Max. humerus length
MAXHUMR	1	297	297	297	297.00			
HMAPL	5	15.48	24.27	20.06	19.96	1.41	3.16	Humerus midshaft ap
HMMLL	5	16.67	20.97	17.58	18.25	0.76	1.70	Humerus midshaft ml
HMAPR	4	20.39	23.06	20.985	21.36	0.59	1.19	

*Measurements are from the Standards manual (Buikstra and Ubelaker 1994) with the exception of *[1] dimensions.
*[1] dimensions are described in Addendum 12-1.
S.E. = standard error of the mean.
S.D. = standard deviation.

continued.

Table 12-1. (continued)

	N	MIN.	MAX.	MEDIAN	MEAN	SE	SD	Measurement *
HMMLR	4	16.35	22.93	16.765	18.20	1.58	3.17	
RMLL	2	139	209	174	174.00	35.00	49.50	Radius max. length
UMLL	2	13.03	268	140.52	140.52	127.49	180.29	Ulna max. length
TMLML	8	15.51	36.85	23.69	23.86	2.22	6.27	Tibia midshaft ml
TAPNL	8	22.52	40.8	36.265	33.59	2.33	6.58	Tibia ap at nutrient foramen
TAPNR	6	17.75	37.59	29.61	29.40	3.31	8.106	
TMLMR	6	20.89	26.42	22.88	22.95	0.85	2.09	
LMC1	2	40.72	42.83	41.775	41.78	1.06	1.49	Metacarpal 1 - left
LMC3	1	63.03	63.03	63.03	63.03			Metacarpal 3 - left
LMC4	1	56.93	56.93	56.93	56.93			Metacarpal 4 - left
LMC5	2	50.58	60.56	55.57	55.57	4.99	7.06	Metacarpal 5 - left
RMC1	1	42.87	42.87	42.87	42.87			
RMC2	2	58.32	61.26	59.79	59.79	1.47	2.08	
RMC4	1	64.92	64.92	64.92	64.92			
FSIDNL	2	23.47	32.09	27.78	27.78	4.31	6.10	Femur superior-inferior neck dia.
FSIDNR	2	28.83	32.72	30.775	30.78	1.95	2.75	
MT1APBL	2	26.13	28.05	27.09	27.09	0.96	1.36	
MT1APBR	4	24.72	30.71	26.355	27.04	1.37	2.74	Metatarsal 1 base ap diameter
MT1MLBL	2	19.17	20.08	19.625	19.63	0.45	0.64	Metatarsal 1 base ml diameter
MT1MLBR	3	19.29	19.47	19.3	19.35	0.06	0.10	
MT2APBL	4	18.1	20.73	20.015	19.72	0.59	1.17	
MT2APBR	2	19.63	19.86	19.745	19.75	0.12	0.16	

*Measurements are from the Standards manual (Buikstra and Ubelaker 1994) with the exception of *[1] dimensions.
*[1] dimensions are described in Addendum 12-1.
S.E. = standard error of the mean.
S.D. = standard deviation.

continued.

Table 12-1. (continued)

	N	MIN.	MAX.	MEDIAN	MEAN	SE	SD	Measurement *
MT2MLBL	6	12.56	16.11	14.505	14.40	0.49	1.20	
MT2MLBR	3	15.18	17.26	16.08	16.17	0.60	1.04	
MT3APBL	3	16.09	21.17	20.54	19.27	1.60	2.77	
MT3APBR	3	15.72	22.49	20.07	19.43	1.98	3.43	
MT3MLBL	3	12.98	14.17	13.96	13.70	0.37	0.64	
MT3MLBR	4	12.97	16.14	14.09	14.32	0.66	1.33	
MT4APBL	5	13.28	19.52	18.39	17.22	1.14	2.54	
MT4APBR	3	17.93	19.37	18.69	18.66	0.42	0.72	
MT4MLBL	5	12.25	13.59	13.1	13.07	0.23	0.52	
MT4MLBR	3	12.6	13.28	13.04	12.97	0.20	0.34	
MT5APBL	9	12.96	15.58	14.25	14.19	0.25	0.76	
MT5APBR	6	12.08	21.02	14.13	14.89	1.30	3.18	
MT5MLBL	9	14.32	23.13	18.26	18.61	0.86	2.57	
MT5MLBR	6	13.63	21.35	18.355	18.07	1.09	2.67	
MC1APBL	4	13.88	15.12	14.36	14.43	0.26	0.51	Metacarpal 1 base ap dia.
MC1APBR	2	12.13	15.93	14.03	14.03	1.90	2.69	Metacarpal 1 base ml dia.
MC1MLBL	4	13.88	15.12	14.36	14.43	0.26	0.51	
MC1MLBR	3	13.93	15.95	15.04	14.97	0.58	1.01	
MC2APBL	2	15.37	16.36	15.865	15.87	0.50	0.70	
MC2APBR	4	15.52	16.92	15.625	15.92	0.33	0.67	
MC2MLBL	3	16.14	18.16	16.32	16.87	0.65	1.12	

*Measurements are from the Standards manual (Buikstra and Ubelaker 1994) with the exception of *[1] dimensions.
*[1] dimensions are described in Addendum 12-1.
S.E. = standard error of the mean.
S.D. = standard deviation.

continued.

Table 12-1. (continued)

	N	MIN.	MAX.	MEDIAN	MEAN	SE	SD	Measurement *
MC2MLBR	4	12.44	17.19	14.36	14.59	1.15	2.31	
MC3APBL	5	11.29	17.01	15.74	15.13	0.99	2.21	
MC3APBR	3	12.46	16.77	15.77	15.00	1.30	2.26	
MC3MLBL	5	13.42	16.19	14.19	14.55	0.48	1.08	
MC3MLBR	5	11.38	14.87	13.99	13.21	0.76	1.70	
MC4APBL	4	11.3	12.91	11.46	11.78	0.38	0.76	
MC4APBR	3	11.19	13.88	12.65	12.57	0.78	1.35	
MC4MLBL	4	10.83	13.07	11.25	11.60	0.51	1.02	
MC4MLBR	3	12.06	12.66	12.54	12.42	0.18	0.32	
MC5APBL	3	9.67	15.64	10.52	11.94	1.86	3.23	
MC5APBR	4	10.87	17.78	11.595	12.96	1.62	3.23	
MC5MLBL	3	10.87	13.74	12.69	12.43	0.84	1.45	
MC5MLBR	4	11.18	15.5	13.975	13.66	1.07	2.13	
LUNLL	10	15.18	17.44	16.505	16.50	0.22	0.69	Lunate length from tip to tip*[1]
LUNLR	11	11.92	19.1	15.42	16.05	0.63	2.07	
LUNHL	7	7.45	14.88	14.3	13.04	1.00	2.65	Lunate dimension at right angles to lunl*[1]
LUNHR	9	9.91	19.1	13.99	14.12	0.81	2.43	
HMDAPL	5	17.74	24.45	20.43	20.96	1.09	2.44	Humerus at deltoid tuberosity - ap dimensions
HMDAPR	4	18.56	26.38	23.64	23.06	1.63	3.26	
HMDMLL	4	15.7	23.8	20.95	20.35	1.90	3.80	Humerus at deltoid tuberosity - ml dimensions
HMDMLR	3	16.9	18.65	17.42	17.65	0.51	0.89	

*Measurements are from the Standards manual (Buikstra and Ubelaker 1994) with the exception of *[1] dimensions.
*[1] dimensions are described in Addendum 12-1.
S.E. = standard error of the mean.
S.D. = standard deviation.

continued.

Table 12-1. (concluded)

	N	MIN.	MAX.	MEDIAN	MEAN	SE	SD	Measurement *
RMTAPL	3	13.34	16.15	14.99	14.83	0.82	1.41	Radius max.ap dimension thru radial tuberosity*[1]
RMTAPR	4	11.22	15.19	14.3	13.75	0.90	1.81	
RMTMLL	3	15.03	15.48	15.05	15.19	0.15	0.25	Radius max. ml dimension at radial tuberosity *[1]
RMTMLR	4	12.56	16.35	15.33	14.89	0.91	1.82	
XFMSAPL	4	19.95	26.31	23.81	23.47	1.41	2.83	Femur subtrochanteric ap
XFMSAPR	7	17.51	28.71	24.7	23.06	1.60	4.22	
XFMSMLL	4	24.45	33.45	27.51	28.23	2.16	4.31	Femur subtrochanteric ml
XFMSMLR	7	21.55	33.54	26.74	27.59	1.84	4.87	
STATURE	9	149.97	181.82	163.53	164.40	3.65	10.94	Stature estimate

*Measurements are from the Standards manual (Buikstra and Ubelaker 1994) with the exception of *[1] dimensions.
*[1] dimensions are described in Addendum 12-1.
S.E. = standard error of the mean.
S.D. = standard deviation.

Table 12-2. Inventory of Sites from which Texas Femur and Tibia Dimensions are Drawn.

Texas Site Name/Number	N	Date B.P.
41AD2	2	
Beacon Harbor*	1	
41BL4	2	
41BQ1	1	
41BW4	12	500
41BW8	1	730
41CH1	2	
41CK11	1	
41CP5	2	500
41CR0	1	
41CS14	3	500
41CV1	3	
41CV17	2	
Calle del Oso, 41NU2	14	752
Caplen, 41GV1	14	601
41EL11	3	
41FS1	1	100
41HI1	1	
41JS0	3	
41JS1	1	
41JS10	6	
41JS9	1	

Texas Site Name/Number	N	Date B.P.
Leonard K., 41AU37*	3	4610
41LR2	18	630
Langtry Cr.	4	
M Espiritu Santo, 41GD1	10	175
Polecat Hollow	3	
41RE1	6	
41RW2	1	1850
41RW4	6	1850
Ranney Creek Cave	7	
41SA89	2	500
Sanders Site, 41LR2	26	
41SS2	2	
41TA0	1	
41TV0	1	
41VT1	5	
41VV0	2	
41VV2	1	
41VV72	4	
41VV82	3	
Wilson-Leonard, 41WM235*	1	10000
41WM3	1	
Yarbrough, 41VN6*	6	200
41ZZ10	2	

Notes: The Sanders Site Provides Femur Midshaft Dimensions. All Sites Except * Sites are Drawn from Doran (1975).
* Site backgrounds are provided in Addendum 12-2 at the end of this chapter, along with a listing of sites used in the dental and postcranial metric comparisons.

eye Knoll materials. This was very useful in dealing with fragmented subadult postcranial material often containing limited information.

In the case of the nondental metric data, two comparisons are included on a burial-by-burial basis. The individual burial metrics from Buckeye Knoll are compared to two comparative data sets, one compiled from Texas sites and a second from other North American locales, including Windover (Tables 12-2 and 12-3). Each of these data sets are comprised of femur and tibia dimensions. This strategy provides both an aid to sex assessment and also provides information for framing the Buckeye Knoll people within a broader perspective. As mentioned, comparisons are limited and simplistic and not the primary focus of this report.

Texas metrics (dental, cranial, and postcranial) were extracted from the literature and unpublished sources accumulated over the last several decades, many from Doran's thesis on the longbones of the Texas Indians (Doran 1975). Table 12-2 provides a list of the sites from which various postcranial dimensions have been drawn. Metrics from 382 individuals

Table 12-3. Comparative Postcranial Statistics with Texas Comparative Group and Femur Midshaft Comparisons (North America).

Texas Males: Femur Midshaft Dimensions and Femur and Tibia Length						
	FMSAPL	FMSAPR	FMSMLL	FMSMLR	MXFEM	TIBIA
N of cases	7	3	7	3	57	63
Minimum	30	20	24	26	398	342
Maximum	35	34	28	27	498	423
Median	33	32	26	27	456	383
Mean	32.71	28.67	26.43	26.67	454.38	382.5
SE	0.68	4.37	0.53	0.33	2.87	2.26
SD	1.8	7.57	1.4	0.58	21.67	17.95
(Variable abbreviations are in Addendum 12-1.) (All femur mid shaft dimensions are from the Sanders site.)						

Texas Females: Femur Midshaft Dimensions and Femur and Tibia Length						
	FMSAPL	FMSAPR	FMSMLL	FMSMLR	MXFEM	TIBIA
N of cases	8	8	8	8	29	33
Minimum	23	23	22	20	386	315
Maximum	27	27	25	25	473	393
Median	25.5	25.5	23.5	22.5	429	354
Mean	25.25	25.37	23.5	22.75	427.89	355.5
SE	0.45	0.5	0.42	0.59	3.45	3.19
SD	1.28	1.41	1.2	1.67	18.6	18.36

Texas All Sex: Femur Midshaft Dimensions and Femur and Tibia Length						
	FMSAPL	FMSAPR	FMSMLL	FMSMLR	MXFEM	TIBIA
N of cases	16	12	16	12	86	96
Minimum	23	20	22	20	386	315
Maximum	35	34	28	27	498	423
Median	28.5	26	25	24	446.5	375
Mean	29.03	26.75	24.93	24.08	445.45	373.2
SE	1.05	1.17	0.47	0.69	2.6	2.26
SD	4.2	4.07	1.91	2.39	24.13	22.16

continued.

Table 12-3. (continued)

North American Femur Dimensions												
	Femur (L) Midshaft Anterior-Posterior Diameter						Femur (L) Midshaft Medio-Lateral Diameter					
SITE	N	MIN	MAX	MEDIAN	MEAN	S.D.	N	MIN	MAX	MEDIAN	MEAN	S.D.
Sanders	16	23	35	28.5	29.06	4.2	16	22	28	25	24.94	1.91
Buckeye Knoll	13	21.12	33	26.24	26.47	3.56	13	20.8	27.34	24.66	24.5	1.97
Little Salt	6	15.61	33.2	26.52	25.58	6.52	6	14.5	29.46	25.74	24.54	5.17
3AM (Arikara and Oneota)	3	23	29	28	26.67	3.21	3	25	28	26	26.33	1.53
301 (Coastal South Carolina)	39	20	33	28	27.79	2.88	39	17	32	24	24.36	3.17
303(Coastal South Carolina)	67	23	34	27	27.66	2.88	67	22	31	26	26.22	1.87
SUN (Sun Watch)	53	23	38	29	29.26	3.35	53	20	29	26	25.51	2.14
Dolores (Colorado)	20	20	39	27.5	27.6	4.64	20	19	35	25	26.25	4.24
MON (Monongahela)	60	22	33	27	27.15	2.78	60	19	28	24	24.32	1.97
KIT (Archaic, Great Lakes)	12	22	32	27.5	27.08	3.15	12	23	28	26	25.33	1.44
PEA (Pearson)	39	24	32	28	28.31	2.24	39	22	29	26	25.31	1.54
BUF (Buffalo)	57	22	38	28	28.07	3.16	57	20	29	25	24.93	1.95
WO7 (Coastal South Carolina)	57	20	35	28	28.14	3.29	57	18	30	25	25.26	2.11
KX1 (Plains Village)	6	24	32	26.5	27.33	3.08	6	22	27	24.5	24.5	1.87
WW7 (Plains Village)	20	21	34	28.5	28.3	3.11	20	22	28	26	25.55	1.85
CHY (Cheyenne)	3	27	32	30	29.67	2.52	3	24	29	27	26.67	2.52
CRW (Crow)	19	23	35	30	30.47	3.2	19	22	31	27	27.11	2.35
Windover	8	19.77	32.4	26.94	26.59	5.11	8	22.2	29.38	23.87	24.91	2.47
DW2 (Plains Village)	14	24	33	26	26.64	2.53	14	20	28	25	24.79	2.33
DK 2 (Plains Village)	9	23	32	27	27.56	3.32	9	20	29	25	24.33	2.74
BU2 (Plains Village)	1	26	26	26	26	.	1	22	22	22	22	.

continued.

Table 12-3. (continued)

North American Tibia Dimensions

Tibia (L) Anterior-Posterior at Nutrient Foramen (TAPNL)

SITE	N	MIN	MAX	MEDIAN	MEAN	SEM	SD
Little Salt	7	20.44	39.06	32.07	32.20	2.21	5.84
Windover	13	20.46	39.57	30.8	30.51	1.64	5.92
Knight	24	31	40	36	35.12	0.57	2.77
Klunk	19	28	46	33	34.11	0.91	3.96
Steuben	14	22	39	35	33.64	1.24	4.65
Chota-Tanase	12	25.5	36	31.5	32.00	1.00	3.45
Gautier Site	1	29	29	29	29.00	.	.
Waddells's Mill Pond	2	25.2	33.1	29.15	29.15	3.95	5.59
Cedar Creek	1	29.4	29.4	29.4	29.40	.	.
Wilson-Leonad	1	29	29	29	29.00	.	.
Piney Island	1	33	33	33	33.00	.	.
Fort Cetner	15	29	39	35	34.53	0.71	2.75
11-S-86	1	36.21	36.21	36.21	36.21	.	.

Tibia (R) Anterior-Posterior at Nutrient Forament (TAPNR)

SITE	N	MIN	MAX	MEDIAN	MEAN	SEM	SD
Little Salt	11	26.83	36.93	33.99	33.63	0.94	3.10
Windover	8	26.27	33.97	29.05	30.11	1.13	3.19
Gautier Site	1	30.1	30.1	30.1	30.10	.	.
Waddells's Mill Pond	2	26.4	33.3	29.85	29.85	3.45	4.88
Cedar Creek	1	29.2	29.2	29.2	29.20	.	.
Wade Burial	1	29	29	29	29.00	.	.
11-S-86	2	31.7	36.31	34.005	34.01	2.31	3.26
Drondski Site	1	34.4	34.4	34.4	34.40	.	.

Tibia (L) Mediolateral Diameter at Nutrient Foramen (TMLML)

SITE	N	MIN	MAX	MEDIAN	MEAN	SEM	SD
Little Salt	8	17.52	28.5	23.455	23.17	1.07	3.03
Windover	13	15.96	33.36	21.6	22.24	1.35	4.87
Knight	24	20	30	23	23.33	0.46	2.28
Klunk	19	20	31	24	24.11	0.57	2.47
Steuben	14	17	26	22	22.57	0.68	2.53
Chota-Tanase	12	17.5	26	22	22.13	0.69	2.39
Gautier Site	1	26.5	26.5	26.5	26.50	.	.

continued.

Table 12-3. (concluded)

TMLML (continued)							
SITE	N	MIN	MAX	MEDIAN	MEAN	SEM	SD
Waddells's Mill Pond	2	18.9	22.7	20.8	20.80	1.90	2.69
Cedar Creek	1	18.4	18.4	18.4	18.40	.	.
Wilson-Leona	1	19	19	19	19.00	.	.
Piney Island	1	21	21	21	21.00	.	.
Fort Center	15	17	31	23	23.80	0.86	3.34
11-S-86	1	24.12	24.12	24.12	24.12	.	.

Tibia (R) Mediolateral Diameter at Nutrient Foramen (TMLMR)							
SITE	N	MIN	MAX	MEDIAN	MEAN	SEM	SD
Little Salt	11	20.73	25.4	23.32	23.14	0.56	1.86
Windover	8	16.73	22.65	20.29	19.97	0.80	2.26
Gautier Site	1	27.8	27.8	27.8	27.80	.	.
Waddell's Mill Pond	2	20.2	23.3	21.75	21.75	1.55	2.19
Cedar Creek	1	18	18	18	18.00	.	.
Wade Burial	1	18	18	18	18.00	.	.
11-S-86	2	21.91	23.04	22.475	22.48	0.56	0.80
Drondski Site	1	22.4	22.4	22.4	22.40	.	.

from 78 sites are included, and the majority are from the last 1,000 years. Comparatively, this sample is much more recent than the Buckeye Knoll materials, and, functionally, we would argue that the data pertain to two basic time periods, with Buckeye Knoll indicative of the early sample and all but Wilson-Leonard representing the more recent series dating to the past two millennia (many, if not all, of the undated sites are also probably from the last 2,000 years). The reality is that most of the individuals in this potential series provided only a few metrics and reflect small samples at some sites, poor preservation, and incomplete recording of skeletal metrics.

Although, for the purposes of this report, these are the best series we have been able to obtain; however, they are severely lacking and limit comparative rigor. This issue is illustrated by the reality that of the potential 382 individuals from 78 sites, there are only eight females and seven males with data for the femur midshaft dimensions. For every metric presented in the individual burial discussions and the aggregate discussion, sample size is a problem. This will not be reiterated at each location.

All measurements in the following Burial-by-Burial Inventory are in millimeters, unless otherwise stated. Dental metrics are also mentioned in the burial-by-burial inventory primarily as an aid to sex assignment. As noted above, full dental inventory and discussion follows the burial inventory in Chapter 13. Common abbreviations in both chapters include: LX = left maxillary; LN = left mandibular; I1, I2 = first and second incisors; PM1, PM2 = first and second premolar; M1, M2, M3 = first, second and third molars; bl = buccolingual dimension; a "d" preceding the dental abbreviation indicates it is a deciduous tooth; mad = mesiodistal dimension; ch = crown height; ap = anterior-posterior, ml = mediolateral dimension.

Each burial is listed under its own heading. Under the initial suheading "Metrics," there is a list of postcranial metrics for the individual and, where appropriate, a discussion of the implications with respect to age assessment. This is followed under the subheading "Description" by a general discussion of the burial inventory and information pertinent to our assessment of the MNI for the burial. Age and sex assessments are presented under the subsequent subheading "Summation." The decimal places in the age assessment do not imply this degree of accuracy, but are the product of the regression equation. We would propose that, as with most attrition assessments of age, the age range is more realistically plus or minus seven to ten years.

In some cases, we were able to match field notes (Burial 1B, for example) with individuals during the inventory. However, in other cases this was more difficult, and in some cases "new" individuals (not identified in the field) appeared and were generally numbered sequentially. For example, Burial 4 was later identified as two individuals. The primary individual was labeled Burial 4 #1, while the second individual was identified as Burial 4 #2.

For sex designations (i.e., sexnum) the following designations were used, 1 = male; 1.5 = probable male; 2 = female; 2.5 = probable female; 3 = indeterminate sex due to immaturity; 4 = adult of indeterminate sex.

Burial-by-Burial Inventory

Burials 1-A, 1-B

Metrics

No metrics on postcranial or cranial material were collectable. An estimated tibial length of 360 mm for Burial 1-B was made in the field. Tibia of this size, based on other Texas skeletal samples (see Table 12-3), strongly suggest that this individual was almost certainly a female. Of the nearly 100 individuals (Texas sample) represented by tibia dimensions, only 28 adults were smaller than 360 mm, and all but seven were identified as female.

Description

This burial consisted of the poorly preserved remains of an adult and a subadult. Although initially grouped as a single burial in the field, full exposure of the remains led to the conclusion that separate burials were actually represented. Identifiable elements included a right temporal fragment, shaft fragments from a right femur, and two tibial shaft fragments. There were small bags of postcranial and cranial fragments present. The two individuals were designated as 1-A and 1-B. The former was an adult with advanced dental attrition. Individual 1-B was much younger with essentially no attrition on the existing tooth surfaces (see next description) and contained deciduous dentition. Although initially identified as an adult, this individual was actually a subadult.

These burials were represented by cranial and postcranial fragments, poorly preserved and highly weathered. Burial 1-B was clearly younger than 1-A, since none of the adult dentition showed evidence of attrition, and a single deciduous tooth was loosely associated with this individual. The isolated deciduous tooth was a DLXM2. This tooth is lost at approximately 7 years of age. Given the absence of wear, and developmental stages of the dentition, it is likely many of these teeth were unerupted at the time of death. The best age estimate, based on the developmental sequence determined by examining the tooth roots, was 7 to 9 years. This individual was almost identical in terms of dental development to the individual identified as 4 #2, 7 to 9 years of age. In fact, they were so close in terms of age it was initially tempting to suggest they were the same individual; however, there was a duplication of the maxillary canines—both sides were present in [4 #2] but only one was present here, thus negating the possibility of these being fragments of the same individual. The absence of attrition and the presence of a deciduous tooth (LXM2) suggest this individual was a subadult of approximately 7 to 9 years of age.

A third individual, designated as 1-C, was identified in the field. Field photographs indicated some cranial material and fragmented postcranial elements. In the laboratory, a distinct person (i.e., 1-C) could not be isolated. It is likely the material identified as the third person was disturbed material from either individual 1-A or 1-B—most likely 1-A given that the denser bone of the adult would be more likely to survive in greater concentration than the more fragmented material of the subadult. No material from the shipping containers holding the remains of 1-A and 1-B clearly indicated the presence of this third ephemeral individual; thus, it is not considered further in this report.

Summation

Burial 1-A was female (sexnum = 2). Her estimated age was greater than 55 years. Burial 1-B was a subadult, around 7 years old, whose sex was indeterminate because of age (sexnum = 3).

Burial 2

Metrics

The dental material was relatively well preserved and provided good metric and nonmetric series for this burial. There were also measurable patella fragments (left), which had a maximum superior-inferior dimension of 33.06 mm. This value is next to the smallest in the Buckeye Knoll series and is below the male/female cut-off point for a series of 52 sexed individuals from North America. In this comparative series, all but two are males when patella height is greater than 40 mm, and all but two are female when this dimension falls below 40 mm. In Burial 2, there were sufficient femur fragments that could be refitted to provide an approximate estimate of midshaft location and, thus, midshaft dimensions (anterior-posterior and mediolateral), respectively 28.37 and 26.8 mm. These midshaft dimensions exceed the Texas female maximum values, although there are only eight females in the Texas series. These values are much more similar to the reported Texas male values (see Table 12-3), and it is reasonable to suggest, based on these limited metrics, this individual was probably male. All the comparative Texas femur midshaft values come from the Sanders site (see Table 12-3). In a much larger series of 588 individuals from across North America (all Native Americans), there are only 76 individuals with this dimension larger than 28 mm. Of these individuals, only ten are identified as females. Based on this limited postcranial metric information, this individual was more than likely a male, although the dental information (see below) suggests otherwise.

Description

These were the poorly preserved remains of an adult. Cranial fragments included portions of the basicrania, zygomatic arch, and the superior orbital wall. Fragmented remains included the right ulna, femoral shaft, tibia, and clavicle. A right patella was partially complete. One of the most intact elements was a tibia, and it was no more than 45 percent complete. There were roughly half a dozen recognizable femur midshaft fragments, but neither the tibia nor femur fragments were sizeable. There was also a series of identifiable humeral fragments. The tibia, femur, fibula, and humeral fragments all were similar in gross morphology and size to those from Windover Individual #147 (hereafter identified as W147), which was an adult male.

However, based on a dental metric analysis of a series of 565 canine dimensions, only 63 are equivalent in size or smaller. Of the individuals with smaller maxillary canine dimensions (buccolingual), only 21 are males; the rest are either females or unsexed individuals. Based solely on the canine dimension, the individual's dentition was more clearly either a small male or female. Molar dimensions, as would be expected, and other dental dimensions were also very small and more typical of individuals ascribed as females. The mandibular second molar (10.16 mm) out of a series of 166 individuals from North America, falls into the lower quartile and only 50 are smaller or equivalent in size. Based solely on dental metrics, which may be less influenced by environmental factors and more controlled by genetics, this individual was more than likely a female or a very gracile male. A brief examination of the other dental dimensions confirmed the small size of this individual. For virtually all of the collected dental metrics this individual fall into the lower third or, more frequently, in the lower quartile of several hundred North American prehistoric individuals—the lower quartile being composed largely of females.

Summation

Burial 2 consisted of a single individual, who was identified as a female (sexnum = 2). Her estimated age at the time of death was 37.6 years.

Burial 3

Metrics

The radial tuberosity dimensions (see Table 12-3) for Burial 3 are both smaller than the mean values in the rest of the Buckeye Knoll sample (12.48 mm and 13.58 mm, respectively). The minimum and maximum tuberosity dimensions of Burial 3 are next to the smallest represented in the Buckeye series. Estimated femur midshaft dimensions (21.12 and 25.41 mm) are also relatively small. The ap dimension is smaller than any reported Texas female dimension, while the ml dimension is roughly equivalent to the female mean and median (see Table 12-3). The femur dimensions are consistently smaller than observed in any of the Texas males. Estimated midshaft locations on the humerus (left) provide an ap estimate of 20.06 mm and an ml dimension of 17.29 mm. These values are also smaller than the male mean and median and larger than the comparable female values. In the small series of humerus shaft dimensions (ap, ml—eight specimens in all, nine ap), 9 mm is the fourth largest ap dimension and the seventh smallest mediolateral dimension.

There was distinct frontal bossing on the crania of this individual, which is more typical of males than of females. The zygomatic arches, however, were very gracile, and this is a feature more strongly suggestive of a female. The single dental dimension (RXMCBL dimension; 9.63 mm) has a rank of 113 out of 131 individuals in our data set and is slightly larger than the overall mean for this tooth. Overall, the best assessment is that this individual was more than likely a female.

Description

This burial represents the poorly preserved remains of an adult. Fragmented remains included the cranium, humerus, vertebrae, and ribs. Much of the cranium existed, but was badly fragmented. In the few locations where sutures could be identified there was a substantial amount of suture closure. At the same time, the posterior sagittal suture had minimal evidence of closure, suggesting a younger individual. However, the dental material showed heavy attrition. This individual exhibited the most advanced wear of any of the incisors examined from Buckeye Knoll and showed extremely advanced wear for the few other scorable teeth. Based on status of external suture closure, it is estimated the individual was around 50 years of age.

Summation

Burial 3 represents the remains of a single individual, who was probably female (sexnum = 2.5). The estimated age at the time of death is 51.49 years.

Burials 4 #1, 4 #2

Metrics

Maximum length of left navicular = 20.89. Maximum height of left patella = 32.24.

Description

This burial was comprised mainly of the highly fragmented and poorly preserved remains of an adult, Burial 4 #1. There was also dental material, which was clearly from a subadult, which was identified in the laboratory as Burial 4 #2. Fragments of Burial 4 #1 included cranial, humerus, radius, tibia, and vertebrae. There was a right scaphoid and five medial phalanges present. Right and left auricular surfaces of the innominate were present. Most of the elements of this individual were badly fragmented, unmeasurable, and frequently unidentifiable. Some of the hand elements were preserved, which provided the only relative assessment. The scaphoid was an excellent match to Windover #115, an adult female. Additional fragmentary metacarpals, such as the base of the first metacarpal and a section of a medial foot phalanx, were also gracile and support a female sex assessment.

A nearly complete patella was almost a perfect match for Windover #124, another adult female. Fragments of the superior margins down to the middle of the auricular surface survived, and, while incomplete, exhibited surface features equivalent to Phase 7 (Illustration J) of auricular changes in the SOD manual (Buikstra and Ubelaker 1994). Individuals at this stage are ascribed an age of 51 years and more, or, broadly speaking, 50 to 59 years. The extreme wear stages observed on the limited number of teeth also support an advanced age assessment. Attrition leads to a dental age estimate of 54.07 years, which is consistent with the auricular-surface age estimate.

There was some rodent gnawing on the tibia fragments along the margins of the anterior crest. Visible, identifiable rodent gnawing was extremely unusual in this collection and, thus, it is specifically mentioned here.

The second individual was identified as 4 #2 and was represented by no skeletal material. It was identified based on the presence of a variety of unworn and often unerupted teeth. A subadult, based on maturation stage of the roots, this individual was between 4 and 5 years of age.

Summation

Burial 4 includes the remains of two individuals. The primary individual (Burial 4 #1) was a female (sexnum = 2) with an estimated age of 54.07 years. Burial 4 #2 was represented only by teeth of a subadult, sex indeterminate because of immaturity (sexnum = 3), estimated to have been around 4 to 5 years at the age of death.

Burials 5 #1, 5 #2, 5 #3, 5 #4

Metrics

Estimated midshaft of right femur—a/p=33.19, m/l=24.77; right femur subtrochanteric—a/p=24.70, m/l=32.87; right ulna just below olecranon process—a/p=16.2, m/l=14.78; left ulna just below olecranon process—a/p=16.16, m/l=14.03; unsided femur fragment estimated superior-inferior neck dimension =

32.09; left femur estimated midshaft dimension—a/p=32.99, m/l=26.47

Within the Texas series of left femur midshaft dimensions, specifically the mediolateral, from Burial 5 #1 is the next to the largest in the Buckeye Knoll series (*n*=11). Compared to the 29 other Texas individuals, it is the fourth largest. The anterior-posterior dimensions are also large and only five of the 29 Texas individuals are larger. Compared to the other 19 Texas individuals for which we have right dimensions, Burial 5 #1's anterior-posterior dimension is only slightly larger than the mean (42nd percentile), while the mediolateral left dimension is next to the largest of the other 20 Texas dimensions. Compared to the much larger (*n*=588) sample of other Native Americans (left dimensions only), this individual is in the top quartile. Of those individuals with dimensions larger than this individual, only 40 of the 142 individuals are identified as female. The limited inventory of subtrochanteric dimensions also places this individual in the robust group (*n*=5). The single subtrochanteric dimension is not as robust, but still falls in the upper half of the distribution of Native Americans in the sample. Those approximately of this size are generally male.

Dentally, the metrics are ambiguous with respect to sex. It seems a more likely proposition that this was a male and a relatively robust one at that.

Description

This burial consisted primarily of the poorly preserved remains of an adult. The cranium was well represented by numerous fragments and was estimated to be approximately 75 percent complete, though it was highly fragmented. Other fragments included portions of femur, ribs, sacrum, and scapula. Metacarpals and phalanges were fragmented, as were a talus and calcaneus. These elements and element fragments all were relatively large and were attributed to the adult male. They were associated with the worn dentition that was relatively complete (estimated dental attrition age of 55+).

There is a direct AMS date on this individual of 6,730-6,650 B.P., calibrated. There was a minimum of two individuals represented in this burial, based minimally on portions of three mandibular glenoid fossa. The primary individual (5 #1) was represented by the majority of the cranial fragments and longbone fragments and was robust. The secondary individual (5 #2) was much less robust. The preserved right mastoid process was moderate in size, and there was no evidence of auditory canal changes associated with age or pathology (auditory extoses).

There is a possibility that some of the fragments from this burial actually came from Burials 9 or 38, both of which were extremely fragmented and intersected Burial 5. Based on dental material alone, there were an additional three individuals represented. One (5 #2) was an unsexed adult with an estimated dental attrition age of 22.22 years. The tooth was replicated in the series from 5 #1. There was a third adult (5 #3) represented by teeth replicated in 5 #1 and much more worn that the single tooth from burial 5 #2. It also had an advanced attrition age of 55+ years. The last individual, represented by a series of deciduous teeth (5 #4) was clearly not attributable to any of the individuals in this burial.

Summation

Burial 5 contained the remains of five individuals. The primary individual (Burial 5 #1) was a male (sexnum = 1) with an estimated age of greater than 55 years at death. Three other individuals were represented only by teeth. Dental attrition rates indicate that Burial 5 #2 (an adult of indeterminate sex; sexnum = 4) was 22.2 years old at death. Burial 5 #3 (another adult of indeterminate sex; sexnum = 4) was greater than 55 years old. Burial 5 #4 was a subadult of unknown sex (sexnum = 3) who was between 3 and 9 months old.

Burials 6 #1, 6 #2, 6 #3, 6 #4

Metrics

Estimated midshaft of right femur—a/p=30.28, m/l=26.34; estimated midshaft of left femur—a/p=27.84, m/l=25.48; estimated midshaft of right humerus—a/p=21.24, m/l=16.35; maximum development of deltoid tuberosity of right humerus—a/p=25.67, m/l=22.11; maximum development of deltoid tuberosity of the right humerus (a second individual)—a/p=24.76, m/=23.97; right tibia at nutrient foramen—a/p=34.36, m/l=22.29; superior articular surface of right talus = 32.76; breadth of right mandibular fossa = 21.78.

Femur midshaft dimensions (left) are in the middle third of the distribution of the 13 Buckeye Knoll individuals, and provide little that is diagnostic in terms of sex assessment. The humerus midshaft dimension (8 individuals, 5 left 5 right) from Buckeye Knoll show this is the third largest of the ap dimensions (right) and the smallest of the entire series of midshaft dimensions; again this diversity in size provides little with respect to sex differentiation, but supports the proposition we are dealing with multiple individuals. Dental metrics suggest two of the four individuals (6 #2 and 6 #3) were female and one (6 #4) was probably a subadult. The "primary individual" (Burial 6 #3) was a relatively robust male (see further discussion below).

Description

Burial 6 contained primarily the fragmented remains of an adult. The cranial vault was complete with orbits and one mastoid process. Fragmented remains included radius, ulna, femur, ribs, scapula, and innominate. The femur fragments were shaft fragments that were approximately 75 percent intact with very prominent gluteal lines. The scapula had well developed muscle attachment sites.

The dental material indicates the remains came from four individuals—three adults and one subadult. Duplicated elements included two right humeri. There was a relatively complete cranium, which for the sake of this discussion will be considered the primary individual in Burial 6. There was a series of femur fragments for which we have midshaft and subtrochanteric dimensions, all of which fall in the upper half of the respective distributions. These fragments were relatively robust, and it is unlikely they relate to the second identified person. The surviving cranial fragments, part of the orbits, and other small fragments, also support this individual's male assessment. There were sections of the crania that exhibited scorable isolated sutures—specifically suture location 1 with a score of 2, location 2 with a score of 3, location 3 with a score of 2, location 4 with a score of 2, location 5 with a score of 2, location 6 with a score of 1, and locations 7 and 8 with scores of 2 for suture closure. Interestingly, and this may be a better indicator of age, all the endocranial sutures appear completely fused. Weathering and degradation may have artificially "opened" some of the ectocranial sutures, but clearly the endocranial closure suggests a more advanced age. The mandible, while edentulous, was relatively robust and had a particularly square profile, supporting a male attribution.

A second person, here identified as 6 #2, was represented by a small series of cranial fragments that were much more gracile than that represented in 6 #1 proper. A left mastoid fragment was complete enough to be scored as a 2 (SOD manual), which is consistent with the presence of both male and female elements in this burial. There was also a small fragmented right mastoid that is consistent with the smaller individual identified as 6 #2. Individual 6 #2 was also represented by a small radius head fragment and pieces of the ulna, which were very close in size to Windover #115 (an adult female). There were also some small rib fragments from the head down to the tubercle that could have either been from this presumed female or even from the subadult (see below).

The femurs, presumably attributable to the primary individual 6 #1, exhibited extremely well developed gluteal muscle markings. They were so well developed they exceeded all but a few of the individuals this observer (Doran) has ever seen in 30 years of human-osteological work. Only a few individuals from Windover exhibited such a dramatic exaggeration of ridging along the gluteal line.

A third individual, 6#3 was represented by a right maxillary M3 and a left maxillary canine. The degree of wear provides an estimate of 55+ years of age, but no sex attribution is possible. There was a series of 6 teeth associated with Burial 6 that were from a 6- to 8-year-old subadult (6 #4), here formally identified as the fourth person in the burial. All of this individual's adult crown dimensions were extremely small. Root formation provides an estimate of age, as well as the very slight dental attrition, and indications that the mandibular M2 is not in occlusion. Stojanowski notes this individual has some of the smallest teeth of any adult teeth he has ever seen. Between the two of us (Stojanowski and Doran), we have examined teeth from several thousand individuals from coast to coast, and this individual consistently shows small dental dimensions for the multiple teeth represented (n=6) and misidentification is highly unlikely.

Some of the material from one of the adults was represented by small miscellaneous longbone fragments, none more than a few centimeters in size. What makes the scattered fragments distinct was their extremely weathered and degraded appearance. Much of the surface of these fragments looked like extremely weathered wood with distinct splitting along the stress lines. This was distinct from the material represented in 6 #1, 6 #2, and 6 #3, which, while fragmented, did not exhibit such a distinctly weathered surface. The bone from 6 #1, 6 #2, and 6 #3, while fragmented, displayed no splitting along stress lines and was "solid" within the utility of that definition given the preservation of the Buckeye Knoll material. The differential preservation could indicate some surface exposure of these fragments long ago as the site was being deflated by erosion while some of the bone material was not exposed on the surface.

The dental material is useful in identifying the MNI and estimated ages of the individuals in this burial. To simplify, at least one individual exhibited extreme wear (an older adult, 6 #3), hypercementosis, and alveolar problems. Another adult, Burial 6 #2, showed little dental attrition but was not associated with any deciduous teeth and was clearly not a subadult. In this individual, the third molar was fully erupted with a modest amount of wear, which places the individual in the 30-40 year age range (dental attrition age estimate is 39).

Burial 6 #1, however, was completely endentulous with extensive remodeling of the mandible, which was essentially intact. Such a condition is characteristic of a much older individual. In addition to these three adults, there were a number of deciduous teeth, some of which were very worn—no doubt just prior to exfoliation—specifically the left maxillary deciduous second molar, which would place the subadult (6 #4) between 6 and 8 years of age.

Summation

Burial 6 contained the remains of six individuals. Burial 6 #1 was identified as an adult male (sexnum = 1) who was completely edentulous. Burial 6 #2 was a probable female (sexnum = 2.5), estimated to have been 39.64 years old. Burial 6 #3, represented only by teeth, was from a probable female (sexnum = 2.5) greater than 55 years old. Finally, Burial 6 #4, also identified just by teeth, was a subadult between 6 and 8 years old (sexnum = 3).

Burials 7 #1, 7 #2, 7 #3

Metrics

Right humerus epicondyle breadth = 46.47; maximum deltoid tuberosity of right humerus—a/p=26.38, m/l=17.42; maximum deltoid tuberosity of left humerus—a/p=24.45, m/l=23.08; estimated midshaft of right femur—a/p=32.31, m/l=27.03; right femur subtrochanteric—a/p=26.45, m/l=25.87; left tibia at nutrient foramen—a/p=38.05, m/l=24.32; superior articular surface of left talus = 32.64; superior articular surface of right talus = 32.68; maximum head diameter of left radius = 22.94; maximum head diameter of left ulna—a/p=25.15, m/l=25.41; maximum head diameter of right femur = 46.42; superior/inferior neck dimensions of right femur = 32.72; left capitate height = 22.2; left capitate width = 13.58; maximum length of left scaphoid = 27.79; length of left lunate = 17.30, height = 13.31; maximum length of right scaphoid = 28.62; base dimensions of right mc5—a/p=17.78, m/l=15.37; mandibular condyle dimensions—a/p=11.22, m/l=18.01). Carpal metric protocols are taken from Hoover's Master's thesis (1997).

Essentially, all of the metrics collected place individual 7 #1 as one of the largest in the Buckeye Knoll series, especially for femur, tibia, and the major elements showing significant sexual dimorphism. As an illustration, the dimensions at the tibia nutrient foramen place this individual in the 93rd percentile of over 288 individuals from around the world.

Femur midshaft dimensions (right) place individual 7 #1 as the largest of the Buckeye Knoll series and the largest of the Texas series (for the right dimensions, all we have is the Texas comparative series). Compared to a much larger series of individuals of all geographic origins (from China to Africa), this individual's right dimensions are at the 92nd percentile. This individual's anterior-posterior dimensions place him in the top five of this larger series of 249 individuals. Femur subtrochanteric dimensions are the second largest observed at Buckeye Knoll, and are in the 90th percentile for femur head dimensions out of a global series of 288 individuals with right dimensions reported. Clearly, individual 7 #1 was a large, robust male.

Tibia dimensions of this individual are also large. The ap dimension at the nutrient foramen is third highest in the Buckeye Knoll series and the mediolateral is fourth largest in the Buckeye Knoll series. Based on a series of 119 North American individuals with ap dimensions greater than 37, all but two of the 43 sexed individuals were male. In the same group, values below 30 were, in all but two of 36 cases, identified as female. In all but three of the 29 cases in this series, mediolateral tibia dimensions at the nutrient foramen are identified as males when the ml dimension is greater than 24, and identified as females in all but two of the 30 sexed cases falling below 21 mm. These features strongly suggest this was a robust male. Most of the metrics for this individual are large regardless for the comparative sample (here either Buckeye Knoll or Windover), and even the lunate dimensions fall into this larger category and are the second largest recorded at Buckeye Knoll.

Description

Three individuals were represented in Burial 7—one adult (7 #1), one young subadult (7 #2), and a young adult (7 #3). The adult had a complete calotte with sutures obliterated. Right and left mastoids were both present and large, indicating, again, that the individual was a male. Both humeri were present but incomplete, as well as ulna, femur, and tibia. Fragmented remains included a left clavicle, vertebral spinous processes, and ribs. Hands were represented by a scaphoid, lunate, capitate, and distal and proximal phalanges. Feet were represented by left and right talus, medial and intermediate cuneiforms, and distal phalanges. The Windover individuals for which we have matches were all identified as adult males. Much of the adult dental material showed extreme wear (stage 8), frequently completely obliterating the tooth surface and exposing the pulp cavity. There was also some alveolar resorption around the LNM2, also supporting advanced age (55+ years based on attrition). Most of the metrics are best associated with burial 7 #1 the adult male.

The subadult (7 #2) was represented by fragmented remains of the cranium and radius. Capitate, scaphoid and lunate were present, as were parts of the medial phalanges and several distal elements of the hand. The best Windover match for this subadult, based on dozens of fragments (no complete longbone elements), is Windover 137, a neonate estimated to have been 0.5 years at the time of death. The deciduous teeth showed no evidence of wear and were presumably all unerupted (see dental discussion). These provide an age estimate in advance of the skeletal comparison to the Windover individual. Dentally, the age estimate is between 1.5 and 3 years of age.

The third individual, the young adult (7 #3), was represented by a femur fragment that was clearly not from the individuals represented in either 7 #1 or 7 #2. Individual 7 #3 also was represented by an RNM3 that exhibited very light wear. All root formation was complete and intact enough to judge the maturation stage. The estimated age, given the light wear, was in the 20s, but probably the lower range within this interval (i.e., between 18 and 25 years of age).

Summation

Three individuals were identified among the remains in Burial 7. Burial 7 #1 was a robust male (sexnum = 1) who was greater than 55 years old at the time of death. Burial 7 #1 was a subadult of indeterminate sex (sexnum = 3) who was an estimated 2.25 years old. Burial 7 #3 was an adult of unknown sex (sexnum = 4) whose age was placed at 21.5 years.

Burial 8

Metrics

Maximum proximal epiphysial breadth of left tibia = 77; maximum distal epiphysial breadth = 41; right tibia maximum length = 382; right tibial maximum proximal epiphyseal breadth = 40; right tibia maximum diameter at tibial tuberosity = 47.09; left radius distal head—m/l=29.54; left radius maximum diameter at radial tuberosity—a/p=16.15, m/l=15.05; right radius maximum diameter at radial tuberosity—a/p=15.19, m/l=16.35; left humerus epicondylar breadth = 59; right humerus a/p breadth = 46.35; right ulna m/l head breadth = 25.27; left ulna m/l head breadth = 24.29; right femur maximum length = 464; right femur bicondylar length = 468; right femur epicondylar breadth = 80; right femur a/p subtrochanteric diameter = 26.16; left femur maximum head diameter = 48.15; left femur maximum length = 468; left femur bicondylar length = 472; left femur epicondylar breadth = 83; left patella m/l diameter = 42.29; left MT1 base—a/p=28.05, m/l=20.08; left MT2 base—a/p=20.73, m/l=14.86; left MT3 base—a/p=20.54, m/l=14.17; left MT4 base—a/p=18.79, m/l=13.44; left MT5 base— a/p=15.00, m/l=18.02; right MT3 base—m/l=14.22; right MT4 base—a/p=18.69, m/l=12.60; right MT5 base—a/p=14.54, m/l=17.77; right MC3 base—a/p=16.77, m/l=13.99; right MC2 base—a/p=16.92, m/l=15.86; left hamate body length = 21.64; left hamate body height = 20.37; right calcaneus max length = 75.42; right talus max length = 52.74; right talus body height = 31.80; left talus body height = 29.45; left navicular width = 20.68; mandibular chin height = 29.55; breadth of left mandibular body = 11.55; breadth of right mandibular body = 11.23; left mandibular body height = 35.97; right mandibular body height = 33.95; mandibular body length = 79; right mandibular ramus breadth = 32.65; left mandibular ramus breadth = 37.15.

This was a robust individual based on almost any series of measures and any comparative group used as a reference population. For example, the maximum femur-head dimension (one of the rare femur heads preserved enough for measurement) is in the 92nd percentile for a series of 469 individuals from the global sample. In this series, all but two or three of the individuals with larger femur-head dimensions are male. Maximum femur length is in the 83rd percentile of 1,277 individuals in the global sample, again clearly indicting this was a robust individual. Using femur length as an estimator for stature (Trotter 1970—Mongoloid male formulae), this individual had an estimated stature of 172 cm (5 ft, 7.6 inches).

Based on the femur dimensions, he was more robust than he was tall.

Patella dimensions of this individual are the second largest (breadth) in the Buckeye Knoll series and are well above a reasonable cut point between males and females, at least based on a series of 52 sexed individuals from North America.

Description

The remains of two crania were present (with one attributed to Burial 7). The first consisted of fragments from frontal and parietal bones, all highly weathered and sutures fully closed. The second cranium was also highly fragmented, with sutures exhibiting minimal closure. Dental material exhibited significant attrition and was almost certainly a mature adult seemingly attributable to the first older individual (Burial 8). However, we feel the second set of cranial fragments in this burial actually went with Burial 7 (the skull of which was situated only ca. 30 cm to the south of the skull of Burial 8), and we do not feel it appropriate to formally register these materials as a second person in this burial. (Editor's note: This accords with field observations, which indicated clearly that only one individual was present in Burial 8.)

Postcranial remains included fragments from both humeri, both radii, both ulna, both tibia, left patella, right clavicle, vertebrae, ribs, both fibula, and both illiae. Present were left capitate, lunate, trapezium, trapezoid, and scaphoid. Right scaphoid and pisiform were present. Seventeen phalanges and two unidentifiable metacarpals were also represented.

Summation

Burial 8 contained the remains of a single individual. This person was an adult male (sexnum = 1) with an estimated age of 45.77 years at the time of death.

Burial 9

Metrics

Right lunate maximum length = 19.1 mm. Breadth measure of the epicondyle is 41.79 mm. This individual was very badly fragmented and this limited series of metrics provides little information of utility. However, it is the largest lunate dimension in the Buckeye Knoll series of ten individuals for which we could obtain a lunate length. Compared to a similar number of individuals from Windover (total lunate-length series of 20), this dimension is the fourth largest in the series; the largest are generally males. Mandibular morphology, however, is more strongly suggestive that this was an adult male. Dental indicators suggest this individual might have been a male, but it is uncertain (sexnum = 1.5).

Description

This burial was represented by poorly preserved, highly fragmented remains. Fragments from cranium, humeri, radii, femur, tibia, fibula, scapula, and innominates were present.

Summation

Burial 9 contained the remains of a single individual. This was a probable male (sexnum = 1.5) with an estimated age of 56.39 years.

Burials 10 #1, 10 #2

Description

The poorly preserved remains in Burial 10 were represented by a few fragments. Primarily for that reason, no metrics were available. Fragments included cranial, mandibular, femoral, tibial, and ribs. Two individuals were included, one adult and one subadult based on longbones and rib fragments. There also appeared to be elements from two individuals, based mainly on the few surviving cranial fragments (glenoid fossa), mandible fragments, and cranial elements. The second individual may well have been simply floating skeletal material. It may not evidence a true "second person," although the subadult is represented by a number of very small rib fragments of a young individual that seem unlikely to have traveled far together. In addition to the rib fragments, there was a small/subadult femur fragment.

The ribs clearly were not adult; they were equivalent in size to Windover 141, which was approximately five years of age at time of death. Additional femur and tibia fragments were clearly from an adult (based on gross size and morphology) and were similar to matched fragments from Windover 111, an adult male. Indivdual 10 #1 was designated as the adult and is a good match to Windover 111. A small number of tibia fragments are consistent with Windover 111. Individual 10 #2 was a subadult and was represented by a femur fragment and a series of small rib fragments. These materials are consistently a good match to Windover 141, an individual 5 years of age, as noted above.

Summation

Two individuals were represented in Burial 10. Burial 10 #1 was an adult male (sexnum = 1) with an estimated age of 38.84 years at the time of death. Burial 10 #2 was a subadult (sexnum = 3) who died around 5 years of age.

Burials 11 #1, 11 #2

Description

This interment was a poorly preserved burial represented by fragmented remains from cranium and humerus for which no metrics are available. The larger, more mature fragments of this burial were clearly from an adult. There were humeral fragments, which were also clearly an adult and were equivalent in size to Windover 142 (an adult male). This was the primary interment recognized in the field and is designated herein as Burial 11 #1.

Some of the cranial fragments from the general lot and from separate bags clearly came from a subadult identified as Burial 11 #2. Based on the subadult cranial material, small fragments of longbones, and comparisons to Windover material (particularly W56 and W116), it is estimated that this individual was between 6 and 11 years of age (mean age 8) at time of death. The consistently small size suggests the individual was from the lower range of this age interval. Much of the subadult material came from a bag from an excavation "pedestal," and this makes it more likely the material represents a burial rather than scattered bone inadvertently associated with this individual (i.e., not loose, floating material from other strata/locations). Dental analysis indicates a younger age of roughly 5.85 years.

Summation

Burial 11 contained the remains of two individuals. Burial 11 #1 was an adult male (sexnum = 1) whose age could not be estimated with the recovered material. Burial 11 #12 was a subadult (sexnum = 3) around 5.85 years old.

Burial 12

Metrics

Left tibia at nutrient foramen—a/p=22.52, m/l=15.51; superior articular surface of left talus = 24.83.

Description

Burial 12 consisted of the poorly preserved remains of a subadult. Fragmented remains included cranial, humeri, radii, ulna, femur, tibia, vertebrae, and ribs. Most of the cranial fragments were a good match to Windover 77 and Windover 112. Windover 112 was also a good match, particularly for some of the tibia fragments. There are also a variety of dental metrics. Windover 77 was between 9 and 11 years of age, with a best age estimate of 10, while Windover 112 is considered to be older, between 10 and 15 years of age with an estimated best age of 14 years. Some of the material from Burial 12 was also commingled with Burial 45. Evidence for the age of this individual is in the immature (undulating) surfaces of two vertebral body fragments. Both surfaces showed the immature surface features expected of an individual of this age. There were a series of calcaneus fragments that were more robust than Windover 75. Windover 75 was between 7 and 9 years of age. Collectively, this individual appears to be best estimated at between 10 and 11 years of age. Subadult tibia fragments recovered with Burial 45, but which clearly belong to this individual, were slightly smaller than Windover 112, a 12- to 15-year-old subadult. This supports the age estimate of Burial 12. Distal and proximal femur fragments technically recovered with Burial 45 were smaller than those from Windover 112.

Dental maturation is a more reliable estimate of age than gross morphology and size, specifically the focus of the preceding discussion. The dental maturation and both root formation and attrition (or lack thereof) are preferred and will be used as the primary age estimate. This places this individual much closer to an estimated age of 20 years. Given that the postcranial material was clearly small and gracile and would, by itself, suggest a much younger individual, it seems reasonable to argue this was a gracile female. While not entirely conclusive, it seems highly likely that this was a probable female (2.5) around 20 years of age. Some of the skeletal material from this individual was attributed to the subadult postcranial material in Burial 45.

Summation

Burial 12 contained the remains of a single individual. This was probably a female (sexnum = 2.5) who died around 20.24 years of age.

Burial 13

Metrics

Left lunate length = 16.4, height = 14.3; left scaphoid maximum length = 25.22; right MT5 base measurement—a/p=21.02; left talus superior articular surface = 25.47. The left lunate length of this individual falls below the median value reported in the Windover and Buckeye Knoll series. All Windover individuals of this size or smaller were identified as female.

Description

Burial 13 consisted of the poorly preserved remains of a gracile adult. The cranium was represented by small fragments, both petrous pyramids, and a portion of occipital. Sutures were open. It appeared that roughly 50 percent of the cranium had survived, although in badly fragmented condition. The material appeared to be relatively robust, although taphonomically reduced in size. Fragmented remains included humerus, radius, ulna, femur, tibia, fibula, scapula, patella, and ribs. The best match for the relatively abundant postcranial material is with Windover 93, which was an adult female. The fragmented postcranial material was gracile, and particularly so for some of the scapula fragments. Some of the cranial fragments were so gracile, in fact, that they were tentatively identified in the field as a subadult. However all the material looks adult, and this also was supported by relatively advanced dental attrition.

Summation

Burial 13 was the interment of a single individual. This person was an adult female (sexnum = 2) who was estimated to have been 48.02 years old.

Burial 14

Description

Burial 14 consisted of poorly preserved, highly weathered remains, for which no metrics are available. Fragments included crania, humeri, ulna, femur, tibia, fibula, and ribs. Nothing from this individual was measurable. There were no good indicators of sex in this fragmented material, although, based on comparisons with larger tibia fragments, this individual was similar in size to Windover 142, an adult male. The overall morphology suggests this individual was an adult male. There was no dental material from this individual, which was unusual but certainly not unprecedented. This burial was right on the surface of the underlying clay and was one of the deepest with respect to overall burial placement.

Summation

Burial 14 contained the remains of one identified individual. This was an adult male (sexnum = 1) of undetermined age.

Burial 15

Metrics

No metrics are available. Nevertheless, based on the dimensions of the RNMN1BL, which obviously is a limited basis for comparison, this individual has the smallest absolute value of the neck dimension of any of the 84 individuals for which we have this dimension. It is so unusually small it seems this was probably an adult female. If there had been more dental material preserved, greater confidence might be possible, but a probability estimate seems the most cautious approach in this case.

Description

Burial 15 was represented by poorly preserved remains that consisted of small portions of cranial and postcranial fragments. Very little remained of this individual, and some of the burial may still extend into the unexcavated wall. This burial, like Burial 14, was placed right on the underlying clay surface. This was one of the most poorly preserved individuals in the Buckeye Knoll series. All of the fragmented material appears to have been from an adult.

Summation

Burial 15 represents a single individual. This was a probable female (sexnum = 2.5) who was around 39.88 years old.

Burials 16 #1, 16 #2, 16 #3

Description

Burial 16 consisted of a small amount of postcranial material, highly fragmented. No metrics are available. Most of the material appears to represent an adult, but that is the extent of the assessment. There were no skeletal indicators of sex, although some estimates of age are possible based on dental development and attrition.

Dentally, the picture is clearer, and there appear to have been a minimum of three individuals represented in this burial. There was an adult (16 #1) with modest dental attrition, an estimated age of 33.3, but no sex assessment. The second individual (16 #2) is estimated to have been 1-3 years of age based on dental maturation. There was a third individual (16 #3) with less dental wear and was, thus, categorized as a younger adult.

Summation

Three individuals were represented in Burial 16. The first (Burial 16 #1) appears to have been an adult of undetermined sex (sexnum = 4) who was 33.34 years old. Burial 16 #2 was around 1-3 years old and of indeterminate sex (sexnum = 4). Finally, Burial 16 #3 was also an adult of undetermined age or sex (sexnum = 4).

Burial 17

Description

Burial 17 consisted of highly fragmented cranial and mandible fragments and unidentifiable long bone fragments for which no metrics are available. These materials were from a subadult. The mandibular and maxillary fragments contained a mix of deciduous and adult dentition, the adult dentition being completely unworn. Based on the dental development and attrition, the individual is estimated to have been between 8 and 10 years of age with no sex assessment possible.

Summation

Burial 17 consisted of the poorly preserved remains of a subadult of undetermined sex (sexnum = 3). This individual was between 8 and 10 years old at the time of death.

Burials 18 #1, 18 #2

Metrics

Left femur at nutrient foramen—a/p=25.44, m/l=21.9; left femur estimated midshaft dimensions—a/p=25.63, m/l=23.98; left femur subtrochanteric—a/p=26.31, m/l=24.45. Femur midshaft dimensions (left) are in the middle third of the distribution of the 13 Buckeye Knoll individuals, and provide little diagnostic utility in terms of sex assessment.

Description

This burial was represented by highly fragmented remains. Fragments included cranial, radial, ulnar, femoral, tibial, fibular, patellar, and clavicular material. Cranial fragments were small and were clearly incomplete. Mandible fragments were a close match to Windover 81, which was identified as an adult female. Distal ulna fragments were a reasonable match to Windover 93. Femur fragments, particularly mid shaft, were a good match to Windover 115 and Windover 93. Muscle markings on the femur were relatively small and gracile. Patella fragments were also similar to Windover 93. The postcranial fragments were all matches to Windover females, although the cranial fragments could be matched to a Windover "possible male." Collectively, this makes for a gracile individual that was more than likely a female. The adult is estimated to have been 55+ years of age.

Based on the dental inventory, two individuals were represented. One was an adult discussed above (18 #1), probably a female, and the other was a subadult (18 #2) that produced no postcranial material, but was represented by several maxillary teeth with very light wear. These teeth provided an estimated age of between 9 and 12 years.

Summation

Burial 18 contained the remains of two individuals. Burial 18 # 1 was an adult female (sexnum = 2) who was greater than 55 years old. Burial 18 # 2 was around 11 years old and of indeterminate sex (sexnum = 3).

Burial 19

Description

No material was recovered. No assessment of age or sex was made in the field. No suggestion in the field notes if these remains might belong to another burial in the vicinity. The bones were left in the wall of Unit S16W96. (Note: This individual is excluded from subsequent discussions of MNI.)

Burial 20

Metrics

Metrics were obtained on the minimum and maximum radial tuberosity dimensions. Considering these same dimensions, Burial 20 has a minimum above-the-mean value and a maximum below-the-mean value. Half the minimum values are larger and half are smaller than those from Burial 20. The maximum value of the radial tuberosity of Burial 20 is smaller than the Buckeye Knoll mean, and six of the 10 individuals show larger maximum values than recorded for Burial 20. The individual appears to have been a relatively gracile male based on this limited set of dimensions.

Right humerus estimated midshaft—a/p=20.39, m/l=16.44; right radius at radial tuberosity—a/p=14.37, m/l=14.29; right radius estimated midshaft diameter—a/p=10.67, m/l=13.69; left ulna estimated midshaft dimensions—a/p=14.47. m/l=13.03; right mandibular condyle width = 14.19.

Description

Burial 20 represents the fragmented remains of a robust adult. The calotte was present but badly fragmented. Additional fragmented portions of the shafts of the right humerus, right and left radius, and right and left ulna, plus two lumbar vertebrae spinous processes and the lateral border of the left scapula were recovered. The size and morphology of the recovered mastoid processes indicates the individual was an adult male.

Longbone midshafts and other sections of the longbones show there is a good match to Windover individuals 102 and 109. Both Windover 102 and Windover 109 were adult males. There were no materials that can be used to provide an estimate of age for Burial 20.

Summation

Burial 20 consisted of the remains of a single individual. This was an adult male (sexnum = 1) whose age could not be determined.

Burial 21

Metrics

There were tibia and femur midshaft fragments (estimated locations based on morphology) that provide some dimensions. Femur midshaft dimensions of 26.79 and 26.18 mm (ap, ml) are in the midrange of the Buckeye Knoll dimensions, which range from lows of 21.12 and 20.76 mm to highs of 33.19 and 27.34 mm (ap, ml). Unfortunately, these are metrically ambiguous and provide no strong statement with respect to sex assessment; estimated midshaft dimension of unsided tibial fragment—a/p=26.97, m/l=16.94.

Description

Burial 21 consisted of highly fragmented, poorly preserved remains of cranial and postcranial unidentifiable elements. A small fragment of a right sciatic notch suggests a female based on the angle of the notch fragments. Some other fragments from this burial were close to Windover 115, which was identified as a female. When coupled with the sciatic notch fragment, this supports a female sex assessment.

Summation

Burial 21 represented the remains of a single individual. This is believed to have been an adult female (sexnum = 2) of undetermined age.

Burials 22 #1, 22 #2

Metrics

A number of metrics, particularly from estimated midshaft locations of the humerus, femur, and tibia were obtained. The estimated femur midshaft dimensions (30.34 and 27.03—ap, ml) are in the upper ranges of observed femur midshaft dimensions. The tibia, on the other hand, provided midshaft estimates at the nutrient foramen (35.25 and 23.06 mm—ap, ml), and are by contrast the third smallest observed in the Buckeye Knoll series. The ap tibia dimensions for left and right elements differ by almost 11 mm (35.25 left; 24.75 right), although the mediolateral dimensions are equivalent, 23.06 and 20.89 mm. Based on a series of 119 North American individuals with ap dimensions greater than 37, all but two of the 43 sexed individuals were male. In the same group, values below 30 were identified as female in all but two of 36 cases. Mediolateral tibia dimensions at the nutrient foramen in this series are, in all but three of the 29 cases, identified as males when the ml dimension is greater than 24, and are identified as female in all but two of the 30 sexed cases falling below 21 mm. These metrics and morphological observations suggest there were clearly two adults represented in this series, a male and a female.

Description

Burial 22 was the poorly preserved, highly weathered remains of young adult and a second, substantially older, adult. Present were several small fragments of right zygomatic base, a distal shaft fragment of a right humerus, midshaft segments of a left femur, and clavicle. There was a distinct small scar of recent union on the dorsal metaphysic of the tibia fragment. There were a few fibula fragments and a single small fragment of the ischium. Humerus fragments were slightly larger than Windover 92. The small series of tibia fragments were similar in size and morphology to Windover 111. However, the superior end of the tibia (R) was almost intact and was almost identical to Windover 65. No arthritic changes to the articular surface were observed. The only indicator of age was observed in the superior end of the tibia (R) where there was a scar of recent union (epiphysis to metaphysis), which was quite clear. Such a feature might be visible into the early 20s but is unlikely to survive longer than that. There was a significant discrepancy between the scar of recent union and the advanced dental attrition. These contradictions are part of the reasoning that there must have been two adults (one older and one younger) in this burial, with the older being an adult female and the younger being a possible young adult male. This is also supported by dramatic differences in tibia dimensions, which if they were from the same person would indicate an astonishing degree of bilateral asymmetry or, much more likely, that we are dealing with two distinct individuals. The younger adult male was identified as individual 22 #2 and the older adult female was labeled as individual 22 #1. Only the adult female male produced dental metrics.

Summation

There were remains of at least two individuals in Burial 22. One (Burial 22 # 1) was an adult female (sexnum = 2) who was estimated to have been 53.27 years old at the time of death. The second (Burial 22 #2) was a male (sexnum = 1) who was around the age of 17 years.

Burials 23 #1, 23 #2, 23 #3

Metrics

Right tibia at nutrient foramen—a/p=24.85, m/l=20.89; left MC3 base dimension—m/l=11.38; right patella—breadth=38.32, m/l=37.94; right clavicle estimated length = 13.5; right humerus through deltoid tuberosity—a/p=23.64, m/l=18.65; chin height = 32.05; left radius at radial tuberosity—a/p=14.64, m/l=12.76; left humerus at deltoid tuberosity—a/p=20.43, m/l=15.70; left mandibular body breadth = 11.09; right mandibular body breadth = 10.66; left mandibular body height = 29.23; right mandibular body height = 29.03; left mandibular minimum ramus breadth = 32.51; mandibular length = 82.

Patella dimensions of the main individual fall in the middle of the distribution (in the 5th and 7th places in height and breadth, respectively) of the 13 individuals at Buckeye Knoll maximally represented by at least one dimension. Based on a larger series of 52 individuals from North America, this individual would be categorized as female (all but two males exhibit heights >40, while females are <40 in all but two cases).

Some of the dimensions, such as those of the tibia nutrient foramen, are some of the smallest in the comparative series of 32 North American individuals. They are so small, in fact, they almost certainly belong to the 13.88-year-old subadult (23 #3), and not to the more mature adult (23 #1). Dentally, the metrics are ambiguous with respect to sex, specifically for the main individual (23 #1).

Description

The main individual (23 #1) in this burial was one of the most complete of the Buckeye Knoll population. Most of the longbones were represented (although incomplete), with almost no exceptions. Included were right and left shafts of humeri, shaft of a right radius, right and left shafts of ulna, right and left femurs (which were nearly complete), right and left shafts of tibia, single fragmented clavicle, four lumbar vertebral body fragments, right and left ribs (highly fragmented), fragmented scapula, right and left shafts of fibula, and left innominate (complete but broken; right was highly fragmented). Both patella were complete. Hands were represented by right metacarpals 1, 2, 3, and 5, four proximal phalanges, left hamate, and fragments of a triquetral. Sacral fragment exhibited moderate spina bifida.

The primary individual (23 #1) was an adult with advanced dental attrition indicating an age of roughly 41. There also was a second individual with a combined dental attrition and maturation age estimate of 12.8 years (23 #3), plus a third individual (23 #2) (as noted later in the dental descriptions), who was identified by a number of additional teeth that cannot be associated with either the older adult or the older subadult (the teenager). This latter individual appears to be roughly 4 to 9 years of age.

Summation

Three individuals were represented in Burial 21. The first (Burial 23 #1) was a female (sexnum = 2), 40.86 years of age. The second individual was a subadult of undetermined sex (sexnum = 3) who was between 4 to 9 years old at the time of death. Burial 23 #3 was another subadult (sex indeterminate; sexnum = 3) who died at 12.82 years.

Burial 24

Description

This burial was represented by a few fragmented remains. No metrics are available. Identifiable fragments included those from the occipital and parietal, plus one small piece from the shaft of a radius. Most of the cranial fragments were small and provided little information. There was no dental material from this individual. The small radius fragment was the same approximate size as Windover 114, which was an adult male.

Summation

One individual was represented in Burial 24. This appears to have been an adult male (sexnum = 1) of undetermined age.

Burial 25

Metrics

Left tibia at nutrient foramen—a/p=38.88, m/l=21.07; right tibia at nutrient foramen—a/p=37.07, m/l=23.47; right femur head maximum diameter = 42.57; right femur at nutrient foramen—a/p=26.54, m/l=2.87; right femur estimated midshaft dimensions—a/p=27.97, m/l=24.40; right femur subtrochanteric—a/p=24.94, m/l=33.54; right femur epicondylar breadth = 78.0; right patella—breadth=41.17, m/l=41.07; left patella—breadth=41.32, m/l=42.27; left humerus maximum length = 300; right humerus maximum length = 297; left humerus epicondylar breadth = 62; right humerus epicondylar breadth = 59; left humerus midshaft diameter—a/p=19.16, m/l=20.97; right humerus midshaft diameter—a/p=20.73, m/l=22.93; left radius midshaft diameter—a/p=11.83, m/l=13.91; left radius at radial tuberosity—a/p=14.99, m/l=15.48; left ulna maximum length = 268; left ulna at maximum diameter of crest—a/p=13.38, m/l=14.97; right calcaneus body height = 43.71; left calcaneus body height = 43.92; right talus body height = 31.60, body width = 40.93; left talus body height = 30.41, body width = 40.86; right navicular length = 36.92, right navicular width = 18.58; right navicular body height = 27.46; left navicular body height = 25.50; right MT1 base—a/p=27.54, m/l=19.30; right MT2 base—a/p=19.63, m/l=16.08; right MT3 base—a/p=20.07, m/l=13.96; right MT4 base—a/p=19.37, m/l=13.28; right MT5 base—a/p=15.02, m/l=21.35; left MT2 base—a/p=19.62, m/l=14.89; left MT3 base—a/p=21.17, m/l=12.98; left MT4 base—a/p=18.39, m/l=12.25; left scaphoid length = 25.26, left scaphoid width =11.06; left capitate height = 21.67, width = 13.28; left lunate length = 16.61, left lunate height = 7.45; left MC1 base—a/p=14.01, m/l=14.33, left MC2—a/p=15.37, m/l=18.16; left MC3 base—a/p=15.69, m/l=14.19; left MC4 base—a/p=11.40, m/l=10.99; left MC5 base—a/p=9.67, m/l=13.74; right scapular glenoid fossa—sup/inf=38.76; right clavicle maximum length = 144; right clavicle midshaft = 13.84; left scapular glenoid fossa—superior/inferior 35.24, width - 25.71.

This individual was one of the best preserved in the entire Buckeye Knoll series and had the most abundant metrics available. Not surprisingly, this person was from the more recent Late Archaic occupation at Buckeye Knoll. The left lunate length is below the overall sample median, but is above the Buckeye Knoll median and below the Windover median. It has the second smallest femur head dimension of the small Buckeye Knoll series (*n*=5). Of the five left and five right humerus fragments with reconstructable midshaft dimensions, the right specimen from this individual is the largest of the right mediolateral dimensions, and the second largest of the left mediolateral dimensions. Humeral ap dimensions do not rank as highly and are respectively 8th and 5th in the series of 9 left and right dimensions. Many of the other dimensions tend to fall in the upper ranges for most of the comparative data, supporting a sex assessment of male. Based on a series of 119 North American individuals with ap dimensions greater than 37, all but two of the 43 sexed individuals were male. In the same group, values below 30 were identified as female in all but two of 36 cases. This dimension in this individual would thus be categorized as a female under this criterion. Mediolateral tibia dimension at the nutrient foramen in this series are identified as males in all but three of the 29 cases when the ml dimension is greater than 24, and identified as female in all but two of the 30 sexed cases falling below 21 mm. So, three of the four tibia nutrient foramen dimensions indicate the individual was a male.

Interestingly, the patella (left and right) of this individual were, compared to the other Buckeye Knoll patellas, quite large. Respectively, they are the 3rd and 4th largest dimensions of the left and right heights (12 measures), and are 3rd and 5th largest dimensions of the 16 breadths. In the larger patella series of North American prehistoric individuals (*n*=52), these dimensions indicate this individual was almost certainly a male (>40 male, <40 female in all but four cases).

Description

This burial was the most complete of the Buckeye Knoll population, doubtless due to its relatively recent chronological position (i.e., in the Late Archaic). Most longbones were complete, although some were broken. The cranium was represented by a calotte that was removed from a matrix block. The face was fragmented, and crumbled upon removal from the matrix. Complete longbones included the left and right humeri, a left radius, a left ulna, right and left femurs (complete but broken), right and left tibia, right and left patellae, right and left fibulae, and left and right innominate. Hands were represented by the left hamate, trapezoid, pisiform, lunate, capitate, triquetral, and scaphoid. Right trapezoid was present but fragmented. All left metacarpals were present with the exception of MC2. Nine phalanges were present. The feet were represented by the left calcaneus, talus, cuboid, navicular, and medial, intermediate, and lateral cuneiforms; the right calcaneus, talus, navicular, and medial, intermediate, and lateral cuneiforms. The right and left metatarsals were complete with the exception of MT1. Four foot phalanges were present. There were 20 vertebral bodies present but fragmented. The second cervical vertebra was complete, as well as five lumbar, 10 thoracic, and five cervical vertebra. The base of the sacrum was present, as well as a portion of the top three sacral vertebrae elements. The scapula was represented by the right and left coracoids, the right acromion, and the right glenoid fossa. There were prominent muscle-attachment sites, but extreme taphonomic damage to most longbones precluded more detailed observations.

Radial tuberosity dimensions of Burial 25 are larger than the means for the minimum and maximum values. The minimum value is the third largest reported at Buckeye Knoll, and the maximum value (15.48 mm) is intermediate; half the values are larger, half are smaller. Metrically, it seems clear this individual was an adult male. While, overall, the individual appears to have been robust, it is interesting that the radial dimensions are not particularly large compared to the other Buckeye Knoll individuals (small though the sample is). There was no duplication of elements (or element fragments) ,and it did appear to be a single individual with significant asymmetry. The vast majority of the dimensions, morphological features, etc., all indicate this was an adult male. Dentally, the attrition scores indicate an age of 38.62 years.

Summation

Burial 25 consisted of the remains of a single individual. This appears to have been an adult male (sexnum = 1) around 38.62 years old.

Burials 26 #1, 26 #2

Description

The remains of Burial 26 were represented by a few highly fragmented elements for which no metrics are available. The calotte was present but crushed and held together with consolidant. Sutures appeared to display minimal closure, suggesting a young adult. Longbones were represented by shaft fragments of femur, fibula, and humerus. There were a few rib and vertebral fragments. Remains were highly weathered.

Humerus fragments were similar in size to Windover 142, which was an adult male. The nuchal crest was smooth and exhibited no robusticity or rugosity typical of robust males. The mandible fragments appeared morphologically small, and, overall, the individual appeared gracile. Attrition rates were low and indicative of a young adult. The diversity in robusticity in postcranial fragments was mirrored in divergent dental attrition scores for a series of overlapping teeth, indicating there were at least two individuals here. While both were sex ambiguous, both were adults. One individual had low attrition scores and the other had higher attrition scores.

Sex assessment for the main individual (26 #1) is questionable at best given the limited material and undiagnostic nature of the burial. Dental sex indicators are male but are insufficient to warrant a firm attribution beyond “possible” male. For example, the LXCCBL dimensions are the largest reported in the Buckeye Knoll series and are larger than the majority of individuals of both sexes from Windover and Bird Island (both sites in excess of 5,000 B.P.). Maxillary molar dentition is closer to the middle of the metric distribution, and we are only willing to identify this individual as a possible male (1.5). Based on dental attrition the possible male is 32 years of age and the unsexed individual (26 #2) is younger with an attrition age estimate of 24.49 years.

Summation

There were two individuals represented in Burial 26. The first (Burial 26 #1) appears to have been a probable male (sexnum = 1.5) who was around 32 years old. Burial 26 # 2 was an adult of undetermined sex (sexnum = 4) who died a 24.49 years.

Burial 27

Description

Burial 27 was represented by the highly fragmented, poorly preserved remains that included cranial, humerus, femur, tibia, vertebral, and rib fragments. No metrics are available. All the material was heavily weathered, even for this collection, which was extreme. Humerus fragments were equivalent to Windover 142, which was identified as an older adult male. Humerus fragments by themselves are suggestive at best, but hardly conclusive for sex assessment. This burial was scored as a possible male.

Summation

Burial 27 was represented by the remains of a single individual. This person was a probable male (sexnum = 1.5) who was greater than 55 years old at the time of death.

Burial 28

Description

Burial 28 was represented by highly fragmented, poorly preserved remains that included fragments from cranium, humerus, tibia, and a single vertebra. No metrics are available. The individual appears to have been a gracile adult. Fragments of humerus were equivalent to Windover 142, which was an older adult male. The material was so limited, sex assessment was impossible.

Summation

Burial 28 was represented by a single individual. This appears to have been an adult of undetermined sex (sexnum = 4) whose age could not be determined.

Burial 29

Description

Burial 29 was represented by highly fragmented, poorly preserved remains of an individual that consisted of a few cranial and postcranial fragments. The elements were heavily weathered and severely eroded. The material was so limited that sex assessment from the skeletal material is impossible. No metrics are available.

Summation

Burial 29 was represented by the remains of a single individual. The condition of the remains was such that it could only be determined that the body was that of an adult of undetermined sex (sexnum = 4) and age.

Burial 30

Metrics

Right radius at radial tuberosity—a/p=11.22, m/l=12.56; right ulna at maximum crest development—a/p=12.12, m/l=11.47; left femur estimated midshaft dimensions—a/p=22.37, m/l=20.76; left humerus at deltoid tuberosity—a/p=17.74, m/l=18.82; right humerus at deltoid tuberosity—a/p=18.56, m/l=16.90; left MC4 base—a/p=11.30, m/l=11.51; right MC2—a/p=15.52, m/l=17.19; right lunate length = 15.42; right lunate height = 13.59; left capitate width = 18.50; left capitate height = 16.64; left scaphoid length = 22.65.

Of the 13 femur midshaft dimensions at Buckeye Knoll, this ap dimension is the third smallest in the series, and the ml dimension is absolutely the smallest in the series. Alternatively, the lunate dimensions are the largest observed at Buckeye Knoll and the humerus dimensions of the four in the site's series are the smallest, as are the scaphoid dimensions. Overall, the dimensions suggest a relatively diminutive individual, presumably a female.

Dental indicators suggest this individual might be a female. For example, the LNM1 neck dimensions consistently fall into the lower ranges of a maximum of 128 measures from Windover and Buckeye Knoll. The mesiodistal neck dimension is next to the smallest out of 128 comparable dimensions and the buccolingual dimension (8.81 mm) is 36th in a series of 54 (very small in the entire Buckeye Knoll series). The buccolingual dimension is in the lowest quartile (18th out of 54 comparable dimensions).

Description

This individual was represented by the highly fragmented remains of a gracile adult. The cranium consisted of highly fragmented vault pieces and fragments of left and right petrous pyramids. Longbones were represented by fragments from humerus, radius, ulna, femur, tibia, fibula, and clavicle. The humeri included the proximal shafts and exhibited developed deltoid tuberosities. Ribs and vertebra were few and highly fragmented. The hands were represented by the left scaphoid, capitate and metacarpal 4. right hamate, lunate, metacarpal 2, and four phalanges.

Tibia and fibulae fragments were comparable to Windover 138, which was an adult female. Overall, the indications suggest this was probably a female (2.5).

Summation

Burial 30 consisted of the remains of a single individual. This appears to have been a probable female (sexnum = 2.5) who was greater than 55 years old at the time of death.

Burials 31 #1, 31 #2

Metrics

Main individual's right adult tibia at nutrient foramen—a/p=36.85, m/l=23.71, and a second individual (31 #2) with a left tibia fragment that measures a/p=27.17 and m/l=17.75 at the nutrient foramen. This second individual was diminutive in size and dentally appears to have been a subadult between 5 and 11 years of age. Based on a series of 119 North American individuals with ap dimensions greater than 37 (the larger individual here), all but two of the 43 sexed individuals were male. Mediolateral tibia dimension at the nutrient foramen in this series are identified as males in all but three of the 29 cases.

Dental metrics of the adult (31 #1) indicate the RNM1NBL (9.36 mm) is the 18th largest of 57 comparative specimens, and the mesiodistal dimension of the same tooth is the 9th largest out of a series of 58 teeth (9.36 mm). The LNM1NMD (8.88 mm) is 34th out of 54, thus making sex assessment less than clear-cut. We are only willing to suggest this was probably a male (1.5) with a dental attrition score indicating an age of 55+ years.

Description

This burial was represented by a few poorly preserved, unidentifiable cranial and postcranial fragments. As noted in the metric section (above), there appear to have been two individuals—an adult (31 #1) who was probably male and a much smaller individual who was a subadult (31 #2).

Summation

The remains of at least two individuals were present in Burial 31. The first (31 #1) appears to have been a probable male (sexnum = 1.5) who was older than 55 years at the time of death. The second (31 #2) was a subadult (sexnum = 3) who was around 8 years old.

Burial 32

Description

No material was recovered from Burial 32. Only lower leg and foot bones were exposed at the edge of the excavation, but they were not removed. No assessment of age or sex was made in the field. There was no suggestion in the field notes if these remains might have belonged to another burial in the vicinity. (Note: This individual is excluded from subsequent discussions of MNI.)

Summation

The remains of Burial 32 were not removed during excavation. An assessment of age and sex cannot be made with the information at hand.

Burial 33

Metrics

Right talus superior articular surface = 28.69; right MT5 base—a/p=12.98, m/l=18.94; left patella—breadth=36.09, breadth=37.07; right patella—breadth=35.27, breadth=37.24; left tibia at nutrient foramen—a/p=28.73, m/l=19.13.

All these dimensions are relatively small; so small in fact that, while there are no preserved elements providing any assessment of age, there is deciduous dental material from this burial clearly indicating it was from a subadult. Dentally, the best age estimate is 6 to 8 years of age, which clearly explains the diminutive dimensions record here.

Description

Burial 33 consisted of the poorly preserved, highly fragmented remains of a subadult. The individual was represented by a few cranial and postcranial elements.

Summation

Burial 33 consisted of the remains of a single individual. This appears to have been a subadult of indeterminate sex (sexnum =3) who was around 6.5 years old at the time of death.

Burials 34 #1, 34 #2

Metrics

Right femur estimated midshaft dimensions—a/p=24.59, m/l=25.24. Femur shaft dimensions of this size (considering lefts for which there are more measurements) are much more likely to be female, with males being larger in the North American series of 776 individuals. This individual also falls into the bottom five of 29 individuals from Texas. All but three of the 13 Buckeye Knoll individuals with femur midshaft dimensions are larger than this adult.

Description

Burial 34 consisted of the poorly preserved remains of two individuals—one adult (34 #1) and one subadult (34 #2). The adult was represented by highly fragmented cranial and postcranial remains. The gonial angle of a mandible was present, which appeared to be small and gracile. Longbone fragments included humerus, radius, ulna, femur, tibia, and fibula. There were fragments from the innominate, ribs, and vertebrae. Hands were represented by carpal and phalange fragments. There were two medial foot phalanges. The subadult was represented by an unidentifiable longbone fragment that appears to have been from a child under one year of age. The adult appears to have been gracile and was a match to Windover 93, which was an older adult female, and to Windover 143, a young adult female. The female assignment is also supported by the fragments of the sciatic notch, which would be scored a 1 or a 2 on the SOD manual scale (Buikstra and Ubelaker 1994).

The subadult limb fragments were the same approximate size as Windover 160, which was identified as a neonate (0 years of age). However, dental maturation indicates this individual was older than a neonate, and was roughly 5 years of age based on mandibular premolar development. It is possible this was a small individual with a more advanced age than would be expected given the general size of the few fragments. Dental age is much less variable in the face of environmental and health conditions, suggesting some growth retardation/delay in this individual. Stojanowski notes the single adult premolar from 34 #2 is the smallest adult tooth of this type he has ever seen (MD = 5.79, BL = 6.42, CH = 6.50) and is, in fact, the smallest in the Buckeye Knoll series and second smallest of the series of 51 from North America. This second individual is quite close to being considered an example of microdonita induced by ontogenetic causes.

Summation

The remains of two individuals were recovered from Burial 34. The first (34 #1) was an adult female (sexnum = 2) that was greater than 55 years old at the time of death. The second (34 # 2) appears to have been a subadult of indeterminate sex (sexnum = 3) who was around 5 years old.

Burial 35

Metrics

Unsided femur estimated midshaft dimensions—a/p=28.76, m/l=27.34. Femur mid-shaft dimensions (ml) are the largest observed in the Buckeye Knoll series (*n*=11), while the ap dimension is the fourth largest in the Buckeye Knoll series. These limited metrics suggest the individual was a male.

Description

This burial was represented by a few highly fragmented remains, including unidentifiable cranial fragments and shaft fragments from humerus and femur. There was a single medial foot phalanx. The few metrics of the femur tend to be large and argue this was more than likely a male.

Summation

The remains of a single individual were recovered from Burial 35. This appears to have been an adult male (sexnum = 1) of undetermined age.

Burials 36 #1, 36 #2

Metrics

Right femur estimated subtrochanteric dimensions—a/p=28.71, m/l=26.74. These femur dimensions are in the larger range for Buckeye Knoll and are more characteristic of males than females in the broad comparative group of individuals from North America; however, these dimensions are close to the middle of the distribution for both anterior-posterior and mediolateral dimensions, and are not strongly diagnostic with respect to sex. Dentally, the metrics are also ambiguous with respect to sex.

Description

Burial 36 consisted of the highly fragmented remains of two individuals. One was gracile. The remains included poorly preserved cranial fragments with a small portion of the right superior orbital margin and a portion of the left side of a mandible. Longbone fragments included femur, tibia, and fibula. A distal foot phalanx showed extreme lipping and erosion of proximal articular surface and some osteoarthritic growth of the distal tip, either from injury or pathology. The tibia and femur did not appear to be from the same individual, with the femur segment much larger than the other femur and the tibial fragments. The cranial fragments were similar to Windover 111, an adult male, while the femur and tibia fragments were approximately similar to Windover 78 and Windover 81, both of which were adult females.

One distal toe phalanx, 36 #2, showed extreme lipping and erosion of the proximal articular surface, plus some osteoarthritic growth of the distal tip. This injury or pathology was one of the few observed in the population. This appears to have resulted from a soft-tissue inflammation or tumor, which pressed on the distal joint of the proximal phalanx and pressured it to expand and essentially follow the outline of the enlarged soft tissue abutting the bone (see Rothschild discussion, below). This formed a thin cap of bone over the now-deteriorated soft-tissue growth. Unfortunately, it is impossible to determine to which individual the pathology should be attributed.

The diversity of morphology is explained by the presence of two series of dentitions indicating the presence of two distinct individuals—one male roughly 30 years of age (36 #1) and a second, younger adult (36 #2). The second individual may have been female.

Summation

Burial 36 contained the remains of two individuals. Burial 36 #1 was an adult male (sexnum = 1) who was 29.22 years old. Burial 36 #2 was a female (sexnum = 2) who was around 20 years of age at the time of death.

Burials 37 #1, 37 #2

Metrics

Right talus superior articular surface = 12.32; right talus head—superior/inferior 20.43, m/l=27.05; right talus max length = 52.54; left scapula glenoid fossa surface—superior/inferior=34.58, m/l=24.37; left ulna estimated midshaft dimension—a/p=10.08, m/l=13.07; right ulna estimated midshaft dimension—a/p=10.42, m/l=11.58; left radius at radial tuberosity—a/p=13.34, m/l=15.03; left radius maximum head diameter = 21.00; left femur estimated midshaft dimensions—a/p=21.34, m/l=24.66; left femur subtrochanteric—a/p=19.95, m/l=30.08; right patella—superior/inferior=37.04, m/l=36.46; right femur estimated midshaft dimensions—a/p=21.76, m/l=23.82; right femur subtrochanteric—a/p=20.52, m/l=30.49; left radius = 209.

Left femur midshaft dimensions are in the middle third of the distribution of the 13 Buckeye Knoll individuals and provide little diagnostics in terms of sex assessment, while the right dimensions are clearly in the smaller ranks of the Buckeye Knoll series. Femur subtrochanteric dimensions are the smallest ap dimensions reported in the Buckeye Knoll series, but are the next to the largest with respect to the mediolateral dimension. Again, this provides little information of diagnostic utility. The radius, on the other hand, is one of the shortest in the entire series of nearly 300 individuals and the talus dimensions are also small.

With respect to the adult in the burial, it is unusual in that there were almost complete radius and two humerus shafts and fragmented tibia shafts with evidence of pathological/injury changes that were well healed (see below). Patella dimensions, both breadth and height <40 mm, are more strongly indicative of this individual being female. Out of a series of 52 individuals from North America, all but two of the sexed individuals with dimensions <40 mm were female.

Description

This burial was represented by postcranial remains. Longbones included complete right and left humeri, a right shaft of an ulna, shaft fragments from femur, shaft fragments of tibia exhibiting significant periosteal reaction, a complete right patella, and a right shaft of a fibula. The vertebrae, ribs, and innominates were highly fragmented.

Tibia of the adult female (37 #1) showed distinct pathological changes reflecting a serious injury. Both tibia were present, though fragmented, and could be reconstructed, although each was missing the proximal and distal epiphyses. Surface features of both were almost identical and a description of one is essentially a description of both. The bone had been remodeled in contour, and each element was essentially pentagonal in cross section. What would be normal curved surfaces had been restructured and were completely flattened. This gave each element a distinctly atypical cross-sectional geometry. The bone surface itself was smooth but had the appearance, for lack of a better descriptive pronoun, of soft taffy pulled linearly along the surface of the bone. There were some areas where there were linear striations 5 to 8 mm in diameter extending toward the superior end. Some of these features were very reminiscent of the "hot wax" appearance occasionally used in paleopathological descriptions. Some of the bone surface appeared folded over in ridges, again emphasizing the "malleable" characteristic of the bone surface. There were no cloaca or other signs of infection. Bone texture in less than 50 percent of the impacted areas was basically normal. Other sections of the impacted regions consisted largely of new periosteal bone. More of the surface of the right elements showed the deposition of this new bone. This appeared to be a case of bilateral calcified subperiosteal hematoma of both tibia. An extensive soft-tissue injury could precipitate this type of response. In the right element, this process covered the superior two-thirds of the bone; the distal one-third appeared perfectly normal. In the left element, the process covered the upper half of the element.

The left and right humeri both exhibited well-healed fractures. In the right, the fracture appeared just below the deltoid tuberosity. Bone surface was normal, and there was only a small boney callus that virtually blended into the large deltoid tuberosity. The fracture in the left element was just inferior to the deltoid tuberosity and was almost exactly at midshaft. It too, had a small boney callus. Both, while well healed and exhibiting no atypical bone surface remodeling, were slightly angulated. The right lower element was slightly shifted in a medial direction, though only by a few degrees. The left showed an almost identical angulation. Either one of these sets of injuries would have been a significant event in this person's life. Combined, they suggest a relatively traumatic injury with no evidence of an infectious process. Basically, both upper arms were fractured and both tibia experienced significant soft-tissue injuries. The rest of the skeletal fragments appeared unremarkable.

Overall, the longbone fragments appeared relatively gracile, and radius fragments matched Windover 93, an adult female. Many of the fragments were also a good match to Windover 115, also an adult female.

There was a second adult cervical vertebrae there which did not belong (based on size) to the primary adult in Burial 37, but was isolated and presumably float from some adjacent burial. The adult female (37 #1) exhibited relatively advanced attrition and had an age estimate of 48.44 years. However, there was yet a second individual (37 #2) who was represented by four subadult teeth. This person had a dental age of between 2 and 3 years. Technically, these isolated teeth might also have been float from an adjacent burial, although their clustering in this burial makes it more likely they were all that remains of a subadult intentionally buried with the adult.

Summation

The remains of two individuals were identified in Burial 37. The first (37 #1) was an adult female (sexnum = 2) with a dental age of 48.44 years. The second (37 #2) was a subadult of undetermined sex (sexnum = 3) who was approximately 2.5 years old.

Burials 38 #1, 38 #2, 38 #3

Description

This burial was represented by a few highly fragmented remains, including unidentifiable cranial fragments, one distal hand phalanx, a fragment of a medial foot phalanx, and a midshaft fragment from a clavicle. No metrics are available. One cranial fragment, along the lambdoidal suture, showed significant closure, indicating an advanced age. Other small suture fragments did not show such dramatic closure, but the fragments were small and heavily weathered. All cranial fragments were less than 3 cm in diameter and most were under 2 cm.

The identifiable cranial fragments fell between Windover 81 and Windover 78 in terms of overall size. Both of these individuals were identified as adult females, which is consistent with the relatively gracile morphological features.

Clavicle fragments were a good match to Windover 111, which was identified as an adult male. Fibula shaft fragments were similar to Windover 93, an adult female. The diversity in observations (suture closure progress, size, etc.) is explained by the multiple sets of dentition with implications of multiple adults as well. Dentally, the adult (38 #1) is estimated to have been 47.49 years of age, while the second individual (38 #2) dentally is estimated to have been less than five years of age. However, this latter individual was represented only by a single tooth. Some of the adult material also appears to be female and relatively young, based on the minimal suture closure. These remains can be attributed to a third individual (38 #3).

Summation

Burial 38 contained the remains of at least three individuals. Burial 38 #1 was an adult of undetermined sex (sexnum = 4) with a dental age of 47.49 years. Burial 38 #2 appears to have been a subadult of undetermined sex (sexnum = 3) who was 1.5 years old. Finally, Burial 38 #3 was probably a young adult female (sexnum = 2) whose age could not be determined.

Burial 39

Metrics

Right lunate length = 18.22; right capitate height = 21.64. Of the ten lunates from Buckeye Knoll, this is the second largest in the series, and, compared to the Windover comparative data on an additional ten individuals, this is the fourth largest in the entire comparative series. However, in this limited sample these dimensions are not sex specific, and three of the four larger lunates are from individuals identified as females. The capitate height is also in the larger range, but is not strongly diagnostic.

Description

This burial was represented by a few highly fragmented remains that included unidentifiable cranial fragments, a fragment of an external auditory meatus, and a portion of the inferior margin of the left zygomatic arch, suggesting an adult. A few rib fragments and small fragments of a radius midshaft survived. All this material appeared adult but is undiagnostic of sex. Six teeth were recovered, and attrition age estimates indicate the individual was a young adult age 24.24.

Summation

The remains of a single individual were identified in Burial 39. This person was an adult of undetermined sex (sexnum = 4) who was 24.24 years old.

Burial 40

Description

This burial was represented by highly fragmented, unidentifiable cranial and postcranial remains for which no metrics are available. The cranial fragments were relatively thin. Small sections of a badly fragmented humerus shaft existed. Weathering and deterioration was extreme even for this site, which exhibited excessive weathering in the best of circumstances. It was impossible to judge sex based on these materials. Maxillary canines and very worn and fragmented left maxillary molar (either 1 or 2 – difficult to identify) all exhibited substantial wear with an estimated age of 49.89 years.

Summation

The remains of a single individual were identified in Burial 40. This appears to have been an adult of undetermined sex (sexnum = 4) with a dental age of 49.89 years.

Burial 41

Metrics

Left MT5 base—a/p=15.58, m/l=18.73. The limited metrics are solely on the metatarsals and are too limited and undiagnostic to be of much use in assigning sex. The ap dimension of the MT5 is one of the largest in the limited comparative series (n=20) and is the third largest at Buckeye Knoll, while the ml dimension is close to the middle of the distribution.

Description

This burial was represented by a few highly fragmented remains of cranial and postcranial elements. Identifiable elements included a humeral fragment, a right fourth metacarpal, one hand phalanx, one foot phalanx, a right medial cuneiform, a left talus fragment, a left fifth metatarsal fragment, tibial shaft fragments, rib shaft fragments, fibular shaft fragments, and small fragments from the innominate.

Humerus fragments were a good match to Windover 142, which was an adult male. The shaft fragments, particularly the upper shaft fragments, were robust. However, tibia and fibula fragments, in contrast, were a good match to Windover 115, an adult female, and were not particularly robust.

There was a small section of the left supraorbital margin that appeared to be robust and we feel it would be more characteristic of a male than a female. Sex is far from conclusive, but it is felt, overall, that the individual was a male. Dental attrition suggests the age of this individual was 32.17 years.

Summation

The remains in Burial 41 were identified as belonging to a single individual. This was an adult male (sexnum = 1) that had a dental age of 32.17 years.

Burials 42 #1, 42 #2

Metrics

Mxdfemh = 40.2. Out of a series of North American prehistoric individuals with femur head dimensions (*n*=181), only two with dimensions this small or smaller are identified as males; all the rest are identified as females. This supports a female attribution for the adult in this burial.

Description

This burial contained the highly fragmented remains of an adult (42 #1) and a subadult (42 #2). There were a few unidentifiable cranial fragments. Postcranial elements included fragments of a radius, the unfused head of a femur, a tibial shaft fragment, and unidentifiable postcranial fragments that represent the subadult parts. The latter were an excellent match to Windover 134 in terms of size and morphology. There was also a small fragment of the unfused distal epiphysis (femur). Windover 134 was identified as a two-year-old subadult. Tibia fragments also were a good match to Windover 134. Dentally, age assessment is based on multiple teeth and indicates an age of between 6 and 9 months for the subadult.

The adult (42 #1) was represented by highly fragmented, poorly preserved, gracile remains that included a small fragment of the mandible. Postcranial material included fragments from the humerus, radius, ulna, femur, patella, and fibula. There was one proximal hand phalanx and one right talus fragment. There were also a small number of rib fragments. All the material was relatively gracile.

Ulna fragments were a good match to Windover 114, an adult male. By way of contrast, the patella and fibula fragments were a good match to Windover 93, which was an older adult female. Between the generally gracile nature of most of the postcranial material and the small size of the femur head, the preponderance of evidence indicates this burial contained an adult female accompanied by a subadult less than two years of age (generally between 6 to 9 months and two years). We are inclined to give preference to the dental age estimate of between 6 and 9 months.

Summation

The remains of two individuals were identified in Burial 42. Burial 42 #1 was an adult female (sexnum = 2) who had a dental age of 46.11 years. Burial 42 #2 was a subadult of undetermined sex (sexnum = 3) who was approximately .75 years of age.

Burial 43

Metrics

Femur midshaft ml (left) = 24.03, ap = 29.96. Femur midshaft dimensions (left) are in the middle third of the distribution of the 13 Buckeye Knoll individuals and provide little diagnostics in terms of sex assessment. Dentally, the metrics are ambiguous with respect to sex, which is not surprising since this individual dentally has an estimated age of 13.9 years.

Description

This burial was represented by highly fragmented, poorly preserved remains. The cranium consisted of fragments of the left internal auditory meatus. Postcranial remains included fragments from humerus, tibia, and innominate. Also present were a single hand phalanx and two phalanx fragments.

All material was small and weathered. The largest single piece of cranial material was barely 4 cm in diameter and all other fragments were less than 1 cm in size. Humerus shaft sections were a reasonable match to Windover 115, which was an adult female. Windover 111, an older adult male, was a good match to the radius shaft fragments. Neither, however, is convincing with respect to sex. Such is to be expected, given the dentally derived age of the individual.

Summation

Burial 43 contained the remains of a single individual. This appears to have been subadult of undetermined sex (sexnum = 3) who had a dental age of 13.9 years.

Burials 44 #1, 44 #2, 44 #3, 44 #4, 44 #5

Metrics

Left lunate length—16.13, height 14.33. These individuals were poorly represented with few metrics. The only measurable item was the left lunate length, which is the third smallest in the series of ten individuals from Buckeye Knoll. Its position within the Windover series is also below the median of that site's distribution. When both measures are taken into consideration they indicate this individual (44 #2) was probably a female.

Description

This burial was represented by the highly fragmented, poorly preserved remains of multiple individuals, each of which was most distinct in the dental analysis. The cranium was highly fragmented, and represented by unidentifiable pieces. Postcranial elements included fragments from humerus, radius, a single fragmented patella, a single vertebral body, a single rib, and a scapula. Sutures on cranial material showed no evidence of closure.

Evidence of multiple individuals included the following observations of the commingled skeletal material: the lunate was small and gracile (although adult) and there were other hand elements that were from an even smaller individual that had not reached adult proportions. Portions of the surviving adult radius shaft were a good match to Windover 115, which was an adult female. Another individual was a good match to Windover 116, an eleven-year-old subadult.

Dentally, the picture is even more complex, and an additional three (3) individuals were represented in this burial. Dentally, 44 #1 was a subadult approximately 6 years of age, 44 #2 was an adult approximately 23.76 years of age, while 44 #3 appears to have been an adult with extreme attrition (55+ years of age). Burial 44 #4 was a fourth individual, a subadult approximately 1 year of age, and 44 #5 was another subadult but between 8 and 14 years of age.

Summation

Burial 44 contained the remains of five individuals. Burial 44 #1 was a subadult of indeterminate sex (sexnum = 3) who had a dental age of 5.85 years. Burial 44 #2 was an adult female (sexnum = 2), 23.76 years old. Burial 44 #3 was an adult, over the age of 55, whose sex could not be determined (sexnum = 4). The fourth (44 #4) and fifth (44 #5) individuals were both subadults (sexnum = 3) with respective ages of approximately 1 and 11 years old.

Burial 45

Description

This burial represents the highly fragmented, poorly preserved remains of an adult and a subadult for which no metrics are available. The adult was identified as Burial 45, while the subadult material was attributable to the 20-year-old female in adjacent Burial 12. (This was very gracile individual, so it is easy to see how the remains of that 20 year old could be considered a subadult.) As such, the subadult remains were not assigned a secondary Burial 45 number. The subadult was represented by fragments from humerus, ulna, radius, femur, and tibia. The fact that there was no overlap between these subadult elements and those of the individual in Burial 12 provides added support to the likelihood that only one individual contributed both sets of remains.

The adult in Burial 45 was represented by fragments from a patella, clavicle, vertebra, and coccyx. The humeral fragments from this individual were a good match to Windover 111, an adult male. Fragments of the coccyx survived and were reflective of male morphology, although they were smaller than the previously mentioned Windover males, thus indicating a relatively gracile person in contrast to the Florida materials. Tibia and femur fragments of the adult also appeared relatively gracile. The fragments of an adult clavicle (clearly not from the subadult best formally associated with the subadult in Burial 12) were adult in size and morphology. However, the sternal end was clearly not mature, indicating that the individual was no older than the mid to late 20s at the time of death. The relative youth of this individual may explain the field ambiguity with respect to sex. Subadult tibia fragments here were slightly smaller than Windover 112, and distal femur fragments were also slightly smaller than Windover 112, a 12- to 15-year-old subadult. This supports the age estimate of adjacent Burial 12 as an individual of approximately 20 years of age while Burial 45 (adult) was roughly 30.

Summation

The remains associated with Burial 45 were linked to a single individual. This appears to have been an adult male (sexnum = 1) with a dental age of 30.18 years.

Burials 46 #1, 46 #2

Description

The remains in this burial were so poorly preserved that no metrics are available. The primary individual in this burial was represented by the highly fragmented, poorly preserved remains of a subadult. The cranium consisted of few unidentifiable fragments. The postcranial material included fragments from humerus, radius, femur, tibia, and clavicle. While this individual was physically close to, and roughly the same age as, the subadult formally identified as Burial 12 (of whom some bone fragments are commingled with Burial 45, as just noted), the two were, in fact, absolutely distinct based on the duplication of the distal femur. The humeral fragments were a good match to Windover 112, a 14-year-old subadult.

In a loose bag of bone from this burial were several adult teeth exhibiting wear. These came from an individual who was clearly older than the subadult. They indicate the presence of two individuals in this burial: the subadult (46 #1) just discussed and an adult (46 #2) with modest tooth wear indicative of an age in the late 20s. There were nine teeth from the adult, which together have an estimated attrition age of 26.36 years. Most of the dental measures are in the lower quartile. In one series, for example, with 961 measures, LNM1CBL, this individual's tooth (10.13 mm) is 845th out of 961. Dentally, it appears to have been a female but there was nothing about the fragmentary skeletal material even hinting at sex, so sex assessment was identified as a probable female (2.5).

Summation

The remains of two individuals were identified in Burial 46. The first (46 #1) was that of a subadult, around 14 years old, whose sex could not be determined because of age (sexnum = 3). The second (46 #2) was a probable female (sexnum = 2.5) with a dental age of 26.31 years).

Burials 47 #1, 47 #2, 47 #3

Metrics

Left patella breadth = 38.97; right patella breadth = 41.61, m/l = 41.48; humerus mid shaft md = 23.8, ap = 21.74; mt4 ap = 19.52, ml = 13.59.

The primary individual in this burial (47 #1) exhibited the largest observed humerus md dimension of any of the Buckeye Knoll series or the Windover comparative group (*n*=25). This individual also exhibited the second largest patella height (left and right) of the entire series of 13 patella from Buckeye Knoll. When compared to a larger (*n*=52) series of North American prehistoric individuals, this was almost certainly a male (>40 = male, <40 = female in all but four cases). The metatarsal 4 also displayed absolutely the largest dimensions of any in either the Buckeye Knoll or the Windover series.

Description

This burial was represented by a few highly fragmented remains of perhaps three individuals.[1] Two proximal ulna diaphyses were different in size and morphology to what would be expected from the primary individual, but they were clearly adult. Some of the foot elements exhibited similar gross differences in size. The cranium consisted of few unidentifiable fragments. Postcrania included fragments from ulna, femur, tibia, patella, ribs, and fibula. Feet were represented by two left talli, a left intermediate cuneiform, and a left navicular. The midshaft fragments and foot elements were clearly from two different adults of different sizes. There was a small fragment of the pubic symphysis rim, which still displayed distinct ridging indicative of a younger individual.

Dentally, there was a third individual represented, a subadult between one and three years of age. However, this individual was not represented by any cranial or postcranial material (dental presence only).[2] As mentioned above, the metrics on some of these fragments indicate one of the adults was a large male. The other set of adult fragments included elements that were much smaller and possibly from a female. There were two indicators of age—the pubic symphysis rim and the relatively unworn adult dentition. Both yielded age estimates in the lower 20s and could be from the same individual or from two adults of roughly the same age. At the most conservative level, there were two adults (47 #1 and 47 #3—minimally one is in the early 20s) plus a third individual (47 #2), the subadult, between one and three years of age.

[1] Editor's note: Three skeletons—Burials 47, 73, and 49—were identified in proximity to one another in the field and interpreted to be three individuals placed within a single grave. Since the remains of these three individuals were so close to one another, it is likely that some of the remains from one of them constitute the additional adult elements noted for Burial 47.

[2] Editor's note: This individual was not identified in the field.

Summation

The possible remains of three individuals were identified in Burial 47. One (47 #1) appears to have been an adult male (sexnum = 1) with a dental age of 24.13 years. Burial 47 #2 was a subadult of indeterminate sex (sexnum = 3) who was around two years old. The third individual (Burial 47 #3) was an adult, a probable female (sexnum = 2.5), whose age could not be determined.

Burials 48 #1, 48 #2

Metrics

Left humerus at deltoid tuberosity—a/p=21.74, m/l=23.80; right clavicle estimated midshaft diameters—a/p=13.32, superior/inferior=10.69; femur head (left) = 48.15. Of the small series of femur heads (five right, three left) from Buckeye Knoll, this specimen (left) was the largest of all left and right femur heads. In addition, and with only two exceptions, all the specimens with femur heads larger than this individual (i.e., >48 mm) in a series of 88 individuals from North American were male. Femur heads are considered one of the most metrically diagnostic of the postcranial metric traits. Accordingly, the primary individual in this burial (48 #1) was almost certainly a male.

Dental indicators for the secondary individual (48 #2) suggest this individual might have been a male. Of 54 LNM1NBL dimensions from Buckeye Knoll and Windover, this specimen falls into 22nd place. However, the mesiodistal dimension of the same tooth is 4th in size out of 64 measures from the same sites, thus indicating its relatively large size and the possibility that it might have been a male (1.5).

Description

The primary individual (48 #1) in this burial was represented by the fragmented remains of an adult. The cranium consisted of large, highly weathered pieces that included both petrous pyramids and a temporal fragment. Postcranial materials included fragments from humerus, ulna, femur, tibia, patella, clavicle, vertebrae, and ribs. There was a single foot phalanx and metacarpal fragments. There were two adult sections of left mandible from the angle to the symphysis; one matched the right side of a third mandible fragment indicating the presence of two adults.

Fragments of the clavicle and radius were good matches to Windover 142, also a male. Humerus fragments matched Windover 36, identified as an adult female. Therefore, it seems there might have been one adult male (48 #1) and a relatively gracile male or a female (48 #2) in this burial.

One of the individuals (48 #1) exhibited substantial dental wear and was predicted to have had an adult age of 46.24 years. This individual also had very large dentition within the Buckeye Knoll series, and was probably associated with the clearly male postcranial material. The younger adult (48 #2) had a younger attrition age estimate of 37.45 years. Sex assignment of the younger, smaller individual was questionable and could only provide a probable male status (1.5).

Summation

The remains of two individuals were found in Burial 48. The first (48 #1) was that of an adult male (sexnum = 1) with a dental age of 46.24 years. The second (48 #2) was a probable adult male (sexnum = 1.5) who was 37.45 years old.

Burials 49 #1, 49 #2, 49 #3

Metrics

Radius head max diameter = 25.17; humerus shaft—ap=20.81, mediolateral=16.67 (left). Of the 10 left and right humerus shaft dimensions (5 left, 5 right) from Buckeye Knoll, this is the third largest ap of the series, but the third smallest of the mediolateral dimensions (again, 5 right and 5 left).

Description

This burial was primarily represented by the highly fragmented adult remains. There were few identifiable cranial fragments. The postcranial elements included fragments from humerus, radius, ulna, femur, tibia, patella, clavicle, and ribs. The radius fragment exhibited a healed, well-aligned fracture with a large callus formation near the proximal end of shaft.

The skeletal material in this burial was clearly adult, and much of the postcranial material looked relatively robust. However, some of the postcranial fragments were also relatively gracile, and it is possible that we were dealing with two adults. Some of the longbone fragments appeared close to Windover 93, identified as an adult female. Other femur fragments, particularly the superior shaft fragments, were similar to Windover 142, an adult male.

There was a bag of material identified as "49A" (as opposed to a bag labeled simply "49"), and the material did not obviously duplicate any of the existing identifiable fragments. This bag contained primarily longbone fragments and appeared more gracile than the majority of the fragments from Burial 49 proper.

The dental material provided an age estimate of 54.77 and, based on the dental metrics, appeared to be from the adult male (49 #1). The smaller postcranial material, while possibly also a male, was unaged although it is a relatively gracile male, if truly a male (49 #2). Dentally, there was also a subadult represented here who is estimated to have been between 0.5 and 1 year of age (49 #3).

Summation

Three individuals were identified in the Burial 49 remains. The first (49 #1) was an adult male (sexnum = 1) with a dental age of 54.77. Burial 49 #2 was an adult, a probable male (sexnum = 1.5), whose age was uncertain. The third individual (49 #3) was a subadult, around 1 year old, whose sex could not be determined because of age (sexnum = 3).

Burials 50 #1, 50 #2

Description

This burial was represented by a few cranial and postcranial fragments, including a fragment of the left orbit and a shaft fragment of a humerus for which no metrics are available. The cranial fragments, particularly the orbital and zygomatic sections, were comparable to Windover 81, which was an adult female. Femur fragments, particularly the distal section of the right femur, were a closer match to Windover 142 than they were to Windover 81. Windover 142 was an adult male. Dentally, the canine was small. Out of a series of 635 individuals, this individual's canines rank 50th, and virtually all individuals in these lower groups are female. Molar dimensions also indicate the dentition is the smallest observed at Buckeye Knoll, and is the 11th smallest out of a series of 148 individuals from North America. Dentally and skeletally, the small dentition and the small postcranial material indicate that the main person in this burial was likely an adult female with an attrition age of 39.90 years.

Field notes indicate the possibility that two people were represented in Burial 50; however, we found no duplication of elements or significant differences in overall size of the materials in this burial. Nevertheless, there is an indication of a second individual based strictly on the dental analysis (see Chapter 13 for details). There was clearly a series of dental material from a mature adult. There was also a series of teeth clearly from a subadult between 4 and 11 years of age (50 #2).

Summation

The remains of two individuals were identified in the Burial 50 remains. Burial 50 #1 was an adult female (sexnum = 2) with a dental age of 39.90. Burial 50 #2 was a subadult, sex indeterminate due to age (sexnum = 3), estimated to have been 7.5 years old.

Burial 51

Metrics

Left lunate length = 17.44, height = 14.88; right humerus estimated midshaft dimensions—a/p=23.06, m/l=17.09. Left radius at radial tuberosity—a/p=13.09, m/l=17.54; left MC3 base—a/p=17.01, m/l=13.97; right MC5 base—a/p=11.75, m/l=11.18.

There are limited metrics and most are consistently in the higher percentiles of size. For example, the lunate dimensions of this individual are the largest recorded at Buckeye Knoll and only three Windover individuals of the 11 in the series are larger then those of this individual. The humerus (right) midshaft estimate ap dimension is the second largest of the Buckeye Knoll series, and the mediolateral dimensions ranks six out of a total of nine left and right mediolateral dimensions. Dentally, the molar (LNM2CBL) is the 63rd largest out of 152 individuals from North America, and only those from one or two females in the entire series are larger.

Description

This burial was represented by highly fragmented remains. Cranial fragments were highly eroded and cemented together. Postcrania included fragments from humerus, ulna, femur, clavicle, fibula, rib, and radius. There was a medial hand phalanx and a left lunate. The humerus, in particular, was robust and was almost certainly a male. This burial also included two loose large cranial fragments, a medial hand phalanx, a left third metacarpal, a base fragment of a right metacarpal five, a distal foot phalanx, and a proximal head of an unidentifiable metatarsal. There was a small fragment of the orbital wall and, while incomplete, no cribra was observed.

Summation

One individual was identified in Burial 51. This was an adult male (sexnum = 1) with an estimated age of 24.87 years.

Burial 52

Metrics

No metrics are available. However, dental indicators suggest this individual might have been a male, although such is not entirely convincing. The LNM2NMD of 10 mm is the largest in a series of 44 teeth while the LNM2C dimensions are consistently in the lower quartile. The LNM2CMD of 11.37 is 86th out of 133 comparative dimensions, while the LNM2CBL dimensions, 10.96 mm, is 127th out of 165.

Description

This burial was represented by highly fragmented, poorly preserved remains. The cranium consisted of a few small fragments, and there was a ramus fragment from the mandible. Postcrania included fragments from ulna, fibula, and innominate. Innominate fragments appeared gracile. The fact that this burial had the largest reported LNM2NMD, shifts the authors' opinions toward a gracile male (1.5), but this is hardly a strong argument. Overall, this was one of the most poorly preserved burials in the Buckeye Knoll series, and it provided little information.

Summation

A single individual was identified in Burial 52. This was an adult, a probable male (sexnum = 1.5), with a dental age of 47.81 years.

Burials 53 #1, 53 #2

Metrics

Left femur maximum head diameter—a/p=39.54, m/l=40.43; left lunate length = 15.18; right lunate length = 15.34; right capitate height = 19.03; left MC4 base—a/p=11.52, m/l=10.83; left MC3 base—a/p=15.93, m/l=13.42; left MC2 base—a/p=16.36, m/l=16.32; left capitate height = 20.34; width = 17.71; left lunate length = 13.57, height = 15.66; right capitate height = 20.64; right scaphoid length = 25.21; right MC3 base—a/p=15.77, m/l=14.45; right MC4 base—a/p=11.19, m/l=12.06; right MC5 base—a/p=10.87, m/l=12.58.

The maximum femur head dimension, one of the eight available (five right, three left) from Buckeye Knoll, is in the bottom 25 percent of all those reported for North America, out of a sample of over 200 individuals. All but three of the individuals equivalent to, or smaller than, this metric are female, and the specimen is the smallest of all the specimens from Buckeye Knoll.

The left lunate dimensions of the main individual (53 #1) are the smallest reported for the ten individuals at Buckeye Knoll for which such dimensions are available. The bulk of the dimensions collected almost always fall below the mean and median values, and strongly support the assessment of this being a female. Nevertheless, some of the dimensions are in the upper 25 percent of the metric series, leaving a high degree of ambiguity and an assignment of probable female (2.5).

Description

This burial consisted of the highly fragmented remains of an adult and subadult. The adult (53 #1) was represented by fragments from the cranium, humerus, radius, femur, patella, and ribs. A subadult (53 #2) was represented by fragments from a fibula.

Windover 115 was a good match to the humerus fragments; Windover 115 was identified as an adult female. Windover 141, which was a good match to the subadult fibula fragments, was estimated to be five (5) years of age. The general small size of the adult element fragments suggest this individual was probably a female.

Summation

The remains in Burial 53 were attributed to two individuals. The first (53 #1) was an adult, a probable female (sexnum = 2.5), of undetermined age. Burial 53 #2 was that of a subadult, aged around 5 years old, whose sex could not be determined because of age (sexnum =3).

Burial 54

Description

This burial was represented by a few highly fragmented remains for which no metrics are available. Several cranial fragments, with suture lines exhibiting minimal closure, suggested a younger individual. Postcrania included fragments from a humerus, femur, metacarpal and a phalanx, all of which appear to have been relatively gracile, as to be expected given the age of the individual. Several of the longbone fragments showed evidence of rodent gnawing which, again, was unusual in this collection.

There were no epiphyses showing any evidence of age, but the dental material indicates this was a younger individual. The LXM2 showed minimal wear. Dentally, age was much clearer, suggesting this individual was between 12 and 15 years old at the time of death, with a median age of 13.5.

Summation

A single individual was identified in Burial 54. This was a subadult of undetermined sex because of age (sexnum = 3). The dental age was around 13.5 years.

Burial 55

Metrics

Left MC5 base—a/p=10.52, m/l=12.69; left MT5 base—a/p=13.91, m/l=16.64; left MT4 base—a/p=16.13, m/l=13.10; left MT3 base—a/p=16.09, m/l=13.96; left MT2 base—a/p=20.41, m/l=12.56; left MT1 base—a/p=26.13, m/l=19.17; right MT1 base—a/p=24.72, m/l=19.47; right MT2 base—m/l=15.18; right MT3 base—a/p=15.72, m/l=12.97; right MT4 base—a/p=17.93, m/l=13.04; right MT5 base—a/p=13.72, m/l=16.93; right patella breadth = 37.40; right scapular glenoid fossa—superior/inferior=37.65, m/l=24.55; left radius head—a/p=21.88, m/l=20.88.

This individual exhibited small patella dimensions, ranking 12th out of 16 for breadth, and was well below the cut-off point dividing males and females in a larger series of sexed individuals from North America (all but two are males when length or breadth is >40 and all but two are females when the dimension is <40). Most of the other dimensional data collected also place this individual into the ranks of physically smaller series, the majority of which are female. For many of the hand and/or foot dimensions, this person is often the absolute smallest of the 45 or so individuals for which we have comparative data.

Description

This burial was represented by the poorly preserved remains of a gracile adult. The cranium was highly fragmented. Fragmented longbones included the humerus, radius, ulna, femur, tibia, and fibula. The feet were represented by right medial, intermediate, and lateral cuneiforms, right cuboid, right navicular fragment, left navicular, left medial, intermediate, and lateral cuneiform, a left tarsal fragment, all metatarsals (fragmented), and three fragmented phalanges. Hands were represented by left second, third, fourth, and fifth metacarpals, right third, fourth, and fifth metacarpals, left capitate, lunate, and trapezoid, right scaphoid, capitate, pisiform, and triquetral. There were twenty-one phalanges present, some fragmented; but, in contrast to most of the burials from Buckeye Knoll, this one had good pedal preservation.

The radius, which was one of the rare longbones from Buckeye Knoll that was virtually intact, was small and gracile and strongly suggests the individual was a female, although some of the material was a good match to Windover 142, a 56-year-old male. In general, the skeletal material argues more convincingly that this was an adult female with advanced dental attrition, minimally 55+ years of age.

Summation

A single individual was identified in Burial 55. This appears to have been an adult female (sexnum = 2) who was greater than 55 years of age at the time of death.

Burial 56

Description

This burial consisted of only cranial fragments identified in the field. Additional (unspecified) portions of skeletal material may have been beyond the south wall of the excavation. The burial was not excavated or recovered and is, therefore, excluded from MNI discussion.

Summation

Burial 56 was not fully excavated and was not removed. Therefore, no information regarding age or sex are available.

Burial 57

Metrics

Left humerus at deltoid tuberosity—a/p=25.32, m/l=25.79; left tibia at nutrient foramen—a/p=37.28, m/l=24.80; left MT4 base—a/p=13.28, m/l=12.95; right MC5 base—a/p=11.44, m/l=15.50; right capitate height = 22.22; scapular glenoid fossa—superior/inferior=38.63, m/l=26.83; left MT5 base—a/p=14.30, m/l=20.48; right MC4 base—a/p=13.88, m/l=12.66; right tibia at nutrient foramen—a/p=37.59, m/l=26.42.

This individual exhibited the largest humeral ap dimension of the five left and five right specimens in the Buckeye Knoll series. The mediolateral dimension is the second largest observed at Buckeye Knoll. This individual's tibia dimensions at the nutrient foramen fall into the upper quartile of those observed at Buckeye Knoll (although numerically this is obviously a small data set). Based on a series of 119 North American individuals with ap dimensions greater than 37 mm, all but two of the 43 sexed individuals were male. In the same group, values below 30 mm were identified as female in all but two of 36 cases. Mediolateral tibia dimension at the nutrient foramen in this series are identified as males in all but three of the 29 cases when the ml dimension is greater than 24. In all but two of the 30 sexed cases falling below 21 mm, the individuals are identified as female. All of this strongly suggests that this was a robust male.

Description

This burial was represented by the highly fragmented, poorly preserved remains of a robust adult. The cranium was crushed and fragmented. Identifiable cranial elements included a fragment of the left mastoid, a fragmented glenoid fossa, and a crushed left side of a mandible. Fragmented longbones included humerus, radius, ulna, femur, tibia, and fibula. Hands were represented by right MC3, MC4, MC5, capitate, trapezoid, and trapezium; left hamate; and 17 phalanges. Feet were represented by a right cuboid fragment, right MT5, three medial phalanges, and one distal phalanx. There was pronounced upper extremity robusticity. These features and the metrics suggest the individual was an adult male.

Summation

Burial 57 related to a single individual. This was an adult male (sexnum = 1) whose age could not be determined.

Burial 58

Metrics

Left femur estimated midshaft dimensions—a/p=25.34, m/l=20.83. Metrically, these femur dimensions are small and the fragments are consistent with the dental estimate of age of between five and six years.

Description

This burial was represented by the poorly preserved and highly fragmented remains of a subadult. The cranium consisted of small fragments. Fragmented longbones included humerus, femur, tibia, and fibula. There were several small pelvic and vertebral fragments. The only suggestion of age in this individual was a small section of the rim of the pubic symphysis, which exhibited a ridged margin indicative of a younger individual. Its small size points toward a young individual, while dental maturation indicates an age of between five and six years. Several of the longbone fragments showed rodent gnawing, which, as noted previously, was unusual in this collection. The gnawing damage appeared old and was focused around one of the "lesions" that were described earlier in this section (burrowing creature/insect?).

Summation

Burial 58 included the remains of one individual. This was a subadult of undetermined sex (sexnum = 3) whose dental age was 5.5 years.

Burials 59 #1, 59 #2

Description

This burial was represented by highly fragmented, poorly preserved remains of mostly unidentifiable material, although a few pieces of humerus had survived. No metrics are available. The only observation is that some of these latter pieces were similar in size to Windover 142, an adult male, but the fragments were small and few in number. Skeletally, the material was clearly from an adult; however, dentally there were a variety of teeth that were unquestionably subadult. None of the postcranial skeletal fragments was clearly from the subadult, although, again, fragment size made such identification difficult. The conclusion is that there were two individuals; one an adult (59 #1) and the other a small subadult approaching three years of age (59 #2).

Summation

Two individuals were identified in the remains from Burial 59. One (59 #1) was an adult of undetermined sex (sexnum = 4) and age. The second (59 #2) was a subadult, indeterminate sex (sexnum = 3), with a dental age of 2.7 years.

Burial 60

Description

This burial was represented by the highly fragmented, poorly preserved remains of a subadult, for which no metrics are available. Postcrania consisted of fragments from femur, tibia, clavicle, and vertebrae. The vertebral bodies were clearly immature, and suggest the individual was probably between 13 or 14 years of age. This estimate fits with the very low dental attrition rates (see Chapter 13). The proximal metaphysis of the tibia was also unfused, and all the materials were small in size. There was a good inventory of dental material, the majority of which is adult dentition. However, they exhibited essentially no wear, suggesting they were either unerupted or so recently erupted that there was not much time for wear to occur.

The dental metrics are some of the largest in the Buckeye Knoll series, suggesting quite likely that this individual was a male. Although sex attributions based strictly on dentition are not optimal, the large dimensions certainly suggest that this is a young male. As noted in the dental analysis section (Chapter 13), the age of this individual is estimated to have been between five and seven years, although the attrition rate suggests a slightly older person around 11.69 years. Nevertheless, the median age within this range is roughly eight years of age, as given below.

Summation

Burial 60 contained the remains of a single individual. This was identified as a subadult, whose sex was indeterminate (sexnum = 3), around 8 years old.

Burials 61 #1, 61 #2

Metrics

No metrics are available. However, dental indicators suggest the secondary individual (Burial 61 #2) in this burial might be a male. The RNM1NBL (9.16 mm) is in the lower quartile (32 of 57), although comparative measures would shift it toward a possible female. However, the RNM2CBL dimension (10.90 mm) places it higher in the top quartile (28th out of 110) of a larger series of 110 individuals. Balancing these two contradictory indicators in the absence of other, and better, skeletal indicators, suggests that this may have been a male. However, this is not a firm conclusion (thus a 1.5 sex assessment).

Description

The main individual (61 #1) in this burial was represented by highly fragmented, poorly preserved remains of a subadult, mainly small rib shaft fragments. Other skeletal fragments were limited to a few unremarkable cranial pieces. However, the rib fragments were similar morphologically to those from Windover 141, which was a five-year-old subadult.

As note above, there also was dental material in this burial that clearly was adult and exhibited a moderate degree of wear, thus suggesting a ca. 30-year-old individual. The teeth from this person also exhibited substantial calculus formation. Conversely, the subadult's dental material was restricted to a single deciduous canine that clearly was not associated with the adult teeth. This canine did, however, match the rib fragments with respect to gross size and stage of maturity.

Summation

Burial 61 included the remains of two individuals. The first (61 #1) was a subadult of undetermined sex (sexnum = 3) who was around 5 years old. The second (61 #2) was a probable male (sexnum = 1.5) with a dental age of 31.68.

Burials 62 #1, 62 #2, 62 #3

Metrics

Right calcaneus maximum length = 76.88; right femur head max diameter = 46.54; left calcaneus maximum length = 82.49; left talus superior articular surface = 29.07; left MC1 base—a/p=15.63, m/l=15.12.

Of the small number of measurable (*n*=5) femur heads (r), this is the second largest from the site. The disparity between the right and left calcaneus maximum dimensions supports the presence of two adults. Neither was well represented, although there is clear duplication of some of the element fragments (i.e., two right tali).

Description

This burial was represented by the highly fragmented, poorly preserved remains of two adults. The cranial material was highly fragmented and unidentifiable. Fragmented longbones included humerus, ulna, right femur head, tibia, and fibula. Hands were represented by an MC1. Feet were represented by two right tali, one left talus, and a right and left calcaneus with the left being much smaller than the right.

As noted, there appear to have been two adults represented, as indicated by the duplicated elements and the gross differences in size. Given the large size of the femur head, one was almost certainly a male. The larger talus was almost a perfect match for Windover 114, which was an adult male, while the smaller matched a number of Windover females. Some of the humerus shaft fragments were similar in size to Windover 93, which was an adult female. Although the male was listed above as the main individual in the burial, this is an arbitrary convenience in keeping with the reporting standards established earlier. The field team did not recognize any one skeleton as the primary individual, and, in fact, described the burial as a jumble of bones from several people.

There was also a cluster of teeth indicting that a third individual (62 #3) was represented, and this third individual was a subadult. Dentally, the metrics are ambiguous with respect to sex for the primary individual (62 #1), and we relied on the femur head dimensions to indicate the person was a male and was presumably associated with the metrically larger dental material. The smaller dental series, of a more advanced age (49.04 years) was female (62 #2), with the male exhibiting less wear and an attrition estimate of 31.13 years of age.

Summation

Three individuals were identified in Burial 62. The first (62 #1) was an adult male (sexnum = 1) with a dental age of 31.13 years. The second (62 #2) was an adult female with a dental age of 49.04 years. Burial 62 #3 was a subadult, around seven years old, whose sex was indeterminate because of age (sexnum = 3).

Burial 63

Description

This burial was represented by highly fragmented and poorly preserved remains for which no metrics are available. These included a very small series of cranial fragments, essentially unidentifiable as to anatomical location, plus a small series of limb fragments, none identifiable as to element or side. The condition of the latter fragments was poor, although their size suggests they were from an adult.

Summation

Burial 63 contained the remains of a single individual. This was identified as an adult male (sexnum = 1) of undetermined age.

Burials 64 #1, 64 #2

Metrics

Femur midshaft—ap=26.24, mal=23.93. Measures of the subadult include the right femur subtrochanteric dimensions —a/p=18.58, m/l=21.55. The midshaft dimensions are in the lower quartile of the distribution of 522 Native American individuals available for comparison. In addition, the majority of individuals in this series with dimensions either at or below those listed above are female. While limited, this information is consistent with a probable female. These subtrochanteric dimensions are clearly subadult fragments and are roughly 7 mm below the nearest adult dimension for the comparable locations.

Description

This burial contained the highly fragmented, poorly preserved cranial and postcranial remains of an adult (64 #1). Many of the postcranial fragments were a good match to Windover 93, but the cranial material was somewhat larger than Windover 93. Windover 93 was identified as an adult female.

This burial also contained the highly fragmented, poorly preserved remains of a gracile individual (subadult) (64 #2). The cranium consisted of a right temporal fragment and fragments of left and right orbits. Postcranial material consisted of fragments of humerus and femur. The subadult right femur was identical in size to the right femur from the subadult in Burial 65 (see below), but both were rights and clearly represented two distinct people.

Summation

Burial 64 contained the remains of two individuals. The first (64 #1) was an adult, a probable female (sexnum 2.5), whose age was undetermined. The second (64 #2) was a subadult of indeterminate sex (sexnum = 3) with a dental age of 15.27 years.

Burials 65 #1, 65 #2

Metrics

Right femur estimated subtrochanteric dimensions—a/p=17.51, m/l=22.06. These dimensions are small and come from the subadult and not the adult. They are roughly 7 mm below the nearest adult dimension.

Description

This burial was represented by the highly fragmented, poorly preserved remains of two individuals. The cranium consisted of two large, highly weathered fragments. The postcrania consisted of fragments from the shafts of the humerus and femur. The second person (65 #2) was a subadult based on the skeletal material within this burial.

There were a number of femur shaft fragments that appeared metrically to have been from an adult. These were also matched by a larger series of humerus fragments that also appear to have been adult. In addition to these, there were femur shaft fragments (proximal) that were absolutely identical to those observed in Burial 63. However, the fragments overlapped and were from right femurs and, thus, clearly represent two distinct individuals. The femur fragments and fragments from a tibia were close approximations to Windover 112, identified as a 14-year-old subadult. However, dentally, the subadult appears to have been a bit older and a median date between 14 and 16.54 years was used (15.27) for the age estimate.

There was a small fragment of the mandible that had a mental eminence that would be scored as a "2" indicating a female (Buikstra and Ubelaker 1994). Unfortunately, it was impossible to determine if this was from the subadult or the adult, so we retained the unsexed assessment of the adult. There was a single RNM1 with a cbl of 10.62 mm, which is 74th in a series of 118, so it appeared relatively small and had little wear (14). It was attributed to the subadult, given the minimal wear. There was no way of estimating the age of the adult in this burial.

Summation

Two individuals were identified in Burial 65. The first (65 #1) was an adult whose age and sex (sexnum = 4) were indeterminate. The second (65 #2) was a subadult with a dental age of 15.27 and whose sex could not be determined (sexnum =3).

Burials 66 #1, 66 #2

Metrics

Right patella—height=35.68, breadth=35.32; left femur estimated midshaft dimensions—a/p=25.44, m/l=23.75; left talus superior articular surface = 27.04. The patella dimensions, both height and breadth, are below the female/male cut-off point of 40, as based on a series of 52 sexed individuals from North America. Plus, they are in the lower half of the Buckeye Knoll series distribution. Dentally, the metrics are ambiguous with respect to sex and are near the middle of the distribution for all the teeth that were recovered from the site.

Description

This burial was mainly represented by the highly fragmented, poorly preserved remains of an adult (66 #2). Subadult teeth (66 #1) also were found in association with the burial. The adult was represented by cranial fragments and fragments from humerus, radius, femur, and tibia. Feet were represented by a talus, calcaneus, and two naviculars. One complete right patella was present. There were fragments of the right acetabulum and sacrum; they were unremarkable with respect to features potentially useful in sex assignment.

Summation

The remains of two individuals were identified in Burial 66. One (66 #1) was a subadult of indeterminate sex (sexnum = 3) who was around six years old. The other (66 #2) was an adult, a probable female (sexnum = 2.5), with a dental age of 38.67.

Burials 67 #1, 67 #2

Metrics

Right patella — superior/inferior = 35.61, breadth=36.74; right lunate—length=16.60, height=12.65; left lunate—length=17.05, height=13.99. There are few metrics for this individual, but the left and right lunate lengths are both above the group and Buckeye Knoll median values. Both heights, however, are below the median values of all the samples.

The patella dimensions, both height and breadth, are below the female/male cut point of 40, as based on a series of 52 sexed individuals from North America, and are in the lower half of the Buckeye Knoll series distribution. Given these metrics, it seems reasonable to identify this individual as female.

Description

Burial 67 mainly contained the highly fragmented, poorly preserved remains of an adult. The cranium was represented by a small number of unidentifiable fragments. Postcrania remains consisted of fragments from humerus, radius, femur, and tibia. A right patella was present. Feet were represented by four phalanges. Right and left lunates also were present. There was a large fragment of the left iliac crest.

Fragments of the humerus were similar in size and morphology to those of Windover 138, identified as a young adult female (21 years of age). The subadult (67 #2) in this burial was represented by dental material alone, as no related cranial or postcranial material survived.

Summation

Two individuals were identified in Burial 67. The first (67 #1) was an adult female (sexnum = 2) with a dental age of 30.64 years. Burial 67 #2 was a subadult of indeterminate sex (sexnum = 3) who was about 2.5 years old.

Burial 68

Description

This burial was represented by highly fragmented, poorly preserved, unidentifiable remains for which no metrics are available. This was one of the smallest surviving series of bone fragments. It may well have been float from other parts of the site. It was such an ephemeral collection of unidentifiable material that it is hard to justify it as a "burial" in the strictest sense. In addition to the obviously human fragments, there was also a variety of faunal material, which was clearly not human. Most of the faunal material appears to have been fragmented deer bone. Based on dental maturation, the individual was between five and six years of age.

Summation

Burial 68 contained the remains of a single individual. This was a subadult of indeterminate sex (sexnum = 3) with a dental age of 5.5 years.

Burials 69 #1, 69 #2

Description

This burial contained highly fragmented, poorly preserved, unidentifiable remains of two individuals for which no metrics are available. This "burial" was very much like Burial 68 in that the material was more a collection of small fragments than a formal burial. However, unlike Burial 68, there were both adult and subadult teeth. Like Burial 68, some nonhuman bone was mixed with this collection.

Some of the cranial pieces were heavily eroded on the endocranial surface, making them thin, but they appeared to be adult. The deciduous dentition, on the other hand, clearly indicates at least one subadult (69 #2) was represented in this burial. A few of the cranial fragments were similar to Windover 113 in terms of size and morphology. Windover 113 was identified as an individual less than eight years of age. The adult dental material exhibited significant wear and clearly did not belong to the subadult. The adult had an estimated dental age of 56.15 years. There were a few dental metrics, but they are ambiguous with respect to sex and fall close to the middle of the distributions.

Summation

The remains of two individuals were identified in Burial 69. One (69 #1) was an adult of undetermined sex (sexnum = 4) with a dental age of 56.15 years. The second (69 #2) was a subadult, estimated to have been around 9 years old, whose sex was indeterminate due to age (sexnum = 3).

Burial 70

Description

This burial was represented by the highly fragmented, poorly preserved, and largely unidentifiable remains of an adult for which no metrics are available. All that was recovered included five cranial fragments, all small and similar to several others burials (particularly Burial 68).

Summation

The remains of a single individual were identified in Burial 70. This person was an adult of undetermined age and sex (sexnum = 4).

Burials 71 #1, 71 #2

Metrics

Right talus superior articular surface = 27.14; right femur superior/inferior diameter of neck = 28.83; left femur superior/inferior diameter of neck = 23.47; right scapular glenoid fossa—superior/inferior=31.95, m/l=20.50. The postcranial metrics, plus many of the dental metrics, indicate that the main individual (71 #1) in the burial was a small person and almost certainly a female.

Description

This burial was mainly represented by the highly fragmented remains of an adult female. The cranium was represented by fragmented basicrania pieces. Longbone fragments included humerus, radius, ulna, femur, tibia, clavicle, and fibula. Feet were represented by right talus fragment. There was a left innominate fragment, one eroded vertebral body, and a small number of rib fragments.

Auricular surface fragments existed, and, based on the SOD illustrations, would be scored as a 35-year-old adult (Buikstra and Ubelaker 1994). Dental attrition was less pronounced than what would be expected in an individual 35 years of age. In this case, the dental attrition age estimate (21.2 years) was regarded as the best indicator, since it is based on more observations than the single observation of an auricular surface fragment. A large portion of the greater sciatic notch survived and was relatively open, also suggesting a female. This was supported by a very distinct preauricular sulcus much more commonly observed in females.

A single dlxm1 was in the burial fill and was clearly not part of the adult. It was unworn, suggesting recent eruption. The adult LNM2, by way of contrast, showed some wear, although it was relatively light and provided a dental attrition age, as noted, of 21.2 years.

Summation

The remains of two individuals were identified in Burial 71. The first (71 #1) was an adult female (sexnum = 2) with a dental age of 21.2 years. The second (71 #2) was a subadult of indeterminate sex (sexnum = 3) who was about one year old.

Burial 72

Metrics

Right femur maximum head diameter = 48.07; left tibia at nutrient foramen—a/p=40.80, m/l=26.10; right navicular maximum length = 40.69; right MT3 base—a/p=22.49, m/l=16.14; right MT2 base—a/p=19.86, m/l=17.26; left navicular maximum length = 40.26; left MT2 base = m/l=16.11; right MC3 base—a/p=12.46, m/l=14.87; right MC1 base—a/p=12.13, m/l=15.95; right MT1 base—a/p=30.71, m/l=19.29.

Of the limited number (*n*=5) of right femur heads intact enough to measure, this was the largest of the Buckeye Knoll series. Of the ten tibia fragments measurable at the nutrient foramen, this individual exhibited the largest ap and second largest mediolateral dimension. Based on a series of 119 North American individuals with ap dimensions greater than 37, all but two of the 43 sexed individuals were male. In the same group, values below 30 were identified as female in all but two of 36 cases. Mediolateral tibia dimensions at the nutrient foramen in this series are identified as males in all but three of the 29 cases when the ml dimension is greater than 24. In all but two of the 30 sexed cases falling below 21 mm, the individuals are identified as female. These features strongly suggest this was a robust male.

Description

This burial was represented by the poorly preserved remains of an adult. The cranium consisted of unidentifiable fragments, a left mastoid fragment, and a fragment of the left gonial angle of the mandible. Postcrania consisted of fragments from humerus, ulna, femur, tibia, fibula, and clavicle. There was a right patella fragment. Feet were represented by right calcaneus fragment, right talus fragment, right navicular, right cuboid, right MT2 and MT3, left talus, navicular, and medial cuneiform, LMT1, LMT2, and LMT5. Tibia and femur shafts, in particular, were robust with distinct muscle markings.

Windover 142, an adult male, was comparable to the femur fragments of this individual. The talus was similar in size and morphology to Windover 111, also an adult male.

Summation

Burial 72 consisted of the remains of a single individual. This person was an adult male (sexnum = 1) who had a dental age of 38.15 years).

Burial 73

Metrics

Left capitate body height = 22.27, width = 18.20; left MC3 base—a/p=15.74, m/l=15.00. These dimensions, especially the capitate body height, are the largest observed in the Buckeye Knoll series and the second largest observed in a group of 11 individuals from Windover and Buckeye Knoll. The dimensions on the MC3 base are also large and indicate this was a male.

Dental dimensions, however, place the individual in the lower one half of the metric distribution, usually well below the mean or median values; this would argue for this individual being a female. Collectively, however, sex assessment seems uncertain and will be best regarded simply as an adult.

Description

This burial was represented by the highly fragmented, poorly preserved remains of an adult. The cranium consisted of small, unidentifiable fragments. Postcrania consisted of fragments from humerus, radius, and femur. Small innominate fragments were present, as well as a few rib fragments. There was a right hamate and a left capitate. While there were fragments from many elements, most of the material was badly broken and heavily eroded. Distal radius fragments were similar to Windover 93, an adult female. Collectively, these differences in dimensions render sex assessment difficult. (Editor's note: In the field, only a skull and a mandible were identified as pertaining to this burial; the postcranial remains mentioned above may pertain to other individuals believed, on the basis of field observations, to have been placed within the same burial pit.)

Summation

Burial 73 contained the remains of a single individual. This was an adult of indeterminate sex (sexnum = 4) with a dental age of 30.30 years.

Burials 74 #1, 74 #2

Metrics

Left MC5 base—a/p=15.64, m/l=10.87; right talus superior articular surface = 31.43. All these dimensions fall into the larger range and are more consistently suggestive of a male than a female. The talus articular surface, for example, is the second largest in the entire Windover and Buckeye Knoll series. While these series admittedly only include 13 individuals, it is still suggestive and consistent.

Description

Burial 74 contained the highly fragmented, poorly preserved remains of an adult (74 #1) and subadult (74 #2). The subadult was represented by fragments of rib heads. The adult was represented by small cranial fragments and postcranial fragments from humerus, clavicle, patella, vertebrae, and sacrum. Feet were represented by a distal phalanx, a robust talus fragment, and right and left medial cuneiforms. The talus of the adult was particularly large and close to Windover 131, an adult male.

As noted, in addition to the clearly large robust adult, there were a variety of rib fragments, which were unquestionably subadult. These materials included rib heads and shafts and were a close match to Windover 137, a 0.5-year-old individual. The subadult rib fragments were also accompanied by a small series of cranial fragments that were consistent with a neonate or very young individual.

Summation

Two individuals were identified among the remains of Burial 74. One (74 #1) was a adult male (sexnum = 1) with a dental age of 44.76 years. The other (74 #2) was a subadult of indeterminate sex (sexnum = 3) who was approximately .75 years of age.

Burial 75

Metrics

Left MT5 base—a/p=14.25, m/l=23.13; right MC1 base—a/p=14.05, m/l=15.13; right radius at radial tuberosity—a/p=9.76, m/l=11.20; left MC3 base—a/p=11.29, m/l=16.19.

The MT5 base dimensions are large for both the Buckeye Knoll and Windover series. The ap dimension is closer to the middle of the distribution, but the ml dimension is one of the largest, if not the largest, observed in the series of 20 individuals from those two sites. Most of the other base dimensions for the metacarpals and metatarsals are well above the median or mean values, though the number of individuals for which we have comparative data is limited.

Description

This burial was represented by the highly fragmented, poorly preserved remains of an adult. The cranium consisted of unidentifiable fragments and pieces from the coronoid process of the mandible. Postcranial fragments included radius, ulna, femur, fibula, innominate, vertebrae, and ribs.

Several individuals were used as comparisons to this individual. The radius of this individual was slightly larger than Windover 111, but the femur fragments were a good match. Carpals were a bit larger than those observed in Windover 115, although the patella fragments were close. Windover 142 was a good match to the fibula fragments of this individual. Windover 111 was an adult male. Windover 115 was an adult female, and Windover 142 was an adult male. The diversity of these comparisons provided little definitive information for a conclusive assessment of sex.

Summation

Burial 75 contained the remains of one individual. This was an adult of undetermined sex (sexnum = 4) with a dental age of 29.96 years.

Postcranial Information

A variety of postcranial metrics were collected on the Buckeye Knoll series. The sample statistical parameters of these metrics are presented in Table 12-4. Table 12-5 presents similar statistics for the comparative sites used in some comparisons, particularly where there are more than three or four dimensions from Buckeye Knoll. To assist in finding landmarks, particularly midshaft locations, comparisons to intact elements of approximately the same size were used. This expanded the collectable measures and, at the same time, did not seriously compromise measurement accuracy. Addendum 12-1 provides a list of measures and abbreviations used here.

In some cases, the Buckeye Knoll materials are compared to data sets we have been compiling at FSU as part of a larger comparative project. There is a limited Texas presence in this database, but many of the samples included are from sites that have played a major role in shaping our understanding of prehistoric populations in North America. In most cases, the left element distributions are presented in lieu of presenting both left and right elements, as is standard practice in osteology. In a few cases, particularly where rights have substantially larger sample sizes, results for rights will also be discussed; however, this strategy often reduced the size of comparative samples. The comparative effort is neither extensive nor exhaustive, but it is a first step to providing a frame of reference for the Buckeye Knoll materials within the larger prehistoric context. Addendum 12-2 provides basic site, state, and chronological placement for these series. Not surprisingly, many of the specific measures are not reported for many of the samples and some of the comparative possibilities are limited in nature. A more serious effort to compile Texas comparative data in particular is highly desirable. In Addendum 12-3, the Buckeye Knoll burial number (1 through 75) is used, corresponding to the numbers assigned in Chapter 10. However, when specimens could not be associated with specific burials (i.e., an isolated skeletal element or element fragments), a number in excess of 75 is assigned. This is generally expressed as a five or six digit number representing the coordinates of the unit from which the elements were excavated, as well as the level. For instance, isolated material from S14W86, Level 15 would be coded as 148615.

Needless to say, the standard caveat would have to be a caution about the small sample size. Also, the comparative samples used in this phase of analysis are sample metrics already in possession of the authors. The goal of this report is to present the basic information and other, more detailed comparisons. The creation of more robust comparative samples is an ongoing process, which is beyond the Treatment Plan submitted to the USACE. Some of the results from the following analyses already have been mentioned in the burial-by-burial inventories with respect to sex assignment.

Addendum 12-3 provides the postcranial dimensions for the Buckeye Knoll sample, burial-by-burial, plus an inventory list (with metrics) of postcranial materials from unassociated contexts.

Humerus Midshaft Dimensions

Midshaft dimensions (anterior-posterior and medio-lateral) of the humerus show the left anterior-posterior dimensions of Buckeye Knoll and encompass nearly the entire range of comparative individuals from this small series of eight sites. There is an unassociated fragment (#2122) with very small ap dimension, one of the smallest in the series (Figures 12-1 and 12-2). The humeral midshaft dimensions in this individual are small, specifically 15.48 mm (HMAPL), although the mediolateral dimension is not quite so diminutive (17.58 mm). This individual, given the overall dimen-

Table 12-4. Postcranial Statistical Parameters for Buckeye Knoll.

MALE STATS	N	MIN	MAX	MEDIAN	MEAN	SE	SD
MXLFEML	1	468.00	468.00	468.00	468.00	.	.
MXLFEMR	1	464.00	464.00	464.00	464.00	.	.
BILFEML	1	472.00	472.00	472.00	472.00	.	.
BILFEMR	1	468.00	468.00	468.00	468.00	.	.
MXDFEMHL	1	48.15	48.15	48.15	48.15	.	.
MXDFEMHR	2	42.57	48.07	45.32	45.32	2.75	3.89
FMSAPL	1	30.34	30.34	30.34	30.34	.	.
FMSAPR	1	27.97	27.97	27.97	27.97	.	.
FMSMLL	1	25.67	25.67	25.67	25.67	.	.
FMSMLR	1	24.40	24.40	24.40	24.40	.	.
LENTIBL	0	.	.	.	.	.	.
LENTIBR	1	382.00	382.00	382.00	382.00	.	.
PATMXHL	1	41.32	41.32	41.32	41.32	.	.
PATMXHR	2	41.17	41.61	41.39	41.39	0.22	0.31
PATMXBL	3	38.97	42.29	42.27	41.18	1.10	1.91
PATMXBR	2	41.07	41.48	41.28	41.28	0.20	0.29
MAXHUML	1	300.00	300.00	300.00	300.00	.	.
MAXHUMR	1	297.00	297.00	297.00	297.00	.	.
HMAPL	3	19.16	24.27	20.81	21.41	1.51	2.61
HMMLL	3	16.67	20.97	18.75	18.80	1.24	2.15
HMAPR	3	20.39	23.06	20.73	21.39	0.84	1.45
HMMLR	3	16.44	22.93	17.09	18.82	2.06	3.57
RMLL	1	139.00	139.00	139.00	139.00	.	.
UMLL	2	13.03	268.00	140.52	140.52	127.49	180.29
TMLML	4	21.07	26.10	23.93	23.76	1.09	2.18
TAPNL	4	35.25	40.80	38.08	38.05	1.18	2.36
TAPNR	2	37.07	37.59	37.33	37.33	0.26	0.37
TMLMR	2	23.47	26.42	24.95	24.95	1.48	2.09
LMC1	1	42.83	42.83	42.83	42.83	.	.
LMC3	1	63.03	63.03	63.03	63.03	.	.
LMC4	1	56.93	56.93	56.93	56.93	.	.
LMC5	1	50.58	50.58	50.58	50.58	.	.
RMC1	0	.	.	.	.	.	.
RMC2	0	.	.	.	.	.	.
RMC4	1	64.92	64.92	64.92	64.92	.	.

continued.

Table 12-4. (continued)

MALE STATS	N	MIN	MAX	MEDIAN	MEAN	SE	SD
FSIDNL	0	.	.	.	.	.	.
FSIDNR	0	.	.	.	.	.	.
MT1APBL	1	28.05	28.05	28.05	28.05	.	.
MT1APBR	2	27.54	30.71	29.13	29.13	1.59	2.24
MT1MLBL	1	20.08	20.08	20.08	20.08	.	.
MT1MLBR	2	19.29	19.30	19.30	19.30	0.01	0.01
MT2APBL	2	19.62	20.73	20.18	20.18	0.55	0.78
MT2APBR	2	19.63	19.86	19.75	19.75	0.12	0.16
MT2MLBL	3	14.86	16.11	14.89	15.29	0.41	0.71
MT2MLBR	2	16.08	17.26	16.67	16.67	0.59	0.83
MT3APBL	2	20.54	21.17	20.86	20.86	0.32	0.45
MT3APBR	2	20.07	22.49	21.28	21.28	1.21	1.71
MT3MLBL	2	12.98	14.17	13.58	13.58	0.59	0.84
MT3MLBR	3	13.96	16.14	14.22	14.77	0.69	1.19
MT4APBL	4	13.28	19.52	18.59	17.50	1.42	2.85
MT4APBR	2	18.69	19.37	19.03	19.03	0.34	0.48
MT4MLBL	4	12.25	13.59	13.20	13.06	0.30	0.60
MT4MLBR	2	12.60	13.28	12.94	12.94	0.34	0.48
MT5APBL	3	13.60	15.00	14.30	14.30	0.40	0.70
MT5APBR	2	14.54	15.02	14.78	14.78	0.24	0.34
MT5MLBL	3	18.02	20.65	20.48	19.72	0.85	1.47
MT5MLBR	2	17.77	21.35	19.56	19.56	1.79	2.53
MC1APBL	1	14.01	14.01	14.01	14.01	.	.
MC1APBR	2	12.13	15.93	14.03	14.03	1.90	2.69
MC1MLBL	1	14.33	14.33	14.33	14.33	.	.
MC1MLBR	2	15.04	15.95	15.50	15.50	0.46	0.64
MC2APBL	1	15.37	15.37	15.37	15.37	.	.
MC2APBR	1	16.92	16.92	16.92	16.92	.	.
MC2MLBL	1	18.16	18.16	18.16	18.16	.	.
MC2MLBR	1	15.86	15.86	15.86	15.86	.	.
MC3APBL	1	15.69	15.69	15.69	15.69	.	.
MC3APBR	2	12.46	16.77	14.62	14.62	2.15	3.05
MC3MLBL	1	14.19	14.19	14.19	14.19	.	.
MC3MLBR	2	13.99	14.87	14.43	14.43	0.44	0.62
MC4APBL	1	11.40	11.40	11.40	11.40	.	.
MC4APBR	1	13.88	13.88	13.88	13.88	.	.
MC4MLBL	1	10.99	10.99	10.99	10.99	.	.

continued.

Table 12-4. (continued)

MALE STATS	N	MIN	MAX	MEDIAN	MEAN	SE	SD
MC4MLBR	1	12.66	12.66	12.66	12.66	.	.
MC5APBL	2	9.67	15.64	12.66	12.66	2.99	4.22
MC5APBR	1	11.44	11.44	11.44	11.44	.	.
MC5MLBL	2	10.87	13.74	12.31	12.31	1.43	2.03
MC5MLBR	1	15.50	15.50	15.50	15.50	.	.
LUNLL	2	16.61	17.44	17.03	17.03	0.42	0.59
LUNLR	0	.	.	.	.	.	.
LUNHL	2	7.45	14.88	11.17	11.17	3.72	5.25
LUNHR	0	.	.	.	.	.	.
HMDAPL	1	21.74	21.74	21.74	21.74	.	.
HMDAPR	0	.	.	.	.	.	.
HMDMLL	1	23.80	23.80	23.80	23.80	.	.
HMDMLR	0	.	.	.	.	.	.
RMTAPL	2	14.99	16.15	15.57	15.57	0.58	0.82
RMTAPR	1	15.19	15.19	15.19	15.19	.	.
RMTMLL	2	15.05	15.48	15.27	15.27	0.21	0.30
RMTMLR	1	16.35	16.35	16.35	16.35	.	.
XFMSAPL	0	.	.	.	.	.	.
XFMSAPR	2	24.94	28.71	26.83	26.83	1.89	2.67
XFMSMLL	0	.	.	.	.	.	.
XFMSMLR	2	26.74	33.54	30.14	30.14	3.40	4.81
STATURE	3	170.76	173.58	173.19	172.51	0.88	1.53

FEMALE STATS	N	MIN	MAX	MEDIAN	MEAN	SE	SD
MXLFEML	2	.	.	.	.	.	.
MXLFEMR	0	.	.	.	.	.	.
BILFEML	0	.	.	.	.	.	.
BILFEMR	0	.	.	.	.	.	.
MXDFEMHL	0	.	.	.	.	.	.
MXDFEMHR	2	40.55	46.42	43.485	43.49	2.94	4.15
FMSAPL	3	21.34	26.79	25.63	24.59	1.66	2.87
FMSAPR	4	21.76	32.31	26.48	26.76	2.29	4.59
FMSMLL	3	23.98	26.18	24.66	24.94	0.65	1.13
FMSMLR	4	23.82	27.03	26.02	25.72	0.75	1.50
LENTIBL	1	360	360	360	360.00	.	.

continued.

Table 12-4. (continued)

FEMALE STATS	N	MIN	MAX	MEDIAN	MEAN	SE	SD
LENTIBR	0	.	.	.	.	.	.
PATMXHL	0	.	.	.	.	.	.
PATMXHR	3	35.61	38.32	37.04	36.99	0.78	1.36
PATMXBL	1	33.06	33.06	33.06	33.06	.	.
PATMXBR	4	36.46	37.94	37.07	37.14	0.33	0.67
MAXHUML	0	.	.	.	.	.	.
MAXHUMR	0	.	.	.	.	.	.
HMAPL	0	.	.	.	.	.	.
HMMLL	0	.	.	.	.	.	.
HMAPR	0	.	.	.	.	.	.
HMMLR	0	.	.	.	.	.	.
RMLL	1	209	209	209	209.00	.	.
UMLL	0	.	.	.	.	.	.
TMLML	1	24.32	24.32	24.32	24.32	.	.
TAPNL	1	38.05	38.05	38.05	38.05	.	.
TAPNR	1	24.75	24.75	24.75	24.75	.	.
TMLMR	1	20.89	20.89	20.89	20.89	.	.
LMC1	1	40.72	40.72	40.72	40.72	.	.
LMC3	0	.	.	.	.	.	.
LMC4	0	.	.	.	.	.	.
LMC5	0	.	.	.	.	.	.
RMC1	0	.	.	.	.	.	.
RMC2	1	61.26	61.26	61.26	61.26	.	.
RMC4	0	.	.	.	.	.	.
FSIDNL	1	23.47	23.47	23.47	23.47	.	.
FSIDNR	2	28.83	32.72	30.775	30.78	1.95	2.75
MT1APBL	1	26.13	26.13	26.13	26.13	.	.
MT1APBR	1	24.72	24.72	24.72	24.72	.	.
MT1MLBL	1	19.17	19.17	19.17	19.17	.	.
MT1MLBR	1	19.47	19.47	19.47	19.47	.	.
MT2APBL	1	20.41	20.41	20.41	20.41	.	.
MT2APBR	0	.	.	.	.	.	.
MT2MLBL	1	12.56	12.56	12.56	12.56	.	.
MT2MLBR	1	15.18	15.18	15.18	15.18	.	.
MT3APBL	1	16.09	16.09	16.09	16.09	.	.
MT3APBR	1	15.72	15.72	15.72	15.72	.	.
MT3MLBL	1	13.96	13.96	13.96	13.96	.	.

continued.

Table 12-4. (continued)

FEMALE STATS	N	MIN	MAX	MEDIAN	MEAN	SE	SD
MT3MLBR	1	12.97	12.97	12.97	12.97	.	.
MT4APBL	1	16.13	16.13	16.13	16.13	.	.
MT4APBR	1	17.93	17.93	17.93	17.93	.	.
MT4MLBL	1	13.1	13.1	13.1	13.10	.	.
MT4MLBR	1	13.04	13.04	13.04	13.04	.	.
MT5APBL	1	13.91	13.91	13.91	13.91	.	.
MT5APBR	2	13.72	21.02	17.37	17.37	3.65	5.16
MT5MLBL	1	16.64	16.64	16.64	16.64	.	.
MT5MLBR	2	13.63	16.93	15.28	15.28	1.65	2.33
MC1APBL	0	.	.	.	.	.	.
MC1APBR	0	.	.	.	.	.	.
MC1MLBL	0	.	.	.	.	.	.
MC1MLBR	0	.	.	.	.	.	.
MC2APBL	0	.	.	.	.	.	.
MC2APBR	0	.	.	.	.	.	.
MC2MLBL	0	.	.	.	.	.	.
MC2MLBR	0	.	.	.	.	.	.
MC3APBL	0	.	.	.	.	.	.
MC3APBR	0	.	.	.	.	.	.
MC3MLBL	0	.	.	.	.	.	.
MC3MLBR	1	11.38	11.38	11.38	11.38	.	.
MC4APBL	0	.	.	.	.	.	.
MC4APBR	0	.	.	.	.	.	.
MC4MLBL	0	.	.	.	.	.	.
MC4MLBR	0	.	.	.	.	.	.
MC5APBL	1	10.52	10.52	10.52	10.52	.	.
MC5APBR	1	17.78	17.78	17.78	17.78	.	.
MC5MLBL	1	12.69	12.69	12.69	12.69	.	.
MC5MLBR	1	15.37	15.37	15.37	15.37	.	.
LUNLL	3	16.4	17.3	17.05	16.92	0.27	0.46
LUNLR	1	16.6	16.6	16.6	16.60	.	.
LUNHL	2	13.99	14.3	14.145	14.15	0.16	0.22
LUNHR	1	12.65	12.65	12.65	12.65	.	.
HMDAPL	2	20.43	24.45	22.44	22.44	2.01	2.84
HMDAPR	2	23.64	26.38	25.01	25.01	1.37	1.94
HMDMLL	1	23.08	23.08	23.08	23.08	.	.
HMDMLR	1	17.42	17.42	17.42	17.42	.	.

continued.

Table 12-4. (concluded)

FEMALE STATS	N	MIN	MAX	MEDIAN	MEAN	SE	SD
RMTAPL	1	13.34	13.34	13.34	13.34	.	.
RMTAPR	0	.	.	.	.	.	.
RMTMLL	1	15.03	15.03	15.03	15.03	.	.
RMTMLR	0	.	.	.	.	.	.
XFMSAPL	2	19.95	26.31	23.13	23.13	3.18	4.50
XFMSAPR	2	20.52	26.45	23.485	23.49	2.97	4.19
XFMSMLL	2	24.45	30.08	27.265	27.27	2.81	3.98
XFMSMLR	2	25.87	30.49	28.18	28.18	2.31	3.27
STATURE	2	149.97	155.98	152.975	152.98	3.00	4.25

sions, and in the absence of other associated material, is probably an older teenager or a gracile female. The larger individual, with dimensions of 24.27 mm (HMAPL) and 18.75 mm (HMLLL) is from Burial 57, helping to argue that Burial 57 is a male. While of limited comparative and interpretive value, it could be taken that the Buckeye Knoll series is very similar to the comparative samples coming from a wide range of geographic areas over the last 7,000 years.

A bivariate plot of left humerus anterior-posterior vs. mediolateral dimensions (Figure 12-3) shows where the Buckeye Knoll individuals with both dimensions fall in the overall distribution. The Buckeye Knoll individuals, compared to the other groups in the aggregate, fall more or less into the lower left quadrant, suggesting they are, as a group more gracile than many of the individuals in the comparative set. This can also be seen, more strongly, in the mediolateral dimension distribution, where virtually all the comparative samples have multiple individuals with much larger dimensions than observed at Buckeye Knoll, again supporting the site's overall gracile nature.

Femur Midshaft Dimensions

Femur dimensions are more commonly presented in the comparative literature than almost any other postcranial measurement set, and there are too many sites to plot using the format that was used for the more limited humerus midshaft data. As a result, femur midshaft dimensions (left) are presented in Figure 12-4 (mediolateral) and Figure 12-5 (anterior-posterior) by date B.P. and show the relative position of the Buckeye Knoll materials in this slightly modified format. As can be seen, the Buckeye Knoll sample falls into the center of the distribution for both dimensions. Also noticeable is an absence of extreme values, either large or small, in the Buckeye Knoll collection. For the comparative sites, there are greater numbers of individuals who are substantially larger than the Buckeye Knoll range and a smaller subset with dimensions substantially smaller than the Buckeye Knoll series. To some extent this is what is expected when sample sizes increase dramatically—i.e., the range of values expands while central tendencies may not change much at all. While it makes statistical sense, it could also be, at a simplistic level and as was observed in the humerus dimensions, that the femur midshaft dimensions are shifted toward the lower ranges, suggesting a more gracile population profile. From a chronological standpoint, this suggests femur robusticity increased through time. There are several individuals from the Late Archaic component at Buckeye Knoll who are from the lower half of the Buckeye Knoll range, but are not distinctly different from the earlier materials.

The bivariate plot of femur midshaft dimensions (Figure 12-6) shows this phenomenon to some extent. In this figure there is no control for chronology but (a) virtually all the comparative individuals (except those from Windover—7000 B.P. series) are substantially younger, (b) there are more individuals at the larger ranges for both dimensions, (c) the Buck-

Table 12-5. Postcranial Statistics for the Comparative Series.

Texas Males								
	FMSAPL	FMSAPR	FMSMLL	FMSMLR	HMAPL	HMMLL	HMAPR*	HMMLR*
N of Cases	7	3	7	3	39	41	—	—
Minimum	30	20	24	26	18	15	—	—
Maximum	35	34	28	27	24	24	—	—
Median	33	32	26	27	21	21	—	—
Mean	32.71	28.67	26.43	26.67	21.36	21.11	—	—
Std. Error	0.68	4.37	0.53	0.33				
Standard Dev.	1.8	7.57	1.4	0.58	1.44	2.09		
c.v.					0.07	0.1		
* No Rights Presented.								

Texas Females								
	FMSAPL	FMSAPR	FMSMLL	FMSMLR	HMAPL	HMMLL	HMAPR	HMMLR
N of Cases	8	8	8	8	20	22	2	2
Minimum	23	23	22	20	16	13	16	20
Maximum	27	27	25	25	22	21	18	20
Median	25.5	25.5	23.5	22.5	19	18.5	17	20
Mean	25.25	25.37	23.5	22.75	19.25	18.29	17	20
Std. Error	0.45	0.5	0.42	0.59				
Standard Dev.	1.28	1.41	1.2	1.67	1.41	1.79		
c.v.					0.07	0.1		

Femur (L) Midshaft Anterior-Posterior Diameter							
SITE	N	MIN.	MAX.	MEDIAN	MEAN	S.D.	C.V.
Sanders Site	16	23	35	28.5	29.06	4.2	0.14
Buckeye Knoll	13	21.12	32.99	26.24	26.47	3.56	0.13
Little Salt	6	15.61	33.18	26.52	25.58	6.52	0.25
3AM	3	23	29	28	26.67	3.21	0.12
301	39	20	33	28	27.79	2.88	0.10
303	67	23	34	27	27.66	2.88	0.10
SUN	53	23	38	29	29.26	3.35	0.11
Dolores	20	20	39	27.5	27.6	4.64	0.17
MON	60	22	33	27	27.15	2.78	0.10
KIT	12	22	32	27.5	27.08	3.15	0.12

continued.

Table 12-5. (continued.)

Femur (L) Midshaft Anterior-Posterior Diameter (continued)							
SITE	N	MIN.	MAX.	MEDIAN	MEAN	S.D.	C.V.
PEA	39	24	32	28	28.31	2.24	0.08
BUF	57	22	38	28	28.07	3.16	0.11
WO7	57	20	35	28	28.14	3.29	0.12
KX1	6	24	32	26.5	27.33	3.08	0.11
WW7	20	21	34	28.5	28.3	3.11	0.11
CHY	3	27	32	30	29.67	2.52	0.08
CRW	19	23	35	30	30.47	3.2	0.11
Windover	8	19.77	32.39	26.945	26.59	5.11	0.19
DW2	14	24	33	26	26.64	2.53	0.09
dk2	9	23	32	27	27.56	3.32	0.12
BU2	1	26	26	26	26	.	1.00
Texas Males (L)	**7**	**30**	**35**	**33**	**32.71**	**1.8**	**0.94**
Texas Males (R)	**3**	**20**	**34**	**32**	**28.67**	**7.57**	**0.94**
Texas Females (L)	**8**	**23**	**27**	**25.5**	**25.25**	**1.28**	**0.94**
Texas Females (R)	**8**	**23**	**27**	**25.5**	**25.37**	**1.41**	**0.94**

Femur (L) Midshaft Medio-Lateral Diameter						
N	MIN.	MAX.	MEDIAN	MEAN	S.D.	C.V.
16	22	28	25	24.94	1.91	0.08
13	20.76	27.34	24.66	24.5	1.97	0.08
6	14.49	29.46	25.74	24.54	5.17	0.21
3	25	28	26	26.33	1.53	0.06
39	17	32	24	24.36	3.17	0.13
67	22	31	26	26.22	1.87	0.07
53	20	29	26	25.51	2.14	0.08
20	19	35	25	26.25	4.24	0.16
60	19	28	24	24.32	1.97	0.08
12	23	28	26	25.33	1.44	0.06
39	22	29	26	25.31	1.54	0.06
57	20	29	25	24.93	1.95	0.08
57	18	30	25	25.26	2.11	0.08
6	22	27	24.5	24.5	1.87	0.08

continued.

Table 12-5. (concluded.)

Femur (L) Midshaft Medio-Lateral Diameter (continued)						
N	MIN.	MAX.	MEDIAN	MEAN	S.D.	C.V.
20	22	28	26	25.55	1.85	0.07
3	24	29	27	26.67	2.52	0.09
19	22	31	27	27.11	2.35	0.09
8	22.22	29.38	23.87	24.91	2.47	0.10
14	20	28	25	24.79	2.33	0.09
9	20	29	25	24.33	2.74	0.11
1	22	22	22	22	.	.
7	24	28	26	26.43	1.4	0.05
3	26	27	27	26.67	0.58	0.02
8	22	25	23.5	23.5	1.2	0.05
8	20	25	22.5	22.75	1.67	0.07

eye Knoll dimensions fall very close to the overall middle of the range, and (d) several Buckeye Knoll individuals are relatively small. Only one of these individuals, Burial 58, is a subadult. Burials 3 and 30 are both identified as 55+ individuals based on attrition. Both of these latter individuals were identified as probable females.

Femur Head Dimensions

There are only two maximum dimensions of the left femur head but there are five for the right, so in this case the Buckeye Knoll right dimensions will be compared to the other samples' left dimensions (not the rights, as typically reported in the comparative literature). Samples are relatively restricted and are only presented with respect to date B.P. (Figure 12-7). It is interesting that all but one of the Buckeye Knoll individuals fall into the upper range of this dimension. Either this is an unusually sex-biased sample of femur fragments or the population is, compared to the other limited series, relatively robust. This is at variance with what was seen in the humeral dimensions which suggested the Buckeye Knoll individuals were relatively gracile. Burial 42 is a 46-year-old female which explains the relatively diminutive metric.

The only other femur dimensions obtained from the Buckeye Knoll series in any numbers are the subtrochanteric mediolateral and anterior-posterior dimensions. Again, there are more measures for the right and these are compared to the limited series from Little Salt Spring and Windover (the only samples for which we readily have comparative data) (Figure 12-8). In the absence of a more geographically diverse series, the Buckeye Knoll materials appear to span the entire range of dimensions expressed at the two other sites, which are roughly contemporaneous (i.e., Middle Archaic–Little Salt Spring, or Early Archaic–Windover). The mediolateral dimension shows essentially the same type of distribution with the bulk of the specimens in the center of the range (Figure 12-9). There are several individuals (Burial 64 and #651, an unassociated femur fragment) which are unusually small. Burial 64 is identified as either a female or a subadult and could not be positively associated with the small series of material from the burial. Both of these are so small it is probably reasonable to posit they are both subadults and have not reached full maturity. Plotting the mediolateral dimension against the anterior-posterior dimension highlights the diminutive nature of these two individuals and shows that the Buckeye Knoll individuals are not clustered together but are widely distributed and scattered around the edges of the main cluster of dimensions (Figure 12-10).

Tibia Shaft Dimensions at the Nutrient Foramen

The only other dimensions for the lower extremities that were collected in any appreciable numbers were the tibia shaft dimensions at the nutrient foramen

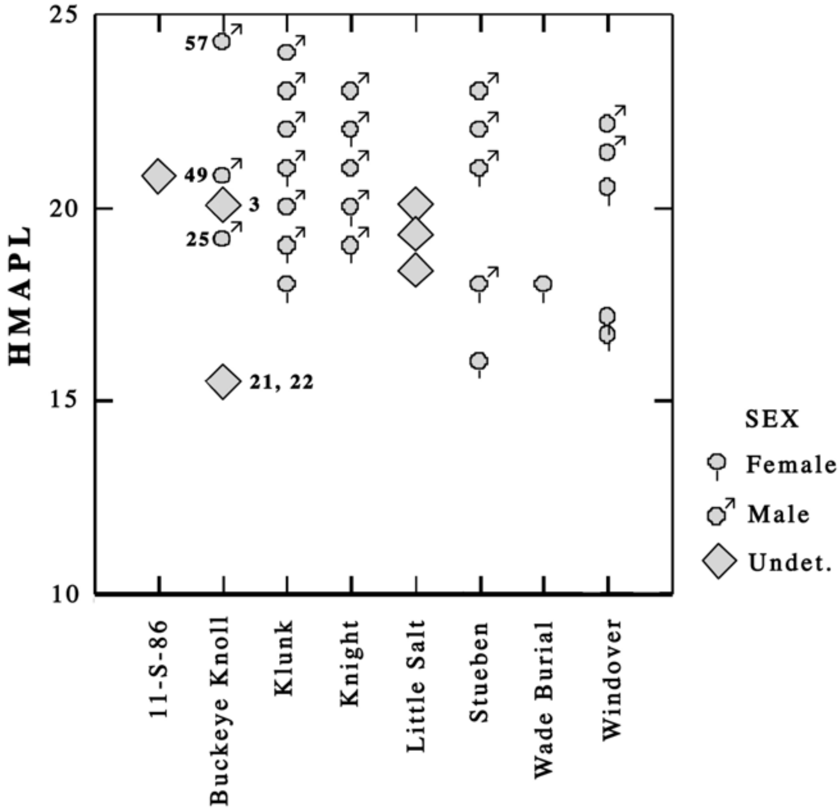


Figure 12-1. Humerus midshaft anterior-posterior dimensions (left).

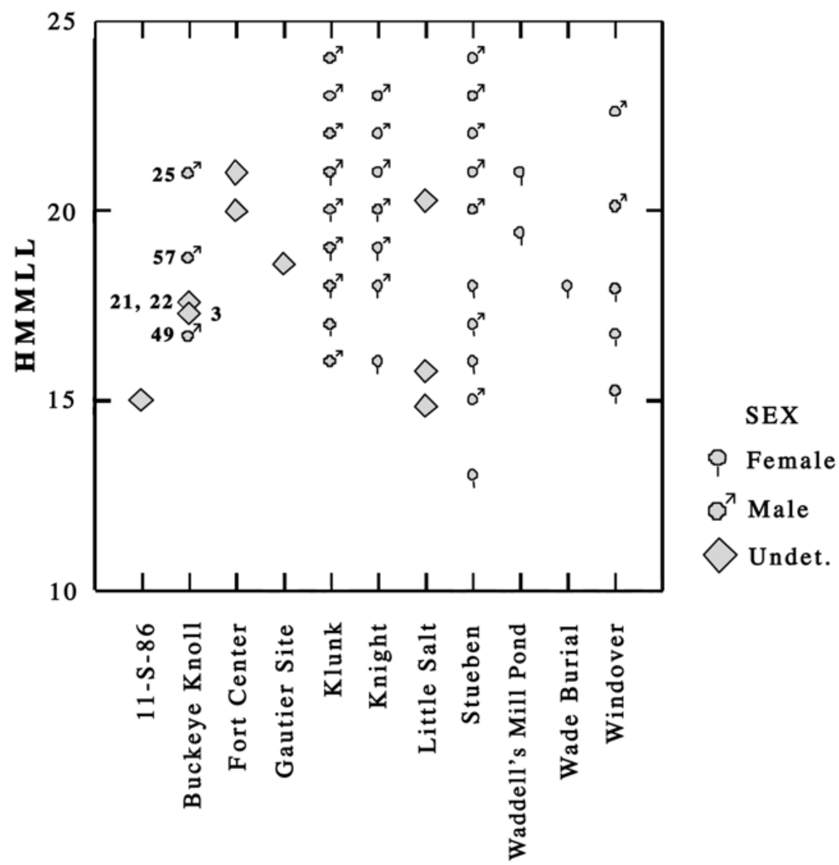


Figure 12-2. Humerus midshaft mediolateral dimensions (left).

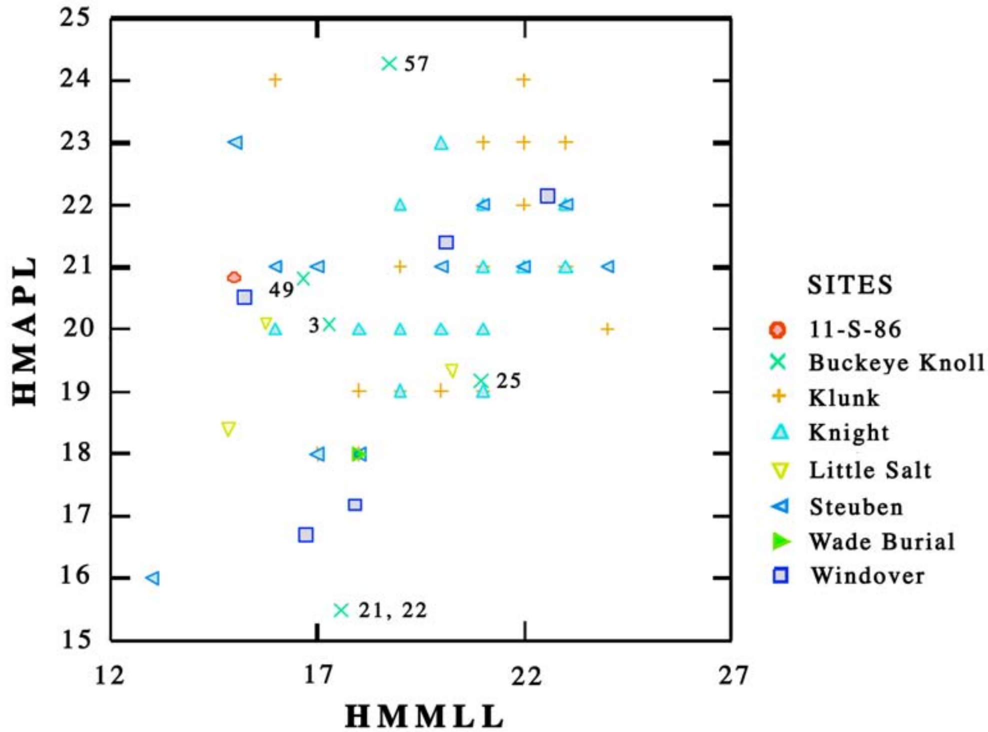


Figure 12-3. Bivariate plot of mediolateral and anterior-posterior humerus dimensions (left).

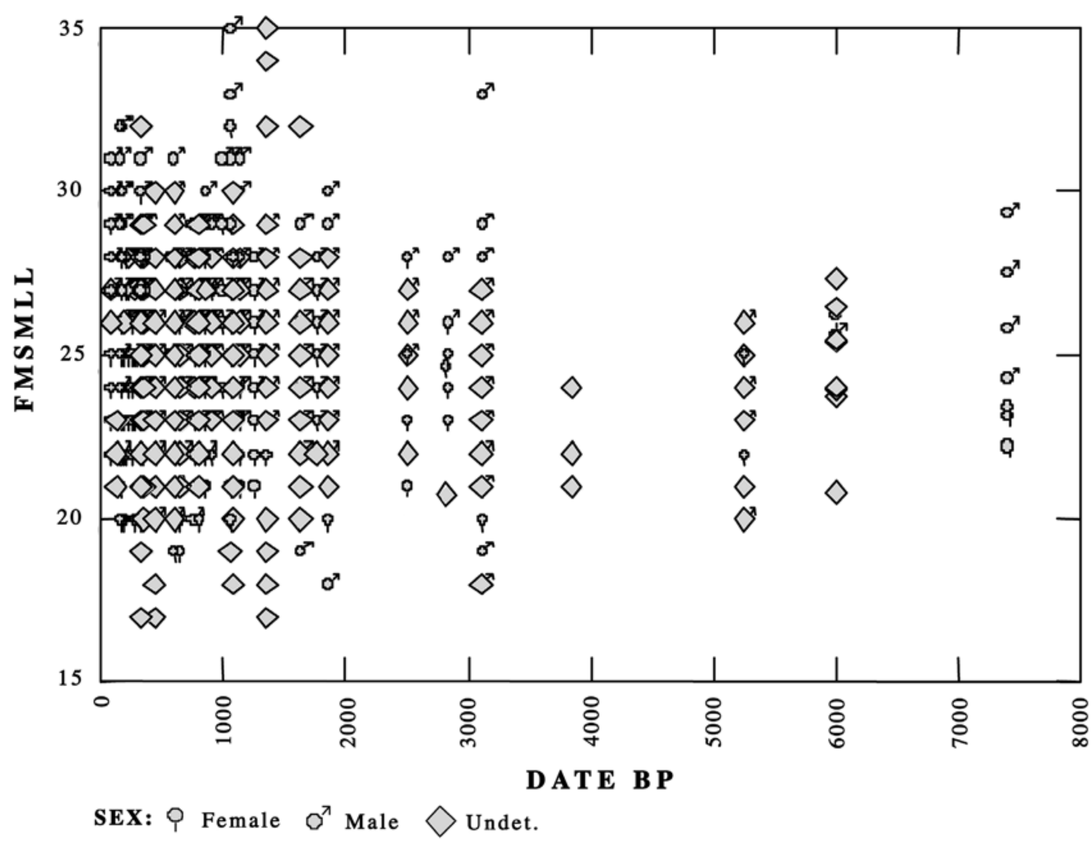


Figure 12-4. Femur midshaft mediolateral dimensions (left) by date B.P.

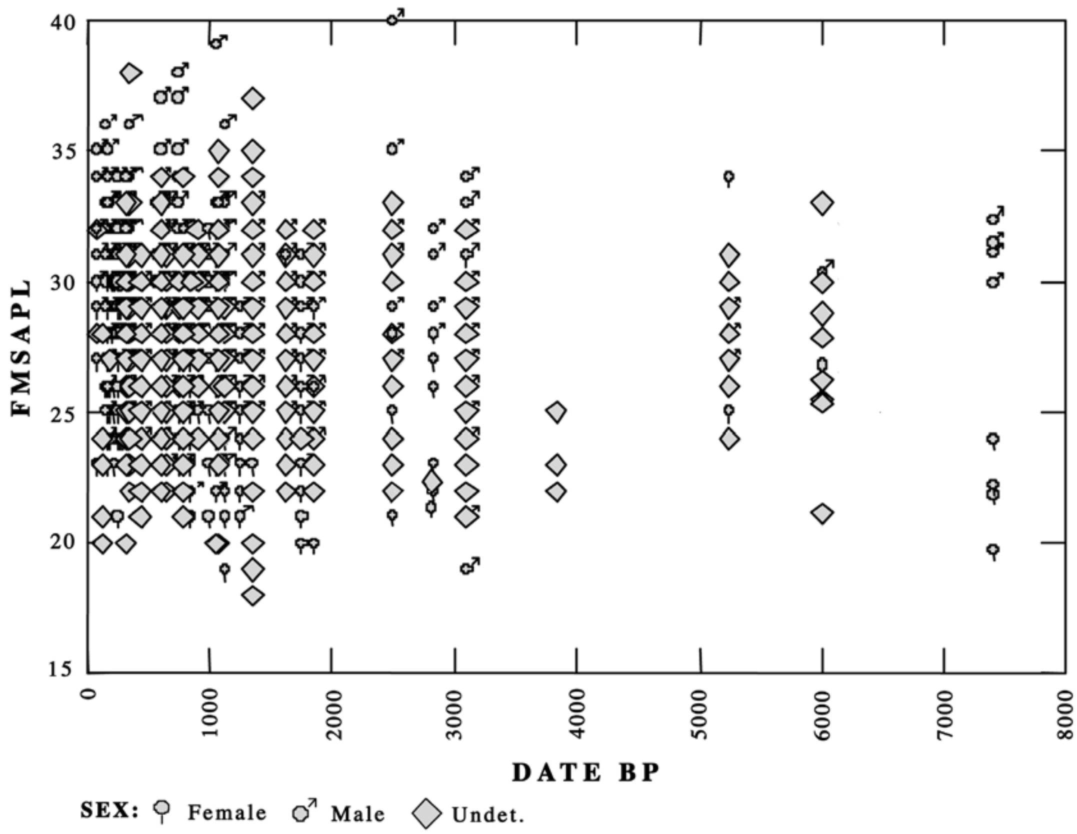


Figure 12-5. Femur midshaft anterior-posterior dimensions (left) by date B.P.

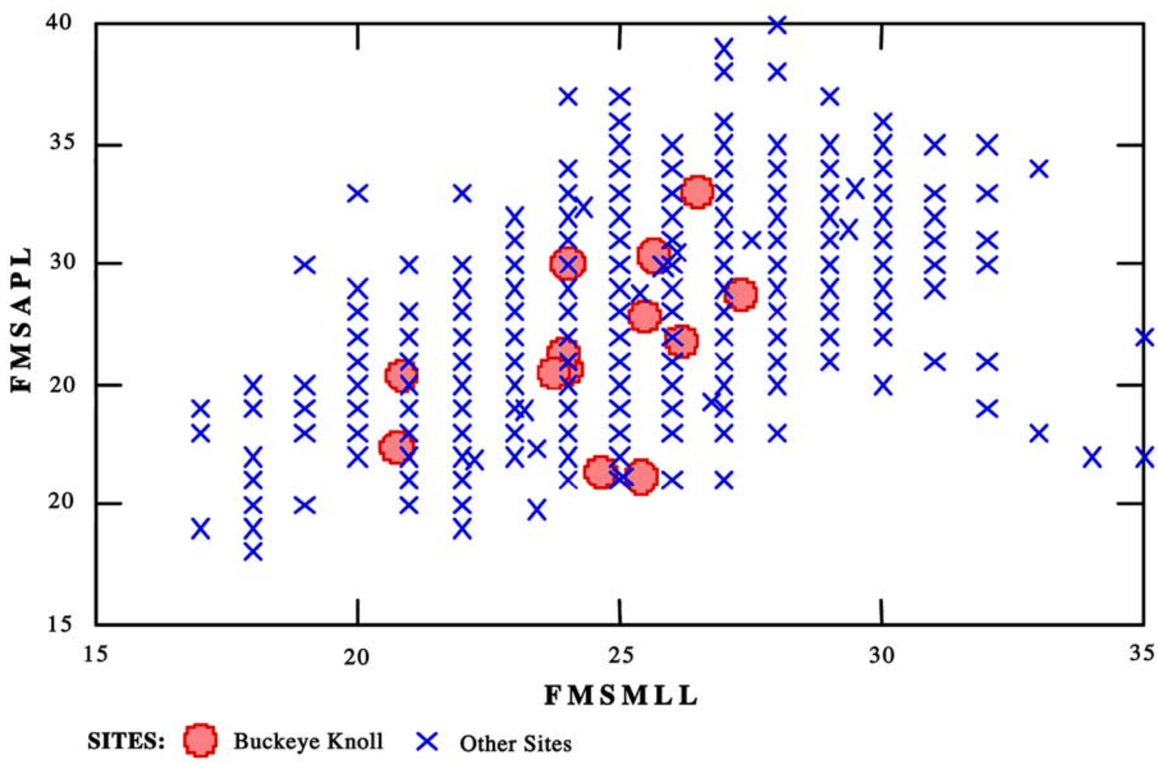


Figure 12-6. Bivariate plot of femur (left) midshaft mediolateral and anterior-posterior dimensions.

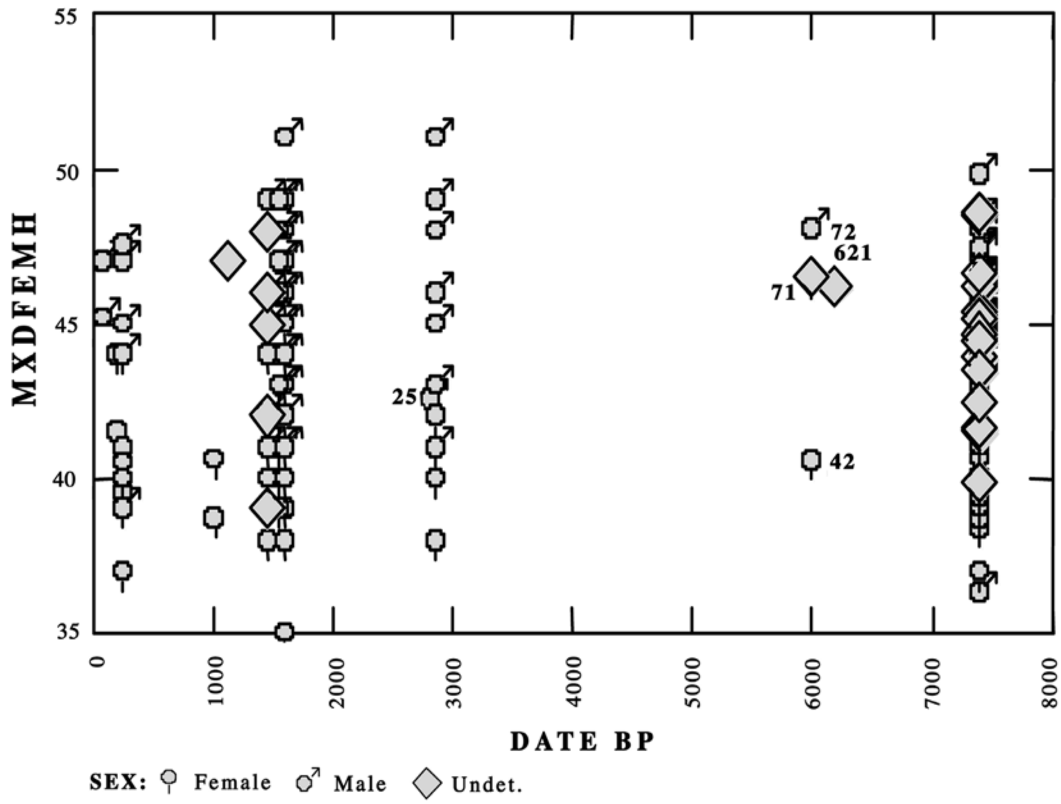


Figure 12-7. Maximum dimensions of the femur head by date B.P. (Buckeye Knoll rights are used because of the larger sample size; for all other sites the left side is used.)

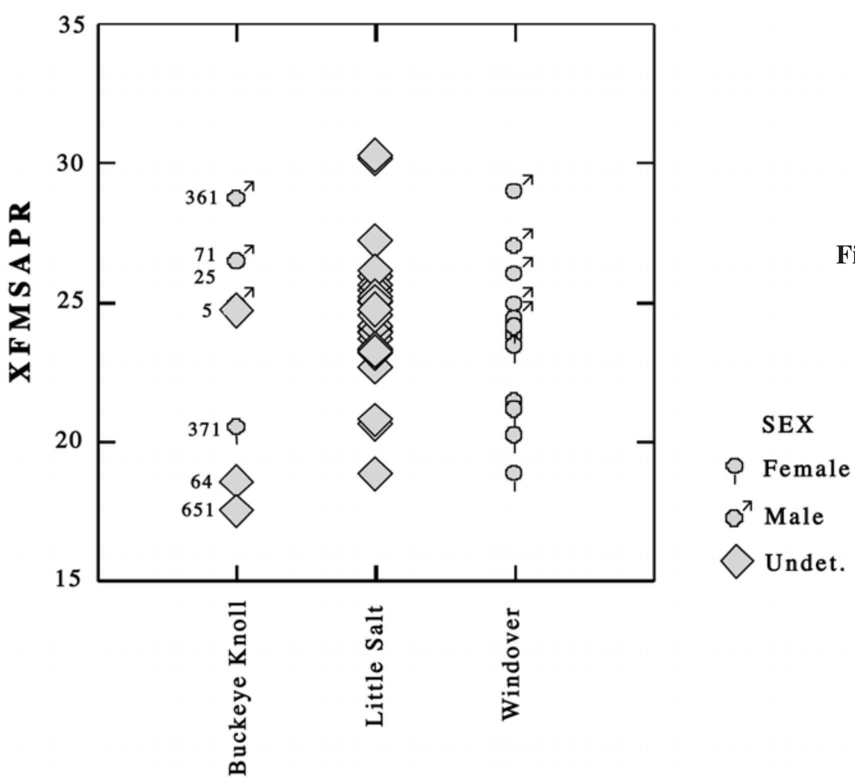
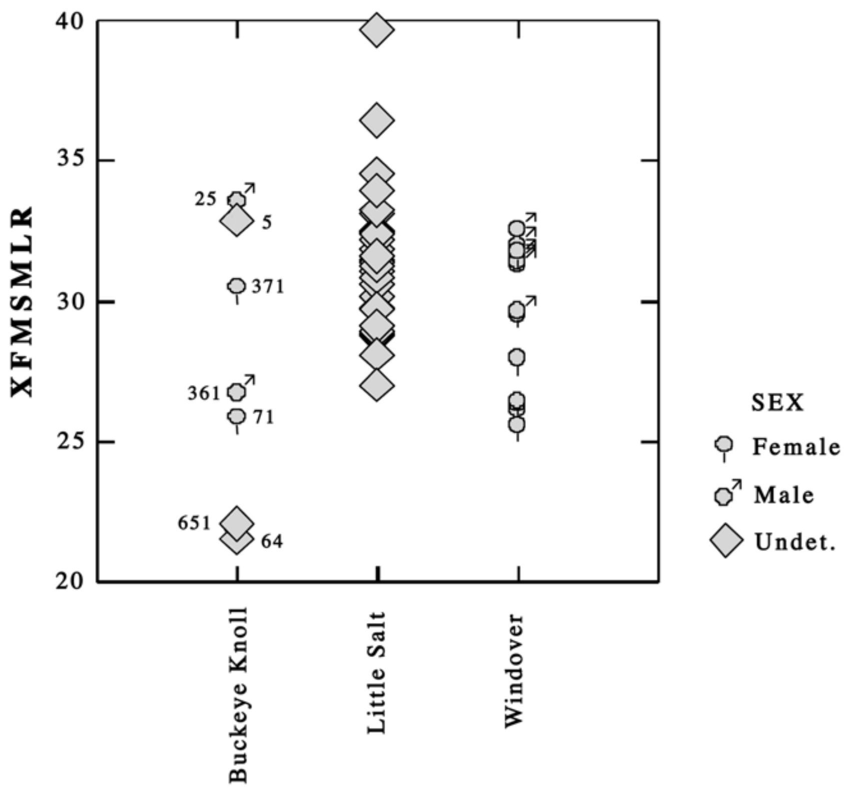


Figure 12-8. Femur (right) subtrochanteric anterior-posterior dimensions.

Figure 12-9. Femur subtrochanteric mediolaterial dimension (Buckeye Knoll's dimensions are rights; the rest are lefts).



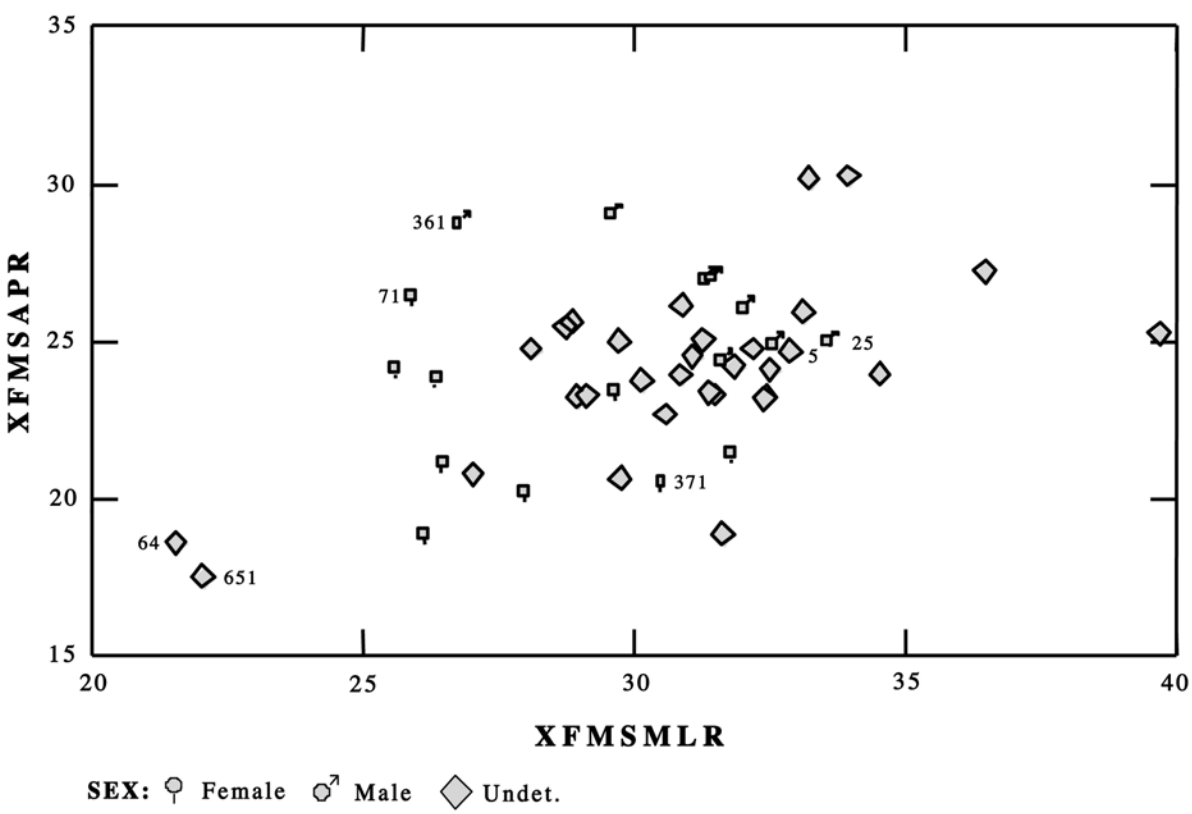


Figure 12-10. Femur subtrochanteric mediolaterial and anterior-posterior dimensions (Buckeye Knoll's dimensions are rights; the rest are lefts).

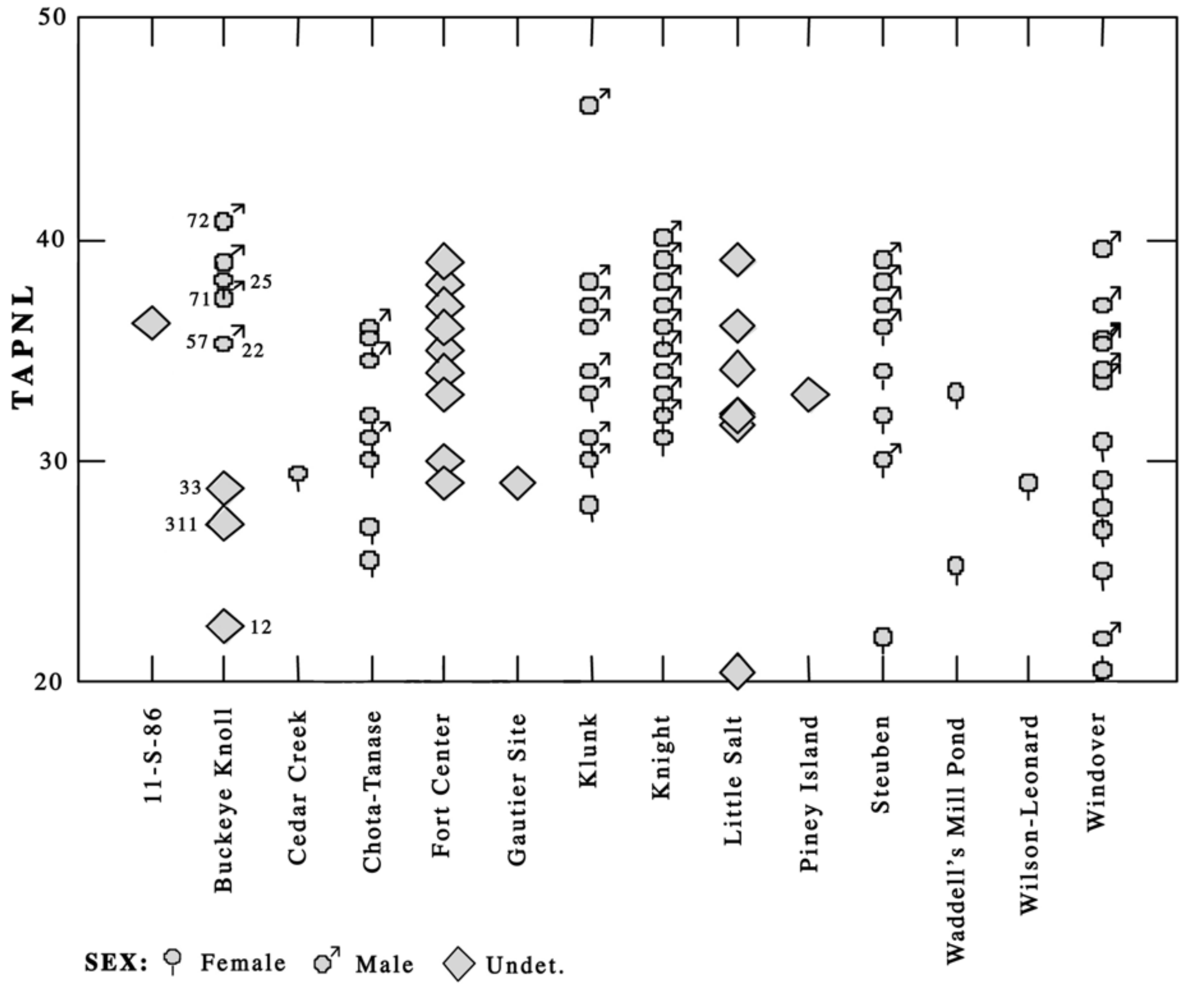


Figure 12-11. Tibia (left) anterior posterior dimension at nutrient foramen.

(Figures 12-11 and 12-12). The left anterior-posterior dimensions for the Buckeye Knoll series encompass virtually the entire metric distribution of this dimension. Burial 72 is one of the largest in the series from 14 sites and there is a clear separation in the distribution from a cluster of large individuals, identified as males, along with a series of smaller individuals with no sex attribution. Based solely on this tibia dimension, it would be tempting to suggest the individuals in Burial 12 and 33, plus the unassociated material identified as #311, are females. Burial 12, however, is the smallest individual in the series and is, in fact, identified as a probable male approximately 20 years of age. This illustrates the hazard of relying on single dimensions for sex assessment. Similarly Burial 33 is, based on the dental material, a 6.5-year-old subadult.

The mediolateral dimensions of the tibia exhibit less robusticity than the anterior-posterior dimensions. There is one extremely large mediolateral dimension, identified as #311, which is very unusual in that it had one of the smallest anterior-posterior dimensions. This is clearly unusual in the extreme differences displayed in these two dimensions (see previous discussion of the anterior-posterior dimension for an additional explanation). Excluding this single, rather aberrant dimension, many of the other and more recent sites have larger maximum dimensions than observed in the Buckeye Knoll series, though the majority of the Buckeye Knoll dimensions are unremarkable and would fit into virtually any of the other series.

In looking at the cross-sectional geometry of the tibia, the bivariate plot illustrates that many of the Buckeye Knoll individuals have proportionately larger anterior-posterior dimensions (Figure 12-13), thus shifting their overall distribution in comparison to the majority of the rest of the individuals. Some of these kinds of differences reflect differences in loading factors and stress on longbones, and some studies have shown such changes

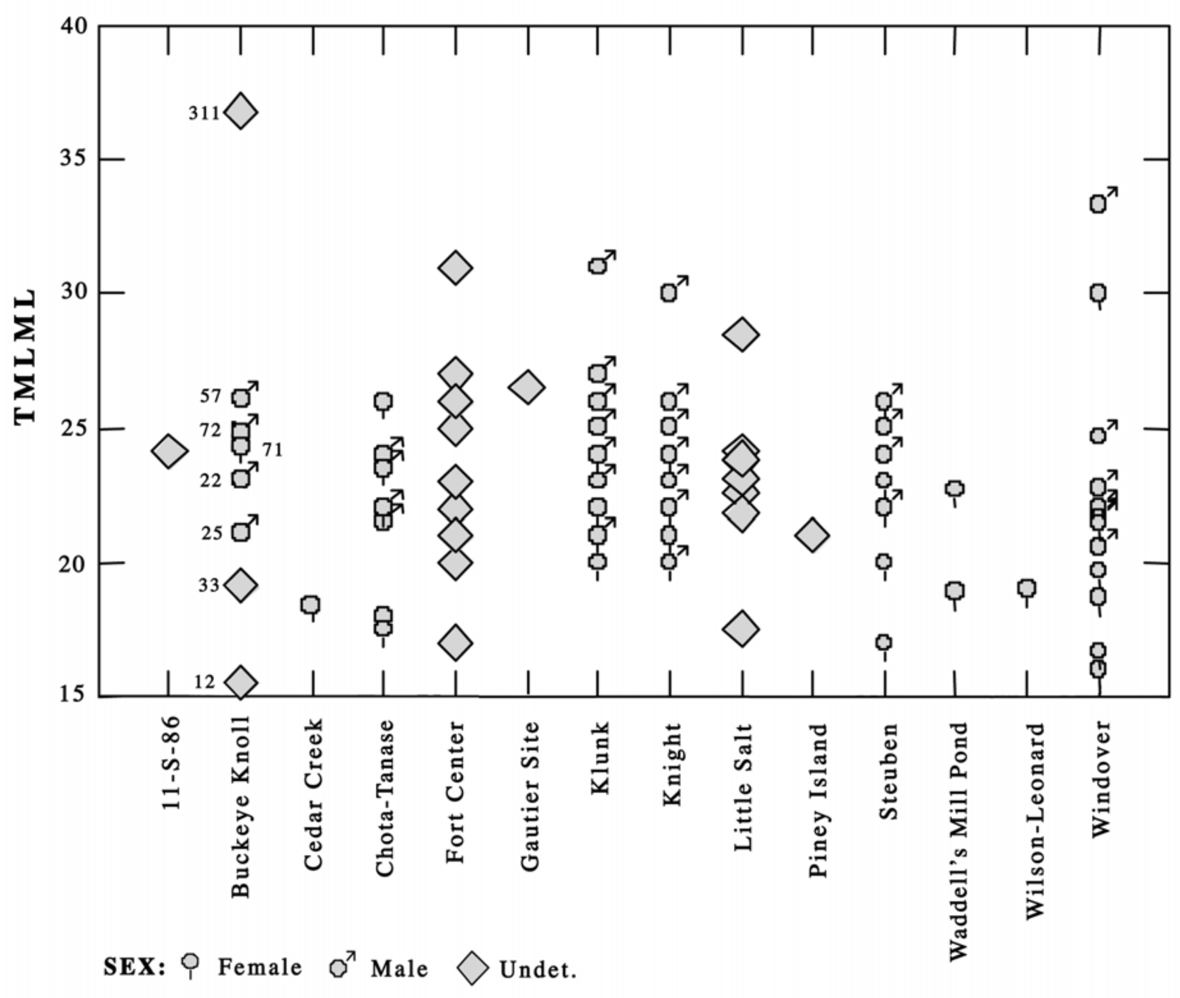


Figure 12-12. Tibia (left) mediolateral dimension at nutrient foramen.

can be identified in the shift to agriculture. These kinds of differences are more commonly identified in the femur (Ruff et al. 1984) and further investigation of the tibia using Buckeye Knoll, Windover, and other early samples, in contrast to later samples, may be called for by the relatively distinct distribution seen here. While not presented here, it appears the Windover sample follows a very similar distributional pattern, with proportionally larger anterior-posterior dimensions at the expense of the mediolateral, resulting in a more asymmetric cross-section. Often, cross-sectional geometry is examined in reference to total element length; this clearly will be impossible since there are no intact tibia in the Buckeye Knoll series.

Other dimensions were collected (see Table 12-1) in the Buckeye Knoll analysis, but the comparative samples are small and more restricted than in the case of the preceding dimensions. The only other metric to be examined in any detail is the estimation of stature. That discussion will follow a more detailed review of the methods used to estimate stature.

Estimates of Stature

There are several possible ways to estimate stature. Unfortunately, the materials from Buckeye Knoll were so poorly preserved that the stature of only four individuals could be estimated using the most common longbone-estimation formula (Table 12-6). Longbone formulae incorporated here were taken from Trotter (1970). Musgrave and Harneja (1978) provided estimates of stature of a British (Caucasian) sample based on metacarpal dimensions (generally interarticular midpoint at the base to the center of the distal articular surface, as opposed to maximum lengths). Stature estimates are provided for both right and left hands and for males and females. While the reference population is clearly not the best, these formulae do, in fact, provide estimates of stature for individuals at Buck-

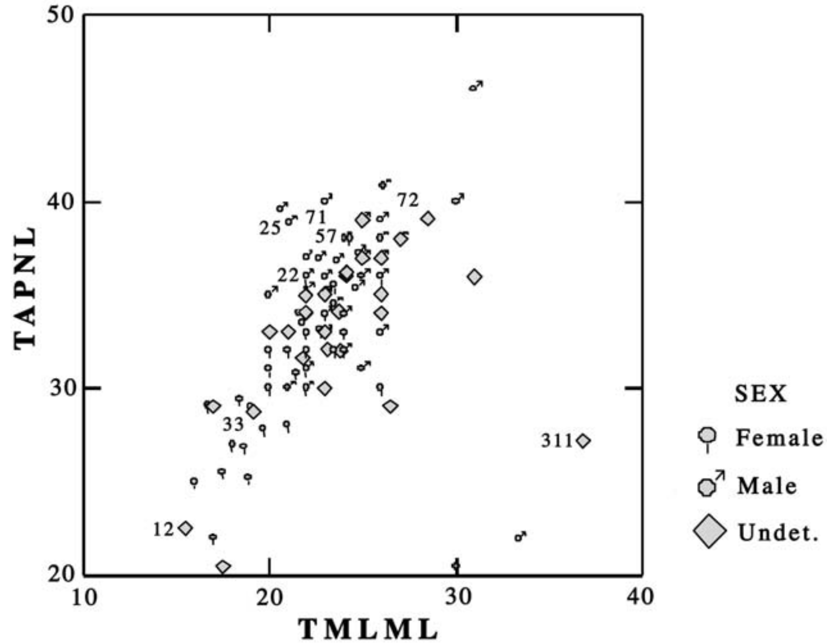


Figure 12-13. Bivariate plot of tibia (left) mediolateral and anterior-posterior dimensions at the nutrient foramen.

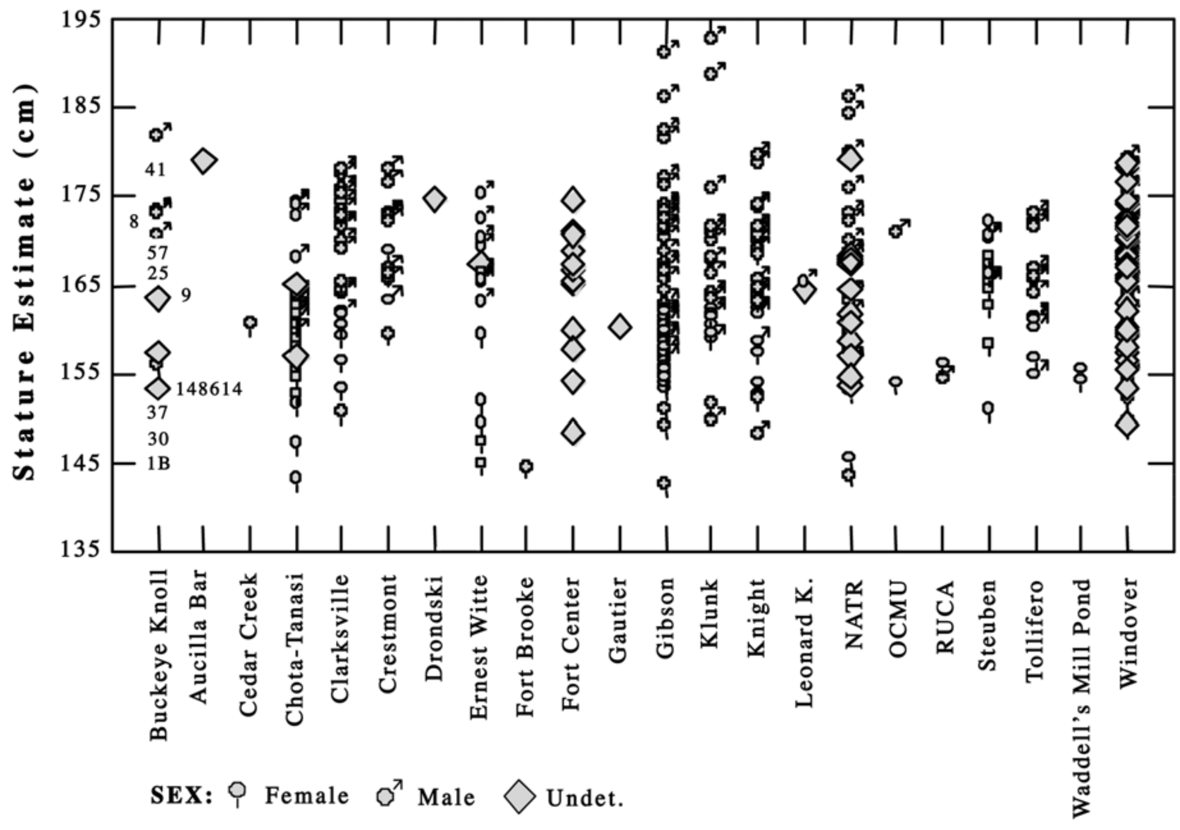


Figure 12-14. Estimates of stature based on femur, tibia, and metacarpal dimensions for Buckeye Knoll. (Stature estimates for other sites preferentially based on femur length.)

Table 12-6. Estimates of Stature (in cm) at Buckeye Knoll Based on Longbone Dimensions.

Burial No.	Sex	Element	Dimension	Formulae	Estimate
8	Male	Femur	464 (r) 468 (l)	2.15 (fem) + 72.57 ± 3.8	173.19
		Tibia[1]	350 (r)	2.39 (tib) + 81.46 ± 3.27	165.11
37	Female	Radius[2]	209	3.54 (rad) + 82.0 ± 4.6	155.98
25	Male	Ulna	268 (l)	349 (uln) + 77.45 + 4.66	170.76
1B	Female	Femur[2]	360 (l)	2.15 (fem) + 72.57 ± 3.8	149.97

[1] Tibia Maximum length is 382 mm; less the superior tubercle and lateral malleolus tibia dimension is 30 mm, for a tibia length of 350 mm for stature estimation purposes.

[2] Trotter (1970) did not provide a female Mongoloid formulae and we have used the male formulae here, though it is undoubtedly an over estimate of stature.

eye Knoll for which there are no other ways of doing so. Generally, the metacarpal estimates coincide fairly closely to those of other elements (Doran 1998), particularly longbone estimates, and in the absence of any other estimators they are presented in the following table, as well. Figure 12-14 combines stature estimates for a wide range of samples using diverse estimators. Most estimates are based on femur length, while the Buckeye Knoll data, because of preservation limitations, are based on tibia, femur, ulna, and metacarpal estimates. In the case of ambiguously sexed individuals, estimates for both males and females are provided (Table 12-7), and the mean value is used in Figure 12-14.

The two oldest samples (Buckeye Knoll and Windover) are arrayed at opposite ends of Figure 12-14, while all other samples are arranged alphabetically and are much more recent than either of these two sites. In a closer examination (not presented here), there is little clarity in chronological patterns, though there is a hint of spatial patterning suggesting the sites from Illinois tend to have more individuals with larger statures. This increases mean stature values in the later sites so that sites dating from 5000 to 3000 B.P. appear to have lower mean and median values, as do sites that date to the last identified chronological period (i.e., <500 B.P.). A more careful consideration of both time and space, coupled with subsistence, population density, and sex, would be more useful than this meager effort. If, as many argue (see Steckel and Rose 2002, for example), stature is an index of overall population health, then chronologically these differences should show up in a continental perspective which warrants greater detail than presented here. It is possible that mean and median values may be only partially informative. Closer scrutiny of the differences between male and female maximum and minimum values may be equally informative.

Pathology

In the course of matrix removal, cleaning, and analysis, all bone fragments were examined for evidence of pathologies. The following burials and attendant skeletal materials are the only ones that exhibited any evidence of pathological changes, though the taphonomic condition of the material complicates observation of some of the more subtle pathologies. Unless indicated otherwise, the burials in question are assigned to the Early Archaic.

Burial 11 exhibits slight marginal erosion of the mandibular fossa indicative of temporomandibular joint disorder (TMJ). Burial 21 contains a single cranial fragment that exhibits moderate hyperporosity on the external surface, but there is no associated expansion of the diploe. Burial 23 (Late Archaic) produced

Table 12-7. Estimates of Stature (in cm) at Buckeye Knoll Based on Metacarpal Dimensions.

Burial No.	Sex	Element	Dimension	Formulae	Estimate
9	Unid.[1]	MC1 (r)	42.87	male: 17.5 (mc1) + 92.04 ± 5.8	167.06
				female: 11.6 (mc1) + 110.29 ± 5.54	160.01
25	Male	MC1 (l)	42.83	16.9 (mc1) + 94.76 ± 5.49	167.14
		MC3 (l)	63.03	11.2 (mc3) + 98.21 ± 5.82	168.80
		MC4 (l)	56.93	12.9 (mc4) + 96.86 ± 5.79	170.3
		MC5 (l)	50.58	11.7 (mc5) + 109.35 ± 6.2	168.53
30	Female	MC2 (r)	58.32	13.5 (mc2) + 74.61 ± 4.7	153.34
37	Female	MC1 (l)	40.72	22.5 (mc1) + 65.62 ± 7.21	157.24
		MC2 (r)	61.26	13.5 (mc2) + 74.61 ± 4.7	157.31
41	Unid.[1]	MC5 (l)	60.56	male: 11.7 (mc5) + 109.35 ± 6.3	180.21
				female: 22.7 (mc5) + 45.97 ± 8.14	183.44
57	Male	MC4 (r)	64.92	13.5 (mc4) + 85.94 ± 4.98	173.58
148614	Unid.[1]	MC1 (r)	38.67	male: 16.9 (mc1) + 94.76 ± 5.49	159.7
				female: 11.6 (mc1) + 110.29 ± 5.54	155.14

Stature (cm)	N	Min.	Max.	Mean	Median
Comparative Male Stature Parameters	165	148.1	192.7	169.2	170.2
Comparative Female Stature Parameters	135	142.5	172.9	158.4	159.0
Buckeye Knoll Adult Stature	9	149.9	181.8	164.3	163.5
Buckeye Knoll Male Stature	3	170.7	173.5	172.5	173.1
Buckeye Knoll Female Stature	2	149.9	155.9	152.9	152.9

[1] Sex is indeterminate, and estimates for both males and females are presented; mean for Burial 9 is 163.54 cm, mean for Burial 41 is 181.82 cm, and mean for 148614 is 157.4 cm. Means are used in Figure 12-14.

a sacral fragment that exhibits moderate spina bifida. The element was broken postmortem with only the distal fragment represented. This renders the severity and extent of the anomaly (a midline developmental failure; Dickel and Doran 198**9**) difficult to assess. Burial 36 exhibits a distal toe phalange with extreme lipping and erosion of the proximal articular surface. There also is slight osteoarthritic growth at the distal tip. The deformity is either from injury or pathology, possibly soft-tissue inflammation secondary to tumorous growth. This exerted pressure on the distal joint of the proximal phalange which, in turn, may have caused hard tissue expansion of the distal phalange.

Burial 49 exhibits a healed fracture of the left radius with large callus formation located approximately 90 mm from the proximal end. There is no infection associated with the injury and the element is well aligned with no remodeling of the site.

Burial 37 (Late Archaic, possibly Late Prehistoric) shows a number of injuries/pathologies that are quite striking. Both humeri were fractured and well healed and both tibia showed significant remodeling. This suggests the presence of bilateral subperiosteal hematoma which, no doubt, was quite traumatic, especially if these injuries were all sustained at the same time. Clearly, this would have been both painful and temporarily debilitating and indicate a degree of care sufficient to support the individual during her incapacitation.

While orbits are infrequently preserved, none exhibit evidence of cribra orbitalia, nor do surface fragments of the cranial vault exhibit obvious hyperostosis. Such pathologies would indicate responses to generalized metabolic stress.

In addition to the formal burials, there are a few specimens from non-burial contexts that show pathological problems. In the small inventory of bone fragments from Unit S14W84, Level 14, there are large foot elements and element fragments. One of these is a terminal phalange of the first digit (MT1) that shows arthritic changes to the distal edge. Several of the other fragmented elements show lipping and erosive changes that are indicative of a generalized osteoarthritic condition often associated with advancing age, though such changes can also be brought about by injury.

At first glance it might appear that the population was relatively free of significant pathology. It should be remembered, however, that the condition of the surface of the bone and completeness of the skeletal inventory must be taken into consideration, so it is hard to assess the true level of pathology. Nevertheless, of the pathologies observed, most are relatively minor and, while some may have been problematic to the individual, it is tentatively suggested the population was not carrying a heavy disease load that would be expressed in the skeletal material. This conclusion is essentially born out by the Rothschilds' study of periosteal reaction in the Buckeye Knoll materials and the relatively low LEH rates (see below).

The study by the Rothschilds provides a more detailed discussion of periosteal reactions. Those authors have been engaged for several decades in the direct examination of longbones from many of the most important sites in North America. The value of such a survey comes from the consistency of observation and the use of consistent standards and thresholds of conditions that provide a more reliable overview of specific conditions. In this case, the focus is on periosteal reaction in the Buckeye Knoll materials from a continental perspective.

Miscellaneous Postcranial Material and Observations

There are three isolated lunates from non-burial contexts (128815, 168611, and 168612). (As noted, these numbers represent a shorthand used during the analysis: 128815 is N12W88, Level 15; 168611 is N16W86, Level 11; and so on.) The first two are both below the median values for all comparative samples for length and height. The third specimen is above the median for length, but just below the median for the right dimensions. However, it is the fourth smallest of the entire series for right height.

One humerus fragment (1486xx [no level number recorded]) provided mid-shaft dimensions (estimated) at 15.48 mm (left ap) and 17.58 mm (left mediolateral). The ap dimension is the smallest of those from Buckeye Knoll and the mediolateral is the fourth largest. These inconsistent dimensions provide little assistance in sex assessment and their isolation precludes any confidence in sex assessment.

The largest reported patella height (superior-inferior dimension) is recorded for an isolated patella (128417) that also has the largest breadth (left—42.57; 44.58). The 44.58-mm dimension from this patella is the 13th largest in the North American series of 52 patella measures. In this series of 52 individuals, all but two are males when the patella height is greater than 40 mm, and all but two are females when the height is less than 40 mm. This provides a consistent and accurate dividing line that is relatively simple to utilize.

Two other isolated patellae (out of eight left and nine right patellae), exhibit the smallest and next-to-smallest height dimensions reported at Buckeye Knoll (respectively, 31.12 and 35.19 mm). One also has the absolutely smallest breadth dimension (32.97 mm), while the other has the 11th smallest breadth dimension (36.72 mm) out of 16 patellae available for measurement.

Addendum 12-1. Measurement Abbreviations, Measurement Protocols, and Digital Data Structure.

Measurement *	Abbreviation
Maximum femur length	MXLFEML
	MXLFEMR
Bicondylar femur length	BILFEML
	BILFEMR
Maximum dia. Femur head	MXDFEMHL
	MXDFEMHR
Femur midshaft anterior-posterior	FMSAPL
	FMSAPR
Femur midshaft mediolateral	FMSMLL
	FMSMLR
Max. tibia length	LENTIBL
	LENTIBR
Patella height	PATMXHL
	PATMXHR
Patella breadth	PATMXBL
	PATMXBR
Max. humerus length	MAXHUML
	MAXHUMR
Humerus midshaft ap	HMAPL
	HMAPR
Humerus midshaft ml	HMMLL
	HMMLR
Radius max. length	RMLL
Ulna max. length	UMLL
Tibia midshaft ml	TMLML
Tibia ap at nutrient foramen	TAPNL
	TAPNR
Tibia ml at nutrient foramen	TMLNL
	TMLNR
Metacarpal 1 – left*	LMC1
Metacarpal 3 – left*	LMC3
Metacarpal 4 – left*	LMC4
Metacarpal 5 – left*	LMC5
Metacarpal 1 – right*	RMC1
Metacarpal 2 – right*	RMC2
Metacarpal 4 – right*	RMC4

Measurement *	Abbreviation
Femur superior-inferior neck diameter	FSIDNL
	FSIDNR
Metatarsal 1 base ap diameter	MT1APBL
	MT1APBR
Metatarsal 1 base ml diameter	MT1MLBL
	MT1MLBR
Metatarsal 2 base ap diameter	MT2APBL
	MT2APBR
Metatarsal 2 base ml diameter	MT2MLBL
	MT2MLBR
Metatarsal 3 base ap diameter	MT3APBL
	MT3APBR
Metatarsal 3 base ml diameter	MT3MLBL
	MT3MLBR
Metatarsal 4 base ap diameter	MT4APBL
	MT4APBR
Metatarsal 4 base ml diameter	MT4MLBL
	MT4MLBR
Metatarsal 5 base ap diameter	MT5APBL
	MT5APBR
Metatarsal 5 base ml diameter	MT5MLBL
	MT5MLBR
Metacarpal 1 base ap diameter*xx	MC1APBL
	MC1APBR
Metacarpal 1 base ml diameter*xx	MC1MLBL
	MC1MLBR
Metacarpal 2 base ap diameter*xx	MC2APBL
	MC2APBR
Metacarpal 2 base ml diameter*xx	MC2MLBL
	MC2MLBR
Metacarpal 3 base ap diameter*xx	MC3APBL
	MC3APBR
Metacarpal 3 base ml diameter*xx	MC3MLBL
	MC3MLBR
Metacarpal 4 base ap diameter*xx	MC4APBL
	MC4APBR

Note: Unless otherwise specified, postcranial measurements and abbreviations are from the SOD manual (Buikstra and Ubelaker 1994). The L or R following the abbreviation (MXLFEML) indicates it is the left or right side measurement. "ml" = mediolateral, "ap" = anterior-posterior dimension.

* Metacarpal measures from Musgrave and Harneja (1978).
*1 Measurement specific to this report.
xx Hoover (1997).

continued.

Addendum 12-1 (concluded)

Measurement *	Abbreviation
Metacarpal 4 base ml diameter*xx	MC4MLBL
	MC4MLBR
Metacarpal 5 base ap diameter*xx	MC5APBL
	MC5APBR
Metacarpal 5 base ml diameter*xx	MC5MLBL
	MC5MLBR
Lunate length from tip to tip*1	LUNLL
	LUNLR
Lunate dimension at right angles to lunl*1	LUNHL
	LUNHR
Humerus at deltoid tuberosity - ap dimensions*1	HMDAPL
	HMDAPR
Humerus at deltoid tuberosity - ml dimensions*1	HMDMLL
	HMDMLR

Measurement *	Abbreviation
Radius maximum ap dimension through radial tuberosity*1	RMTAPL
	RMTAPR
Radius maximum ml dimension at radial tuberosity *1	RMTMLL
	RMTMLR
Femur subtrochanteric ap	XFMSAPL
	XFMSAPR
Femur subtrochanteric ml	XFMSMLL
	XFMSMLR
Stature Estimate	STATURE
Maximum Cranium Length	Max Cran L
Maximum Cranium Breath	Max Cran B
Frontal Chord	Front. Chord
Parietal Chord	Pariet. Chord
Minimum Frontal Breadth	Min Front. Breadth

Note: Unless otherwise specified, postcranial measurements and abbreviations are from the SOD manual (Buikstra and Ubelaker 1994). The L or R following the abbreviation (MXLFEML) indicates it is the left or right side measurement. "ml" = mediolateral, "ap" = anterior-posterior dimension.

* Metacarpal measures from Musgrave and Harneja (1978).
*1 Measurement specific to this report.
xx Hoover (1997).

Addendum 12-2. Sites Providing Comparative Information (Dental and Postcranial): Primary Comparisons for Texas-Specific Sites.

Primary Postcranial Inventory

Ernest Witte, Texas

The Ernest Witte site (41AU36) is a large Late Archaic cemetery located in Austin County, Texas. Situated between a section of coastal prairie and floodplain approximately 4.2 km west of the Brazos River, the site was the focus of a salvage excavation from 1974-1975. Excavations were completed under the direction of archaeologist Grant Hall (1981). The site produced the poorly preserved, highly fragmented remains of 238 individuals. A bioarchaeological analysis of a portion of these remains was completed by Dockall (1997), the results of which are included in the comparative sample for Buckeye Knoll. Two radiocarbon assays were made on apatite fractions from bone samples, producing corrected dates of 2470+130 and 1590+80 B.P. (Dockall 1997).

Sanders, Texas

The Sanders site (41LR2), located in the northwest corner of Lamar County, Texas, was discovered and excavated in 1931 by A. T. Jackson and B. B. Gardener, two University of Texas archaeologists. The site was the first to yield a major hoard of Mississippian prestige goods west of the Mississippi River. It consisted of a village and two mounds (Jackson et al. 2000). Twenty-one burials were excavated, many of them multiple interments, producing a total of 58 individuals. Burials were generally fully extended with accompanying grave goods of ceramic pottery and personal adornment.

Blue Bayou, Texas

The Blue Bayou site (41VT94) is a Late Archaic to Late Prehistoric cemetery located in Victoria County, Texas. One of the largest mortuary sites in the coastal plain, it was excavated by a group of avocational archaeologists over two field seasons in 1982 and 1983 (Huebner and Comuzzie 1992). Two M.A. theses were prepared to report the results of the excavations. Comuzzie (1987) completed a bioarchaeological analysis of the human remains from the site while Huebner (1988) reported on the archaeological and material remains. Although there is disagreement as to the number of people interred at the site, between 36 and 45 individuals were recovered. Radiocarbon assays from bone and charcoal range from 1152+80 to 1636+ 210B.P.

Crestmont, Texas

The Crestmont site (41WH39) is a Late Archaic cemetery located in the central part of Texas' Gulf coatal plain. Margaret Kluge, a graduate student at the Univeristy of Texas, Austin, supervised excavations, while analysis of the human skeletal remains was reported in Vernon (1989). No skeletal remains were suitable for radiocarbon dating. Relative dating, based on similarities to Burial Group 2 at the Ernest Witte site, places the site between about 500 B.C. and A.D. 400. The fragmented remains of 31 individuals were recovered.

Windover, Florida

The Windover site (8BR246) is one of several Archaic mortuary ponds in Florida. Located near the central-east coast, excavations took place over three field seasons in the mid-1980s, supervised by Glen Doran of Florida State University. The site produced the well-preserved remains of over 168 individuals, ranging in age from neonates to elderly. The mean of nine radiocarbon dates on human bone, wooden stakes, and remains of a bottle gourd is 7442 radiocarbon years B.P., making Windover the largest sample of its antiquity in North America (Doran 2002a). This collection was in almost constant use during the present study for comparative

continued.

Addendum 12-2. (continued)

(particularly of fragment curvature, morphology, etc.), with the goal of differentiating individuals and making assessments of the minimum number of individuals and sexes represented in each Buckeye Knoll burial.

Little Salt Spring, Florida

Little Salt Spring (8SO10) is another wet site in Florida that has produced a large quantity of human skeletal material. Two excavations were undertaken in 1971 (Clausen et al. 1979), although the bulk of the remains were removed in the 1950s by avocational archaeologist William Royal. Most of the remains lack provenience and are the result of selective recovery. Samples of preserved human brain tissue date to over 6000 B.P. (Paabo et al., 1988) but the collection consists primarily of femorae representing a minimum of 31 individuals (Rachel Wentz, personal communication, 2003) most of whom probably date between 6000 and 5000 B.P.

List of Sites Used in the Postcranial Metric Comparisons

Site	State	Years B.P.	Reference
11-S-86	IL		Doran 2001b
13AM103	IO	600	Steckel et al. 2002
13AM21	IO	275	Steckel et al. 2002
25BU1	NE	155	Steckel et al. 2002
25BU2	NE	152	Steckel et al. 2002
25BU4	NE	200	Steckel et al. 2002
25CX1	NE	287	Steckel et al. 2002
25DK10	NE	155	Steckel et al. 2002
25DK2	NE	155	Steckel et al. 2002
25KX1	NE	155	Steckel et al. 2002
25WT1	NE	170	Steckel et al. 2002
39DW2	SD	184	Steckel et al. 2002
39HU6	SD	550	Steckel et al. 2002
39ST215	SD	162	Steckel et al. 2002
39ST216	SD	225	Steckel et al. 2002
39WW7	SD	250	Steckel et al. 2002
7 Mile Bend	GA	600	Steckel et al. 2002
Windover (8BR246)	FL	7400	FSU osteology lab files
AD2	TX		Doran 1975
Airport	GA	1350	Steckel et al. 2002
AN21	TX	250	Doran 1975
AS0	TX		Doran 1975
AS1	TX		Doran 1975
Aucilla Bar	FL		Dickel 1991
BE1	TX		Doran 1975
Beacon Harbor	TX		Doran 1975
BL127	TX		Doran 1975
BL4	TX		Doran 1975
Blackfoot	MT	75	Steckel et al. 2002

continued.

Addendum 12-2. (continued)

Site	State	Years B.P.	Reference
Blue Bayou	TX	1394	Huebner and Commuzzie 1992
Boose	OH	2500	Steckel et al. 2002
BQ1	TX		Doran 1975
BT0	TX		Doran 1975
Buffalo	OH	350	Steckel et al. 2002
BW3	TX		Doran 1975
BW4	TX	500	Doran 1975
BW8	TX	730	Doran 1975
Byrne Cemetery	TX	200	Fox 1984
Byrne Cemetery - bad	TX	200	Fox 1984
Calle del Oso	TX	752	Doran 1975
Cannons Pt.	GA	1350	Steckel et al. 2002
Caplen GV1	TX	601	Doran 1975
CCO138	CA	3834	Steckel et al. 2002
Cedar Creek	FL	1118	Dickel 1991
Cedar Grove A	GA	1350	Steckel et al. 2002
Cedar Grove B	GA	1350	Steckel et al. 2002
Cedar Grove C	GA	1350	Steckel et al. 2002
CH1	TX		Doran 1975
CH13	TX		Doran 1975
Charlie King	GA	1350	Steckel et al. 2002
Chota-Tanase	AL	250	Schroedl 1986
CHYAMM	NE	71	Steckel et al. 2002
CK11	TX		Doran 1975
Clarksville	VA	735	St. Hoyme 1962
COL1218	CA	3834	Steckel et al. 2002
Wilson Leonard	TX	10000	Collins 1998b
Couper Field	GA	600	Steckel et al. 2002
CP5	TX	500	Doran 1975
CR0	TX		Doran 1975
Crestmont Site	TX		Vernon 1989
CRWHF	MT	75	Steckel et al. 2002
CS10	TX		Doran 1975
CS14	TX	500	Doran 1975
CU7	TX		Doran 1975
Cungham C	GA	1350	Steckel et al. 2002
Cungham D	GA	1350	Steckel et al. 2002
Cungham E	GA	1350	Steckel et al. 2002
CV1	TX		Doran 1975
CV17	TX		Doran 1975
CV33	TX		Doran 1975
Deptford	GA	1350	Steckel et al. 2002
Deptford Mnd	GA	600	Steckel et al. 2002

continued.

Addendum 12-2. (continued)

Site	State	Years B.P.	Reference
Dolores	CO	1050	Steckel et al. 2002
Drondski Site	FL		Dickel 1991
Duff	OH	2500	Steckel et al. 2002
Edwards Mound	FL	1118	Dickel 1991
EL11	TX		Doran 1975
Ernest Witte	TX	4610	Hall 1981
Evelyn Plant.		1350	Steckel et al. 2002
Fitzgibbons	IL	1850	Robison and Butler 1986
FN12	TX	410	Doran 1975
Fort Brooke	FL	85	Weinker 1982
Fort Center	FL	1450	Dickel 1991
FS1	TX	100	Doran 1975
Gautier Site	FL	1660	Dickel 1991
Gibson	IL	1600	**Perino 1973**
Gordon Creek	CO	9700	Breternitz 1971
Grove's Crk.	GA	600	Steckel et al. 2002
Harris Co. B	TX	1175	Doran 1975
Haw	NM	398	Steckel et al. 2002
HI1	TX		Doran 1975
Hugh Wilson-	TX		Doran 1975
Indian Field	GA	600	Steckel et al. 2002
Indian King	GA	1350	Steckel et al. 2002
Irene Mound	GA	600	Steckel et al. 2002
JF24	TX		Doran 1975
Johns Mnd	GA	1350	Steckel et al. 2002
JS0	TX		Doran 1975
JS1	TX		Doran 1975
JS10	TX		Doran 1975
JS9	TX		Doran 1975
Kent Mound	GA	600	Steckel et al. 2002
Kirian Tregua	OH	2830	Steckel et al. 2002
Klunk	IL	2858	Droessler 1981
Knight	IL	1550	Buikstra 1976
KY8	TX		Doran 1975
Langtry Cr.	TX		Doran 1975
Leonard K. Site	TX	4610	Hall 1981
Lewis Crk. E	GA	600	Steckel et al. 2002
Lewis Crk. II	GA	600	Steckel et al. 2002
Lewis Crk. III	GA	600	Steckel et al. 2002
Little Pine Is.	GA	600	Steckel et al. 2002
Little Salt Spring	FL	6000	Rachel Wentz, p.c. 2003
Low Mound	GA	600	Steckel et al. 2002
LR2	TX	630	Doran 1975
M Espiritu S	TX	175	Doran 1975

continued.

Addendum 12-2. (continued)

Site	State	Years B.P.	Reference
M. S. Juan C	TX	177	Doran 1975
Marys Mnd	GA	1350	Steckel et al. 2002
McLeod Mnd	GA	1350	Steckel et al. 2002
MK2	TX		Doran 1975
Monongahela	PA/ WV	650	Steckel et al. 2002
N. End Mnd	GA	600	Steckel et al. 2002
NA3	TX	500	Doran 1975
NATR	UN		NPS NAGPRA inventory
Norman Mnd	GA	600	Steckel et al. 2002
Oatland Mnd	GA	600	Steckel et al. 2002
OCMU	UN		NPS NAGPRA inventory
OJ0	TX		Doran 1975
OR33	TX		Doran 1975
Pearson	OH	900	Steckel et al. 2002
Pine Harbor	GA	325	Steckel et al. 2002
Piney Island	FL		Dickel 1991
Polecat Holl	TX		Doran 1975
Ranney Cr. C	TX		Doran 1975
RE1	TX		Doran 1975
Red Bird Crk.	GA	600	Steckel et al. 2002
Red Knoll	GA	600	Steckel et al. 2002
Rock Pile Ra	TX	1000	Doran 1975
RUCA	UN		NPS NAGPRA inventory
RW2	TX	1850	Doran 1975
RW4	TX	1850	Doran 1975
S C d St Maria	FL	325	Steckel et al. 2002
Santa Catalina de Guale	GA	325	Steckel et al. 2002
S. End I	GA	600	Steckel et al. 2002
S. End II	GA	1350	Steckel et al. 2002
S. New Grnd	GA	1350	Steckel et al. 2002
SA89	TX	500	Doran 1975
SAC43	CA	1359	Steckel et al. 2002
San Cristobel	NM	448	Steckel et al. 2002
Sanders Site	TX		Jackson et al. 2002
SB35	TX	500	Doran 1975
SBA-?	CA	3834	Steckel et al. 2002
SBA104	CA	1359	Steckel et al. 2002
SBA106	CA	1359	Steckel et al. 2002
SBA126	CA	3834	Steckel et al. 2002
SBa13	CA	1625	Steckel et al. 2002
Sba142	CA	5250	Steckel et al. 2002
SBa17	CA	1625	Steckel et al. 2002

continued.

Addendum 12-2. (continued)

Site	State	Years B.P.	Reference
SBa1c	CA	1625	Steckel et al. 2002
SBa1d	CA	3834	Steckel et al. 2002
SBa20	CA	1359	Steckel et al. 2002
SBa205	CA	3834	Steckel et al. 2002
SBa28	CA	434	Steckel et al. 2002
SBa30	CA	434	Steckel et al. 2002
SBa31	CA	1359	Steckel et al. 2002
SBA-38	CA	3834	Steckel et al. 2002
SBa46	CA	1359	Steckel et al. 2002
SBa46a	CA	1625	Steckel et al. 2002
SBa477	CA	1359	Steckel et al. 2002
SBa485	CA	1359	Steckel et al. 2002
SBa52	CA	5250	Steckel et al. 2002
SBa520	CA	119	Steckel et al. 2002
SBa53	CA	5250	Steckel et al. 2002
SBa58	CA	434	Steckel et al. 2002
SBa6	CA	1625	Steckel et al. 2002
SBa60	CA	434	Steckel et al. 2002
SBa62	CA	3834	Steckel et al. 2002
Sba-7	CA	4100	Steckel et al. 2002
SBa-71	CA	1625	Steckel et al. 2002
SBa72	CA	1625	Steckel et al. 2002
Sba-72	CA	1625	Steckel et al. 2002
SBa73	CA	1625	Steckel et al. 2002
SBa77	CA	3834	Steckel et al. 2002
SBa78	CA	434	Steckel et al. 2002
SBa81	CA	1625	Steckel et al. 2002
SBa82	CA	434	Steckel et al. 2002
SBa84	CA	434	Steckel et al. 2002
SBa86	CA	1359	Steckel et al. 2002
SBa87	CA	1625	Steckel et al. 2002
SC1I1215	CA	1625	Steckel et al. 2002
SC1I43c	CA	1625	Steckel et al. 2002
SCL1	CA	1625	Steckel et al. 2002
SCL1-43	CA	5250	Steckel et al. 2002
SCr1	CA	1359	Steckel et al. 2002
SCRI0	CA	2418	Steckel et al. 2002
SCrI100	CA	434	Steckel et al. 2002
SCRI156	CA	1359	Steckel et al. 2002
SCRI158	CA	1359	Steckel et al. 2002
SCRI159	CA	3834	Steckel et al. 2002
SCri3	CA	5250	Steckel et al. 2002
SCRI-43	CA	3834	Steckel et al. 2002
SCrI83	CA	1625	Steckel et al. 2002

continued.

Addendum 12-2. (continued)

Site	State	Years B.P.	Reference
Sea Island	GA	1350	Steckel et al. 2002
Seaside I	GA	1350	Steckel et al. 2002
Seaside II	GA	1350	Steckel et al. 2002
Skidaway	GA	600	Steckel et al. 2002
SMI0.01	CA	434	Steckel et al. 2002
SMI0.02	CA	434	Steckel et al. 2002
SOL?	CA	1359	Steckel et al. 2002
Sol357	CA	1075	Steckel et al. 2002
Sowell Mound	FL	1340	FSU osteology lab files
SP78	TX		Doran 1975
SRI?	CA	3834	Steckel et al. 2002
SRI1	CA	3834	Steckel et al. 2002
SRI24	CA	3834	Steckel et al. 2002
SRI2a	CA	434	Steckel et al. 2002
SRI2B	CA	434	Steckel et al. 2002
SRI-3	CA	5250	Steckel et al. 2002
SRI41A	CA	5250	Steckel et al. 2002
SRI-41A	CA	5250	Steckel et al. 2002
SRI5A	CA	1625	Steckel et al. 2002
SRI60	CA	434	Steckel et al. 2002
SRI63a	CA	3834	Steckel et al. 2002
SRI9A	CA	434	Steckel et al. 2002
SS2	TX		Doran 1975
Steuben	IL	1452	Morse 1963
Sunwatch	OH	750	Steckel et al. 2002
TA0	TX		Doran 1975
Taylor Mnd	GA	600	Steckel et al. 2002
Taylor/Mart.	GA	600	Steckel et al. 2002
Tolliferro	UN		St. Hoyme 1962
Townsend	GA	600	Steckel et al. 2002
TV0	TX		Doran 1975
TV41	TX		Doran 1975
VEN110	CA	1075	Steckel et al. 2002
Ven61	CA	3834	Steckel et al. 2002
VT1	TX		Doran 1975
VV0	TX		Doran 1975
VV2	TX		Doran 1975
VV72	TX		Doran 1975
VV82	TX		Doran 1975
Waddell's Mill Pond 8J	FL	1500	Dickel 1991
Wade Burial	CO	2309	Wanner and Brunswig 1992
Walthour	GA	1350	Steckel et al. 2002
WEN62a	CA	1625	Steckel et al. 2002

continued.

Addendum 12-2. (concluded)

Site	State	Years B.P.	Reference
WM1	TX		Doran 1975
WM3	TX		Doran 1975
WM8	TX		Doran 1975
WM9	TX		Doran 1975
Yarbrough	TX	200	Fox 1984
Yokem-Mississippi	IL	800	Droessler 1981
Yokem-Woodland	IL	1080	Droessler 1981
ZZ10	TX		Doran 1975

Addendum 12-3. Buckeye Knoll Basic Metrics.

	Burial 1B	Burial 2	Burial 3	Burial 4	Burial 5	Burial 6	Burial 7 #1	Burial 8	Burial 9	Burial 12	Burial 13	Burial 18	Burial 20	Burial 21	Burial 22	Burial 22#2
AGE91	55+	37.6	51.49	54.07	55+	55+	55.99	45.77	56.39	20.24	48.02	55+	-	-	53.27	17
SEXNUM	2	2	2.5	2	4	4	1	1	1.5	1.5	2	2	1	2	2	1
MXLFEML	-	-	-	-	-	-	-	468	-	-	-	-	-	-	-	-
MXLFEMR	-	-	-	-	-	-	-	464	-	-	-	-	-	-	-	-
BILFEML	-	-	-	-	-	-	-	472	-	-	-	-	-	-	-	-
BILFEMR	-	-	-	-	-	-	-	468	-	-	-	-	-	-	-	-
MXDFEMHL	-	-	-	-	-	-	-	48.15	-	-	-	-	-	-	-	-
MXDFEMHR	-	-	-	-	-	-	46.42	-	-	-	-	-	-	-	-	-
FMSAPL	-	-	21.12	-	32.99	27.84	-	-	-	-	-	25.63	-	26.79	-	30.34
FMSAPR	-	28.37	-	-	33.19	30.28	32.31	-	-	-	-	-	-	-	-	-
FMSMLL	-	-	25.41	-	26.47	25.48	-	-	-	-	-	23.98	-	26.18	-	25.67
FMSMLR	-	26.8	-	-	24.77	26.34	27.03	-	-	-	-	-	-	-	-	-
LENTIBL	360	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LENTIBR	-	-	-	-	-	-	-	382	-	-	-	-	-	-	-	-
PATMXHL	-	-	-	32.24	-	-	-	-	-	-	-	-	-	-	-	-
PATMXHR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PATMXBL	-	33.06	-	-	-	-	-	42.29	-	-	-	-	-	-	-	-
PATMXBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXHUML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXHUMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXVDHHL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXVDHHR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MBL	-	-	-	-	-	-	-	79	-	-	-	-	-	-	-	-
HMAPL	-	-	20.06	-	-	-	-	-	-	-	-	-	-	-	-	-
HMMLL	-	-	17.29	-	-	-	-	-	-	-	-	-	-	-	-	-
HMAPR	-	-	-	-	-	21.24	-	-	-	-	-	-	20.39	-	-	-
HMMLR	-	-	-	-	-	16.35	-	-	-	-	-	-	16.44	-	-	-
RMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UMLL	-	-	-	-	-	-	-	-	-	-	-	-	13.03	-	-	-
MFAB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TMLML	-	-	-	-	-	-	24.32	-	-	15.51	-	-	-	-	-	23.06
TAPNL	-	-	-	-	-	-	38.05	-	-	22.52	-	-	-	-	-	35.25
TAPNR	-	-	-	-	-	34.36	-	-	-	-	-	-	-	-	24.75	-
TMLMR	-	-	-	-	-	22.29	-	-	-	-	-	-	-	-	20.89	-
LMC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC1	-	-	-	-	42.87	-	-	-	-	-	-	-	-	-	-	-
RMC2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	26.97	-	-
TDAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDML	-	-	-	-	-	-	-	-	-	-	-	-	-	16.94	-	-
TDMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FSIDNL	-	-	-	-	32.09	-	-	-	-	-	-	-	-	-	-	-
FSIDNR	-	-	-	-	-	-	32.72	-	-	-	-	-	-	-	-	-
MT1APBL	-	-	-	-	-	-	-	28.05	-	-	-	-	-	-	-	-
MT1APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT1MLBL	-	-	-	-	-	-	-	20.08	-	-	-	-	-	-	-	-
MT1MLBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT2APBL	-	-	18.1	-	-	-	-	20.73	-	-	-	-	-	-	-	-
MT2APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT2MLBL	-	-	14.15	-	-	-	-	14.86	-	-	-	-	-	-	-	-
MT2MLBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT3APBL	-	-	-	-	-	-	-	20.54	-	-	-	-	-	-	-	-
MT3APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT3MLBL	-	-	-	-	-	-	-	14.17	-	-	-	-	-	-	-	-
MT3MLBR	-	-	-	-	-	-	-	14.22	-	-	-	-	-	-	-	-
MT4APBL	-	-	-	-	-	-	-	18.79	-	-	-	-	-	-	-	-
MT4APBR	-	-	-	-	-	-	-	18.69	-	-	-	-	-	-	-	-
MT4MLBL	-	-	-	-	-	-	-	13.44	-	-	-	-	-	-	-	-
MT4MLBR	-	-	-	-	-	-	-	12.6	-	-	-	-	-	-	-	-
MT5APBL	-	-	-	-	-	-	-	15	-	-	-	-	-	-	-	-
MT5APBR	-	-	-	-	-	-	-	14.54	-	-	21.02	-	-	-	-	-
MT5MLBL	-	-	-	-	-	-	-	18.02	-	-	-	-	-	-	-	-
MT5MLBR	-	-	-	-	-	-	-	17.77	-	-	13.63	-	-	-	-	-
MC1APBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC1APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC1MLBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC1MLBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC2APBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC2APBR	-	-	-	-	-	-	-	16.92	-	-	-	-	-	-	-	-
MC2MLBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC2MLBR	-	-	-	-	-	-	-	15.86	-	-	-	-	-	-	-	-
MC3APBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC3APBR	-	-	-	-	-	-	-	16.77	-	-	-	-	-	-	-	-

continued.

Addendum 12-3. (continued)

	Burial 1B	Burial 2	Burial 3	Burial 4	Burial 5	Burial 6	Burial 7 #1	Burial 8	Burial 9	Burial 12	Burial 13	Burial 18	Burial 20	Burial 21	Burial 22	Burial 22#2
MC3MLBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC3MLBR	-	-	-	-	-	-	-	13.99	-	-	-	-	-	-	-	-
MC4APBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC4APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC4MLBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC4MLBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC5APBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC5APBR	-	-	-	-	-	-	17.78	-	-	-	-	-	-	-	-	-
MC5MLBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC5MLBR	-	-	-	-	-	-	15.37	-	-	-	-	-	-	-	-	-
SGFSIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFSIR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LUNLL	-	-	-	-	-	-	16.67	-	-	-	16.4	-	-	-	-	-
LUNLR	-	-	-	-	-	-	-	-	19.1	-	-	-	-	-	-	-
LUNHL	-	-	-	-	-	-	15.83	-	-	-	14.3	-	-	-	-	-
LUNHR	-	-	-	-	-	-	-	-	19.1	-	-	-	-	-	-	-
CAPBLL	-	-	-	-	-	-	22.2	-	-	-	-	-	-	-	-	-
CAPBLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPBHL	-	-	-	-	-	-	20.31	-	-	-	-	-	-	-	-	-
CAPBHR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDAPL	-	-	-	-	-	-	24.45	-	-	-	-	-	-	-	-	-
HMDMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDAPR	-	-	-	-	-	-	26.38	-	-	-	-	-	-	-	-	-
RMTAPL	-	-	-	-	-	-	-	16.15	-	-	-	-	-	-	-	-
RMTAPR	-	-	-	-	-	-	-	15.19	-	-	-	-	-	-	-	-
RMTMLL	-	-	-	-	-	-	-	15.05	-	-	-	-	-	-	-	-
RMTMLR	-	-	-	-	-	-	-	16.35	-	-	-	-	-	-	-	-
SCAPHLL	-	-	-	-	-	-	-	-	-	-	25.22	-	-	-	-	-
SCAPHLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHWL	-	-	-	-	-	-	10.64	-	-	-	11.3	-	-	-	-	-
SCAPHWR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHSIL	-	-	19.67	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHSIR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHMLL	-	-	26.09	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHMLR	-	-	-	-	-	-	-	52.74	-	-	-	-	-	-	-	-
LTALLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LTALWAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALWAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TSASWL	-	-	27.21	-	-	-	32.64	-	-	24.83	25.47	-	-	-	-	-
TSASWR	-	-	-	-	-	32.76	32.68	-	-	-	-	-	-	-	-	-
LTALBHAV	-	-	-	-	-	-	-	29.45	-	-	-	-	-	-	-	-
RTALBHAV	-	-	-	-	-	-	-	31.8	-	-	-	-	-	-	-	-
XFMSAPL	-	-	25.09	-	-	-	-	26.16	-	-	-	26.31	-	-	-	-
XFMSAPR	-	-	-	-	24.7	-	26.45	-	-	-	-	-	-	-	-	-
XFMSMLL	-	-	24.94	-	-	-	-	-	-	-	-	24.45	-	-	-	-
XFMSMLR	-	-	-	-	32.87	-	25.87	-	-	-	-	-	-	-	-	-
RAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RAPR	-	-	-	-	-	-	-	-	-	-	-	-	10.67	-	-	-
UAPL	-	-	-	-	-	-	-	-	-	-	-	-	14.47	-	-	-
UAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDMLL	-	-	-	-	-	-	23.08	-	-	-	-	-	-	-	-	-
HMDMLR	-	-	-	-	-	-	17.42	-	-	-	-	-	-	-	-	-
FNAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FEBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FEBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UTDL	-	-	-	-	-	-	16.22	-	-	-	-	-	-	-	-	-
UTDR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stature (in cm)	150	-	-	-	-	-	-	173.19	163.53	-	-	-	-	-	-	-
FMSAP	-	28.37	-	-	33.19	30.28	-	-	-	-	-	-	-	-	-	-
FMSML	-	26.8	-	-	24.77	26.34	-	-	-	-	-	-	-	-	-	-
LNAVWAV	-	-	-	-	-	-	-	20.68	-	-	-	-	-	-	-	-
LNAVLAV	-	-	-	20.89	-	-	-	-	-	-	-	-	-	-	-	-
RNAVLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTSUPINFL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALARTSUR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LCALLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RCALLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RCALLAWAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALTWL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALTWR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

All metrics are in mm except Stature which is in cm. Variable abbreviations are in Addendum 12-1.

continued.

Addendum 12-3. (continued)

	Burial 23	Burial 25	Burial 30	Burial 31	Burial 31#2	Burial 33	Burial 34	Burial 35	Burial 36	Burial 37	Burial 37#2	Burial 39	Burial 41	Burial 42	Burial 43	Burial 44#2
AGE91	40.86	38.62	55+	55+	8	6.5	55+	-	29.22	48.4	48.44	24.24	32.17	46.11	13.9	23.76
SEXNUM	2	1	2.5	1.5	3	3	2	4	1	2	2	4	4	2	3	2
MXLFEML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MXLFEMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BILFEML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BILFEMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MXDFEMHL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MXDFEMHR	-	42.57	-	-	-	-	-	-	-	-	-	-	-	40.55	-	-
FMSAPL	-	-	22.37	-	-	-	-	28.76	-	-	21.34	-	-	-	29.96	-
FMSAPR	-	27.97	-	-	-	-	24.59	-	-	-	21.76	-	-	-	-	-
FMSMLL	-	-	20.76	-	-	-	-	27.34	-	-	24.66	-	-	-	24.03	-
FMSMLR	-	24.4	-	-	-	-	25.24	-	-	-	23.82	-	-	-	-	-
LENTIBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LENTIBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PATMXHL	-	41.32	-	-	-	36.09	-	-	-	-	-	-	-	-	-	-
PATMXHR	38.32	41.17	-	-	-	35.27	-	-	-	-	37.04	-	-	-	-	-
PATMXBL	-	42.27	-	-	-	37.07	-	-	-	-	-	-	-	-	-	-
PATMXBR	37.94	41.07	-	-	-	37.24	-	-	-	-	36.46	-	-	-	-	-
MAXHUML	-	300	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXHUMR	-	297	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXVDHHL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXVDHHR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MBL	82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMAPL	-	19.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMMLL	-	20.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMAPR	-	20.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMMLR	-	22.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMLL	-	139	-	-	-	-	-	-	-	-	209	-	-	-	-	-
UMLL	-	268	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MFAB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TMLML	-	21.07	-	36.85	-	19.13	-	-	-	-	-	-	-	-	-	-
TAPNL	-	38.88	-	27.17	-	28.73	-	-	-	-	-	-	-	-	-	-
TAPNR	24.85	37.07	-	-	17.75	-	-	-	-	-	-	-	-	-	-	-
TMLMR	20.89	23.47	-	23.71	-	-	-	-	-	-	-	-	-	-	-	-
LMC1	-	42.83	-	-	-	-	-	-	-	40.72	-	-	-	-	-	-
LMC2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC3	-	63.03	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC4	-	56.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC5	-	50.58	-	-	-	-	-	-	-	-	-	-	60.56	-	-	-
RMC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC2	-	-	58.32	-	-	-	-	-	-	61.26	-	-	-	-	-	-
RMC3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FSIDNL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FSIDNR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT1APBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT1APBR	-	27.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT1MLBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT1MLBR	-	19.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT2APBL	-	19.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT2APBR	-	19.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT2MLBL	-	14.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT2MLBR	-	16.08	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT3APBL	-	21.17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT3APBR	-	20.07	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT3MLBL	-	12.98	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT3MLBR	-	13.96	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT4APBL	-	18.39	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT4APBR	-	19.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT4MLBL	-	12.25	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT4MLBR	-	13.28	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT5APBL	-	13.6	-	-	-	-	-	-	-	-	-	-	15.58	-	-	-
MT5APBR	-	15.02	-	-	-	12.98	-	-	-	-	-	-	-	-	-	-
MT5MLBL	-	20.65	-	-	-	-	-	-	-	-	-	-	18.73	-	-	-
MT5MLBR	-	21.35	-	-	-	18.94	-	-	-	-	-	-	-	-	-	-
MC1APBL	-	14.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC1APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC1MLBL	-	14.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC1MLBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC2APBL	-	15.37	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC2APBR	-	-	15.52	-	-	-	-	-	-	-	-	-	-	-	-	-
MC2MLBL	-	18.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC2MLBR	-	-	17.19	-	-	-	-	-	-	-	-	-	-	-	-	-
MC3APBL	-	15.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC3APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

continued.

Addendum 12-3. (continued)

	Burial 23	Burial 25	Burial 30	Burial 31	Burial 31#2	Burial 33	Burial 34	Burial 35	Burial 36	Burial 37	Burial 37#2	Burial 39	Burial 41	Burial 42	Burial 43	Burial 44#2
MC3MLBL	-	14.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC3MLBR	11.38	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC4APBL	-	11.4	11.3	-	-	-	-	-	-	-	-	-	-	-	-	-
MC4APBR	-	-	-	-	-	-	-	-	-	-	-	-	12.65	-	-	-
MC4MLBL	-	10.99	11.51	-	-	-	-	-	-	-	-	-	-	-	-	-
MC4MLBR	-	-	-	-	-	-	-	-	-	-	-	-	12.54	-	-	-
MC5APBL	-	9.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC5APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC5MLBL	-	13.74	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC5MLBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFSIL	-	35.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFSIR	-	38.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFMLL	-	25.71	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LUNLL	-	16.61	-	-	-	-	-	-	-	-	-	-	-	-	-	16.13
LUNLR	-	-	15.42	-	-	-	-	-	-	-	-	18.22	-	-	-	-
LUNHL	-	7.45	-	-	-	-	-	-	-	-	-	-	-	-	-	14.33
LUNHR	-	-	13.59	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPBLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPBLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPBHL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPBHR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDAPL	20.43	-	17.74	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDAPR	23.64	-	18.56	-	-	-	-	-	-	-	-	-	-	-	-	-
RMTAPL	-	14.99	-	-	-	-	-	-	-	-	13.34	-	-	-	-	-
RMTAPR	-	-	11.22	-	-	-	-	-	-	-	-	-	-	-	-	-
RMTMLL	-	15.48	-	-	-	-	-	-	-	-	15.03	-	-	-	-	-
RMTMLR	-	-	12.56	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHLL	-	25.26	22.65	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHWL	-	11.06	9.58	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHWR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHSIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHSIR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LTALLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALLAV	-	-	-	-	-	-	-	-	-	-	52.54	-	-	-	-	-
LTALWAV	-	40.86	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALWAV	-	40.93	-	-	-	-	-	-	-	-	37.45	-	-	-	-	-
TSASWL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TSASWR	-	-	-	-	-	28.69	-	-	-	-	13.25	-	-	30.03	-	-
LTALBHAV	-	30.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALBHAV	-	31.6	-	-	-	38.41	-	-	-	-	-	-	-	-	-	-
XFMSAPL	-	-	-	-	-	-	-	-	-	-	19.95	-	-	-	-	-
XFMSAPR	-	24.94	-	-	-	-	-	-	28.71	-	20.52	-	-	-	-	-
XFMSMLL	31.67	-	-	-	-	-	-	-	-	-	30.08	-	-	-	-	-
XFMSMLR	-	33.54	-	-	-	-	-	-	26.74	-	30.49	-	-	-	-	-
RAPL	-	11.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UAPL	-	-	-	-	-	-	-	-	-	-	10.08	-	-	-	-	-
UAPR	-	-	-	-	-	-	-	-	-	-	10.42	-	-	-	-	-
HMDMLL	15.7	-	18.82	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDMLR	18.65	-	16.9	-	-	-	-	-	-	-	-	-	-	-	-	-
FNAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNAPR	-	26.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNMLR	-	25.87	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FEBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FEBR	-	78	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UTDL	-	-	-	-	-	-	-	-	-	-	13.07	-	-	-	-	-
UTDR	-	-	-	-	-	-	-	-	-	-	11.58	-	-	-	-	-
Stature (in cm)	-	170.76	153.34	-	-	-	-	-	-	155.98	-	-	181.82	-	-	-
FMSAP	-	27.97	-	-	-	-	24.59	-	-	-	21.76	-	-	-	-	-
FMSML	-	24.4	-	-	-	-	25.24	-	-	-	23.82	-	-	-	-	-
LNAVWAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LNAVLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RNAVLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTSUPINFL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALARTSUR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LCALLAV	-	-	-	-	-	-	-	-	-	43.95	-	-	-	-	-	-
RCALLAV	-	-	-	-	-	-	-	-	-	-	44.98	-	-	-	-	-
RCALLAWAV	-	-	-	-	-	-	-	-	-	-	37.49	-	-	-	-	-
TALTWL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALTWR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

All metrics are in mm except Stature which is in cm. Variable abbreviations are in Addendum 12-1.

continued.

Addendum 12-3. (continued)

	Burial 47	Burial 48 #1	Burial 48 #2	Burial 49	Burial 51A	Burial 53	Burial 55	Burial 57	Burial 58	Burial 62#1	Burial 62#2	Burial 64#1	Burial 64#2	Burial 65#2	Burial 66	Burial 67
AGE91	24.13	46.24	37.45	54.77	24.87	-	55+	-	5.5	31.13	49.04	ADULT	15.27	15.27	38.67	30.64
SEXNUM	1	1	1.5	1	1	-	2	1	3	1.5	2	2.5	3	3	2.5	2
MXLFEML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MXLFEMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BILFEML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BILFEMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MXDFEMHL	-	48.15	-	-	-	40.43	-	-	-	-	-	-	-	-	-	-
MXDFEMHR	-	-	-	-	-	-	-	-	-	46.54	-	-	-	-	-	-
FMSAPL	-	-	-	-	-	-	-	-	25.34	-	-	26.24	-	-	25.44	-
FMSAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FMSMLL	-	-	-	-	-	-	-	-	20.83	-	-	23.93	-	-	23.75	-
FMSMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LENTIBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LENTIBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PATMXHL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PATMXHR	41.61	-	-	-	-	-	-	-	-	-	-	-	-	-	35.68	35.61
PATMXBL	38.97	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PATMXBR	41.48	-	-	-	-	-	37.4	-	-	-	-	-	-	-	35.32	36.74
MAXHUML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXHUMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXVDHHL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MAXVDHHR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMAPL	-	-	-	20.81	-	-	-	24.27	-	-	-	-	-	-	-	-
HMMLL	-	-	-	16.67	-	-	-	18.75	-	-	-	-	-	-	-	-
HMAPR	-	-	-	-	23.06	-	-	-	-	-	-	-	-	-	-	-
HMMLR	-	-	-	-	17.09	-	-	-	-	-	-	-	-	-	-	-
RMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MFAB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TMLML	-	-	-	-	-	-	-	24.8	-	-	-	-	-	-	-	-
TAPNL	-	-	-	-	-	-	-	37.28	-	-	-	-	-	-	-	-
TAPNR	-	-	-	-	-	-	-	37.59	-	-	-	-	-	-	-	-
TMLMR	-	-	-	-	-	-	-	26.42	-	-	-	-	-	-	-	-
LMC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LMC5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMC4	-	-	-	-	-	-	-	64.92	-	-	-	-	-	-	-	-
RMC5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TCL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDMR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FSIDNL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FSIDNR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT1APBL	-	-	-	-	-	-	26.13	-	-	-	-	-	-	-	-	-
MT1APBR	-	-	-	-	-	-	24.72	-	-	-	-	-	-	-	-	-
MT1MLBL	-	-	-	-	-	-	19.17	-	-	-	-	-	-	-	-	-
MT1MLBR	-	-	-	-	-	-	19.47	-	-	-	-	-	-	-	-	-
MT2APBL	-	-	-	-	-	-	20.41	-	-	-	-	-	-	-	-	-
MT2APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MT2MLBL	-	-	-	-	-	-	12.56	-	-	-	-	-	-	-	-	-
MT2MLBR	-	-	-	-	-	-	15.18	-	-	-	-	-	-	-	-	-
MT3APBL	-	-	-	-	-	-	16.09	-	-	-	-	-	-	-	-	-
MT3APBR	-	-	-	-	-	-	15.72	-	-	-	-	-	-	-	-	-
MT3MLBL	-	-	-	-	-	-	13.96	-	-	-	-	-	-	-	-	-
MT3MLBR	-	-	-	-	-	-	12.97	-	-	-	-	-	-	-	-	-
MT4APBL	19.52	-	-	-	-	-	16.13	13.28	-	-	-	-	-	-	-	-
MT4APBR	-	-	-	-	-	-	17.93	-	-	-	-	-	-	-	-	-
MT4MLBL	13.59	-	-	-	-	-	13.1	12.95	-	-	-	-	-	-	-	-
MT4MLBR	-	-	-	-	-	-	13.04	-	-	-	-	-	-	-	-	-
MT5APBL	-	-	-	-	-	-	13.91	14.3	-	-	-	-	-	-	-	-
MT5APBR	-	-	-	-	-	-	13.72	-	-	-	-	-	-	-	-	-
MT5MLBL	-	-	-	-	-	-	16.64	20.48	-	-	-	-	-	-	-	-
MT5MLBR	-	-	-	-	-	-	16.93	-	-	-	-	-	-	-	-	-
MC1APBL	-	-	-	-	-	-	-	-	-	15.63	-	-	-	-	-	-
MC1APBR	-	-	-	-	-	-	-	15.93	-	-	-	-	-	-	-	-
MC1MLBL	-	-	-	-	-	-	-	-	-	15.12	-	-	-	-	-	-
MC1MLBR	-	-	-	-	-	-	-	15.04	-	-	-	-	-	-	-	-
MC2APBL	-	-	-	-	-	16.36	-	-	-	-	-	-	-	-	-	-
MC2APBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC2MLBL	-	-	-	-	-	16.32	-	-	-	-	-	-	-	-	-	-
MC2MLBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MC3APBL	-	-	-	-	17.01	15.93	-	-	-	-	-	-	-	-	-	-
MC3APBR	-	-	-	-	-	15.77	-	-	-	-	-	-	-	-	-	-

continued.

Addendum 12-3. (continued)

	Burial 47	Burial 48 #1	Burial 48 #2	Burial 49	Burial 51A	Burial 53	Burial 55	Burial 57	Burial 58	Burial 62#1	Burial 62#2	Burial 64#1	Burial 64#2	Burial 65#2	Burial 66	Burial 67
MC3MLBL	-	-	-	-	13.97	13.42	-	-	-	-	-	-	-	-	-	-
MC3MLBR	-	-	-	-	-	14.45	-	-	-	-	-	-	-	-	-	-
MC4APBL	-	-	-	-	-	11.52	-	-	-	-	-	-	-	-	-	-
MC4APBR	-	-	-	-	-	11.19	-	13.88	-	-	-	-	-	-	-	-
MC4MLBL	-	-	-	-	-	10.83	-	-	-	-	-	-	-	-	-	-
MC4MLBR	-	-	-	-	-	12.06	-	12.66	-	-	-	-	-	-	-	-
MC5APBL	-	-	-	-	-	-	10.52	-	-	-	-	-	-	-	-	-
MC5APBR	-	-	-	-	11.75	10.87	-	11.44	-	-	-	-	-	-	-	-
MC5MLBL	-	-	-	-	-	-	12.69	-	-	-	-	-	-	-	-	-
MC5MLBR	-	-	-	-	11.18	12.58	-	15.5	-	-	-	-	-	-	-	-
SGFSIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFSIR	-	-	-	-	-	-	37.65	38.63	-	-	-	-	-	-	-	-
SGFMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SGFMLR	-	-	-	-	-	-	24.55	26.83	-	-	-	-	-	-	-	-
LUNLL	-	-	-	-	17.44	15.18	-	-	-	-	-	-	-	-	-	17.05
LUNLR	-	-	-	-	-	15.34	-	-	-	-	-	-	-	-	-	16.6
LUNHL	-	-	-	-	14.88	-	-	-	-	-	-	-	-	-	-	13.99
LUNHR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.65
CAPBLL	-	-	-	-	-	17.71	-	-	-	-	-	-	-	-	-	-
CAPBLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CAPBHL	-	-	-	-	-	20.34	-	-	-	-	-	-	-	-	-	-
CAPBHR	-	-	-	-	-	20.64	-	-	-	-	-	-	-	-	-	-
HMDAPL	21.74	21.47	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDMLL	-	23.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMTAPL	-	-	-	-	13.09	-	-	-	-	-	-	-	-	-	-	-
RMTAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RMTMLL	-	-	-	-	17.54	-	-	-	-	-	-	-	-	-	-	-
RMTMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHWL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SCAPHWR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHSIL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHSIR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALHMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LTALLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LTALWAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALWAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TSASWL	-	-	-	-	-	-	-	-	-	29.07	-	-	-	-	-	-
TSASWR	-	-	-	-	-	-	-	-	-	30.63	-	-	-	-	-	-
LTALBHAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALBHAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XFMSAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XFMSAPR	-	-	-	-	-	-	-	-	-	-	-	-	18.58	17.51	-	-
XFMSMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
XFMSMLR	-	-	-	-	-	-	-	-	-	-	-	-	21.55	22.06	-	-
RAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDMLL	23.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HMDMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNAPL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNAPR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNMLL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FNMLR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FEBL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FEBR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UTDL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UTDR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stature (in cm)	-	-	-	-	-	-	-	173.58	-	-	-	-	-	-	-	-
FMSAP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FMSML	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LNAVWAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LNAVLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RNAVLAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTAPL	-	13.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTSUPINFL	-	10.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RTALARTSUR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LCALLAV	-	-	-	-	-	-	-	47.53	-	82.49	-	-	-	-	-	-
RCALLAV	-	-	-	-	-	-	-	-	-	-	76.88	-	-	-	-	-
RCALLAWAV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALTWL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TALTWR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

All metrics are in mm except Stature which is in cm. Variable abbreviations are in Addendum 12-1.

continued.

Addendum 12-3. (continued)

	Burial 71	Burial 72	Burial 73	Burial 74	Burial 75	S14W88 Level 4 (Loose bone)	S14W86 Level 7 (Loose bone)	S14W87 Level 5 (Loose bone)	S14W86 Level ? (Loose bone)	S14W86 Level 3 (Loose bone)	S14W86 Level 9 (Loose bone)
AGE91	21.2	38.1	30.3	44.76	29.96	-	-	-	-	-	-
SEXNUM	2	1	4	1	4	0	4	4	4	4	4
MXLFEML	-	-	-	-	-	-	-	-	-	-	-
MXLFEMR	-	-	-	-	-	-	-	-	-	-	-
BILFEML	-	-	-	-	-	-	-	-	-	-	-
BILFEMR	-	-	-	-	-	-	-	-	-	-	-
MXDFEMHL	-	-	-	-	-	-	-	-	-	-	-
MXDFEMHR	-	48.07	-	-	-	-	-	-	-	-	-
FMSAPL	-	-	-	-	-	-	-	-	-	-	-
FMSAPR	-	-	-	-	-	-	-	-	-	-	-
FMSMLL	-	-	-	-	-	-	-	-	-	-	-
FMSMLR	-	-	-	-	-	-	-	-	-	-	-
LENTIBL	-	-	-	-	-	-	-	-	-	-	-
LENTIBR	-	-	-	-	-	-	-	-	-	-	-
PATMXHL	-	-	-	-	-	-	-	-	-	-	-
PATMXHR	-	-	-	-	-	-	-	-	-	-	-
PATMXBL	-	-	-	-	-	-	-	-	-	-	-
PATMXBR	-	-	-	-	-	-	-	-	-	-	-
MAXHUML	-	-	-	-	-	-	-	-	-	-	-
MAXHUMR	-	-	-	-	-	-	-	-	-	-	-
MAXVDHHL	-	-	-	-	-	-	-	-	-	-	-
MAXVDHHR	-	-	-	-	-	-	-	-	-	-	-
MBL	-	-	-	-	-	-	-	-	-	-	-
HMAPL	-	-	-	-	-	-	-	-	15.48	-	-
HMMLL	-	-	-	-	-	-	-	-	17.58	-	-
HMAPR	-	-	-	-	-	-	-	-	-	-	-
HMMLR	-	-	-	-	-	-	-	-	-	-	-
RMLL	-	-	-	-	-	-	-	-	-	-	-
UMLL	-	-	-	-	-	-	-	-	-	-	-
MFAB	-	-	-	-	-	-	-	-	-	-	-
TMLML	24.32	26.1	-	-	-	-	-	-	-	-	-
TAPNL	38.05	40.8	-	-	-	-	-	-	-	-	-
TAPNR	-	-	-	-	-	-	-	-	-	-	-
TMLMR	-	-	-	-	-	-	-	-	-	-	-
LMC1	-	-	-	-	-	-	-	-	-	-	-
LMC2	-	-	-	-	-	-	-	-	-	-	-
LMC3	-	-	-	-	-	-	-	-	-	-	-
LMC4	-	-	-	-	-	-	-	-	-	-	-
LMC5	-	-	-	-	-	-	-	-	-	-	-
RMC1	-	-	-	-	-	-	-	-	-	-	-
RMC2	-	-	-	-	-	-	-	-	-	-	-
RMC3	-	-	-	-	-	-	-	-	-	-	-
RMC4	-	-	-	-	-	-	-	-	-	-	-
RMC5	-	-	-	-	-	-	-	-	-	-	-
TCL	-	-	-	-	-	-	-	-	-	-	-
TDAPL	-	-	-	-	-	-	-	-	-	-	-
TDAPR	-	-	-	-	-	-	-	-	-	-	-
TDML	-	-	-	-	-	-	-	-	-	-	-
TDMR	-	-	-	-	-	-	-	-	-	-	-
FSIDNL	23.47	-	-	-	-	-	-	-	-	-	-
FSIDNR	32.72	-	-	-	-	-	-	-	-	-	-
MT1APBL	-	-	-	-	-	-	-	-	-	-	-
MT1APBR	-	30.71	-	-	-	-	-	-	-	-	-
MT1MLBL	-	-	-	-	-	-	-	-	-	-	-
MT1MLBR	-	19.29	-	-	-	-	-	-	-	-	-
MT2APBL	-	-	-	-	-	-	-	-	-	-	-
MT2APBR	-	19.86	-	-	-	-	-	-	-	-	-
MT2MLBL	-	16.11	-	-	-	13.83	-	-	-	-	-
MT2MLBR	-	17.26	-	-	-	-	-	-	-	-	-
MT3APBL	-	-	-	-	-	-	-	-	-	-	-
MT3APBR	-	22.49	-	-	-	-	-	-	-	-	-
MT3MLBL	-	-	-	-	-	-	-	-	-	-	-
MT3MLBR	-	16.14	-	-	-	-	-	-	-	-	-
MT4APBL	-	-	-	-	-	-	-	-	-	-	-
MT4APBR	-	-	-	-	-	-	-	-	-	-	-
MT4MLBL	-	-	-	-	-	-	-	-	-	-	-
MT4MLBR	-	-	-	-	-	-	-	-	-	-	-
MT5APBL	-	-	-	-	14.25	-	-	-	-	-	-
MT5APBR	-	-	-	-	-	-	-	-	-	-	-
MT5MLBL	-	-	-	-	23.13	-	-	-	-	-	-
MT5MLBR	-	-	-	-	-	-	-	-	-	-	-
MC1APBL	-	-	-	-	14.05	-	14.17	-	-	-	-
MC1APBR	-	12.13	-	-	-	-	-	-	-	-	-
MC1MLBL	-	-	-	-	-	-	14.39	-	-	-	-
MC1MLBR	-	15.95	-	-	15.13	-	-	-	-	-	-
MC2APBL	-	-	-	-	-	-	-	-	-	-	-
MC2APBR	-	-	-	-	-	-	-	-	-	-	-
MC2MLBL	-	-	-	-	-	-	-	-	-	-	-
MC2MLBR	-	-	-	-	-	-	-	-	-	-	-
MC3APBL	-	-	15.74	-	11.29	-	-	-	-	-	-
MC3APBR	-	12.46	-	-	-	-	-	-	-	-	-

continued.

Addendum 12-3. (continued)

	Burial 71	Burial 72	Burial 73	Burial 74	Burial 75	S14W88 Level 4 (Loose bone)	S14W86 Level 7 (Loose bone)	S14W87 Level 5 (Loose bone)	S14W86 Level ? (Loose bone)	S14W86 Level 3 (Loose bone)	S14W86 Level 9 (Loose bone)
MC3MLBL	-	-	15	-	16.19	-	-	-	-	-	-
MC3MLBR	-	14.87	-	-	-	-	-	-	-	-	-
MC4APBL	-	-	-	-	-	-	-	-	-	-	-
MC4APBR	-	-	-	-	-	-	-	-	-	-	-
MC4MLBL	-	-	-	-	-	-	-	-	-	-	-
MC4MLBR	-	-	-	-	-	-	-	-	-	-	-
MC5APBL	-	-	-	15.64	-	-	-	-	-	-	-
MC5APBR	17.78	-	-	-	-	-	-	-	-	-	-
MC5MLBL	-	-	-	10.87	-	-	-	-	-	-	-
MC5MLBR	15.37	-	-	-	-	-	-	-	-	-	-
SGFSIL	-	-	-	-	-	-	-	-	-	-	-
SGFSIR	31.95	-	-	-	-	-	-	-	-	-	-
SGFMLL	-	-	-	-	-	-	-	-	-	-	-
SGFMLR	20.5	-	-	-	-	-	-	-	-	-	-
LUNLL	17.3	-	-	-	-	-	-	-	-	-	-
LUNLR	-	-	-	-	-	-	-	-	-	14.16	15.22
LUNHL	-	-	-	-	-	-	-	-	-	-	-
LUNHR	-	-	-	-	-	-	-	-	-	13.99	14.99
CAPBLL	-	-	18.2	-	-	-	-	-	-	-	-
CAPBLR	-	-	-	-	-	-	-	-	-	-	-
CAPBHL	-	-	22.27	-	-	-	-	-	-	-	-
CAPBHR	-	-	-	-	-	-	-	-	-	-	-
HMDAPL	24.45	-	-	-	-	-	-	-	-	-	-
HMDMLL	-	-	-	-	-	-	-	-	-	-	-
HMDAPR	26.38	-	-	-	-	-	-	-	-	-	-
RMTAPL	-	-	-	-	-	-	-	-	-	-	-
RMTAPR	-	-	-	-	9.76	-	-	13.7	-	-	-
RMTMLL	-	-	-	-	-	-	-	-	-	-	-
RMTMLR	-	-	-	-	11.2	-	-	14.32	-	-	-
SCAPHLL	-	-	-	-	-	-	-	-	-	-	-
SCAPHLR	-	-	-	-	-	-	-	-	-	-	-
SCAPHWL	-	-	-	-	-	-	-	-	-	-	-
SCAPHWR	-	-	-	-	-	-	-	-	-	-	-
TALHSIL	-	-	-	-	-	-	-	-	-	-	-
TALHSIR	-	-	-	-	-	-	-	-	-	-	-
TALHMLL	-	-	-	-	-	-	-	-	-	-	-
TALHMLR	-	-	-	-	-	-	-	-	-	-	-
LTALLAV	-	-	-	-	-	-	-	-	-	-	-
RTALLAV	-	-	-	-	-	-	-	-	-	-	-
LTALWAV	-	-	-	-	-	-	-	-	-	-	-
RTALWAV	-	-	-	-	-	-	-	-	-	-	-
TSASWL		-	-	-	-	-	-	-	-	-	-
TSASWR	27.14	-	-	-	-	-	-	-	-	-	-
LTALBHAV	-	-	-	-	-	-	-	-	-	-	-
RTALBHAV	30.88	-	-	-	-	-	-	-	-	-	-
XFMSAPL	-	-	-	-	-	-	-	-	-	-	-
XFMSAPR	26.45	-	-	-	-	-	-	-	-	-	-
XFMSMLL	-	-	-	-	-	-	-	-	-	-	-
XFMSMLR	25.87	-	-	-	-	-	-	-	-	-	-
RAPL	-	-	-	-	-	-	-	-	-	-	-
RAPR	-	-	-	-	-	-	-	-	-	-	-
UAPL	-	-	-	-	-	-	-	-	-	-	-
UAPR	-	-	-	-	-	-	-	-	-	-	-
HMDMLL	23.08	-	-	-	-	-	-	-	-	-	-
HMDMLR	17.42	-	-	-	-	-	-	-	-	-	-
FNAPL	-	-	-	-	-	-	-	-	-	-	-
FNAPR	-	-	-	-	-	-	-	-	-	-	-
FNMLL	-	-	-	-	-	-	-	-	-	-	-
FNMLR	-	-	-	-	-	-	-	-	-	-	-
FEBL	-	-	-	-	-	-	-	-	-	-	-
FEBR	-	-	-	-	-	-	-	-	-	-	-
UTDL	-	-	-	-	-	-	-	-	-	-	-
UTDR	-	-	-	-	-	-	-	-	-	-	-
Stature (in cm)	-	-	-	-	-	-	-	-	-	-	-
FMSAP	32.31	-	-	-	-	-	-	-	-	-	-
FMSML	27.03	-	-	-	-	-	-	-	-	-	-
LNAVWAV	-	14.94	-	-	-	-	-	-	-	-	-
LNAVLAV	-	40.26	-	-	-	-	-	-	-	-	-
RNAVLAV	-	40.69	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTAPL	-	-	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTSUPINFL	-	-	-	-	-	-	-	-	-	-	-
RTALARTSUR	-	-	-	31.43	-	-	-	-	-	-	-
LCALLAV	-	-	-	-	-	-	-	-	-	-	-
RCALLAV	-	50.85	-	-	-	-	-	-	-	-	-
RCALLAWAV	-	42.64	-	-	-	-	-	-	-	-	-
TALTWL	-	31.3	-	-	-	-	-	-	-	-	-
TALTWR	-	33.32	-	-	-	-	-	-	-	-	-

All metrics are in mm except Stature which is in cm. Variable abbreviations are in Addendum 12-1.

continued.

Addendum 12-3. (continued)

	S14W88	S16 W84	S10W90	S12W84	S12W84	S12W88	S14W84	S14W84	S14W86
	Level 6	Level 4	Level 14	Level 12	Level 17	Level 15	Level 14	Level 14	Level 14
	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)
AGE91	-	-	-	-	-	-	-	-	-
SEXNUM	4	4	4	4	4	4	4	4	4
MXLFEML	-	-	-	-	-	-	-	-	-
MXLFEMR	-	-	-	-	-	-	-	-	-
BILFEML	-	-	-	-	-	-	-	-	-
BILFEMR	-	-	-	-	-	-	-	-	-
MXDFEMHL	-	-	-	-	-	-	-	-	-
MXDFEMHR	-	-	-	-	-	-	-	-	-
FMSAPL	-	-	-	-	-	-	-	-	-
FMSAPR	-	-	-	-	-	-	-	-	-
FMSMLL	-	-	-	-	-	-	-	-	-
FMSMLR	-	-	-	-	-	-	-	-	-
LENTIBL	-	-	-	-	-	-	-	-	-
LENTIBR	-	-	-	-	-	-	-	-	-
PATMXHL	-	31.12	-	-	42.57	-	-	-	-
PATMXHR	-	-	-	-	-	-	-	-	-
PATMXBL	-	-	-	-	44.58	-	-	-	-
PATMXBR	-	32.97	-	-	-	-	-	-	-
MAXHUML	-	-	-	-	-	-	-	-	-
MAXHUMR	-	-	-	-	-	-	-	-	-
MAXVDHHL	-	-	-	-	-	-	-	-	-
MAXVDHHR	-	-	-	-	-	-	-	-	-
MBL	-	-	-	-	-	-	-	-	-
HMAPL	-	-	-	-	-	-	-	-	-
HMMLL	-	-	-	-	-	-	-	-	-
HMAPR	-	-	-	-	-	-	-	-	-
HMMLR	-	-	-	-	-	-	-	-	-
RMLL	-	-	-	-	-	-	-	-	-
UMLL	-	-	-	-	-	-	-	-	-
MFAB	-	-	-	-	-	-	-	-	-
TMLML	-	-	-	-	-	-	-	-	-
TAPNL	-	-	-	-	-	-	-	-	-
TAPNR	-	-	-	-	-	-	-	-	-
TMLMR	-	-	-	-	-	-	-	-	-
LMC1	-	-	-	-	-	-	-	-	-
LMC2	-	-	-	-	-	-	-	-	-
LMC3	-	-	-	-	-	-	-	-	-
LMC4	-	-	-	-	-	-	-	-	-
LMC5	-	-	-	-	-	-	-	-	-
RMC1	-	-	-	-	-	-	-	-	-
RMC2	-	-	-	-	-	-	-	-	-
RMC3	-	-	-	-	-	-	-	-	-
RMC4	-	-	-	-	-	-	-	-	-
RMC5	-	-	-	-	-	-	-	-	-
TCL	-	-	-	-	-	-	-	-	-
TDAPL	-	-	-	-	-	-	-	-	-
TDAPR	-	-	-	-	-	-	-	-	-
TDML	-	-	-	-	-	-	-	-	-
TDMR	-	-	-	-	-	-	-	-	-
FSIDNL	-	-	-	-	-	-	-	-	-
FSIDNR	-	-	-	-	-	-	-	-	-
MT1APBL	-	-	-	-	-	-	-	-	-
MT1APBR	-	-	-	-	-	-	-	-	-
MT1MLBL	-	-	-	-	-	-	-	-	-
MT1MLBR	-	-	-	-	-	-	-	-	-
MT2APBL	-	-	-	-	-	-	-	-	-
MT2APBR	-	-	-	-	-	-	-	-	-
MT2MLBL	-	-	-	-	-	-	-	-	-
MT2MLBR	-	-	-	-	-	-	-	-	-
MT3APBL	-	-	-	-	-	-	-	-	-
MT3APBR	-	-	-	-	-	-	-	-	-
MT3MLBL	-	-	-	-	-	-	-	-	-
MT3MLBR	-	-	-	-	-	-	-	-	-
MT4APBL	-	-	-	-	-	-	-	-	-
MT4APBR	-	-	-	-	-	-	-	-	-
MT4MLBL	-	-	-	-	-	-	-	-	-
MT4MLBR	-	-	-	-	-	-	-	-	-
MT5APBL	-	-	-	14.29	-	-	-	-	-
MT5APBR	12.08	-	-	-	-	-	-	-	-
MT5MLBL	-	-	-	14.32	-	-	-	-	-
MT5MLBR	19.79	-	-	-	-	-	-	-	-
MC1APBL	-	-	-	-	-	-	-	-	14.58
MC1APBR	-	-	-	-	-	-	-	-	-
MC1MLBL	-	-	-	-	-	-	-	-	13.88
MC1MLBR	-	-	-	-	-	-	-	-	-
MC2APBL	-	-	-	-	-	-	-	-	-
MC2APBR	-	-	-	-	-	-	-	-	-
MC2MLBL	-	-	-	-	-	-	-	-	-
MC2MLBR	-	-	-	-	-	-	-	-	-
MC3APBL	-	-	-	-	-	-	-	-	-
MC3APBR	-	-	-	-	-	-	-	-	-

continued.

Addendum 12-3. (continued)

	S14W88	S16 W84	S10W90	S12W84	S12W84	S12W88	S14W84	S14W84	S14W86
	Level 6	Level 4	Level 14	Level 12	Level 17	Level 15	Level 14	Level 14	Level 14
	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)	(Loose bone)
MC3MLBL	-	-	-	-	-	-	-	-	-
MC3MLBR	-	-	-	-	-	-	-	-	-
MC4APBL	-	-	-	-	-	-	-	-	-
MC4APBR	-	-	-	-	-	-	-	-	-
MC4MLBL	-	-	-	-	-	-	-	-	-
MC4MLBR	-	-	-	-	-	-	-	-	-
MC5APBL	-	-	-	-	-	-	-	-	-
MC5APBR	-	-	-	-	-	-	-	-	-
MC5MLBL	-	-	-	-	-	-	-	-	-
MC5MLBR	-	-	-	-	-	-	-	-	-
SGFSIL	-	-	-	-	-	-	-	-	-
SGFSIR	-	-	-	-	-	-	-	-	-
SGFMLL	-	-	-	-	-	-	-	-	-
SGFMLR	-	-	-	-	-	-	-	-	-
LUNLL	-	-	-	-	-	15.9	-	-	-
LUNLR	-	-	-	-	-	-	-	-	17.88
LUNHL	-	-	-	-	-	11.88	-	-	-
LUNHR	-	-	-	-	-	-	-	-	13.59
CAPBLL	-	-	-	-	-	-	-	-	-
CAPBLR	-	-	-	-	-	-	-	-	-
CAPBHL	-	-	-	-	-	-	-	-	-
CAPBHR	-	-	-	-	-	-	-	-	-
HMDAPL	-	-	-	-	-	-	-	-	-
HMDMLL	-	-	-	-	-	-	-	-	-
HMDAPR	-	-	-	-	-	-	-	-	-
RMTAPL	-	-	-	-	-	-	-	-	-
RMTAPR	-	-	-	-	-	-	14.9	-	-
RMTMLL	-	-	-	-	-	-	-	-	-
RMTMLR	-	-	-	-	-	-	16.34	-	-
SCAPHLL	-	-	-	-	-	-	-	-	-
SCAPHLR	-	-	25.77	-	-	-	-	-	-
SCAPHWL	-	-	-	-	-	-	-	-	-
SCAPHWR	-	-	-	-	-	-	-	-	-
TALHSIL	-	-	-	-	-	-	-	-	-
TALHSIR	-	-	-	-	-	-	-	-	-
TALHMLL	-	-	-	-	-	-	-	-	-
TALHMLR	-	-	-	-	-	-	-	-	-
LTALLAV	-	-	-	-	-	-	-	-	-
RTALLAV	-	-	-	-	-	-	-	-	-
LTALWAV	-	-	-	-	-	-	-	-	-
RTALWAV	-	-	-	-	-	-	-	-	-
TSASWL	-	-	-	-	-	-	-	-	-
TSASWR	-	-	-	-	-	-	-	-	-
LTALBHAV	-	-	-	-	-	-	28.6	26.5	-
RTALBHAV	-	-	-	-	-	-		-	-
XFMSAPL	-	-	-	-	-	-	-	-	-
XFMSAPR	-	-	-	-	-	-	-	-	-
XFMSMLL	-	-	-	-	-	-	-	-	-
XFMSMLR	-	-	-	-	-	-	-	-	-
RAPL	-	-	-	-	-	-	-	-	-
RAPR	-	-	-	-	-	-	-	-	-
UAPL	-	-	-	-	-	-	-	-	-
UAPR	-	-	-	-	-	-	-	-	-
HMDMLL	-	-	-	-	-	-	-	-	-
HMDMLR	-	-	-	-	-	-	-	-	-
FNAPL	-	-	-	-	-	-	-	-	-
FNAPR	-	-	-	-	-	-	-	-	-
FNMLL	-	-	-	-	-	-	-	-	-
FNMLR	-	-	-	-	-	-	-	-	-
FEBL	-	-	-	-	-	-	-	-	-
FEBR	-	-	-	-	-	-	-	-	-
UTDL	-	-	-	-	-	-	-	-	-
UTDR	-	-	-	-	-	-	-	-	-
Stature (in cm)	-	-	-	-	-	-	-	-	-
FMSAP	-	-	-	-	-	-	-	-	-
FMSML	-	-	-	-	-	-	-	-	-
LNAVWAV	-	-	-	-	-	-	-	-	-
LNAVLAV	-	-	-	-	-	-	-	-	-
RNAVLAV	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTAPL	-	-	-	-	-	-	-	-	-
CLAVMIDSHAFTSUPINFL	-	-	-	-	-	-	-	-	-
RTALARTSUR	-	-	-	-	-	-	-	-	-
LCALLAV	-	-	-	-	-	-	-	-	-
RCALLAV	-	-	-	-	-	-	-	-	-
RCALLAWAV	-	-	-	-	-	-	-	-	-
TALTWL	-	-	-	-	-	-	-	-	-
TALTWR	-	-	-	-	-	-	-	-	-

All metrics are in mm except Stature which is in cm. Variable abbreviations are in Addendum 12-1.

continued.

Addendum 12-3. (continued)

	S15W84 Level 13 (Loose bone)	S16W84 Level 14 (Loose bone)	S16W86 Level 10 (Loose bone)	S16W86 Level 12 (Loose bone)	S16W86 Level 11 (Loose bone)	S16W86 Level 14 (Loose bone)
AGE91	-	-	-	-	-	-
SEXNUM	4	4	4	4	4	-
MXLFEML	-	-	-	-	-	-
MXLFEMR	-	-	-	-	-	-
BILFEML	-	-	-	-	-	-
BILFEMR	-	-	-	-	-	-
MXDFEMHL	-	-	-	-	-	-
MXDFEMHR	-	-	-	-	-	-
FMSAPL	-	-	-	-	-	-
FMSAPR	-	-	-	-	-	-
FMSMLL	-	-	-	-	-	-
FMSMLR	-	-	-	-	-	-
LENTIBL	-	-	-	-	-	-
LENTIBR	-	-	-	-	-	-
PATMXHL	-	-	-	-	-	35.19
PATMXHR	-	-	-	-	-	-
PATMXBL	-	-	-	-	-	36.72
PATMXBR	-	-	-	-	-	-
MAXHUML	-	-	-	-	-	-
MAXHUMR	-	-	-	-	-	-
MAXVDHHL	-	-	-	-	-	-
MAXVDHHR	-	-	-	-	-	-
MBL	-	-	-	-	-	-
HMAPL	-	-	-	-	-	-
HMMLL	-	-	-	-	-	-
HMAPR	-	-	-	-	-	-
HMMLR	-	-	-	-	-	-
RMLL	-	-	-	-	-	-
UMLL	-	-	-	-	-	-
MFAB	-	-	-	-	-	-
TMLML	-	-	-	-	-	-
TAPNL	-	-	-	-	-	-
TAPNR	-	-	-	-	-	-
TMLMR	-	-	-	-	-	-
LMC1	-	-	-	-	-	-
LMC2	-	-	-	-	-	-
LMC3	-	-	-	-	-	-
LMC4	-	-	-	-	-	-
LMC5	-	-	-	-	-	-
RMC1	-	-	-	-	-	-
RMC2	-	-	-	-	-	-
RMC3	-	-	-	-	-	-
RMC4	-	-	-	-	-	-
RMC5	-	-	-	-	-	-
TCL	-	-	-	-	-	-
TDAPL	-	-	-	-	-	-
TDAPR	-	-	-	-	-	-
TDML	-	-	-	-	-	-
TDMR	-	-	-	-	-	-
FSIDNL	-	-	-	-	-	-
FSIDNR	-	-	-	-	-	-
MT1APBL	-	-	-	-	-	-
MT1APBR	-	-	25.17	-	-	-
MT1MLBL	-	-	-	-	-	-
MT1MLBR	-	-	-	-	-	-
MT2APBL	-	-	-	-	-	-
MT2APBR	-	-	-	-	-	-
MT2MLBL	-	-	-	-	-	-
MT2MLBR	-	-	-	-	-	-
MT3APBL	-	-	-	-	-	-
MT3APBR	-	-	-	-	-	-
MT3MLBL	-	-	-	-	-	-
MT3MLBR	-	-	-	-	-	-
MT4APBL	-	-	-	-	-	-
MT4APBR	-	-	-	-	-	-
MT4MLBL	-	-	-	-	-	-
MT4MLBR	-	-	-	-	-	-
MT5APBL	-	13.86	-	-	12.96	-
MT5APBR	-	-	-	-	-	-
MT5MLBL	-	18.26	-	-	17.23	-
MT5MLBR	-	-	-	-	-	-
MC1APBL	-	-	-	-	-	-
MC1APBR	-	-	-	-	-	-
MC1MLBL	-	-	-	-	-	-
MC1MLBR	-	-	-	-	-	-
MC2APBL	-	-	-	-	-	-
MC2APBR	-	-	-	-	-	-
MC2MLBL	-	-	-	-	-	-
MC2MLBR	-	-	-	-	-	-
MC3APBL	-	-	-	-	-	-
MC3APBR	-	-	-	-	-	-

continued.

Addendum 12-3. (concluded)

	S15W84 Level 13 (Loose bone)	S16W84 Level 14 (Loose bone)	S16W86 Level 10 (Loose bone)	S16W86 Level 12 (Loose bone)	S16W86 Level 11 (Loose bone)	S16W86 Level 14 (Loose bone)
MC3MLBL	-	-	-	-	-	-
MC3MLBR	-	-	-	-	-	-
MC4APBL	-	-	-	-	-	-
MC4APBR	-	-	-	-	-	-
MC4MLBL	-	-	-	-	-	-
MC4MLBR	-	-	-	-	-	-
MC5APBL	-	-	-	-	-	-
MC5APBR	-	-	-	-	-	-
MC5MLBL	-	-	-	-	-	-
MC5MLBR	-	-	-	-	-	-
SGFSIL	-	-	-	-	-	-
SGFSIR	-	-	-	-	-	-
SGFMLL	-	-	-	-	-	-
SGFMLR	-	-	-	-	-	-
LUNLL	-	-	-	16.85	16.13	-
LUNLR	11.92	-	-	15.17	-	-
LUNHL	-	-	-	-	14.42	-
LUNHR	9.91	-	-	14.05	-	-
CAPBLL	-	-	-	-	-	-
CAPBLR	-	-	-	-	-	-
CAPBHL	-	-	-	-	-	-
CAPBHR	-	-	-	-	-	-
HMDAPL	-	-	-	-	-	-
HMDMLL	-	-	-	-	-	-
HMDAPR	-	-	-	-	-	-
RMTAPL	-	-	-	-	-	-
RMTAPR	-	-	-	-	-	-
RMTMLL	-	-	-	-	-	-
RMTMLR	-	-	-	-	-	-
SCAPHLL	-	-	-	-	-	-
SCAPHLR	-	-	-	-	-	-
SCAPHWL	-	-	-	-	-	-
SCAPHWR	-	-	-	-	-	-
TALHSIL	-	-	-	-	-	-
TALHSIR	-	-	-	-	-	-
TALHMLL	-	-	-	-	-	-
TALHMLR	-	-	-	-	-	-
LTALLAV	-	-	-	-	-	-
RTALLAV	-	-	-	-	-	-
LTALWAV	-	-	-	-	-	-
RTALWAV	-	-	-	-	-	-
TSASWL	-	-	-	-	-	-
TSASWR	-	-	-	-	-	-
LTALBHAV	-	-	-	-	-	-
RTALBHAV	-	-	-	-	-	-
XFMSAPL	22.53	-	-	-	-	-
XFMSAPR	-	-	-	-	-	-
XFMSMLL	33.45	-	-	-	-	-
XFMSMLR	-	-	-	-	-	-
RAPL	-	-	-	-	-	-
RAPR	-	-	-	-	-	-
UAPL	-	-	-	-	-	-
UAPR	-	-	-	-	-	-
HMDMLL	-	-	-	-	-	-
HMDMLR	-	-	-	-	-	-
FNAPL	-	-	-	-	-	-
FNAPR	-	-	-	-	-	-
FNMLL	-	-	-	-	-	-
FNMLR	-	-	-	-	-	-
FEBL	-	-	-	-	-	-
FEBR	-	-	-	-	-	-
UTDL	-	-	-	-	-	-
UTDR	-	-	-	-	-	-
Stature (in cm)	-	-	-	-	-	-
FMSAP	-	-	-	-	-	-
FMSML	-	-	-	-	-	-
LNAVWAV	-	-	-	-	-	-
LNAVLAV	-	-	-	-	-	-
RNAVLAV	-	-	-	-	-	-
CLAVMIDSHAFTAPL	-	-	-	-	-	-
CLAVMIDSHAFTSUPINFL	-	-	-	-	-	-
RTALARTSUR	-	-	-	-	-	-
LCALLAV	-	-	-	-	-	-
RCALLAV	-	-	-	-	-	-
RCALLAWAV	-	-	-	-	-	-
TALTWL	-	-	-	-	-	-
TALTWR	-	-	-	-	-	-

All metrics are in mm except Stature which is in cm. Variable abbreviations are in Addendum 12-1.

Chapter 13

Dental Analysis

Christopher Stojanowski

Dentition offers an abundance of information on basic life history, such as age at death, an individual's sex, and health conditions related to the oral environment. This information may have inferential applications to the reconstruction of paleodiet. Dentition is so inference-rich that even a single tooth can provide all of this information, although admittedly this depends on the specific tooth and its preservation. Fortunately, dental enamel is the hardest substance in the human body and resists deterioration to a much greater degree than do the osseous portions of the human osteodental system. For this reason, much of the information we present on individuals from Buckeye Knoll derives from dental anthropological analysis.

The dental analysis used here followed protocols of the Standards Manual (Buikstra and Ubelaker 1994), with a few additions, as appropriate. Data recorded included: inventory, dental development, dental eruption, dental attrition, caries (cavities), abscesses, antemortem tooth loss, alveolar resorption, dental calculus (mineralized dental tartar), dental metrics, dental morphology, dental malocclusion data, and dental anomalies. Data for both right and left sides were recorded.

Inventory

The dental inventory consisted of two components: teeth affiliated with burial numbers, which due to their commingled nature are best referred to as burial lots, and teeth not affiliated with burial numbers. The latter were recovered independently in the field, discovered in matrix during laboratory processing, or recovered during the course of wet screening at the site. Often, loose teeth could be assigned to a unit or unit quadrant but could not be re-associated with a specific burial. As will be discussed below, many of the burials were commingled such that the issue of discreteness was moot.

Because a great majority of burial-associated and non-associated dental remains were loose, (i.e., not recovered in the maxilla or mandible), the first task was to assign, as specifically as possible, each tooth to an exact position within the tooth row (for example, maxillary right premolar 1). This was done visually and with reference to actual dentitions from the Windover population, as well as using criteria from standard dental and osteological textbooks (Bass 1995; White and Folkens 1999). We adopted a conservative strategy and did NOT attempt to specifically identify loose teeth that were isolated and heavily worn as we find the accuracy to be suspect. While this makes our assessments conservative, we also struggled with teeth, which could not be assigned a specific position and therefore were excluded from all summary analyses (for example, a left maxillary premolar that could not be assigned a number, a lower first molar that could not be sided, etc.). While siding loose teeth is generally straightforward, even for very worn examples, assessing tooth number for non-associated, heavily worn teeth is very difficult because criteria for establishing position within the tooth row are often based on comparative morphology (for example, M1 size, cusp number >M2 >M3).

Once identified, we used the following abbreviations to specify tooth position, and we refer to these throughout the report. Deciduous teeth are identified as lower case and in some instances the code is preceded by a “d” (i.e., dlxm1) depending on context. Coding is as follows: L = left; R = right; X = maxillary; N = mandibular; I = incisor; C = canine; P = premolar; M = molar. Numbers follow standard conventions (1,2,3) with use of 1,2 rather than 3,4 for adult premolars and retention of common (although technically incorrect) nomenclature of referring to deciduous posterior teeth as molars (by definition molars have no deciduous homologue; however, few prescribe to this cannon in practice). For example, LXM1 is a left maxillary first molar, RNP2 is a right mandibular second premolar. To avoid potential typographical errors we used two symbols to differentiate deciduous from adult dentition. Adult teeth are always written in capital letters while deciduous teeth are written in lower-case letters. In addition, deciduous teeth are prefaced with a lower-case “d.” For example, LXM1 is a left maxillary adult first molar and dlxm1 is a left maxillary deciduous first molar. LXM1/2 is either a left maxillary first or second molar, XM1 is an unsided maxillary first molar, LX/NM1 is a left maxillary OR mandibular first molar, etc. A full listing of dental variables and their abbreviations is given in Addendum 13-1.

Inventorying Burial Lots

Teeth were identified by type, then maxillary or mandibular, then side, then number. Identification of a single individual was based on the tooth condition (root texture, crown preservation), fit of interproximal contact facets (between contiguous teeth), and crown attrition (which should be consistent throughout the dental row). Additional individuals were specified in burial lots when a tooth, or multiple teeth, were found that could not, within reason, belong to the primary burial. Such reasons included: (1) element replication, (2) gross disparity in dental attrition, excluding consideration of third molars, and (3) differences in age as evidenced by dental formation stage. Once individuals were segregated, each tooth was assigned an inventory category from the Standards manual (Buikstra and Ubelaker 1994:Table 2). These categories were as follows:

> (1) Present, but not in occlusion. This refers to teeth that are unworn and have not yet reached the occlussal plane and were therefore in the process of formation and eruption at time of death. These teeth figure prominently in our subadult age estimates. These teeth are NOT included in MNI estimates for the purposes of calculating population frequencies for caries, calculus, abscessing, and dental morphological variables.

(2) Present, development completed, in occlusion. This refers to teeth that are completely formed and actively being used at the time of death. These teeth are included in MNI estimates for the purposes of calculating population frequencies for caries, calculus, abscessing, and dental morphological variables.

(3) Missing, with no associated alveolar bone. These teeth are NOT included in MNI estimates for the purposes of calculating population frequencies for caries, calculus, abscessing, and dental morphological variables.

(4) Missing, with alveolus resorbing or fully resorbed: e.g., premortem loss. These teeth are NOT included in MNI estimates for the purposes of calculating population frequencies for caries, calculus, abscessing, and dental morphological variables.

(5) Missing, with no alveolar resorption: e.g., postmortem loss. These teeth are NOT included in MNI estimates for the purposes of calculating population frequencies for caries, calculus, and dental morphological variables, but ARE included in MNI estimates for the purposes of calculating population frequencies for abscessing.

(6) Missing, congenital absence. These teeth are NOT included in MNI estimates for the purposes of calculating population frequencies for caries, calculus, abscessing, and dental morphological variables.

(7) Present, damage renders measurement impossible, but other observations are recorded. These teeth are included in MNI estimates for the purposes of calculating population frequencies for caries, calculus, abscessing, and dental morphological variables.

(8) Present, but unobservable (e.g., deciduous or permanent tooth in crypt). These teeth are NOT included in MNI estimates for the purposes of calculating population frequencies for caries, calculus, abscessing, and dental morphological variables.

Dental Development

The development phase for each tooth was also recorded in accordance with the Standards manual (Buikstra and Ubelaker 1994). The following stages were used:

1. Initial cusp formation (Ci)
2. Coalescence of cusps (Cco)
3. Cusp outline complete (Coc)
4. Crown 1/2 complete (Cr1/2)
5. Crown 3/4 complete (Cr3/4)
6. Crown complete (Crc)
7. Initial root formation (Ri)
8. Initial cleft formation (C1i)
9. Root length 1/4 (R1/4)
10. Root length 1/2 (R1/2)
11. Root length 3/4 (R3/4)
12. Root length complete (Rc)
13. Apex half closed (A1/2)
14. Apex closed (Ac)

Dental Attrition

Dental attrition scores were recorded for both left and right sides of the maxillary and mandibular dentition using the scoring criteria in the Standards manual (Buisktra and Ubelaker 1994). For premolars, canines, and incisors, an eight-point scale was used (see Buikstra and Ubelaker 1994:52). This system reflects Smith's (1984) modification of the scoring system developed by Murphy (1959). For molars, Scott's (1979) quadrant scoring system was used where each molar crown quadrant was assigned a wear grade from 0 to 10 and the total summed to 0 to 40 (Buikstra and Ubelaker 1994:53).

Dental Caries

Dental caries reflect the action of specific species of bacteria, which inhabit the oral environment. These species thrive in specific environments, usually those rich in processable carbohydrates (sugars), and produce, as a by-product of their metabolism, acids that demineralize the enamel and dentine. Caries have been used most effectively in North American bioarchaeology as a simple, macroscopic measure of prehistoric diet since their rates within a population are sensitive to carbohydrate consumption: caries rates increase when maize assumes a more dominant position within paleodiets (Larsen 1997). The presence of dental caries was noted for all teeth using the scoring system in Buikstra and Ubelaker (1994). Seven different types of caries were recorded:

(1) Occlusal surface caries. These occur on the occlusal surface of the tooth, usually found in the fissures and pits of the molars.

(2) Interproximal surface caries. These occur on the mesiodistal vertical surfaces of the crown and cervical regions between two teeth.

(3) Smooth surface caries. These occur on the buccal and lingual vertical surfaces of teeth, but not in any grooves or pits that may be located there.

(4) Cervical caries. These occur at the cemento-enamel junction on the buccal and lingual surfaces.

(5) Large caries. These affect more of an area than any of the locations described above.

(6) Noncarious pulp exposure. These represent large pits in the occlusal surface of a tooth. They reflect excessive wear and pulp exposure rather than enamel and dentine demineralization resulting from cariogenic bacteria metabolism.

In keeping with protocols established in the Standards manual, noncarious pulp exposure was recorded but not tabulated in the caries frequencies.

Abscesses

Dental abscesses reflect a sequellae of severe dental attrition resulting in 1) pulp chamber exposure and subsequent infection, 2) large dental caries that penetrate the pulp chamber resulting in subsequent infection, or 3) dental cracking that allows bacteria to invade the pulp chamber resulting in subsequent infection. Although technically affecting the bone surrounding tooth roots, their manner of development suggests incorporation into the dental anthropological discussion. The presence of dental abscessing was noted for all teeth using the scoring system in Buikstra and Ubelaker (1994). Two types of abscesses were recorded: 1) buccal or labial perforations and 2) lingual perforations.

Calculus

Calculus is mineralized plaque that accumulates on the dentition, usually at the cemento-enamel junction and on those portions of the teeth nearest the salivary glands. Calculus can lead to significant gingival irritation, ultimately resulting in infection of soft tissue and periodontal resorption and subsequent tooth loss. Although dietary signatures have been related to calculus severity in a population, there is really no clear relationship between diet and calculus (Lieverse 1999), and its utility in anthropological inference remains somewhat limited. The presence of dental calculus was noted for all teeth using the scoring system in Buikstra and Ubelaker (1994). Three grades were recorded: 1) small amount of calculus, 2) moderate amount of calculus, and 3) large amount of calculus. In addition, the location of the calculus on the tooth was recorded: buccal, lingual, mesial, distal, labial, or all surfaces.

Dental Metrics

Dental metrics were recorded using crown measurements (definition in Buikstra and Ubelaker 1994) derived originally from Mayhall (1992) and Moorrees (1957). For the tooth crown, three measurements were recorded. Mesiodistal dimensions were recorded to the nearest tenth of a millimeter for both left and right sides using Hillson-Fitzgerald calipers. We used maximum tooth size rather than interproximal tooth size for all teeth. Visibly worn teeth were not measured, if it was felt they would compromise the integrity of the dental measure of the crown or neck dimensions (excluding crown height measures). Buccolingual dimensions were recorded perpendicular to the mesiodistal dimensions to the nearest tenth of a millimeter for left and right sides using Hillson-Fitzgerald calipers. Crown heights were recorded to the nearest tenth of a millimeter for left and right sides using Hillson-Fitzgerald calipers to the nearest tenth of a millimeter for left and right sides. For anterior teeth, crown heights were recorded along the long axis of the tooth crown from the most apical portion of the cemento-enamel junction to the midpoint of the crown on the facial surface of the tooth. For molars, crown height was measured from the cemento-enamel junction to the highest point on the occlusal surface of the mesiobuccal cusp. In unworn teeth, this point reflected the center of the cusp. Because crown heights are often used as a measure of age in prehistoric samples, data were recorded for all teeth, regardless of wear, unless the cemento-enamel junction itself had been obliterated. In addition, we recorded mesiodistal and buccolingual cervical dimensions using the measurement definitions of Corruccini (1977). These data were recorded using Hillson-Fitzgerald calipers to the nearest tenth of a millimeter for left and right sides. All measurements were recorded by Stojanowski to avoid inter-observer error and to ensure maximum compatibility with published data.

Dental Morphology

Dental morphology was recorded using the Arizona State University (ASU) scoring system (Scott and Turner 1997). Data were recorded using the ASU plaques; such recording was performed under bright light after cleaning off all matrix from the dentition. All observations were recorded by Stojanowski to avoid inter-observer error. Although initial efforts were made to record all of the ASU traits, sample sizes were so small for some that we excluded them from our report (root number, radical number). The list of recorded variables is presented in Table 13-1. In addition, we attempted to record information on malocclusion and several classes of dental anomalies that are not typically recorded in a descriptive osteological report (Table 13-2). These variables are based on definitions in Alt (1997). Unfortunately, poor preservation precluded recording much of this information. We nonetheless want to inform the reader of our intent, and we propose that this becomes a traditional and important part of detailed dental inventories, particularly for materials that are subject to repatriation thereby precluding further analysis.

Analyses Using Dental Data

Age Estimation

Age estimation was effectively divided into two components, one for subadults and young adults and one for older adults only.

Subadults

Subadult age estimation was based on three criteria: dental formation, dental eruption, and dental attrition. These produce relatively accurate subadult age estimates with smaller age ranges. The amount of missing data and poor preservation of the remains required a more informal approach to subadult age estimation than might be desired. While complex statistical regression techniques exist (e.g., Bolanos et al. 2000) we were unable to use these methods because of the amount of missing data we encountered. We, therefore, used normative longitudinal data on dental formation and eruption, combined with information on the amount of dental attrition on specific teeth, to derive an age estimate for each individual. Several examples should demonstrate our methodology.

Table 13-1. Dental Morphological Variables.

1.	Winging	28.	M2 cusp 5	55.	M2 groove pattern
2.	Labial curvature	29.	M1 cusp 5	56.	M1 groove pattern
3.	C shovel	30.	M3 Carabelli's cusp	57.	M3 cusp number
4.	I2 shovel	31.	M2 Carabelli's cusp	58.	M2 cusp number
5.	I1 shovel	32.	M1 Carabelli's cusp	59.	M1 cusp number
6.	P2 double shovel	33.	M3 parastyle	60.	M1 deflecting wrinkle
7.	P1 double shovel	34.	M2 parastyle	61.	M3 protoconid
8.	Canine double shovel	35.	M1 parastyle	62.	M2 protoconid
9.	I2 double shovel	36.	M3 enamel extension	63.	M1 protoconid
10.	I1 double shovel	37.	M2 enamel extension	64.	M3 cusp 5
11.	I2 IP groove	38.	M1 enamel extension	65.	M2 cusp 5
12.	I1 IP groove	39.	P2 enamel extension	66.	M1 cusp 5
13.	C tuberculum dentale	40.	P1 enamel extension	67.	M3 cusp 6
14.	I2 tuberculum dentale	41.	M3 peg-shaped tooth	68.	M2 cusp 6
15.	I1 tuberculum dentale	42.	I2 peg-shaped tooth	69.	M1 cusp 6
16.	C mesial ridge	43.	P2 odontome	70.	M3 cusp 7
17.	C dist acc. cusp	44.	P1 odontome	71.	M2 cusp 7
18.	P2 MD cusps	45.	M3 agenesis	72.	M1 cusp 7
19.	P1 MD cusps	46.	P2 agenesis	73.	M3 enamel extension
20.	Uto-Aztecan premolar	47.	I2 agenesis	74.	M2 enamel extension
21.	M3 metacone	48.	I2 shovel	75.	M1 enamel extension
22.	M2 metacone	49.	I1 shovel	76.	P2 odontome
23.	M1 metacone	50.	C dist. acc. Cusp	77.	P1 odontome
24.	M3 hypocone	51.	P2 lingual cusps	78.	M3 agenesis
25.	M2 hypocone	52.	P1 lingual cusps	79.	P2 agenesis
26.	M1 hypocone	53.	M1 anterior fovea	80.	I2 agenesis
27.	M3 cusp 5	54.	M3 groove pattern		

See Alt (1997) for a discussion of these variables.

Table 13-2. Malocclusion and Dental Anomaly Variables.

MALOCCLUSION
- Anterior crowding (mandible, maxilla, both)
- Malposition of anterior teeth (rotation, tipping, displacement)
- Dysgnathia (Angle Class I, II, III)
- Diastema (Trema, other)
- Sagital malocclusion (overjet, anterior crossbite)
- Vertical malocclusion (open bite, over bite)
- Transversal malocclusion (to left, to right)
- Malposition of posterior teeth (rotation, tipping, displacement)
- Posterior vertical malocclusion (open bite, over bite)
- Transversal crossbite (edge-to-edge, posterior, buccal, lingual)
- Widely spaced teeth (mandible, maxilla, both)
- Transpositions

DENTAL ANOMALIES (specify tooth)
- Incisor talon cusp
- Incisor/Canine dens invaginatus
- Premolar foramen caecum
- Caniniform premolar
- Molar crown mesiodistal compression
- Accessory tooth roots
- Radix paramolaris, praemolarica, Citroen,
- Carabelli accessory roots
- Pyramidal root
- Horseshoe reduction
- Dens in dente
- Abnormal root bending
- Mesiodens tooth
- Paramolar tooth
- Distomolar tooth
- Premolar buccolingual compression
- Supplemental teeth of reduced form
- Interradicular teeth
- Fusion (synodontia), Gemination, Twinning
- Macrodontia
- Hypodontia
- False direction of eruption
- Retention/Impaction

See Alt (1997) for discussion of these variables.

Burial 4 #2 was represented by a single maxillary adult canine. The canine was unworn and therefore likely unerupted at the time of death. The range of eruption for a maxillary canine is 9 to 15 years, with a mean time of eruption around 12 years. Therefore, we can say this individual was certainly less than 15 years of age, more likely less than 12 years of age, and possibly less than 9 years of age. Although the root of the canine was broken, precluding assessment of the developmental phase of the tooth, we did record information on both crown and cervical dimensions, which is only possible if the root was at least initiated at the time of death. Therefore, we can estimate the developmental phase for this individual was at least (Ri), a stage attained between 5 and 9 years of age. Overall, the age range for this individual was somewhere between 5 and 12 years of age.

Burial 7 #3 was represented by a single mandibular third molar. The molar was barely worn, indicating recent eruption into occlusion. Because the age of eruption of third molars is between 18 and 21 years of age, and the amount of wear indicates death slightly after eruption, we estimated a broad range of death between 18 and 25 years.

Burial 33 was represented by a deciduous canine, first molar, and second molar and adult first and second molars. All deciduous teeth were worn flat, indicating they were not recently erupted. Because the deciduous second molar erupts around 2 years of age (the last of the deciduous dentition to emerge), we know this individual was at least several years older than this (to account for eruption followed by significant attrition). These three deciduous teeth are lost between the ages of 7.5 and 12.5 years, and their presence indicates an age at death less than 12.5 years (conservatively). Both adult molars were unworn, suggesting they had not yet erupted. The second molar erupts around age 12 and the first molar between 5 and 9 years. Developmental phase for the first molar was unobservable, but crown and cervical dimensions were recorded and indicated a stage of at least (Ri) which suggests an age greater than 4 years. The second molar was at developmental stage (Crc), which occurs between 6 and 10 years of age. The age range for this individual was probably around 6 to 8 years.

This informal, yet often multifactoral, process of age estimation for subadults was applied to all remains with associated burial lots. Results for subadults are presented in Table 13-3.

Adults

Adult age estimation relied almost exclusively on dental attrition. Following the procedures of the Standards Manual (Buikstra and Ubelaker 1994), dental attrition was scored on an 8-point scale for the incisors, canines, and premolars, while molars were scored using a quadrant scale where each quadrant could range from 0 to10 and each molar could be scored an aggregate of 0 to 40. Turning these attrition grades into an estimate of chronological age was considerably more difficult and required knowledge of both the age of eruption of the individual teeth, particularly the molars, and the rate of wear as determined through independent skeletal indicators. As it turned out, this latter requirement was most problematic. In addition, using a seriation technique assumed that wear progressed through stages in a linear, consistent fashion. Examination of the data, particular the molar series differentials, suggests this was not the case; that is, the rate of wear varied with age such that a linear model was not entirely appropriate. Multiple steps, described below, were used to obviate some of these concerns.

Step 1: Collapse similar wear variables to remove missing data cells and generate consensus age point estimates for each individual. To simplify the dataset and alleviate some of the missing data problems, we averaged left and right, and mandibular and maxillary scores for each posterior tooth type. This resulted in each individual having a single M1, M2, and M3 wear score, which, while somewhat variable, were generally consistent. We also noted general similarity among anterior tooth attrition scores and generated a single modal value for anterior attrition for each individual.

Step 2: Evaluate data for appropriateness of seriation method. A simple seriation method of dental-attrition age estimation uses recorded wear scores and relates these to independently determined age-at-death estimates. Because the sequence of molar eruption is M1> M2> M3 and the mean ages of eruption are 6 years, 12 years, 18 years, respectively, locating one individual with a recently erupted M2 and an observable M1 should indicate the rate of wear between the ages of 6 and 12. Similarly, an individual with a recently erupted M3 and an observable M2 should indicate the rate of wear between the ages of 12 and 18. When combined with individuals for whom chronological age is estimated based on independent skeletal morphological observations (for example, pubic symphysis metamorphosis, auricular surface changes, cranial suture closure, etc.) one can generate a regression model of wear by age and estimate the chronological ages for unknown individuals. This process assumes a steady rate of wear throughout the life of an individual.

Examination of the data suggested this simple procedure was not appropriate, because wear does not appear to progress at a constant rate through time. This is evidenced in the Buckeye Knoll data set for both anterior and posterior tooth wear.

For the anterior dentition we have two individuals with independent age estimates. Individual 4 #1 has an anterior wear score of 7 and is estimated to be 50 to 59 years old (with a midpoint at 55 years) based on auricular surface morphology. Individual 45 has an anterior wear score of 4 and is estimated to be 25 years old based on an actively fusing medial clavicular epiphysis. Assuming the anterior dentition has an average age of eruption of around 10 years (averaging canine and second premolars with incisors and first premolars), this then results in the following rates of wear: from age 10 to 25, grade 0 becomes grade 4; progress 4 grades in 15 years = .26 grades/year. From age 10 to 55, grade 0 becomes grade 7; progress 7 grades in 45

Table 13-3. Summary of Subadult Age Estimates.

Burial	Estimated Age	Basis of estimate
1B	5-9 years	Attrition and formation of adult teeth
4 #2	5-12 years	Attrition and formation of adult teeth
5 #4	3-9 months	Attrition and eruption of deciduous teeth
6 #4	6-8 years	Attrition, formation and eruption of adult teeth
7 #2	1.5-3 years	Attrition and formation of adult teeth
7 #3	18-25 years	Attrition of adult teeth
11 #2	~7 years	Attrition and eruption of adult teeth
12	18-25 years	Aruption of adult teeth
16 #2	1-3 years	Attrition and eruption of deciduous teeth
17	8-10 years	Attrition, formation and eruption of adult teeth
18 #2	9-13 years	Attrition and eruption of adult teeth
23 #2	4-9 years	Attrition, formation, and eruption of adult and deciduous teeth
31 #2	5-11 years	Attrition and eruption of adult teeth
33	6-8 years	Attrition, formation, and eruption of adult and deciduous teeth
34 #2	4-6 years	Formation of adult teeth
37 #2	2-3 years	Attrition and formation of adult teeth
38 #2	1-2 years	Attrition and formation of adult teeth
42 #2	6-12 months	Formation of deciduous teeth
44 #4	0.5-1.5 years	Formation of deciduous teeth
44 #5	8-14 years	Formation of deciduous teeth
47 #2	1-3 years	Formation of deciduous teeth
49 #2	0.5-1.5 years	Formation of deciduous teeth
50 #2	4-11 years	Attrition of adult teeth
54	12-15 years	Attrition of adult teeth
58	5-6 years	Attrition and eruption of adult teeth
59 #2	2-3.5 years	Attrition and formation of deciduous teeth
60	5-7 years	Attrition, formation, and eruption of adult and deciduous teeth
62 #3	6-8 years	Attrition and eruption of adult teeth
66 #2	4-8 years	Attrition, formation and eruption of adult teeth
67 #2	2-3 years	Attrition, formation, and eruption of deciduous teeth
68	5-6 years	Attrition and formation of adult teeth
69 #2	<8 years	Eruption of adult teeth
71 #2	~1 year	Attrition, formation, and eruption of deciduous teeth
74 #2	0.5-1.0 year	Attrition, formation, and eruption of deciduous teeth

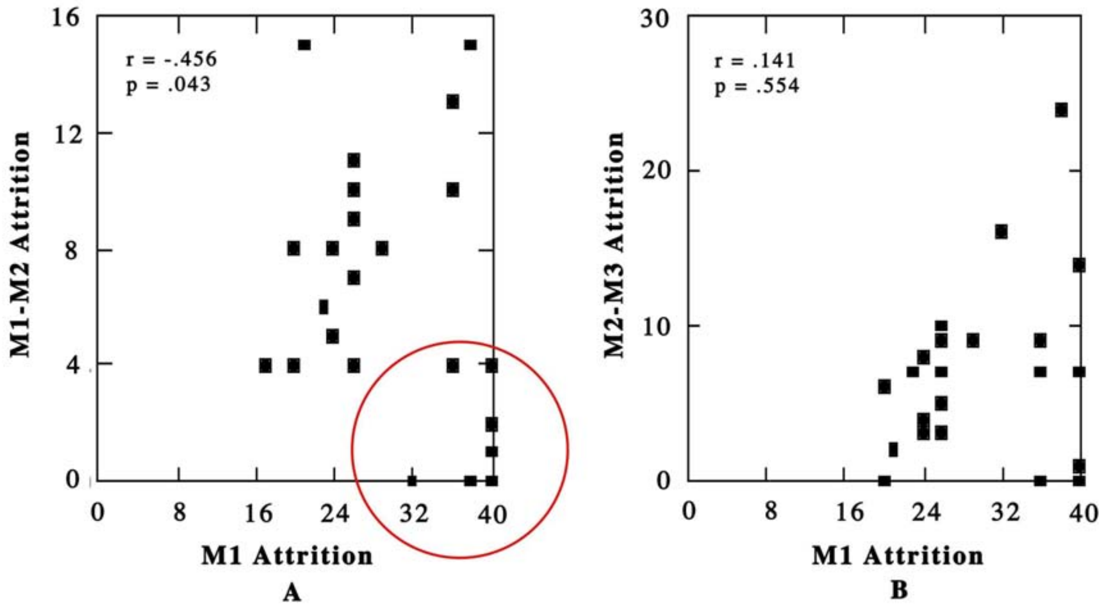


Figure 13-1. M1 attrition grade plotted against M1-M2 and M2-M3 attrition grades for Buckeye Knoll.

years = .15 grades/year. Or, from age 25 to 55, grade 4 becomes grade 7; progress 3 grades in 30 years = .10 grades/year.

This indicates the rate of wear is not consistent and actually slows down as the individual ages, from .26 grades per year to .10 per year. The average rate of wear overall is .15 grades per year, or somewhere in the middle of both end-point estimates, as expected.

Similar data are presented for the posterior dentition. Although we did not have a single burial with a recently erupted M2 that also had an observable M1, Individual 12 provides an example of wear gradients for M2 and M3. This individual had an M2 wear score of 12 and unworn, recently erupted M3s indicating an M2 rate of wear of 2 grades per year—12 grades divided by 6 years on average between eruption of M2 and M3 (note the anterior and molar scores are not recorded on the same scale). However M2-M3 wear comparisons were not stable throughout all age ranges, with differences ranging from 1 to 12 grades. That is, some individuals had M2-M3 wear differentials of 1 while others had wear differentials of 12.

To examine further the relationship between wear gradients within the posterior tooth row, we generated a series of bivariate plots of raw molar attrition scores by M1-M2 and M2-M3 residuals. Results for M1 are presented in Figure 13-1. The correlation between M1 wear, which increases with age, and the residual wear for M1-M2 is negative (r=-.456) and significantly different from 0 (p=.043); variation in M1-M2 residual increases with age. The correlation between M1 wear and the residual wear for M2-M3 is positive (r=.141) and not significantly different from 0 (p=.554); variation in M2-M3 residual also increases with age. The correlations in both cases are likely not accurate because the relationship between variables is clearly not linear. In fact, further consideration of Figure 13-1 shows that some individuals with advanced M1 wear (35+) have large M1-M2 residuals, whereas others have 0 M1-M2 residuals. We argue the latter (circled within Figure 13-1) are actually the oldest individuals in the population; those individuals whose degree of M1 attrition approached the limitations of the measurement scale, which allowed M2 and M3 wear to "catch up" with M1 wear scores. These individuals, as well as others for whom missing data precluded their inclusion in this figure (Burials 1B Skull 1, 5, 5 #3, 6 #3, 7, 9, 18, 27, 30, 31, 34, 37, and 44 #3), would be under-aged by the attrition seriation method. If these individuals are excluded, the correlations between wear gradients and age are not significantly different from 0 and low in magnitude (M1-M2, r=-.053, p=.815; M2-M3, r=.10, p=.615), meaning, if we exclude the oldest individuals (i.e., those for whom the scoring system inaccurately reflects the accumulation of time), there is no residual relationship between raw wear scores and wear differentials. This is a desirable

Table 13-4. Correlations among Attrition Scores within Individuals for Buckeye Knoll.

	Ant Wear	M1 Wear	M2 Wear	M3 Wear
Ant Wear	1.000	.0001	.0001	.0001
M1 Wear	0.935	1.000	.0001	.0001
M2 Wear	0.894	0.952	1.000	.0001
M3 Wear	0.809	0.862	0.917	1.000

(Note: correlations are below diagonal, p-values are above diagonal.)

property. Therefore, excluding these 12 individuals from the principal components analysis is justified. The remaining variation in wear grade could reflect recording inaccuracy, the crudeness of the measurement scale, variation in the eruption timing of the molars, idiosyncratic behaviors, or dietary differences.

Similar analyses for the M2 and M3 attrition scores produced similar patterns. The correlations, including the oldest individuals identified above, for M2 were: vs. M1-M2 attrition, r=-.759, p=.0001 with a decrease in variation as age increases; vs. M2-M3 attrition, r=.112, p=.639 with an increase in variation as age increases. These changed little when the oldest individuals were excluded, reflecting less sensitivity of M2 attrition scores to the "catch up" effect described for M1. The correlations, including the oldest individuals identified above, for M3 were: vs. M1-M2 attrition, r=-.715, p=.0001 with a decrease in variation as age increases; vs. M2-M3 attrition, r=-.320, p=.168 with a decrease in variation as age increases. These correlations also changed little with the exclusion of the oldest individuals in the dataset, as expected.

Step 3: Impute Missing Attrition Data. Using the aggregate anterior, M1, M2, and M3 attrition scores, we imputed missing values in the data matrix using an expectation-maximization (EM) algorithm in Systat V11. The EM procedure is an interative process that uses inter-variable correlations to maximize the best estimate for a missing data point (Wilkinson et al. 1996). While missing data imputation is a difficult decision, and one which is somewhat controversial, it does allow implementation of more advanced multivariate statistics such as that required here. We also feel justified in using this process for two reasons. First, the amount of missing data was not excessive, about 30 percent of the total of 240 observations. Second, the correlations among attrition scores were all large, positive, and significantly different from 0 (Table 13-4), thereby justifying the EM procedure.

Step 4: Extraction of Principal Components Reflecting a Common "Age" Factor. After missing data values were estimated, we used principal components analysis to extract a common factor for all attrition variables, which we assume to reflect age at death. For reasons discussed below, we excluded the anterior attrition scores from this analysis. The results based on the aggregate molar scores were satisfactory and as expected. All three molar scores (M1, M2, M3) returned large positive loadings (.968, .981, and .962, respectively) with PC1 returning an eigenvalue greater than 1 (2.825) explaining 94 percent of the variation in the original data matrix. Individual factor scores were saved and represent a scalar, internal seriation of age-at-death for individuals with at least one measurable adult tooth, excluding the twelve oldest individuals identified above.

Step 5: Generate Prediction Equation for Estimation of Age for Unknown Individuals. To estimate age at death for individuals with at least one recorded tooth-wear score, we used a simple linear regression between PCA loading and age-at-death for those individuals whose age could be determined using criteria independent of dental attrition (epiphysial closure, auricular surface metamorphosis, dental eruption and dental formation). Unfortunately, only eight individuals satisfied these analytical requirements, and a majority of these were in the younger age range (see Table 13-5). We generated several models to determine which produced the best fit between dental and skeletal age: 1) including older individuals and anterior tooth scores, 2) including older individuals excluding anterior tooth scores, 3) excluding older individuals including anterior tooth scores, and 4) excluding older individuals and anterior tooth scores. We used the model with the smallest residual sum-of-squares to generate point estimates of age for the remaining adults in the sample. Sum-of-squares for each of the four iterations were as follows: 207, 122, 116, and 92. The last model (no older individuals, no anterior tooth scores) performed the best, which justifies exclusion of the 12 oldest individuals in the sample whose M1 wear scores exceeded the measurement scale. Although sample size was limited, the residuals were randomly distributed through ages and generally supportive of the appropriateness of the linear model. We used PCA score as the dependent variable and skeletal age at death as the independent variable; these produced the following regression equation: *PCA*=.068(Age)–2.234. Solving this equation for "Age" yields: *Age*=(PCA+2.234)/.068.

This equation was used to generate dental age estimates as presented in Table 13-5. One should be aware that the specificity with which these ages are presented is an artifact of the mathematical model we used to generate the estimates and not a statement of confidence in the actual estimates. We feel a 10-year age range centered on the point estimates provides a conservative range of variation for each individual.

For those individuals in Table 13-5 without estimated dental ages (Burials 7 #1 through 34 #1), we have lumped these into a 55+ category on the basis of their being older than the oldest estimated individual from the multivariate analysis. These individuals are listed in a preliminary rank order, such that 7#1 is the youngest of this elderly cohort and 34#1 is likely the oldest individual in the entire burial population (that has any dental representation). Table 13-6 provides an inventory of age, sex, and rank (based on initial artifact inventories provided by Ricklis in an early stage of his analysis).

Dental Pathology

Caries

Descriptive Statistics

Caries were infrequently recorded at Buckeye Knoll and are presented by burial number in Table 13-7. There were 15 teeth with some form of caries; three of these were noncarious pulp exposures which are not considered pathological conditions (Buikstra and Ubelaker 1994). Of the remaining 12 affected teeth, 10 were molars (83 percent), one was an incisor (8 percent), and one was a canine (8 percent). Both occlusal and cervical caries were recorded and there was no side preference of expression. Occlusal caries were slightly more frequent than cervical caries (6 to 4; excluding the two "large" caries involving much of the crown in this calculation). Of the sided dentition, there was a higher incidence in the right (7) than in the left (4). Caries incidence was equally divided between the mandibular and maxillary dentition (6 in each setting).

Only five individuals presented caries, and of these two presented only noncarious pulp exposure. Three "floating" teeth also presented caries. Since these could not be associated with any individual, the counts of individuals with caries is imprecise. Regardless, carries are a minor occurrence at the site. Even if all three of the floating teeth came from different individuals, this would result in a maximum of six individuals out of 94 individuals from burials that yielded at least one tooth, or six individuals out of the maximum of 116 individuals based on the highest estimated MNI. Clearly, caries are a relatively minor issue. As in many hunting-gathering-fishing groups, tooth wear often is so rapid that caries formation is often precluded. Estimating the population prevalence of caries is fraught with difficulties because the dental MNI is floating. Using the high MNI estimate (n=116) and a maximum of six individuals, results in a population prevalence of 5 percent; if the lower MNI (n=94) is used, the caries presence on a population basis is just over 6 percent. In either case, caries is a minor concern when viewed on a population basis. However, one must realize many of these individuals were represented by only a single tooth and, given the tendency of caries to affect teeth with complex crown morphology (molars), the opportunity to observe caries was not equal for all 94 individuals. Therefore, these estimates must be viewed cautiously.

One way to avoid issues with sample MNI estimation is to tabulate caries frequencies by tooth type.

Table 13-5. Adult Age Estimates for Individuals Included in PCA and Regression Analysis.

Burial No.	Skel. Age	PCA Score Age	Dent.	Residual Resid.	Ant SoS	M1 Att.	M2 Att.	M3 Att.	Att.
44 #1	.	-1.84	5.73	.	.	1	2	0	0
11 #2	7	-1.84	5.73	1.27	1.61	2	2	0	0
54	13	-1.78	6.75	6.25	39.11	1	4	0	0
17	9	-1.72	7.51	1.49	2.21	0	6	0	0
6 #4	7	-1.67	8.27	-1.27	1.61	0	7	0	0
36 #2	.	-1.56	9.98	.	.	1	10	1	0
60	6	-1.54	10.15	-4.15	17.26	1	10	1	0
23 #3	.	-1.36	12.82	.	.	2	12	4	0
43	.	-1.29	13.90	.	.	2	14	4	0
65 #2	.	-1.22	14.97	.	.	3	14	6	0
12	22	-0.86	20.24	1.76	3.08	1	16	12	2
71 #1	.	-0.79	21.20	.	.	3	21	6	4
5 #2	.	-0.72	22.22	.	.	3	18	10	4
44 #2	.	-0.62	23.76	.	.	3	19	11	5
39	.	-0.59	24.24	.	.	4	17	13	6
26 #2	.	-0.57	24.49	.	.	4	19	12	6
47 #1	.	-0.59	24.13	.	.	3	21	12	4
51	.	-0.54	24.87	.	.	4	20	12	6
46 #2	.	-0.44	26.36	.	.	4	21	13	6
36 #1	.	-0.25	29.22	.	.	4	20	12	12
75	.	-0.20	29.96	.	.	3	20	16	10
45	25	-0.18	30.18	-5.18	26.87	4	23	15	9
67 #1	.	-0.15	30.64	.	.	4	24	16	8
73	.	-0.17	30.30	.	.	5	26	16	6
62 #1	.	-0.12	31.13	.	.	4	26	15	8
61 #2	.	-0.08	31.68	.	.	4	24	16	10
26 #1	.	-0.06	32.00	.	.	5	23	17	10
41	.	-0.05	32.17	.	.	5	26	17	8
16 #1	.	0.03	33.34	.	.	6	24	16	12
2	.	0.32	37.60	.	.	5	24	19	16
48 #2	.	0.31	37.45	.	.	5	28	20	12
25	.	0.39	38.62	.	.	4	26	19	16
72	.	0.36	38.15	.	.	5	27	20	14
10 #1	.	0.38	38.48	.	.	5	29	21	12
6 #2	.	0.46	39.64	.	.	5	27	20	16
15	.	0.48	39.88	.	.	5	28	21	15

continued.

Table 13-5. (concluded)

Burial No.	Skel. Age	PCA Score Age	Dent.	Residual Resid.	Ant SoS	M1 Att.	M2 Att.	M3 Att.	Att.
66 #2	.	0.40	38.67	.	.	4	36	16	11
23 #1	.	0.54	40.86	.	.	5	26	22	17
50 #1	.	0.48	39.90	.	.	5	29	24	12
74 #1	.	0.81	44.76	.	.	6	34	23	16
48 #1	.	0.91	46.24	.	.	6	31	25	19
42 #1	.	0.90	46.11	.	.	6	31	25	18
8	.	0.88	45.77	.	.	7	36	23	16
52	.	1.02	47.81	.	.	7	31	27	20
38 #1	.	1.00	47.49	.	.	7	38	23	17
13	.	1.03	48.02	.	.	7	36	26	17
37 #1	.	1.06	48.44	.	.	6	32	32	16
62 #2	.	1.10	49.04	.	.	8	35	26	19
40	.	1.16	49.89	.	.	8	32	28	21
3	.	1.27	51.49	.	.	8	40	30	16
4 #1	55	1.44	54.07	0.93	.	7	36	30	23
49 #1	.	1.49	54.77	.	.	6	37	30	23
22 #1	.	1.39	53.27	.	.	7	38	38	14
69 #1	.	1.58	56.15	.	.	7	37	31	24
9	.	1.60	56.39	.	.	7	36	32	25
7 #1	.	.	.	.	.	8	40	36	22
30	.	.	.	.	.	8	36	32	32
31 #1	.	.	.	.	.	7	40	34	27
5 #3	.	.	.	.	.	8	40	35	28
18 #1	.	.	.	.	.	8	40	38	30
6 #3	.	.	.	.	.	7	40	39	31
27	.	.	.	.	.	7	40	39	32
55	.	.	.	.	.	8	40	38	36
5 #1	.	.	.	.	.	8	40	39	38
44 #3	.	.	.	.	.	8	40	40	36
1-B	.	.	.		5	40	40	40	-
34 #1	.	.	.	.	.	8	-	-	-

MNI data by tooth are presented in Table 13-8 and represent a total of 1,081 adult teeth that could be exactly positioned within the tooth row coming from the burial lots (an additional 107 came from "floating" contexts). Combining sides results in the following frequencies of carious teeth for those with at least one caries: XI1 = 1 of 56 (1.5 percent); XC=1 of 83 (1.2 percent); NM1 = 3 of 101 (2.9 percent); NM3 = 2 of 78 (2.5 percent); XM2 = 2 of 63 (3.1 pecent); XM3 = 2 of 96 (2.9 percent). These estimates are exclusive of the large caries on the ambiguously identified teeth, both from Burial 3. Regardless of whether one calcu-

Table 13-6. Burial Summaries: Multiple Indicators of Age and Sex Assessment, MNI Based on Combination of Dental and Postcranial Inventories, and Burial Rank.*

Burial No.	Dental Age	Skeletal Age	Skeletal Sex	Possible Sex	Burial Rank
1-A	55+ years	--	--	2	46
1-B	5-9 years	--	--	3	14
2	37.60 years	--	Female	2	41
3	51.49 years	--	--	2.5	43
4 #1	54.07 years	50-59 years	Female	2	29
4 #2	4-5 years	--	--	3	--
5 #1	55+ years	--	--	2.5	15
5 #2	22.22 years	--	--	1.5	--
5 #3	55+ years	Adult	--	4	--
5 #4	3-9 months	--	--	3	--
6 #1	Adult (edentulous)	Adult	--	4	2
6 #2	39.64 years	Adult	--	4	--
6 #3	55+ years	--	--	2.5	--
6 #4	6-8 years	--	--	3	--
7 #1	55+ years	--	Male	1	28
7 #2	1.5-3 years	--	--	3	--
7 #3	21.5 years	Adult	--	4	--
8	45.77 years	--	Male	1	3
9	56.39 years	--	--	1.5	47
10 #1	38.48 years	--	--	1	33
10 #2	3-5 years	--	--	3	--
11 #2	5.85 years	--	--	3	16
12	20.24 years	--	--	1.5	17
13	48.02 years	--	Female	2	34
14	Adult	--	Male	1	0
15	39.88 years	--	--	2.5	0
16 #1	33.34 years	Adult	--	4	--
16 #2	1-3 years	--	--	3	--
16 #3	Adult	Adult	--	4	44
17	8-10 years	--	--	3	0
18 #1	55+ years	--	Female	2	39

continued.

Table 13-6. (continued)

Burial No.	Dental Age	Skeletal Age	Skeletal Sex	Possible Sex	Burial Rank
18 #2	9-13 years	--	--	3	--
20	--		Male	1	38
21	--	--	Female	2	18
22 #1	53.27 years	--	Female	2	22
22 #2	17 years	--	--	1	0
23 #1	40.86 years	--	--	2	0
23 #2	4-9 years	--	--	3	--
23 #3	12.82 years	--	--	3	--
24	--	Adult		4	0
25	38.62 years	--	Male	1	0
26 #1	32.00 years	--	--	1	19
26 #2	24.49 years	--	--	2.5	--
27	55+ years	--	--	1.5	10
28		Adult	--	4	23
29		Adult	--	4	48
30	55+ years	--	--	2.5	0
31 #1	55+ years	--	--	1.5	49
31 #2	5-11 years	--	--	3	--
33	6-7 years	--	--	3	50
34 #1	55+ years	--	Female	2	24
34 #2	4-6 years	--	--	3	--
35	Adult	Adult	--	4	0
36 #1	29.22 years	--	--	1	0
36 #2	20 years	--	--	2	0
37 #1	48.44 years	--	Female	2	--
37 #2	2-3 years	--	--	3	--
38 #1	47.49 years	Adult	--	4	45
38 #2	1-2 years	--	--	3	--
38 #3		Young Adult	--	2	--
39	24.24 years	Adult	--	4	0
40	49.89 years	Adult	--	4	51
41	32.17 years	--	--	1	52

continued.

Table 13-6. (continued)

Burial No.	Dental Age	Skeletal Age	Skeletal Sex	Possible Sex	Burial Rank
42 #1	46.11 years	--	--	2	0
42 #2	6-9 months	--	--	3	--
43	13.90 years	--	--	3	9
44 #1	5.85 years	--	--	3	21
44 #2	23.76 years	--	--	2	--
44 #3	55+ years	Adult	--	4	--
44 #4	.5-1.5 years	--	--	3	--
44 #5	8-14 years	--	--	3	--
45	30.18 years	--	--	1	4
46 #1	26.36 years	--	--	2.5	25
46 #2	14 years	--	--	3	--
47 #1	24.13 years	--	--	1	30
47 #2	1-3 years	--	--	3	--
48 #1	46.24 years	--	Male	1	0
48 #2	37.45 years	--	--	1.5	--
49 #1	54.77 years	--	Male	1	5
49 #2	0.5-1.5 years	--	--	3	--
50 #1	39.90 years	--	--	2	0
50 #2	4-11 years	--	--	2	--
51	24.87 years	--	Male	1	0
52	47.81 years	--	--	1.5	26
53 #1	No info.	--	--	2.5	42
53 #2	3-5 years	--	--	3	--
54	12-15 years	--	--	3	0
55	5+ years	--	Female	2	12
57	No info.	--	Male	1	40
58	5-6 years	--	--	3	8
59 #2	2-3.5 years	--	--	3	31
60	5-7 years	--	--	3	13
61 #1	31.68 years	--	--	1.5	6
61 #2	5 years	--	--	3	--
62 #1	31.13 years	--	--	1	11

continued.

Table 13-6. (concluded)

Burial No.	Dental Age	Skeletal Age	Skeletal Sex	Possible Sex	Burial Rank
62 #2	49.04 years	--	--	2	--
62 #3	6-8 years	--	--	3	--
64 #1	--	Adult	--	2.5	0
64 #2	15.27	--	--	3	--
65 #1	15.27 years	--	--	3	7
65 #2	--	Adult	--	4	--
66 #1	4-8 years	--	--	3	32
66 #2	38.67 years	--	--	2.5	--
67 #1	30.64 years	--	Female	2	35
67 #2	2-3 years	--	--	3	--
68	5-6 years	--	--	3	0
69 #1	56.15 years	Adult	--	4	0
69 #2	<8 years	--	--	3	--
70	--	Adult	--	4	0
71 #1	21.20 years	--	--	2	0
71 #2	~1 year	--	--	3	--
72	38.15 years	--	Male	1	27
73	30.30 years	Adult	--	4	36
74 #1	44.76 years	--	--	1	1
74 #2	0.5-1.0 year	--	--	3	--
75	29.96 years	Adult	--	4	37

* Rankings are preliminary. The ranking order was later adjusted by detailed consideration of burial goods with each grave (see Chapter 18). However, the rankings given here remain approximately valid at a very general level.

Note: The dental and skeletal indicators of sex are the conservative assessment of sex. As is obvious, the condition of the material in many cases precludes a high degree of confidence. After careful consideration of the fragments, comparisons to other skeletal samples, references to limited dental analysis and postcranial analysis, a less conservative, more "speculative," "possible" assessment of sex is provided in the column identified as "Possible Sex." The numeric field follows that used in the databases: 1 = male, 2 = female, 3 = subadult–sex ambiguous, 1.5 = possible male, 2.5 = possible female and 4 = adult–sex ambiguous. Age estimates are based on deciduous dental development or assessments of dental attrition as discussed in detail in the previous section. Attrition ages are estimates based on the regression analysis and do not purport to have the degree of precision shown (2 decimal places). In truth, ranges of + 8 to 10 years is probably a reasonable estimate. As noted above, burial ranks are preliminary, provided by R. Ricklis relatively early in site analysis, and are based on the nature and quantity of artifacts associated with each burial. In multiple burials, rank is given to all individuals, though there is probably a primary individual and we would predict it is the adult rather than one of the subadults to whom rank should be attributed.

Table 13-7. Caries at Buckeye Knoll.

Burial Number	Tooth Type/Location	Caries Type (Numeric Score)
1-A	LNM2	7 Noncarious pulp exposure*
	LNM3	7 Noncarious pulp exposure*
3	XI?	6 Large caries
	RNM1	1 Occlusal surface
	RNM1/2?	6 Large caries
7	RXM1	7 Noncarious pulp exposure*
9	RNM1	1 Occlusal surface
25	RXM3	4 Cervical caries
	RXM2	4 Cervical caries
	LNM1	1 Occlusal surface
	RNM3	1 Occlusal surface
	LXC	1 Occlusal surface
Floating	LXM2	4 Cervical caries
Floating	LXM3	4 Cervical caries
Floating	RNM3	1 Occlusal surface

* Noncarious pulp exposure not included in caries calculations.

lates caries incidence on individual teeth, on a burial inventory, or on the estimated number of people, caries incidence is low. Burial 5, an adult probable female of advanced age (55+ years, based on advanced attrition scores), was experiencing a-higher-than-typical caries incidence. This may have been influenced by the high attrition scores sufficient to envision that many of these teeth might have been compromised by both age and attrition.

Table 13-9 provides similar information for the deciduous dentition. Just taking the deciduous dentition alone, the greatest MNI suggested is 15, which falls short of the MNI indicated from the burial-by-burial analysis. It is obvious that many of these individuals possessed mixed dentition (both adult dentition and deciduous dentition) and thus deciduous dentition is a poor indicator of MNI in this context.

Dental Abscesses

The opportunity to observe dental abscesses was severely inhibited by the poor preservation of osseous portions of the osteodental complex. Three individuals of only 19 total observed had evidence of abscesses resulting in a population frequency of 15.8 percent (Table 13-10). Of these three individuals, two also had caries. For Burial 1-B, Skull 1, the abscess is clearly a sequellae of the noncarious pulp exposure of the mandibular molars. For Burial 25, the eight caries in the posterior dentition are also clearly related to the three abscesses recorded in the posterior dentition.

Dental Calculus

As noted earlier, calculus was scored as light, medium or heavy accumulations (scored 1, 2, and 3 indicating increasing accumulation) following the SOD Manual (Buikstra and Ubelaker 1994) and location was identified as to position on the tooth (ignoring in most of the following discussion those teeth not identified to specific location; see Table 13-11 for counts).

In the examination of the deciduous dental material only a single deciduous tooth exhibited formation of dental calculus. Burial 60 (an eight-year-old subadult) exhibited light dental calculus formation on the buccal surface of the right mandibular and right maxil-

Table 13-8. Dental MNIs by Tooth Type for Adult Dentition in all Contexts.*

Tooth	Left Mandibular	Right Mandibular	Left Maxillary	Right Maxillary	Total
I1	23	20	27	38	108
I2	23	24	28	37	112
C	34	38	35	48	155
PM1	36	35	39	45	155
PM2	34	43	37	38	152
M1	51	50	43	52	196
M2	39	35	27	36	137
M3	33	45	50	46	174
Total	**273**	**290**	**286**	**340**	**1,189**
Max No.	**51**	**50**	**50**	**52**	

* An additional 433 adult teeth could not be located by position and included 48 incisors, 19 canines, 90 premolars, 187 molars, and 89 teeth too worn or fractured for any attribution. This included 120 mandibular teeth, 120 maxillary teeth, and 193 unidentified teeth, for a grand total of 1,622 teeth (of which 1,189 were identified to precise location).

Table 13-9. Deciduous Dental Inventory from All Contexts.*

Tooth	Left Mandibular	Right Mandibular	Left Maxillary	Right Maxillary	Total
i1	9	2	15	10	36
i2	12	11	9	5	37
c	12	13	7	8	40
m1	8	13	12	13	46
m2	14	14	15	11	54
Total	**55**	**53**	**58**	**47**	**213**

* This does not include teeth that were clearly deciduous but which could not be identified as to exact position. There were 25 teeth in this group: 1 mandibular molar, 15 maxillary teeth, and 9 unidentified deciduous teeth. Also comprising this group were 9 incisors, 2 canines, 11 molars, and 3 unidentified deciduous teeth.

lary second molars and on the left mandibular second molar. None of the other deciduous teeth showed evidence of calculus formation.

In the inventory of burials, 94 of the 116 possessed at least one tooth that could be observed for calculus formation. Of these 94 individuals, 53 exhibited no calculus formation and 41 exhibited at least one tooth with calculus formation (43 percent with evidence of formation). The average percentage of teeth exhibiting some calculus formation was 40 percent. In those individuals with at least 18 teeth (*n*=11), the average

Table 13-10. Dental Abscesses at Buckeye Knoll.

Burial Number	Socket Affected	Perforation
1-A	LNM2	1 buccal
25	RXM3	1 buccal
	RXM2	1 buccal
	LNM1	1 buccal
27	LNM1	1 buccal

calculus rate was 30.4 percent. In those with fewer than 18 teeth (essentially those with poorer dental representation), the average calculus rate was 44 percent. The average number of teeth for the no-calculus group was five and the average number of teeth in the calculus-present group was 13. Clearly, the more teeth preserved, the more likely that calculus formation could be observed. In contrast to caries, calculus formation was clearly much more common.

An additional way to examine calculus formation is from a tooth-by-tooth inventory, which avoids the issue of the number of teeth observed per person. Of the 1,189 adult teeth identified as to location, 237 exhibited some degree of calculus formation (Table 13-11; 19.9 percent). Left maxillary dentition exhibited the highest calculus rates (25.9 percent) while the other quadrants showed almost identical incidences between 16 and 17 percent.

The left mandibular dentition shows higher calculus incidence in five of the eight tooth comparisons (the first incisor, canine, both premolars, and the third molars) than does the right mandibular detention, while calculus incidence is higher in the right quadrant only in the case of the second incisor and the first and second molars. The differences are less than 5 percent for most teeth. The greatest difference is observed in the second and third mandibular molars where the right second molar has a higher incidence than the left second molar and the right first molar has a much higher incidence than the left first molar (differences of 23 percent and 15.3 percent, respectively). The calulus incidence is nearly as high for the left first premolar (at 22 percent) but is much lower for the right first premolar (at only 8.8 percent). The differences between the other left and right mandibular tooth calculus rates are much lower and are between 2 and 5 percent.

A similar pattern is seen in the maxillary dentition where the incidence is higher in the left incisors, canines, premolars, and second molar, with only the right first and third molar exhibiting higher incidences than the left. One simple interpretation is that there may be some tendency toward greater masticatory loads in the left dentition than in the right.

In a recent study of Natufian and Neolithic dentition comprising nearly 2,000 individuals, calculus rates are also higher in the maxilla than the mandible and are higher in the agricultural (Neolithic series) than in the Natufian hunters and gatherers (Eshed et al. 2006). The Natufian rates for mandible and maxilla are, respectively, 14.3 percent and 15.9 percent, while the Neolithic samples are, respectively, 50 percent and 45 percent. Clearly, the Buckeye Knoll rates of between 16 and 26 percent are much closer to the preagricultural sample, which is what one would expect given what we understand of factors causing higher calculus buildups.

There are distinct differences in calculus incidence by tooth class (i.e. mandibular incisors vs. maxillary incisors; Table 13-11). Maxillary premolars show a nearly 10-percent-higher calculus incidence than was observed in the mandibular premolars (23 percent vs. 12.8 percent). This magnitude of difference is also seen in the comparison of calculus incidence in the incisors, with the maxillary incisor incidence at 23 percent but the mandibular incisors only at 13 percent. Maxillary and mandibular incidences by tooth class for the other teeth (canines, and molars) are much more similar and indicate like levels of oral stress (using this term loosely).

The pattern of severity of calculus is also scored by tooth (1 = minimum, 2 = medium, and 3 = extensive). In the entire series, not a single tooth was scored as extensive, and the most common condition was mild (score of 1). The ratios between mild and medium varied between tooth quadrants. Twenty percent of the left mandibular scores were medium, while the right mandibular quadrant was a close second with 18 percent scored as medium. This was followed by slightly lower medium scores in the right maxillary quadrant. The left maxillary quadrant was quite distinct and had the lowest incidence of medium scores, a mere 3 percent.

As noted earlier, the left maxillary quadrant had an overall higher incidence rate, but here the severity is mild compared to the other quadrants with a higher percentage of medium scores. In the left maxillary and

Table 13-11. Calculus Incidence by Tooth Location and Severity (Score: Buikstra and Ubelaker 1994).

Tooth	Teeth with Calculus (No.)	Percent by Tooth	Total No. of Teeth	Percent Incidence	Severity	
					Mild (1)	Medium (2)
LNI1	3	6.4	23	13.0	3	
LNI2	3	6.4	23	13.0	3	
LNC	8	17.0	34	23.5	7	1
LNP1	8	17.0	36	22.2	6	2
LNP2	4	8.5	34	11.8	2	2
LNM1	5	10.6	51	9.8	4	1
LNM2	4	8.5	39	10.3	3	1
LNM3	12	25.5	33	36.4	10	2
TOTAL LN	**47**		**273**	**17.2**	**38**	**9**
RNI1	2	4.0	20	10.0	2	
RNI2	4	8.0	24	16.7	4	
RNC	7	14.0	38	18.4	7	
RNP1	3	6.0	35	8.6	3	
RNP2	4	8.0	43	9.3	2	2
RNM1	9	18.0	50	18.0	7	2
RNM2	13	26.0	35	37.1	9	4
RNM3	8	16.0	45	17.8	7	1
TOTAL RN	**50**		**290**	**17.2**	**41**	**9**
LXI1	8	11.0	27	29.6	8	
LXI2	13	17.8	28	46.4	12	1
LXC	11	15.1	35	31.4	11	
LXP1	14	19.2	39	35.9	14	
LXP2	7	9.6	37	18.9	7	
LXM1	11	15.1	43	25.6	11	
LXM2	4	5.5	27	14.8	4	
LXM3	5	6.8	50	10.0	4	1
TOTAL LX	**73**		**286**	**25.5**	**71**	**2**
RXI1	7	10.3	38	18.4	5	2
RXI2	7	10.3	37	18.9	5	2
RXC	10	14.7	48	20.8	7	3
RXP1	11	16.2	45	24.4	11	
RXP2	8	11.8	38	21.1	8	
RXM1	13	19.1	52	25.0	11	2
RXM2	5	7.4	36	13.9	5	
RXM3	6	8.8	46	13.0	5	1
TOTAL RX	**67**		**340**	**19.7**	**57**	**10**
TOTAL	**237**	**19.9%**	**1,189**			

left and right mandibular quadrants, the higher scores were almost always found in the premolars or molars. Only in the right maxillary anterior dentition was there a significant departure from this pattern, were a higher number of teeth exhibited the higher (2) scores. As noted, the incidence of calculus is higher in the left maxillary dentition (25 percent) and occurs at almost equal but lower percentages in the other quadrants (16.1 to 17.7 percent). For the highest incidence of the more severe examples (scored as a 2), a similar, though not identical pattern, is observed. Overall severity in this collection is never extreme (scored as a 3). It is interesting to note that the left maxillary quadrant was the section with the highest incidence of calculus in general (25 percent), and it is the quadrant that has the highest incidence of low involvement. Clearly, it is a more widespread phenomenon, but it is not expressed intensively with abundant high scores. It is also interesting that the few medium incidents are in the rear molars and second incisor (left maxillary quadrant). In the other quadrants with higher incidences of medium expression (score of 2), the incidences are more uniformly distributed over the post-molar dentition.

In a closer look at the medium scores (which are, in this collection, examples of the heaviest calculus formation), there were only 30 teeth exhibiting this level of deposition (12.6 percent). Of these, the majority was evenly divided between the buccal and lingual surfaces (each accounting for 30 percent; Table 13-11), and seven teeth exhibited medium deposition on both of these surfaces (23.2 percent). The remainder of the teeth showing medium deposition included three with deposition only on the labial surface, one with deposition only on the distal surface, and another with deposition completely encompassing the tooth. As a group, mandibular teeth (*n*=18) exhibited greater numbers of medium depositions than maxillary teeth (*n*=12). The right dentition, oddly enough, exhibited almost twice the incidence of medium deposition (19 vs. 11) of that observed in the left dentition, with the left maxillary dentition showing the least incidence of this severity. The low incidence in the left maxillary dentition is what is most striking with the incidence in the other arcades being roughly equivalent (9, 9 and 10 in the right maxillary quadrant). The tooth most severely affected was the right second mandibular molar followed closely by the right maxillary canine (respectively with 4 and 3 teeth exhibiting medium deposition). With respect to broader tooth categories, each molar (1, 2, and 3) showed five incidences of medium deposition. The second premolars also showed four teeth, the canines showed four teeth, and the second incisors showed three teeth with medium deposition. The first premolar and first incisor each showed two occurrences of medium deposition.

Collectively posterior dentition was more likely to exhibit relatively greater deposition, but this is certainly not striking. What is most "striking" (and we use that term loosely), is the low incidence of medium deposition in the left maxillary dental arcade. This arcade showed, overall, the highest incidence of teeth with calculus deposition. Clearly, it was more frequently observed but it was less frequently severe. It should be remembered that the majority of these teeth are isolated and cannot be attributed to specific individuals, so that comparative studies will have to focus on a population-level and/or a tooth-level analysis rather than an individual "mouth-level" analysis.

As noted earlier, calculus formation was much more common than caries formation and reflects both wear rates (minimizing caries formation) and food composition (which influences calculus formation). Calculus formation rates here might be a bit lower if the deposits themselves are removed by the same taphonomic forces that destroy the bone. Even so, calculus formation is quite common and some individuals exhibited high calculus rates with higher formation rates in the maxillary dentition. Incidence rates vary from tooth to tooth, but are higher in the incisors and canines.

Calculus in the deciduous dentition is almost unheard of and only three such teeth, all belonging to the subadult in Burial 60, exhibited any calculus formation. In this individual, the left and right second molars and the right maxillary molar exhibited slight calculus formation (drxm2, dlnm2, drnm2). Of the 213 teeth identified to location plus the additional unassigned deciduous dentition (*n*= 25), this results in an estimated 1.2-percent calculus rate in the subadults. Based on the number of individuals identified in burials that produced deciduous dentition (*n*=15), the single individual exhibiting calculus formation translates to an incidence by person of 6.6 percent. While higher than the incidence calculated on the total number of teeth, this is still low. Realistically it is clear that calculus formation was not a significant issue in the subadults at Buckeye Knoll.

Dental Morphology

Trait frequencies for an extensive list of dental morphological features are presented in Tables 13-12 and 13-13. Traits were scored for both right and left sides and trait frequencies are presented for scorable

Table 13-12. Dental Morphology, Maxillary Dentition Trait Frequency (Left and Right Dentition).

Maxillary Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Winging Labial Curvature	4	5	3	1						4	6	2						
%	31	39	23	8						33	50	17						
Shoveling- C	5	2	1	1		1				15	4	1						
%	50	20	10	10		10				75	20	5						
Shoveling I2		1	5	2		3	5	2	1	1	1	2	3		4	5	4	
%		5	26	10		6	26	10	6	5	5	10	15		20	25	20	
Shoveling I1			4	7			1	2			1	2	10			1	2	
%			29	50			7	14			6	13	63			6	13	
Double Shoveling P2	15	4	3				1			12	3	3						
%	65	17	13				5			67	17	17						
Double Shoveling P1	12	3	5	1			1			27	7	5	6					
%	54	14	23	4			4			60	16	11	13					
Double Shoveling C	4	2	3	1						10	7	1	2					
%	40	20	30	10						50	35	5	10					
Double Shoveling I2	4	3	4	2		3	1			6	4	2	2		3			
%	23	18	23	12		18	6			35	23	12	12		18			
Double Shoveling I1		4	2	2		5	3			1	2	2	6		2	2		
%		24	13	13		31	19			7	13	13	40		13	13		
Interruption Grooves I2	12		1			2				16		2						
%	80		7			13				89		11						

Note: All observable I1, I2, C, P1, and P2 exhibited single-root condition for both mandibular and maxillary dentition, except for mandibular first and second premolars, which are included in the above table.

continued.

Table 13-12. (continued)

Maxillary Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Interruption Grooves I1	7									18		1						
%	100									100								
Tuberculum Dentale C	13									18	1	1			1	1		
%	100									82	4	4			4	4		
Tuberculum Dentale I2	16									18					1	1		
%	100									90					5	5		
Tuberculum Dentale I1	13	1								15	2	1			1			
%	93	7								79	19	5			5			
Canine Mesial Ridge	2	1								10	1							
%	67	33								91	9							
C Distal Accessory Ridge	3									7			2		3	1		
%	100									54			13		23	7		
MD Accessory Cusps P2	24	2								NA	NA	NA						
%	92	8																
MD Accessory Cusps P1	21	1								42	2							
%	95	5								95	5							
Uto-Aztecan P1	20									45	1							
%	100										2							
Odontome P2	25									13								
%	100									100								

Note: All observable I1, I2, C, P1, and P2 exhibited single-root condition for both mandibular and maxillary dentition, except for mandibular first and second premolars, which are included in the above table.

continued.

Table 13-12. (continued)

Maxillary Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Odontome P1	22									30								
%	100									100								
Metacone M3		2	4	12	4	3					2	2	11	6	6			
%		8	16	48	16	12					7	7	41	22	22			
Metacone M2				1	3	2	2					1	2	3	4	1		
%				13	38	26	26					9	18	27	36	9		
Metacone M1				2	4	10	2						3	4	12			
%				11	22	55	11						16	21	63			
Hypocone M3		1	4	4	1						2	14	12	4	3			
%		10	40	40	10						8	56	48	16	12			
Hypocone M2		1	1	1	1	3	1					1	1	1	4	2		
%		13	13	13	13	38	13					11	11	11	44	22		
Hypocone M1			1	1	4	8	5							2	17	3		
%			5	5	21	42	26							9	77	13		
Cusp 5 M3	26									29								
%	100									100								
Cusps 5 M2	7			1						8	1							
%	88			12						89	11							
Cusps 5 M1	12	2					1			12	1	1						
%	80	13					7			80	7	7				7		
Carabelli M3	24									29								
%	100									100								

Note: All observable I1, I2, C, P1, and P2 exhibited single-root condition for both mandibular and maxillary dentition, except for mandibular first and second premolars, which are included in the above table.

continued.

Table 13-12. (continued)

Maxillary Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Carabelli M2	10		1							14								
%	91		9							100								
Carabelli M1	13		1			4	2		1	9					2	2	1	1
%	62		5			19	9		5	60					13	13	6	6
Parastyle M3	25									26	2							
%	100									93	7							
Parastyle M2	13									14								
%	100									100								
Parastyle M1	25									21								
%	100									100								
Enamel Extension M3	15									16	2							
%	100									89	11							
Enamel Extension M2	9	2								14	1							
%	82	18								93	7							
Enamel Extension M1	13	1								19	1							
%	93	7								95	5							
Enamel Extension P2	19									14								
%	100									100								
Enamel Extension P1	21	1								25								
%	95	5								100								
Peg/Reduced M3	15									17	1							
%	100									94	6							

Note: All observable I1, I2, C, P1, and P2 exhibited single-root condition for both mandibular and maxillary dentition, except for mandibular first and second premolars, which are included in the above table.

continued.

Table 13-12. (continued)

Maxillary Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Peg/Reduced I2	12									11	1							
%	100									92	8							
Agenesis M3	14									18								
%	100									100								
Agenesis P2	20									20								
%	100									100								
Agenesis I2	20									13								
%	100									100								
Root Number M3		1	1	2							3		2					
%		25	25	50							60		40					
Root Number M2				7								1	4					
%				100								20	80					
Root Number M1		1		8									7					
%													100					
Root Number P1		9									9	1						
%		100									90	10						
Root Number P2		10									9							
%		100									100							
Root Number C		10									11							
%		100									100							
Root Number I2		6									6							
%		100									100							

Note: All observable I1, I2, C, P1, and P2 exhibited single-root condition for both mandibular and maxillary dentition, except for mandibular first and second premolars, which are included in the above table.

continued.

Table 13-12. (concluded)

Maxillary Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Root Number i1		6									7							
%		100									100							
Radical Number M3				1		1					1		1					
%				50		50					50		50					
Radical Number M2				4								1	3					
%				100								25	75					
Radical Number M1		1		3									4					
%		25		75									100					
Radical Number P2		4	2															
%		67	33															
Radical Number P1		3	1								5	1						
%		80	20								83	17						
Radical Number C		7									8	1						
%		100									89	11						
Radical Number I2		3									3							
%		100									100							
Radical Number I1		1									4							
%		100									100							

Note: All observable I1, I2, C, P1, and P2 exhibited single-root condition for both mandibular and maxillary dentition, except for mandibular first and second premolars, which are included in the above table.

Table 13-13. Dental Morphology, Mandibular Dentition Trait Frequency (Left and Right Dentition).

Mandibular Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Shoveling I2		4	2	2							5	1	1					
%		50	25	25							71	14	14					
Shoveling I1		1	1	1							2	1	1					
%		33	33	33							50	25	25					
Double Shoveling I2	2	1					1			4	4							
%	50	25					25			50	50							
Double Shoveling I1	2									2								
%	100									100								
Canine Distal Acc. Ridge	9	1	2			2				5	1	1	1		2			
%	64	7	14			14				50	10	10	10		20			
Premolar Cusps P2	22									21	1	1	1					
%	100									88	4	4	4					
Premolar Cusps P1	13									15	1							
%	100									94	6							
Anterior Fovea M1	4	3	1	4		4				7	3	2	1		3			
%	25	19	6	25		25				44	19	13	6		19			
Groove Pattern M3 (X,Y,+)		2	5	2						-	11	4	3					
%		22	56	22						-	61	22	17					
Groove Pattern M2 (X,Y,+,2)	3	5	4	1						4		4						
%		23	38	31	8					-	50		50					
Groove Pattern M1 (X,Y,+)	3	10	5							5	6	5						
%		16	55	28							31	38	31					

Note: All observable I1, I2, and C exhibited single-root condition for both mandibular and maxillary dentition.

continued.

Table 13-13. (continued)

Mandibular Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Cusp No. M3						7	4	1							11	5		
%						58	33	8							69	31		
Cusp No. M2						5	5	1							4	4	1	
%						45	45	10							44	44	11	
Cusp No. M1							14	7								13	2	
%							67	33								86	14	
Deflecting Wrinkle M1	9	3	2	1						8	1	3	3					
%	60	20	13	7						53	7	20	20					
Protostylid M3	9	1					1			18	1							
%	82	9					9			94	6							
Protostylid M2	14	1								13	1							
%	93	7								93	7							
Protostylid M1	15	4								13	2	1	1					
%	79	21								76	12	6	6					
Cusp 5 M3	7			1		1	1			12		1				3		
%	63			9		9	9			75		6				18		
Cusp 5 M2	5		1	2		3				4					2	2		
%	45		9	18		27				50					25	25		
Cusp 5 M1	0	1	1	3		10	3						5		10	1		
%		6	6	17		56	17						31		63	6		
Cusp 6 M3	10		1							19								
%	91		9							100								

Note: All observable I1, I2, and C exhibited single-root condition for both mandibular and maxillary dentition.

continued.

Table 13-13. (continued)

Mandibular Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Cusp 6 M2	8			1						7	1							
%	89			11						88	12							
Cusp 6 M1	12	1	5				1			15		1			1			
%	63	5	26				5			88		6			6			
Cusp 7 M3	12									19					1			
%	100									95					5			
Cusp 7 M2	13									9								
%	100									100								
Cusp 7 M1	18									16	1							
%	100									94	6							
TOMES ROOT P1	9			1			1			3								
%	82			9			9			100								
Root Number M3		1	7								1	6						
%		13	83								14	86						
Root Number M2		1	7	1							2	7						
%		11	78	11							22	78						
Root Number M1			11									10						
%			100									100						
Root Number P2		7									7							
%		100									100							
Root Number p1		9	1								5							
%		90	10								100							

Note: All observable I1, I2, and C exhibited single-root condition for both mandibular and maxillary dentition.

continued.

Table 13-13. (concluded)

Mandibular Dentition	Left									Right								
Trait	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**	**0**	**1**	**2**	**3**	**3.5**	**4**	**5**	**6**	**7**
Root Number C		12									6							
%		100									100							
Root Number I2		7									10							
%		100									100							
Root Number I1		9									7							
%		100									100							
Odontome P2	24	1								27	1							
%	96	4								96	4							
Odontome P1	20	1								17	1							
%	95	5								94	6							
Agenesis M3	13	1								17								
%	93	7								100								
Agenesis P2	14									19								
%	100									100								
Agenesis I2	12									12								
%	100									100								

Note: All observable I1, I2, and C exhibited single-root condition for both mandibular and maxillary dentition.

teeth. Not infrequently, teeth were too worn or fragmented to score, and the maximum number of teeth of each category identified may be larger than the number that could be scored. Some traits, such as winging, require intact alveolus, and their trait frequencies were impossible to accurately assess due to the deterioration of much of the supporting tissue. The differences between right- and left-side incidences are relatively small and reflect the small sample sizes and differential, apparently random, preservation of antimeres. For some comparative purposes, others may find it reasonable to combine the right and left incidences, though this would include some double counting of left and right teeth from the same individual. Unfortunately, there is no way to control for this phenomenon given the high number of isolated, loose, unaffiliated teeth. Although the primary utility of this data element is for comparative research purposes for other investigators, some of the "highlights" of the tabulation are briefly discussed in the following section. Most dental anthropology texts provide excellent descriptions of these conditions, and they will not be elaborated upon here (see for example Scott and Turner 1997 for an excellent overview of most of these traits; the rest can be found in Alt 1997).

Maxillary Dental Morphology

The dominant condition for labial curvature for both right and left maxillary dentition was predominantly slight (score 1), although there were a few cases of stronger expression (scores 2 and 3). Incisor shoveling, both first and second and left and right teeth, was nearly universal and relatively pronounced (a single right I2 did not show shoveling). Shoveling was less common in the canines but was present in 50 percent of the left and 25 percent of the right canines, though the sample sizes were small. Shoveling also was less pronounced in the canines. Most maxillary incisors exhibited double shoveling (on both margins of the tooth) and appeared in about 50 percent of the canines. High shoveling frequencies are common in prehistoric North American populations. Interruption grooves in incisors are rare and were only slightly more frequent in the second than in the first incisors.

Some traits, such as tuberculum dentale, appeared at relatively low frequencies in both incisors and canines but were more common on the right side. Presumably, this represents a sampling bias, although sample sizes are nearly the same for both right and left sides. This trait, as noted earlier, is rare, and most teeth (79 to 100 percent) showed no expression of this feature.

Some traits were never observed and others were observed rarely. Burial 26 #2 had a Uto-Aztecan premolar, which is one of the rarest of all North American traits. Other rare traits in this collection included premolar odontomeres, accessory cusps (5), and Crabelli's cusp on the third molars. Second and first molars were slightly more likely to exhibit Carabelli's cusp formation with the first showing the most frequent expression (approaching 40 percent in the first molars). Parastyle expression on the molars was also rare and only observed on the right side, not on the left. Metacone and hypocone formation in the molars was the norm and showed incrementally increasing expression, with more profound expression moving from the first molars to the second molars and then to the third molars.

Enamel extensions were rare and declined from the first molars to the second. They were never observed in the third molars. Only a single left first premolar showed the development of enamel extensions. Overall, this trait, across the molars and premolars, was usually less than 10 percent.

Complete absence (agenesis) of teeth was rare, as was the presence of peg-shaped teeth. With respect to agenesis, it must be remembered that relatively few intact alveolar sections (in which this could be accurately scored) were recovered.

Only a single premolar exhibited a double root; all the rest of the incisors, canines, and premolars were single rooted. All but four molars exhibited the "norm" of three roots, with the single-rooted molars always being in the second or third molar.

In all teeth, radicals (essentially extensions connecting roots) were usually single and rarely expressed as double radicals. They were more frequent in molars than in any other tooth sets and were more commonly observed in premolars than in incisors (as would be expected).

Mandibular Dental Morphology

All incisors exhibited shoveling, and this was more strongly expressed in the first incisor, although the differences between first and second incisors are small and certainly are not profound (see Table 13-12 for a list of dental morphology, maxillary dentition trait frequency). About half of the incisors exhibited double shoveling, although it was not strong in most cases.

Roughly half the canines exhibited no distal accessory riding and those in which it was expressed tended to show relatively moderate expressions of the trait (scores of 4 or less). Most premolars showed only a single lingual cusp, although there were five individuals that showed multiple lingual cusps. These, however, were not strongly expressed (scores of less than 4 in most cases).

Anterior foveas on the first molar were quite common and most individuals exhibited distinct expressions of this dental feature, some of which were well developed (high observed score of 4).

The most common dental cusp pattern in all molars was the "Y" pattern but, interestingly, the x and + patterns were almost equally represented at lower frequencies. The right first molar was at variance with this statement and in it the most common pattern was the "x" pattern (61 percent). Such a high incidence in one molar may be something of a statistical fluke, and the overall dominance of the "Y" pattern is clear, although there is obvious polymorphism in this population.

Cusp numbers on the molars also exhibited a high degree of variability, with four cusps being slightly more common than the presence of a fifth or sixth cusp in both the right and left molars. The third molar is most likely to have four cusps, while the second molar is equally divided between four and five cusps. The first molar predominantly exhibits a five-cusp pattern with a low frequency of the six-cusp pattern.

The right and left first molars exhibited a 50 to 63 percent incidence of the absence of deflecting wrinkle expression, with the remainder exhibiting scores of 1 to 3 at high incidences (between 7 and 20 percent). Sample counts were small and the differences between incidences in the left and right sides may not be significant but only sampling fluctuations.

Protostylid expression was missing in most molars but, as is typical, reached its highest expression in the first molar with declining rates moving toward the rear of the mouth. Most molars also did not show the expression of the 6th (entoconulid) cusp, while the majority did exhibit some expression of a 5th cusp. While the 6th-cusp expression was the dominant pattern (63 to 88 percent left to right) other expressions (scores of 1, 2, and 5) were visible and reflect some variability in this population. The 6th cusp was more commonly observed in the first molar, but also was observed in the second and third molars, again emphasizing some variability in the population.

Cusp 7 expression was rare and only one rnm3 and one rnm1 exhibited this condition. This was out of 88 observed molars, so the development of this 7th cusp is rare indeed (1.1 percent). Most of the molars exhibited double-root morphology (most common in general), which accounted for between 78 and 100 percent of the root variation. Single-rooted molars were only observed in the third and second molars (one each in the left and one in the right in the case of the third molar) and a single left second molar and two right second molars. There was a single instance of a three-rooted lnm2, and all first molars were double rooted. Incisors, canines, and premolars were, with one exception (a lnp1), single rooted.

Only a few premolars exhibited odontome expression, and only a few teeth (four out of 88) expressed this feature. It was always a slight condition rather than a more profound expression. Odontomes were found once in each of the premolars (mandibular). Three were loose, unassociated premolars, and one premolar was from Burial 31 #2 (an 8-year-old subadult). All showed no wear and had similar metric dimensions, which support the possibility they were from a single individual. Burial 31 #2 was from S9.7W87.1, Zone 3 (T2100 – RNP2). The other three odontomes came from within a 4-m radius of one another, and two were from essentially the same context, from the east wall fall of S14W88 Zone 3, level 14 (LNP2 – T206, RNP1 – T207). The third, LNP1 (T398) came from S14W84, Zone 3, level 14. It is entirely possible that they all originated from a single individual, given their proximity and lack of wear.

Agenesis was again rare, perhaps exhibiting a diminished observational capability due to damage, and there was only a single case of an lnm3 being missing out of 30 observed alveolar segments where this could be scored.

Dental Descriptions by Burial

Burial 1 (MNI=2)

Burial 1-A

Inventory: Maxillary Right: I1; Maxillary Left: I2; Mandibular Left: M3, M2, M1, P2, P1; Mandibular Right: I2, P1, P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: LNM3, RNM3 fully formed (14); adult (18+); Dental Eruption: LNM3, RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: LNM2, LNM3 (7), non-carious pulp exposure; 0 teeth affected of 13 observed;

Abscess: LNM2 (1); 1 affected of 11 observed; Calculus: 0 teeth affected of 11 observed. **Notes:** Also includes 1 XP root, wear = 8, cannot side or ID number due to wear, but is not lower Premolar because all are accounted for already. Tooth is single rooted. LNM2, 3 have exposed pulp chambers due to wear and abscessing, likely as a sequellae. LNM2 has large buccal abscess with alveolar pit opening on lingual surface. No porosity noted near abscess margins.

Burial 1-B

Inventory: Maxillary Right: dm2, P1, C, I2, I1; Maxillary Left: I2, C, M1, M2; Mandibular Left: P1, I2, I1; Mandibular Right: I1, I2, P1, P2. **Demographics:** Sex: Unknown; Age: Subadult (5-9 years); Dental Formation: LXM2 has a complete crown, roots broken (7+ years), drxm2 (14) with no resorption (7 years); Dental Eruption: LXM2 has broken roots but is unworn, suggests not in occlusion (<12 years); Dental Attrition: LXM1 = 3, LXM2 = 0; drxm2 = 25. **Pathology:** Caries: 0 teeth affected of 16 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 17 observed. **Notes:** All mandibular teeth are broken at the roots making assessment of development stage impossible. Roots are well developed for those teeth where some observation is available. Only one deciduous tooth present with complete roots, no root resorption, tooth heavily worn. Adult teeth appear complete but demonstrate no dental wear. drxm2 erupts 18 months +/- 6 months. drxm2 root resorption begins 7 years. drxm2 is lost at 10 years +/- 3 years. Adult LXM1/2 crown complete, LXM1 very slight rounding of cusps (3), just entered into occlusion.

Burial 2

Inventory: Maxillary Right: M3, M2, M1, P2, P1, C, I2, I1; Maxillary Left: I1, I2, C, P1, P2, M1, M2, M3; Mandibular Left: M3, M2, M1, P2, P1, C, I2, I1; Mandibular Right: I1, I2, C, P1, P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (37.60 years); Dental Formation: M3s fully formed (14); adult (18+); Dental Eruption: M3s fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 32 observed; Abscess: 0 observed; Calculus: RXM2 (1 mesial), RXM2 (1 buccal), RXI1 (1 labial), LXM2 (1 buccal), LNP1 (1 lingual), RNM3 (1 mesial). Six teeth affected of 32 observed.

Burial 3

Inventory: Maxillary Left: M3; Mandibular Right: M1/2; Includes 5 unidentifiable single-rooted teeth worn to the root—no crown surface remaining. **Demographics:** Sex: Unknown; Age: Adult (51.49 years); Dental Formation: LXM3 fully formed (14); adult (18+); Dental Eruption: LXM3 fully erupted (2); adult (18+). **Pathology:** Caries: Non-carious pulp exposure (7) on maxillary anterior tooth (incisor of unknown side or number); RNM1/2 (6); Two teeth affected of 3 observed; Abscess: 0 affected of 8 observed; Calculus: 0 teeth affected of 1 observed. **Notes:** LXM3—root hypercementosis. The lower molar has significant wear and pulp exposure. The rounded edges of the pulp exposure suggest active infection at time of death.

Burial 4 (MNI=2)

Burial 4 #1

Inventory: Maxillary Right: P2, C; Mandibular Left: C. **Demographics:** Sex: Unknown; Age: Adult (54.07 years); Dental Formation: RXP2, RXC, LNC fully formed (14); adult; Dental Eruption: RXP2, RXC, LNC fully erupted (2); adult. **Pathology:** Caries: 0 observed; Abscess: 0 observed; Calculus: RXP2 (1 lingual), RXC (1 lingual). Two teeth affected of 3 observed. **Notes:** This burial also contains several teeth, which did not appear to match the primary individual. Three maxillary molars were inconsistent with anterior teeth and with each other; U #19: RXM1 or 2, wear = 31; U #16: XM3, wear = 36, 0 caries, 0 calculus; U #86: XM1 or 2, wear = 4, caries = 7.

Burial 4 #2

Inventory: Maxillary Right: C; Mandibular Left: M1. **Demographics:** Sex: Unknown; Age: Subadult (4-5 years); Dental Formation: RXC at least (Crc) = 4-8 years, LNM1 (Ri) = 3-5 years; Dental Eruption: RXC (1/2) = <11 years, LNM1 (1/2) = <6 years, both likely unerupted based on attrition; Dental Attrition: Teeth unworn. **Pathology:** Caries: 0 affected of 2 observed; Abscess: 0 observed; Calculus: 0 observed. **Notes:** Based on tooth wear, Individual 4 #2 is similar in age to Individual 1, Skull 2. Estimated age for both is 7 +/- 2 years. This cannot be the same individual because of replication of maxillary canine.

Burial 5 (MNI=4)

This burial contains the remains of multiple individuals. The primary burial is a adult with significant tooth wear and complete loss of crown surfaces. The second individual is represented by fragmented deciduous tooth caps. This individual is clearly a very young juvenile. Replication of maxillary canines indicates a second adult is present, also of advanced age. This third individual is represented by three isolated teeth from the anterior maxilla. In addition to replication of dental elements with the primary individual in this burial, the surface encrustation on the three roots of this individual suggests a distinct taphonomic history. A fourth individual is represented by a single tooth (LXP2) which is worn flat but has not experienced the wear typical of adults 5 #1 and 5 #2. This could be a supernumerary tooth or a tooth not in occlusion, but this is unlikely.

Burial 5 #1

Inventory: Maxillary Right: M2, M1, P2, P1 I2; Maxillary Left: C, P1, P2, M1, M2, M3; Mandibular Left: M2, M1, P2, P1, C, I2; Mandibular Right: I2, C, P1, P2, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: LXM3, RNM3 fully formed (14); adult (18+); Dental Eruption: LXM3, RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 23 observed; Abscess: 0 affected of 22 observed; Calculus: RXM1 (buccal), LNM2 (1 buccal), RNM2 (2 buccal). Three teeth affected of 23 observed. **Notes:** Note asymmetrical wear on NP2, NM2. LNM1-2 exhibiting alveolar resorption with damaged to area of P2 – L1 making it difficult to determine the extent of alveolar involvement. RNP1-2 alveolar resorption.

Burial 5 #2

Inventory: Maxillary Left: P2. **Demographics:** Sex: Unknown; Age: Adult (22.22 years); Dental Formation: LXP2 fully formed (14); adult (18+); Dental Eruption: LXP2 fully erupted (2); (11+). **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed. **Notes:** Single adult tooth which duplicates Burial 5 #1.

Burial 5 #3

Inventory: Maxillary Right: C, I1; Maxillary Left: C. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: RXC, RXI1, LXC fully formed (14); adult (18+); Dental Eruption: RXC, RXI1, LXC fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 3 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 3 observed. **Notes:** By attrition, is same age as Burial 5 #1.

Burial 5 #4

Inventory: Maxillary Left: di1, di2; Mandibular Left: dm1, dc; Mandibular Right: di1, di2, dc. **Demographics:** Sex: Unknown; Age: Subadult (3-9 months); Dental Formation: No information; Dental Eruption: No information; Dental Attrition: All teeth unworn. **Pathology:** Caries: 0 teeth affected of 7 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 7 observed. ***Notes:*** Small cranial fragment included with burial. Diploic expansion has just commenced which suggests an age of two years or less. All teeth are unworn and may be unerupted. Lack of wear suggests deciduous incisors are unerupted. This places age at 6 months +/- 3 months.

Burial 6 (MNI=4)

Burial 6 #1

Inventory: This is an edentulous adult and there are no teeth present, sockets are all in some stage of healing or are completely healed. **Demographics:** Sex: Unknown: Age: Adult. Crypts for the mandibular M3 are almost completely filled in with healthy, well-healed bone. Barring extremely unusual dental pathology this is clearly an older individual. Dental Formation: M3s fully formed (14); adult (18+); Dental Eruption: M3s fully erupted (2); adult (18+). **Pathology:** Caries: 0 observed; Abscess: 0 observed; Calculus: 0 observed. **Notes:** Single complete mandible with no teeth and extensive alveolar resorption in area of posterior teeth. Anterior alveoli are damaged making assessment difficult; however, it appears that some anterior teeth were in situ at time of death.

Burial 6 #2

Inventory: Mandibular Right: M2, M3. **Demographics:** Sex: Unknown; Age: Adult (39.64 years); Dental Formation: RNM3 fully formed (14); adult (18+); Dental Eruption: RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: RNM2 (1 lingual). One tooth affected of 2 observed. **Notes:** RNM3—reduced. RNM3 fully erupted with wear—18+ years of age. Wear is considerable with flat occlusal surface but typical of a younger adult in this population.

Burial 6 #3

Inventory: Maxillary Right: M3; Mandibular Left: C. **Demographics:** Sex: Unknown; Age: Adult

(55+ years); Dental Formation: RXM3 fully formed (14); adult (18+); Dental Eruption: RXM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 2 observed. **Notes:** RXM3 hypercementosis.

Burial 6 #4

Inventory: Maxillary Right: M3, I2; Mandibular Right: P1, P2, M1, M2. **Demographics:** Sex: Unknown; Age: Subadult (6 – 8 years); Dental Formation: RNM1 (R1/4) = 3.75-5.25 years; RNM2 (R1/4) = 6-10 years; Dental Eruption: RNM1 fully erupted (2) = >6 years; RNM2 (<12 years), RNP2 (<11 years), RNP1 (<10 years), RXI2 (<8 years) not erupted. **Pathology:** Caries: 0 teeth affected of 6 observed; Abscess: 0 observed; Calculus: RNM2 (1 mesial). One tooth affected of 6 observed. **Notes:** RNP2—crown complete, root broken, minimum (Crc) = 6 +/- 1 years; RNP1—crown complete, root broken, minimum (Crc) = 6 +/- 1 years. Lack of distal IPCF on RNM1 and lack of mesial and distal IPCF on RNM2 suggest M1 is in occlusion and M2 is not in occlusion.

Burial 7 (MNI=3)

Burial 7 #1

Inventory: Maxillary Right: M3, M2, M1; Maxillary Left: M1, M2, M3; Mandibular Left: M2, M1, P2; Mandibular Right: M2. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: XM3s fully formed (14); adult (18+); Dental Eruption: XM3s fully erupted (2); adult (18+). **Pathology:** Caries: RXM1 (7) non-carious pulp exposure; 0 teeth affected of 10 observed; Abscess: 0 affected of 10 observed; Calculus: 0 teeth affected of 10 observed. **Notes:** All molar series have alveolar resorption. In addition to the teeth scored on data sheets, there were also 9 tooth roots from anterior teeth. Wear precluded identification of tooth type and no observations were available beyond wear scores of 8 for all.

Burial 7 #2

Inventory: Maxillary Right: dm2, M1; Maxillary Left: M1; Mandibular Left: dc; Mandibular Right: dm1, dm2, M1. **Demographics:** Sex: Unknown; Age: Subadult (1.5 – 3 years); Dental Formation: RXM1, LXM1, RNM1 (Crc); subadult (2-4 years); drxm2 (R1/2) = 1.6 years +/- .2 years; drnm1 (Rc) = 1.4 years +/- .2 years, drnm2 (R1/2) = 1.6 years +/- .2 years; Dental Eruption: RXM1, LXM1, RNM1 not erupted (<6 years); difficult to identify eruption stage of subadult teeth, could be unerupted or recently erupted due to lack of wear on teeth: drcm2 (2 years +/- 8 months), dlnc (18 months +/- 6 months), drnm1 (18 months +/- 6 months), drnm2 (18 months +/- 6 months); Dental Attrition: Adult teeth all unworn; subadult teeth all unworn. **Pathology:** Caries: 0 teeth affected of 6 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 6 observed.

Burial 7 #3

Inventory: Mandibular Right: M3. **Demographics:** Sex: Unknown; Age: Young Adult (18-25 years); Dental Formation: RNM3 fully formed (14); adult (18+); Dental Eruption: RNM3 fully erupted (2); adult (18+); Dental Attrition: RNM3 wear = 4, just erupted. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 1 tooth affected of 1 observed.

Burial 8

Inventory: Maxillary Right: M3, M2, M1, P2, P1, C, I2, I1; Maxillary Left: I1, I2, C, P1, P2, M1, M2, M3; Mandibular Left: M3, M2, M1, P2, P1, C, I1; Mandibular Right: I1, I2, P1, P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (45.77 years); Dental Formation: M3s fully formed (14); adult (18+); Dental Eruption: M3s fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 28 observed; Abscess: 0 affected of 28 observed; Calculus: RXM3 (1 buccal), RXM2 (1 buccal), RXM1 (2 buccal), RXP2 (1 buccal), RXP1 (1 buccal), LCM3 (2 buccal/lingual), LNM2 (2 buccal/lingual), LNM1 (1 buccal/lingual), LNP2 (1 buccal), RNM1 (2 buccal), RNM2 (2 buccal), RNM3 (2 buccal). 12 teeth affected of 28 observed.

Burial 9

Inventory: Maxillary Right: M2, P2, P1, C; Maxillary Left: I2, C, P1, P2, M1; Mandibular Left: M2; Mandibular Right: C, M1. **Demographics:** Sex: Unknown; Age: Adult (56.39 years); Dental Formation: M2s are completely formed (14); adult; Dental Eruption: LNM3 has a socket (14); adult. **Pathology:** Caries: RNM1 (1). One tooth affected of 12 observed; Abscess: 0 teeth affected of 2 observed; Calculus: LXM1 (1 buccal). One tooth affected of 12 observed. **Notes:** RNM1 has hypercementosis. Burial includes 5 anterior tooth roots completely worn (wear = 8), all single-rooted.

Burial 10 #1

Inventory: Maxillary Right: M1, P2; Maxillary Left: C, P1, P2, M1, M2; Mandibular Right: P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (38.48 years); Dental Formation: RNM3 (14); adult (18+); Dental Eruption: RNM3 (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 11 observed; Abscess: 0 affected of 12 observed; Calculus: LXC (1 lingual), LXP1 (1 lingual), LXP2 (1 lingual), LXM1 (1 buccal), LXM2 (1 buccal), RNM2 (1 lingual). Six teeth affected of 11 observed. **Notes:** Very large RNM2 with impacted RNM3. Size suggests male. Alveolar resorption in area of RNM2.

Burial 11#2

Inventory: Maxillary Left: M1; Mandibular Left: M1, P1; Mandibular Right: P2. **Demographics:** Sex: Unknown; Age: Subadult (~7 years); Dental Formation: No information; Dental Eruption: No information; Dental Attrition: LXM1, LNM1 wear = 2; LNP1, RNP2 wear = 0. **Pathology:** Caries: 0 teeth affected of 4 observed; Abscess: 0 observed; Calculus: LNP1 (1 lingual). One tooth affected of 4 observed.

Burial 12

Inventory: Maxillary Right: M3, M2, P2, P1, I2, I1; Maxillary Left: I1, I2, C, P2, M2; Mandibular Right: M2, M3. **Demographics:** Sex: Unknown; Age: Young Adult (20.24 years); Dental Formation: LXM3, RNM3 fully formed (14); adult (18+); Dental Eruption: RNM3 fully erupted (2); adult (18+); Dental Attrition: RNM3 = 2, LXM3 = 0. **Pathology:** Caries: 0 teeth affected of 13 observed; Abscess: 0 observed; Calculus: RXI2 (2 labial), RXI1 (2 labial), LXI1 (1 labial), LXI2 (2 labial), LXM2 (1 buccal). Six teeth affected of 13 observed.

Burial 13

Inventory: Maxillary Right: M2, M1, P2, P1, C; Maxillary Left: P1, M3; Mandibular Left: P1; Mandibular Right: M2, M3. **Demographics:** Sex: Unknown; Age: Adult (48.02 years); Dental Formation: LXM3, RNM3 fully formed (14); adult (18+); Dental Eruption: LXM3, RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 10 observed; Abscess: 0 observed; Calculus: RNM2 (1 mesial), RNM3 (1 mesial). Two teeth affected of 10 observed. **Notes:** RNM2 has unusual asymmetrical wear pattern. RXM2 is odd—looks like a twinned premolar; tooth measurements for this tooth are suspect and not recorded.

Burial 15

Inventory: Maxillary Right: M1; Mandibular Right: M1. **Demographics:** Sex: Unknown; Age: Adult (39.88 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 2 observed.

Burial 16 (MNI=3+)

Burial 16 #1

Inventory: Maxillary Left: M1, M2, M3; Mandibular Left: M2. **Demographics:** Sex: Unknown; Age: Adult (33.34 years); Dental Formation: No information; Dental Eruption: No information; Dental Attrition: RNM1=24, RNM2=16, RNM3=12, LMN2=22. **Pathology:** Caries: 0 teeth affected of 4 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 4 observed. **Notes:** Additional teeth are associated with burial 16. They include four unsided mandibular molars with similar and slightly less wear including an fifth molar, specifically a mandibular M3, which is unworn. It is this tooth that provides substantial justification for the identification of an additional, slightly younger adult. Even without it there is still an additional slightly younger adult represented (4 molars from 16#1, plus 5 additional molars that can not all come from 16#1, but which belong to 16#1 or 16#2 is problematic. There are also three unidentified tooth fragments, an unidentified maxillary premolar, a maxillary incisor (unsided), and an LXI2, none of which can be clearly allocated to one or the other of the adults in this burial. Attrition scores on the molars, in sequence mentioned, are 12+2 missing unscorable quads, scores of 12, 18, 16 and the unerupted molar with a score of 0.

Burial 16 #2

Inventory: Maxillary Left: dm1. **Demographics:** Sex: Unknown; Age: Subadult (1-3 years); Dental Formation: M3s fully formed (14); adult (18+); Dental Eruption: dlxm1 (2) = 2 years +/- 8 months; Dental Attrition: dlxm1 wear = 4. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed. **Notes:** Includes an unidentified deciduous incisor.

Burial 16 #3

Inventory: Mandibular Left: Unsided mandibular M3 = 0 wear. **Demographics:** Sex: Unknown; Age:

Adult (younger than 33.34 years); Dental Formation: No information; Dental Eruption: No information; Dental Attrition: M3=0. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed. **Notes:** See note above (16#1) for discussion of supplemental, unattributable teeth, some of which must belong to this individual and some to Burial 16#1, but not to Burial 16#2.

Burial 17

Inventory: Maxillary Right: dc, P1, I1; Maxillary Left: di2; Mandibular Left: P2, P1, C; Mandibular Right: I1, I2, C, P1. **Demographics:** Sex: Unknown; Age: Subadult (8-10 years); Dental Formation: No information; Dental Eruption: drxc erupted (1-10 years), dlxi2 erupted (1-8 years). RXP1 (<10 years), RXI1 (5-9 years) formed but unworn, suggests unerupted. LNP2 partially erupted at time of death (8-12 years). **Pathology:** Caries: 0 teeth affected of 11 observed; Abscess: 0 observed; Calculus: 1 tooth affected of 11 observed. **Notes:** Maxillary deciduous canines are some of the last deciduous teeth to be replaced. Impossible to determine if this individual only had maxillary deciduous canines in situ at time of death. Adult dentition is well formed but unworn, absence of molars is interesting.

Burial 18 (MNI=2)

Burial 18 #1

Inventory: Maxillary Left: M3; Mandibular Left: M2, M1, P1, C, I2; Mandibular Right: M1, M2. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 10 observed; Abscess: 0 observed; Calculus: LXP2 (1 labial), LXM1 (1 labial). Two teeth affected of 10 observed. **Notes:** LNM3, RNM3 congenital absence.

Burial 18 #2

Inventory: Maxillary Left: P2. **Demographics:** Sex: Unknown; Age: Subadult (9-13 years); Dental Formation: No information; Dental Eruption: LXP2 erupted (9-12 years +); Dental Attrition: LXP2 wear = 1. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: LNP2 (1 labial). One tooth affected of 1 observed.

Burial 22

Inventory: Maxillary Right: M2, M1; Mandibular Left: M3; Mandibular Right: M1, M2. **Demographics:** Sex: Unknown; Age: Adult (53.27 years); Dental Formation: LMM3 fully formed (14); adult (18+); Dental Eruption: LNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 5 observed; Abscess: 0 observed; Calculus: LNM3 (1 mesial, lingual). One tooth affected of 5 observed. **Notes:** Plus one unidentified tooth root. All teeth are heavily worn and tooth identifications are tentative. There is postcranial material with a great discrepancy in metrics and a tibia with a scar of recent union suggesting there is a second person in this burial; apparently a young adult female around 22 years of age.

Burial 23 (MNI=3)

Burial 23 #1

Inventory: Maxillary Right: M1, P2, P1, C, I2, I1; Maxillary Left: I1, I2, C, P1, P2, M1, M2; Mandibular Left: M3, M2, M1, P2, P1, C, I2, I1; Mandibular Right: I1, I2, P1, P2, M1, M2, M3. **Demographics:** Sex: Unknown: Age: Adult (40.86 years); Dental Formation: LNM3, RNM3 fully formed (14); adult (18+); Dental Eruption: LNM3, RNM3 fully erupted (2); adult (18+); Dental Attrition: note: Late Archaic, different wear pattern expected. **Pathology:** Caries: 0 teeth affected of 29 observed; Abscess: 0 affected of 29 observed; Calculus: RXM1 (1 buccal), RXP1 (1 buccal), RXC (1 buccal), LXC (1 buccal), LNM3 (1 lingual), LNM2 (1 lingual), LNM1 (2 lingual), LNP2 (2 lingual), LNP1 (2 lingual), LNC (1 lingual), LNI2 (1 lingual), LNI1 (1 lingual, labial), RNI1 (1 lingual, labial), RNI2 (1 lingual, labial), LNP1 (1 lingual), LNP2 (2 lingual), LNM1 (2 lingual), LNM2 (1 lingual), LNM3 (1 lingual, distal). Nineteenth teeth affected of 28 observed.

Burial 23 #2

Inventory: Maxillary Right: P2; Mandibular Right: di2. **Demographics:** Sex: Unknown; Age: Subadult (4-9 years); Dental Formation: RXP2 at least (Crc) = 5 years +; Dental Eruption: drni2 has erupted = 8 months +; Dental Attrition: RXP2 = 0; drni2 = 4, lightly worn suggests recent eruption (<2 years). **Pathology:** Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 2 observed. **Notes:** These teeth may not belong to the same individual.

Burial 23 #3

Inventory: Mandibular Right: M1. **Demographics:** Sex: Unknown; Age: Subadult (12.82 years); Dental Formation: No information; Dental Eruption: No information; Dental Attrition: RNM1 = 12. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed. **Notes:** This single tooth is clearly not related to the primary Burial 23.

Burial 25

Inventory: Maxillary Right: M3, M2, M1, P2, P1, C; Maxillary Left: I1, I2, C, P1, P2, M1, M2, M3; Mandibular Left: M3, M2, M1, P2, P1, C, I2, I1; Mandibular Right: I1, I2, C, P1, P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (38.62 years); Dental Formation: M3s fully formed (14); adult (18+); Dental Eruption: M3s fully erupted (2); adult (18+). **Pathology:** Caries: RXM3 (4), RXM2 (4), LNM1 (1), RNM3 (1). Four teeth affected of 30 observed; Abscess: RXM3 (1), RXM2 (1), LNM1 (1). 3 affected of 30 observed; Calculus: RXM1 (1 buccal), RNC (1 buccal), LXI1 (1 buccal), LXI2 (1 buccal), LXC (1 buccal), LXP1 (1 buccal), LXM1 (1 buccal), LNM3 (1 buccal), LNP1 (1 buccal), LNC (1 lingual), LNI2 (buccal, lingual), LNI1 (1 buccal, lingual), RNI1 (1 buccal, lingual), RNI2 (1 buccal, lingual), RNC (1 buccal, lingual), RNP1 (1 lingual, RNP2 (lingual), RNM2 (1 buccal), RNM3 (1 buccal). Nineteenth teeth affected of 26 observed. **Notes:** RXM2, 3—there appears to be a large cervical caries located between these two teeth. There is also a pocket of periodontal resorption between the teeth. Unusual wear pattern on upper incisors, which is likely use-related. **Malocclusion:** Mandibular anterior tooth crowding, RNI2 labial rotation, LXI1 palatal displacement, LXC labial rotation, Angle Class I Dysgnathia, no diastema, normal sagittal malocclusion, normal vertical malocclusion, normal transverse malocclusion, LNP1, 2 not in tooth row and appear to be palatally displaced, normal vertical posterior malocclusion, edge-to-edge crossbite, no widely spaced teeth or transpositions.

Burial 26 (MNI=2)

Burial 26 #1

Inventory: Maxillary Right: M3, M2, M1, P2, P1; Maxillary Left: I2, C, P1, P2, M1, M2, M3; Mandibular Left: M2, C; Mandibular Right: M2, M3. **Demographics:** Sex: Unknown; Age: Adult (32.00 years); Dental Formation: M3s fully formed (14); adult (18+); Dental Eruption: M3s fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 14 observed; Abscess: 0 observed; Calculus: RXP2 (1 buccal), RXP1 (1 buccal), LXI2 (1 buccal), LXC (1 buccal), LXP1 (1 buccal), LXP2 1 buccal). 6 teeth affected of 14 observed.

Burial 26 #2

Inventory: Maxillary Right: M1, P2, P1, C. **Demographics:** Sex: Unknown; Age: Adult (24.49 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 4 observed; Abscess: 0 teeth affected of 4 observed; Calculus: 0 teeth affected of 4 observed. **Notes:** Uto-Aztecan premolar.

Burial 27

Inventory: Maxillary Right: P1, C; Mandibular Left: M2, I1; Mandibular Right: I1, I2, C, P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: RNM3 fully formed (14); adult (18+); Dental Eruption: RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 11 observed; Abscess: LNM1 (1). One tooth affected of 2 observed; Calculus: 0 teeth affected of 10 observed. **Notes:** LNM3 congenital absence. Includes one unidentified tooth root worn beyond the crown which was found in the fine screen, likely unrelated to primary burial based on root condition (which suggests different taphonomic condition).

Burial 30

Inventory: Mandibular Left: M3, M2, M1, P2, P1, C, I2, I1; Mandibular Right: I1, C. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: LNM3 fully formed (14); adult (18+); Dental Eruption: LNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 10 observed; Abscess: 0 teeth affected of 10 observed; Calculus: LNM3 (1 buccal), LNM2 (1 lingual), LNM1 (1 lingual), LNP2 (2 buccal, lingual), LNP1 (2 lingual). Five teeth affected of 32 observed. **Notes:** Includes one unidentified anterior tooth root that is completely worn and one unidentified posterior tooth root that also is completely worn.

Burial 31 (MNI=2)

Burial 31 #1

Inventory: Mandibular Left: M1; Mandibular Right: M1. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: No information; Dental Eruption: No information; Dental Attrition: LNM = 40, RNM = 40. **Pathology:** Caries:

0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 2 observed.

Burial 31 #2

Inventory: Mandibular Right: P2. **Demographics:** Sex: Unknown; Age: Subadult (5-11 years); Dental Formation: RNP2 at least (Crc) = 5 years +; Dental Eruption: RNP2 likely not erupted = <11 years; Dental Attrition: RNP2 = 0. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 33

Inventory: Mandibular Left: dm2, dm1, M2, M1, I2. **Demographics:** Sex: Unknown; Age: Subadult (6-7 years); Dental Formation: LNM2 (Crc) = 6.5 +/- .7 years; Dental Eruption: LNM2 not erupted (< 12 years), LNM1 just erupted with no wear (6 years +/- 2 years), LNI2 just erupted (8 yeas +/- 2 years); Dental Attrition: LNM1 = 0, LNI2 = 0, dlnm2 = 14, dlnm1 = 16. **Pathology:** Caries: 0 teeth affected of 5 observed; Abscess: 0 teeth affected of 4 observed; Calculus: 0 teeth affected of 5 observed.

Burial 34 (MNI=2)

Burial 34 #1

Inventory: See "Notes" below. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 observed; Abscess: 0 observed; Calculus: 0 observed. **Notes:** This burial contains three molars worn beyond the crown; all wear = 40+ years of age. These teeth cannot be identified due to excessive wear and abnormal root formation. Burial also includes two roots from either premolar or canines, which are worn completely (wear = 8).

Burial 34 #2

Inventory: Mandibular Right: P1. **Demographics:** Sex: Unknown; Age: Subadult (4-6 years); Dental Formation: RNP1 (Crc) = 5.2 +/- .5 years; Dental Eruption: RNP1 is likely unerupted or just erupted (< 11 years); Dental Attrition: RNP1 = 0. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed. **Notes:** This is the smallest premolar Stojanowski has ever seen.

Burial 36 (MNI=2)

Burial 36 #1

Inventory: Maxillary Right: M3, M2, M1; Maxillary Left: P2; Mandibular Left: M3, M2, M1, I1; Mandibular Right: I1, I2, M1. **Demographics:** Sex: Unknown; Age: Adult (29.22 years); Dental Formation: RXM3, LNM3 fully formed (14); adult (18+); Dental Eruption: RXM3, LNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 10 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 10 observed.

Burial 36 #2

Inventory: Maxillary Right: I2; Mandibular Left: P1, C; Mandibular Right: P2. **Demographics:** Sex: Unknown; Age: Young Adult?; Dental Formation: All teeth fully formed; Dental Eruption: All teeth recently erupted based on wear. **Pathology:** Caries: 0 teeth affected of 4 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 4 observed.

Burial 37 (MNI=2)

Burial 37 #1

Inventory: Maxillary Right: M3, C, I2, I1; Maxillary Left: I1, I2, C, P1, P2, M2, M3; Mandibular Left: M3, M2, M1, P2, P1, C, I2, I1; Mandibular Right: I1, I2, C, P1, P2, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (48.44 years); Dental Formation: M3s fully formed (14); adult (18+); Dental Eruption: M3s fully erupted (2); adult (18+). **Pathology:** Caries: LXM2 (4), LXM3 (4), RNM2 (1), RNM3 (1). 4 teeth affected of 25 observed; Abscess: 0 affected of 12 observed; Calculus: RXM3 (1 buccal, lingual), LXM3 (2 buccal, lingual), LNM3 (2 buccal, lingual), RNM3 (1 buccal, lingual). 4 teeth affected of 26 observed. **Notes:** Very unusual wear on NI1s. Possible fourth molar in right mandible, difficult to identify.

Burial 37 #2

Inventory: Maxillary Right: M1. **Demographics:** Sex: Unknown; Age: Subadult (2-3 years); Dental Formation: RXM1 (Crc) = 2.2 +/- .5 years (males); Dental Eruption: RXM1 likely not erupted (< 6 years); Dental Attrition: RXM1 = 0 (< 6 years). **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 38 (MNI=2)

Burial 38 #1

Inventory: Maxillary Right: M1, P1; Maxillary Left: M2; Mandibular Left: M2, M1, P2. **Demographics:** Sex: Unknown; Age: Adult (47.49 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 6 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 6 observed. **Notes:** Includes two unidentified roots worn beyond the crown—single-rooted anterior teeth, likely canine but could be premolar.

Burial 38 #2

Inventory: Mandibular Left: M1. **Demographics:** Sex: Unknown; Age: Subadult (1-2 years); Dental Formation: LNM1 (Cr3/4) = 18 months +/- 6 months; Dental Eruption: LNM1 is unerupted (<5 years); Dental Attrition: LNM1 = 0 (<5 years). **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed. **Notes:** This individual was represented by only a single tooth found in association with Burial 38 #1. The primary individual from this burial was advanced in age as evidenced by dental attrition. This unworn LNM1 is clearly from a different person and supports the presence of another individual.

Burial 39

Inventory: Maxillary Right: M2, M1, P2; Maxillary Left: I2, P1, P2. **Demographics:** Sex: Unknown; Age: Adult (24.24 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 6 observed; Abscess: 0 observed; Calculus: RXM1 (1 buccal), LXI2 (1 labial), LXP1 (1 buccal). Three teeth affected of 6 observed.

Burial 40

Inventory: Maxillary Left: C, M1/2. **Demographics:** Sex: Unknown; Age: Adult (49.89 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: LXC (1 labial). One tooth affected of 2 observed.

Burial 41

Inventory: Maxillary Right: M3, M2, M1; Maxillary Left: M2, M3; Mandibular Left: M3. **Demographics:** Sex: Unknown; Age: Adult (32.17 years); Dental Formation: RXM3, LXM3, LNM3 fully formed (14); adult (18+); Dental Eruption: RXM3, LXM3, LNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 6 observed; Abscess: 0 observed; Calculus: RXM1 (1 buccal), LXM2 (1 buccal), LXM3 (1 mesial), LNM3 (1 buccal). Four teeth affected of 6 observed. **Notes:** RXM3 mesiodistal compression.

Burial 42 (MNI=2)

Burial 42 #1

Inventory: Maxillary Right: M1, P1, C, I2; Maxillary Left: C; Mandibular Left: P2, I1. **Demographics:** Sex: Unknown; Age: 46.11 years; Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 7 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 6 observed.

Burial 42 #2

Inventory: Maxillary Right: dc, di2; Maxillary Left: dm1, dm2; Mandibular Right: dc, dm1, dm2; Includes NM1 of unknown side. **Demographics:** Sex: Unknown; Age: Subadult (6-9 months); Dental Formation: NM1 (Coc) = 9 months +/- 3 months), dlxm2 (Cr3/4) = 6 months +/- 3 months, drxm2 (Cr3/4) = 6 months +/- 3 months, drnc (Ri) = 9 months +/- 3 months, drnm1 (Ri) = 9 months +/- 3 months; Dental Attrition: dlni2 = 2 (likely 6-9 months). Others unworn and likely not erupted or recently erupted. **Pathology:** Caries: 0 teeth affected of 14 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 14 observed.

Burial 43

Inventory: Maxillary Right: P1, P2, M1, M2, M3; Maxillary Left: C, P1, P2, M1, M2, M3; Mandibular Left: I2, C, P1, M1, M2, M3; Mandibular Right: P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Subadult (13.90 years); Dental Formation: No information; Dental Eruption: LXM3 formed but not yet erupted (<21 years). **Pathology:** Caries: 0 teeth affected of 19 observed; Abscess: 0 observed; Calculus: RXP1 (1 labial), RXM1 (1 buccal), LXC (1 labial), LXP1 (1 labial), LXM1 (1 buccal), RNM1 (1 lingual), RNM2 (1 mesial), LNI2 (1 all sides), LNC (1 labial/lingual), LNP1 (1 labial), LNM3 (1 buccal). Eleven teeth affected of 19 observed.

Burial 44 (MNI=5)

Burial 44 #1

Inventory: Maxillary Right: M3; Mandibular Right: I2, M1. **Demographics:** Sex: Unknown; Age: Subadult (~ 6 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 3 observed; Abscess: 0 observed; Calculus: RNI2 (1 labial). One tooth affected of 3 observed.

Burial 44 #2

Inventory: Mandibular Left: M1. **Demographics:** Sex: Unknown; Age: Adult (23.76 years); Dental Formation: No information; Dental Eruption: No information; Dental Attrition: LNM1 = 19. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 44 #3

Inventory: Maxillary Right: C; Maxillary Left: C, P1/2; Mandibular Right: M2, M3. **Demographics:** Sex: Unknown' Age: Adult (55+ years); Dental Formation: RNM3 fully formed (14); adult (18+); Dental Eruption: RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 2 observed.

Burial 44 #4

Inventory: Mandibular Right: dc. **Demographics:** Sex: Unknown; Age: Subadult (~ 1 year); Dental Formation: drnc (Ri) = 1 year; Dental Eruption: drnc unworn suggests unerupted or recently erupted; Dental Attrition: drnc = 0. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 44 #5

Inventory: An unsided maxillary third molar exhibiting partial crown formation was recovered and indicates a young individual. This degree of crown formation places the individual around 11 years of age. This tooth is clearly not from any of the other individuals in burial lot 44. It is clearly not from an adult and is too old to be associated with the 6 year old individual from 44 #1; Maxillary Right: Unsided third molar; Includes unsided XM3. **Demographics:** Sex: Unknown; Age: Subadult (8-14 years); Dental Formation: L/RXM3 (Cr3/4) = 11 years +/- 30 months; Dental Eruption: L/RXM3 unerupted = <18 years. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 45

Inventory: Maxillary Right: I1; Maxillary Left: I1; Mandibular Right: I2. **Demographics:** Sex: Unknown; Age: Adult (30.18 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 3 observed; Abscess: 0 observed; Calculus: RXI1 (1 labial), LXI1 (1 labial). Two teeth affected of 3 observed.

Burial 46

Burial 46 #2

Inventory: Maxillary Right: P2, P1; Maxillary Left: C, P1, P2, M1, M2, M3; Mandibular Left: M3, M2, M1; Mandibular Right: M1, M3. **Demographics:** Sex: Unknown; Age: Adult (26.36 years); Dental Formation: LXM3, LNM3, RNM3 fully formed (14); adult (18+); Dental Eruption: LXM3, LNM3, RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 9 observed; Abscess: 0 observed; Calculus: LXC (1 labial), LXP1 (1 labial). Two teeth affected of 7 observed.

Burial 47 (MNI=2)

Burial 47 #1

Inventory: Maxillary Right: P1, C; Maxillary Left: P2, M1, M3; Mandibular Left: P2, C; Mandibular Right: P2. **Demographics:** Sex: Unknown; Age: Adult (24.13 years); Dental Formation: No information; Dental Eruption: LXM3 is erupted with light wear = 18+ years. **Pathology:** Caries: 0 teeth affected of 8 observed; Abscess: 0 observed; Calculus: RXP1 (1 labial), LXP2 (1 labial), LXM1 (1 buccal), LNC (1 mesial). Four teeth affected of 8 observed.

Burial 47 #2

Inventory: Maxillary Right: M1; Maxillary Left: dm1; Mandibular Right: dm1. **Demographics:** Sex: Unknown; Age: Subadult (1-3 years); Dental Formation: RXM1 (Cr3/4) = 2 years +/- 8 months, rdnm1 (R3/4) = 1.25 years; Dental Eruption: RXM1 unerupted = < 5 years +/- 16 months, rdnm1 erupted = 18 months +/- 6 months; Dental Attrition: RXM1 = 0, dlxm1 = 4, drnm1 = 4. **Pathology:** Caries: 0 teeth affected of 3 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 3 observed.

Burial 48 (MNI=2)

Burial 48 #1

Inventory: Maxillary Left: I1, I2; Mandibular Left: M3, M2, M1. **Demographics:** Sex: Unknown; Age: Adult (46.24 years); Dental Formation: LNM3 fully formed (14); adult (18+); Dental Eruption: LNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 4 observed; Abscess: 0 observed; Calculus: LXI2 (I buccal). One tooth affected of 4 observed.

Burial 48 #2

Inventory: Maxillary Right: C; Mandibular Left: M3, M2, M1, P1, I1; Mandibular Right: P1, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (37.45 years); Dental Formation: RNM3, LNM3 fully formed (14); adult (18+); Dental Eruption: RNM3, LNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 10 observed; Abscess: 0 affected of 6 observed; Calculus: RXC (1 buccal, lingual), LNM3 (1 distal), LNM1 (1 buccal), LNP1 (1 buccal, lingual), LNI2 (buccal, lingual), RNM1 (buccal, lingual). Six teeth affected of 7 observed.

Burial 49 (MNI=2)

Burial 49 #1

Inventory: Maxillary Left: P2, M1. **Demographics:** Sex: Unknown; Age: Adult (54.77 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: LNP2 (1 buccal). One tooth affected of 2 observed.

Burial 49 #2

Inventory: Maxillary Right: M1. **Demographics:** Sex: Unknown; Age: Subadult (.5-1.5 years); Dental Formation: RXM1 (Cr1/2) = .5-1.5 years; Dental Eruption: RXM1 unerupted = <6 years; Dental Attrition: RXM1 = 0. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 50 (MNI=2)

Burial 50 #1

Inventory: Maxillary Right: M3, M2, M1, P2, P1, C, I2, I1; Maxillary Left: I1, I2, C, P1, P2, M1, M2. **Demographics:** Sex: Unknown; Age: Adult (39.90 years); Dental Formation: RXM3 fully formed (14); adult (18+); Dental Eruption: RXM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 10 observed; Abscess: 0 observed; Calculus: RXM2 (1 buccal), RXP2 (1 buccal), RXI2 (1 buccal). Three teeth affected of 10 observed.

Burial 50 #2

Inventory: Mandibular Left: C. **Demographics:** Sex: Unknown; Age: Subadult (4-11 years); Dental Formation: LNC at least (Crc) = 4 years +; Dental Eruption: LNC likely unerupted or recently erupted (<11 years); Dental Attrition: LNC = 0. **Pathology:** Caries: 0 teeth affected of 14 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 14 observed.

Burial 51

Inventory: Maxillary Right: M3; Maxillary Left: M2, M3; Mandibular Left: M2, M1; Mandibular Right: P1, P2, M2. **Demographics:** Sex: Unknown; Age: Adult (24.87 years); Dental Formation: RXM3, LXM3 fully formed (14); adult (18+); Dental Eruption: RXM3, LXM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 6 observed; Abscess: 0 affected of 1 observed; Calculus: 0 teeth affected of 5 observed.

Burial 52

Inventory: Maxillary Left: C, P1, M1; Mandibular Left: M3, M1; Mandibular Right: M1, M3. **Demographics:** Sex: Unknown; Age: Adult (47.81 years); Dental Formation: LNM3, RNM3 fully formed (14); adult (18+); Dental Eruption: LNM3, RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 5 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 5 observed. **Notes:** Includes five molar crown fragments, which are heavily worn with no recoverable information as to location within the tooth row.

Burial 54

Inventory: Maxillary Right: M2. **Demographics:** Sex: Unknown; Age: Subadult (12-15 years); Dental Formation: No information; Dental Eruption: XRM2 is recently erupted (~ 12-15 years); Dental Attrition: XRM2 = 4. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 55

Inventory: Maxillary Right: I1; Maxillary Left: I1; Mandibular Left: M3, M2; Mandibular Right: C, P1, P2, M2. **Demographics:** Sex: Unknown; Age: Adult (55+ years); Dental Formation: LNM3 fully formed (14); adult (18+); Dental Eruption: LNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 8 observed; Abscess: 0 affected of 3 observed; Calculus: 0 teeth affected of 6 observed. **Notes:** Includes five anterior tooth roots worn beyond the crown. These could not be identified.

Burial 58

Inventory: Maxillary Right: M1; Maxillary Left: M2. **Demographics:** Sex: Unknown; Age: Subadult (5-6 years); Dental Formation: RXM1 at least (R1/4) = 5 years +; Dental Eruption: RXM1 likely not erupted = < 6 years +/- 24 months; Dental Attrition: RXM1 = 0. **Pathology:** Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 2 observed. **Notes:** Molars might not belong to same individual

Burial 59 #2

Inventory: Maxillary Right: C, I2, dc; Maxillary Left: M1, I1, dm2, dc; Mandibular Right: M1, dm2; Mandibular Left : dm2. **Demographics:** Sex: Unknown; Age: Subadult (2 – -3.5 years); Dental Formation: RXC (Cr1/2) = 2.2 +/- .2 years, LXM1 (Ri) = 3.2 years; Dental Eruption: All likely unerupted (< 6 years); Dental Attrition: All unworn. **Pathology:** Caries: 0 teeth affected of 4 adult teeth observed; Abscess: 0 observed; Calculus: 0 teeth affected of 4 adult observed. **Notes:** The adult, 59 #1, is represented only by long bone fragments that are clearly not associated with the individual (59 #2) which is represented by 10 teeth, all unworn and probably all unerupted.

Burial 60

Inventory: Maxillary Right: M2, M1, P2, P1, C, I2, I1, dm2, dm1, dc, di2, di1; Maxillary Left: I1, I2, C, P1, P2, M1, M2, di1, dc, dm1, dm2; Mandibular Left: M2, M1, P1, C, I2, I1, dm2, dm1, di2, di1; Mandibular Right: I1, I2, C, P1, P2, M1, M2, di2, dc, dm1, dm2. **Demographics:** Sex: Unknown; Age: Subadult (5-7 years); Dental Formation: RXM2, RXP2, RXP1, LXM2, LNM2, LNP1, RNP1, RNP2, RNM2 (Crc) = 5-6 years, RXI1, RXI2, RXC (R1/4) = 5 years +/- 16 months, LXP1 (Ri) = 6 years +/- 24 months. dlxc (Ac) = 5-7 years; Dental Eruption: LNM2 is unerupted (<11 years +/- 30 months). All deciduous teeth are erupted = 3+ years; Dental Attrition: M1s ~9-10, others 0. Suggests older age than the development data. **Pathology:** Caries: 0 teeth affected of 41 observed; Abscess: 0 observed; Calculus: dlcm2 (1 buccal), dlnm2 (1 buccal), drnm2 (1 buccal). Two teeth affected of 41 observed.

Burial 61 (MNI=2)

Burial 61 #1

Inventory: Maxillary Right: P2, P1, C, I2, I1; Maxillary Left: C, P1, P2; Mandibular Right: M1,M2. **Demographics:** Sex: Unknown; Age: Adult (31.68 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 9 observed; Abscess: 0 observed; Calculus: RXP2 (1 buccal), RXC (1 buccal), RXI1 (2 buccal), LXC (1 buccal), LXP1 (1 buccal), RNM1 (1 buccal), RNM2 (1 buccal, lingual). Seven teeth affected of 9 observed. **Notes:** Includes one anterior tooth root with wear = 8, unable to identify but looks like a canine or premolar.

Burial 61 #2

Inventory: Maxillary Left: dc. **Demographics:** Sex: Unknown; Age: Subadult; Dental Formation: No information; Dental Eruption: No information; Dental Attrition: dlxc = 3. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 62 (MNI=3)

Burial 62 #1

Inventory: Maxillary Right: M3, M2, M1, P1; Maxillary Left: M1, M2; Mandibular Right: M3. **Demographics:** Sex: Unknown; Age: Adult (31.13 years); Dental Formation: RXM3, RNM3 fully formed (14); adult (18+); Dental Eruption: RXM3, RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 7 observed; Abscess: 0 observed; Calculus: RXM1 (1 lingual), RXP1 (1 lingual). Two teeth affected of 7 observed.

Burial 62 #2

Inventory: Maxillary Right: M1, P1/2; Maxillary Left: M2. **Demographics:** Sex: Unknown; Age: Adult (49.04 years); Dental Formation: No information; Dental Eruption: No information.

Pathology: Caries: 0 teeth affected of 2 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 2 observed.

Burial 62 #3

Inventory: Maxillary Right: M1, P1; Maxillary Left: I1, M2; Mandibular Left: M2, M1, dm2; Mandibular Right: dm2, M2. **Demographics:** Sex: Unknown; Age: Subadult (6-8 years); Dental Formation: LNM2, RNM2 (Crc) = 6.5 +/- .7 years; Dental Eruption: RXM1, LXI1, LNM1 recently erupted, LXM2, LNM2, RNM2 unerupted (<11 years). Presence of dm2s suggests 10 years +/- 30 months; Dental Attrition: M1s lightly worn (4-5), dm2s = 20. **Pathology:** Caries: 0 teeth affected of 9 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 9 observed.

Burial 65

Burial 65 #2

Inventory: Mandibular Right: M1. **Demographics:** Sex: Unknown; Age: Subadult (~16 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 1 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 1 observed.

Burial 66 (MNI=2)

Burial 66 #1

Inventory: Maxillary Right: M3, M2, M1, P2, P1, C, I1; Maxillary Left: C, P1, M1, M2, dxm1. **Demographics:** Sex: Unknown; Age: Subadult (4-8 years); Dental Formation: LXC (Ri) = 5-6 years, LXP1 (Ri) = 5-7 years; Dental Eruption: No information; Dental Attrition: lxdm1 = 12, all adult teeth unworn. **Pathology:** Caries: 0 teeth affected of 3 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 3 observed.

Burial 66 #2

Inventory: Maxillary Right: M2; Maxillary Left: C, P1; Mandibular Left: P1, P2, M1, M2; Mandibular Right: I2, P1, M1, M2. **Demographics:** Sex: Unknown; Age: Adult (38.67 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 11 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 11 observed.

Burial 67 (MNI=2)

Burial 67 #1

Inventory: Maxillary Right: M2, P1, C, I2, I1; Maxillary Left: I1, I2, C, P2, M1, M2, M3; Mandibular Left: M3, M2, M1, P2, P1, C; Mandibular Right: I1, C, P1, P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (30.64 years); Dental Formation: LNM3, RNM3 fully formed (14); adult (18+); Dental Eruption: LNM3, RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 24 observed; Abscess: 0 affected of 1 observed; Calculus: LXC (1 buccal). One tooth affected of 24 observed. **Notes:** LNM3 buccal rotation and palatal displacement, LNM2 buccal rotation.

Burial 67 #2

Inventory: Mandibular Left: dm1, dc, di2; Mandibular Right: dc, dm1, dm2, M1. **Demographics:** Sex: Unknown; Age: Subadult (2-3 years); Dental Formation: RNM1 (Crc) = 2.2 +/- .2 years; Dental Eruption: RNM1 not erupted = < 6 years, dlnc, dlni2, drnm1 recently erupted (18 -24 months), drnm2 unerupted (1-2 years). **Pathology:** Caries: 0 teeth affected of 6 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 6 observed. **Notes:** RNM1 has mesial paraconid tubercle

Burial 68

Inventory: Maxillary Right: M1; Mandibular Left: I1; Mandibular Right: I1, I2, C, M1, dm2. **Demographics:** Sex: Unknown; Age: Subadult (5-6 years); Dental Formation: RXM1 (R1/4) = 3-6 years; Dental Eruption: RNM1 recent eruption (5-9 years); Dental Attrition: drnm2 = 32, RNM1 = 4. **Pathology:** Caries: 0 teeth affected of 3 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 3 observed.

Burial 69 (MNI=2)

Burial 69 #1

Inventory: Maxillary Right: I1; Maxillary Left: C; Mandibular Right: M1. Includes three premolar roots worn beyond the crown, plus one molar crown fragment. **Demographics:** Sex: Unknown; Age: Adult (56.15 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 3 observed; Abscess: 0 observed; Calculus: RNM1 (1 buccal, lingual). One tooth affected of 3 observed.

Burial 69 #2

Inventory: Maxillary Right: I1. Includes fragment of unworn enamel from lower left molar. **Demographics:** Sex: Unknown; Age: Subadult (<8 years); Dental Formation: No information; Dental Eruption: RXI1 unerupted or recently erupted = < 8 years); Dental Attrition: RXI1 = 0. **Pathology:** Caries: 0 teeth affected of 14 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 14 observed.

Burial 71 (MNI=2)

Burial 71 #1

Inventory: Maxillary Right: M2, M1, P2; Maxillary Left: P1, P2, M1, M2, M3; Mandibular Left: M2, M1, P2, P1, C, I2; Mandibular Right: P2. **Demographics:** Sex: Unknown; Age: Adult (21.20 years); Dental Formation: LXM3 fully formed (14); adult (18+); Dental Eruption: LXM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 15 observed; Abscess: 0 observed; Calculus: LXM1 (1 buccal). One tooth affected of 15 observed.

Burial 71 #2

Inventory: Maxillary Right: dm1, dc, M1; Maxillary Left: m2; Mandibular Left: m2, m1; Mandibular Right: m2. **Demographics:** Sex: Unknown; Age: Subadult (~1 year); Dental Formation: drxm1 (R1/2) = 1 +/- .1 years, drxc (C1i) = 6-12 months, dlxm2, drxm2 (C1i) = 8-16 months, dlxm1 (R1/4) = 8-16 months), RXM1 (Cr1/2) 6-12 months; Dental Eruption: RXM3, LNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 7 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 7 observed.

Burial 72

Inventory: Maxillary Left: C; Mandibular Left: C, I2; Mandibular Right: P1, P2. **Demographics:** Sex: Unknown; Age: Adult (38.15 years); Dental Formation: No information; Dental Eruption: No information. **Pathology:** Caries: 0 teeth affected of 5 observed; Abscess: 0 affected of 6 observed; Calculus: 0 teeth affected of 5 observed.

Burial 73

Inventory: Maxillary Right: M3, M2, M1, P2, P1, C; Maxillary Left: I1, I2, C, P1, P2, M1, M2, M3; Mandibular Left: M3, M2, M1, P2, P1; Mandibular Right: P1, P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (30.30 years); Dental Formation: RXM3, LXM3, LNM3, RNM3 fully formed (14); adult (18+); Dental Eruption: RXM3, LXM3, LNM3, RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 24 observed; Abscess: 0 observed; Calculus: RXC (1 buccal), LXC (1 buccal), LXP1 (1 buccal), LXP2 (1 buccal), LNM3 (1 lingual). Five teeth affected of 24 observed. **Notes:** RXM3 is reduced; LXM3 essentially looks like a very large premolar, 2 cusped; LXI2 is cone-shaped.

Burial 74 (MNI=2)

Burial 74 #1

Inventory: Maxillary Left: M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (44.76 years); Dental Formation: LXM3 fully formed (14); adult (18+); Dental Eruption: LXM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 3 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 3 observed.

Burial 74 #2

Inventory: Mandibular Left: dm2, dm1, dc; Mandibular Right: dc, dm2. **Demographics:** Sex: Unknown; Age: Subadult (6-12 months); Dental Formation: dlnm2, drnm2 (Cr3/4) = 6-12 months, dlnm1 (R1/4) = 8-16 months, dlnc, drnc (Crc) = 6-12 months; Dental Eruption: All unerupted based on wear (<12 months); Dental Attrition: All unworn. **Pathology:** Caries: 0 teeth affected of 5 observed; Abscess: 0 observed; Calculus: 0 teeth affected of 5 observed.

Burial 75

Inventory: Maxillary Right: I2; Mandibular Left: M2, M1, P2, P1, C; Mandibular Right: I1, I2, C, P1, P2, M1, M2, M3. **Demographics:** Sex: Unknown; Age: Adult (29.96 years); Dental Formation: RNM3 fully formed (14); adult (18+); Dental Eruption: RNM3 fully erupted (2); adult (18+). **Pathology:** Caries: 0 teeth affected of 14 observed; Abscess: 0 observed; Calculus: RNI2 (1 buccal), RNC (1 buccal, lingual), RNP2 (1 buccal), RNM1 (1 buccal, lingual), RNM2 (2 buccal, lingual). Five teeth affected of 14 observed.

Buckeye Knoll Dental Metrics

As noted in the proceeding section, dental analysis followed protocols of the Standards Manual (Buikstra and Ubelaker 1994), with a few additions. Data for both right and left sides of adult and deciduous dentition were recorded, and statistics for both sides are presented in the following section. All measures are in millimeters. Here, comparative considerations will be given to the left dimensions only. As noted earlier, virtually all the dental data was collected by Stojanowski to minimize interobserver differences. This is particularly important because of the large comparative data set Stojanowski compiled as a part of his dissertation research and subsequently used for various parts of the Buckeye Knoll analysis procedures (Stojanowski 1997, 2002, 2004, and 2005). Also used for comparative purposes were data from sites identified in the Windover monograph (Doran 2002).

Basically, the current section provides a brief comparison of the collected dental metric information (crown dimensions only) for the Buckeye Knoll materials and includes all dental metrics collected, not just dental metrics from specific burials. Neck dental statistics are presented only in the data tables and are not compared to the other samples. They are presented for other researchers' potential comparative efforts.

As noted, this section focuses specifically on the dental metrics of the Buckeye Knoll materials. Dental metrics on both subadults and adults were collected. In addition to buccolingual, mesiodistal, and crown-height data, metrics on neck dimensions were collected. Measures are abbreviated in the following manner for the sake of brevity, following the same procedures outlined earlier (to refresh: Lnm1cmd = left mandibular first molar crown mesiodistal dimension; rnm1cbl = right mandibular second molar buccolingual dimension, etc.). Abbreviations preceded by a "d" indicate a deciduous tooth dimension. Adult dental dimensions are presented in Tables 13-14 to 13-17.

Deciduous Dental Metrics

Sample sizes are relatively small for the deciduous dentition with larger sample sizes typically found in the molars, particularly the second molars (see Tables 13-14 through 13-17 and Figure 13-2 for deciduous dental metrics). Sample sizes are larger in the mandibular dentition than in the maxillary dentition. The most poorly represented teeth were the single-rooted anterior teeth, particularly the incisors. This is typical of most archaeological collections where anterior dentition is lost because it is both the earliest in the developmental cycle and the smallest. It is, therefore, the most likely to disappear from the archaeological record. As would be expected, crown-height dimensions are more variable than the other dimensions because there was a greater range of variability in the amount of wear on each tooth; some were unworn while others showed greater amounts of wear.

Deciduous dental dimensions reflect a combination of early developmental processes (fetal to roughly five months) and developmental processes of the molars which are completed between six and nine months after birth (Buikstra and Ubelaker 1994). Deciduous dental dimensions, thus, reflect a combination of factors including maternal health during fetal development and early nutrition after birth. As such, they represent a fairly narrow window on developmental processes early in life.

Sample sizes are small but may be of use to others in examining early childhood health. The basic information, however, will be of use to studies focusing on early health and, when aggregated into larger databases, will provide an additional venue for biocultural adaptation studies. In the FSU database, we have similar dimensions for the Windover subadult series. Figure 13-2 illustrates the comparisons between the left dimensions only. It is interesting to note the anterior dentition, the incisors and canines, in the Buckeye Knoll series appear to be larger. The Buckeye Knoll maximum values tend to be as large as, or larger than, the Windover measures. Minimum values in both series are, however, very similar. It is suggestive that those in the Buckeye Knoll series are shifted to larger values. Taken at its simplest level, this suggests that either genetically the Buckeye Knoll individuals have larger teeth, or maternal health in the Buckeye Knoll individuals is closer to optimum; thus the teeth had an opportunity to reach a larger size in the growing interval. This must be tempered with the previous note that some of the adult teeth are extremely small and, in contrast to what is observed in the deciduous inventory, suggest developmental stress, perhaps more clearly after birth as opposed to prenatally. Crown dimensions in these teeth are largely "set" by birth, and development after birth takes place in root completion as opposed to completion of crown growth. It is worth nothing, and will be discussed later, that only one of the 41 deciduous canines examined for dental defects (LEH) exhibited such defects. This supports the proposition of relatively good early health conditions and near-optimum growth trajectories unassailed by diet and disease perturbations, at least at or near birth.

In the molars, however, crowns completed growth near birth or in the first six months after birth. In these teeth, Buckeye Knoll dental metrics appear to be shift-

Table 13-14. Deciduous Dental Dimensions—Left Mandibular Dimensions.

	di1	di2	Dc	dm1	dm2
Mesiodistal-Crown					
Sample	5	4	9	5	10
Minimum	4.05	4.36	5.76	7.47	10.54
Maximum	4.22	4.74	6.8	8.74	11.11
Median	4.12	4.575	6.07	8.19	10.675
Mean	4.132	4.562	6.174	8.202	10.751
Standard Deviation	0.085	0.174	0.394	0.489	0.19
Buccolingual-Crown					
Sample	6	5	5	6	11
Minimum	3.25	3.95	5.31	5.87	3.94
Maximum	4.17	5.15	5.96	6.99	9.45
Median	3.65	5.01	5.76	6.83	8.88
Mean	3.673	4.728	5.672	6.642	8.097
Standard Deviation	0.356	0.535	0.292	0.414	1.994
Crown Height					
Sample	5	4	7	4	4
Minimum	3.64	2.78	5.15	4.94	5.64
Maximum	6.04	5.82	7.44	6.66	11.21
Median	5.1	5.065	6.86	6.56	6.25
Mean	5.126	4.682	6.56	6.18	7.338
Standard Deviation	0.938	1.345	0.815	0.829	2.598
Mesiodistal-Neck					
Sample	3	4	4	1	2
Minimum	2.76	3.08	4.31	6.75	7.19
Maximum	3.57	3.88	5.31	6.75	7.72
Median	3.22	3.3	4.68	6.75	7.455
Mean	3.183	3.39	4.745	6.75	7.455
Standard Deviation	0.406	0.346	0.42	--	0.375
Buccolingual-Neck					
Sample	4	3	3	2	2
Minimum	3.01	3.61	4.58	4.49	6.5
Maximum	3.74	4.44	5.07	4.56	6.77
Median	3.245	4.07	4.98	4.525	6.635
Mean	3.31	4.04	4.877	4.525	6.635
Standard Deviation	0.31	0.416	0.261	0.049	0.191

Note: All measures in millimeters.

Table 13-15. Deciduous Dental Dimensions—Left Maxillary Dimensions.

	dI1	di2	Dc	dm1	dm2
Mesiodistal-Crown					
Sample	9	6	3	7	5
Minimum	6.19	4.95	6.44	6.73	9
Maximum	7.7	6.56	7.37	9.01	10.3
Median	6.49	6.23	6.97	6.93	9.19
Mean	6.763	5.947	6.927	7.387	9.386
Standard Deviation	0.479	0.694	0.467	0.83	0.53
Buccolingual-Crown					
Sample	8	2	4	7	11
Minimum	4.41	4.99	5.41	8.94	9.49
Maximum	5.59	5.4	6.75	9.56	10.5
Median	4.98	5.195	5.52	9.22	9.94
Mean	5.016	5.195	5.8	9.237	9.941
Standard Deviation	0.409	0.29	0.641	0.191	0.325
Crown Height					
Sample	8	2	2	3	8
Minimum	2.49	6.42	4.88	5.31	3.17
Maximum	7.12	6.5	5.15	6.02	6.07
Median	5.48	6.46	5.015	5.64	5.065
Mean	5.206	6.46	5.015	5.657	4.94
Standard Deviation	1.672	0.057	0.191	0.355	0.922
Mesiodistal-Neck					
Sample	5	2	1	2	4
Minimum	4.13	3.95	4.7	5.47	6.14
Maximum	5.71	5.26	4.7	9.52	7.78
Median	5.21	4.605	4.7	7.495	6.395
Mean	4.986	4.605	4.7	7.495	6.677
Standard Deviation	0.642	0.926	--	2.864	0.746
Buccolingual-Neck					
Sample	2	2	1	2	5
Minimum	4	4.24	4.14	5.47	6.45
Maximum	4.33	4.63	4.14	10.22	9.37
Median	4.165	4.435	4.14	7.845	8.18
Mean	4.165	4.435	4.14	7.845	7.972
Standard Deviation	0.233	0.276	.	3.359	1.401

Note: All measures in millimeters.

Table 13-16. Deciduous Dental Dimensions—Right Mandibular Dimensions.

	di1	di2	dc	dm1	dm2
Mesiodistal-Crown					
Sample	0	9	10	10	10
Minimum	--	4.56	4.78	1.52	9.84
Maximum	--	6.33	7.09	10.87	12.34
Median	--	5.46	6.26	8.28	10.815
Mean	--	5.536	6.171	7.896	10.837
Standard Deviation	--	0.714	0.671	2.446	0.642
Buccolingual-Crown					
Sample	2	6	11	10	8
Minimum	3.57	4.02	4.95	6.11	8.31
Maximum	4.22	4.94	6.54	8.29	9.16
Median	3.895	4.28	5.65	6.56	8.68
Mean	3.895	4.412	5.612	6.809	8.73
Standard Deviation	0.46	0.383	0.46	0.629	0.318
Crown Height					
Sample	1	6	10	7	6
Minimum	4.45	3.91	3.98	4.7	3.92
Maximum	4.45	6.68	7.65	7.22	7
Median	4.45	5.9	7.045	6.56	5.725
Mean	4.45	5.558	6.653	6.249	5.605
Standard Deviation	--	1.181	1.053	0.997	1.32
Mesiodistal-Neck					
Sample	1	2	6	4	5
Minimum	3.07	3.43	4.27	6.17	7.08
Maximum	3.07	3.57	5.19	6.84	8.3
Median	3.07	3.5	4.575	6.63	7.57
Mean	3.07	3.5	4.663	6.567	7.588
Standard Deviation	--	0.099	0.353	0.284	0.498
Buccolingual-Neck					
Sample	0	2	6	4	5
Minimum	--	3.7	4.33	5.14	6.19
Maximum	--	4.32	5.24	5.46	7.3
Median	--	4.01	4.91	5.43	6.77
Mean	--	4.01	4.822	5.365	6.76
Standard Deviation	--	0.438	0.366	0.151	0.415

Note: All measures in millimeters.

Table 13-17. Deciduous Dental Dimensions—Right Maxillary Dimensions.

	di1	di2	Dc	dm1	dm2
Mesiodistal-Crown					
Sample	7	3	4	7	7
Minimum	6.37	5.46	7.14	6.96	8.66
Maximum	7.26	6.69	11.51	7.81	11.05
Median	6.77	6.52	7.215	7.38	9.26
Mean	6.793	6.223	8.27	7.29	9.44
Standard Deviation	0.33	0.667	2.161	0.303	0.778
Buccolingual-Crown					
Sample	7	2	5	9	8
Minimum	4.49	4.66	5.27	8.23	9.89
Maximum	5.6	5.08	6.48	12.42	10.7
Median	5.11	4.87	5.58	9.52	10.09
Mean	5.08	4.87	5.802	9.608	10.194
Standard Deviation	0.334	0.297	0.491	1.151	0.273
Crown Height					
Sample	6	1	4	3	4
Minimum	4.21	4.14	3.87	5.35	5.11
Maximum	6.7	4.14	6.07	6.38	6.56
Median	6.115	4.14	4.63	5.82	5.51
Mean	5.945	4.14	4.8	5.85	5.673
Standard Deviation	0.91	--	0.937	0.516	0.635
Mesiodistal-Neck					
Sample	4	1	3	2	2
Minimum	4.27	4.08	5.26	5.48	6.26
Maximum	5.3	4.08	5.5	5.96	6.47
Median	4.815	4.08	5.39	5.72	6.365
Mean	4.8	4.08	5.383	5.72	6.365
Standard Deviation	0.447	--	0.12	0.339	0.148
Buccolingual-Neck					
Sample	3	1	2	2	1
Minimum	3.86	3.99	4.57	7.78	9.11
Maximum	4.46	3.99	4.97	8.6	9.11
Median	4.11	3.99	4.77	8.19	9.11
Mean	4.143	3.99	4.77	8.19	9.11
Standard Deviation	0.301	--	0.283	0.58	--

Note: All measures in millimeters.

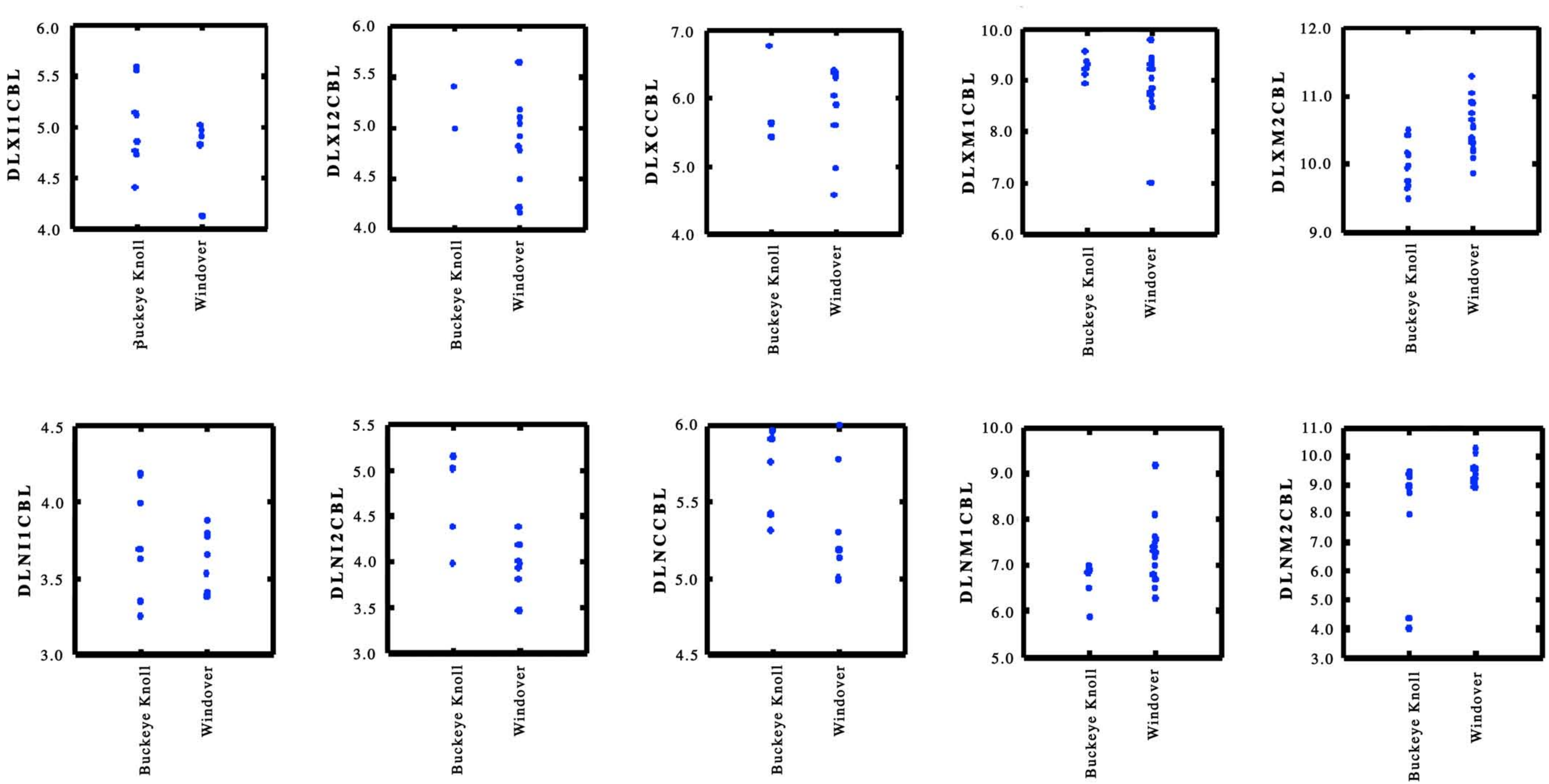


Figure 13-2. Deciduous dental dimensions for Buckeye Knoll and Windover, left mandibular and left maxillary dimensions (in millimeters).

ed toward smaller values. In general, Buckeye Knoll maximum values are slightly lower to noticeably lower (particularly in the maxillary m2), and the Buckeye Knoll series has lower minimum values. The range of values (low to high) for most of the Buckeye Knoll series also seems much greater than observed in the Windover series. This suggests a greater range in biocultural/ontogenetic stress after birth and is reflected in the smaller teeth developing from birth to roughly six years. Basically, we could envision this as a context in which there is wide fluctuation in stress—some years are near optimum conditions and stress is low, and in other years (or seasons) stress is much higher. This scenario could account for the greater variability in values expressed in the wider range typical of the Buckeye Knoll series. This scenario is also suggested by the near microdontia condition in some adult teeth associated with subadults who did not survive to adulthood.

It is possible, although this comparison is hardly sufficient to be considered a robust interpretation, that neonatal health and nutrition may not have been as sufficient at Buckeye Knoll as they were at Windover in the period immediately after birth, but were actually better at Buckeye Knoll in the later phases of prenatal development. This interpretation obviously relies more heavily on a developmental/environmental difference rather than positing a genetic difference resulting in differences in dental sizes. At least on the surface, if genetic differences in these two early samples was the more likely cause of the differences, one would have expected these differences to have been more consistent across all the teeth, not just those which mature earlier. A taphonomic explanation also does not make sense in this context because the smaller teeth across the inventory would have been more dramatically affected by the harsh soil conditions. Had the small teeth been differentially removed, with only the larger teeth surviving, the anterior dentition at Buckeye Knoll would have been reduced in size compared to Windover and this is not the case. Clearly, small sample sizes are factors in this comparison, but the observable variables do provide some information on the differences between samples and permit a speculative interpretation of these differences.

Adult Dental Metrics

Comparisons for the adult dentition will proceed through the dental series from left mandibular to left maxillary dentition. Box-and-whisker plots (Wilkinson et al. 1996) are provided along with dot-density distributions of dental dimensions. In the box-and-whisker plots, the solid bar within the box is the sample median and the box incorporates 50 percent of all values in the subsample. The whiskers (the solid lines extending from the box) extend to 1.5 times the first and third quartiles (the box edges) with outliers and extreme outliers noted by circles and an asterisk. Means and medians in these statistics are almost identical and the box-and-whisker plots are a simple way of presenting the distribution of the data.

Rather than compare the Buckeye Knoll dimensions to individual sites (of which there are many, but few with large datasets), sites are combined into chronological groups (BPGROUP). The comparative groups are partitioned into 1000-year-BP intervals (uncorrected intervals) and subsequent figures (plus the following discussion) will consider these chronological groups under the rubric of the BPGROUP variable (Tables 13-18 through 13-19). The Buckeye Knoll dental metrics comprise the entire 6000 BPGROUP, while the Windover materials represent the entire 8000 BPGROUP. One individual with dentition from Buckeye Knoll comes from a burial that falls into the 3000 BPGROUP. Other than this single metric, all Buckeye Knoll dental metrics fall into the 6000 BPGROUP. Remember that many teeth are not associated with burials and have been lumped with the older skeletal series by fiat. Composition and sample sizes are variable but dental metrics are best represented in the last two-thousand-year intervals (BPGROUP 1000 and 2000). The basic distributions and chronological differences, for the purposes of this report, provide a comparative perspective appropriate to the goals of the project. Crown dimensions are presented first (mesiodistal then buccolingual) and then neck dimensions followed by the deciduous dental dimensions. Comparative series for neck dimensions and deciduous dentition come only from the Windover site but are, again, presented in detail to provide maximum comparative utility for other researchers. Crown height is presented in the tables (see Tables 13-15 to 13-16) but is not presented in the figures or discussion since crown height is so directly tied to age and attrition; plus it was already discussed with respect to generating age estimates. As noted, sample size increases with time, as does sample composition diversity (more sites, wider geographic range). Windover is the only 8000-year BPGROUP, Buckeye Knoll is the only 6000 BPGROUP, while the 5000 BPGROUP is largely composed of individuals from Bird Island, a Florida site with roughly 23 dimensions (see Table 13-19). The only other 5000-B.P. data are the reported means for Indian Knoll (Perzigian 1976). While inclusion of means as "raw" values may not be statistically precise, it expands the geographic coverage of

Table 13-18. Comparison of BPGROUP Medial Dental Dimensions.

BPGROUP	LNI1CMD	LNI2CMD	LNCCMD	LNP1CMD	LNP2CMD	LNM1CMD	LNM2CMD	LNM3CMD
1000	5.32	6.24	7.27	7.23	7.11	11.58	10.99	10.96
2000	5.22	6.3	7.28	7.05	6.61	11.58	10.87	10.5
3000	5.11	6.07	7.08	6.88	7.04	11.35	11.00	10.85
4000	5	6.05	7.15	6.72	6.96	11.7	11.01	10.7
5000	5.31	6.26	7.47	7.29	7.21	11.87	11.41	10.95
6000	*5.86	6.48	7.04	6.59	*7.3	11.84	11.54	11.07
8000	5.52	6.61	7.30	7.48	7.2	11.75	11.76	11.45

BPGROUP	LNI1CBL	LNI2CBL	LNCCBL	LNP1CBL	LNP2CBL	LNM1CBL	LNM2CBL	LNM3CBL
1000	5.4	6.01	7.47	7.93	8	10.70	10.33	10.16
2000	5.86	6.05	7.63	7.8	7.91	11	10.18	9.94
3000	5.46	5.94	7.62	7.79	8.3	10.92	10.46	10.26
4000	5.72	5.97	7.6	8.05	8.3	11.05	10.78	10.29
5000	5.64	6.19	7.74	8.08	8.25	11.33	10.84	10.77
6000	5.43	5.72	7.39	7.36	7.72	10.67	10.7	10
8000	5.65	6.01	7.42	8.06	8.14	10.91	10.73	10.91

Note: Buckeye Knoll is shaded in yellow. Asterisks indicate when the Buckeye Knoll median is the largest in the comparative series.

continued.

Table 13-18. (concluded)

BPGROUP	LXI1CMD	LXI2CMD	LXCCMD	LXP1CMD	LXP2CMD	LXM1CMD	LXM2CMD	LXM3CMD
1000	8.64	6.95	8.13	7.4	6.87	10.73	9.9	9.23
2000	8.57	7.05	8.13	7.24	6.95	10.60	10	8.9
3000	8.75	7.37	8.25	7.09	6.96	10.51	9.9	8.59
4000	8.8	7.39	8.17	7.08	6.7	10.74	9.8	8.81
5000	8.76	7.35	8.64	7.2	6.95	11.14	10.64	9.66
6000	8.05	7.00	7.97	7.38	7.04	*11.32	10.12	9.17
8000	8.96	7.84	8.15	7.61	7.32	10.92	9.97	9.02

BPGROUP	LXI1CBL	LXI2CBL	LXCCBL	LXP1CBL	LXP2CBL	LXM1CBL	LXM2CBL	LXM3CBL
1000	7.05	6.6	8.22	9.50	9.12	11.5	11.1	10.4
2000	6.93	6.28	8.2	9.45	8.6	11.73	11.37	10.48
3000	6.96	6.25	8.76	9.56	9.35	11.6	11.175	10.62
4000	7.02	6.40	8.55	9.34	9.34	11.8	11.63	10.95
5000	7.21	6.54	8.45	9.73	9.49	12.28	12.09	11.49
6000	*7.23	6.32	8.13	9.47	8.88	11.56	11.34	11.1
8000	7.09	6.38	8.33	9.86	9.63	12.10	12.06	11.54

Note: Buckeye Knoll is shaded in yellow. Asterisks indicate when the Buckeye Knoll median is the largest in the comparative series.

Table 13-19. Comparative Dental Sample Compositions and Maximum Number of Individuals from Each Site/Data Set.

SITE	BP GROUP	MAX. No.	MAX. PERCENT	SITE	BP GROUP	MAX. No.	MAX. PERCENT
7 Mile Bend	2000	6	0.2	Lake Jackson Mound	1000	12	0.3
8BR246 (Windover)	8000	110	3.1	Lewis Creek	1000	9	0.3
8WA52	1000	4	0.1	Little Pine	1000	7	0.2
9BR2	1000	14	0.4	Mangum	1000	15	0.4
9FL5	1000	97	2.7	Marco Island	2000	2	0.1
9GE5	1000	4	0.1	Mound Ave. Mound	2000	3	0.1
9GE948	1000	5	0.1	Mary's Mound	2000	4	0.1
9MG28	1000	2	0.1	Mayport Mound	2000	25	0.7
9MU100	2000	17	0.5	McCleod	1000	8	0.2
9MU101	2000	2	0.1	McKeithen Mound	2000	15	0.4
9MU102	1000	34	1	Norman	1000	21	0.6
9PM137	1000	2	0.1	Oak Knoll	2000	1	0
9TP64	1000	11	0.3	Pecos Pueblo	1000	1	0
Adena	3000	2	0.1	Pine Island	1000	3	0.1
Airport	2000	32	0.9	Piney Island	1000	1	0
Amelia	1000	114	3.2	Patale (Mission)	1000	33	0.9
Bayshore Home	2000	7	0.2	Pine Harbor	1000	69	1.9
Bennett Land	4000	1	0	S-237	1000	1	0
Bird Island	5000	48	1.4	S-239	1000	4	0.1
Block Stern	3000	3	0.1	S-818	1000	6	0.2
Borrow Pit	1000	2	0.1	S-86	1000	16	0.5
Browne Mound	2000	7	0.2	SCDG-OSS	1000	105	3
Edwards Mound	2000	2	0.1	Schultz Mound	2000	1	0
Fairyland	3000	1	0	SMDYamassee	1000	73	2.1
Fitzgibbons	2000	1	0	Sowell Mound	2000	62	1.7
Fig Springs	1000	49	1.4	San Luis	1000	71	2
Gautier	2000	1	0	Santa Catali	1000	314	8.8
Glacial Kame	4000	2	0.1	Seaside 1	2000	17	0.5
Grant Mound	2000	1	0	Seaside 2	2000	6	0.2
Highland Beach	1000	3	0.1	South End Mound	1000	15	0.4

Note: Specific dental dimension contributions are smaller than N Max. indicated here. References in Addendum 13-2 though the majority are from Stojanowski (2001).

continued.

Table 13-19. (concluded)

SITE	BP GROUP	MAX. No.	MAX. PERCENT
Hopewell	2000	2	0.1
Holy Spirit	1000	20	0.6
Indian Knoll	5000	3	0.1
Irene Mort	1000	48	1.4
Irene Mound	1000	125	3.5
Johns Mound	2000	30	0.8
Kent Mound	2000	11	0.3
Manasota Key	2000	1	0

SITE	BP GROUP	MAX. No.	MAX. PERCENT
Tn. Woodland	2000	1	0
Tomoka River	2000	1	0
Turner Site	1000	1	0
Tatham Mound	1000	98	2.8
Tierra Verde	1000	18	0.5
Waddell's Mill	2000	4	0.1
Weeki Wachee	1000	9	0.3

Note: Specific dental dimension contributions are smaller than N Max. indicated here. References in Addendum 13-2 though the majority are from Stojanowski (2001).

the 5000 BPGROUP, which is close in chronological position to the Buckeye Knoll materials. In reality, its inclusion, or exclusion, is a relatively minor factor, since it only provides two data points for each dimension (male mean and female mean values). Samples sizes are much more robust for the last two time intervals (1000 and 2000 BPGROUP) and are, thus, more reliable, with measures exceeding 100 individuals for most dimensions and sometimes exceeding 800. Sample composition for the 3000 and 4000 intervals is limited by their small sample sizes, but these are included for comparative purposes.

Typically, and across all dental metrics, sample sizes are largest for the first molar, first premolar, canine, second incisor, second molar and second premolar. Samples for the third molar and first incisor typically fall below 50. This is particularly problematic when the samples span thousands of years, and many of these comparisons are of limited utility (again emphasizing the intrinsic value of the discipline developing an integrated large-scale database of human dento- and osteo-metrics).

Left Manibular Dimensions

The Buckeye Knoll left mandibular first incisor crown mesiodistal dimension (see Table 13-20 for left mandibular dental metrics; right mandibular dental metrics are also included in Table 13-21) (LNI1C-MD; Figure 13-3) shows that most of the comparative groups are smaller than the 41VT98 series. All other group medians are roughly .5 mm below those of Buckeye Knoll. In general the earlier samples (>4000 B.P.) are larger than the more recent series. The group that is most similar to Buckeye Knoll is the Windover series (the 8000 BPGROUP), which is the second largest series in this inventory. This, when compared to some of the other dimensions, exhibits the smallest sample sizes, although it is relatively robust (*n*=43) for the Buckeye Knoll series.

The Buckeye Knoll left mandibular second incisor crown mesiodistal dimensions (Figure 13-4) draws on numerically larger comparative samples, again heavily clustered in the last two thousand years, but the results are essentially the same. The median of the small series of Buckeye Knoll individuals, compared to the majority of the more recent samples, is larger. The only chronological cluster that is larger than the Buckeye Knoll series is that comprised of the individuals from Windover.

In both incisor mesiodistal dimensions, the general trend is for a reduction in group medians until the pre-3000 series and then the median values rise. Both

Table 13-20. Left Mandibular Dental Metrics.

	I1	I2	C	P1	P2	M1	M2	M3
Mesiodistal-Crown								
Sample	3	5	13	14	13	15	7	13
Minimum	5.12	5.56	6.50	5.68	6.64	10.97	10.89	5.49
Maximum	6.37	6.83	7.66	8.16	7.48	12.66	12.02	12.85
Median	5.86	6.48	7.02	6.60	7.30	11.84	11.54	11.10
Mean	5.78	6.35	7.06	6.75	7.20	11.83	11.50	10.86
Standard Deviation	0.63	0.47	0.40	0.69	0.26	0.40	0.34	1.74
Buccolingual-Crown								
Sample	8	10	20	23	25	24	21	23
Minimum	3.26	5.45	6.74	5.96	7.05	9.72	9.85	5.14
Maximum	6.33	7.02	8.50	8.97	8.64	11.20	12.28	11.17
Median	5.46	5.81	7.41	7.39	7.76	10.66	10.70	10.02
Mean	5.37	5.92	7.49	7.49	7.82	10.53	10.72	9.91
Standard Deviation	0.93	0.45	0.51	0.72	0.36	0.41	0.64	1.17
Crown Height								
Sample	11	10	25	18	15	22	17	19
Minimum	2.91	3.59	2.67	3.94	3.67	1.41	1.38	2.56
Maximum	10.28	9.96	12.06	8.85	7.62	8.15	6.69	10.26
Median	6.30	8.40	9.07	7.63	5.95	4.96	5.19	5.37
Mean	6.58	8.04	8.44	7.04	5.56	5.05	4.70	5.38
Standard Deviation	2.49	1.85	2.75	1.47	1.30	1.70	1.67	1.70
Mesiodistal-Neck								
Sample	9	7	18	15	12	16	10	7
Minimum	2.85	3.22	4.23	3.90	4.44	4.67	7.36	6.42
Maximum	3.84	4.66	5.93	5.26	5.57	9.80	10.00	8.36
Median	3.44	4.07	5.32	4.70	4.83	8.82	8.81	7.84
Mean	3.37	4.05	5.20	4.77	4.87	8.59	8.75	7.72
Standard Deviation	0.32	0.54	0.52	0.37	0.31	1.15	0.67	0.62
Buccolingual-Neck								
Sample	7	6	16	13	12	14	10	9
Minimum	5.23	5.56	6.45	5.94	5.78	8.02	8.04	5.15
Maximum	6.38	6.96	8.79	7.96	7.32	9.49	10.30	8.71
Median	5.62	5.89	7.30	6.69	6.37	8.89	8.98	8.20
Mean	5.70	6.02	7.36	6.85	6.49	8.89	8.90	7.66
Standard Deviation	0.45	0.53	0.57	0.59	0.55	0.44	0.73	1.25

Note: All measures in millimeters.

Table 13-21. Right Mandibular Dental Metrics.

	I1	I2	C	P1	P2	M1	M2	M3
Mesiodistal-Crown								
Sample	2	5	10	6	17	16	5	17
Minimum	4.65	6.09	6.65	5.41	6.61	10.95	11.51	9.04
Maximum	5.91	7.47	8.09	7.38	7.62	12.65	12.44	12.14
Median	5.28	6.48	7.08	6.88	7.21	11.79	11.6	10.82
Mean	5.28	6.56	7.21	6.78	7.11	11.78	11.75	10.72
Standard Deviation	0.89	0.54	0.45	0.72	0.30	0.45	0.39	0.82
Buccolingual-Crown								
Sample	8	7	11	18	31	21	20	29
Minimum	5.03	4.16	6.33	6.84	7.07	9.61	9.61	8.23
Maximum	6.12	8.19	9	8.97	9.64	11.23	11.62	10.99
Median	5.48	6.08	7.43	7.65	7.80	10.57	10.53	10.19
Mean	5.52	6.01	7.77	7.73	7.94	10.43	10.63	10.13
Standard Deviation	0.35	1.20	0.84	0.61	0.51	0.45	0.55	0.67
Crown Height								
Sample	8	8	16	14	24	20	20	21
Minimum	2.52	4.35	2.35	3.42	3.22	2.01	1.12	2.58
Maximum	9.42	10.26	12.44	9.05	9.11	7.9	10.8	10.37
Median	6.81	7.05	8.93	7.23	6.81	5.31	4.80	5.26
Mean	6.32	7.33	8.10	6.79	6.50	5.31	5.19	5.31
Standard Deviation	2.38	2.13	3.22	1.61	1.65	1.52	1.95	1.57
Mesiodistal-Neck								
Sample	7	5	10	9	16	12	12	10
Minimum	2.99	3.38	5.12	4.55	4.14	4.16	5.86	6.42
Maximum	4.01	4.37	6.02	5.23	5.68	9.36	9.52	9.57
Median	3.41	3.67	5.57	4.89	4.74	8.81	8.63	8.07
Mean	3.38	3.74	5.55	4.93	4.78	8.36	8.46	7.96
Standard Deviation	0.39	0.40	0.33	0.20	0.42	1.41	1.01	0.87
Buccolingual-Neck								
Sample	6	6	9	8	18	13	12	11
Minimum	4.6	5.26	6.88	6.2	4.64	8.15	8.5	5.98
Maximum	6.08	6.25	8.75	8.03	7.68	9.60	9.54	9.17
Median	5.35	5.71	7.76	6.58	6.78	9.15	8.78	7.58
Mean	5.30	5.73	7.82	6.82	6.61	9.05	8.91	7.79
Standard Deviation	0.57	0.42	0.65	0.59	0.85	0.41	0.36	0.98

Note: All measures in millimeters.

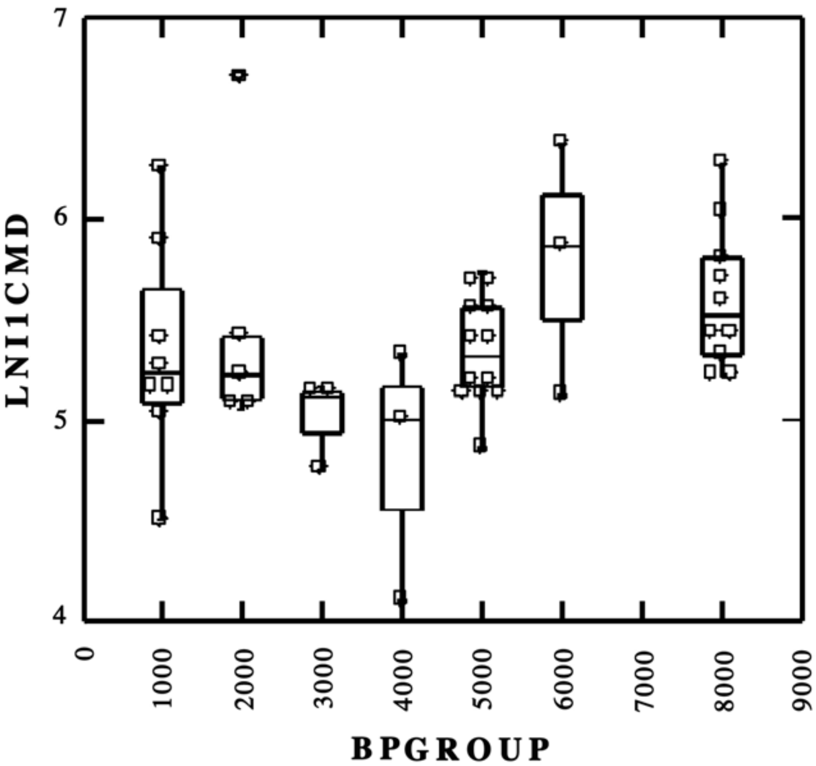


Figure 13-3. Left mandibular first incisor crown mesiodistal dimension (mm), showing distribution over time (Buckeye Knoll is BPGROUP 6000).

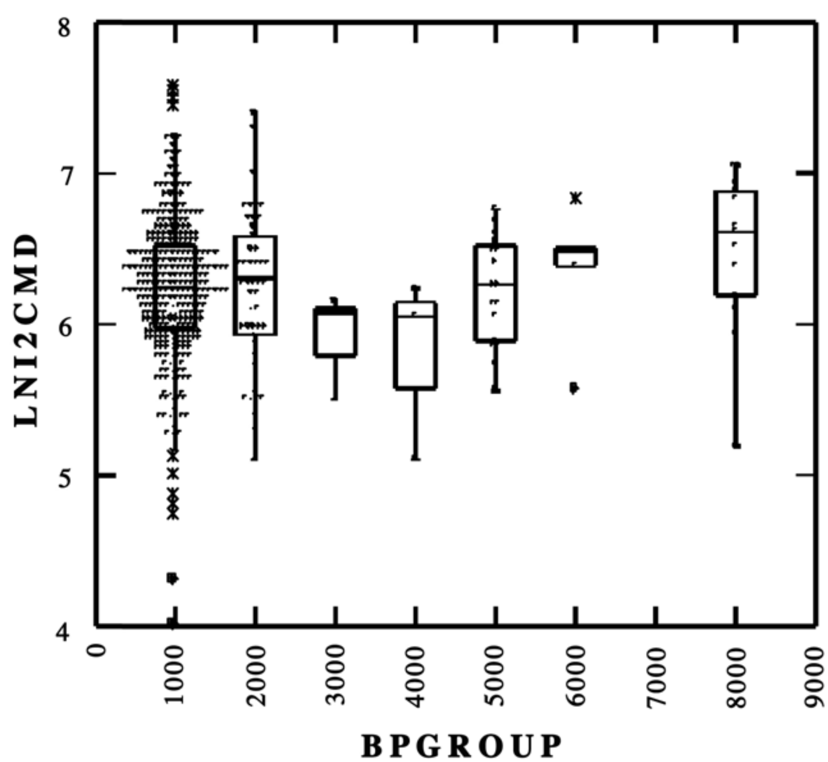


Figure 13-4. Left mandibular second incisor crown mesiodistal dimension, showing chronological comparison (Buckeye Knoll is BPGROUP 6000).

the 1000 and 2000 clusters are nearly equivalent with respect to ranges and medians, with the interval between 3000 and 6000 years showing smaller median dimensions and smaller sample sizes.

The distribution of left mandibular canine crown mesiodistal dimensions is at variance with the previous patterns (see Figure 13-5). There, the Buckeye Knoll dimensions are smaller than the other chronological clusters and, in fact, Buckeye Knoll shows the smallest median values of any of the series. While the pattern is not dramatic, the most recent chronological clusters (1000 and 2000) are slightly larger than all but the 5000 series. The Windover and Buckeye Knoll series, representing the two oldest sets in the comparison, show relatively small medians in contrast to the other groups. Roughly one-half of the individuals in the 3000 BPGROUP are from Buckeye Knoll, and the other three to five individuals are typically single individuals from a small series of sites. In the 1000–2000 BPGROUPs, sample sizes are much larger and more geographically diverse. Thus, the comparative utility of the 3000–5000 groups is marginal, given the sample sizes and limited group composition of this poorly represented interval.

Left mandibular first premolar crown mesiodistal dimensions (Figure 13-6) indicate that, like the canines, the Buckeye Knoll series is small when compared to the other groups. In fact, the median for the Buckeye Knoll series is the smallest of all the chronological groups and, by contrast, the earlier sample from Windover shows the largest median of the entire series. The 5000-BPGROUP series is larger than the Buckeye Knoll series and has a median dimension more nearly equivalent to the Windover series, while the series represented in BPGROUPs 3000 and 4000 is smaller. Median values consistently rise in each of the chronological clusters from 4000 B.P. on.

The left mandibular second premolar crown dimensions (Figure 13-7) clearly show that the Buckeye Knoll series has, relative to the other samples, larger average dimensions. Sample sizes are relatively small, with the exception of the 5000 BPGROUP (in all there are 76 individuals with lnp2cmd dimensions, not including those from Buckeye Knoll). The significance of this observation must be tempered by the small sample sizes.

The left mandibular first molar crown mesiodistal dimensions (Figure 13-8) also reflect the relatively large dimensions of the Buckeye Knoll materials. Windover (the 8000 BPGROUP) is substantially smaller. All the other more recent series, with the exception of the 5000 BPGROUP (particularly the Florida Bird Island series) are smaller than the Buckeye Knoll series. The largest samples (the 1000 and 2000 BPGROUPs) have medians consistently lower than the Buckeye Knoll series. What is particularly noticeable in this comparative framework is the significant number of large teeth in the 1000 BPGROUP. By contrast, the Buckeye Knoll series shows reduced variability, and there are few extreme values at either end of the distribution. This is also reflected in the standard deviations of the respective groups—for the 2000 B.P. series the standard deviation is .723 (n=132) and is .399 (n=15) in the Buckeye Knoll series. Clearly, the sample sizes are quite different, but it should be noted the Student's t-test indicates this difference is statistically significant at the .04% probability (t=-2.165, df=26). A t-test of the 1000 BPGROUP vs. the 6000 BPGROUP (Buckeye Knoll) also indicates this difference is statistically significant (t=-2.417, df=15.9 and p=0.28), confirming what is suspected from visually observing the distributions alone.

The left second mandibular molar mesiodistal crown dimensions (Figure13-9) have smaller sample sizes when compared to the first molars (113 specimens from the non-Buckeye Knoll series). Even with the caveat of this sample size, the Buckeye Knoll sample shows a larger median value than all other samples except Windover (8000 BPGROUP). This does rise to meet a t-test statistical significance of p<01. This dimension appears to be substantially smaller in virtually all the more recent time intervals, clearly highlighting the earlier larger sizes of this second molar dimension.

The left third mandibular molar mesiodistal crown dimensions (Figure 13-10) numerically have some of the smallest sample sizes of any of the left dentition but, here again, the Buckeye Knoll materials are larger than all groups except Windover. In fact, one of the specimens from Buckeye Knoll is larger than any other specimen reported in the entire series, although the sample sizes are relatively small (n=111; third molars are notoriously variable in size and morphology, and are often excluded from data tabulations). The consistent direction of difference lies in the Buckeye Knoll materials being generally larger than the more recent samples, especially with respect to molar dimensions.

Crown Buccolingual Dimensions

The corresponding mandibular buccolingual dimensions show roughly the same sample distribution

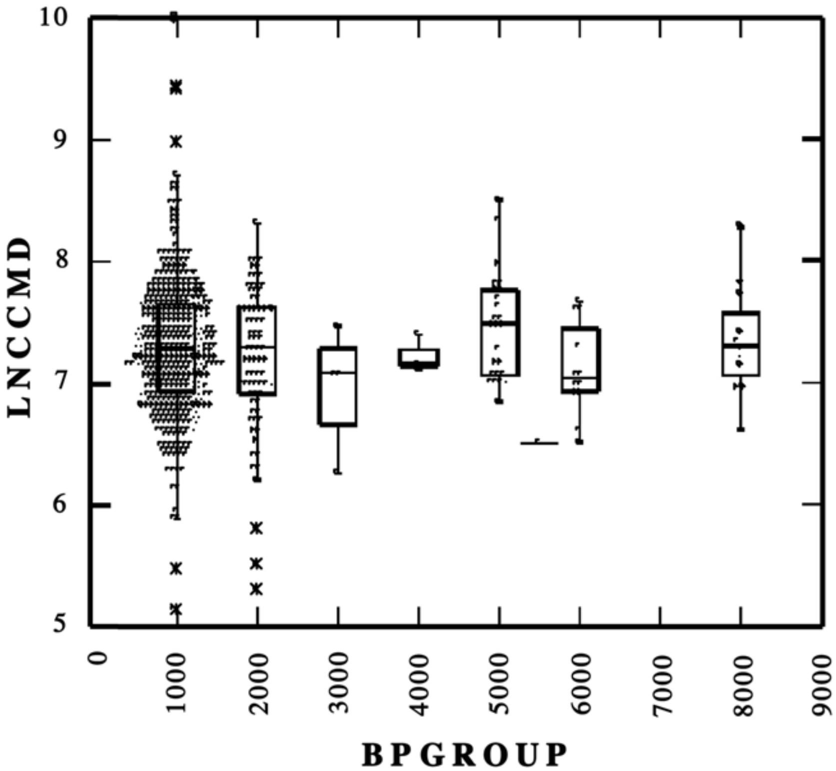


Figure 13-5. Left mandibular canine crown mesiodistal dimension (mm).

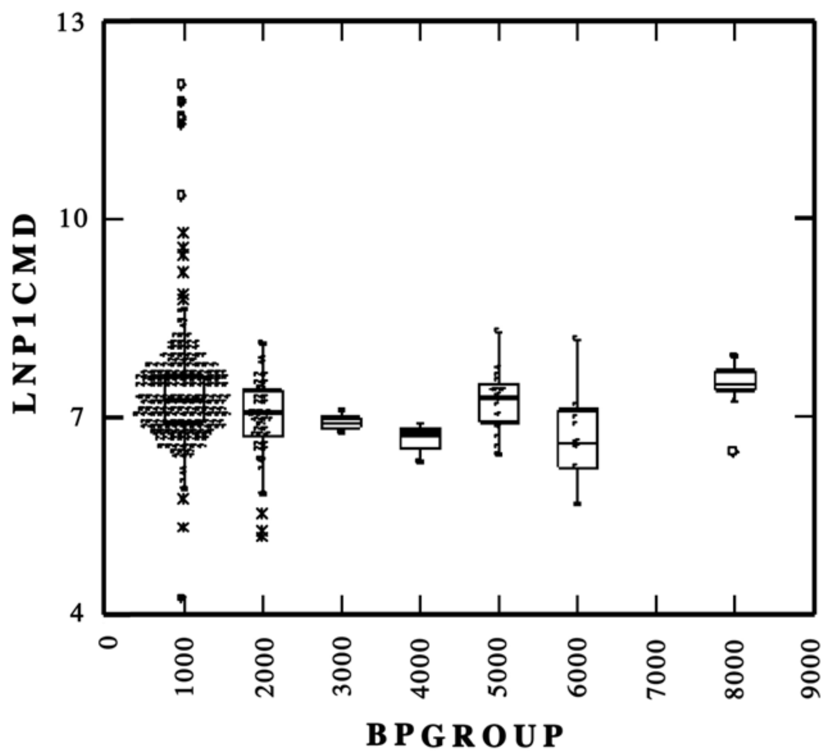


Figure13-6. Left mandibular first premolar crown mesiodistal dimension (mm).

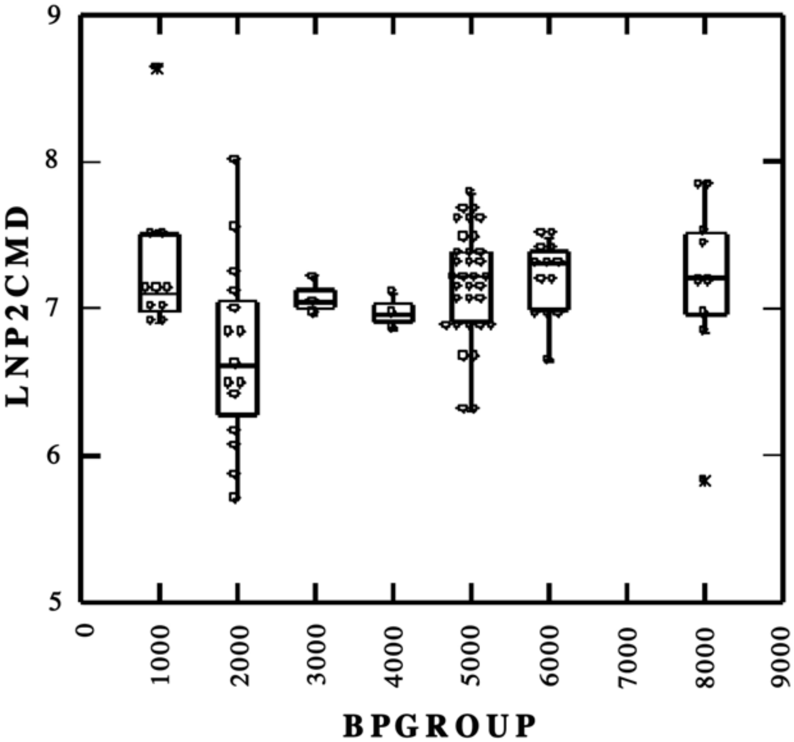


Figure 13-7. Left mandibular second premolar crown mesiodistal dimension (mm).

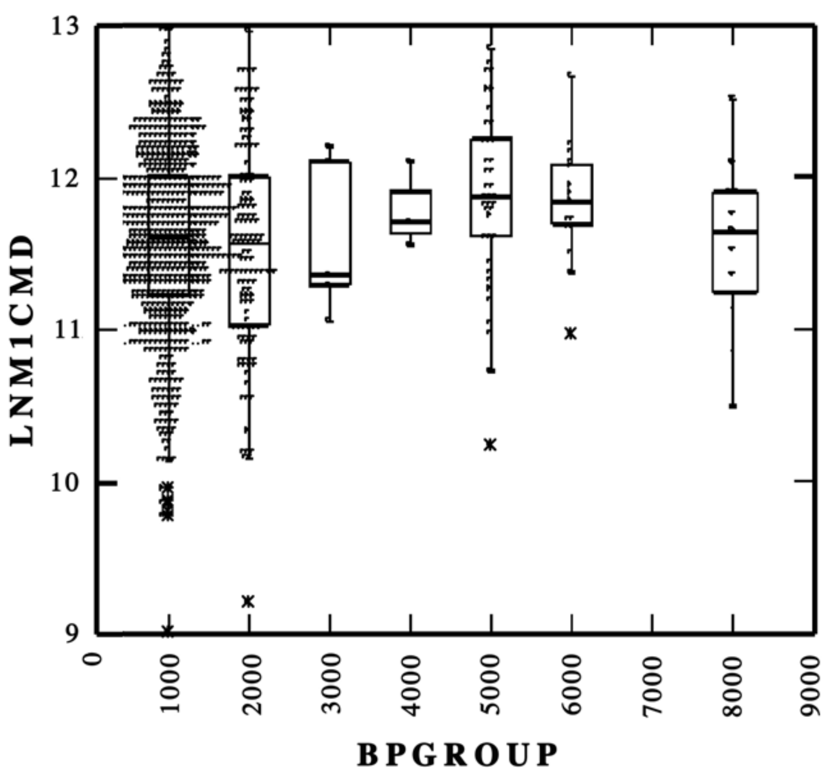


Figure 13-8. Left mandibular first molar crown mesiodistal dimension (mm).

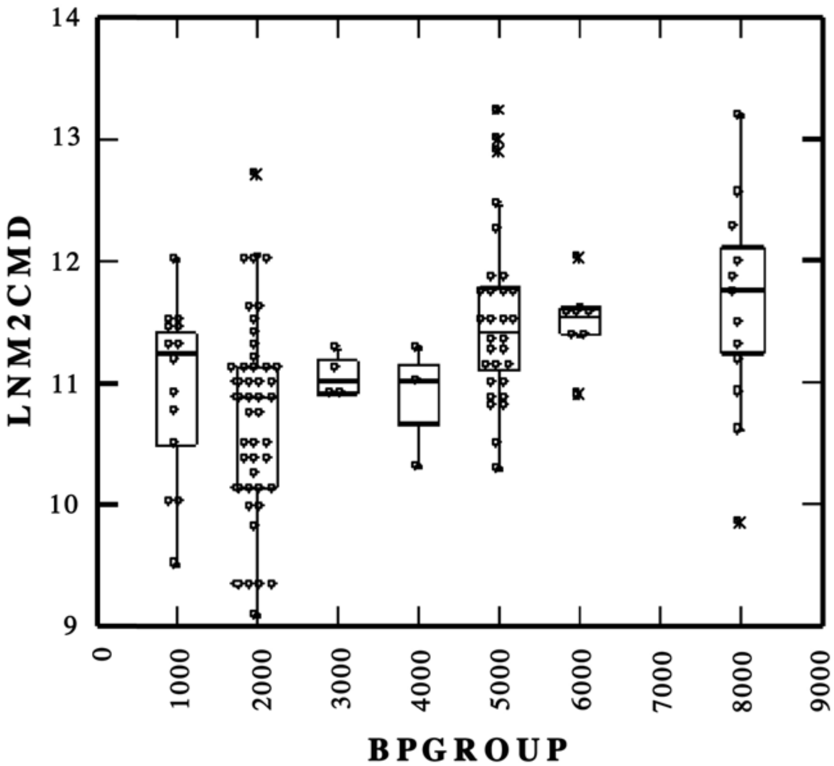
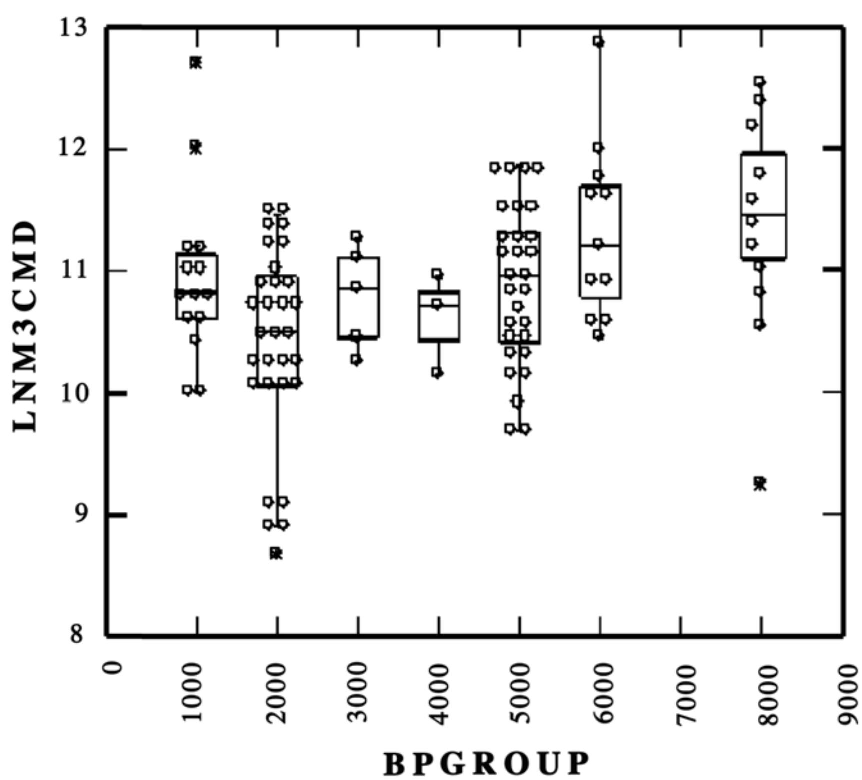


Figure 13-9. Left mandibular second molar crown mesiodistal dimension (mm).

Figure 13-10. Left mandibular third molar crown mesiodistal dimension (mm).



with respect to chronological positions, and some of the same issues with respect to divergent sample sizes for different teeth.

Left mandibular first incisor crown buccolingual dimension inventory is relatively small but indicates that the Buckeye Knoll series falls into the lower registers of the overall range of this dimension (Figure 13-11). The only group that has smaller median dimensions is, interestingly, the 1000 BPGROUP (*n*=47). There is a small sample for the 3000 BPGROUP but those individuals are almost identical in median values to the Buckeye Knoll series. The other early samples, Windover (8000 BPGROUP) and Bird Island (5000 BPGROUP) are shifted towards larger values. Sample sizes limit confidence in the validity of these comparisons, but the Buckeye Knoll materials certainly seem to fall into the lower ranks of the overall distribution. This is in direct contrast to the mesiodistal dimensions for which Buckeye Knoll was substantially larger.

Left mandibular second incisor crown buccolingual dimensions are much more numerous (*n*=479), particularly for the more recent time intervals (Figure 13-12). Here, as was observed for the first incisor, the Buckeye Knoll second incisor median is absolutely the smallest observed median of all the chronological groupings. Very few large values were observed in the Buckeye Knoll material. In fact, a reflection of this diminutive series is clear when the largest value in the Buckeye Knoll series is barely larger than the median value for the most recent two chronological groupings, while the minimum values are in the lower ten percent of all lni2cbl dimensions.

The left mandibular canine crown buccolingual dimension continues this pattern of relatively diminutive dimensions, and the Buckeye Knoll median is the smallest of any of the chronological groups presented here (Figure 13-13). Here, in fact, both the Windover and the Buckeye Knoll subsets fall into the lower ranks of dental dimensions and most of their values are well below the overall group median.

Left mandibular first premolar crown buccolingual dimensions show a continued pattern of small Buckeye Knoll buccolingual dimensions (Figure 13-14). Here the Buckeye Knoll sample is again one of the smallest sets within the chronological distribution. While the majority of Buckeye Knoll values are relatively small, there is one specimen that is larger than the majority of values reported in the comparative series. In general, the later series seem slightly smaller than the earlier Windover (8000 B.P.) and Bird Island (5000 B.P.) groups, and the Buckeye Knoll series is shifted toward lower values. This clearly contrasts to the previously observed "earlier-is-larger" pattern seen in some dimensions.

The left mandibular second premolar crown buccolingual dimensions also show the continued pattern of diminutive dimensions (Figure 13-15). Here the Windover sample is significantly larger than the Buckeye Knoll materials, and the Bird Island series (basically the 5000 BPGROUP) is also larger. All other time units show values exceeding the maximum Buckeye Knoll value, and the Buckeye Knoll values are clearly shifted to the smaller range. There are twelve individuals from other sites with values larger than the Buckeye Knoll value and only two sites show values smaller than the smallest Buckeye Knoll dimension.

The left mandibular first molar crown buccolingual dimensions continue the same pattern of small Buckeye Knoll dimensions, and again the Buckeye Knoll sample exhibits the smallest median of any of the time intervals examined (Figure 13-16). Of the 921 comparative measures of this dimension, there are 210 individuals (23 percent) with dimensions larger than the largest Buckeye Knoll dimensions (11.2 mm). This is a variable for which there is a larger number of individuals represented, and clearly the Buckeye Knoll series falls into the small range of this group.

The left mandibular second molar crown buccolingual dimensions constitute a small series of only 132 individuals (other than the individuals from Buckeye Knoll) so the comparison is not as robust (Figure 13-17). Here, however, the Buckeye Knoll sample falls into the larger range of the distribution, and the Buckeye Knoll median is greater than all other time increments except the 5000 BPGROUP. It even exceeds the Windover series. One of the Buckeye Knoll specimens is larger than any other reported second molar dimensions in the entire series—this is in stark contrast to what has been observed in the other mandibular buccolingual dimensions. There are several other individuals with large values that fall into the top 10 percent of the entire series, supporting this pattern of a shift toward larger values in the second molar.

The left third mandibular molar crown buccolingual dimensions again show the Buckeye Knoll materials as being shifted toward smaller values, with most groups' median value exceeding the median of the Buckeye Knoll series (Figure 13-18). The Windover series is distinctly larger and has the largest median of any time/group, while the later samples are slightly

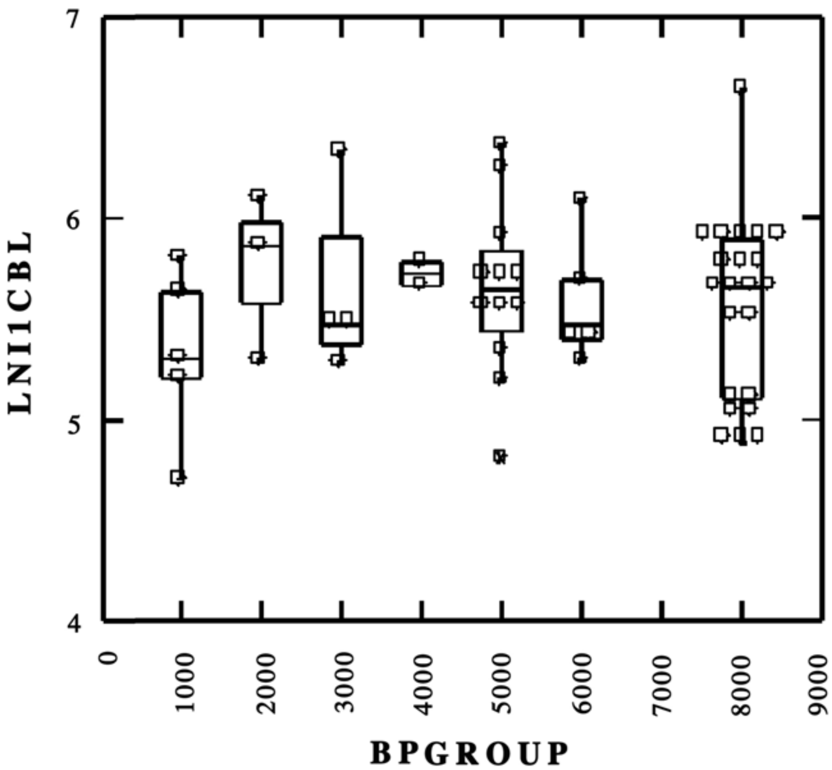


Figure 13-11. Left mandibular first incisor crown buccolingual dimension (mm).

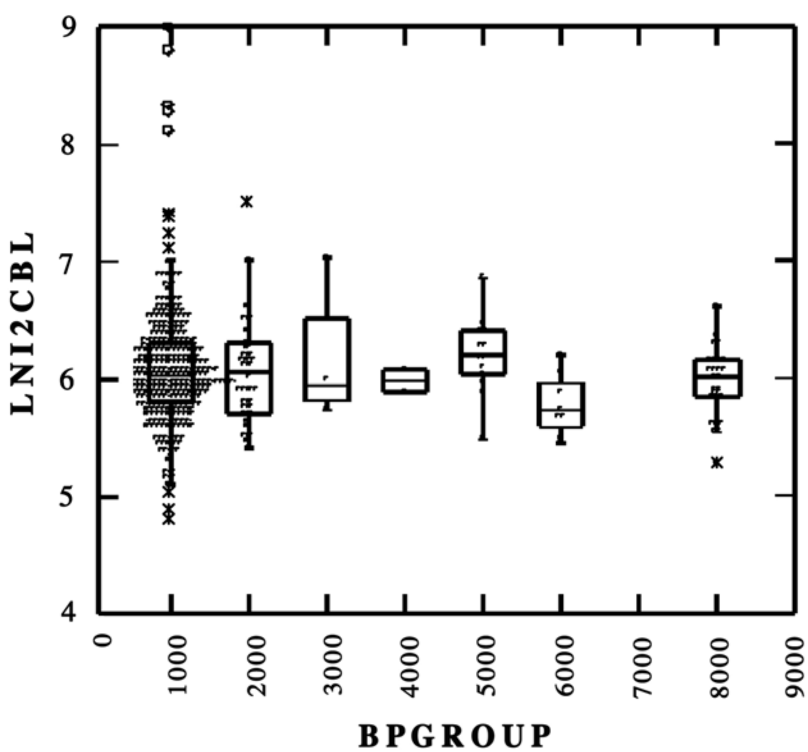


Figure 13-12. Left mandibular second incisor crown buccolingual dimension (mm).

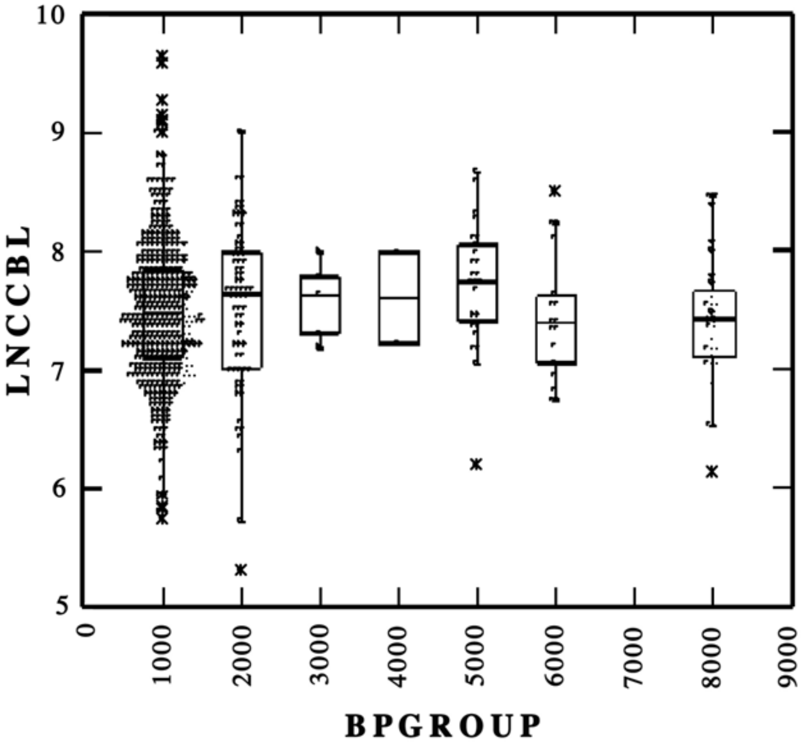


Figure 13-13. Left mandibular canine crown buccolingual dimension (mm).

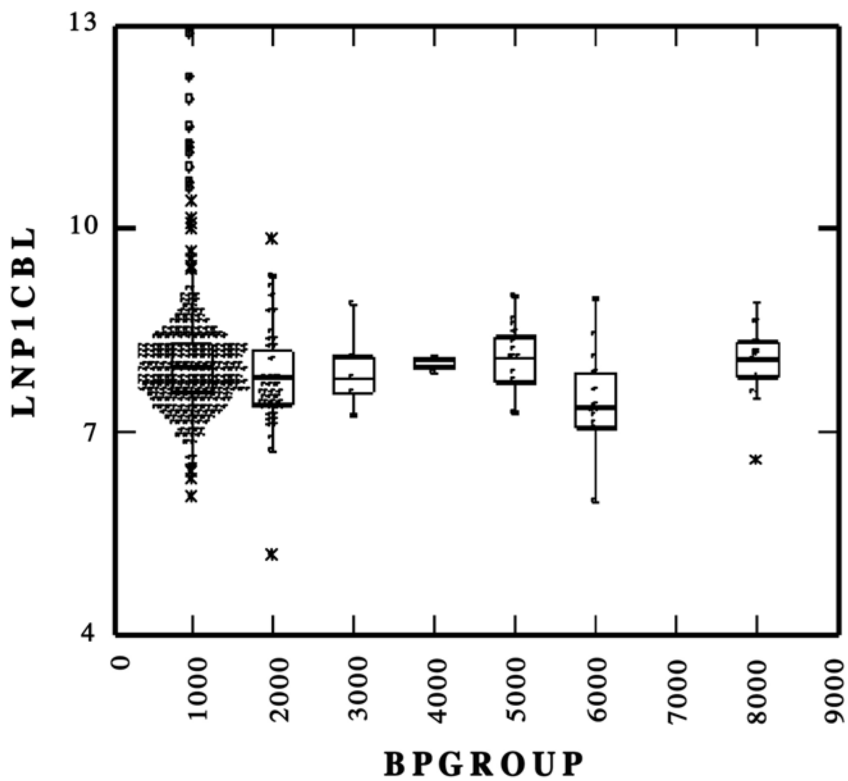


Figure 13-14. Left mandibular first premolar crown buccolingual dimension (mm).

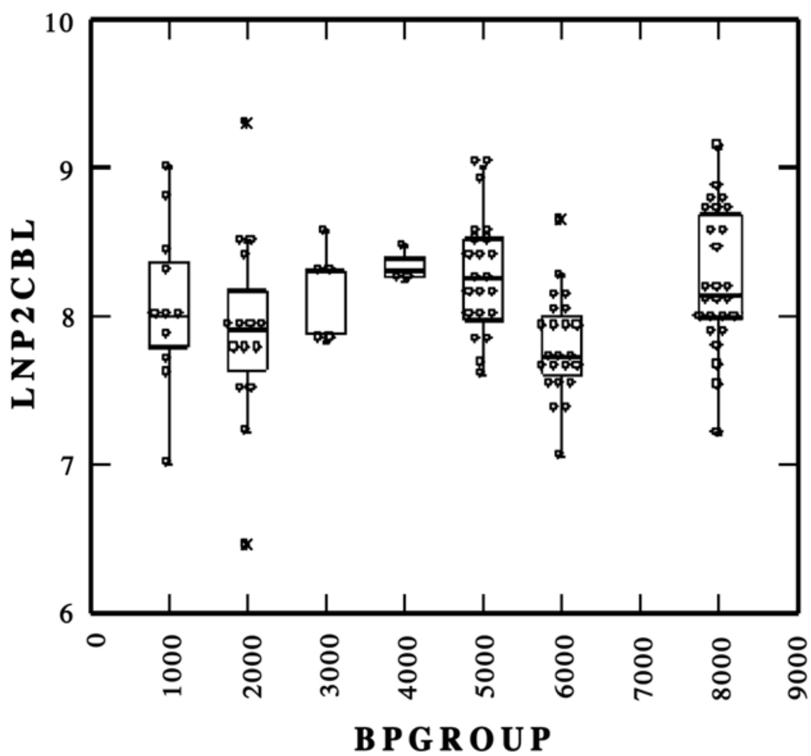


Figure 13-15. Left mandibular second premolar crown buccolingual dimension (mm).

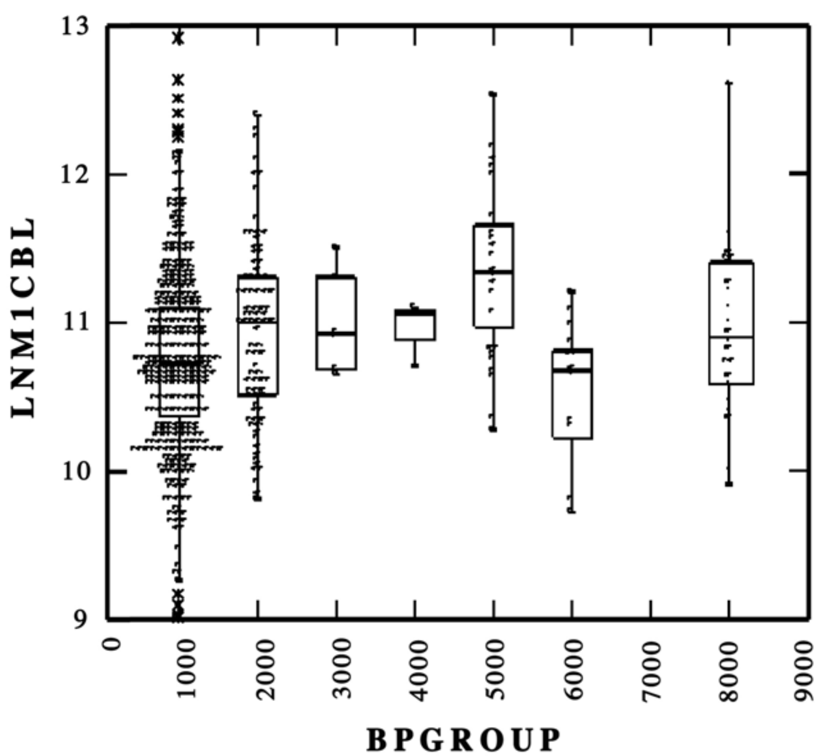


Figure 13-16. Left mandibular first molar crown buccolingual dimension (mm).

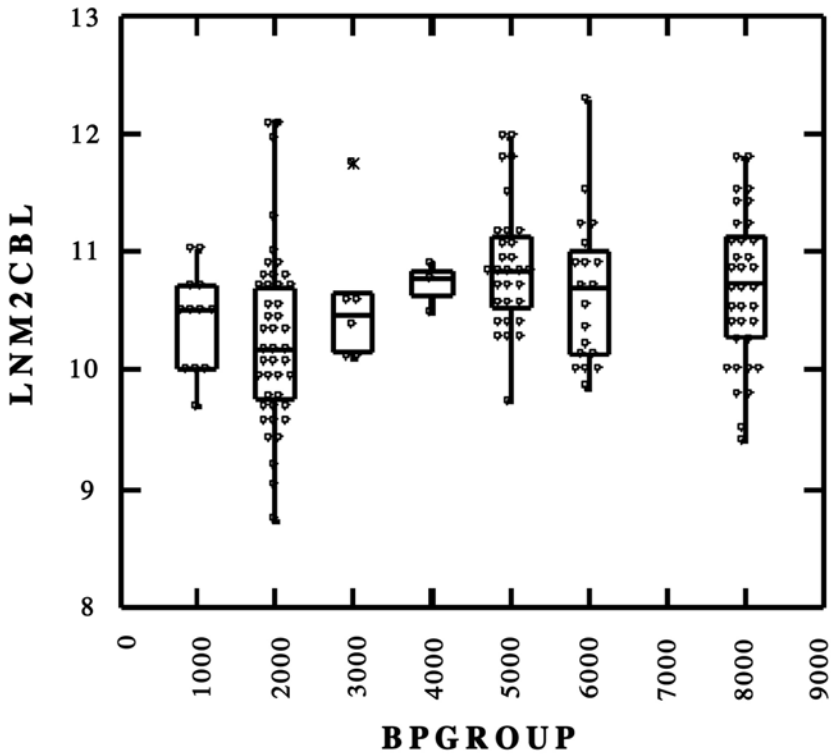


Figure 13-17. Left mandibular second molar crown buccolingual dimension (mm).

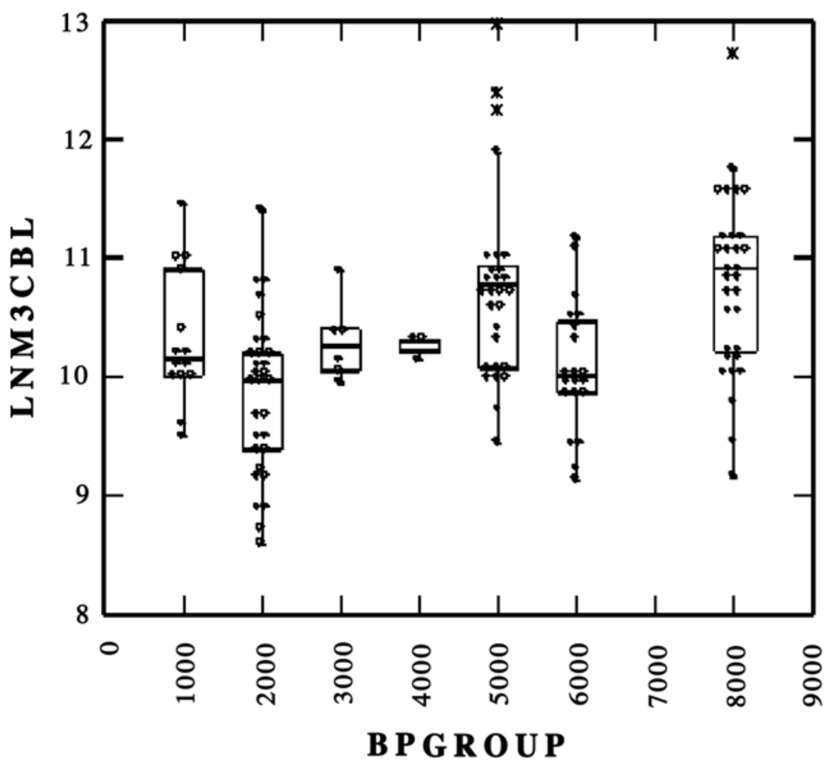


Figure 13-18. Left mandibular third molar crown buccolingual dimension (mm).

larger than the Buckeye Knoll series. As noted in the discussion of the mesiodistal dimensions of the third molar, this tooth exhibits a high degree of variability and is often omitted from comparative studies.

Left Maxillary Crown Dimensions

The same format and procedure is used to illustrate the dimensional distribution of the left maxillary dimensions with sample statistics presented in Table 13-22 (Right malixiary dental metrics are also included in Table 13-23). Sample sizes are generally smaller for the maxillary dimensions, both for the Buckeye Knoll series and especially for the 3000-5000 BPGROUPs (Figures 13-19 to 13-34). Again, the 8000 BPGROUP is Windover, and the Buckeye Knoll materials form the 6000 BPGROUP.

The first maxillary incisor median crown mesiodistal dimension for the Buckeye Knoll series is smaller than for any of the other comparative groups (Figure 13-19). This is consistent with observations in the mandibular incisors. Here again the Windover materials (8000 BPGROUP) have a larger median than any of the other subgroups. Medians decline a small amount to a low observed in the 2000 BPGROUP and then rise in the 1000 BPGROUP (see Table 13-18). The Buckeye Knoll sample size is small (*n*=8) and the range of values is relatively wide and the largest value observed at Buckeye Knoll is within the top 10 percent of the entire series. In contrast to the larger 1000 BPGROUP distribution, the minimum values of the Buckeye Knoll series are not nearly as small as some observed in the most recent comparative group—in a sense this range is constricted by not having as many small values or as many large values. The bulk of the Buckeye Knoll specimens are clustered well below the medians of the other series.

The second maxillary incisory median crown dimensions (Figure 13-20) are also shifted to the smaller end of the distribution, and no Buckeye Knoll values are particularly large. Several of the values are some of the smallest observed in the entire series from North America. The Buckeye Knoll series median is lower than any of the other comparative group, though only slightly lower than the few specimens observed in the 2000 BPGROUP. The majority of the Windover values are well above the largest values of the Buckeye Knoll group. This again supports the proposition of relatively diminutive dental dimensions for both the mandibular and maxillary incisors in the Buckeye Knoll sample.

Left Maxillary Canine Crown Dimensions

The median of the Buckeye Knoll series is again the smallest of all the BPGROUPs (Figure 13-21). The largest Buckeye Knoll value (8.3 mm) is only at the 39th percentile of the entire maxillary canine crown dimension distribution. While this is a small sample size (see Tables 13-18 through 13-19, *n* = 6) the samples for the 2000 through 5000 BPGROUPs are also small (always less than 20), and, yet, they essentially have few values as small as those observed in the Buckeye Knoll series and consistently have a few substantially large values. The Buckeye Knoll collection simply did not include specimens with large values, large here defined as values substantially greater than the overall median.

Left Maxillary First Premolar Crown Mesiodistal Dimensions

The median of the Buckeye Knoll series is based on a relatively small series (see Tables 13-18 through 13-19, *n*=15; Figure 13-22) as are the medians of all but the two most recent BPGROUPs (< 3000 bp). In contrast to the preceding dental dimensions, the Buckeye Knoll median is slightly larger than the medians of all other groups except the Windover series. The difference is small, but clearly the sample distribution is shifted in favor of larger values, and the smallest Buckeye Knoll values are much closer to the median of the larger series. There is also one large Buckeye Knoll (9.57 mm) value that is, compared to the other 725 values, in the 98th percentile, again emphasizing the shift toward larger values in the Buckeye Knoll series. The smallest observed Buckeye Knoll value (7.01 mm) is actually also quite large and falls into the 79th percentile.

Left Maxillary Second Premolar Crown Mesiodistal Dimensions

The second premolar series from Buckeye Knoll also show a large median dimension with only the Windover series exceeding it (Figure 13-23; see Table 13-18). All other chronological series have smaller medians, though they are not dramatically smaller with the exception of the small series from the 4000 BPGROUP, which is the smallest of the entire chronological series. While this series is represented by a limited sample series (total *n,* excluding Buckeye Knoll, of 62) almost all the values above the group median of 7.03 mm are found in Bird Island (5000 BPGROUP, from Florida), Buckeye Knoll, or Windover. Only ten values from the other sites exceed the Buckeye Knoll

Table 13-22. Left Maxillary Dental Metrics.

	I1	I2	C	P1	P2	M1	M2	M3
Mesiodistal-Crown								
Sample	8	12	6	15	12	9	8	24
Minimum	7.56	5.64	6.71	7.01	6.39	9.15	9.46	4.77
Maximum	9.75	7.65	8.30	9.57	7.54	12.16	11.23	10.96
Median	8.06	7.01	7.98	7.38	7.04	11.32	10.13	9.17
Mean	8.43	6.91	7.75	7.50	6.98	11.03	10.26	8.99
Standard Deviation	0.85	0.61	0.60	0.61	0.31	0.88	0.53	1.30
Buccolingual-Crown								
Sample	14	22	16	33	25	23	15	35
Minimum	5.89	5.09	7.12	7.57	8.23	6.71	10.58	6.06
Maximum	8.17	9.27	9.24	10.62	10.24	12.22	12.55	13.57
Median	7.14	6.27	8.14	9.47	8.88	11.60	11.34	11.10
Mean	7.12	6.46	8.16	9.39	9.07	11.41	11.36	10.85
Standard Deviation	0.69	0.90	0.64	0.68	0.58	1.11	0.53	1.35
Crown Height								
Sample	16	18	18	25	21	21	11	20
Minimum	4.31	5.43	2.34	3.11	3.25	4.38	4.14	3.18
Maximum	11.28	11.54	12.21	8.73	8.11	7.51	11.58	11.07
Median	8.71	9.11	8.91	7.27	6.35	6.23	6.41	6.39
Mean	8.56	8.49	8.13	6.91	6.18	6.15	6.61	6.32
Standard Deviation	2.22	1.88	2.90	1.46	1.16	0.97	1.92	1.73
Mesiodistal-Neck								
Sample	10	13	14	17	13	10	8	6
Minimum	4.89	3.41	4.83	4.39	3.95	3.68	7.08	6.60
Maximum	7.27	6.59	7.97	5.54	5.48	8.91	10.94	7.41
Median	6.23	5.08	5.96	4.89	4.56	7.57	7.52	6.84
Mean	6.14	5.00	6.01	4.90	4.68	7.28	7.94	6.94
Standard Deviation	0.60	0.85	0.75	0.30	0.47	1.43	1.25	0.36
Buccolingual-Neck								
Sample	9	15	14	17	12	12	8	11
Minimum	5.90	5.05	6.48	7.41	6.58	7.43	8.49	8.00
Maximum	7.55	7.80	8.79	9.48	8.39	11.83	11.62	11.29
Median	6.68	5.81	7.66	8.16	7.59	10.86	10.64	10.63
Mean	6.60	5.89	7.72	8.18	7.65	10.73	10.38	10.14
Standard Deviation	0.54	0.60	0.73	0.64	0.60	1.12	1.08	0.99

Note: All measures in millimeters.

Table 13-23. Right Maxillary Dental Metrics.

	I1	I2	C	P1	P2	M1	M2	M3
Mesiodistal-Crown								
Sample	9	10	14	22	7	14	6	19
Minimum	6.54	6.20	6.98	6.39	6.90	10.17	9.29	7.96
Maximum	9.78	7.89	8.34	7.82	7.49	12.61	11.20	10.73
Median	8.49	7.38	7.99	7.14	7.22	10.97	10.02	9.57
Mean	8.32	7.13	7.90	7.15	7.22	11.06	10.15	9.35
Standard Deviation	0.92	0.58	0.37	0.40	0.20	0.54	0.68	0.84
Buccolingual-Crown								
Sample	13	13	28	47	23	20	18	35
Minimum	5.96	5.28	7.14	1.77	7.02	11.08	7.67	8.77
Maximum	7.72	6.55	9.24	10.43	10.35	12.19	12.95	12.91
Median	6.84	6.31	8.11	9.52	9.30	11.55	11.70	11.04
Mean	6.86	6.19	8.09	9.21	9.11	11.60	11.33	10.95
Standard Deviation	0.59	0.36	0.50	1.30	0.75	0.31	1.24	0.84
Crown Height								
Sample	18	15	27	22	19	22	16	23
Minimum	3.31	3.41	2.17	2.71	2.34	1.97	4.96	4.77
Maximum	12.51	11.01	11.76	8.55	7.74	8.2	7.44	7.79
Median	8.28	8.63	7.61	6.72	6.13	5.77	6.31	6.12
Mean	8.33	7.98	7.68	6.51	6.07	5.66	6.27	5.94
Standard Deviation	2.66	2.15	2.88	1.43	1.33	1.72	0.72	0.83
Mesiodistal-Neck								
Sample	11	9	19	12	14	15	8	11
Minimum	5.46	3.98	5.01	3.77	4.20	6.67	7.10	5.08
Maximum	7.38	5.66	7.23	5.25	5.19	12.19	8.33	8.95
Median	5.96	4.78	5.76	4.64	4.74	7.60	7.80	7.14
Mean	6.00	4.79	5.88	4.64	4.73	8.08	7.76	7.03
Standard Deviation	0.56	0.60	0.56	0.49	0.28	1.40	0.36	1.07
Buccolingual-Neck								
Sample	4	7	20	16	14	14	11	17
Minimum	5.64	5.05	6.90	6.70	6.47	7.84	7.30	8.43
Maximum	7.14	6.54	8.76	9.02	8.70	12.24	11.96	11.18
Median	6.45	5.87	7.69	8.24	7.76	11.16	10.94	10.02
Mean	6.42	5.88	7.73	8.12	7.79	10.86	10.83	9.96
Standard Deviation	0.64	0.62	0.53	0.65	0.66	1.24	1.25	0.62

Note: All measures in millimeters.

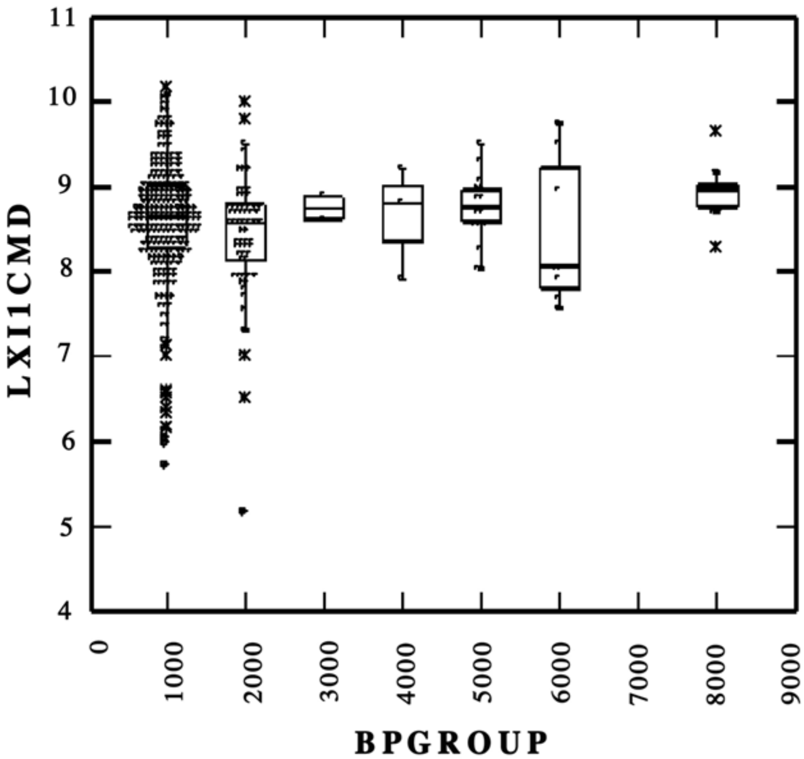
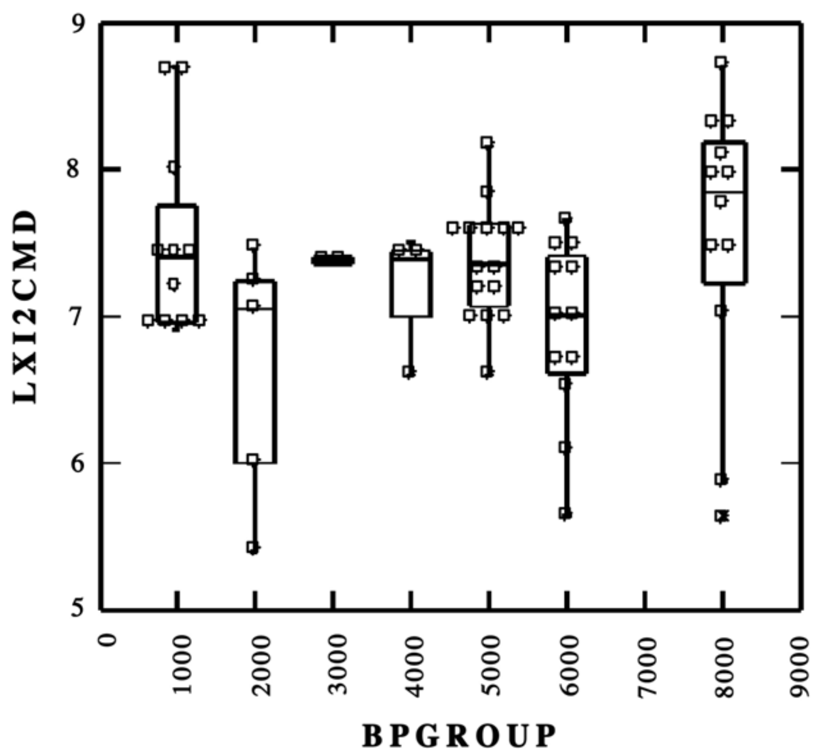


Figure 13-19. Left maxillary first incisor crown mesiodistal dimension (mm).

Figure 13-20. Left maxillary second incisor crown mesiodistal dimension (mm).



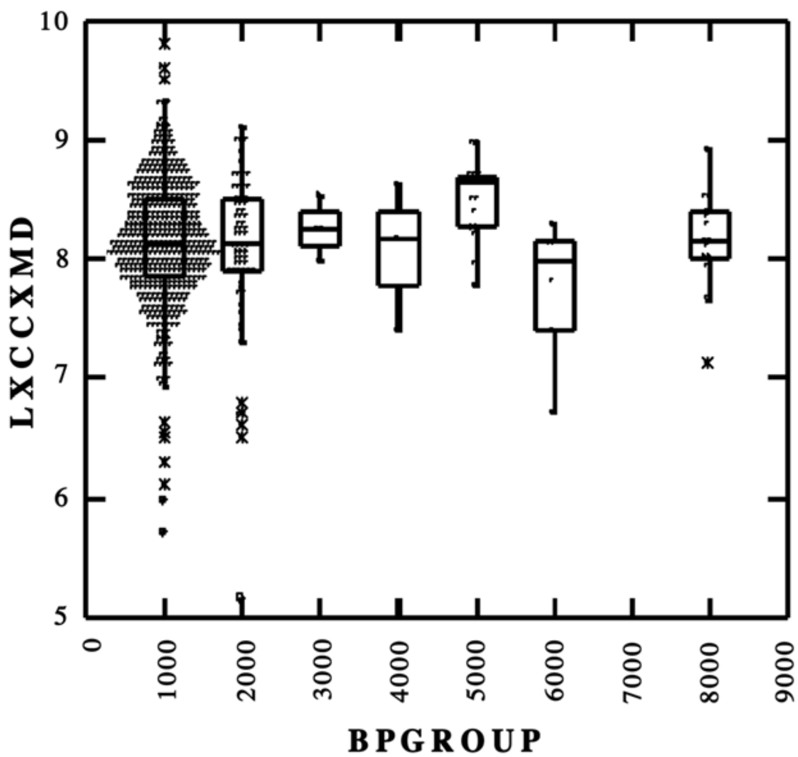


Figure 13-21. Left maxillary canine crown mesiodistal dimension (mm).

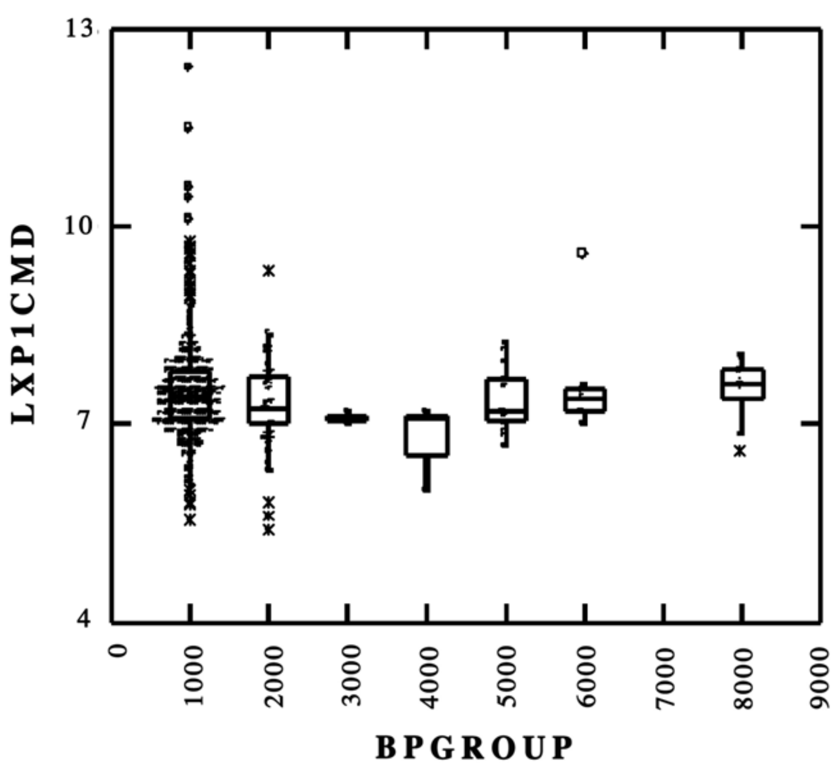


Figure 13-22. Left maxillary first premolar crown mesiodistal dimension (mm).

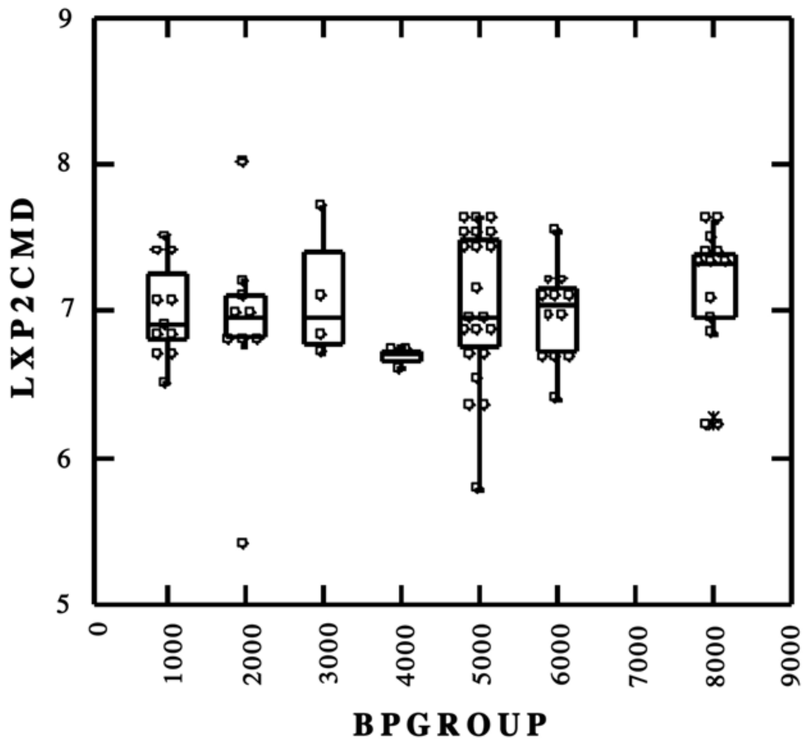


Figure 13-23. Left maxillary second premolar crown mesiodistal dimension (mm).

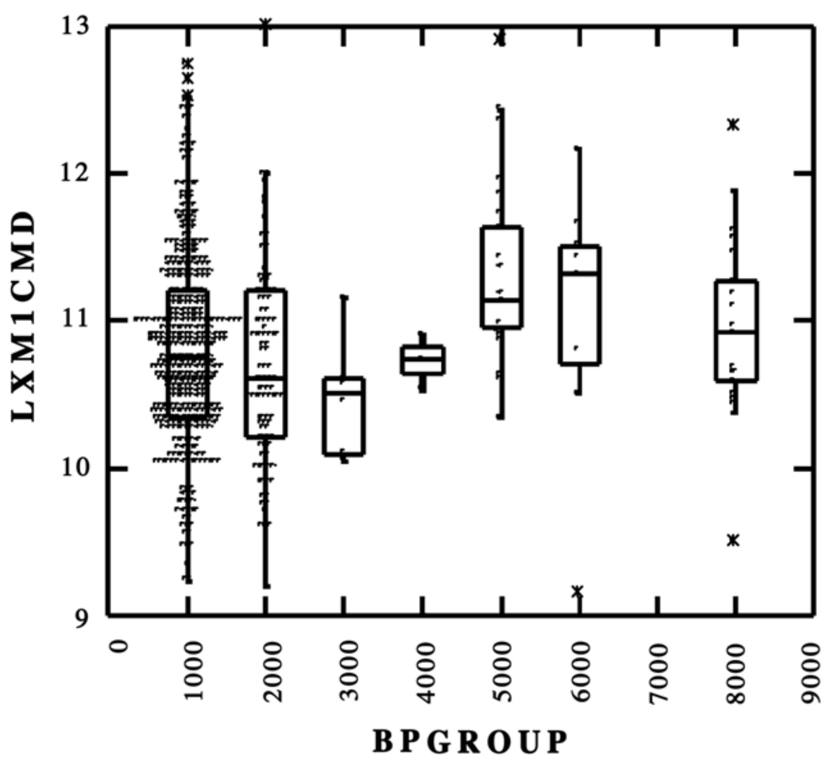


Figure 13-24. Left maxillary first molar crown mesiodistal dimension (mm).

median, and all but two or three of these larger values come from the older sites (Buckeye Knoll, Bird Island or Windover – 5000 through 8000 BPGROUPs).

Left Maxillary First Molar Crown Mesiodistal Dimensions

Sample sizes are dramatically larger for the molar dimensions and particularly so for the last two thousand year groups (BPGROUPs 1000 and 2000 [see Table 13-18], Figure 13-24; *n*=809) but there are only nine measurements from Buckeye Knoll. However, these nine individuals produced one of the largest medians of any of the series, and the Buckeye Knoll median even exceeds that of the Windover and Bird Island BPGROUPS (8000 AND 5000 respectively). The majority of the Buckeye Knoll series are well above the median of the other series. In seeming contradiction, one Buckeye Knoll individual provides one of the smallest values of the entire series (9.15 mm). Only three other specimens out of the 809 individuals are smaller, while six of the nine Buckeye Knoll specimens exceed the group median of the entire series, again indicating a shift toward larger values for this tooth dimension. A first response to this exceedingly small dimension is that the tooth was misidentified. However, this does not appear to be the case. This is an adult tooth from Burial 6 #4, a 5- to 9-year-old subadult, and all of this individual's adult dental dimensions are extremely small. Stojanowski notes that this individual has some of the smallest teeth of any adult he has ever seen. Between the two of us (Stojanowski and Doran), we have examined teeth from perhaps five thousand individuals from coast to coast, and this individual consistently shows small dental dimensions for the multiple teeth represented. Misidentification is highly unlikely. This individual is usually in the bottom 15 to 20 measures, even when the sample size approaches 1000. The few deciduous dimensions are also consistently diminutive and often the smallest reported, although the sample is much more limited.

Left Maxillary Second Molar Mesiodistal Crown Dimensions

There is a substantial reduction in the number of comparative dimensions for this tooth (an *n* of only 103, of which only 8 are from Buckeye Knoll; Figure 13-25). As a group, the > 4000 BPGROUPs have larger medians than observed in the scattered, more recent time intervals. The 41VT98 median is second only to the 5000 BPGROUP series and often has maximum values that exceed those of the later groups as well. Collectively, however, the 41VT98 series median of 10.29 mm is essentially identical to the overall median of 10.219 mm, and most of the Buckeye Knoll series are clustered below the group median. Five of the eight Buckeye Knoll values are actually below the group median, so the impression of a shift to larger values is distorted by a few large values, while the majority are in fact quite close to overall group median.

Left Maxillary Third Molar Crown Mesiodistal Dimensions

The individual and aggregate sample sizes for this dimension are also small, although the Buckeye Knoll series has one of the largest sample sizes with an *n* of 4 (Figure 13-26). The earlier BPGROUPs (5000 through 8000) again have larger medians than the more recent series, and the median for the 41VT98 series is the second largest, exceeded only by the median of the 5000 BPGROUP. The 2000 through 4000 series, while composed of small samples, are shifted toward the lower ranges of the distribution. There is a rise in median dimensions through time, from a low in the 4000 BPGROUP. The 1000 BPGROUP median and the Buckeye Knoll group median are almost identical, although there are a few more large individuals in the Buckeye Knoll series. There is also one very small individual in the Buckeye Knoll series (Burial 6 #4), which was mentioned in the previous discussion.

Left Maxillary First Incisor Crown Buccolingual Dimensions

Sample sizes, while small for most of the time intervals, indicate that the Buckeye Knoll series has a larger median. However, the differences are extremely small. For practical purposes, they do not show as much temporal variability as was seen in some of the other dental dimensions (Figure 13-27), even though the overall sample size is relatively robust (*n*=342). Compared to many of the dental comparisons, this is a tooth category that shows little change across time.

Left Maxillary Second Incisor Crown Buccolingual Dimensions

Here again, sample sizes are small for all groups. However, the Buckeye Knoll series and the Windover series have roughly equivalent sample sizes, and the Windover series has a larger median (Figure 13-28). The Buckeye Knoll series is variable and has both one of the largest observed dimensions of any in the series and also one of the smaller dimensions. The Windover has several individuals that are even smaller. Taking into account this extremely diverse inventory,

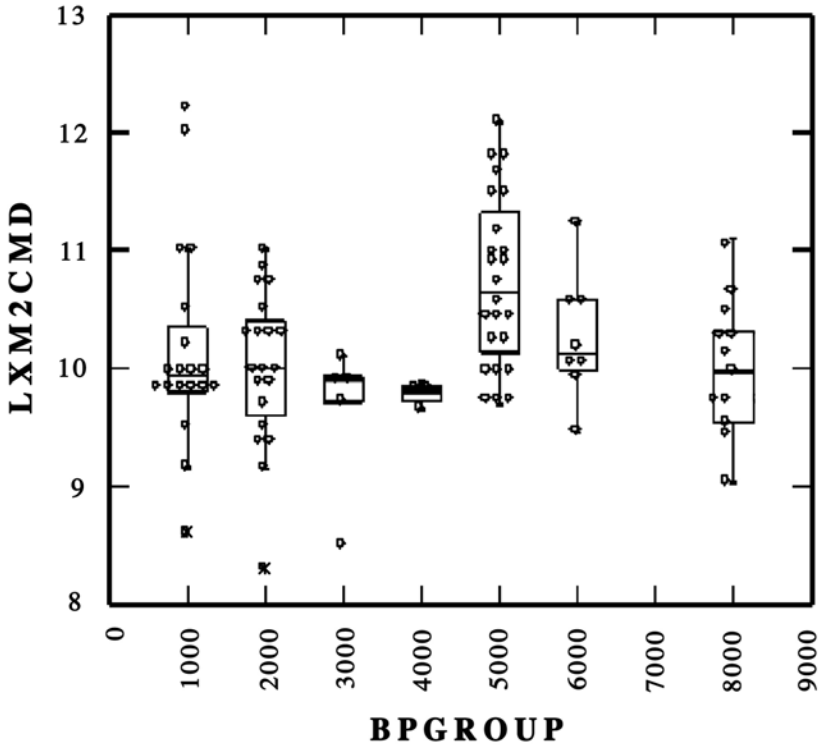


Figure 13-25. Left maxillary second molar crown mesi-odistal dimension (mm).

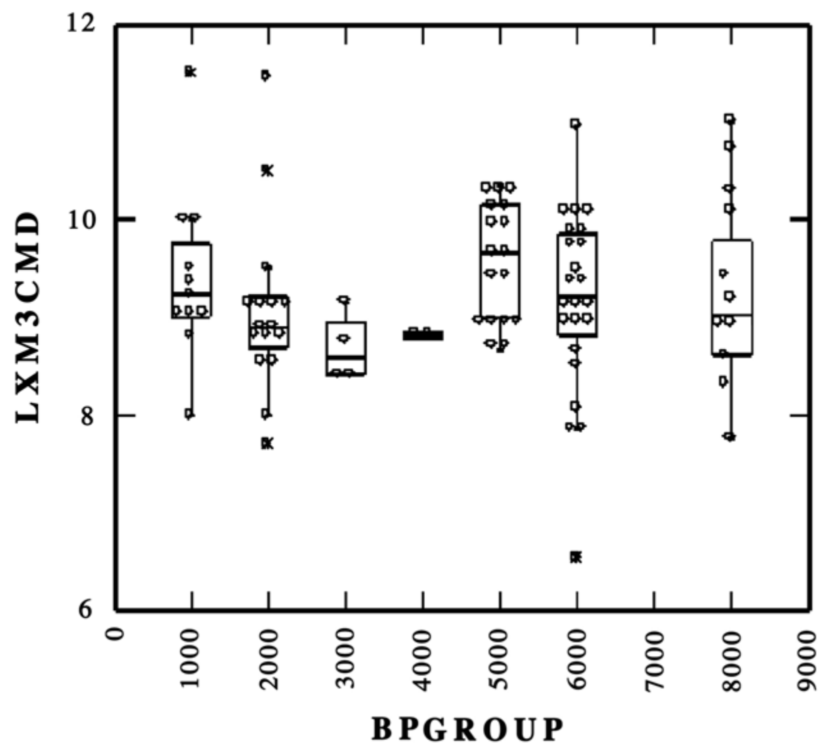


Figure 13-26. Left maxillary third molar crown mesi-odistal dimension (mm).

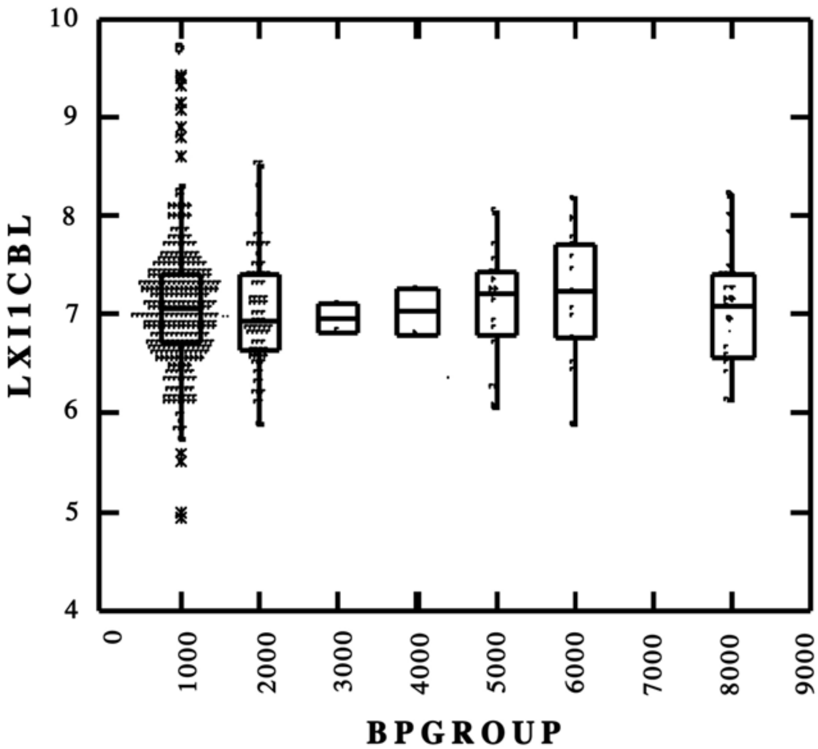


Figure 13-27. Left maxillary first incisor crown bucco-lingual dimension (mm).

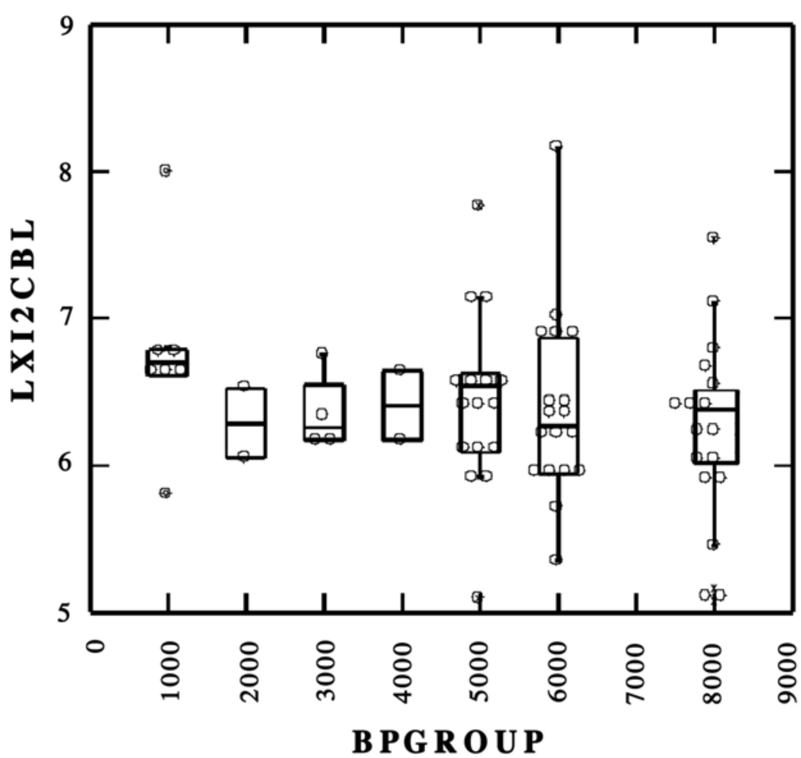


Figure 13-28. Left maxillary second incisor crown buccolingual dimension (mm).

the Buckeye Knoll median is smaller than the medians for all the other groups. The Bird Island (5000 BPGROUP) and the most recent interval (1000 BPGROUP) exhibit slightly larger medians.

Left Maxillary Canine
Crown Buccolingual Dimensions

The Buckeye Knoll median is the smallest of the entire series with 629 individuals, most of which come from the latest time interval (1000 BPGROUP; Figure 13-29). Of the 16 Buckey Knoll individuals, 75 percent fall below the 55^{th} percentile of the entire sample. This suggests a shift toward smaller values in the Buckeye Knoll materials, and the Buckeye Knoll materials are slightly smaller than the Windover sample series. Interestingly, this canine dimension is one which shows a consistent increase in median values from 6000 BPGROUP to 3000 BPGROUP and then shows a distinct drop in median values. Based on a t-test evaluation of the means, none of these differences are statistically significant and suggest little difference in this dental dimension across time. Some of the Buckeye Knoll values are in the lower 10 percent of the entire series, which does provide some support for an interpretation of smaller values.

Left Maxillary First Premolar
Crown Buccolingual Dimensions

This is a larger sample series with 33 specimens from Buckeye Knoll (Figure 13-30) and 782 from the rest of the North American series. The Buckeye Knoll series is metrically smaller than the Windover series and the 5000 BPGROUP (Bird Island). It is roughly equivalent to the rest of the series, regardless of temporal setting, indicating that this dental metric shows relatively little variation across time. The Buckeye Knoll median is 9.47 mm (Table 13-22) and the overall sample mean is 9.44 mm, supporting the proposition this dimensions shows little chronological variation.

Left Maxillary Second Premolar
Crown Buccolingual Dimensions

While the sample sizes are not large and there are only 62 individuals represented in the North American series, the Buckeye Knoll sample size is robust compared to many other measures (*n*=25; see Table 13-18; Figure 13-31). Collectively, the Buckeye Knoll series spans the entire range of values reported in the rest of the limited North American series. Median values suggest that the Buckeye Knoll materials fall into the lower values. Other groups, with the exception of the numerically small 2000 BPGROUP have medians, which are larger than the Buckeye Knoll series. The range in a small series like this suggests, in comparison to some of the other dental dimensions, relatively little difference in the samples used here.

Left Maxillary First Molar
Crown Buccolingual Dimensions

Sample sizes are large for this dimensions (Figure 13-32), although the inventory from Buckeye Knoll is relatively limited (see Table 13-18). From the individuals represented and the sample median, Buckeye Knoll is smaller than most of the other groups but is close to the median value of the numerically largest series (BPGROUP 1000). In contrast to the series with larger number of individuals and/or the older Windover group (8000 BPGROUP) or Bird Island (BPGROUP 5000), there are few large dimensions in the Buckeye Knoll series. Most of these other groups have individuals substantially larger than observed in the Buckeye Knoll series, which exhibits a relatively restricted range of values.

Left Maxillary Second Molar
Crown Buccolingual Dimensions

While sample sizes are not large, there is a noticeable shift toward reduced dimensions across time (Figure 13-33). This is not a perfect progression, and the Buckeye Knoll median is lower than would be predicted by this pattern (see Table 13-18). The general progression, however, does appear to be toward smaller values.

Left Maxillary Third Molar
Crown Buccolingual Dimensions

Median values of this dimension show a similar gradual chronological decline in distributions as noted for the second maxillary molar crown dimensions (Figure 13-34). The Buckeye Knoll series is unusual in that it exhibits a wide range of values, wider in fact, than any other series in the numerically small series. The median values of the three oldest groups (Bird Island, Buckeye Knoll, and Windover – the 5000 to 8000 BPGROUPs) are larger than all the other later samples. This is often a diminutive and highly variable tooth, and this pattern is consistent with the distributions seen here. A number of the Buckeye Knoll teeth are isolated, "floating" specimens. It is possible that the unusually wide range is exaggerated by misidentification, although we have used as much care as possible in the identifications.

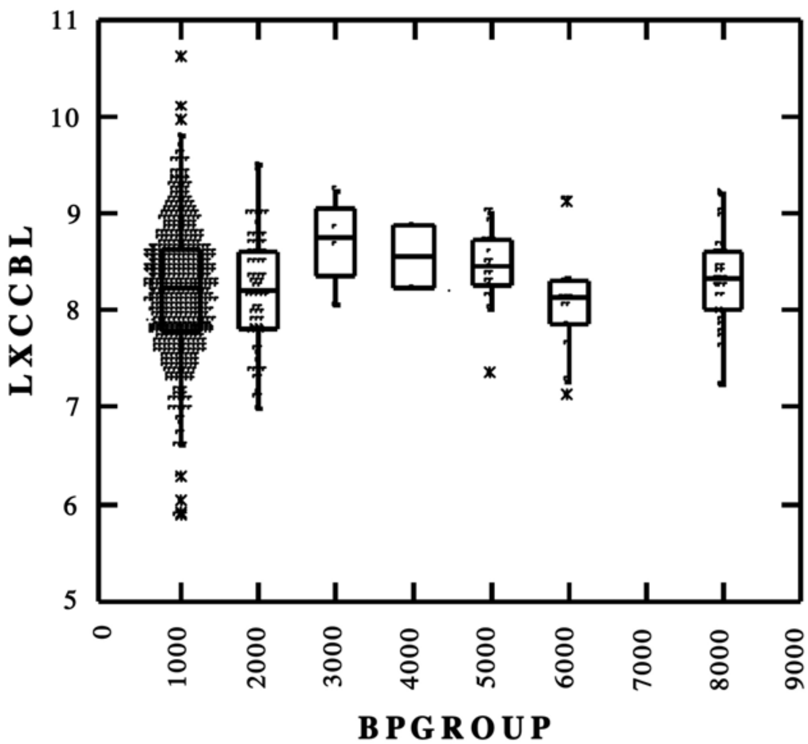


Figure 13-29. Left maxillary canine crown buccolingual dimension (mm).

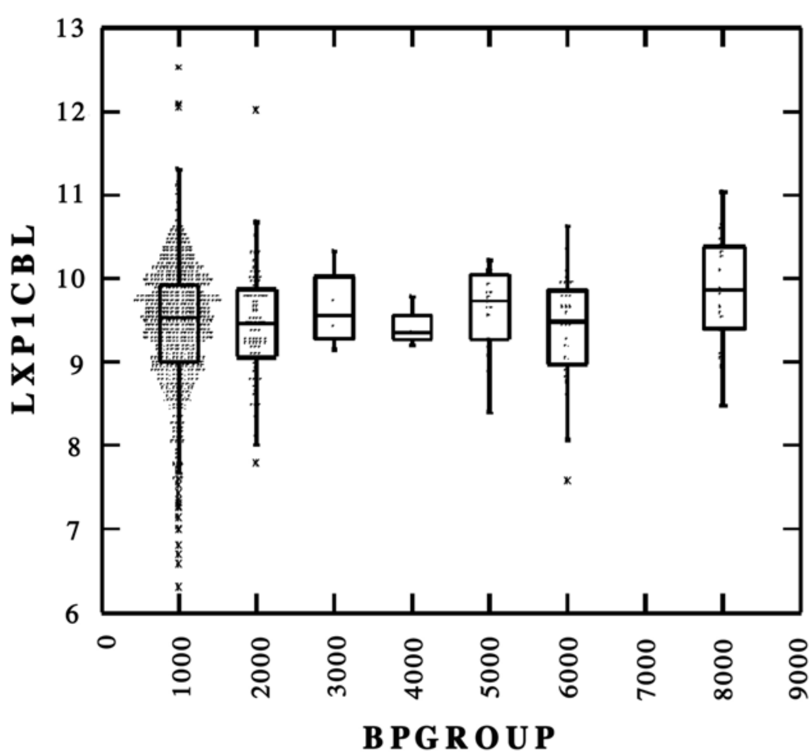


Figure 13-30. Left maxillary first premolar crown buccolingual dimension (mm).

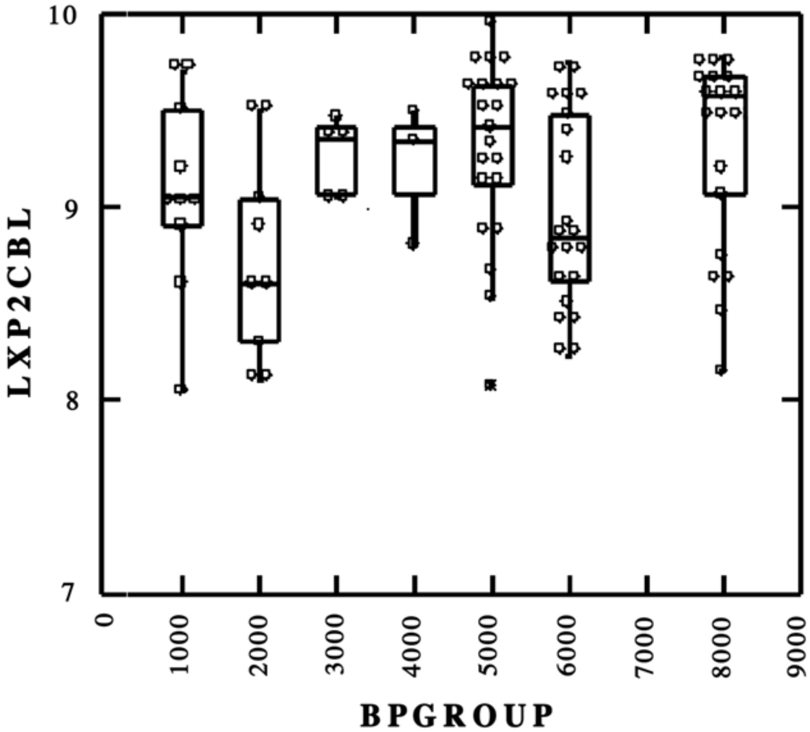


Figure 13-31. Left maxillary second premolar crown buccolingual dimension (mm).

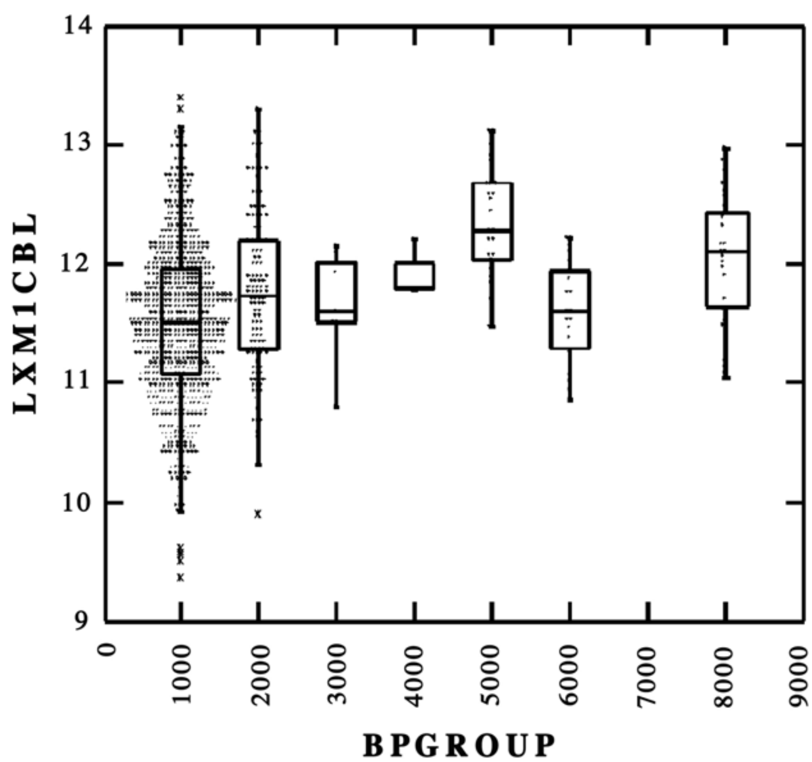


Figure 13-32. Left maxillary first molar crown buccolingual dimension (mm).

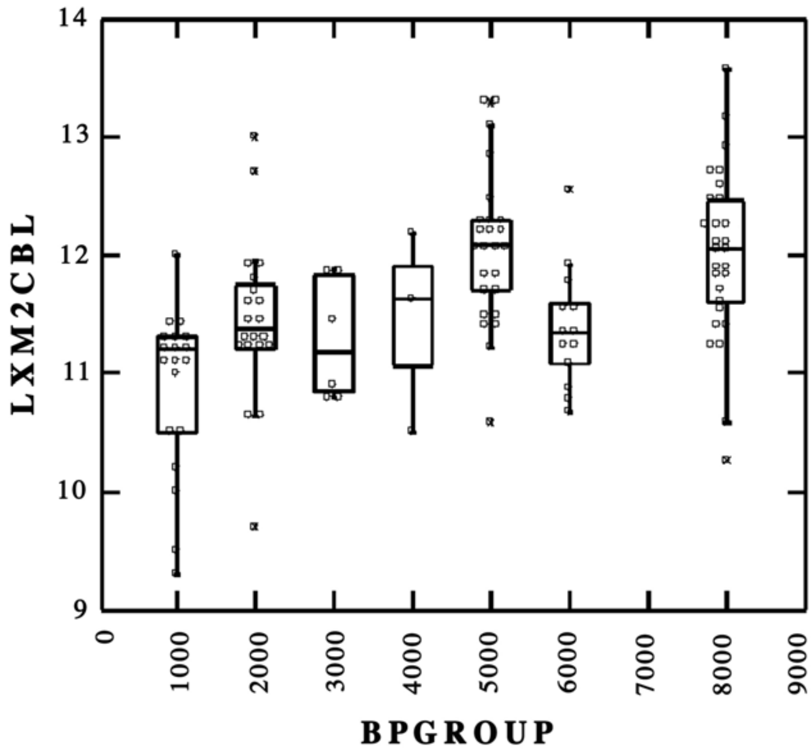


Figure 13-33. Left maxillary second molar crown buccolingual dimension (mm).

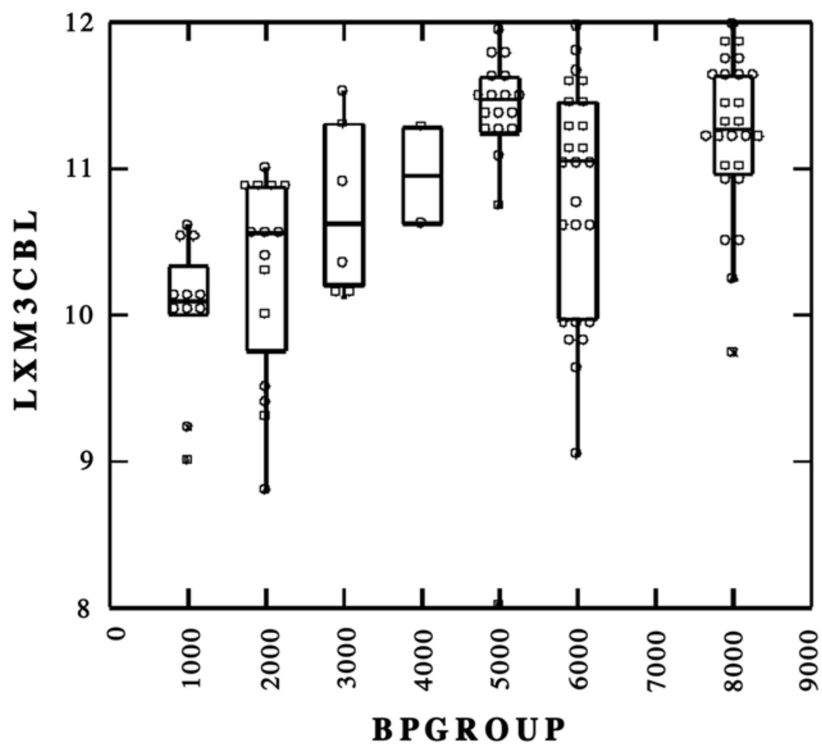


Figure 13-34. Left maxillary third molar crown buccolingual dimension (mm).

Bivariate Analysis

Another strategy of examining the Buckeye Knoll series, vis-à-vis the existing comparative data set, is to look at plot crown buccolingual vs. crown mesiodistal dimensions for the teeth with the largest sample sizes, specifically, LNI2, LNCC, LNP1, and LNM1. In the accompanying figures, the Buckeye Knoll specimens are shown as dots and all other samples are shown as single straight lines, while sample ellipses (68 percent) are illustrated for the Buckeye Knoll material and the rest of the Native American samples regardless of time or origin. This highlights the position of Buckeye Knoll vis-à-vis other North American groups. Figure 13-35 shows the shift, particularly of the buccolingual dimensions toward smaller values, while the mesiodistal dimensions are close to the comparative dimensions distribution. Only two of the Buckeye Knoll values fall within the overall ellipse, highlighting the difference in the distributions.

The sample ellipses in the left mandibular canine bivariate plot (Figure 13-36) tend to overlap more than in the case of the incisors. All of the Buckeye Knoll values fall within the larger sample ellipse, although the Buckeye Knoll ellipse is shifted toward smaller mesiodistal dimensions and smaller buccolingual dimensions.

Of all the teeth, the first premolar shows the greatest variability. This is expressed in the ellipses as well (Figure 13-37) and is particularly obvious in the Buckeye Knoll sample distribution, which is also shifted toward smaller values for both dimensions. There are large Buckeye Knoll values, but there are also numerous small values, which lower the median and mean (as noted above) and also pull the ellipse to lower values. The non-Buckeye Knoll series shows a much tighter, more restricted sample central tendency, which is almost entirely subsumed within the larger range of values in the Buckeye Knoll ellipse.

The first mandibular molar dimensions (Figure 13-38) show that the Buckeye Knoll values tend to be smaller, particularly for the buccolingual dimensions, although mesiodistal dimensions are in the upper half of the over all distribution. In a sense, the two dimensions are showing somewhat contradictory trends—one value, the buccolingual dimension, tends to be small, while the mesiodistal dimension tends to be larger in contrast to the later samples.

Basically, overlap between the ellipses indicates greater sample similarity (incisor and canine dimensions), with sample differences being greatest where the ellipses are most divergent or more tightly restricted within the larger distribution (first premolar and first molar).

In general, the following observations seem relevant vis-à-vis the comparisons of dental dimensions at Buckeye Knoll. First, the left first mandibular incisor crown mesiodistal dimensions for Buckeye Knoll appear larger than many of the comparative samples. The buccolingual dimensions are, on the other hand, shifted to lower values. The buccolingual dimensions for all groups show few striking or consistent differences and, if anything, the Buckeye Knoll series falls into the middle of the distribution.

The left mandibular second incisor crown mesiodistal dimensions tend to be larger than many of the comparative samples. The buccolingual dimensions, are, as for the first incisor, shifted toward the small values. Maxillary mesiodistal crown values and buccolingual dimensions for this tooth also indicate the Buckeye Knoll series is shifted toward smaller dimensions.

The left mandibular canine crown mesiodistal dimensions, by contrast, tend to fall into the smaller ranges of this dimension, as do the buccolingual dimensions. Maxillary mesiodistal crown values, and buccolingual dimensions for this tooth also indicate the Buckeye Knoll series is shifted toward smaller dimensions.

Left mandibular first premolar crown mesiodistal dimensions place the Buckeye Knoll series into the smaller ranges here, as well as do the buccolingual dimensions. The maxillary mesiodistal dimensions for the first premolar tend to be slightly shifted toward larger values in contrast to the mandibular dimensions. Maxillary buccolingual dimensions show little distinct chronological variation, and, here again, the Buckeye Knoll series is close to the other series.

The left mandibular second premolar crown dimensions tend to fall into the larger ranges of the comparative series. By way of contrast, the mandibular buccolingual dimensions are shifted toward larger values. Buccolingual dimensions of the maxillary tooth are shifted toward smaller values, but the shift is relatively small in contrast to some of the other dimensions. The maxillary mesiodistal dimensions tend to be larger in the Buckeye Knoll series, and most of the other groups show lower median values. Maxillary buccolingual dimensions of this tooth tend to be

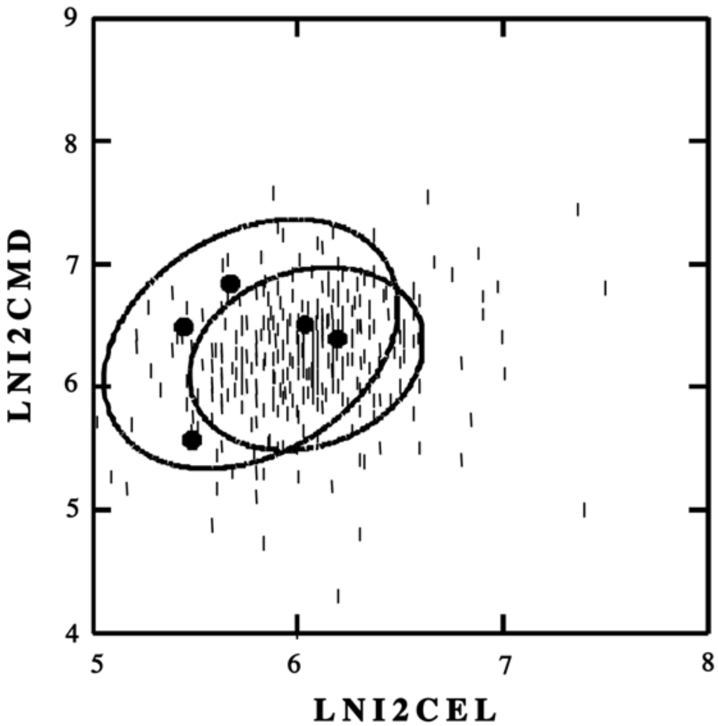


Figure 13- 35. Left mandibular first incisor crown bivariate plots. (Buckeye Knoll is shown as solid dots, and other samples are shown as straight lines. The sample ellipses [68%] are shown for Buckeye Knoll and the rest of the Native American samples regardless of time or origin as they are in Figures 13-36 through 13-38).

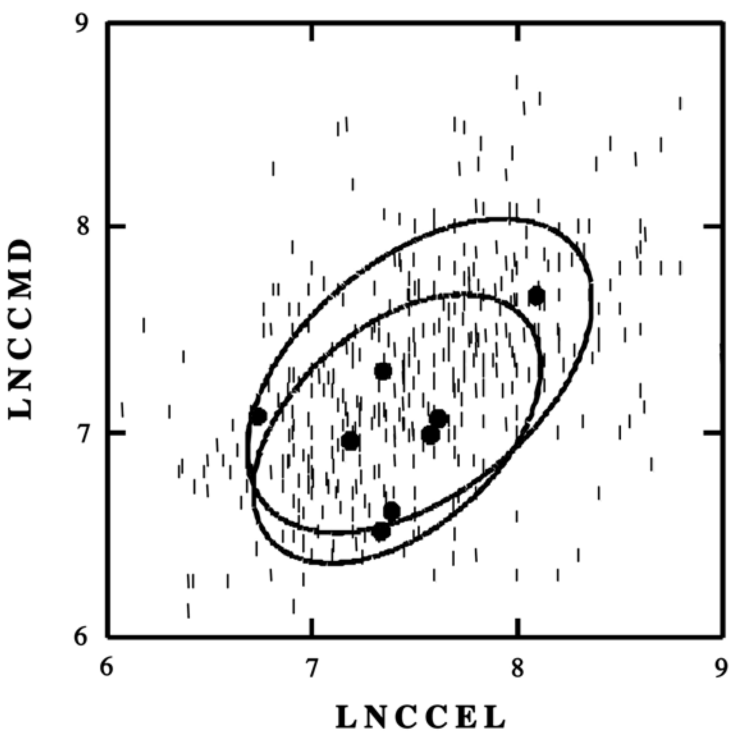


Figure 13-36. Left mandibular canine crown bivariate plots (Buckeye Knoll shown as solid dots, and other samples are shown as straight lines).

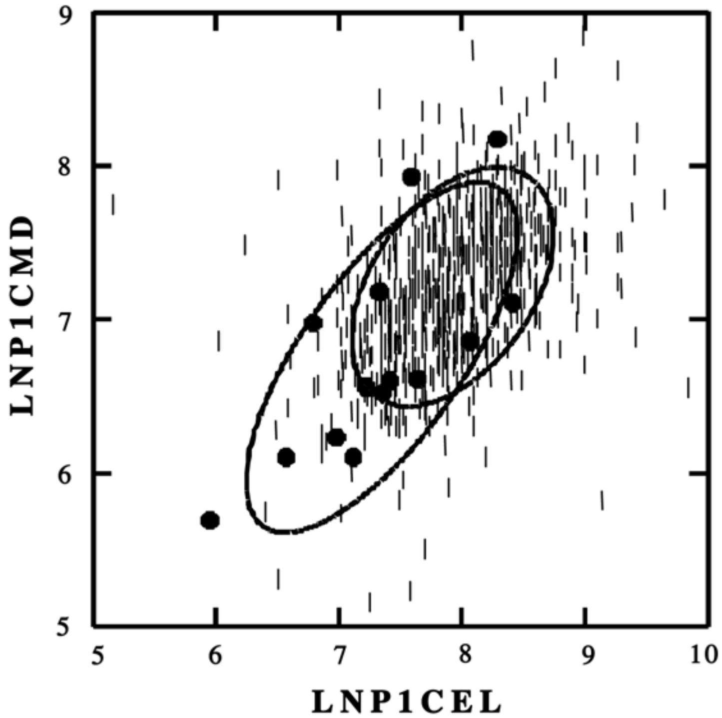


Figure 13-37. Left mandibular first premolar molar bivariate plots (Buckeye Knoll shown as solid dots, and other samples are shown as straight lines).

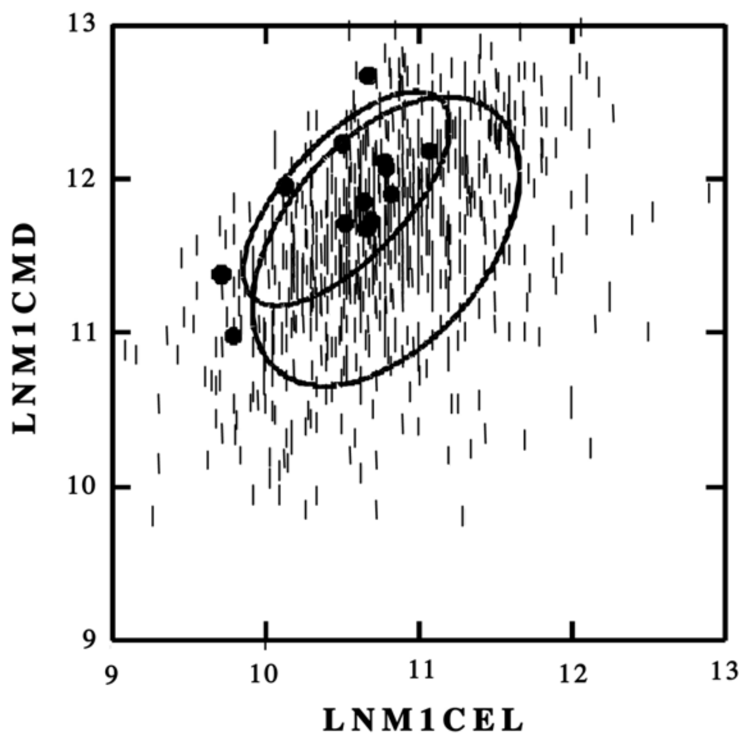


Figure 13-38. Left mandibular first molar bivariate plots (Buckeye Knoll shown as solid dots, and other samples are shown as straight lines).

shifted to lower values in the Buckeye Knoll series. The divergent trends in the maxillary mesiodistal and buccolingual dimensions are unusual. Usually, there is a higher degree of symmetry in these shifts. Sample sizes are relatively small and, compared to some dental dimensions, the chronological differences in the maxillary buccolingual dimensions are relatively small.

The left mandibular first molar crown mesiodistal dimensions for the Buckeye Knoll series tend to be larger, and unusually, show a larger median value than the earlier Windover values. The buccolingual dimensions are, like those of the second premolar, shifted toward larger values. The shift toward larger values is also observed in the maxillary mesiodistal dimensions. At the same time, one individual (Burial 6 #4) exhibits one of the smallest values of any in the series of 800 North American individuals.

The left second mandibular molar mesiodistal crown dimensions for the Buckeye Knoll series tend to exhibit larger values and again have a larger median than the Windover series. The buccolingual dimensions also appear shifted toward larger values, unlike the majority of other buccolingual dimensions in the mandible. The maxillary mesiodistal dimensions at Buckeye Knoll are, if anything, slightly larger, although the overall distribution is similar to the relatively small comparative series.

The left third mandibular molar mesiodistal crown dimensions for the Buckeye Knoll series tend to exhibit larger values and again have a larger median than the Windover series. Here again, the Buckeye Knoll buccolingual dimensions are shifted toward smaller values. The maxillary mesiodistal dimensions at Buckeye Knoll tend, if anything, to be shifted toward larger values. The Buckeye Knoll maxillary buccolingual distribution is, if anything, characterized by a wide range in values, some of which are greater than observed in almost all other groups. It is possible that some of these dimensions may be the result of errors in assignment, artificially inflating this dimension. If accurate, however, the Buckeye Knoll series is larger than all but the Bird Island and Windover series.

One of the patterns that is often observed when looking at dental dimensions spanning the Holocene and earlier Pleistocene samples is a tendency for older samples to have larger dimensions. Here, the samples only span the Holocene, but something of this pattern is observed. If the median values are arranged by time (see Table 13-18), there is a tendency for older samples (here older is > 5000 BP, thus including the Buckeye Knoll materials), to exhibit larger dental dimensions. In 15 of the 32 possible comparisons, the Buckeye Knoll sample is, in fact, larger than the more recent group medians (Note: the BPGROUP 3000 and BPGROUP 4000 have such small sample sizes they are really of little comparative utility). This pattern is clearly more obvious in the mandibular dentition where in 12 comparisons the 'Buckeye Knoll larger pattern' holds. In the maxillary dentition, only 3 of the possible 16 comparisons show the 'Buckeye Knoll larger pattern.' In four maxillary instances the Buckeye Knoll median is next to the largest in the series. On the other hand, and contradictory, in nine of the 16 possible comparisons in the maxillary dentition, the Buckeye Knoll medians are either the smallest, second smallest, or third smallest. Clearly, the mandibular and maxillary dentition are exhibiting different patterns that require additional analysis to fully understand.

The phenomenon for older samples to have larger dentition has been observed in many samples all over the world (Brace et al. 1984, 1987, 1991). In the case of the Buckeye Knoll materials, this pattern is hardly distinct or dramatic. As mentioned above, this is most noticeable in the mandibular dentition. Rather than being a dramatic trend, these observations can be subtle. One of the limitations is the difficulty of assigning sex to isolated teeth, which is a problem in the Buckeye Knoll series but is also problematic (i.e. missing sex assessments) in many of the comparative series used here. A more careful and controlled analysis is warranted to try to clarify the position of the Buckeye Knoll materials within the larger continental context.

Addendum 13-1. Dental Variable Abbreviations Used in the Report and Data File. (Variable descriptions found in Alt [1997]).

MAXILLARY DENTITION	
Trait	**DBF Abbreviation**
Winging	WINGL, WINGR
Labial Curvature	LCURVL, LCURVR
Shoveling- Canine	SHVLXC, SHVRXC
Shoveling I2	SHVLXI2, SHVRXI2
Shoveling I1	SHVLXI1, SHVRXI1
Double Shoveling P2	DSLXP2, DSRXP2
Double Shoveling P1	DSLXP1, DSRXP1
Double Shoveling Canine	DSLXC, DSRXC
Double Shoveling I2	DXLXI2, DSRXI2
Double Shoveling I1	DSLXI1, DSRXI1
Interruption Grooves I2	IGLXI2, IGRXI2
Interruption Grooves I1	IGLXI1, IGRXI1
Tuberculum Dentale Canine	TDLXC, TDRXC
Tuberculum Dentale I2	TDLXI2,TDRXI2
Tuberculum Dentale I1	TDLXI1,TDRXI1
Canine Mesial Ridge	CMRLX, CMRRX
Canine Distal Accessory Ridge	DARXL, DARX
MD Accessory Cusps P2	LXP2MDC, RXP2MDC
MD Accessory Cusps P1	LXP1MDC, RXP1MDC
Uto-Aztecan P1	LXP1UTO, RXP1UTO
Odontome P2	LXP2OD, RXP2OD
Odontome P1	LXP1OD, RXP1OD
Metacone M3	METALM3, METARM3
Metacone M2	METALM2, METARM2
Metacone M1	METALM1, METARM1
Hypocone M3	HYPOLM3, HYPORM3
Hypocone M2	HYPOLM2, HYPORM2
Hypocone M1	HYPOLM1, HYPORM1
Cusp 5 M3	C5XLM3, C5XRM3
Cusps 5 M2	C5XLM2, C5XRM2
Cusps 5 M1	C5XLM1, C5XRM1
Carabelli M3	CARLM3, CARRM3
Carabelli M2	CARLM2, CARRM3
Carabelli M1	CARLM1,CARRM1
Parastyle M3	C2LM3, C2RM3
Parastyle M2	C2LM2, C2RM2
Parastyle M1	C2LM1, C2RM1
Enamel Extension M3	LXM3EE, RXM3EE
Enamel Extension M2	LXM2EE, RXM2EE
Enamel Extension M1	LXM1EE, RXM1EE
Enamel Extension P2	LXP2EE, RXP2EE

MAXILLARY DENTITION	
Trait	**DBF Abbreviation**
Enamel Extension P1	LXP1EE, RXP1EE
Peg/Reduced M3	PEGLM3, PEGRM3
Peg/Reduced I2	PEGLI2, PEGRI2
Agenesis M3	CGXLM3, CGXRM3
Agenesis P2	CGXLP2, CGXRP2
Agenesis I2	CGXLI2, CGXRI2
Root Number M3	RTNOLM3, RTNORM3
Root Number M2	RTNOLM2, RTNORM2
Root Number M1	RTNOLM1, RTNORM1
Root Number P1	RTNOLP1, RTNORP1
Root Number P2	RTNOLP2, RTNORP2
Root Number C	RTNOLC, RTNORC
Root Number I2	RTNOLI2, RTNORI2
Root Number i1	RTNOLI1, RTNORI1
Radical Number M3	RDNOLM3, RDNORM3
Radical Number M2	RDNOLM2, RDNORM2
Radical Number M1	RDNOLM1, RDNORM1
Radical Number P2	RDNOLP2, RDNORP2
Radical Number P1	RDNOLP1, RDNORP1
Radical Number C	RDNOLC, RDNORC
Radical Number I2	RDNOLI2, RDNORI2
Radical Number I1	RDNOLI1, RDNORI1
MANDIBULAR DENTITION	
Trait	**DBF Abbreviation**
Shoveling I2	SHVLNI2, SHVRNI2
Shoveling I1	SHVLNI1, SHVRNI1
Double Shoveling I2	DSNLI2, DSNRI2
Double Shoveling I1	DSNLI1, DSNRI1
Canine Distal Acc. Ridge	LNCDAR, RNCDAR
Premolar Cusps P2	NPMCLP2, NPMCRP2
Premolar Cusps P1	NPMCLP1, NPMCRP1
Anterior Fovea M1	AFVEALM1, AFVEARM1
Groove Pattern M3 (X,Y,+)	GRVELM3, GRVERM3
Groove Pattern M2 (X,Y,+)	GRVELM2, GRVERM2
Groove Pattern M1 (X,Y,+)	GRVELM1, GRVERM1
Cusp No. M3	CSPNOLM3, CSPNORM3
Cusp No. M2	CSPNOLM2, CSPNORM2
Cusp No. M1	CSPNOLM1, CSPNORM1
Deflecting Wrinkle M1	DWLM1, DWRM1
Protostylid M3	PROTOLM3, PROTORM3

continued.

Addendum 13-1. (concluded)

MANDIBULAR DENTITION	
Trait	**DBF Abbreviation**
Protostylid M2	PROTOLM2, PROTORM2
Protostylid M1	PROTOLM1, PROTORM1
Cusp 5 M3	C5NLM3, C3NRM3
Cusp 5 M2	C5NLM2, C5NRM2
Cusp 5 M1	CSPNOLM1, CSPNORM1
Cusp 6 M3	C6LM3, C6RM3
Cusp 6 M2	C6LM2, C6RM2
Cusp 6 M1	C6LM1, C6RM1
Cusp 7 M3	C7LM3, C7RM3
Cusp 7 M2	C7LM2, C7RM2
Cusp 7 M1	C7LM1, C7RM1
Canine Root No. M3	CRTNOLM3, CRTNORM3
Canine Root No. M2	CRTNOLM2, CRTNORM2
Canine Root No. M1	CRTNOLM1, CRTNORM1

MANDIBULAR DENTITION	
Trait	**DBF Abbreviation**
TOMES ROOT P1	TOMESLP1, TOMESRP1
Root Number M3	RTNONLM3, RTNONRM3
Root Number M2	RTNONLM2, RTNONRM2
Root Number M1	RTNONLM1, RTNONRM1
Root Number P2	RTNONLP2, RTNONRP2
Root Number p1	RTNONLP1, RTNONRP1
Root Number C	RTNONLC, RTNONRC
Root Number I2	RTNONLI2, RTNONRI2
Root Number I1	RTNONLI1, RTNONRI1
Odontome P2	LNP2OD, RNP2OD
Odontome P1	LNP1OD, RNP1OD
Agenesis M3	CONGLM3, CONGRM3
Agenesis P2	CONGLP2, CONGRP2
Agenesis I2	CONGLI2, CONGRI2

* All observable I1, I2, C and P1 and P2 exhibited single root condition for both mandibular and maxillary dentition, except for mandibular first and second premolars which are included in the above table.

Addendum 13-2. List of Sites Used in the Dental Metric Comparisons.

Site	State	Years B.P.	Reference
41VT98	TX	5930	This report
7 Mile Bend	GA	1375	Stojanowski 2001
Windover (8BR246)	FL	7410	FSU osteology lab files
8WA52	FL	435	Stojanowski 2001
9BR2	GA	336	Stojanowski 2001
9FL5	GA	370	Stojanowski 2001
9GE5	GA	830	Stojanowski 2001
9GE948	GA	915	Stojanowski 2001
9MG28	GA	270	Stojanowski 2001
9MU100	GA	1030	Stojanowski 2001
9MU101	GA	1300	Stojanowski 2001
9MU102	GA	940	Stojanowski 2001
9PM137	GA	336	Stojanowski 2001
9TP64	GA	435	Stojanowski 2001
Adena	OH	2550	Sciulli 1979
Airport	GA	1870	Stojanowski 2001
Amelia	FL	233	Stojanowski 2001
Bayshore Homes (8PI41)	FL	1175	Dickel 1991
Bennett Landing (8VO24)	FL	3592	Dickel 1991
Bird Island	FL	4570	Stojanowski 1997
Block Stern Site (8LE14)	FL	2350	Dickel 1991
Borrow Pit	FL	435	Stojanowski 2001
Browne Mound	FL	1030	Stojanowski 2001
Cedar Creek (8SJ3155)	FL	?	Dickel 1991
Edwards Mound (8BR140)	FL	1282	Dickel 1991
Fairyland (8BR72)	FL	560	Dickel 1991
Fig Springs	FL	265	Stojanowski 2001
Fitzgibbons	IL	1850	Robison and Butler 1986
Gautier	FL	1660	Dickel 1991
Glacial Kame	OH	3200	Sciulli 1979
Goose Pasture (8JE156)	FL	?	Dickel 1991
Grant Mound (8BR56	FL	1322	Dickel 1991
Highland Beach	FL	950	Dickel 1991
Holy Spirit	FL	435	Stojanowski 2001
Hopewell	OH	1800	Sciulli 1979
Indian Knoll	KY	4301	Perzigian 1976
Irene Mort	GA	545	Stojanowski 2001
Irene Mound	GA	545	Stojanowski 2001
Johns Mound	GA	1320	Stojanowski 2001
Kent Mound	GA	1334	Stojanowski 2001
Lake Jackson	FL	940	Stojanowski 2001
Lewis Creek	GA	890	Stojanowski 2001
Little Pine	GA	667	Stojanowski 2001
Manasota Key	FL	1730	Dickel 1991

continued.

Addendum 13-2. (concluded)

Site	State	Years B.P.	Reference
Mangum	MS	450	NPS NAGPRA inventory
Marco Island (8CR108)	FL	1612	Dickel 1991
Marys Mound	GA	1080	Stojanowski 2001
Mayport Mound	FL	1917	Stojanowski 2001
McCleod	GA	667	Stojanowski 2001
McKeithen Mound	FL	1550	Stojanowski 2001
Mound Ave. Mound (8VO24)	FL	1025	Dickel 1991
Norman	GA	667	Stojanowski 2001
Oak Knoll	FL	1900	Dickel 1991
Patale	FL	267	Stojanowski 2001
Pecos Pueblo	NM	500	Stojanowski 1997
Pine Harbor	GA	435	Stojanowski 2001
Pine Island	FL	550	Dickel 1991
Piney Island (8MR848)	FL	550	Dickel 1991
S-237	IL	130	Doran 1996
S-239	IL	120	Doran 1996
S-818	IL	635	Doran 1998
S-86	IL	810	Doran 1999
SAN CARLOS MOUND 8DU10	FL		Stojanowski 2001
SAN COSMOS (8LE120)	FL		Stojanowski 2001
San Luis	FL	240	Stojanowski 2001
Santa Catalina de Guale	GA	265	Stojanowski 2001
SCDG-OSS	FL	435	Stojanowski 2001
Schultz Mound	KS	1910	Phenice 1969
Seaside 1	GA	1443	Stojanowski 2001
Seaside 2	GA	1320	Stojanowski 2001
SMDYamassee	FL	240	Stojanowski 2001
South End Mound	GA	458	Stojanowski 2001
Tatham	FL	435	Stojanowski 2001
Tennessee Wood.	TN	1025	Hinton et al. 1980
Tierra Verde	FL	940	Dickel 1991
Tomoka River Midden (8VO63)	FL	1540	Dickel 1991
Turner	MO	1700	Black 1979
Waddell's Mill Pond (8JA65)	FL	1500	Dickel 1991
Weeki Wachee	FL	268	Stojanowski 2001

Chapter 14

Linear Enamel Hypoplasia Analysis

Colette Berbesque

Methodology

Methods for this analysis were in part chosen on the quantity of comparative data, as scored photographs can be integrated into other scored databases. Another factor when considering methodology is contestability: from these photographs, another investigator could disagree with the assessment of any given tooth, and thereby obtain their own data using this methodology (with independent judgment). This allows for contestability of data, an important factor in scientific study.

Photographs were taken of the left maxillary and mandibular canines using the Nikon 990 Coolpix in macro mode. Macro mode allows for finer detail, as the object being photographed takes approximately 75 percent of the frame of the photograph. The diminished focal length also presents some difficulty with depth or focus on anything other than one plane. As teeth are often curved, every attempt was made to capture the labial surface of the tooth with greatest clarity. Multiple photographs were taken from different angles to ensure that defects were scorable. These photographs are a part of the Buckeye Knoll digital archive mentioned earlier.

Canines were chosen as a median (maxillary) and sensitive (mandibular) indicator of overall metabolic stress for the population. Though studies often rely on incisors as well as canines (King et al. 2005; Palubeckaite et al. 2002; Reid and Dean 2000), the prevalence of hypoplastic defects on incisors is higher; thus canines were chosen preferentially as they have a slightly longer developmental time, on average, for crown completion than other tooth types (5 months to one year for crown completion for deciduous canines and newborn –to six years for crown completion of permanent canines). Secondly, incisors are often more heavily worn and would preclude LEH scoring due to wear. A metric scale was placed in the plane and parallel to the axis of the tooth in each photograph. The photographs were taken in high quality TIFF file format. Missing teeth, or teeth too worn to score, were excluded from analysis. In some cases, dental calculus prevented an accurate measurement of crown height, and measurements were then taken from the bottom of the calculus to the top of the crown. These measurements are primarily for quality control in using imaging software for analysis.

Each photograph was then scored for LEH in Microsoft Paint due to resolution superior to that of the analysis program, Scion Image (a PC-friendly software modeled after the National Institute of Health's developed Image for Macs) (www.nist.gov/lispix/imlab/labs.html).

Once scored, the images were imported into the software Scion Image for analysis. In Scion, the scale in each photograph was used to set an internal scale for linear, as well as, area measurements. Crown height was again taken using the "measure" command. Due to significant attrition in the Windover sample and expectations of seeing similar attrition in the Buckeye Knoll series, stage of development for each defect was determined by measuring the distance from the cemento-enamel junction (CEJ) to the bottom of each defect. Developmental chronology was determined using a diagram from Berten (1895; in Massler et al. 1941). Use of this developmental chronology necessitates estimation of complete crown height for every tooth. An estimate of completeness for each canine was generated based on surrounding dentition and other canines within the population. This introduces age bias, as older individuals demonstrate a higher degree of attrition. Apart from the deciduous dentition, by estimation the median percent complete for permanent dentition is 85 percent. The mean is 86 percent complete for mandibular canines, and 81 percent complete for maxillary canines. This means that the 15 percent of the tooth developing earliest in a child is often not available for analysis in the Buckeye Knoll sample. Despite the introduction of bias, this method allows for an approximate complete crown height to be calculated rather than relying on standard mean crown heights based on modern populations. Calculation of location for each defect as a percent of the total crown height was accomplished using Scion. Berten (1895) correlated age of development by percent of total crown completion, establishing a relative age of metabolic insult for each defect. Determining the developmental timing of each defect allows for analysis of particular windows of time in each individual's life to be compared on a population basis. This may insinuate changes within the population over time, or susceptibility of children at developmental milestones.

Previous studies, such as that of Goodman (1987), have used developmental chronologies spanning .25 to 7 years based on Massler et al. (1941). Moorrees et al. (1963a, 1963b) have estimated maxillary canine crown completion at approximately 5 years of age. Reid and Dean (2002) estimate crown completion for maxillary canines at 5.3 years of age, and mandibular canine completion at 6.2 years. The timing chosen for this study is from .25 years to 6 years, an estimate based on a diagram by Berten (1895; as depicted in Massler et al. 1941) (Figure 14-1). Though the percentiles of crown completion presented in Reid and Dean (2002) are more detailed than the estimate presented by Berten, this level of detail is unnecessary as the percentiles of crown completion are still dependent on estimated crown heights in the majority of the Windover sample. Also, the developmental standards presented in studies such as Reid and Dean (2002) are based on modern rather than prehistoric populations. The Berten (1895) estimate was chosen for this study in part because crown completion at 6 years of age is a mean of sorts in other studies (Massler et al. 1941; Reid and Dean 2002). Variation in canine crown development within a particular population is consistently estimated as plus or minus 12 to 18 months. Considering this level of variation, the determination of crown completion is fundamentally for the purposes of modeling these defects in a developmental framework. Standards for different populations have yet to be generated specifically for these developmental chronologies of tooth formation.

As opposed to subsequent studies (Massler et al. 1941), the Berten diagram does not assume equal time for each standard developmental increment and parallels the average developmental estimate of crown completion made in more recent studies. This allowed for an overall defect count as well as developmental time frame to be used with comparative data. Despite this precision in measurement as to the placement of each defect on each canine, there is a great deal of subjectivity in defect counts. One investigator may see one large defect, another may see two smaller defects with an apparent recovery. A faint line may be a defect for one investigator, but not another. Methods employed in this study allowed for the magnification of the images for scoring defects, which may result in inflated scores when compared to populations scored with no visual aid. Although this discrepancy may not cause significantly more of a difference in scoring than standard inter-observer error, it is a predictably directional bias.

Results

Since the Buckeye Knoll sample is predominantly based on an examination of 133 canines, many of which are "isolated" (i.e. not associated with specific burials/individuals), this analysis will not discuss incidence of LEH by age or sex. There are 41 deciduous canines in the sample and 92 adult canines. Analysis of among-teeth variation in hypoplastic rates is often explained by time of development. Earlier-forming teeth, such as central incisors, are more hypoplastic. Goodman and Armelagos (1985) suggest it is not only time of development, but also the developmental stability of a tooth type that affects degree of hypoplasia formation. Less developmentally stable (less tightly genetically controlled) tooth types are more resistant to disruption of ameloblasts, and will have fewer hypoplasias than their simultaneously developing, more stable counterparts. Distribution of LEH counts in the permanent dentition by tooth type is shown in Table 14-1.

Of the 133 canines examined (92 adult and 41 deciduous), only one of the deciduous canines exhibited a defect, and it was a single defect. Of the 92 adult teeth, 54 exhibited at least one defect. Thus, 59

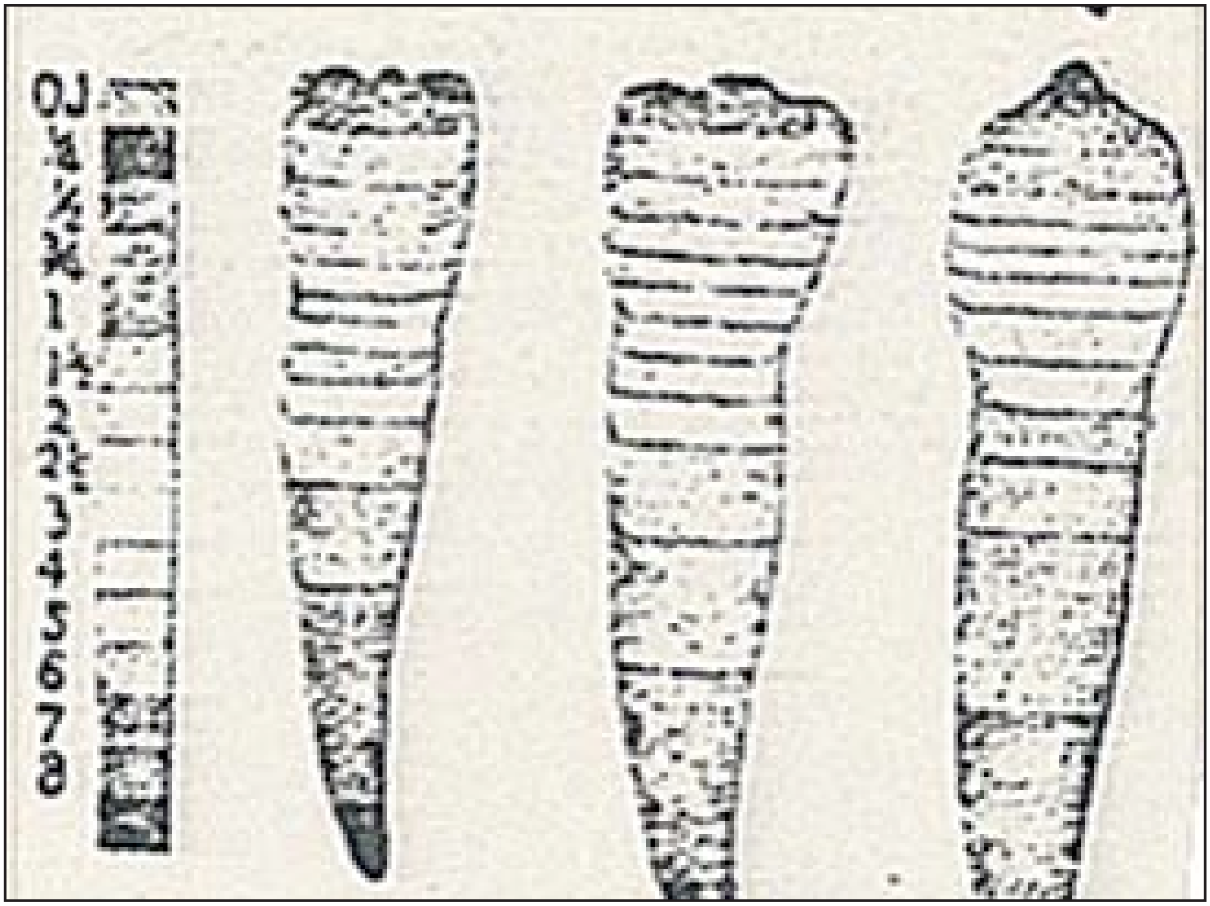


Figure 14-1. The Berten diagram of dental development (from Massler et al. 1941).

percent of the adult teeth exhibited defects and only 2.4 percent of the deciduous teeth exhibited defects. There are equal numbers of maxillary and mandibular teeth, and a small number of UID adult canines (no location assessment was possible). Defect rates are higher in the mandibular dentition than in the maxillary, though the difference is small.

In all, there were 86 defects observed in the adult dentition (Figure 14-2) and they were found in 54 teeth (59 percent) of the teeth examined. Single defects were twice as common as double defects (32 teeth vs. 15; 59 percent and 28 percent, respectively), while only 13 percent of the 54 teeth showed more than two defects and the decline from double defects to triple or quadruple was dramatic. Phrased another way, slightly over half the individuals (as demonstrated by adult canine tooth counts) exhibited a single defect and half this number again were likely to experience a second metabolic insult capable of causing a disruption in enamel formation. In only a few cases would any of these individuals experience additional stress events sufficient to cause growth disruptions presented as LEH formation.

The near absence of LEH defects in deciduous dentition (only one observed out of 40 deciduous canines, or 2.5 percent) suggests early development (deciduous canines with completed crowns by one year of age) is largely uninterrupted by metabolic insults of a sufficient magnitude to disturb dental development. This also suggests an adequate infant diet and/or an adequate maternal diet sufficient to buffer environmental insults, thus minimizing LEH formation in the first year of life.

Age clustering of defects might indicate a milestone cultural or biological (birth) event. In the sample of adult teeth exhibiting defects (n=86 defects) the mean age of defect is 4.3 and the median is 4.0 years. The maximum age of defect is 6 years and the minimum is 1.5 years at insult. Clearly, defect formation was not precipitated by birth, or followed closely by significant defects in the first several years of life.

Table 14-1. Distribution of Linear Enamel Hypoplasia (LEH) Defects in Adult Canines, Buckeye Knoll.

LEH Counts	Mandibular Canine	Maxillary Canine	Unidentified	Total	Remarks
No. teeth w/o LEH	17	17	4	38	41% w/o LEH
No. teeth w/ LEH	27	20	7	54	59% w/ LEH
Minimum LEH	0	0	0	—	
Maximum LEH	4	4	4	—	
Median LEH	2	1	2	—	
Mean LEH	1.7	1.3	2	—	
Standard Deviation	0.82	0.73	1.15	—	
1 LEH	13	16	3	32	
2 LEH	10	3	2	15	
3 LEH	3	—	1	4	
4 LEH	1	1	1	3	

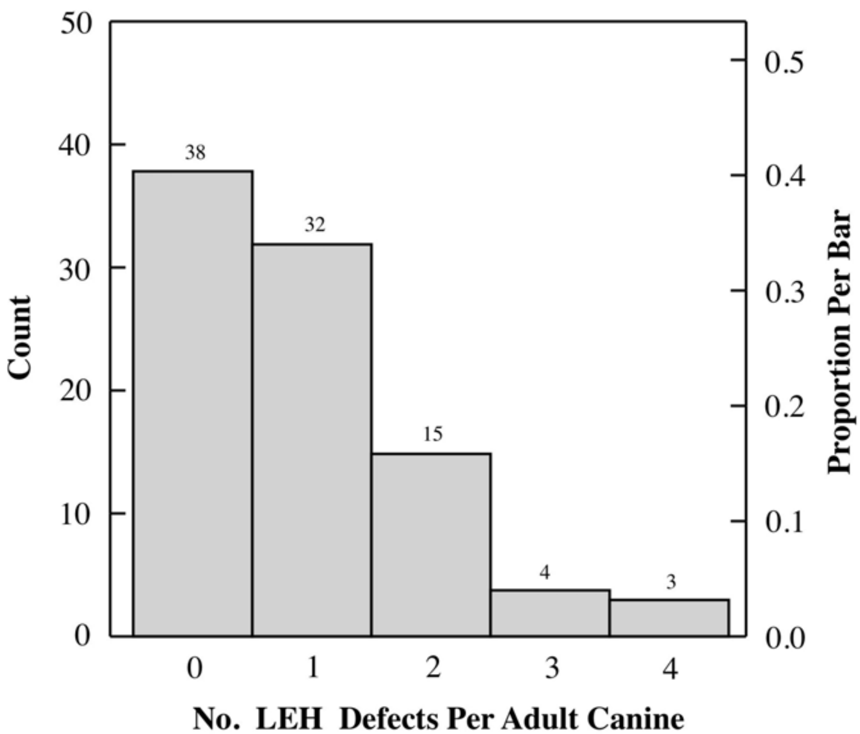


Figure 14-2. Number of LEH defects in adult canines.

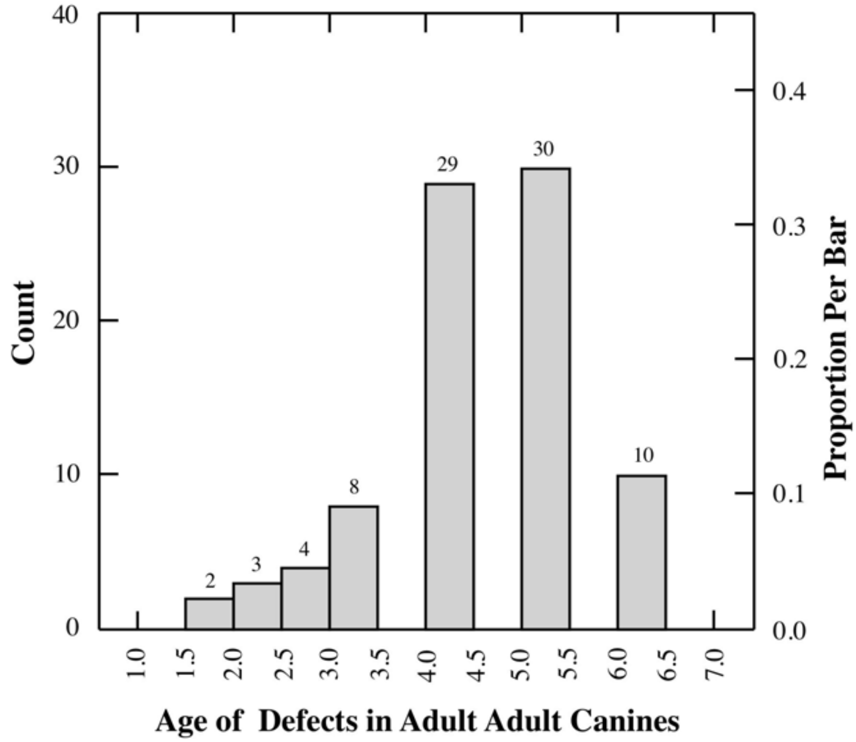


Figure 14-3. Age of defects in adult canines.

This supports the previous interpretation of good early childhood health.

Age clustering in later years is, however, clearly obvious (Figure 14-3). Defect incidence doubles in the third year of life, then quadruples in the fourth and fifth years of life, then declines in the last year of canine formation (sixth year). Clearly, the fourth and fifth years were the most metabolically challenging for individuals in this population. Again, maternal buffering in the first several years of life (through nursing) is a reasonable explanation for the low incidence. The simplest interpretation of the doubling in incidence in the third year, and then the quadrupling of rates in the fourth and fifth years, is explained by weaning stress and a shift to a solid diet. This shift is often associated, even in modern contexts, with fevers, diarrhea, and an increased incidence of illness (all biologically stressful events). Ages from two to four are thought to correspond to the ages of weaning, though in other contexts some suggest a later weaning period (Goodman and Armelagos 1989, for example). Based on the LEH data, we would suggest weaning began in the third year but more commonly occurred in the fourth year, with the weaning process impacting the individual for several years overall.

That the mean ages of all defects, except the bookend defects (those closest to CEJ and closest to the tooth tip), fall into this weaning period is not terribly surprising, as the two to three weaning years encompass a significant percent of the total crown formation time.

The location of each defect gives insight into the timing of metabolic insult. All age reconstruction for this sample of permanent dentition begins at .25 years after birth. This first time period on the occlusal surface of the crown is so often worn away by attrition that much of the data on the first year of life is lost. Reconstruction of health status must then begin with the last portion of the crown formation, since these data are the most prevalent (Table 14-2).

The last metabolic insult to these individuals during crown completion is at a mean of 4.69 years of age. The mean age for the second-to-last defect is 3.82, and for the third-to-last defect is 3.29. Maxillary defects are earlier than mandibular defects on average. This may be due to the developmental timing of maxillary crown formation.

The third- and fourth-to-last defect means are fairly closely grouped in developmental time, indicat-

Table 14-2. Age of LEH Insult Statistics in the Buckeye Knoll Adult Canines.

Statistics	Age of Insult			
	Last Defect Age	2nd to Last Defect Age	3rd to Last Defect Age	4th to Last Defect Age
Total No. of Cases	54	22	7	3
Total Mean	4.69	3.82	3.29	3.00
Total Standard Deviation	0.96	1.02	0.99	1.00
Maxillary No. of Cases	20	4	1	1
Maxillary Mean	4.63	3.38	3.00	2.00
Maxillary Standard Deviation	0.985	1.493	—	—
Mandibular No. of Cases	27	14	4	1
Mandibular Mean	4.78	4.07	3.63	4.00
Mandibular Standard Deviation	0.89	0.73	0.75	—

ing a possible cluster in this population at around three and a half years of age. The first defects in the life of these individuals are often obscured by attrition. The developmental period that has the most data ranges from .75 years to 6 years of age (approximately when the CEJ is formed). Maxillary defects range in timing from 1.5 years of age to 6 years of age. Mandibular defects range from 2 to 6 years of age.

Most of the canines examined were unassociated with burials. However, some of the scored canines did come from distinct burials. Of these 19 scored canines, 11 showed no evidence of defects and a smaller number, eight, showed defects; with four having single defects and four having two defects.
The LEH data from Buckeye Knoll will provide others with a variety of comparative possibilities beyond the ones presented here. Increasingly, researchers are reporting rates per tooth, but in many cases LEH incidence is reported as rates per person. Rates per tooth are far more comparable, particularly when individuals are difficult to identify in commingled samples. Even with these limitations, and taking the per-person rate as based on left mandibular canines (n=27 with defects and 17 without), this provides a simplistic rate per person of 61 percent and 54 percent for the left maxillary dentition which is close to the total canine rate of 59 percent; thus it really makes little difference which figure is used in this particular context. In other studies, Bement (1994) reports a rate of100 percent for Seminole Sink (very roughly contemporaneous to Buckeye Knoll), plus rates for the people at Bering Sinkhole of between 45 and 48 percent to between 64 and 66 percent from the San Geramino through the San Marcos phases (all Archaic) (Bement 1994:89). Within this limited comparative frame, the Buckeye Knoll materials appear to be in the approximate middle of Bement's reported distributions, though substantially lower than the most nearly contemporaneous group from Seminole Sink. More detailed comparative tabulation will ultimately be informative.

Chapter 15

Periosteal Reaction in "Virgin" Texas, 6,000-7,000 B.P.

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The suggestion that periosteal reaction has disease specificity as a population phenomenon is well documented (Rothschild and Martin 1993; Rothschild and Rothschild 1996, 1998a). Cook's (1976, 1984) attribution of non-focal periosteal reaction to trauma has been falsified, except in the presence of complicating osteomyelitis or stress fracture (Resnick 2002; Rothschild and Martin 1993). Treponemal disease, in the form of yaws, has been documented on the basis of periosteal reaction in much of North America (Rothschild and Rothschild 1994, 1995a, 1995b). This pattern extends from the Cascade Mountains to the east coast of Florida, dating from eight to nine millennia before present. Its distribution has been contiguous across North America east of the Cascade Mountains, with several notable exceptions (Rothschild and Rothschild 1994): The Northwest territories of Canada were unaffected, as was Ontario prior to emergence of Iroquoian cultures. A caveat must be considered for some areas (e.g., Saskatchewan, Nebraska, Iowa, Kansas, Oklahoma) that have not had skeletal populations available for analysis in the post-1987 time period for which data-based criteria have been available (Rothschild and Rothschild 1995b). Texas skeletal populations were, therefore, examined for evidence of periosteal reaction.

Materials and Methods

The Texas and other North American sites delineated in Table 15-1 were chosen to assess the population frequency, as well as nature, extent, and character, of any non-focal (e.g., bump) periosteal reaction present. Skeletal remains were subjected to visual examination of all articular and cortical surfaces—to identify all occurrences of alterations throughout each skeleton, specify the types of bony alterations at each occurrence, and map the distribution of occurrences in each skeleton. In sites where preservation was fragmentary, the sample size (denominator) was determined on the basis of sufficient tibial preservation for assessment, as the tibia is the sentinel bone for recognition of treponemal disease as a population phenomenon (Rothschild and Rothschild 1995b). Periosteal reaction in treponemal disease invariably affects the tibia (Rothschild and Rothschild 1995b; Rothschild and Rothschild 1996; Rothschild et al. 1995).

Results

Examination of the skeletons of 37 (number determined on basis of sufficient tibial preservation) individuals from the Texas 6000-year B.P. site of Buckeye Knoll revealed evidence of isolated bumps and occasional cases of osteomyelitis, but no diffuse periosteal reaction (see Table 15-1) and no sabre-shin reaction. This was similar to observations in the Florida 4500-B.P. Bird Island (8DI52) site, in which 19 individuals were similarly spared.

This sparing phenomenon lies in contrast to the east Florida 8000-B.P. Windover and 1800-to-2400-years

Table 15-1. Texas and North American Evidence of Non-focal Periosteal Reaction.

Site	Century BP	Sample	Periostitis		Sabre Shin
			n	%	
Buckeye Knoll (41VT98), Texas	65	37	0	—	Absent
Bird Island (8DI52), Florida	45	19	0	—	Absent
Kamarvik (LeHv-1), NW Territories	8	79	0	—	Absent
Kulaituijavik (LaHw-1), NW Territories	8	22	0	—	Absent
Sadlermuit (KkHh-1). NW Territories	8	25	0	—	Absent
Port Au Chaux, Newfoundland	34-51	124	0	—	Absent
Glen Williams, Ontario	8	99	0	—	Absent
Maurice Ossuary (BeHa-1), Ontario	2	105	0	—	Absent
Hind (AsdHk-1), Ontario	?	18	0	—	Absent
Fairty Ossuary, Ontario	5	147	0	—	Absent
Rankin (40CK6), Tennessee	Woodland	21	0	—	Absent
Big Sandy (40HY16), Tennessee	Archaic	35	0	—	Absent
Oakview Landing (40DR1), Tennessee	Archaic	56	0	—	Absent
Hatten Mound (23MN275), Missouri	28	23	0	—	Absent
Anderson, Minnesota	30	30	12	40%	Present
Younge, Michigan	10	23	9	39%	Present
Galbreath Mounds, Ohio	?	26	7	27%	Present
McMurray, Ohio	?	33	7	21%	Present
Sidner Mound, Ohio	?	46	10	22%	Present
Palmer (8SO2/26), Florida	11	92	28	30%	Present
Windover (8Br246), Florida	79	112	30	27%	Present
Grant Mound (8BR56), Florida	18-24	12	3	25%	Present
Olmos Dam,Texas	11-18	8	3	38%	Present
Carrier Mills, Illinois	63	159	57	36%	Present
LU-25, Alabama	43	89	36	40%	Present
Ward, Kentucky	43	203	73	36%	Present
Ghost Warrior and Nevada	10-90	51	13	26%	Present

Note: Derived from Rothschild and Martin (2005) and Rothschild and Rothschild (1998c, 2000). Sample size is generally based on the inventory of tibia. Presence is without visible surface periosteal reaction.

B.P. Grant Mound sites, as well as the 1800-2000-B.P. Olmos Dam Site in Texas, in which periosteal reaction was common (Table 15-1). Tibial involvement in the east Florida and Olmos Dam sites was invariably bilateral. Disease was predominantly poly-ostotic (>3 bone groups affected). Hand and foot involvement was common and juveniles were commonly affected.

Actually, most early North American skeletal collections manifested the phenomenon observed in the east Florida sites and Olmos Dam, but with other notable exceptions (see Table 15-1). Periosteal reaction was also rare in the Northwest Territories and Atlantic provinces of Canada, eastern Ontario, and Archaic Tennessee and Missouri.

Discussion

Absence of periosteal reaction (unassociated with osteomyelitis and exclusive of isolated bumps) from 6000-year B.P. Texas documents a "virginity" with respect to entities that commonly cause periosteal reaction. Periosteal reaction occurring as a population phenomenon (e.g., more than 1 percent of the population manifesting diffuse involvement of more than one element) has only a limited number of etiologies: treponematoses and hypertrophic osteoarthropathy (McCarty and Koopman 1993; Resnick 2002; Rothschild and Martin 1993). While hypertrophic osteoarthropathy (as a complication predominantly of intrathoracic disease) is actually quite rare in unselected populations (Resnick 2002; Rothschild and Rothschild 1998b) and as noted in the populations studied herein, treponemal disease has a "population signature," if it is present. That population signature is in the form of periosteal reaction, affecting 2 to 13 percent of skeletons with syphilis and 20 to 40 percent of skeletons with yaws or bejel (Rothschild and Martin 2006; Rothschild and Rothschild 1995b).

Rarity of periosteal reaction in 191 individuals in a zone extending from western Florida to Texas and north to Tennessee and Missouri, and in 619 individuals from northern and eastern Canada, clearly documents virgin territory, or, at least, that the Native Americans of those areas were not afflicted by any known treponematosis in the time periods studied.

This contrasts with observations in eastern Florida, more recent Texas populations, and regions outside of the above-defined treponematosis-free areas. Periosteal reaction was prominent outside that catchment area (see Table 15-1), in frequency and pattern indistinguishable from what is seen in yaws (Helfet 1944; Hudson 1958; Hunt and Johnson 1923; Moss and Bigelow 1922; Rothschild and Rothschild 1995; Rothschild and Martin 2006). This disease is easily distinguished from the more pauci-ostotic syphilis (Chi square = 3.973, $p<0.05$), in which hand and foot and subadult affliction are rarely observed in skeletal populations (Rothschild and Rothschild 1995a, 1995b; Rothschild et al. 1995; Rothschild and Rothschild 1994). Other evidence for syphilis (in the form of complete saber-shin surface remodeling and unilateral tibial disease) is also lacking. This is also easily distinguished from the more pauci-ostotic bejel, which infrequently affects hands and feet (Hershkovitz et al. 1995; Rothschild and Rothschild 1995b). Sabre-shin reaction is not found in hypertrophic osteoarthropathy, predominantly a disease of distal diaphyses (Resnick 2002; Rothschild 1982; Rothschild and Martin 1993). Thyroid acropachy spares the proximal appendicular skeleton, predominantly producing hand- and foot-bone periosteal reaction (Resnick 2002; Rothschild 1982; Rothschild and Yoon 1982). Infantile cortical hyperostosis is a disorder afflicting clavicles, scapulae, and ribs (Resnick 2002). Hypervitaminosis A is predominantly an enthesial disease, and fluorosis produces highly characteristic trabecular alterations (Resnick 2002; Rothschild and Martin 1993; Seawright and English 1967).

Explanation

Although there is clear evidence for treponematosis in North America, in the form of yaws, it is also clear that a zone existed in which the inhabitants were not afflicted. Given that yaws is a population phenomenon (afflicting essentially the entire population) and given the evidence (e.g., Winchester and Ghost Warrior sites) that it had a long history, anteceding the Buckeye Knoll and Bird Island sites, it would appear that these were distinct populations. As yaws is contiguous in distribution in Archaic and Woodland North America, it appears to have arrived with an immigrant population from Asia. The absence of yaws in specific Canadian and Southern zones suggests that these may have derived from a separate immigration (migration).

Chapter 16

Age and Sex Distributions at Buckeye Knoll

Glen H. Doran

Burial Patterning and Age/Sex Distribution

Based on a detailed inventory of all skeletal material in each burial, a number of observations can be made. Methodologically, we have tried to be conservative in our MNI estimates. Typically, to identify multiple individuals in a burial, there had to be multiple postcranial elements that were clearly either overlapping (e.g., two left humerus fragments) or dramatically different (e.g., two humeri fragments, a left and right, with such a discrepancy in size and morphology that it was biologically unrealistic to envision them being from the same individual). Additionally, dental analysis clearly shows that the presence of more than one individual in a single grave was not uncommon. In most cases, single "extra" teeth were ignored. In those cases in which burials were identified as containing multiple individuals, there were often a series of teeth that either were duplicates or that displayed such dramatically different wear patterns that they had to originate from different individuals. What we have tried to do is identify those burials in which multiple individuals were represented, within the limits of the poor preservation at Buckeye Knoll, and then to arrive at a conservative estimate of the number of individuals based on multiple indicators.

The dental inventory was performed by Christopher Stojanowski (along with the attrition analysis) and the post-cranial and cranial inventories were performed by Doran and Wentz. Only after these inventories were completed were the results compared and the differences reconciled. In some instances, dental material indicated two individuals, while the post-cranial data indicated only one. In some cases the opposite situation was found. In a few situations, multiple adults could be identified from skeletal material but there was no evidence of a second person from dental analysis alone. No "running" tally of the number of adults, males, females, or ages, etc., was kept, and it was only at the conclusion of the inventory and reconciliation of the dental analysis and burial inventories that a final assessment of MNI was attempted. Hypothetically, this prevented unconscious biases in assessing sex and age.

There were 75 burial locations identified in the field. Thirty-eight (50 percent) contained single individuals, twenty-five (33 percent) contained two individuals, five burials (7 percent) contained three individuals, two burials (3 percent) contained 4 individuals and a single burial (1 percent) location (Burial 44) contained five individuals (see Table 13-6). Of the 116 individuals identified in the burial locations, 19 (16 percent) could only be identified as "adult" or in one case "young adult" and another as an edentulous adult. An additional 12 individuals had high attrition scores that could only be estimated as older than 55+ years (numerically illustrated in the databases as 55.999 years) to allow identification as a minimum age rather than a specific attrition-generated age.

Of the 116 individuals, 20 (17 percent) were identified as males (code = 1), while an additional seven (6 percent) were identified as probable males (code = 1.5). Twenty (17 percent) were identified as females (code = 2.0) and an additional 11 (9 percent) were identified as probable females (2.5). Unsexed subadults (code = 3) accounted for 41 individuals (35 percent) and unsexed adults accounted for another

Table 16-1. Age Parameters of the Buckeye Knoll Sample by Sex Assessment.

	Males	Possible Males	Females	Possible Females	Unsexed Adults	Subadults	Total Sample	Aged Adults
Sample	41	15	5	13	6	9	89	48
Mean Age	35	39	39	33	37	6	23	37
Median Age	32	36	41	33	33	6	21	38
Minimum Age	17	20	20	22	22	0.5	.05	17
Maximum Age	54	56	54	52	56	15.3	56	57
Standard Deviation	9.9	14.04	12.02	11.40	12.06	4.31	17.73	11.24

Note: The 55+ adults are excluded from these calculations. The mean and median values would rise in the adults if distributed over the higher age ranges (i.e., 55 to 70/75).

19 individuals (16 percent). Some of these males and females do not have age estimates and thus the sample sizes mentioned here do not exactly match the statistical parameters in Table 16-1 (i.e. we could tell it was a female but no age estimate was possible other than "adult").

Of the 41 individuals identified as subadults (<20) the youngest was 0.5 years and the oldest was 17 (technically the 17-year-old subadult was identified as a male, so in the table of statistical parameters the maximum subadult age is 15 years). Using the midpoint of age ranges to calculate statistical parameters for sex groups, the mean and median subadult age was six years. The mean of the aged males (excluding the >55 group and a few unaged males) is 35 years and the median is 32 years. The mean of the aged females is 39 years and the median is 36 years (again excluding the >55 and unaged individuals). The mean of the "adults" (again excluding the >55 group and unaged individuals) is 37 years and the median is 33 years. Some reports present average age of the total sample (clearly a problem heavily influenced by the number of subadults). We have included these parameters in Table 16-1. but feel the statistics on adults, males, females and subadults are the most useful. The total sample mean age is 23 with a median of 21. Similarly, if we combine all nonsubadults (i.e. males, possible, males, females, etc.) the mean age is 37 years and the median is 38 years. The mean age estimates for all the adult groups (males, females, and adults) were relatively consistent from subgroup to subgroup. Greater differences would have been expected if methodologically there were sex-based biases in age assessments, but this does not appear to be the case.

These age estimates are similar to those derived from an extensive series of skeletal populations compiled as a part of the Windover analysis (Doran 2002b:271). The average age of adult hunter-gatherer-fishers (HGF) was 34.6, while the age for adult HGFs at Windover averaged 35.9 years. The mean age of all the HGF samples (adults, subadults, etc.) was 23.7 years, while at Windover it was 25.1 years. Given the methodological span of age estimates, those for Windover and Buckeye Knoll are functionally identical. In the HGF series the proportion under 15 years of age (15 being the cutoff for most "dependency" statistics) is 39.8 percent and at Windover it was 37.5 percent. In the Buckeye Knoll sample the proportion of the population under 15 is 33.6 percent. Generally, these comparative statistics suggest demographically that the Buckeye Knoll population was similar to the other HGF samples, most of which are substantially younger than Buckeye Knoll. Infant and subadult under-enumeration does appear to be a problem at Buckeye Knoll and in this analysis the exclusion of the 55+ year-old groups from statistical parameter calculation artificially lowers the mean and median values. If they were included (even using the minimum age estimate of 55), the mean and median values for the adults would rise and would probably be even closer to the other HGF samples.

The overall inventory of burials translates into 27 males or probable males (24 percent), 31 females or probable females (26 percent), and 41 subadults (35 percent) (Figure 16-2; see Table 13-6). Evenly distributing the 19 "adults" into the male and female inventories results in male and female percentages of 32 percent and 34 percent, respectively. Basically this implies that the sample is 66 percent adult and 41 percent subadult, with almost identical numbers of males and females. As noted earlier, there is a problem of infant/subadult under-enumeration, and the harsh preservational conditions at Buckeye Knoll elevate the ratio of adults to subadults, though there are certainly many samples that have this problem, and some that have even far smaller inventories of subadults. Some sites in the Doran (2002b) life-table inventory have low, biologically unrealistic, numbers of subadults. In fact, of the sites that could be included in the life-table component of the study, 38 percent (*n*=28) had subadult inventories lower than 35 percent while 62 percent (*n*=46) had subadult inventories greater than 35 percent. Thus the 35 percent subadult inventory at Buckeye Knoll, while unrealistically low, is not too bad from a comparative perspective and is certainly better than many sites for which we information. Further detailed paleodemographic analysis of the Buckeye Knoll series is planned, but is beyond the scope of this report.

In most "normal" populations there are greater numbers of subadults than adults. Several factors, or combinations of factors, explain this phenomenon. By virtually all standards, subadult skeletal material is much less durable and more prone to disappearance in the taphonomic mill of time, resulting in substantial infant/subadult under-enumeration. This is especially problematic in situations with poor bone preservation as is the case with Buckeye Knoll. Additionally, the methodology we used to calculate numbers of individuals may artificially overestimate the number of adults. Given the spatial distribution of burials, if there were, for example, clearly two right humeri in a burial and fragmentation is too extreme to identify any adjacent individuals to whom one of the humerii might belong, then the most parsimonious interpretation is that the burial contains the remains of two individuals. Skeletal material of two additional people a meter away, also very incomplete and fragmentary, might contain possible candidates for the source of the extra humerus but, again, there is no way to make such an attribution, given the condition of the material. If such was done, it would result in an overestimate of the number of individuals. However, we would artificially inflate the number of adults and subadults, with no bias toward either. Clearly, the taphonomic loss of subadults seems quite real and reflects the relatively harsh soil conditions of the region. It should be noted, again, that sex and age were estimated independently for each burial and no "tally" of age or sex was made until all burials were examined. This hopefully minimized possible biases associated with subconscious expectations of what the overall population profile should look like. The equivalent numbers of males and females is more biologically realistic and strongly suggests there was no sex bias for inclusion in the cemetery, plus no apparent bias in the way we assessed sex. Basically, the cemetery contained both subadults and adults representative of the population living in the area. It is, as noted earlier, the best cross section and largest sample of people from this time period west of the Mississippi. As such, the assemblage is inherently important because of the scarcity of samples of this antiquity.

Eight males were found in single burials and an additional three possible males were found in single burials. Ten males were found in burials with multiple individuals and an additional three possible males were found in multiple burial contexts. Females, by contrast, showed a different pattern, with an emphasis toward multiple burial contexts. Only four females were found in isolated burial situations with another three possible females unaccompanied by another individual. Fifteen were found accompanied by at least one other individual and an additional eight possible females were found in multi-individual burial contexts. Clearly, this is a striking difference in male and female burial patterns, with males much more likely to unaccompanied and females much more likely to be accompanied by additional individuals.

When subadult placement with adults is considered, an additional pattern emerges. Fourteen subadults were found in burials with adult females and an additional five were associated with probable females. In an additional burial, two subadults were found with a single female. In only four cases were subadult burials found with a male, and only two subadult burials

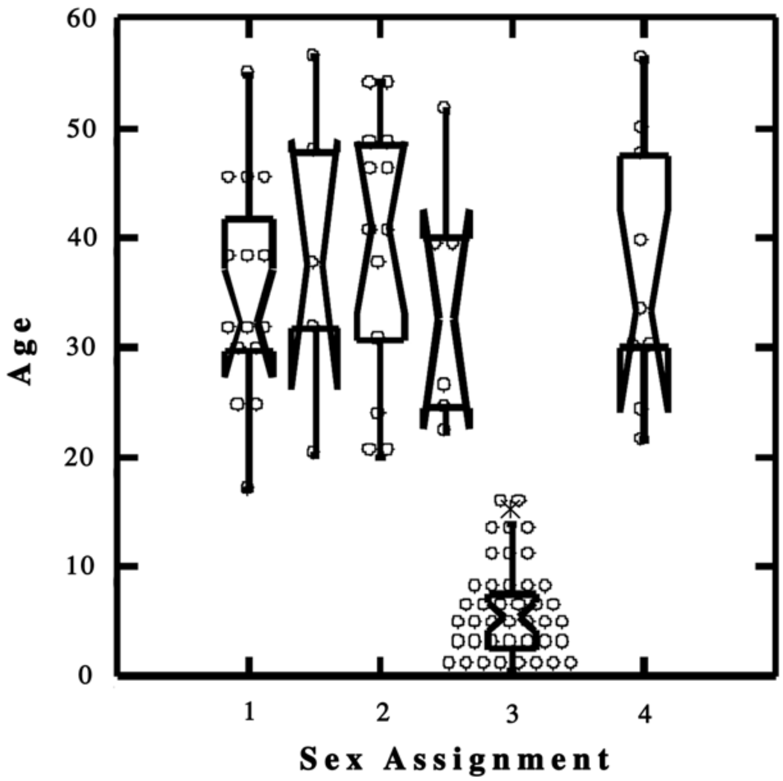


Figure 16-1. Age and sex distribution (omitting unaged individuals) using the standard sex coding (1, males; 1.5, probable males; 2, females; 2.5, probable females; 3, subadults; 4, adult, unsexed.).

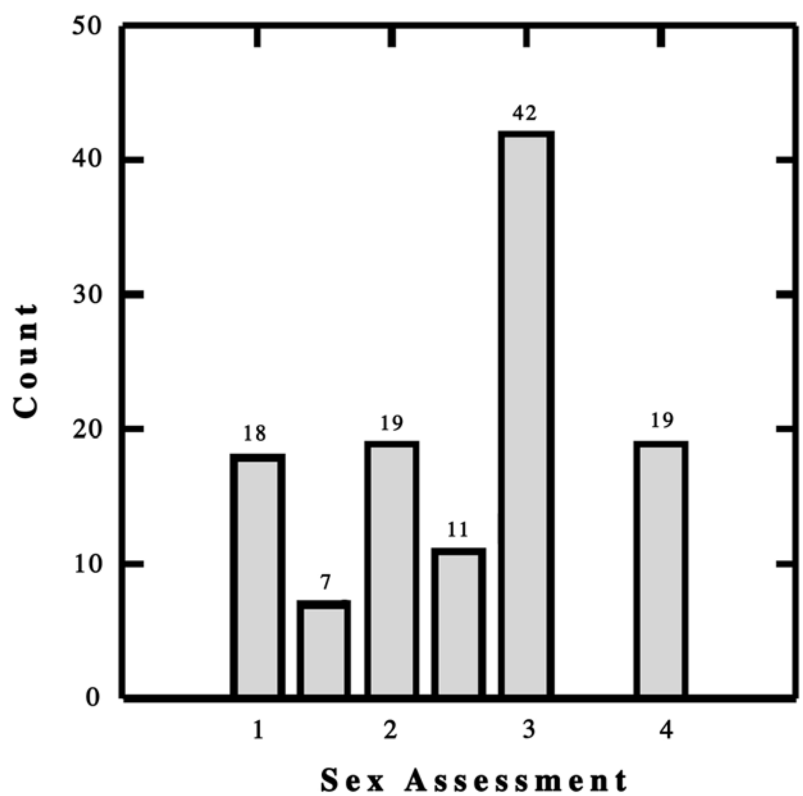


Figure 16-2. Sex distribution using the standard sex coding.

were accompanied by a probable male. One subadult was also found in a burial with both a male and a female. In five additional examples, subadults were found with adults. Clearly, if subadults are accompanied by an adult, they are three times more likely to be accompanied by a female rather than a male. Subadults were much more frequently found with other individuals and more often with females.

Subadults were, however, not strongly associated with females of reproductive age. Instead, they were found almost equally represented across the entire female age spectrum, with individuals from 21 to 56 years of age. Five were found with females between the ages of 21 and 30, two were found with females between the ages of 30 and 40 years, five were found with females between the ages of 40 and 50 years, and four were found with females older than 50. The same absence of clear patterning is also seen in adult males when subadult presence is taken into consideration. Mean female age when accompanied by a subadult was 39, and it was only slightly older (43) in accompanied males. Clearly, there is not a heavy concentration of subadults with the younger age intervals but, rather, they occur all across the entire adult age spectrum. Similarly, subadult age does not seem to have had an impact on whether that person was accompanied by an adult or not. Unaccompanied subadults have a mean age of 7.6, while the mean age of accompanied subadults is 9.2 years. This suggests there is little in the way of an "age factor" involved in whether older or younger subadults were buried with adults.

Of the 41 individuals identified as subadults, the youngest was 0.5 years and the oldest was 17. In the graphic display (see Figure 12-58), box borders include 50 percent of all cases in each category, dots represent individual cases, and the medians are illustrated as the hinge with the solid lines indicating the full range (unaged and 55+ aged individuals excluded) (see Systat Version 11.00; Wilkinson et al. 1996). Greater differences would have been expected if methodologically there were sex-based biases in age assessments. On the other hand, the overall distribution of ages for males and females (Table 16-1) shows that, while the means/medians are similar, there appear to be slightly more older females than there are older males. Demographically, this makes sense, in that survivorship is higher in females than in males in the advanced-age categories. In the group of individuals excluded from Figure 16.1 identified as 55+ year old adults, there was one male, and two probable males. Females (n=4) and probable females (n=3) are more heavily represented in this 55+ age group. There were an additional two unsexed adults in this oldest category. Thus, there are three males or probable males and seven females or probable females—clearly females are more heavily represented in this older age interval. This follows the basic human demographic pattern of increased female longevity, which is seen in almost all populations through time and space.

Presumably, this older category is distributed across the upper age ranges (56 to perhaps the early-80s age interval). Even in the harshest demographic regimes of modern times there are always a few hardy and lucky individuals living to proverbial "ripe old ages" of the 80s and even the 90s. Age truncation in the upper ranges is a common methodological problem in many osteological studies of prehistoric populations, and lumping of these individuals at the 56-year increment is the simplest strategy in this analytical phase.

The overall age distribution (Figure 16-3) shows a larger number of <10-year-old individuals, with a significant decline of subadults from ten to 20 years of age. Gradually the number of individuals rises to a peak between 30 and 40 years of age. After 40 there is a decline in the number of individuals in the sample (note that this excludes the 55+ category, which would elevate the number of older individuals). Compared to many sites, this is a respectable sample from which to derive some estimates of paleodemographic parameters.

The distribution of subadults (<20 years of age) provides additional detail in looking at the distribution of the youngest members of the Buckeye Knoll population (Figure 16-4). Even with the sampling problems and issues of age-estimate accuracy within the limitations of preservation and recovery, the sample does not look too demographically unrealistic if one is willing to ignore the youngest intervals (<5 years of age). There are certainly many samples from archaeological contexts with far fewer subadults represented (Doran 2002b). There are greater numbers of individuals less than ten years of age, and greater numbers of individuals less than five years of age. It is anticipated that under a typical mortality schedule there will be larger numbers of infant deaths than deaths of older individuals and mortality curves will decrease with advancing age until they begin to rise in the child-bearing years.

As noted earlier, there are many sites with fewer subadults. Many would argue that, while there are potential methodological and even theoretical problems with paleodemographic reconstructions, they are a factor that, while perhaps not amenable to independently

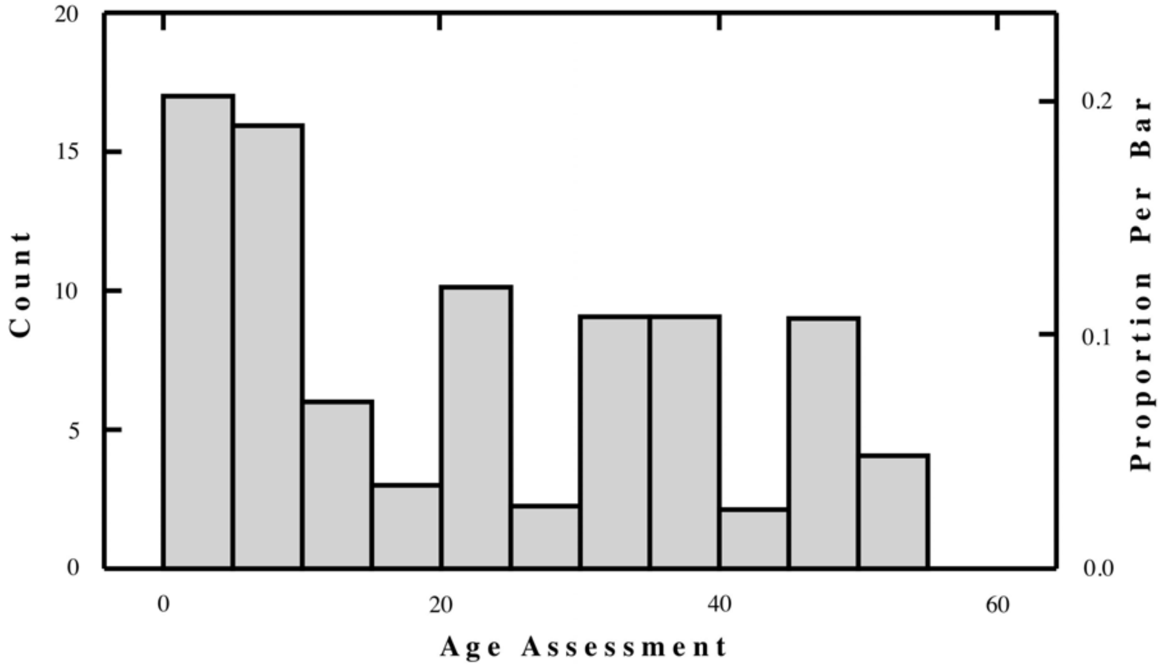


Figure 16-3. Age distribution at Buckeye Knoll. (Note that the 12 individuals scored as 55+ are excluded from this figure as are the four "adults" with no age estimates.)

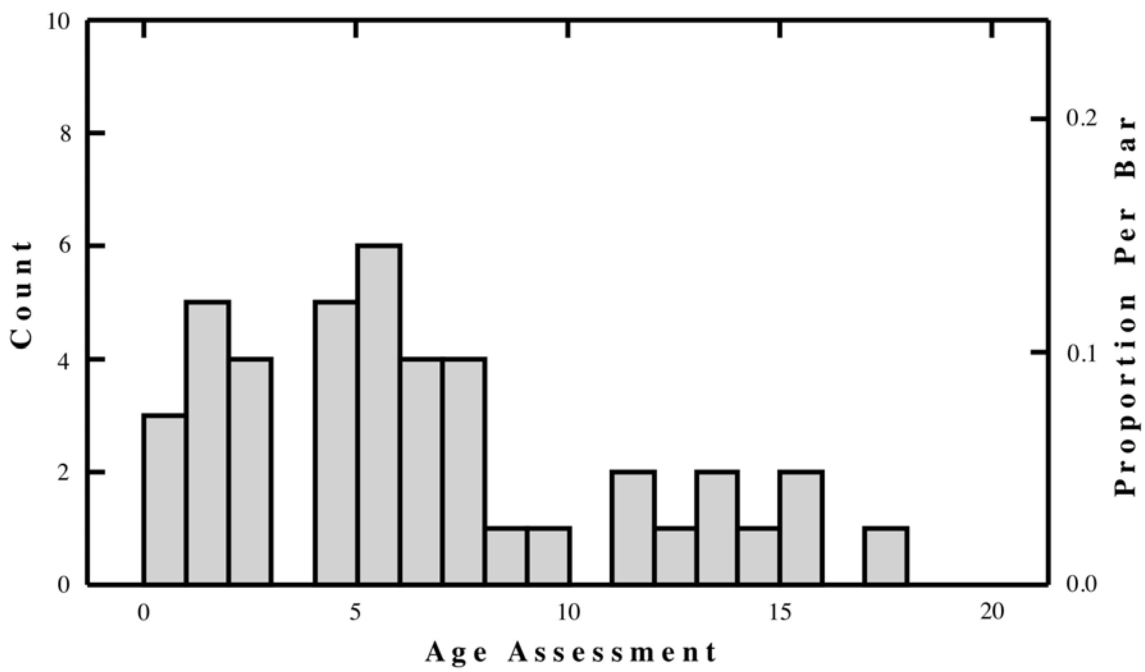


Figure 16-4. Subadult age distribution at Buckeye Knoll.

answering questions, can focus attention on issues of biocultural interest. With this in mind, the following reconstructions follow age divisions and procedures described in Doran (2002b). Unaged adults are linearly distributed over the entire age range of adults; adults identified as 55+ are linearly distributed over the 55 to 75 age categories. Using these procedures, the following life table (Table 16-2) was created showing the standard parameters of a paleodemographic reconstruction. The small number of individuals from the more recent time periods can either be excluded or included. The dx (no. of individuals in each age group) values, including or excluding the more recent Late Archaic burials, make almost no difference. Dx values for the "old" series—omitting the more recent burials—and for "all" series are presented in Table 16-2. The percent in each age category shows their inclusion/exclusion is statistically irrelevant and changes the dx values in only the most ephemeral manner.

None of the differences in the Old vs. All calculations for Dx, lx (survivorship), qx (mortality) or ex (life expectancy) are significant; they functionally constitute little more than rounding errors. The "Old" series will, however, be used because it represents the most chronologically uniform subset from Buckeye Knoll.

Figure 16-5 illustrates the percentage dx values for the Buckeye Knoll series and the values for the "hunting-gatherer-fisher" (HGF), "transitional" (TRAN), and "agricultural" (AG) sets compiled as a part of the Windover paleodemographic analysis (data composition, methodology and sites included in each series can be found in Doran 2002b:Table 14.1, 266-267). The HGF sample includes individuals from 23 sites (*n*=5,462 individuals) with a mean date of 3,170 B.P., spanning the 7,400 to 500 B.P. (uncalibrated) intervals. The TRAN subset basically consists of "Woodland" individuals (or the local variant) from 17 sites, including 2,390 individuals with a mean date of 1204 B.P., spanning the interval from 1850 to 350 B.P. The AG subset consists of individuals from agricultural contexts from 31 sites, including 10,567 individuals, and has a mean date of 760 B.P. with a range of 1655 – 382 B.P. The TRAN subset is basically a series of populations that are "transitional" from the hunting-gathering-fishing subsistence pattern (and all it implies— small sample size, etc.) to an agricultural subsistence pattern. Folks in this categories have begun to utilize agricultural products and, we argue, experience some of the problems as well as potential advantages of an agricultural subsistence regime. The AG subset includes those samples that have made the shift to an agricultural regime (see Doran 2002b for a more complete discussion of these sites and issues).

As noted, Figure 16-5 shows that, compared to the rest of the samples, the very young individuals (<5 years of age) are few in number. This is easily explained by infant under-enumeration. There are also fairly dramatic fluctations across the age categories reflecting both the small sample sizes and aging-allocation strategies. Figure 16-5 presents the unsmoothed dx values, while subsequent life-table figures will use smoothed dx values in the calculation of life-table parameters, as shown in Figure 16-6. The running average (three values) smoothing protocol (Systat; Wilkinson et al. 1996) was used (Figure 16-6), reducing the fluctuations regarded as sampling irregularities that reflect both small sample sizes and aging procedures.

While the smoothing protocol does not remove the issue of infant under-enumeration, it does reduce the erratic fluctations observed in the unsmoothed data set. Interestingly, the dx values of the Buckeye Knoll series are actually higher in the 10 to 20 age interval than they are for most of the other series. Most of these individuals are known from very fragmentary material that was not initially identified in the field but was only extracted upon matrix removal and careful sorting—essentially "pulling out" multiple subadults. After age 20, there is a decline in the number of individuals from 20 to 35 and these proportions are lower than for any of the other series. One simple explanation for a reduced number of individuals in this interval could be a reduced mortality rate during a major part of the peak fertility period that differentially allowed more females to survive—thus implying that they did not enter the cemetery population until later. Between the ages of 20 and 55 the Buckeye Knoll sample is most different from the HGF series and has substantially smaller numbers of individuals entering the cemetery population. Functionally, it looks more like the TRAN series at this point. After 55 years of age, the number of individuals entering the cemetery increased and rose to levels most comparable to the HGF sample; it is markedly different (higher) than the much later TRAN and AG series.

Given the structure of life-tables and the mathematical relationships between the parameters (particularly Dx and lx), survivorship (lx) (Figure 16-7) reflects the infant undernumeration through the age span, and is thus less informative than the interpretation of the qx and ex values. The latter values, again due to their calculation structures, reflect the infant undernumeration only in the age categories from

Table 16-2. Life Table Calculations for the "Old" (Early Archaic) Series and the Complete (All Periods) Series Showing the Negligible Impact of Excluding the More Chronologically Recent Series in Paleodemographic Reconstruction.

x	dx Values		dx Percent		Survivorship (lx)		Mortality (qx)		Life Expectancy (ex)	
Age	**All**	**Old**	**All**	**Old**	**All**	**Old**	**All**	**Old**	**All**	**Old**
1	8.00	7.00	7.0	7.0	100.0	100.00	0.0702	0.0703	26.79	26.40
5	15.00	13.00	13.2	13.1	93.0	92.97	0.1415	0.1405	27.77	27.36
10	16.00	13.00	14.0	13.1	79.8	79.91	0.1758	0.1634	28.02	27.51
15	3.00	3.00	2.6	3.0	65.8	66.85	0.0400	0.0451	28.47	27.39
20	11.08	11.08	9.7	11.1	63.2	63.84	0.1539	0.1744	24.55	23.57
25	3.08	3.08	2.7	3.1	53.4	52.70	0.0506	0.0588	23.56	23.02
30	10.08	10.08	8.8	10.1	50.7	49.61	0.1744	0.2042	19.68	19.30
35	10.08	8.10	8.8	8.1	41.9	39.48	0.2112	0.2061	18.31	18.61
40	3.08	2.10	2.7	2.1	33.0	31.34	0.0819	0.0673	17.54	17.79
45	10.08	8.10	8.8	8.1	30.3	29.23	0.2916	0.2784	13.89	13.89
50	5.08	4.70	4.5	4.7	21.5	21.09	0.2075	0.2238	13.57	13.29
55	5.48	4.70	4.8	4.7	17.0	16.37	0.2824	0.2883	11.47	11.40
60	3.48	2.90	3.1	2.9	12.2	11.65	0.2500	0.2500	10.00	10.00
65	3.48	2.90	3.1	2.9	9.2	8.74	0.3333	0.3333	7.50	7.50
70	3.48	2.90	3.1	2.9	6.1	5.83	0.5000	0.5000	5.00	5.00
75	3.48	2.90	3.1	2.9	3.1	2.91	1.0000	1.0000	2.50	2.50
Sum	**114.00**	**99.55**	**100.0**	**99.6**						

Note: dx is the number of individuals in an age category; lx, qx, and ex follow standard computations. See Doran (2002b) for further discussion of the methodology.

which they are absent, i.e. infant undernumeration does not impact the entire series of qx and ex values like it does the lx values (see Moore et al. 1975) for a discussion of this phenomenon). Figure 16-7 depicts artificially high survivorship (fewer infant deaths) reflecting infant undernumeration, and the subsequent lx curve carries this sampling issue throughout the rest of the curve giving the impression of lower survivorship. This makes the Buckeye Knoll data appear more like the demographic profiles experienced in the more recent series (i.e. TRAN and AG samples), and gives it a distinctly different appearance from the HGF series. This appearance defies expectations, given general parallels in subsistence and possibly demographic experience between the Buckeye Knoll site and the HGF series.

Mortality curves and life expectancy (qx and ex) are, as noted earlier, less heavily impacted by the missing young individuals. The following discussion will focus on the post-15-year intervals, where the samples are more likely to be a better reflection of the population's true demographic experience (Figures 16-8 and 16-9). The mortality curve for Buckeye Knoll shows the lowest mortality for the 20-60-age intervals. Arguably, this is a reasonable reflection of demographic trends, in that it probably represents a single population within a restricted time interval, and individuals in all adult age categories are represented, despite the taphonomic rigors of the setting.

Under the presumption that the sample is indeed reflective of reality, reduced mortality rates could have

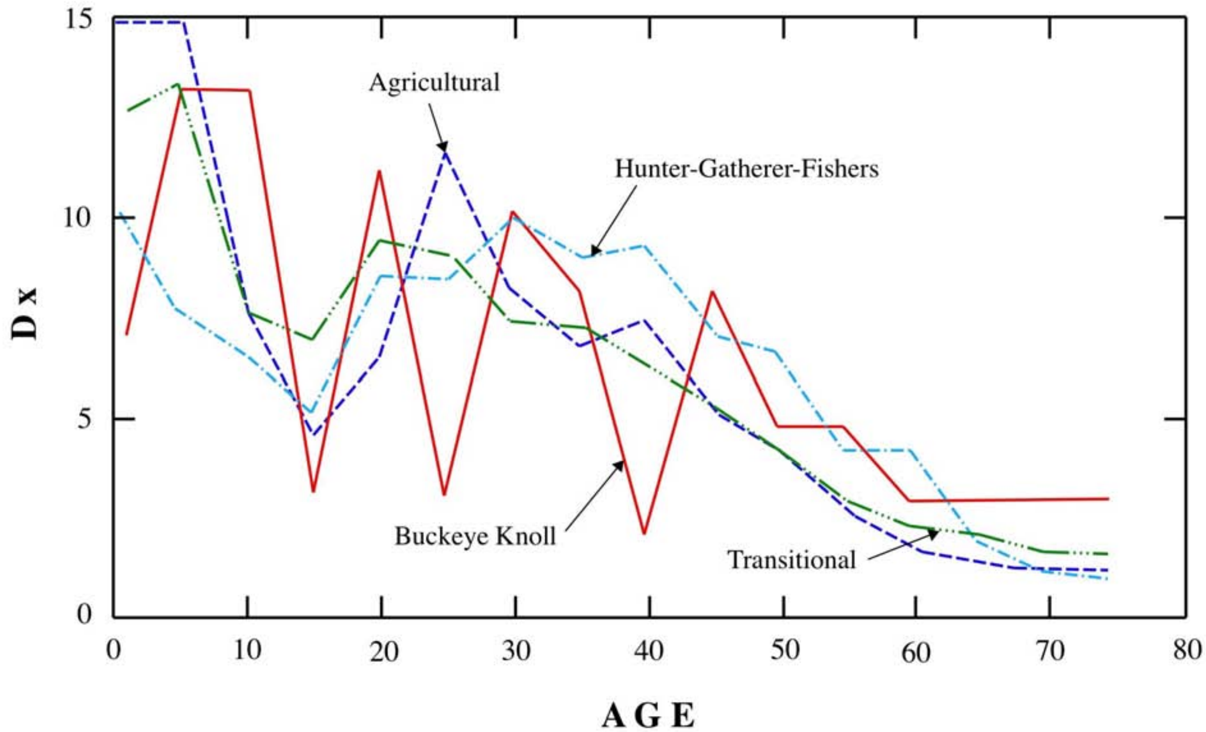


Figure 16-5. Dx (proportion in each age category) values (unsmoothed) for the Buckeye Knoll, hunter-gatherer-fisher, transitional, and agricultural series (from Doran 2002b).

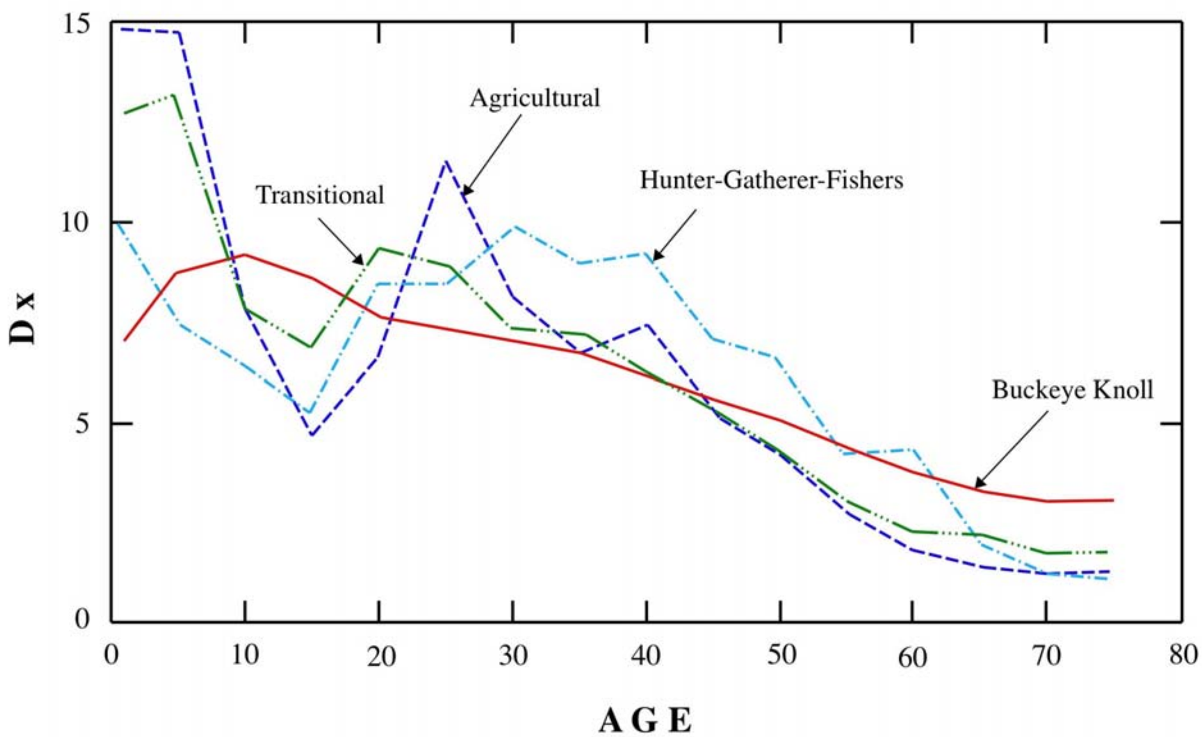


Figure 16-6. Smoothed Dx (proportion in each age category) values for the Buckeye Knoll, hunter-gatherer-fisher, transitional, and agricultural series (from Doran 2002b).

several explanations. The mortality curve indicates the Buckeye Knoll population has a mortality experience during the teen years slightly higher than the other groups represented (Figure 16-8). After this high interval, mortality rates do not rise as rapidly as they do in the other populations. This would suggest, as indicated earlier, demographic experiences of several kinds. The simplest is that the lower mortality rates reflect lower fertility rates in females, and thus reduced mortality in the fertile years (20 to 40 in particular). It also might be that there is reduced conflict in males and thus lower mortality in them as well. The sample is too small in the 20-to-55-year interval to effectively parse the differences in males and females (they exhibit virtually equal numbers in all of these age categories and never vary by more than a single individual—thus the typical, and unfortunate, reliance on sex-neutral life tables).

The combined effects of these two factors (reduced fertility and reduced conflict) with an adequate diet (relatively modest LEH defect counts, caries and abscesses and periosteal infections; see Chapters 12 to 15) would, in fact, produce just this kind of a paleodemographic expression. Such would result in reduced numbers of individuals entering the cemetery population during the fertile years, thus presenting itself as reduced mortality and elevated life expectancy, in contrast to many other hunter-gatherer-fisher groups which in Doran's (2002b) HGF series often come from later time intervals where intergroup competition might have been increasing. Clearly, mortality rates rise in the later years but do not seem to rise as fast until the values for all series converge after age 60 (again this convergence reflects the issues associated with aging of older individuals and it is harder to tease out differences due to the linear smoothing reflecting upper age-distribution protocols). Such a pattern of reduced mortality might also be a logical expectation of lower population density, which seems reasonable given what we know or surmise of the subsistence opportunities and population distribution in this region of Texas. Lower population density and smaller populations also go hand-in-hand with reduced disease loads and less biological stress. This then translates into lower mortality and, ultimately, (see Figure 16-9) higher life expectancy.

Life-table figures reflect the interconnectedness of the life-table calculations and it is to be expected that life expectancy (see Figure 16-9) also is higher through the 20-to-60-year intervals. It may be that small populations, with little competition and low disease loads, reflect similar demographic features. Disaggregating the HGF life tables and sorting by environment, subsistence, and other parameters is the next step in identifying and evaluating such patterns (if they exist). However, the Buckeye Knoll experience can be contrasted to Windover (Figure 16-10) using the smoothed dx values from Buckeye Knoll vis-à-vis the life-expectancy values. In this case it is clear that the Windover ("W" in Figure 16-10), Buckeye Knoll, and HGF values are similar to age 10, no doubt reflecting the almost universal infant under-enumeration that seems to be a problem in the earlier samples (fewer large cemeteries, poorer preservation, etc.). This compounds the problems associated with both large sample sizes and realistic inventories of subadults particularly those individuals less than ten years of age.

Windover and Buckeye Knoll are the two earliest HGF samples, both in excess of 6000 B.P. (calibrated), and they are more similar to each other than they are to the HGF profile. Both have elevated life expectancy (which also implies, logically, a reduced mortality experience) between the ages of 15 and 40. The Windover ex values in this interval (between 15 and 35) are higher than observed at Buckeye Knoll, suggesting lower mortality rates, presumably lower fertility rates, and "better" conditions for survival in this first stage of adult life. At age 35 the curves intersect and Windover drops below the Buckeye Knoll curve, although both are still well above the other comparative series. This would suggest that in the later years (meaning 45+), survival conditions were better at Buckeye Knoll than at Windover. After age 50, the differences are, as noted earlier, essentially masked by the lack of precise age estimates in the upper years. What could explain this initial similarity and subsequent departure between the Buckeye Knoll and Windover samples? That they are more similar to each other is not surprising, given their substantially greater antiquity. This implies a more similar demographic experience, suggesting lower fertility and lower mortality in the early years of adulthood. The reason for the "flip-flop" of their positions in the more mature intervals is less clear. Factors that substantially impact adult survivorship and health in these later years include greater susceptibility to infectious and degenerative diseases, reduced immunological capacity, and the accumulation of stress, all of which eventually takes its toll. It could be argued that infectious diseases are probably less significant in more dispersed, low-density populations, which is presumably the situation encountered in the region around Buckeye Knoll. While it cannot be demonstrated here, there is support for higher population densities in Florida in this interval, and it was certainly a more generous environment with a far greater

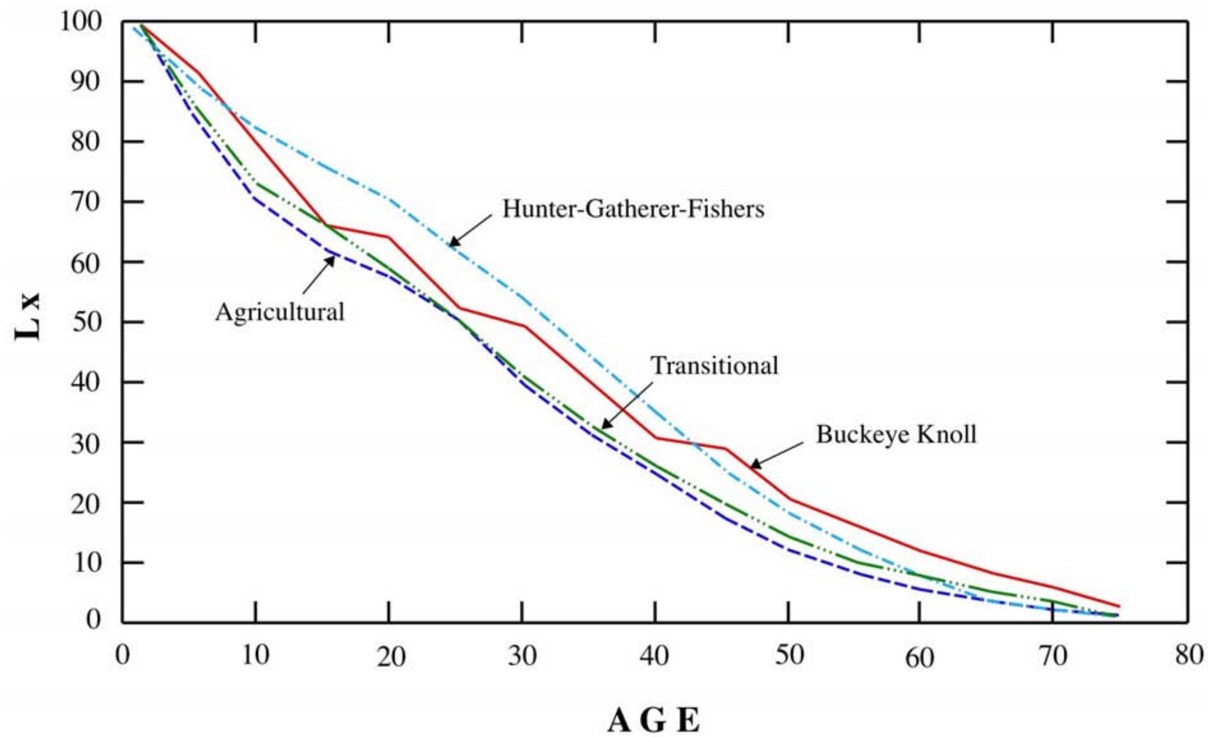


Figure 16-7. Lx (survivorship) values for the Buckeye Knoll (based on smoothed dx values), hunter-gatherer-fisher, transitional, and agricultural series (from Doran 2002b).

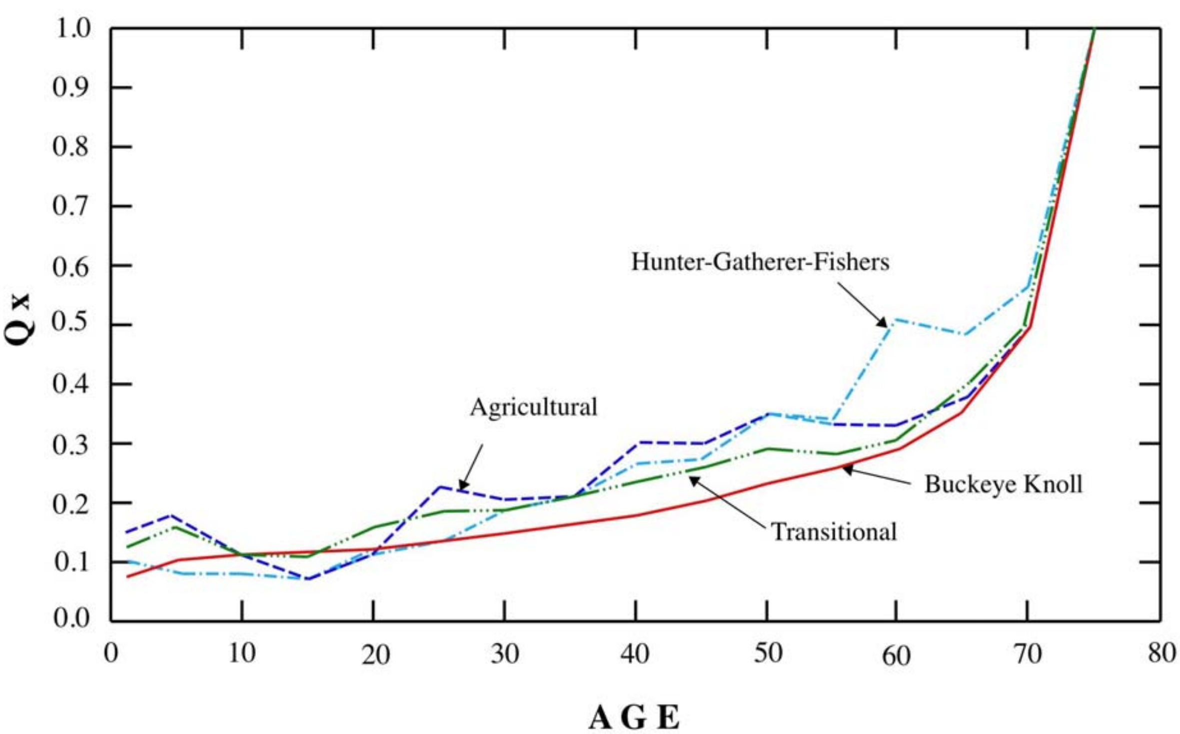


Figure 16-8. Qx (mortality rate) values for the Buckeye Knoll (based on smoothed dx values), hunter-gatherer-fisher, transitional, and agricultural series (from Doran 2002b).

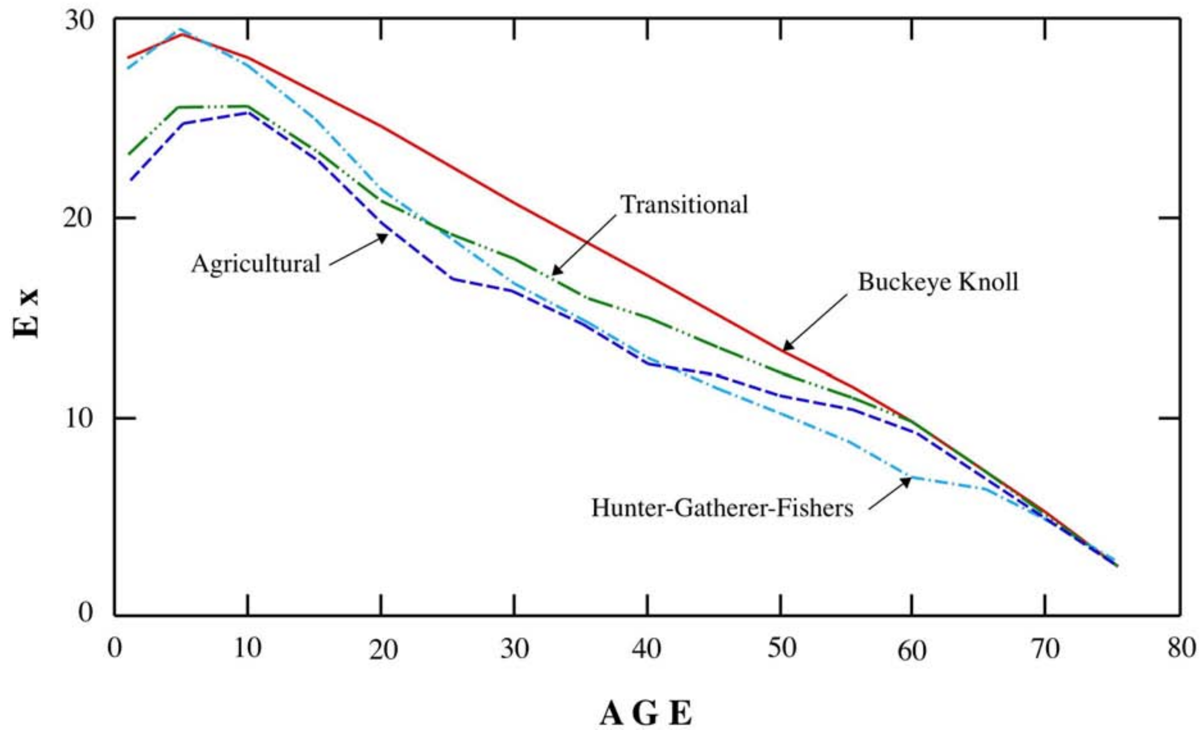


Figure 16-9. Ex (life expectancy) values for Buckeye Knoll (based on smoothed dx values), hunter-gatherer-fisher, transitional, and agricultural series (from Doran 2002b).

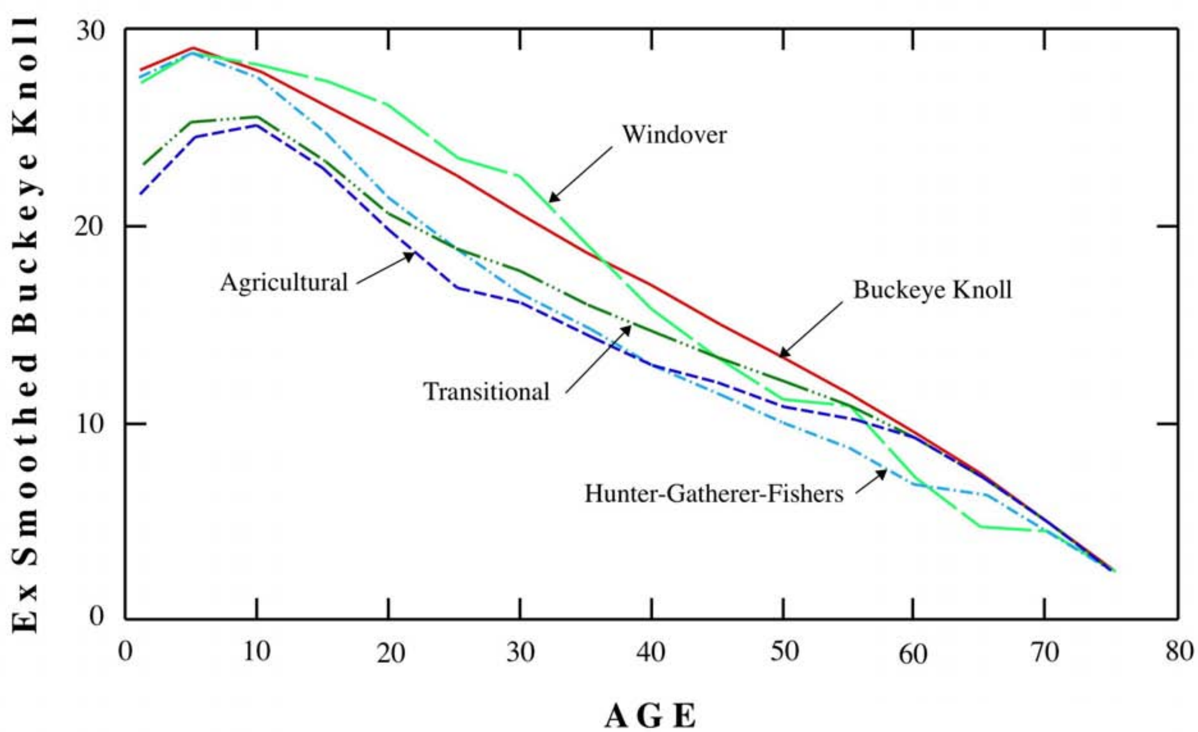


Figure 16-10. Life expectancy (ex) incorporating the Windover experience with the Buckeye Knoll experience.

diversity and density of resources. The presumption is that the Texas population was, as a consequence of these factors, more mobile, while in central-east Florida mobility may have been lower due to the higher density of consumable resources. One would presume the differences in these two environments would make subsistence stress less likely in Florida and more likely in Texas. At the same time, the posited differences in population density might make mature adult mortality rates higher in Florida than in Texas (higher density equals greater opportunity for the spread of disease and contagion). Regardless of accuracy of these tentative explanations, these differences do seem of interest from an adaptive standpoint and deserve further examination beyond the scope of this report.

As noted earlier, paleodemographic analysis often can suggest hypothetical differences, but additional detailed analyses of the two environments, demographic experience, population density, site density, and other factors are necessary to substantiate or refute these interpretations. What is presented here is a cursory but, nonetheless, interesting interpretation of differences of potential archaeological interest when taking the broad perspective on early hunter-gatherer-fisher adaptation in two very different environments.

A Summary Overview

The skeletal material from Buckeye Knoll was first observed by Doran during the fall of 2000 and then by Doran and Stojanowski in the spring of 2001 while excavations were still ongoing. We felt the materials had great potential for providing an almost unparalleled glimpse of the people who inhabited this part of the Texas coastal plain during a very early time interval. This early interval has surprisingly little human skeletal material associated with it, and consequently very little information exists on the biological and biocultural aspects of the people who lived in what amounts to the Early/Middle Archaic period. While preservation is not good, the preceding chapters outline the methodology and results of the analysis of this material.

After more than two years of negotiation and consultation with all appropriate parties the skeletal material was transported to Florida State University by Doran and Ricklis in the fall of 2003. The material was returned to Texas in the spring of 2005 and has subsequently been reburied (spring of 2006) as per guidelines set out in the Treatment Plan developed over the course of the project and during the negotiation process.

Methodologically, we inventoried all identified burials and nonburial lots in multiple sweeps through the collection. Initially we tried to follow as closely as possible the procedures as set out in the Standards manual (SOD manual; Buikstra and Ubelaker 1994). While the collection of dental metrics and nonmetrics was relatively straightforward and provides a good dataset, the postcranial and cranial metrics were, as we feared, less extensive, although we think they will ultimately be useful in broader comparative contexts. To try to offset this void in metric data, we developed a small series of additional measures that would help capture the morphological features of this sample and supplement the more traditional measures in the SOD manual.

Multiple sets of information are summarized in the reports. Dental inventory and analysis are presented in a distinct section and the postcranial and cranial information is presented as another distinct section. In the burial-by-burial inventory, also a discrete section, reference to both the dental and postcranial analyses are made, particularly with respect to sex assignments. Standard sexing traits and aging strategies were used (SOD manual). Aging via a detailed analysis of dental attrition was ultimately the most effective approach for the collection, but many of the individuals (and much of the "floating" skeletal material) are unassociated and unaccompanied by dentition and remain both unsexed and unaged. In many, if not most cases, the fragmented post-cranial material was compared to a suite of adults and subadults from the very well preserved Windover collection in an effort to bolster assessments of sex and, in some cases, the age of subadults (largely based on size and morphological features of the fragments). This is a reasonable strategy given the objectives of the project and the importance of the Buckeye Knoll materials. In some cases, ambiguity remained and no firm sex assignment was possible. This resulted in three sex-ambiguous assignments—1.5, possible male; 2.5, possible female; and 4, unsexed adult (also frequently unaged). Males were coded as 1, females as 2, and subadults (<20 years of age) as 3.

To provide context for the Buckeye Knoll materials, comparisons were made to other North American series of osteological and dental metrics, which were already in the possession of the authors. These comparisons are, of necessity, brief and not exhaustive. They are also uneven with respect to comparative sample sizes and chronological distribution. The focus of the report is on the Buckeye Knoll materials and not specifically on an elaborate comparative strategy.

We urge others to use this information in more detailed and carefully constructed comparative contexts, and in fact, this is what we intend to do as well.

Taphonomic change and destruction of the materials was extensive and pervasive, reflecting both the harsh soil conditions at the site and the passage of time in open sites subject to long-term microenvironmental stress. Only a small series of long bones was intact, even moderately so, and a great deal of the material was unidentifiable even with careful comparative and one-to-one cross references to existing Archaic samples at FSU. Some of the destruction may be related to tunneling of insects or extremely frequent penetration of roots. One of the typical results is a process of deterioration that often leads to nearly circular perforations of much of the bone. Doran, in particular, suspects that this type of damage may be related to burrowing insect activity. Ground pressure, root activity, and the local geochemical conditions also resulted in extreme fragmentation. While these conditions are problematic, every effort was made to extract as much information from the remains as was possible prior to the mandated reburial. While deterioration is extreme, there is very little evidence of rodent or carnivore gnawing, which is highly uncommon in this collection and often restricted to one or two elements within a burial (see, for example, Burial 4). This, along with the burial morphology in general, implies relatively rapid interment in a fully fleshed stage, generally flexed, though in a few cases in a seated position. This also implies little if any exposure to the surface once interred. It may be that the very, very rare cases of rodent gnawing (or similar taphonomic effects) occurred during the occasional exposure of elements to the surface environment during the deflationary epochs in the site's history.

While there were 75 distinct burial locations identified in the field, a very few were left largely intact and not excavated, while others, upon close examination, produced remains of multiple individuals often with a sufficient quantity of material to propose the clear presence of a second, third and sometimes even a fourth person beyond the number of individuals recognized in the field.

Burial-by-burial inventories provide, as closely as possible, descriptions of the materials and issues with assessment of MNI and age and sex of the individuals in each burial. In many cases, those individuals not recognized in the field were subadults, or, more appropriately, portions of subadults sufficiently distinct to categorize them as additional individuals based on combinations of dental and postcranial material. That many of these individuals were not identified in the field is not surprising given the commingling and deterioration of the material.

There is variability in preservation within the series. Those burials that were deepest, especially those either resting on or extending into the underlying clay, are generally the most poorly preserved. These individuals typically provide the least information and often can only be identified as a small concentration of human skeletal material that exists in sufficient quantity to argue it is a burial and not just a scatter of "floating" bone.

Several of the burials exhibit features that are worth noting. Burial 6, one of the adult males, is very robust and has femur gluteal lines that are some of the most massive observed by Doran in 30 years of skeletal analysis. In contrast to this robusticity, there is a subadult in the same burial (Burial 6, Skull 2) with mixed dentition (both adult and deciduous dental material). The adult dentition has some of the smallest metrics either Stojanowski or Doran has ever seen and falls below virtually all dimensions in the comparative data series. What we have in this burial are multiple individuals: one who was extremely robust, and the other, if he or she had lived, would be very, very small. This assessment presumes body size is proportional to dental metrics, which in general is the case (or would have been). It is tempting to interpret reduction in general dental size of this degree as reflecting severe biological stress during development (Stojanowski et al. 2007). The reduction is quite dramatic here, and though it does not quite approach a condition of "true" microdontia, it is a significant reduction in dental dimensions (Alexandersen and Nielsen 1970) and typically falls below the lower quartile, usually in the lower 20 percent of several hundred individuals, depending on the measure in question.

Burial 30, a Late Archaic female, was one of several individuals who appeared to have very large, well-developed deltoid tuberosities. This is the insertion point for the muscles involved in raising the arm, particularly laterally away from the body (abduction). In addition to such movement, these muscles might also be prone to hyper-development by carrying loads with the arms hanging down the side of the body. During the general inventory of the skeletal material there was a general sense that many individuals exhibited very well developed deltoid tuberosities. It stimulated us to take measures through the tuberosity in a mediolateral and anterior-posterior dimension at the most prominent part of the tuberosity. Most of the other humeral shaft dimensions were taken below the deltoid tuberosity. Burial 71 has even larger deltoid tuberosities and is also a female, while #471 (unaffiliated material) is also very robust with respect to deltoid metrics, out of the roughly 23 individual for whom we have metrics.

The subadult in Burial 34 shows an unusual degree of discrepancy between the dental and the postcranial assessments of age. Dental maturation suggests an age of approximately five years, but the small quantity of skeletal material is more suggestive of a much younger individual, basically a neonate. If these are representative of the same person (and there is no overlap or duplication of elements of disparate sizes), it would suggest a high degree of growth retardation given the diminutive size of the postcranial material. In fact, the latter approaches the "near microdontia", as also observed for Burial 6, Skull 2.

Several other individuals, particularly Burial 7, #1. is a very large male with extremely worn teeth (attrition age 55+). The five or six postcranial measurements that we have for this person suggest that he is one of the largest, if not *the* largest, individual at Buckeye Knoll. He is typically at, or above, the 90th percentile of the larger North American series. Burial 8 is also very large, but not as large as Burial 7 # 1. The male in Burial 48 is also extremely robust, particularly based on the femur head dimensions.

Interestingly, the upper extremities of the Buckeye Knoll individuals seem to have greater robusticity than the lower extremities. This was noted by several of us as we did the inventory and often came to the same conclusion independently. Of course, it may simply be a reflection of sample bias. Some of the humeral deltoid tuberosities were so large that initial observations could mistake them for the proximal femur shaft in the area of the gluteal tuberosity. While this is not quantified or demonstrated conclusively in any manner, it is an interesting observation, and is suggestive of potential differences in activity levels between the upper and lower extremities (perhaps indicative of the common use of canoes for transportation).

Caries, as is common in many populations with high attrition rates, were relatively infrequent. Out of the more than 1,000 teeth observed, only 15 caries were observed, and three of these were examples of noncarious pulp exposure and not true caries. However calculated, this is a very low caries frequency, around 5 percent on a population basis, with caries slightly more common in the molar dentition. On a tooth-by-tooth tabulation, caries frequencies were typically less than 3 percent. On a total tooth basis (n=1622 adult teeth) this caries rate would be 0.8 percent, again emphasizing a low caries rate in general.

Almost nothing can be said about dental abscesses given the scarcity of alveolar bone. Three individuals did exhibit abscessing, but it is difficult to translate this into a population statement of any consequence.

Assessment of calculus prevalence is a bit more straightforward and was encountered in approximately 40 percent of the individuals who had at least one observable tooth. It is likely that abscess incidence is somewhat higher than this, but how much higher is difficult to determine given the number of unassociated teeth. On a tooth-by-tooth basis, it is higher in the maxillary dentition. Mandibular anterior teeth show the lowest calculus formation rates. Calculus rates are higher in the mandibular and maxillary molars. Calculus prevalence and severity are relatively mild in comparison to many populations, but were clearly more common than caries formation, as they occurred in about 20 percent of the teeth examined. Incidence by tooth position showed a high degree of variability and ranged from only 8.9 percent (RNP1) to a high of 46 percent in the LXI2. Meaningful patterning was hard to identify and was variable across the dentition, though it was only seen in a single subadult burial (Burial 60; age 8; otherwise Burial 60 was unremarkable).

In the deciduous dentition, several interesting patterns were observed. The anterior teeth, in contrast to a limited series from Windover, appear shifted toward larger values while the posterior teeth, particularly the molars, exhibit no such shift. One simple explanation of this observation is that the anterior teeth develop earlier and crown growth is basically complete by birth. Posterior dentition, on the other hand, completes crown formation within approximately six months after birth. If biological stressors increase after birth, the change could be sufficient to impact maturation trajectories and result in smaller posterior dentition. It is also noted that there are two individuals who have extremely small adult dental dimensions (approaching microdontia). A similar explanation would make sense. Crown formation, at least with respect to maximum dimensions taken as standard crown measures, is functionally complete by six years of age.

In the adult dentition the patterns are less clear, and if there is a pattern at all, it tends to support the common observation that older samples tend to have larger teeth. This is subtle and is not the case for all teeth or all measures. For example, in the mandibular dentition the

Buckeye Knoll median values are either the largest or second largest in 13 of 16 possible comparisons. Clearly, this represents a difference across time intervals, as it shows up in a persistent manner. This is most obvious in the mandibular dentition. The maxillary metrics, on the other hand, tend to be more frequently in the smaller median values when examined chronologically. In ten of the 16 possible comparisons for maxillary dentition, the Buckeye Knoll materials are the smallest, next to smallest, or third smallest in median values. Clearly, these patterns contradict each other and further rigorous analysis is warranted.

Nonmetric traits were collected from the Buckeye Knoll material and will be useful on a population basis for comparative purposes. Perhaps the most interesting observation is that one individual exhibits a Uto-Aztecan premolar. This is one of the rarer dental nonmetric traits and appears at very low frequencies. It is most frequently found in western North American populations, though it has also been identified in populations from the Ohio River valley. As such, it is rarely observed at frequencies greater than 3 percent and generally hovers around 1 percent, if it appears at all. It is a trait absent from most populations. It is tempting to argue, as suggested by others (Johnston and Sciulli 1996:294), that it might be more characteristic of earlier populations. Thousands of individuals from later sites have been inventoried and do not present this trait. It is interesting that two of the oldest sites with more than four or five individuals both exhibit expressions of this trait, namely, Buckeye Knoll and Windover.

Deciduous dental metrics give the impression, due to their generally larger size in the anterior, that the earliest developing teeth are larger on average than those from Windover (the only comparative sample available). This suggests adequate to perhaps even better-than-adequate maternal health during the last trimester and for several years after birth. This good health is also suggested by hypoplastic defect incidence (see below). Deciduous molar teeth, on the other hand, suggest a slightly smaller size in comparison to Windover, which could be taken as an indicator of reduced health, though not sufficient to precipitate significant LEH formation in the first year or two after birth. In contradiction to this, the several individuals with extremely small adult dentition (approaching microdontia) suggest that at least in some years, or seasons, stress could be quite profound.

Adult dentition is variable, depending on which tooth and measure is being examined. Taken as an aggregate pattern, the Buckeye Knoll teeth tend to be larger than the more recent groups (virtually all the comparative samples), but this pattern is most obvious in the mandibular metrics and is less pronounced in the maxillary dentition. In fact, central tendencies for maxillary dental metrics are more typically smaller than the other comparative groups, so the overall pattern is hardly distinct or profound.

An examination of linear enamel hypoplastic (LEH) defects in the Buckeye Knoll canines identified only a single defect in a deciduous canine. This again speaks to the adequacy of prenatal health and growth conditions; otherwise, a higher incidence of defects would have been observed. In adult canines, however, defects were more frequent. In the case of dental defects, over half the adult canines examined exhibited at least one defect, and these were nearly equally common in the mandibular and maxillary dentition. Defects in the canine would have all resulted from metabolic insults in the first six years of life. Most of the teeth with defects exhibited single defects, thus implying recovery from a generalized metabolic insult. Rates of a second or third defect, implying additional and subsequent metabolic insults, were rarer.

In looking at the timing of insult, as expressed by age, of LEH, the insults were relatively rare in the first two or three years of life, then dramatically increased in the third year, and increased again in the fourth and fifth years. It is reasonable to propose that the primary stressor in these intervals may have been weaning and the subsequent shift to a solid, more diverse diet. Increase at these ages is somewhat later than many posit, but is certainly not impossible. It may reflect the absence of what one might think of as “transition foods” that bridge the gap between breast milk and fully adult diets. In the Windover sample (ongoing analysis by Doran and Berbesque), the increase in LEH is most obvious between two and four years of age, and thus peaks somewhat earlier than in the Buckeye Knoll sample. This suggests possible differences in age at weaning, or differences in transitional diets while shifting away from breast milk. Limited comparisons to other Texas samples indicate the Buckeye Knoll rate of LEH is neither high nor low, although only a very few samples were considered. Clearly other factors (age, sex, etc.) may be involved, but the sample of scored teeth from burial contexts is very small and is insufficient to push this assessment much further at the present. Interestingly, in a brief examination of rank in the small number of scored canines from burial contexts, the higher-ranked individuals exhibited fewer defects, while those with more defects had lower ranks. While this is intriguing, and suggests some correlation between early stress and rank, the causal factors are unclear. However, looking at LEH in this manner does provide potential insights into more complex social issues.

Humeral midshaft dimensions of the Buckeye Knoll series are not distinctive in comparison to the other samples for which data are presented. The bivariate plot of anterior-posterior vs. mediolateral midshaft dimensions (see Figure 12-3) does suggest that many of the Buckeye Knoll individuals fall into the somewhat more gracile lower registers and are certainly not as robust as the development of the deltoid tuberosity would suggest (which was mentioned in the burial-by-burial inventory). The mediolateral dimensions of the humerus seem slightly shifted to lower values and emphasize this slightly gracile nature, but the shift is hardly striking. Optimally, to examine this further it would be ideal to compare these midshaft dimensions to overall length, but that is not an option given the scarcity of intact humeri.

There are more femur dimensions for the Buckeye Knoll series and comparative resources are also extensive. This allows the Buckeye Knoll materials to be considered from a chronological standpoint. In the femur midshaft dimensions, as in the humerus midshaft dimensions, there is a noticeable absence of individuals with large measurements. If there was a bias in preservation towards large individuals, in that the more gracile individuals disappear more consistently, it is certainly not obvious in the postcranial analysis. This analysis shows, in this case, an absence of large individuals and the absence of very small adults. Such a trimming of the extremes in dimensions could be taken to indicate a more consistent selection and growth process over time in the Buckeye Knoll materials. Postcranial metrics are more sensitive to biological disruptions than dental development, and if there were no periods of extreme stress, the expectation would be to see smaller individuals who represent those who survive and show a reduction in overall size. At the same time, it would appear there are few really large individuals who one might see if there were intervals (within the duration of site use) in which conditions existed that allowed more nearly optimal achievement of genetic potentials. If conditions were consistently "harsh" with respect to biological stress (diet restrictions, disease, etc.), the expectation would be to see a greater shift toward small values with few large values. What is seen in the Buckeye Knoll materials, however, is more of a trimming process, wherein there are few really large individuals and few really small adults. This is particularly noticeable in the later samples, which have very wide ranges of values, though admittedly the sample sizes are also much larger in the later intervals. It is interesting that the earlier samples (7000 to 4000 B.P.) show an apparent downward trend in the range of values, while in those samples dating after 3000 B.P. there is an apparent increase in variability and an upward trend in many metrics. Again, this cursory analysis is just that—a brief glimpse of an overall, potentially interesting pattern that is hard to assess given the unevenness of the comparative data and the brevity of analysis. This is noticeable in each of the femur midshaft dimensions and is also clear in the bivariate plot that highlights the absence of really large individuals at Buckeye Knoll (see Figure 12-7). This pattern is more obvious in the shaft dimensions than in the femur-head dimensions (see Figure 12-8), which tend to be clustered in the upper ranges of values. The subtrochanteric dimensions are comparatively limited and cover the full range of values. They do not provide additional insights into the overall patterning suggested by the femur and humerus midshaft dimensions.

Sample sizes, particularly comparative samples for the tibia midshaft dimensions, are more limited, but the mediolateral dimensions show a slight shift toward smaller values. This shit is not apparent in the anterior-posterior dimensions. In the comparison of tibia shaft dimensions, it appears that if one of the measures is shifted in any direction, it is the mediolateral dimensions that are less robust than the anterior-posterior dimensions. Here, however, the Buckeye Knoll individuals do not appear as restricted with respect to the range of dimensions, instead covering virtually the entire reported range of presented values.

Using the tibia, femur, and a number of intact metacarpal elements, estimates of stature for nine individuals at Buckeye Knoll were obtained (see Figure 12-14). The range of stature estimates at Buckeye Knoll covers almost the entire range of values observed for over 20 other sites (and 400 individuals) in North America. There does not appear to be a shift in values toward the middle range, as was observed in shaft dimensions of the femur and humerus. Several Buckeye Knoll individuals are very large and several others are very small when compared to the large North American sample (perhaps reflecting the smaller comparative sample sizes?). Average stature at Buckeye Knoll is 164.4 cm, which is quite typical for North American prehistoric individuals (about 5 ft. 3 ¾ inches). There are only estimates for five sexed individuals (3 males and 2 females), with the male mean at 172.5 cm (median 173.2

cm) and the female mean at 153 cm (median also 153 cm). Compared to the larger series (*n*=400) of males and females, the Buckeye Knoll male mean is higher and the female mean is lower. The difference in the male and female mean at Buckeye Knoll is also larger than is typical, but the small sample of sexed individuals could easily skew this result and the difference cannot be taken as significant.

Demographically, samples of this nature are challenging. The MNI counts are based on the inventories of the burial locations only, and it is likely that there is some overestimation of MNI but we have been as conservative as possible. In all, there are 116 individuals represented based on the protocols used here. Many of the "new" individuals, i.e. individuals that were not recognized in the field, came out of the matrix or were distinguished upon identifying duplication of elements, element fragments, or significant discrepancies in size and age within each burial. Many of these "new" individuals were subadults. Clearly, and as with many archaeological samples, there is a problem of infant under-enumeration—i.e. subadult skeletal material not surviving. However, Buckeye Knoll actually has a better inventory of subadults (*n*=41, 35 percent) than many archaeological sites, so it is clearly not unusual or particularly bad in this respect. Some sex assignment could be made in about 50 percent of the cases. Subadults represented about 35 percent of the total inventory. Females had a slightly older mean age than males (excluding the 55+ category). These ages would probably be even more heavily skewed in favor of females (i.e. in the higher ages), since there were more unaged (55+) females than there were unaged males. This and other aggregate statistics clearly indicate the demographic similarity of the Buckeye Knoll series with a larger aggregated sample of hunter-gatherer-fisher samples.

Males were more likely to be in individual burials than were females. Female burials were more likely to also contain subadults and subadults were more frequently buried with adults, particularly females, rather than appearing in isolated burials. There does not, however, appear to be a strong relationship between female age and the presence or absence of subadults in a burial. This suggests, at least tentatively, that death during childbirth was not common. As always, however, preservation issues must be taken in to account in making such statements.

A life table based on the smoothed "Old" series (excluding the few more recent burials) indicates there are proportionally more individuals in the 10-to-20-year-old interval than in the typical HGF (hunter-gatherer-fisher) series. However, a lower number of individuals occupy the 20-35 age ranges at Buckeye Knoll than in the HGF sample. This could reflect a reduced fertility rate, and thus a reduced mortality rate in the peak fertility years. Unfortunately, the number of sexed adults in these intervals is too small to realistically parse out a difference between males and females, although the difference observed is suggestive of a real demographic difference in the adult years and, interestingly, is most similar to the TRAN series (transitional, i.e. Woodland, shifting toward agricultural regimes). Infant under-enumeration can influence the dx and Ddx values. Typically qx and ex values, once outside the under-enumerated years, are more useful in generating paleodemographic interpretations. Buckeye Knoll adult mortality rates, and consequently, higher life expectancy, is consistently "better" (i.e., lower mortality rates and higher life expectancy) than observed in the other comparative series. Again, a simple explanation is lower fertility rates and, thus, lower mortality rates and higher life expectancy. These differences could also be attributed to overall better health and, relatively speaking, lower stress during the adult years. While it is hard to evaluate these statements in detail (given the preservation conditions, etc.), it fits with the relatively modest evidence of pathology, difficult though it might be to assess.

Pathologies, as suggested earlier, are difficult to evaluate on a population basis, mainly because there are so few even relatively complete individuals and the bulk of the information is based on very fragmentary information. Some of the comments about pathologies basically represent anecdotal comments rather than true population statements (with the exception of the Rothschild et al. discussion of periosteal reaction vis-à-vis tibia observations). This is not to say that no pathologies were observed, just that they were relatively minor on a population basis.

A distal foot phalanx shows extreme lipping and erosion of the proximal articular surface plus some osteoarthritic growth of the distal tip either from injury or pathology. This injury or pathology is one of the few observed in the population. It appears to have been the result of a soft-tissue inflammation or tumor, which pressed on the distal joint of the proximal phalanx and pressured it to expand and essentially follow the outline of the enlarged soft tissue abutting the bone. These changes appear in relatively young individuals (around 36 years of age) and are not distinctly attributed to old-age changes.

Burial 49, an adult male, exhibits postcranial fragments from humerus, radius, ulna, femur, tibia, patella, clavicle, and ribs. The radius fragment exhibits a healed, well-aligned fracture with a large callus formation near the proximal end of the shaft.

Both adult tibia in Burial 37 (a Late Archaic or Late Prehistoric female, 48 years of age) are striking in their morphology and reflect pathological changes. While fragmented, most of the two tibia could be reconstructed though they are missing both the distal and proximal ephiphyses. The lower third of both tibia are normal in size and morphology. The changes appear to be the result of a bilateral subperiosteal hematoma, complete with extensive, well organized, new periosteal bone. These changes are coupled with fractures to the right and left humerus. Clearly, this was a significant traumatic injury, but one that was not fatal, and while distinct, it apparently did not lead to long term impairment. It does reflect an effective effort to care for this individual.

One distal phalange (MT1) from a nonburial context shows extreme lipping and osteophytic growth along the distal end, as do several other tarsal and metatarsal fragments from this unassociated cluster of bone found in S14W84, Level 14, 130-140 cmbs). This material apparently comes from a very old individual, but beyond that, little can be said. Taken together, these pathological changes are relatively minor.

Our hope is that limited comparisons provided herein suggest something of the potential of the Buckeye Knoll data. Both the aggregate and raw data are presented in several formats and provide a variety of opportunities to examine this population and others that are typically from more recent chronological intervals. Each prehistoric sample potentially can shed light on the most basic of human experiences—human health, life, and death. This biological dataset, hopefully, will be used by many to address just such issues and will continue to speak to the past in ways that can only be accomplished through analysis of skeletal material.

Chapter 17

Mortuary Artifacts

Robert A. Ricklis

Early Archaic Artifacts

A striking feature of the mortuary remains from the Early Archaic cemetery on the Knoll Top is the large quantity and variety of artifacts associated with the burials. A total of 1,415 artifacts were found in direct association with burials in the cemetery pertaining to this time period, ca. 7,300-6,200 B.P., calibrated. Another 447 (consisting of marginella, nerite, and oliva shell beads) were obtained from the Zone 3 matrix surrounding these burials and are believed to have been associated, as well. These objects (1,862 total) (Table 17-1) can be identified as intentionally placed burial goods, given that they were found resting in immediate proximity to human remains, both in terms of horizontal location and vertical position at the level of the skeletal material.

Since it was decided (in consultation between the U.S. Army Corps of Engineers and Native American tribal representatives) that all mortuary materials would ultimately be reburied after completion of the analyses, a complete record of the mortuary artifacts was made. This included recording measurements of each object along with notations of material characteristics, the compilation of a piece-by-piece photographic record of all items, and the production of epoxy resin replicative casts of each lithic artifact (shell and bone artifacts were not replicated in this way, due to the high likelihood of damage to the artifact). Given that some Native American representatives expressed the wish that no photographs be published of either the human remains or the associated artifacts, a detailed and accurate drawing of each mortuary artifact was made by Alexander N. Cox for inclusion in this report.

The mortuary artifacts were most readily sorted according to the materials from which they were made, namely, flaked chert (*n*=39), ground stone (*n*=29), rough stone (*n*=4), bone or antler (*n*=19), shell (*n*=1,740), and miscellaneous minerals (e.g., iron oxide, asphaltum) (*n*=31). The various kinds of artifacts falling into these classes, and their quantities, are listed in Table 17-1**,** along with the numbers of the burials with which they were associated.

Chipped Stone

This group includes four varieties of dart points (lanceolate, corner-notched, split-stem, and leaf-shaped), other bifaces, bifacial preforms, a Guadalupe Tool, a large uniface, and chert flakes. These are discussed and illustrated in the following paragraphs.

Dart Points

Five lanceolate dart points were found associated with the early burials (see Table 17-1). Two were within a tool kit associated with Burial 8. Two others were within or in close proximity to a small tool kit with Burial 49. One rested with Burial 43. These are individually discussed below. Metric data on these and other stone mortuary artifacts are presented in Table 17-2.

The two lanceolate points associated with Burial 8, an adult male, (see Figures 10-4, 17-1, a-a[1], f-f[1]) were within the cluster of artifacts that rested near the individual's hip. This assemblage was interpreted as a flint knapping tool kit. The two points were morphologically similar and were placed within a new provi-

Table 17-1. Artifacts Associated with the Burials in the Early Archaic Cemetery at Buckeye Knoll.

Class	Material	No.	Burial Nos.
Flaked Stone			
Dart Points (Lanceolate)	Chert	5	8, , 43, 49
Dart Point (Corner-Notched)	Chert	1	4
Dart Point (Split-Stem)	Chert	1	52
Dart Point (Leaf-Shaped)	Chert	1	16
Dart Point Fragments	Chert	2	26, 74
Bifaces (Lanceolate)	Chert	2	1-B
Biface (Bi-Pointed)	Chert	1	21
Biface (Oversize Fluted Stem)	Re-Silicified Brecciated Chert	1	74
Bifacial Preforms	Cßœhert	10	6, 22, 58, 61
Guadalupe Biface	Chert	1	58
Large Uniface	Georgetown Chert	1	58
Chert Flakes	Chert	13	6, 8, 49, 65
		39	
Ground Stone			
Bannerstones	Limestone	3	44-A, 74
Grooved Stones	Quartzite	17	5, 6, 11, 27, 61, 65
Grooved Stones	Limestone	5	6, 28, 65
Plummets	Limestone	4	8, 62
		29	
Rough Stone			
Hammerstone	Quartzite Cobble	1	6
Hammerstone	Chert Cobble	1	6
Abraders	Sandstone	2	8, 73
		4	
Bone/Antler			
Flakers	Bone	4	8, 49
Flakers	Antler	1	8

continued.

Table 17-1. (concluded)

Class	Material	No.	Burial Nos.
Bone/Antler (cont.)			
Billets	Bone	2	8
Billets	Antler	3	8
Beads	Canid (Dog or Coyote) Canine Teeth	4	55
Needle	Bone	1	7
Unworked Bone	Canid Radii	2	8
Unworked Antler	Shaft	2	45, 49
		19	
Shell			
Beads	Marginella	1,725	10, 13, 16, 17, 18, 22, 34, 37, 38, 42, 43, 45, 53, 56, 59, 60, 67, 72, 74, 75,
Beads	Neritina	32	10, 11, 13, Zone 3
Beads	Oliva	2	Zone 3
Beads	Whelk Columella	1	Zone 3
Pendants	Freshwater Mussel Valves	3	55
Pendants	Sunray Venus Valves	7	46, 55
		1,740	
Miscellaneous			
Mineral	Red Ochre	21	2, 33, 39, 43, 49, 52, 53, 55, 57, 58, 61, 66, 67, 68, 73
Mineral	Yellow Ochre	2	61
Mineral	Asphaltum	8	40, 45, 47, 49
		31	
	TOTAL	**1,862**	

Table 17-2. Metric Data on Flaked Stone Artifacts Found with the Early Archaic Burials in the Knoll Top Cemetery at Buckeye Knoll.

Item	Lot No.	Burial	Length	Width	Thickness	Observations
Biface (Lanceolate)	1038	1-B	134.6	34.3	13.1	Light basal-lateral edge grinding
Biface (Lanceolate)	1151	1-B	118.4	35.4	13.1	Light basal-lateral edge grinding
Biface (Oversize Fluted-Stem)	3049	74	276.8	84	10.6	Fluted stem w/ edge grinding
Biface (Bi-Pointed)	1671	21	103	35	9	—
Dart Point (Corner-Notched)	2155	4	40	22.3	6.1	Light basal edge grinding
Dart Point (Lanceolate)	2141	43	97.6	21.8	8.9	No edge grinding
Dart Point (Lanceolate)	2213	49	59.0	17.6	8.6	Light basal edge grinding
Dart Point (Lanceolate)	2186	49	48.6	17.2	8.3	No edge grinding
Dart Point (Lanceolate)	3005	8	19.2	21	10.1	No edge grinding
Dart Point (Lanceolate)	3043	8	61.9	17.8	10.1	No edge grinding
Dart Point (Leaf-Shaped)	1122	16	86	28	8	No edge grinding
Dart Point (Split-Stem)	2298	52	52.7	21	7.4	Heavy stem edge grinding
Dart Point Fragment (Distal)	3176	26	63.2	26.2	6.4	Short, steep edge-bevel flaking
Dart Point Fragment (Distal)	3052	74	—	—	—	Too small for accurate measurements
Large Uniface	2296	58	199	121.7	27.2	Georgetown chert
Guadalupe Biface	1152	58	92.3	31.7	21.2	—
Preform (Lanceolate)	2232	61	106.4	31.7	8.2	—
Preform (Possible Lanceolate)	2219	58	44.9	31.7	8.3	Crude form
Preform (Bifacial)	2035	6 (F. 18)	94.4	45	11	—
Preform (Bifacial)	2034	6 (F. 18)	135	50	18	—
Preform (Bifacial)	2038	6 (F. 18)	110.4	43.4	18.1	—
Preform (Bifacial)	2036	6 (F. 18)	107.6	59.6	15.9	—
Preform (Bifacial)	2037	6 (F. 18)	105.5	43.6	18.1	—
Preform (Bifacial)	2039	6 (F. 18)	106.6	52.1	18.8	Retains cobble cortex on one face
Preform (Bifacial)	2041	6 (F. 18)	87.6	59.3	22.4	Retains cobble cortex on one face
Chert Flake	2040	6 (F. 18)	89.9	61.7	22.5	Retains cobble cortex on one face
Chert Flake	2042	6 (F. 18)	78.9	50.2	18.7	Retains cobble cortex on one face
Chert Flake	2041	6 (F. 18)	87.8	58.8	24.3	Retains cobble cortex on one face
Chert Flake	3061	8	35.7	17.6	4.6	Within a tool kit
Chert Flake	3243	8	32	24.5	4.7	Within a tool kit
Chert Flake	3054	8	68.7	41.4	12.2	Within a tool kit
Chert Flake	2293	49	57.8	15.8	4.9	Within a tool kit
Chert Flake	3179	49	22.2	33.3	4.8	Within a tool kit
Chert Flake	3179	49	35.2	16.3	4.9	Within a tool kit
Chert Flake	2247	65	69.3	38	20.9	Within a cluster of four flakes
Chert Flake	2246	65	62.6	46.8	25.4	Within a cluster of four flakes
Chert Flake	2245	65	75.1	37.5	19.4	Within a cluster of four flakes
Chert Flake	2248	65	39.6	30.3	16.7	Within a cluster of four flakes

Note: All measurements are in millimeters.

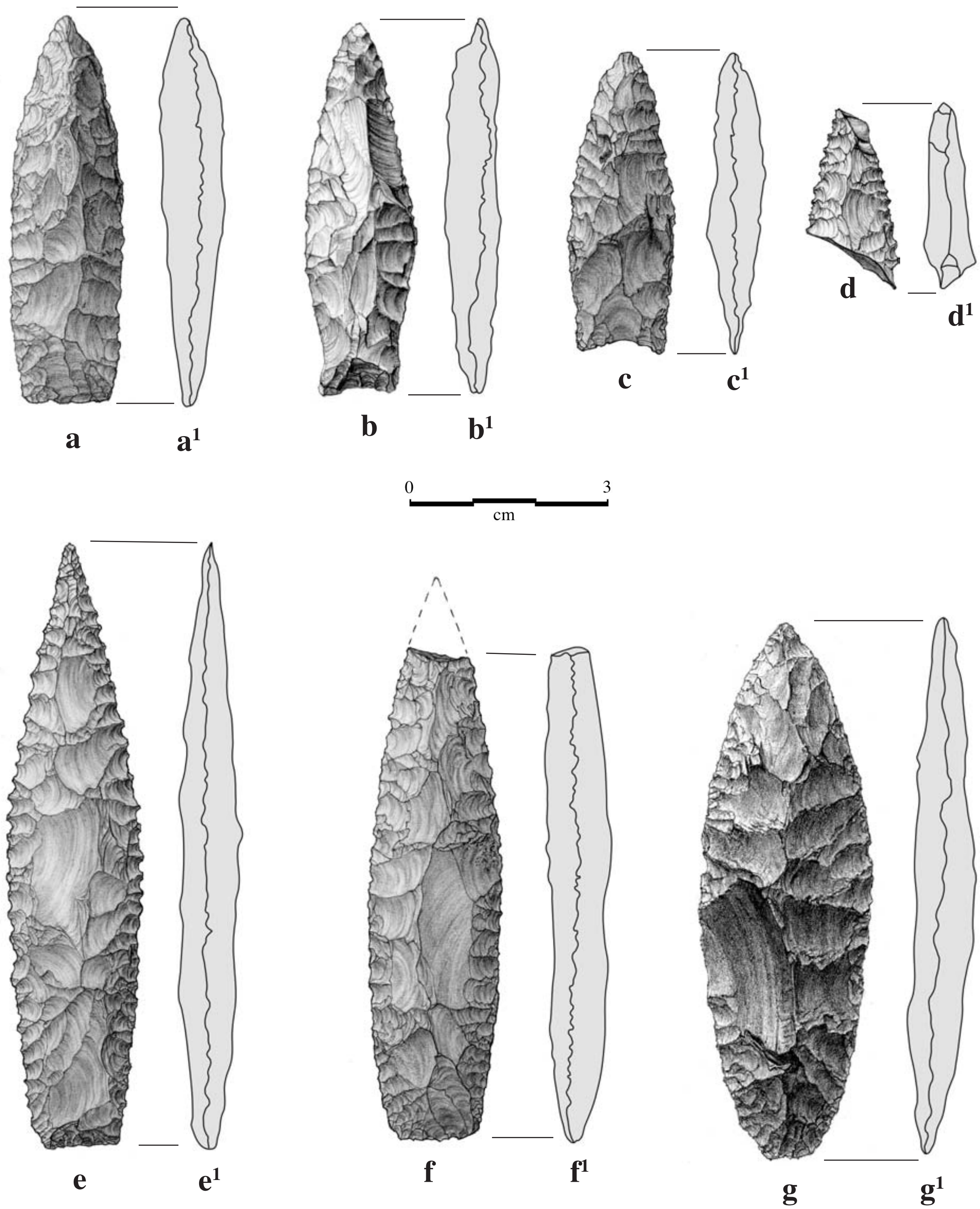


Figure 17-1. Slender lanceolate points and a leaf-shaped point from the early cemetery at Buckeye Knoll: a-a[1], f-f[1], Burial 8 tool kit; b-c[1], Burial 49 small tool kit; d-d[1], Burial 74; e-e[1], Burial 43; and g-g[1], leaf-shaped point from Burial 16.

sional type, the Buckeye point. Both were made of dark gray chert, were slender (a narrow width relative to length), and were thinned with random (non-parallel) flaking. Each was finished by short pressure flaking along the lateral edges. In plan view, these points constricted toward the bases, which in both cases, were quite straight. The bases were well thinned and, in longitudinal cross section, tapered from the main body of the point. In cross section, both points were strongly bi-convex. There was no edge grinding on the basal or lateral edges of these points.

One of the Burial 8 Buckeye points (see Figure 17-1, a-a[1]) was complete. However, it was shorter than other points of this type from the cemetery. It was thickest near the distal end, so that the point thinned abruptly to the distal tip. This suggested that it had received a distal break and was then resharpened. The other point from Burial 8 (see Figure 17-1, f-f[1]) had a transverse break so that the distal tip was missing. The final pressure flaking along its lateral edges created a slightly serrated configuration.

Another lanceolate dart point (see Figure 17-1, e-e[1]) was associated with Burial 43 (see Figure 10-8). It was unbroken and made of dark brown, fine-grained chert and was found in the area of the chest cavity. Like the two points with Burial 8, it was assigned to the new, provisional, Buckeye type. Due to the poor bone preservation in this burial, little of the rib cage remained, so it was not possible to determine whether or not the point had been embedded within the body or placed with the burial, perhaps on or under the chest. The point was tested for animal protein residue (including human) and the results were negative (see Puseman and Cummings report, Appendix C). The point was clearly resting flat in contact with, or very close to, the body, and there is no doubt that it was directly associated with this burial. This point was very similar to the ones from Burial 8 in all of its key attributes. It narrowed toward the base, which was, again, straight. The cross section was strongly bi-convex, again an effect of the narrow width relative to thickness. The point exhibited random flake scarring from final thinning, and also displayed short, parallel pressure flake scars along the edges, which were distinctly serrated. No grinding was present on any of the edges.

Two lanceolate points were found near the pelvis of the flexed adult male, Burial 49 (see Figure 10-9). One, made of rather coarse-grained reddish brown chert, was found within a small cluster of artifacts (a pointed bone tool, an antler fragment, and a chert flake) interpreted as a small flint knapping tool kit. The other was found a few centimeters away. The first specimen (see Figure 17-1, c-c[1]) was a relatively small point that differed from those already described in being wider relative to its length and having a concave base. Like the others, however, it was strongly bi-convex in cross section and lacked edge grinding.

The other specimen (see Figure 17-1, b-b[1]), of gray chert, was constricted or "waisted" just above the slightly concave base. It appeared to have been broken or damaged at the original tip, as evidenced by a long, deep impact scar that ran from the distal end to the midsection of the point. The point was reworked by lateral and distal pressure flaking along this flake scar. It is possible that the impact scar in question was made intentionally to thin the broken distal end and to facilitate the reworking process. The basal sections of the two lateral edges had light edge grinding.

It is possible that the latter point originally had a stemmed morphology and that the constriction or waisting of the basal portion actually was the remnant stem. The shoulders of the point, which would have demarcated the conjunction of stem and body section, possibly were removed when the lateral edges were reworked. Such a trajectory of reworking would be in accord with Elton R. Prewitt's suggestion that this specimen was a reworked point of the stemmed Hoxie type (Elton Prewitt, personal communication 2004).

Another point (see Figure 17-1, g-g[1]) was found resting above, and within 3 cm of, the skull of Burial 16 (see Figure 10-5). It had a "leaf" shape, featured a pointed distal end, and had convex lateral edges and a rounded base. Although the basal shape was rounded, it was slightly flattened by the removal of single small basal thinning flake from one face. The edges were not ground. With a length of 86 mm, a width of 28 mm, and a maximum thickness of 8 mm, this point was approximately the same size as the slender lanceolate points described above. In cross section, the point was distinctly bi-convex. This may, in fact, have been a variant of the Buckeye type, a possibility that can be explored only by acquisition and analysis of additional specimens from securely dated contexts. This would permit defining the full morphological range of the type. A sample of slender lanceolate points from the Kennedy Bluffs site (41BP19) in Bastrop County was (as discussed below) tentatively assigned to the Buckeye type in this report. Some examples had rounded bases that resemble the point from Burial 16.

A distal dart point fragment (Figure 17-2, e-e[1]) of fine-grained brown chert was found resting flat, im-

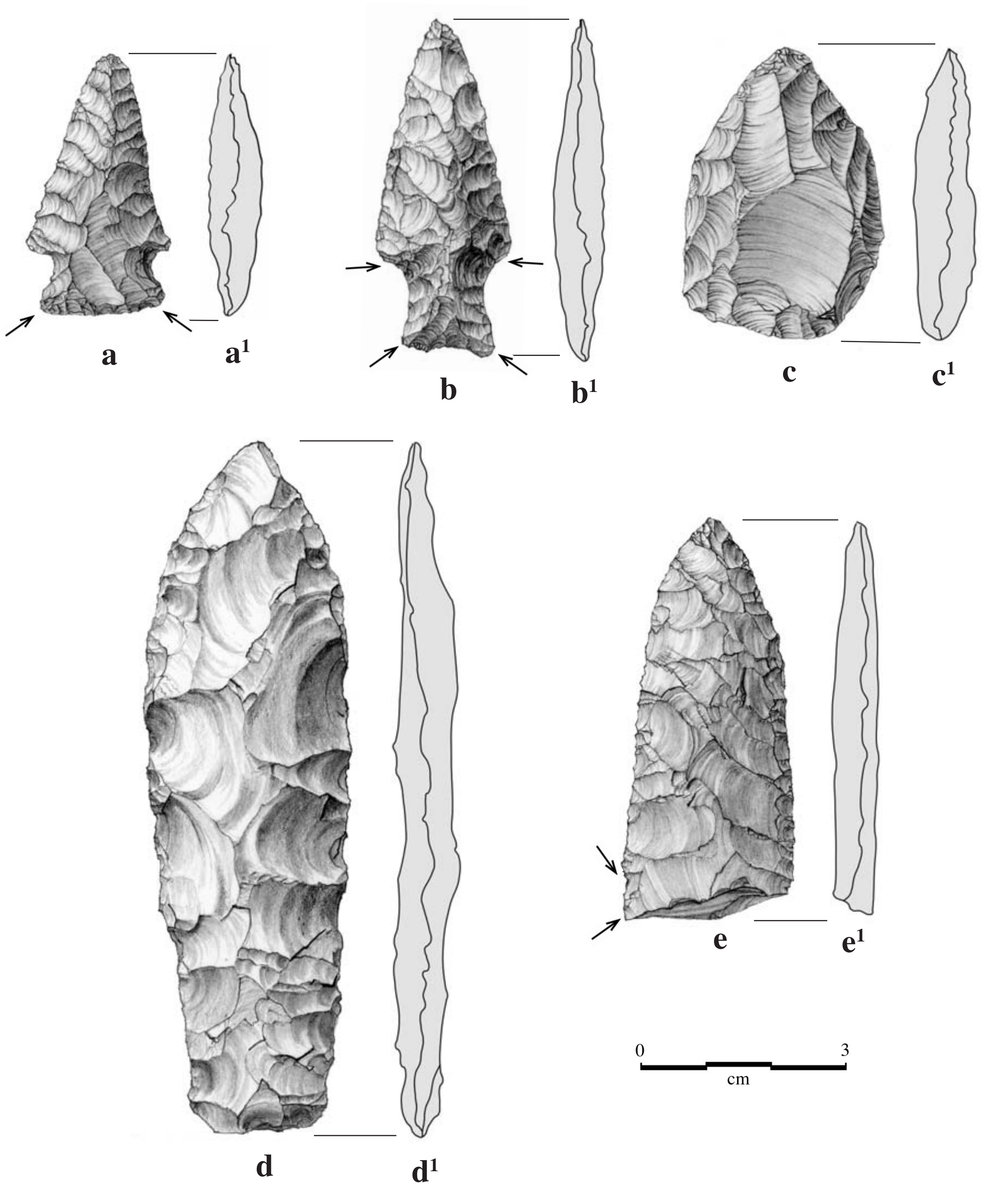


Figure 17-2. Additional bifaces associated with burials at Buckeye Knoll: a-a^1, corner-notched dart point found with Burial 4 (Arrows indicate the extent of light basal edge grinding); b-b^1, stemmed bifurcate-base dart point found next to the cranium of Burial 52 (The blade is alternately beveled. Arrows indicate the extent of edge grinding along each side of the stem.); c-c^1, possible dart point preform associated with Burial 58; d-d^1, lanceolate dart point preform from Burial 61; e-e^1, distal fragment of a possible dart point preform from Burial 26 (Arrows indicate the extent of lateral edge grinding. Note the short, parallel pressure flaking along the right edge, such flaking occurs on both faces, creating an alternately beveled effect.).

mediately adjacent to and at the same level as, a leg bone (tibia) of Burial 26 (see Figure 10-6). Its position strongly suggests association with that burial. This may have been a lanceolate point. While the absence of the proximal portion makes this assessment uncertain, it finds support in the fact that lateral edge grinding was present. Had the point been stemmed or notched, it would be expected that the edge-ground portion would have been separated from the rest of the point by a shoulder, which was absent on this specimen. In any case, this point differed from those previously discussed by virtue of having a wider blade relative to its apparent overall length and in lacking the marked bi-convexity of the cross section. Moreover, this point displayed alternate beveling along the lateral edges that extended to the distal tip, a trait absent on the other points described above. Furthermore, the flaking pattern on the faces of the specimen had a quasi-parallel configuration that was less "random" than the flaking seen on the other specimens.

Another distal dart point fragment (see Figure 17-1, d-d[1]) made of dark brown, fine-grained chert, was found within 10 cm of the leg bones of Burial 74. The association with the burial could be questioned. However, the similarity of this specimen to the distal ends of the slender lanceolate points from Burials 8 and 43 suggests that it was associated with the cemetery and would seemingly support its linkage with Burial 74. The salient similarities between this and the other specimens were (a) its strongly biconvex cross section, (b) fine edge pressure flaking, and (c) edge serration similar to that on the lanceolate point from Burial 43 and one from Burial 8. Additionally, the dimensions (width and thickness) were closely similar to the analogous portions of the Burials 8 and 43 specimens. Thus, this fragment was tentatively assigned to the provisional Buckeye type, along with the complete examples from the other burials.

A stemmed dart point (see Figure 17-2, b-b[1]) rested next to the skull of Burial 52 (see Figure 10-9). This point was made of dark gray, fine-grained chert. It had a triangular blade with straight lateral edges and an expanding stem with a concave base. Heavy edge grinding was present on the lateral edges of the stem. Steep pressure flaking along the edges created alternate beveling. The blade had pronounced but unbarbed and sloping shoulders. Tiny impact fractures (in the form of step fractures) on the distal tip suggested that the point had been used.

This point does not fall neatly into any of the established Texas dart point types. However, its expanding stem and distinctly concave base place it within the generalized category of Early Archaic, bifurcate-base or "split-stem" series defined for Central Texas. That group includes types such as Hoxie, Gower, and Uvalde (see discussion in Kerr and Dial 1998). The specimen from Buckeye Knoll is similar to Uvalde points in regard to its expanding stem. Nonetheless, the heavy stem grinding is not usually present on Uvalde points (Collins and Dial 1998:366). Such edge grinding is typical of Hoxie points, some of which do have expanding stems (see Collins and Dial 1998, Figure 13-32). In a statistical analysis of early bifurcate-stem points, Kerr and Dial (1998) found that there is considerable intergrading of these types. In that regard, the specimen from Burial 52 can be related to this general group with some confidence, even though its specific typological affiliation is ambiguous.

A small corner-notched point made of a fine-grained, reddish-brown chert (see Figure 17-2, a-a[1]) was found with the disarticulated bones of Burial 4 (see Figure 10-2). The blade was triangular with slightly concave lateral edges and prominent but unbarbed shoulders. An expanding stem was created by the two broad corner notches. The stem's base was straight and bore light edge grinding. The point was rather thin (6.1 mm maximum thickness), with only a slightly biconvex cross section.

This point does not fit well into any established Texas type. It somewhat resembles the small, corner-notched and straight-based Palmer type, a variant of Kirk Corner Notched found in northeast Texas, Louisiana, and Arkansas. In any case, the closest morphological similarities seem to be with the smaller corner-notched Early Archaic points of the greater Southeast.

Despite its small size, the sample of dart points from the early cemetery at Buckeye Knoll shows considerable morphological diversity. The most common form of point was the slender lanceolate, assigned here to the provisionally defined Buckeye type. These points were similar in their outline and bi-convex cross sections to the somewhat earlier Angostura type, a diagnostic of the earliest Archaic Circleville Phase of Central Texas (Prewitt 1981, 1985) but distributed more widely into West, East, and South Texas (see Prewitt 1995). While the Buckeye points are of a similar size and shape to Angosturas, they lack the more or less heavy basal edge grinding and parallel oblique flaking that characterize that type (see Turner and Hester 1999:73-74). As just mentioned, Angosturas pertain to an earlier part of the Early Archaic, dating to as early as 8,500 B.P. in the Circleville

Phase (Prewitt 1981) and assigned to an estimated age range of 9,000-8,000 B.P. in Central Texas (Dial et al. 1998:322). This is some one to two millennia earlier than the Buckeye Knoll materials.

There is, however, some evidence for the production of similar points in the larger Central Texas area. Thirty-three slender, contracting-base lanceolate dart points were reported from the Kennedy Bluffs site (41BP19). This multi-component site is situated on the upland margin overlooking the Colorado River floodplain in Bastrop County, Texas. The site was investigated in 1985 by a crew from the Texas Archeological Research Laboratory (TARL), University of Texas at Austin, under contract with the Texas Department of Transportation. This work was limited to the highway rights-of-way that bordered the site, and did not involve the archaeologically most-productive part of the site. Previous digging by non-professionals had, however, produced the mentioned sample of slender lanceolate points (a sample of which are illustrated herein in Figure 17-3). Those points were assigned to the Early Archaic by the TARL investigators, because they came from the site's lower levels (Bement et al. 1989). No radiocarbon dates were obtained from that site. Designated as "Lanceolate Form 1," 12 of these points were described as having a "slender lanceolate outline" and a cross section ranging from thick lenticular to a "flattened diamond shape" [i.e., strongly bi-convex] (Bement et al. 1989:77-80). The sizes of those points are comparable to the examples from Buckeye Knoll.

As noted above, none of the Buckeye Knoll specimens exhibited edge grinding. This attribute was present on a majority (75 percent) of the Kennedy Bluffs specimens (Bement et al. 1989, Table 4). A personal inspection of that collection by this writer, courtesy of Glen Goode, revealed the edge grinding to be light. If those points are placed within the Buckeye type, then occasional light edge grinding can be added to the type's characteristic attributes.

A similar group of slender lanceolate dart points was located by the writer in the collection from the Morhiss site (41VT1) housed at TARL. Recovered during WPA-sponsored excavations of that site in the early 1940s, these materials are among a large collection of points ranging, on typological grounds, from the Early Archaic to the Late Prehistoric. The slender lanceolates from Morhiss in the TARL collection (see Figure 17-4 for examples) are labeled on associated paper tags as "Angostura." All have some degree of basal/lateral edge grinding, but most lack the parallel oblique flaking pattern that is often considered diagnostic of the type. Those points may, in fact, be local counterparts to those from Buckeye Knoll.

The interpretation of the Buckeye Knoll sample of slender lanceolate points is heavily constrained by the small sample size and the general paucity of such points within reported Early Archaic samples from the larger region of Central to Southern Texas. Thus, a cultural context is difficult to define. Clearly, however, similar points are present within the region, and some may well be contemporaneous with the Buckeye Knoll cemetery, thus having both the morphological and chronological characteristics of the Buckeye type. The fact that very different point forms and types, such as Hoxie, Uvalde, and Gower, are more commonly reported and are more widely seen as diagnostic of the period at least suggests that these slender lanceolate points had a relatively limited (temporally and/or spatially) production and were presumably not as widespread in the larger region. This writer suspects, however, that many Buckeye points, identified and given an accurate chronological placement at Buckeye Knoll, have until now been erroneously lumped with Angostura points. Only future research that recovers more examples from clearly dated stratigraphic contexts will shed better light on the geographic extent and temporal range of this point type. For now, the general morphological similarity to Angostura points hints at a possible relationship; it is possible that Buckeye points may have an attenuated relationship with the earlier Angostura type, perhaps representing the recent end of a time-dependant trajectory of production of slender lanceolate dart points.

Larger Bifaces

This category includes four finished bifacially flaked chert artifacts, including a pair of unstemmed bifaces from Burial 1-B, a bi-pointed specimen with Burial 21 (see Figure 10-5), and an unusual oversized stemmed biface associated with Burial 74 (see Figure 10-8). All of these are too large and/or heavy to have functioned as dart points.

The two bifaces associated with Burial 1-B rested next to one another near the cranium. Both were placed with the distal (pointed) ends toward the cranium (to the north), each one parallel to other (see Figure 10-2). One specimen (Figure 17-5, b-b^1), which measured 134.8 mm long, 34.3 mm in maximum width, and 13.1 mm thick, was made of a medium-grained brown (10YR 4/2) chert. It was

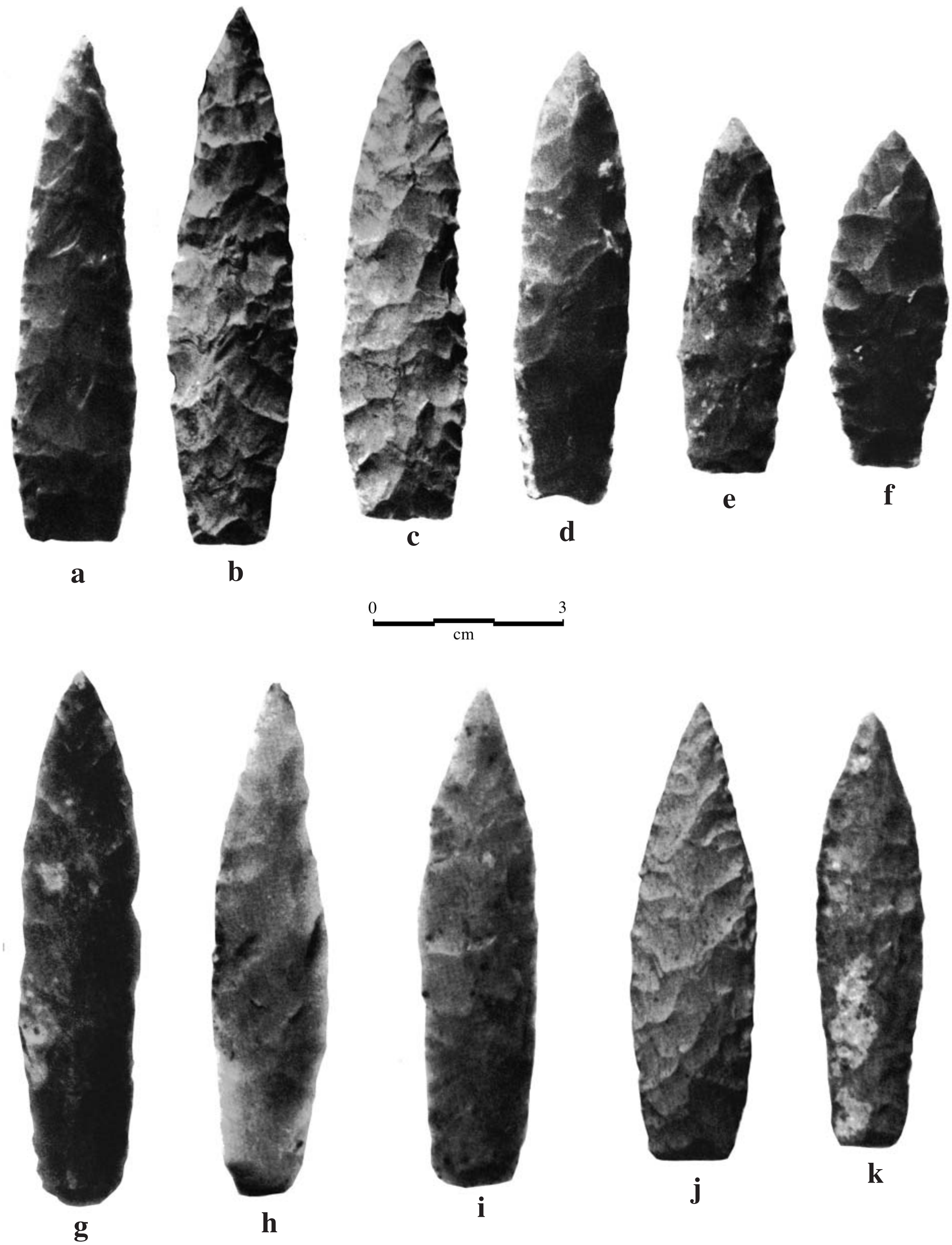


Figure 17-3. Slender lanceolate points from the Kennedy Bluffs site (41BP19) believed to pertain to the Early Archaic. These appear to be examples of the Buckeye type, as provisionally defined in the text. Note the basal rounding on examples g-h. Adapted from Bement (1989:Figure 22).

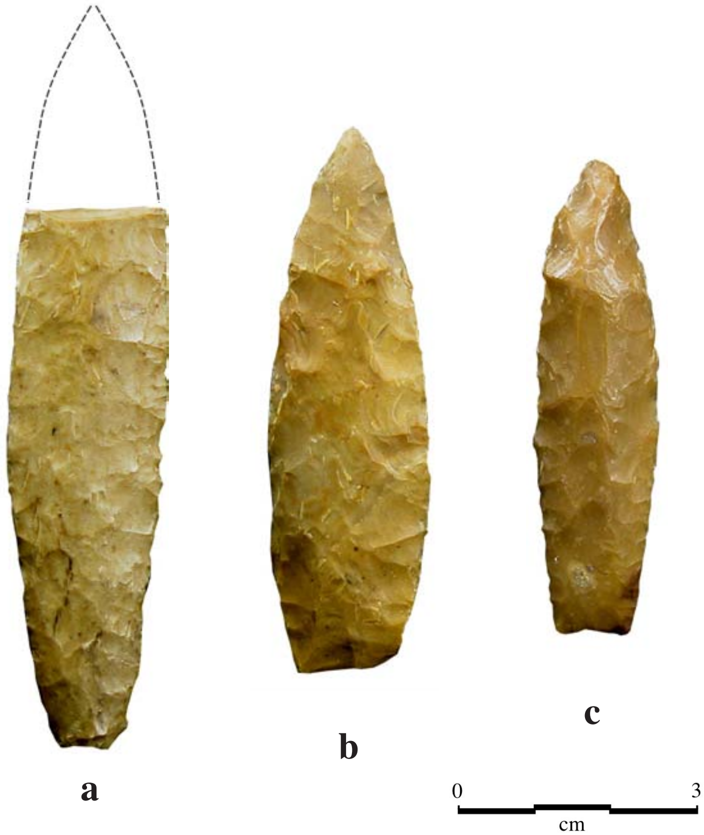


Figure 17-4. Possible Buckeye points from the Morhiss site (41VT1) located in the Guadalupe River valley approximately 8 km north of the Buckeye Knoll site (Artifact photographs courtesy Ms. Laura Nightengale, Texas Archeological Research Laboratory, Austin).

strongly bi-convex in cross section and had a lanceolate outline. It was widest at the mid-section of the blade and had a slightly convex base. There was no edge or basal grinding.

The second specimen of the pair (see Figure 17-5, a-a[1]) was slightly larger, with a length of 188.4 mm, a maximum width of 35.4 mm, and a thickness of 13.1 mm. In cross section it was also strongly bi-convex. Its base was more rounded than the first, and the lateral and basal edges were lightly ground.

Both specimens appeared to have been finished, judging by their precise bilateral symmetry and the presence of fine pressure flake scars along the edges. Both may have been too thick to have served as knives for cutting or slicing, although the concomitant stoutness may have rendered them suitable for use as daggers or thrusting spear points. This interpretation is supported by use-wear analysis (see Barrett, Appendix D), which shows distal-tip attrition on both specimens.

Another biface rested next to the fragmented and disarticulated bones in Burial 21 (see Figures 10-5, 17-5, c-c[1]). It was made of gray (10YR 5/2), fine-grained chert and was well thinned to a slightly bi-convex (relatively flat) cross section. It measured 102.7 mm long, 35.1 mm in maximum width, and 8.9 mm thick. The edges displayed fine, short pressure flake scars and were not ground. This specimen could have served as a knife for cutting and/or slicing tasks. Use-wear analysis (see Appendix D) suggests light wear and only brief use.

An oversize, fluted-stem biface (see Figures 17-6 and 17-7) was found lying flat beneath the leg and pelvic bones of Burial 74 (see Figure 10-8). This was a most unusual artifact, unique at Buckeye Knoll and, for that matter, anywhere else, to the writer's knowledge. It measured 276.8 mm long, 84 mm in maximum width, and 10.6 mm in maximum thickness. The specimen was virtually intact, missing only the extreme distal tip and one corner of the base of the stem. The original length would have been an estimated 287 mm. This artifact was the product of a master flint knapper. The blade was remarkably thin for its size, with a nearly uniform thickness over most of its length. In cross section, the blade was nearly flat, a result of the removal of broad, shallow flakes by means of well-controlled, soft-hammer percussion. These thinning flake scars tended to "dive" at their termini

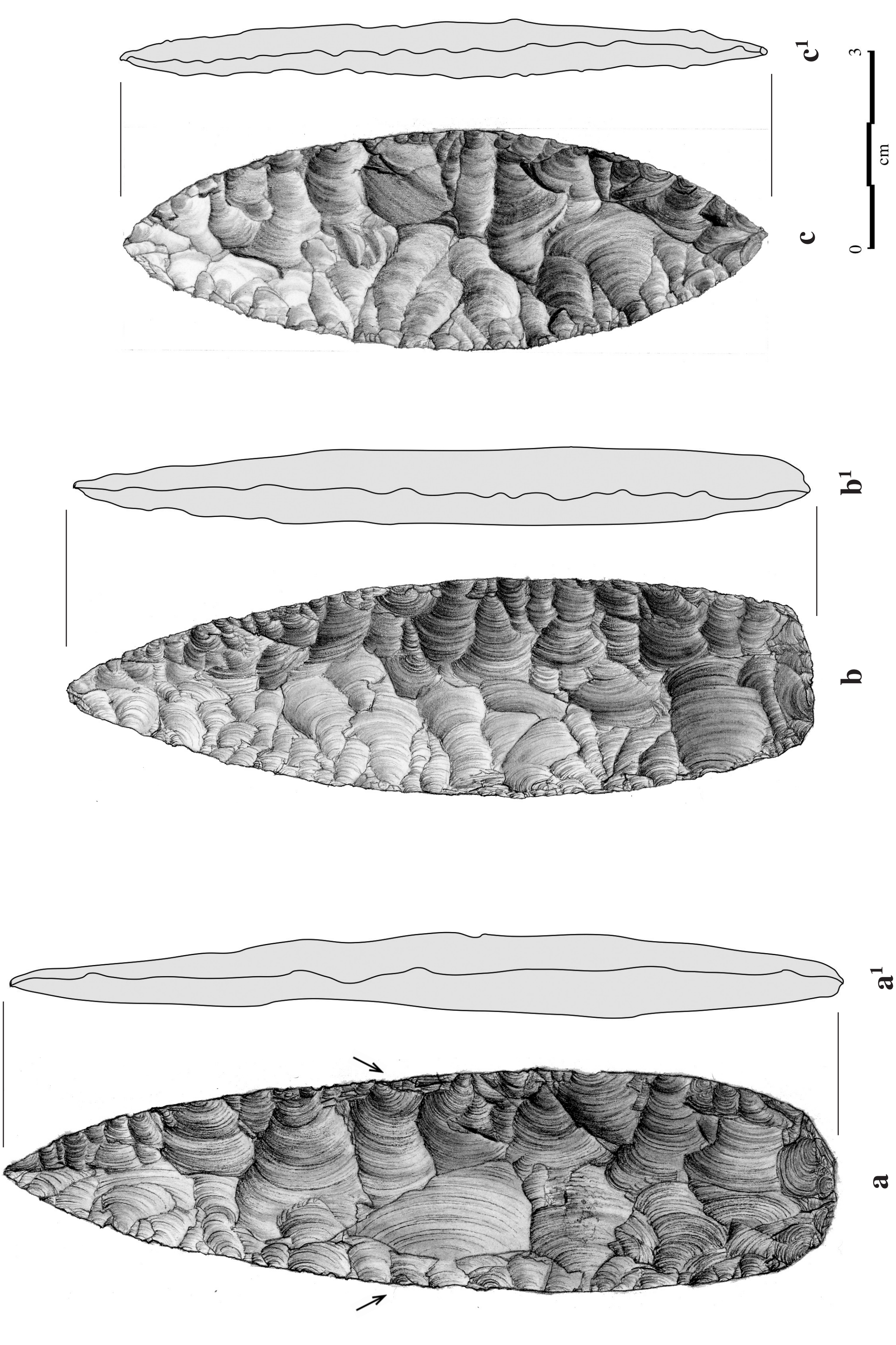


Figure 17-5. Additional bifaces associated with burials at Buckeye Knoll: a-b^1, bifaces associated with Burial 1-B (Arrows indicate the extent of edge grinding where present. As discussed in the text, use-wear analysis of these artifacts suggests use as daggers or points on thrusting spears.); c-c^1, bi-pointed biface associated with Burial 21.

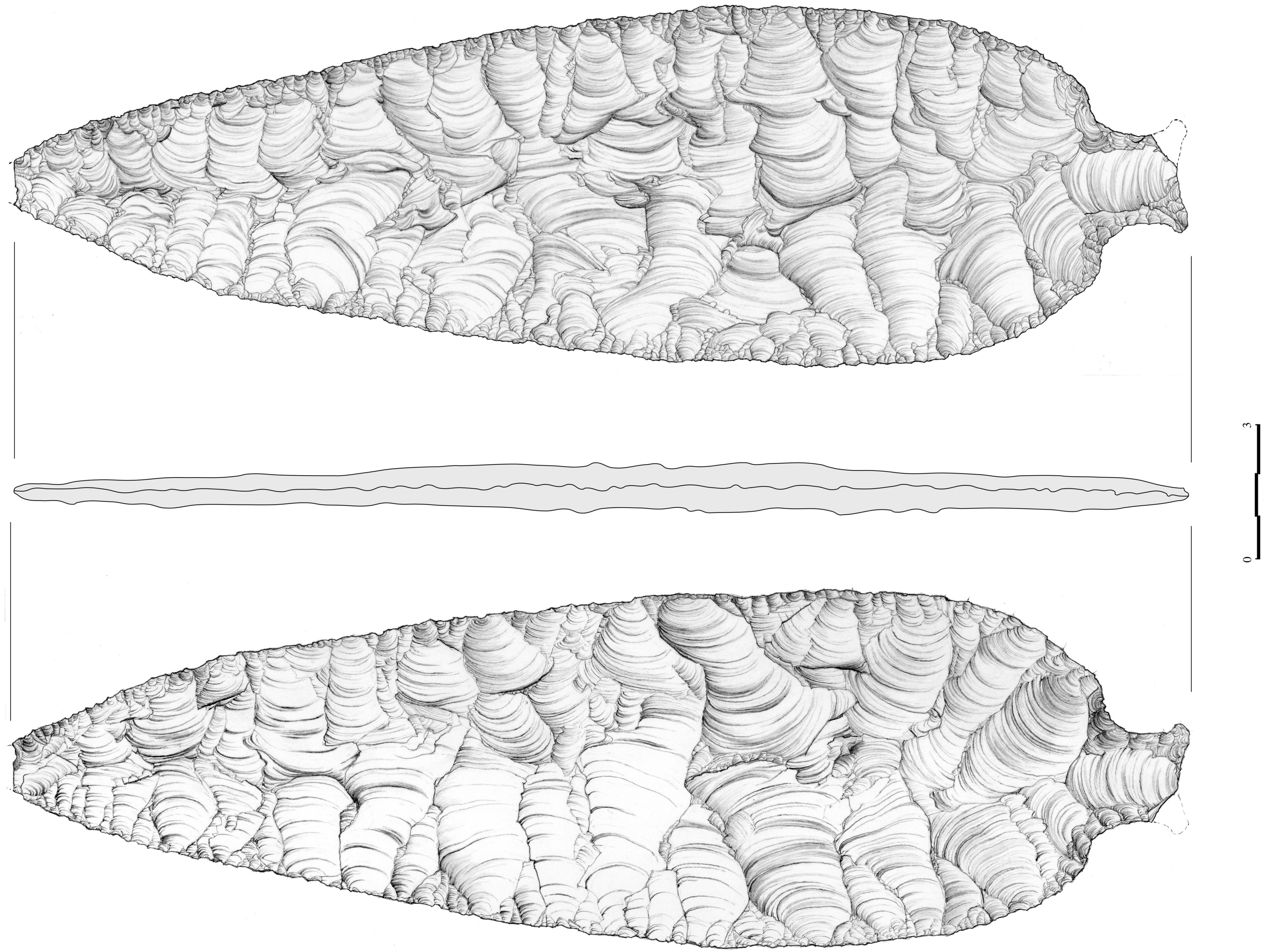


Figure 17-6. The oversize, stemmed, fishtail biface associated with Burial 74 at Buckeye Knoll.

Figure 17-7. Watercolor painting by Alexander Cox showing the colors of the resilicified brecciated cherts in the oversize biface shown in Figure 17-6: (left) watercolor painting alone; (right) watercolor painting overlaid with flake scars.

along the centerline of the blade, which, in places, created a slight central trough. The edges of the blade had been carefully finished by means of minute pressure flaking. The workmanship was so expertly controlled that the piece's edge line is quite straight in profile, showing not the slightest wobble or undulation (see Figures 17-6 and 17-7).

The proximal end featured a stem that flared at the base, creating a "fishtail" shape. The base of the stem was gently concave, and the lateral edges displayed heavy edge grinding. Both faces of the stem were carefully fluted, with channel flake scars running from the base upward along the length of the stem and onto the proximal faces of the blade. The stem edges were neatly trimmed by pressure flaking, which left short flake scars that overlapped the edges of the flutes.

The shoulders, at the juncture of the stem and blade, were gently rounded to slightly angular and lacked any projections or barbs. From the shoulders, the lateral blade edges expanded so that the excurvate blade was widest less than half way up its length and then tapered gradually to the pointed distal end.

The raw material from which this artifact was made is most unusual (shown in an accurate watercolor painting in Figure 17-7). It was a resilicified brecciated chert comprised of angular fragments of both a cream-colored opaque chert and a brown, slightly translucent chert. Both materials were fine-grained, and they had been so completely bonded by resilicification that the joints between pieces presented no impediment to flake removal (i.e., the flake removals traveled smoothly across the constituent pieces of chert over the entire artifact).

The geologic and geographic origins of this material are not known with certainty. The cream-colored and brown cherts do have visually similar counterparts in the cherts from the Edwards Plateau in Central Texas, with the brown material reminiscent of material from the southern part of the Plateau and the cream-colored material resembling thickly patinated chert from the same area. When the artifact was placed under ultraviolet light, both materials were seen to strongly fluoresce a strong yellow to yellow-orange color, as is typical of Edwards Plateau cherts (Michael B. Collins, personal communication 2004). While this suggests a central Texas origin for this material, cherts from other regions can similarly fluoresce, so this effect cannot be taken as definitively diagnostic.

This artifact was shown to a number of professional archaeologists with long familiarity with the cherts and flaked-chert artifacts of Central Texas, including Stephen L. Black, Michael B. Collins, Glen T. Goode, Grant D. Hall, Thomas R. Hester, and Harry J. Shafer. None of these individuals was able to confidently identify it as from that region, and none recalled seeing this kind of resilicified brecciated chert from that area. Glen Goode (personal communication 2004) did suggest, with the caveat of uncertainty, that the material *might* have come Bandera or Kerr Counties along the southern part of the Edwards Plateau. While it can be suggested that Central Texas may be the source area for the material, this cannot be asserted.

The morphology and flaking technology of the specimen merit special consideration. The potentially temporal and/or culturally diagnostic portion of the artifact is the proximal end, specifically from the shoulders to the base of the stem. In both outline and flaking patterns, this part of the biface is virtually identical to only one presently known type of biface, the fluted fishtail points (FFPs) from Central and South America that date to the Paleo-Indian period, ca. 10,800-10,100 B.P., uncalibrated (Morrow and Morrow 1999:225). FFPs have been documented from a vast area, from southern Mexico and Belize in the north, southward along the Andean Cordillera to the El Inga site in Ecuador, and farther south to Fells' Cave in southern Chile near the southern tip of South America (Bird 1969; Mayer-Oakes 1986; Pearson 2002; León 2006). Thus, this point type has an extent of distribution that is comparably vast as that of the Clovis type in North America.

Fluted Fishtail Points (see example in Figure 17-8) typically have, as the name suggests, a distinct stem that flares at the concave base, giving it a "fishtail" shape. The stems are frequently unifacially or bifacially fluted and edge trimmed by short, well-controlled pressure flaking and typically display heavy edge grinding. The stem edges merge with blade edges at unbarbed, often gently rounded shoulders. Thus, in shape and technique of production, the specimen from Buckeye Knoll is virtually identical to the FFP, the sole difference being, of course, the greatly oversized dimensions of the blade. Michael Collins has pointed out that many of the known specimens of the type are likely to have reworked blade edges, meaning that they were originally considerably larger, perhaps in some cases comparable in size to the Buckeye Knoll specimen (Michael B. Collins, personal communication 2006).

Figure 17-8. Basal portions of the oversized, fluted-stem biface from Burial 74 at Buckeye Knoll (left) and a typical stemmed Fluted Fishtail Point from Belize, Central America (right).

Strictly based on these observations, the Buckeye Knoll specimen can be classified as an oversize variety of the FFP type. This ascription is further supported by the flaking technology exhibited on the blade. The pattern of thinning by removal of very broad, shallow flakes, struck off using a soft-hammer tool, with plunging flake termini resulting in a central trough, is also a common feature on the southern FFPs (Pearson 2002). Logically, the only alternative to this classification is to posit that the close similarities between the Buckeye Knoll biface and FFPs in terms of shape and multiple aspects of flaking technology (i.e., bifacial fluting, stem edge trimming, and broad and shallow billet flaking on the blade), as well as heavy stem edge grinding, are all coincidental convergences. Unfortunately, there is no way to calculate the likelihood of such convergences in terms of statistical probabilities, given that they are all qualitative, rather than quantifiable, variables. Intuitively, it seems a long reach to suggest that the multidimensional aspects of the Buckeye Knoll specimen would replicate the form of the FFP type accidentally or randomly.

Glen Goode, a Texas archaeologist who is also an experienced flint knapper, on observing this artifact and comparing it to images and cast replicas of FFPs from Central America, stated that in his view, such an accidental convergence would be virtually impossible, given the specific sequence of technical maneuvers that would be required to produce the finished form. This sequence would have included the following steps. Initially, it would involve early stage biface thinning that produced a preform upon which the final thinning could effectively be accomplished by soft-hammer removal of broad, shallow thinning flakes. Next, the stem would have to be created with a basal configuration amenable to removal of flutes on both faces. Then, the stem would have to have been trimmed to produce the characteristic fishtail form. This would be followed by heavy grinding along the stem edges. The process would require control over the total biface thinning process that was structured by the premeditated intention of producing a perform on which the stem and shoulder shape could be produced without late-stage forcing of the shape so as to risk breakage of the artifact.

To accept that the Buckeye Knoll specimen is in fact a true FFP, made according to a specifically preconceived and known design and thus an intended, culturally recognized type, raises a host of interpretive challenges. These can be articulated in terms of the following factors. First, a FFP in the Buckeye Knoll cemetery is geographically incongruous, in that the northernmost known distribution of FFPs is southern Mexico and Belize, at least 1,000 km distant. While the northern extent of the distribution of the type is perhaps inconclusively defined, and additional specimens may eventually be documented from central or even northern Mexico, with present knowledge, the Buckeye Knoll FFP is far removed from the type's geographical range.

Second, if accepted as a representative of the type, the Buckeye Knoll biface is also chronologically out of place. FFPs are dated to earlier than 11,600 years B.P. (calibrated) in Central and South America (Morrow and Morrow 2006:225). However, Burial 74, with which the Buckeye Knoll specimen is clearly associated, has been dated (by AMS on bone collagen) to a calibrated age range of 6670-6580 B.P., a discrepancy with the age of FFPs of some 5,000 years. Since the age of the burial accords with the cemetery in general, dated on the basis of 20 other AMS assays representing as many individuals, there is no reason to doubt its reliability. This means that the age difference cannot be explained on the basis that the burial is inaccurately dated.

It follows that the presence of an FFP (again, presupposing acceptance of that typological identification) at Buckeye Knoll must be explained by mechanisms that, while speculative, are at least possible. However far-fetched these may seem at first glance, it is reasonable to suggest that the following explanations are possibilities. It could have been that the people who buried their dead at Buckeye Knoll obtained the biface in question from contemporaneous folk living elsewhere, perhaps in what is today Mexico. If that were the case, then the latter group must have come to possess the artifact through inheritance (i.e., it was held by an individual, perhaps a member of a long-lived lineage within that local society) or by means of finding the artifact at its location of original deposition, or perhaps displaced naturally in a context of secondary deposition. Perhaps, the Buckeye Knoll people obtained the artifact directly by traveling southward and discovering it at the location of its original deposition or at a location of secondary deposition. The largely intact and unweathered condition of the specimen would seem to minimize that possibility, however. Alternatively, the creators of the Buckeye Knoll cemetery inherited the artifact from a member of their own society, meaning that it had been possessed for a long time, passed down from generation to generation, having reached their homeland at an earlier time, perhaps in the distant past.

In sum, there is no easy explanation for the presence of this artifact at the site. Given that other artifact forms found in the cemetery are also geographically incongruous (e.g., the bannerstones to be described further on), the distance of this biface from its expectable range is not altogether exceptional. The descriptions and discussion below will show that the Buckeye Knoll people were engaged in sharing of stylistic information and/or materials over a very wide area or areas. The other items suggest connections to the north/northeast rather than the south, but the distances involved may have been comparable. Explaining the temporal incongruity is perhaps even more difficult, again assuming that the Buckeye Knoll biface is, in fact, a true example of the Fluted Fishtail Point type.

Several facts should be noted which, while they do not prove anything, are at least supportive of the idea that the specimen was curated for what had to have been, in human terms, an enormously long time. First, it is notable that the greatly oversized dimensions of the piece strongly suggest that it was an exceptional "ideotechnic" or "sociotechnic" artifact (*sensu* Binford 1962) of special, presumably ritual or ceremonial, significance. Large oversize bifaces are well known from other regions (e.g., the Southeastern United States.) for this and later time periods, and they have been inferred to be of ceremonial function, perhaps representing prototypes for ceremonial "swords" documented for certain historic Southeastern groups (Brookes 2005). Certainly, the Buckeye Knoll specimen must have been too large (and therefore too fragile and unwieldy) to have been used in ordinary domestic tasks. Residue testing on the specimen failed to find any traces of animal or plant residues (see report by Puseman and Cummings in Appendix C), nor was any use wear observed under SEM microscopy (see use-wear analysis discussion by Jason Barrett in Appendix D), which combine to suggest that it was not used for butchering or other mundane techno economic activities. If this is true, then the artifact must have had a very special, even sacred, significance, which would help to explain why it was kept and passed down more or less intact through many generations. Finally, while use-wear analysis found no evidence of use as a tool, it did reveal a light "prehensile" wear over the faces of the artifact, such that the ridges between flake scars were seen to have been slightly worn (see Appendix D). This wear is suggested to be the result of oft-repeated handling, as would be expected in a long-curated heirloom piece.

Bifacial Preforms

A tightly clustered group of seven performs (and three large cortical flakes), designated as Feature 18, was found near Burial 6. These items rested at the same level, and in close proximity to, the bones and are believed to be directly associated with that burial, along with a number of grooved stones. The positions of performs can be viewed in Figure 10-3, wherein it can also be seen that they rested near some of the grooved stones.

The dimensions of the seven specimens are listed in Table 17-2, and the preforms are illustrated in Figure 17-9. Lengths ranged from 87.6 to 110.4 mm, maximum widths from 43.4 to 59.3 mm, and thickness between 11.0 and 22.4 mm. All specimens were made from chert cobbles, and one retained cortex on one face. Generally, use-wear analysis showed all these specimens to be unused as tools, corroborating the assumption that they were not finished products (see Barrett's report, Appendix D).

The color of the cherts ranged from light gray to a darker brownish gray. While it is impossible to know what tool type these performs may have been intended, judging by their sizes, they easily could have been further thinned to produce elongated points, such as the slender lanceolate points found with burials 8 and 43.

A possible dart point perform (see Figure 17-2, c-c[1]) was found in association with Burial 58 (see Figure 10-10). This was a small, pentagonally shaped piece of dark gray chert. It was a flake that had been bifacially trimmed; its crude shape and absence of edge pressure flaking suggested that it was an unfinished artifact, possibly intended to be a dart point. However, use-wear analysis indicated use in cutting and possibly scraping, implying that it may have been a finished tool (see Appendix D). The absence of hafting wear infers that it was hand-held during use.

A lanceolate dart point perform (see Figure 17-2, d-d[1]), associated with Burial 61 (see Figure 10-10), was made from a medium-grained, dark-gray chert. It was slightly longer and wider than the finished Buckeye points from Burials 8 and 43. It featured the scars of fairly broad, shallow soft-hammer thinning flake removals, but its production trajectory was aborted before the final thinning and edge pressure flaking were accomplished. The preform was widest near the distal end and narrowed toward its straight base. The size and shape makes this specimen a likely candidate for a late-stage perform for the kind of slender lanceolate dart point found in Burials 8 and 43.

One other perform from a mortuary context was found associated with Burial 22. This specimen (Figure 17-10, d-d[1]) was fully bifacial, so that none of the cobble cortex remained. Both faces of the artifact had red ochre staining.

Guadalupe Biface

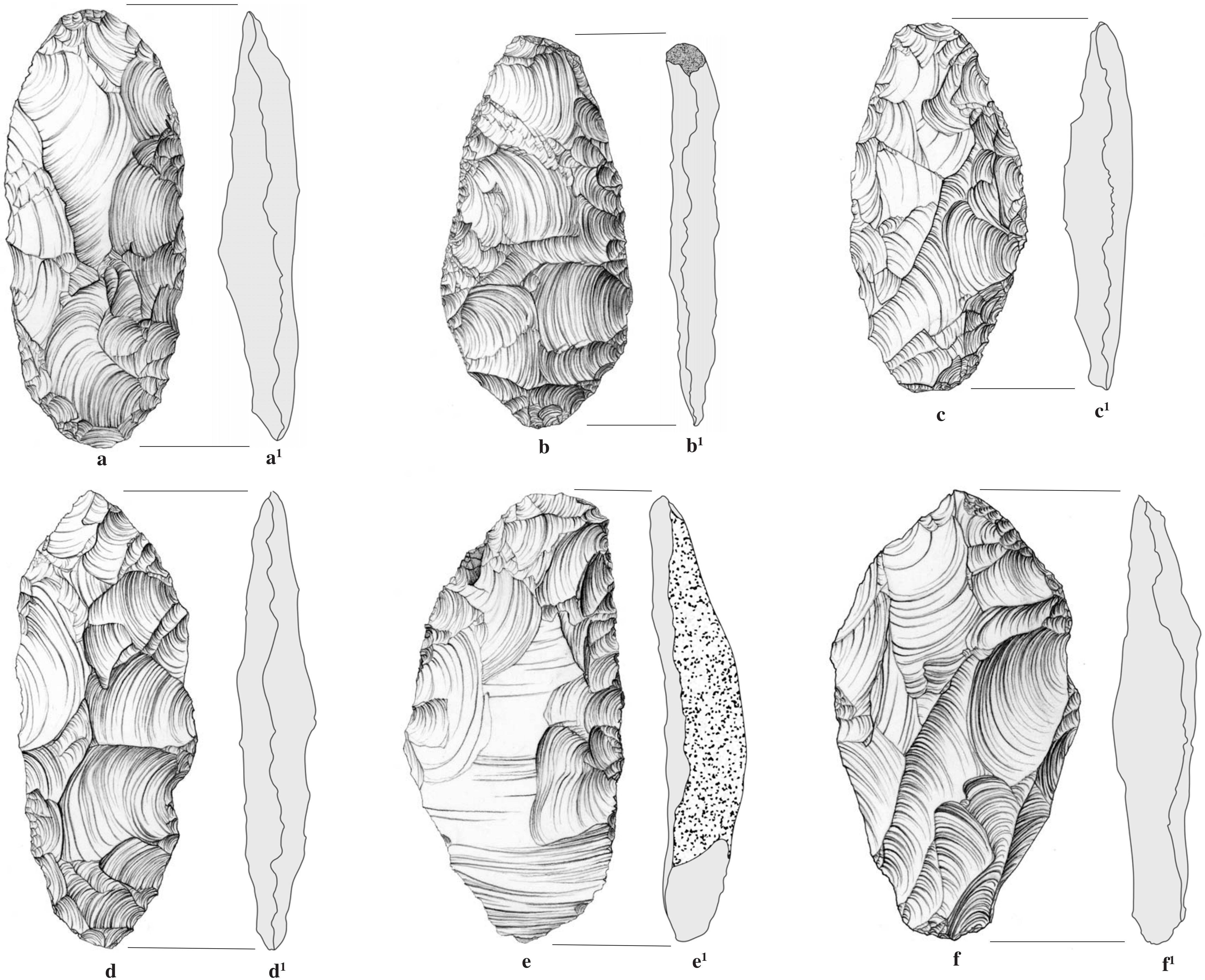
A Guadalupe Biface (see Figure 17-10, e-e[1]) was found resting flat in Zone 3 on grid line W12, at the same level as Burial 58, which was about 50 cm directly to the west (see Figure 10-10). Although a slight distance from the bones of the burial, the association is probable given that this tool type is placed within the Texas Early Archaic, "ca. 3500 B.C. or earlier" (Turner and Hester 1999:256). Therefore, this artifact type chronologically aligns with the general period of the cemetery and is too recent to be associated with the Late Paleo-Indian camp debris found in Zone 3. The specimen from Buckeye Knoll had a steeply truncated bit on the ventral side, opposite which were the long, parallel flake removals typical of the type (Black and McGraw 1985; Turner and Hester 1999:256). It was plano-convex in cross section.

Despite the fact that the Buckeye Knoll site is within the core area of this tool type's distribution (Turner and Hester 1999:256), this was the only specimen found in the excavations at the site. This may be a reflection of the already stated proposition that the site was not used a camping locale during the period of cemetery use.

Large Uniface

An exceptionally large flake of very dark gray (2.5Y 4/1), fine-grained chert was found with Burial 58 (see Figure 10-10). The piece (see Figure 17-10, f-f[1]) measured 199 by 121.7 mm and was 27.2 mm in maximum thickness. It rested flat (on a horizontal plane) at the same level as the associated human bones. The ventral side of the flake featured a prominent bulb of percussion. The dorsal side displayed edge flaking around most of the perimeter that created a beveled margin (the kind seen on unifacial scrapers) on two opposite edges. This artifact, in fact, appears to have been an exceptionally large unifacial scraping tool. The flake had wear polish (the extent indicated by arrows in Figure 17-10, f-f[1]) when viewed under 45X microscopy, suggesting use against soft material such as hide.

The raw material was a good example of Georgetown chert. This was indicated by the dark gray color, the very fine-grained texture, and the white (10YR 8/2), thick (5-8 mm), and chalky patina on the dorsal face. The flatness of the dorsal, patinated surface indicates that the original unworked piece of chert had



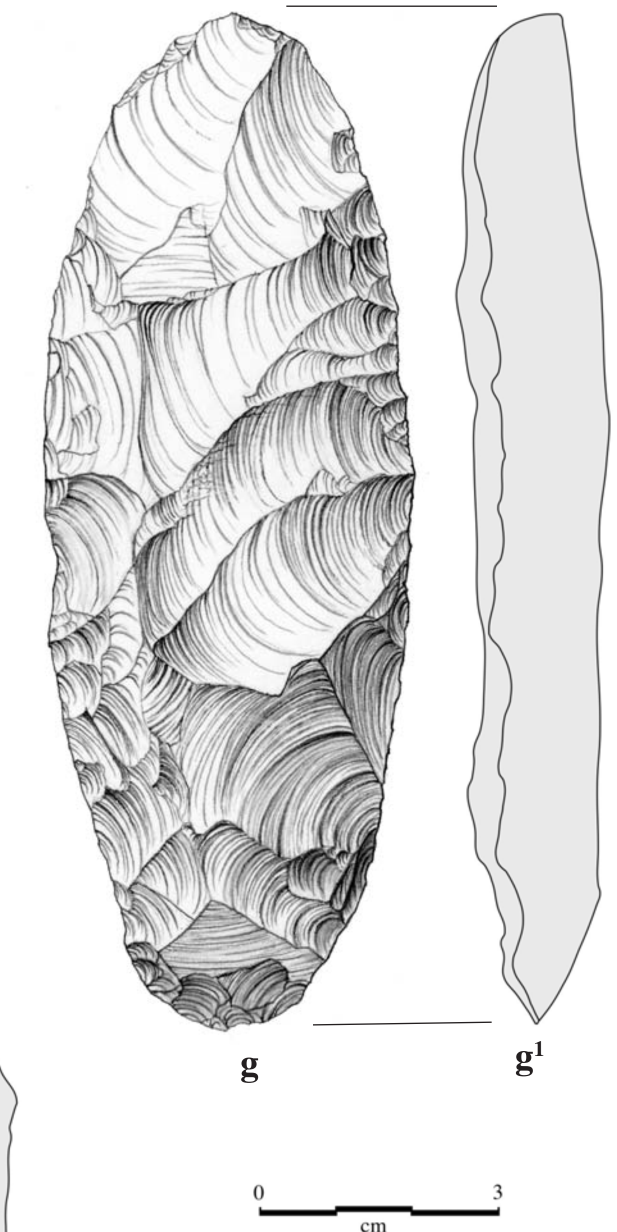


Figure 17-9. Seven bifacial preforms recovered from Feature 18, which was associated with Burial 6 at Buckeye Knoll.

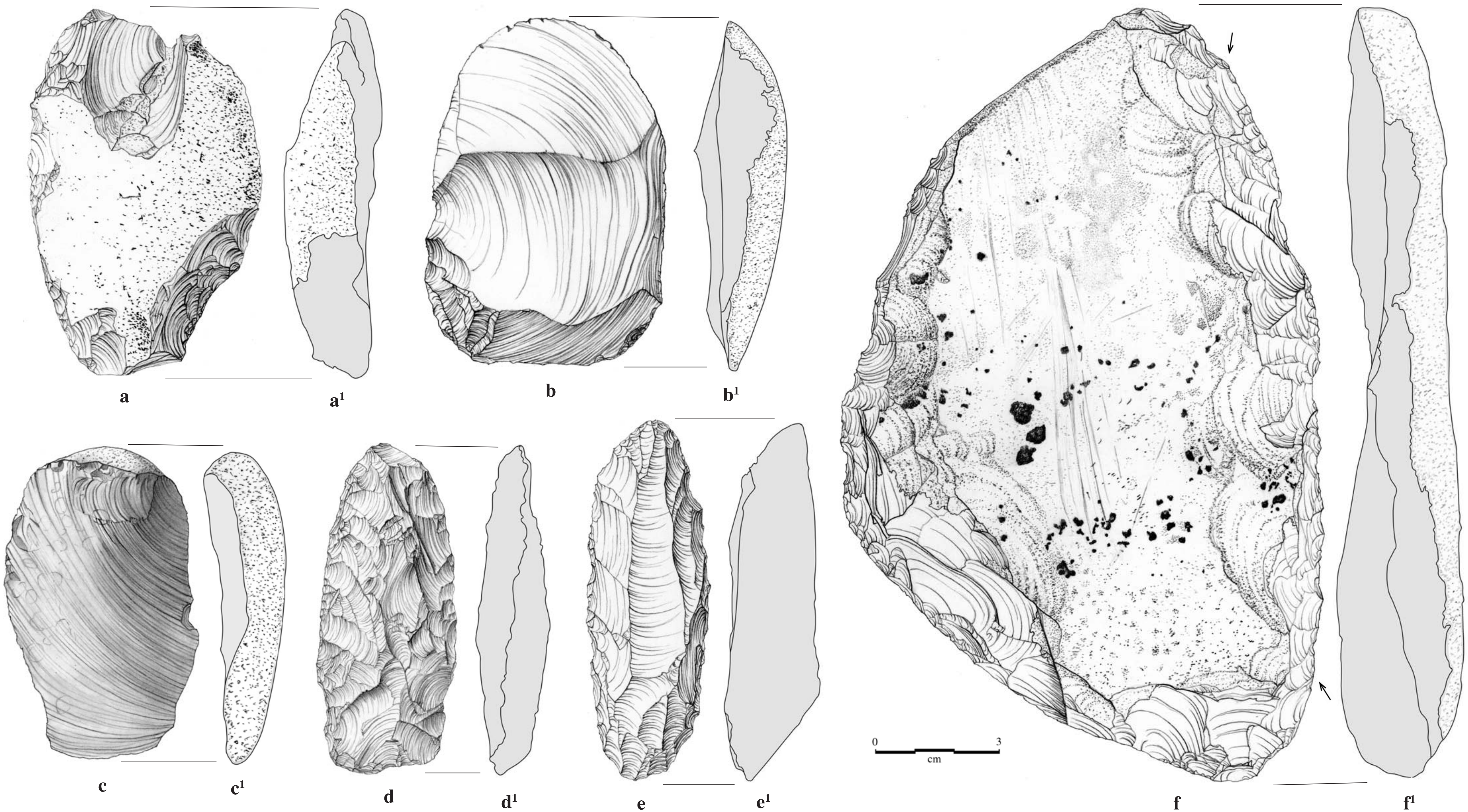


Figure 17-10. Additional lithics associated with burials at Buckeye Knoll: a-c[1], large chert flakes believed to be precursors to early-stage preforms based on their inclusion in Feature 18, a cluster of preforms associated with Burial 6; d-d[1], bifacial chert preform associated with Burial 22 (Both faces of this artifact were stained with red ochre); e-e[1], Guadalupe Biface associated with Burial 58; f-f[1], large uniface made of tabular Georgetown chert (View is of dorsal surface. Arrows delimit the edge wear [polish] visible under 45 microscopy. Note the white, chalky patina remaining on the unflaked portion of the surface).

a tabular form, rather than the rounded cobble shape, which characterizes almost all the other raw materials represented at the site. The tabular form with a white, chalky patina is also typical of the Georgetown material, which originates in Central Texas near the Balcones Escarpment in the area of Georgetown, Texas. It can be concluded that this artifact, or the raw material from which it was made, was imported to the site from that area, some 200 km northwest of Buckeye Knoll.

Chert Flakes

Thirteen chert flakes were found with burials. While chert debitage, thought to be largely of late Paleo-Indian age, was scattered throughout Zone 3 (the stratum containing the cemetery), these thirteen specimens are believed to be associated with graves, based on the facts that they were included within of groups of tightly clustered artifacts in close proximity to human remains. All specimens were made from gray or brown cherts no different in color, texture, or cortical characteristics from the river cobble materials found throughout the site.

Three large cortical flakes were included with the apparent flint knapper's tool kit (Feature 18) associated with Burial 6 (see Figure 10-3). Two of the three (see Figure 17-10 b-c[1]) had little additional flake removal, while the third (see Figure 17-10, a-a[1]) displayed some initial trimming along its edges. As these were recovered from the midst of seven bifacial preforms (some of which retained cortex), it is likely to assume that they were intended for that purpose.

Three flakes (one secondary and two tertiary or interior) were found within the cluster of bone and lithic artifacts associated with Burial 8 and interpreted to be a flint knapper's tool kit (see Figures 10-4, 17-11, a-b[1]). The dimensions of these pieces (and all other miscellaneous flakes from burials) are listed in Table 17-2. The inclusion of these pieces within the tool kit may signify the intention of providing the deceased with raw material to be worked in his "afterlife" existence.

A long and narrow, blade-like flake of dark gray chert (see Figure 17-11, e-e[1]) was found along with an antler (billet?) fragment, a pointed deer medapodial bone (flaking tool?), and a lanceolate dart point, which constituted a small cluster of artifacts (also interpreted as a knapping tool kit) associated with Burial 49 (see Figure 10-9). Two additional non-cortical flakes (see Figure 17-11, c-d[1]) were also recovered from Burial 49. One (see Figure 17-11, d-d[1]) displays prominent flake removal along one edge evidently resulting from use.

Four specimens (two of which are illustrated in Figure 17-11, f-g[1]) were found as a cluster with Burial 65 (see Figure 10-10). One piece was bifacially retouched and may have been a small (length 69.3 mm), early-stage preform. The three other specimens were tertiary flakes. Again, this cluster of flakes may have been intended as a supply of raw material for use in the afterlife.

Ground Stone

Twenty-nine ground stone artifacts were found with burials in the Early Archaic cemetery. These consist of bannerstones (*n*=3), quartzite grooved stones (*n*=17), limestone grooved stones (*n*=5), and limestone plummets (*n*=4).

Bannerstones

As noted above, three bannerstones were associated with burials in the Early Archaic cemetery at Buckeye Knoll. These included two complete winged bannerstones placed with Burial 74 (see Figure 10-8) and one specimen that was found in two pieces with Burial 44-A (see Figure 10-9). All were made of limestone. The two whole specimens were found as a pair, resting together at the base of Zone 3, directly on the underlying silty clay of the Pleistocene Beaumont Formation and in apparent association with Burial 74. Both bannerstones were positioned so that the lower edges rested on the basal clay and one side of each specimen rested against a side of the other one. Both were of the form identified as being of the Semi-Lunar Winged type (Lutz 2000:146-151). David Lutz suggests that this is a relatively early bannerstone type in the eastern United States, with a time range of ca. 5800-3800 B.C. Burial 74 at Buckeye Knoll has been AMS-dated to 4720-4630 B.C. (6670-6580 cal. B.P.), near the middle of Lutz' suggested age range for the type. The type has a wide distribution, with specimens reported from the middle Mississippi Valley eastward through the Midwest to the Atlantic seaboard (Lutz 2000:146-151). Frank Schambach (personal communication 2005) reports that the type is found in Arkansas, where it is usually made of slate.

The larger of the two specimens (Figure 17-12, b-b[1]) was made of a relatively hard, fossiliferous gray limestone. It was 145.1 mm long, 54.0 mm wide at the center, and weighed 173 g. The maximum thickness was 23.4 mm along the centerline of the barrel. It was

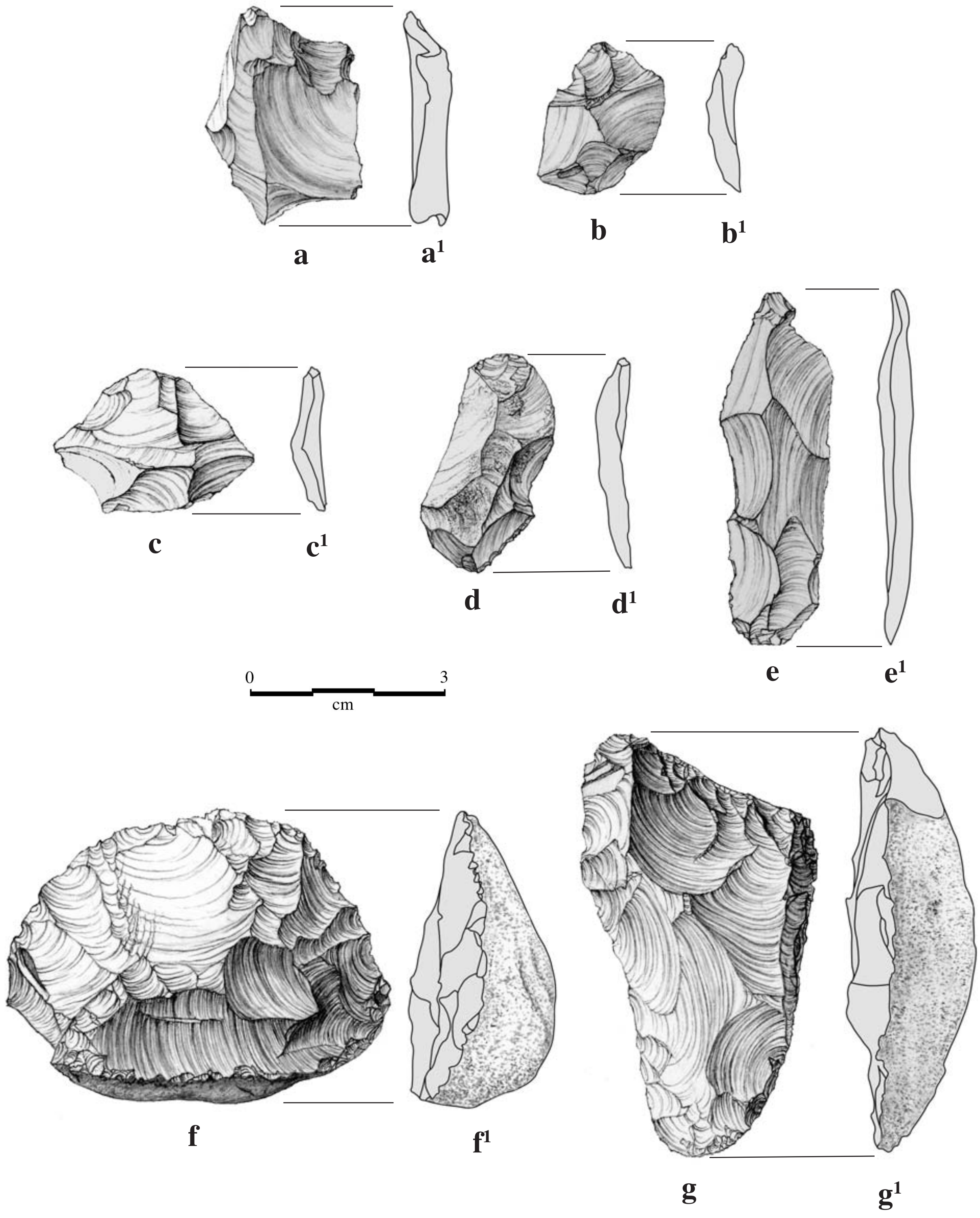


Figure 17-11. Additional lithics associated with burials at Buckeye Knoll: a-b[1], chert flakes from the tool kit with Burial 8; c-e[1], chert flakes from the tool kit with Burial 49; f-g[1], chert flakes from Burial 65 (Both are thick cortex flakes with edge trimming on one face.).

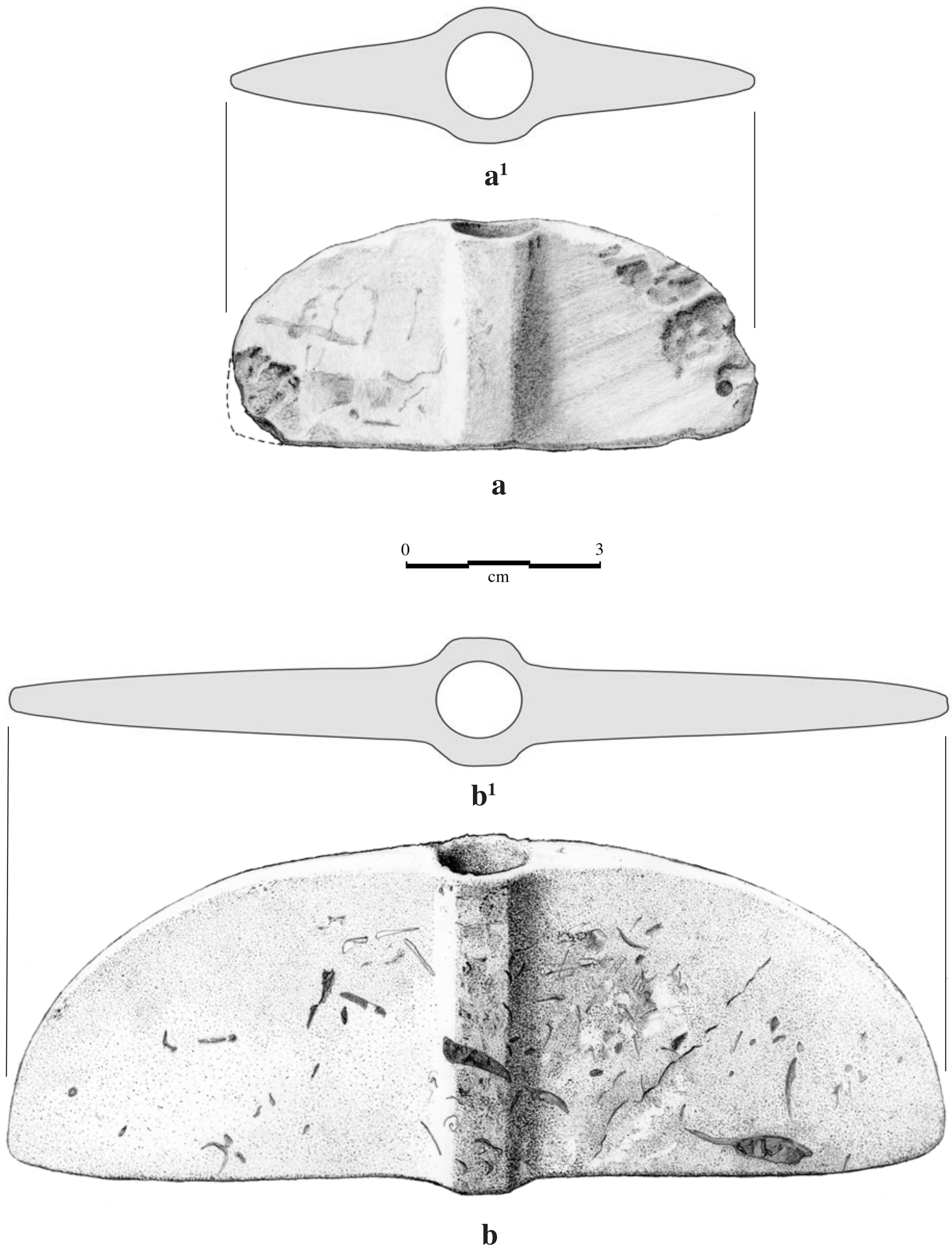


Figure 17-12. A pair of semi-lunar winged bannerstones found together with Burial 74 at Buckeye Knoll. Both are made of limestone; the bottom specimen is made of fossiliferous limestone.

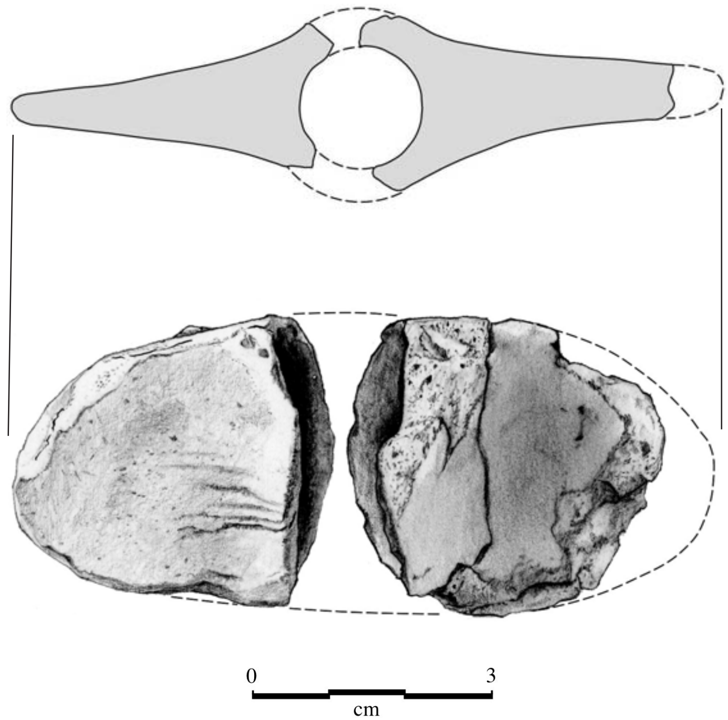


Figure 17-13. A limestone bannerstone found in two pieces and associated with Burial 44-A at Buckeye Knoll.

skillfully made, with a straight, angular barrel (i.e., thickened mid-section) through which was drilled or bored a circular perforation 13.5 mm in diameter. The evenness and consistent circularity of the hole suggests that it was bored, perhaps using a piece of hard cane with an abrasive material such as sand. As may be seen in the cross-sectional diagrams in Figure 17-12, the "wings" tapered gradually and evenly in thickness from the mid-section, next to the raised barrel, to the ends. The edges were all ground flat at right angles to the sides. The surfaces of the piece were finely smoothed, although in places slightly roughened by weathering, probably from ground water acidity.

The smaller specimen (see Figure 17-12, a-a[1]) measured 84.8 mm long by 35.8 mm wide, and weighed 79.8 grams. The maximum thickness was 22.2 mm along the centerline of the barrel. Like the other specimen, the center hole was circular and evenly drilled, with a diameter of 14 mm. The barrel was, again, straight, and displayed an angular but rounded ridge on both sides. The edges were, as in the larger specimen, ground flat to form a series of surfaces at right angle to the sides. The material was a hard, non-fossiliferous brownish gray limestone. The artifact was complete, although it had small flake scars on one side of the ends, seemingly from minor impact damage prior to burial (see Figure 17-12, a-a[1]).

As noted above, the third bannerstone (Figure 17-13) was found in two pieces, associated with Burial 44-A. This specimen also conformed to the Semi-Lunar Winged type. As was the case with the aforementioned pair, it rested at the base of Zone 3 and on the surface of the underlying Beaumont clay. The two pieces were close (within several cm) to one another. The two fragments were of similar size, representing two halves produced by a break along the centerline of the barrel. The material was a rather soft, friable light gray limestone, and the fragments had suffered extensive weathering. Given that a considerable force would be required to break the artifact in two, and the fact that the broken edges were not in immediate proximity to one another (as would be the case if the break was caused *in situ* by ground pressure), it is inferred that it was intentionally broken and placed with the grave in a ritual "killing" of the artifact. Although appearing to pertain to the same original bannerstone, the fragments were not conjoinable, probably due to weathering of the broken edges. Thus, the original length can only be estimated to have been approximately 82 mm. The combined weight of the two pieces was 37.4 g. The width measured 37 mm, while the maximum thickness was estimated to have been 23 mm. The size was, then, nearly identical to the smaller of the two specimens from Burial 74. It differed from both of those artifacts, however, in having a smoother, less angular slope from the surfaces of the wings to the center of the barrel. Also the edges were not neatly flattened to a right angle with the sides. The central perforation was estimated to have had a diameter of 13.5 mm, similar to the diameters of the holes in the Burial 74 bannerstones.

Bannerstones are rare in Texas, and very few are known from the coastal plain. A fragmentary specimen made of an exotic greenstone was recovered by the early excavations at the nearby Morhiss site (41VT1), and is presently curated in the collection from that site housed at the Texas Archeological Research Laboratory (TARL). That specimen, shown in Figure 17-14, b-c, is also of the Semi-Lunar Winged type. The pertinent original field notes record that this item was found near the surface, and there is no indication that this bannerstone was associated with a grave. Hester (2002) has reported an unfinished bannerstone of the same type found by a collector in Coryell County, Texas. The specimen, made of reddish sandstone, has a distinctly raised barrel section and an unfinished central perforation. Hester (2002:1) suggests that this bannerstone may be 4,000-5,000 years old, based on its apparent association with Bulverde dart points. A third bannerstone was found on Padre Island. That piece (see Figure 17-14, a) is of the Notched Wing type (Lutz 2002), as it bears indentations (often expressed as deeper notches on this type) at both ends of the central barrel section, which, on that specimen, is thickened but not ridged. Lutz (2002:153) suggests that this type was made slightly later than, and developed from, the Semi-Lunar Winged type, with an age range at ca. 4,500-3,500 B.C. The specimen from Padre Island is made of a green, faintly banded slate, a recurrent material type for many of the numerous bannerstones reported from the Ohio Valley region (see Lutz 2000).

The very limited evidence suggests, then, that bannerstones are quite rare in Texas and those that have been found are of relatively early types that pertain to the Middle Archaic (ca. 6500-4500 B.P.) in the Southeast and the Midwest. Common later types in those regions, which present a considerable range in forms, appear to be extremely scarce or non-existent in Texas.

The function of bannerstones is not altogether clear. Based on their association with bone/antler hooks and handles in Archaic burials in Kentucky, it has been suggested that they were attached to atlatls as weights that optimized the force of the spear-thrower stick (Webb 1950). Lutz (2002) suggests that bannerstones are symbolic and that different shapes represented correspondingly distinct clans. The findings at Buckeye Knoll do not add any clarity to this issue, although the fact that the other items found with Burial 74 (i.e., hundreds of marginella beads and the oversize stemmed biface) are probably of non-mundane decorative and/or ceremonial significance might suggest a similarly non-mundane function for the associated bannerstones.

Grooved Stones

Twenty-two artifacts associated with the Early Archaic burials at Buckeye Knoll were grooved stones. Seventeen were made of fine-grained quartzites ranging in color from very dark gray to various shades of red, brown, purple, and, in one case, nearly white. The remaining five specimens were made of tan limestone. All were oblong in shape. The limestone specimens were oval, while the quartzite ones varied considerably in length-to-width ratios and frequently had elegantly flared ends. The fact that Burial 65 contained a pair of grooved stones resting next to one another (see Figure 10-10), one limestone and the other quartzite, indicates contemporaneity, and perhaps functional equivalence, for the two varieties.

The quartzite specimens were, as a group, very well made. All had a rather wide, shallow groove that completely circumscribed the long axes of the stones. Generally, the surfaces were very well smoothed, in many instances to a dull polish, while the grooves frequently displayed the rougher surfaces left by the pecking process that produced them. Generally, the grooves were 8.0 to 13.6 mm wide and only 0.5 to 2.0 mm deep. All specimens featured a very well executed bilateral symmetry. While it is likely that the raw material employed to make these items were small cobbles, the pecking, grinding, and polishing of the surfaces had removed the original natural surface contours. The virtually perfect symmetry in the shapes was the result of extensive reshaping of the original cobbles.

All of the recovered specimens are shown in the accompanying figures (Figures 17-15 through 17-17). The illustrations show the range in shapes displayed by the sample of quartzite specimens, from short (relative to width) to elongated with graceful curvatures at the flaring ends. As may be seen in Figure 17-18, the specimens tended to fall into two morphological groups—relatively short (on the one hand) and distinctly more elongated on the other, as indicated by a bi-partite clus-

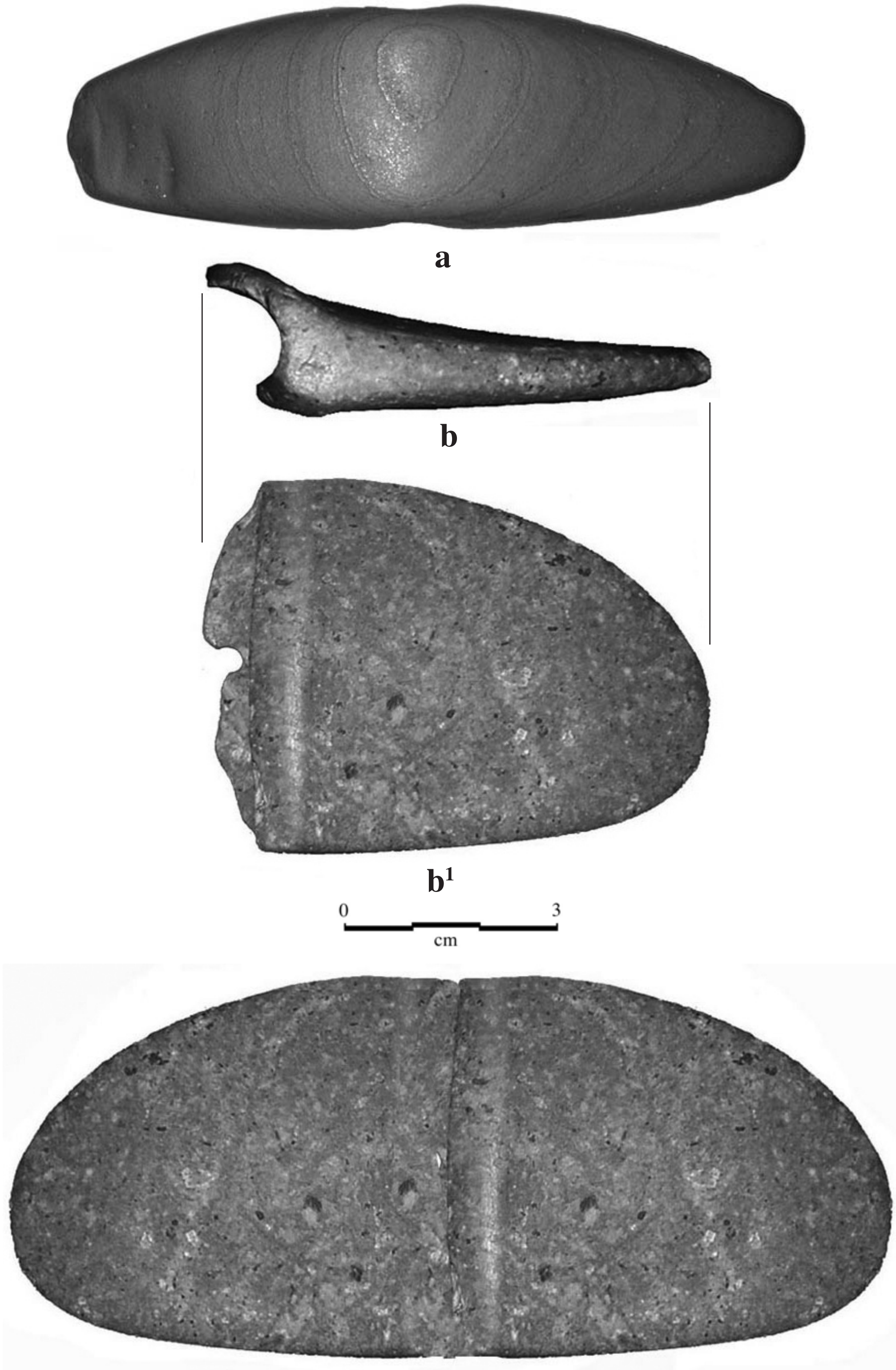


Figure 17-14. Winged bannerstones from other sites along the Texas Gulf coast: a, notched wing type bannerstone recovered as a surface find from Padre Island (Photo courtesy of the Padre Island National Seashore); b-b[1], semi-lunar winged type bannerstone from the Morhiss site (41VT1) found during WPA-sponsored excavations; c, reconstruction showing the probable appearance of the original, complete bannerstone from Morhiss (The material is a non-local greenstone).

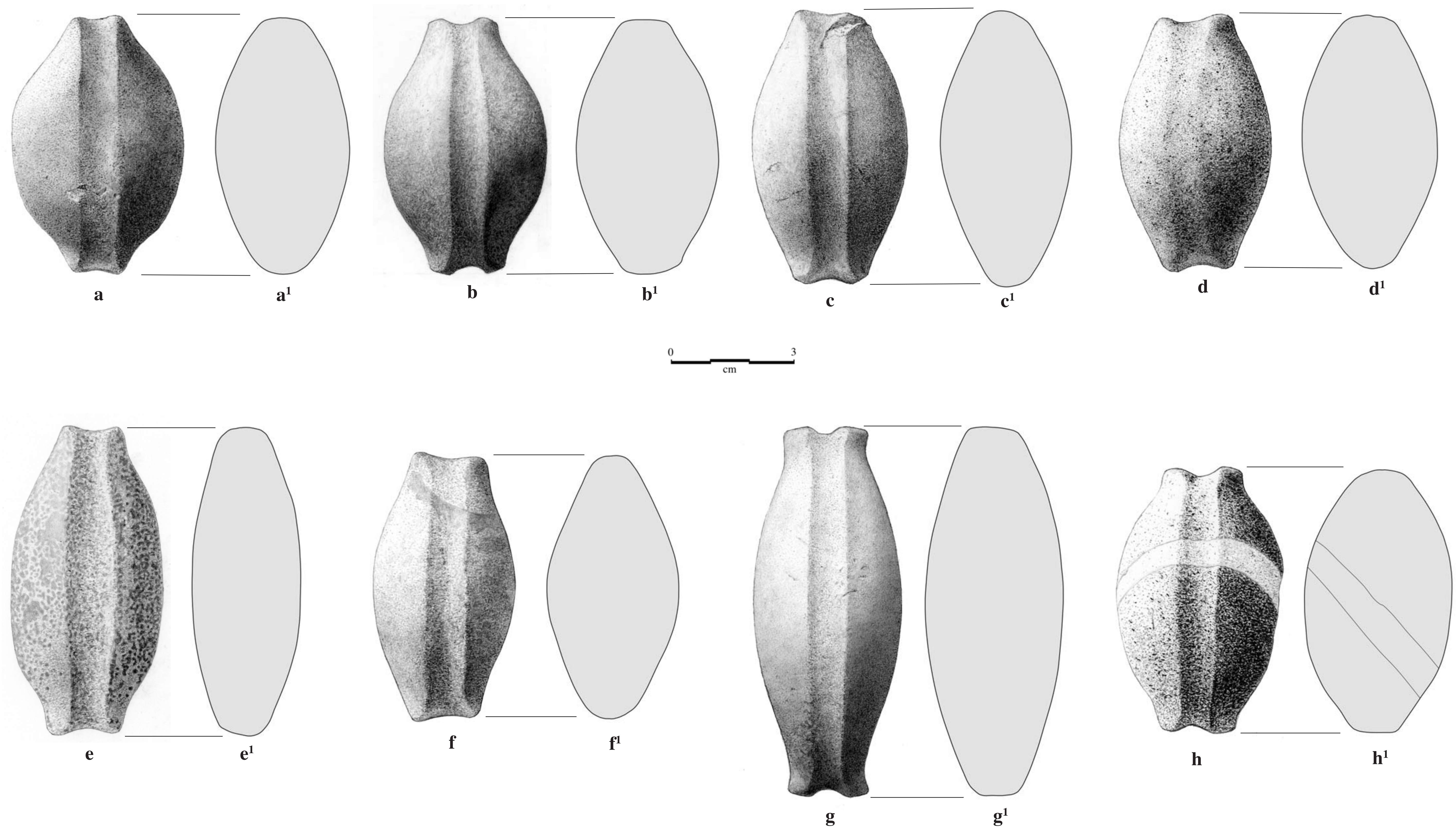


Figure 17-15. Quartzite grooved stones associated with burials at Buckeye Knoll: a-a[1], Burial 5; b-b[1], Burial 11; c-d[1], Burial 27; e-h[1], Burial 6. Note the band of white quartz-grain inclusion in specimen h-h[1]. These examples show the variability in length-to-width ratios in the sample from the site.

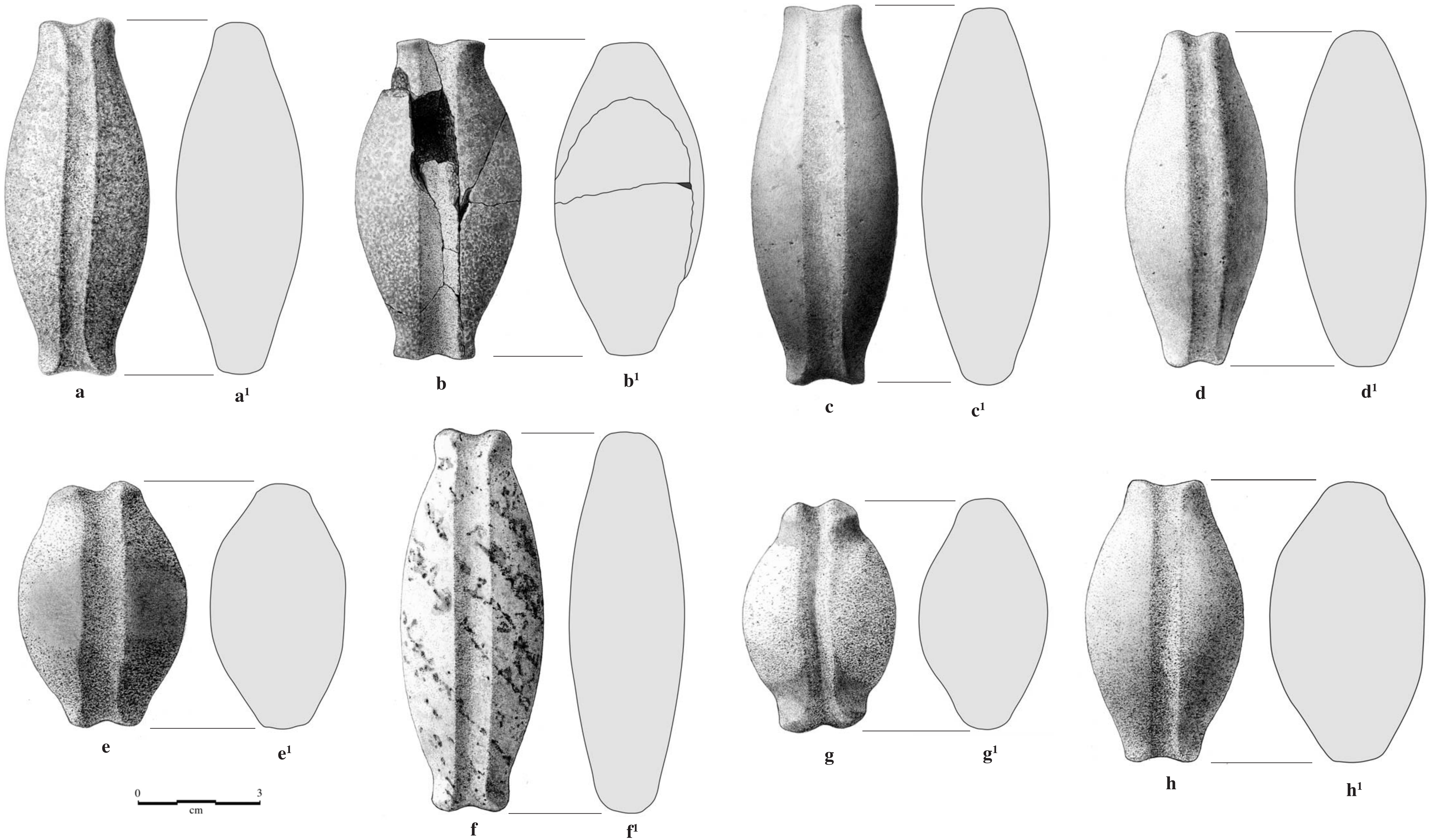


Figure 17-16. Additional quartzite grooved stones associated with burials at Buckeye Knoll: a-d[1], Burial 6; e-h[1], Burial 61.

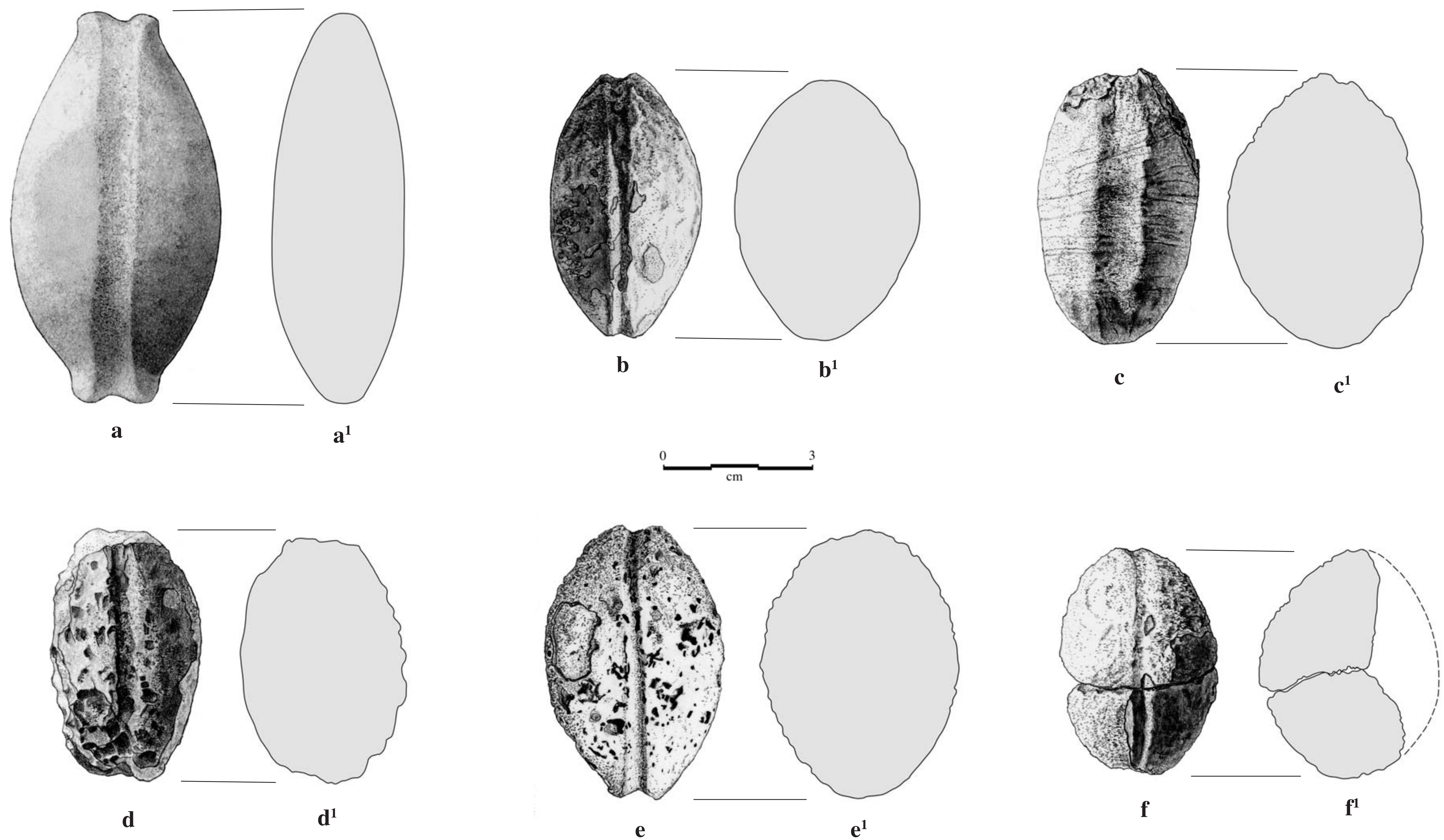


Figure 17-17. Additional grooved stones associated with burials at Buckeye Knoll: a-a[1], quartzite, Burial 65; b-b[1], limestone, Burial 65; c-d[1], f-f[1], limestone, Burial 6; e-e[1], limestone, Burial 28.

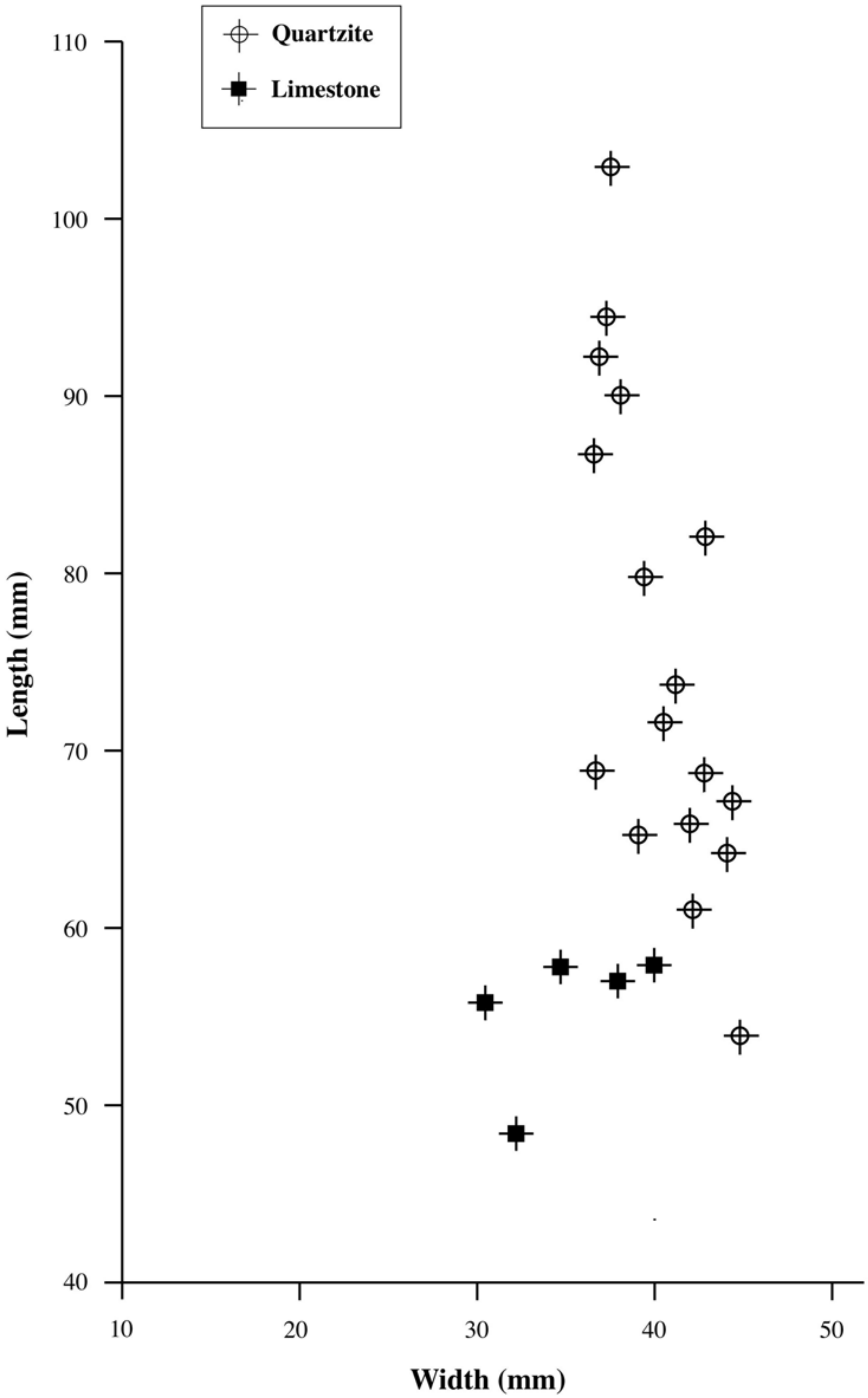


Figure 17-18. A graph showing the distribution of lengths and widths of the grooved stones recovered from the Early Archaic cemetery at Buckeye Knoll.

tering in length-to-width ratios. The ends on all quartzite specimens displayed a pair of projecting nodes on either side of the groove, some of which were rounded, while others were ground flat. Weights ranged between 100 and 172 grams (Table 17-3).

Two quartzite specimens are of special note. One (Figure 17-16, b-b[1]), from Burial 6, made of a deep purple quartzite, was found broken into 13 pieces, all scattered around the human remains in what must have been the grave pit (see Figure 10-3). This breakage was done prior to filling the grave, and probably at the grave site, given the fact that nearly all the pieces were recovered so that the object could be almost completely reassembled in the laboratory. Inferably, this intentional breakage prior to burial was a ceremonial "killing" of the artifact, associated with ritual accompanying burial, and the pieces scattered within the grave. The second unusual specimen was found near, and probably associated with, Burial 6. It was made of a deep purple quartzite, with an inclusive vein of white-quartz grains that formed a band around the circumference of the artifact (see Figure 17-15, h-h[1]). The band formed an arcuate pattern that reached its apogee along the centerline of the artifact, suggesting intentional incorporation of this quartz inclusion into the design of the piece. That this was a local material is suggested by the recovery of quartzite cobbles containing similar quartz inclusions in gravels along the Guadalupe River, just north of Victoria, Texas (Figure 17-19).

The production of these objects clearly must have required a substantial investment of skilled labor. This would have included obtaining suitable quartzite cobbles, which would have been available in the same alluvial gravels that yielded workable chert cobbles (see Collins 2002:153).

Replication experiments performed by Bill Birmingham, an avocational archaeologist residing in Victoria, Texas (Figure 17-20), provide useful insights into the technical requirements and labor investment in producing these artifacts. Working with locally obtained quartzite cobbles, and using another quartzite cobble as a hammerstone, Birmingham was able to replicate a specimen in about 25-30 hours (Bill Birmingham, personal communication 2005). This result indicates that production of the 17 specimens from Buckeye Knoll probably represent approximately 425-510 person-hours of labor investment.

The limestone specimens (see Figure 17-17, b-f[1]) were all of a simpler configuration, lacking the flared ends of the quartzite pieces. Additionally, the grooves in the relatively soft limestone were, with one exception (see Figure 17-17, c-c[1]) V-shaped in cross section, the result of having simply been abraded into the stone. This was in contrast to the broad, shallow grooves in the quartzite specimens, which were painstakingly pecked into the stone with a hammerstone, as verified by Birmingham's experimentation (Bill Birmingham, personal communication 2007). Although probably considerably less labor intensive to produce, the limestone specimens did require a significant effort, judging by their bilateral symmetry, an attribute that would have required reshaping (by pecking and grinding) the natural stone. The weight of the limestone specimens ranged from 52 to 107 grams, somewhat lighter, on average, than the quartzite specimens (see Table 17-3). They were also much smaller (in terms of length), as compared to their quartzite counterparts (see Figure 17-18).

The function of the grooved stones is unclear. They are reminiscent of "Waco sinkers," an artifact type long recognized from inland Central, North Central, and East Texas (e.g., Watt 1938; Story 1990; Turner and Hester 1999). It has been suggested, on the basis of redundant association with early dart point types, that Waco sinkers date to Late Paleo-Indian to Early Archaic times (Boyd and Shafer 1997; Story 1990). This appears to be supported by the association of Waco sinkers with strata pertaining to those periods at the Wilson Leonard site in Williamson County (Sullivan 1998). As the name implies, these items have been thought to have served as net sinkers. This, however, is by no means certain, and their function remains unknown. It has also been suggested that they may have been used as "bolas stones" (Hester 1980: 118; Turner and Hester 1999:316). Six of the quartzite grooved stones from Buckeye Knoll were tested for protein and starch residues. All of results were negative, thus suggesting no particular kind of use (see Puseman and Cummings' report, Appendix C).

Waco sinkers are medium-sized, oblong artifacts made from quartzite and other stone, and are characterized by a notch pecked or abraded into each end. Sometimes, the notches extend from the ends onto the main body of the artifact to the extent of creating a groove reminiscent of the specimens from Buckeye Knoll (see Turner and Hester 1999:317). Some varieties have flared ends with protuberances on either side of the groove, again reminiscent of the shape of the Buckeye Knoll quartzite grooved stones (Watt 1938, Figure 8; Turner and Hester 1999:316; Figure 17-21, f, herein). A similar artifact form made from natural cobbles of comparable size has a narrow cut groove around the entire circumference of the stone, closely resembling the

Table 17-3. Data on the Grooved Stones Found with the Early Archaic Burials at Buckeye Knoll.

Lot No.	Burial	Material	Munsell Color	Length	Maximum Width	Maximum Thickness	Groove Width	Groove Depth	Wt. (g)	Surface Finish
1142	5	Quartzite	10R 4/2	67.2	44.4	34.4	11.0	0.5	133	Light polish
1202	6	Quartzite	10YR 4/2	92.2	36.9	33.6	8.0	1.0-1.5	145	Smooth
1694	6	Quartzite	2.5Y 5/3	68.9	36.7	32.7	11.2	1.5	109	Light polish
1978	6	Quartzite	5YR 4/4	94.4	37.3	35.2	10.6	1.0	166	Smooth/light polish
1989	6	Quartzite	10YR 6/2	86.7	36.6	33.2	10.0	1.5	133	Light polish
2043	6	Quartzite	Gley N/3	90.0	38.1	33.7	11.9	1.4	165	Light polish
2170	6	Limestone	2.5Y 8/6	48.5	32.2	30.9	4.8	3.0	52	Weathered; ("killed")
1653	6	Limestone	10YRY 7/8	58.0	40.1	33.5	10.8	3.0	107	Weathered
2220	6	Quartzite	2.5YR 5/2	79.7	39.4	27.3	13.6	2.0	124	Light polish over peck marks
2277	6	Quartzite	2.5YR 3/1	68.8	42.8	38.7	9.5-10.0	2.0	156	Smoothed over peck marks
1979	6	Quartzite	10R 4/2	82.1	42.9	40.2	11.4	1.0	172	Light polish; shattered ("killed")
1756	28	Limestone	10YR 7/6	56.9	37.9	42.0	4.2	3.0	111	Weathered
2087	11	Quartzite	2.5YR 4/1	65.9	42.0	37.1	10.5	2.0	134	Smoothed over peck marks
2110	27	Quartzite	10YR 6/1	71.6	40.5	33.8	9.0-10.0	1.9	126	Light polish
2111	27	Quartzite	5YR 3/1	65.2	39.1	35.9	11.0	1.5	118	Peck marks
2283	61	Quartzite	10R 5/6	61.0	42.2	31.8	9.0	2.0	100	Smooth
2284	61	Quartzite	5YR 6/4	100.3	37.5	30.6	8.4-9.2	1.5	156	Smooth
2289	61	Quartzite	10YR 6/3	73.7	41.2	31.8	9.0	2.0	124	Smooth
3013	61	Quartzite	10YR 4/3	64.2	44.1	33.8	11.0	1.5	131	Light polish
2240	65	Quartzite	10YR 8/1	53.9	44.8	29.3	9.0	2.0	149	Smooth
2241	65	Limestone	10YR 7/6	55.8	30.5	38.8	4.2	2.5-3.0	80	Weathered
1696	22	Limestone	10YR 7/6	57.8	34.7	30.9	4.2	3.5	78	Weathered

Note: All measurements are in millimeters.

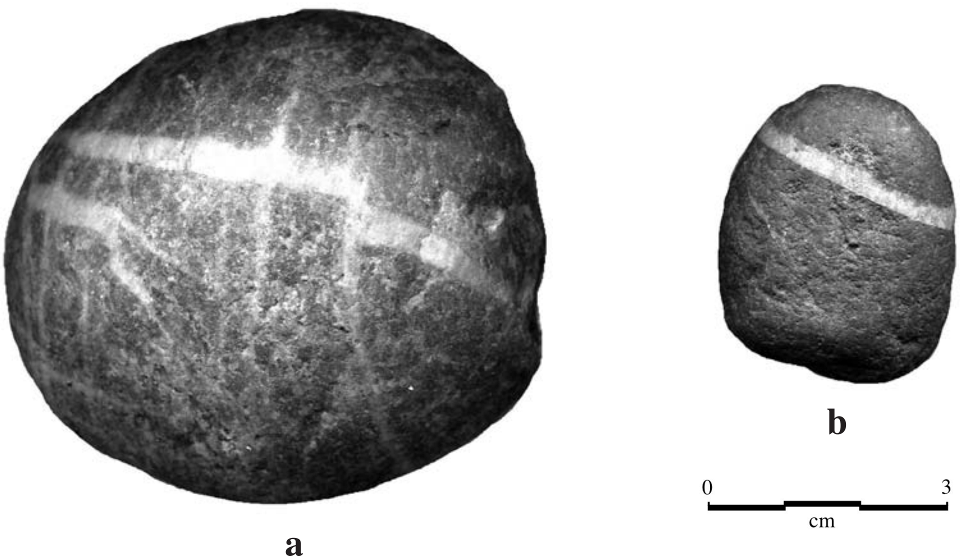


Figure 17-19. Quartzite cobbles containing bands of white quartz-grain inclusions. Both were found in Guadalupe River valley gravels several kilometers north of Victoria, Texas.

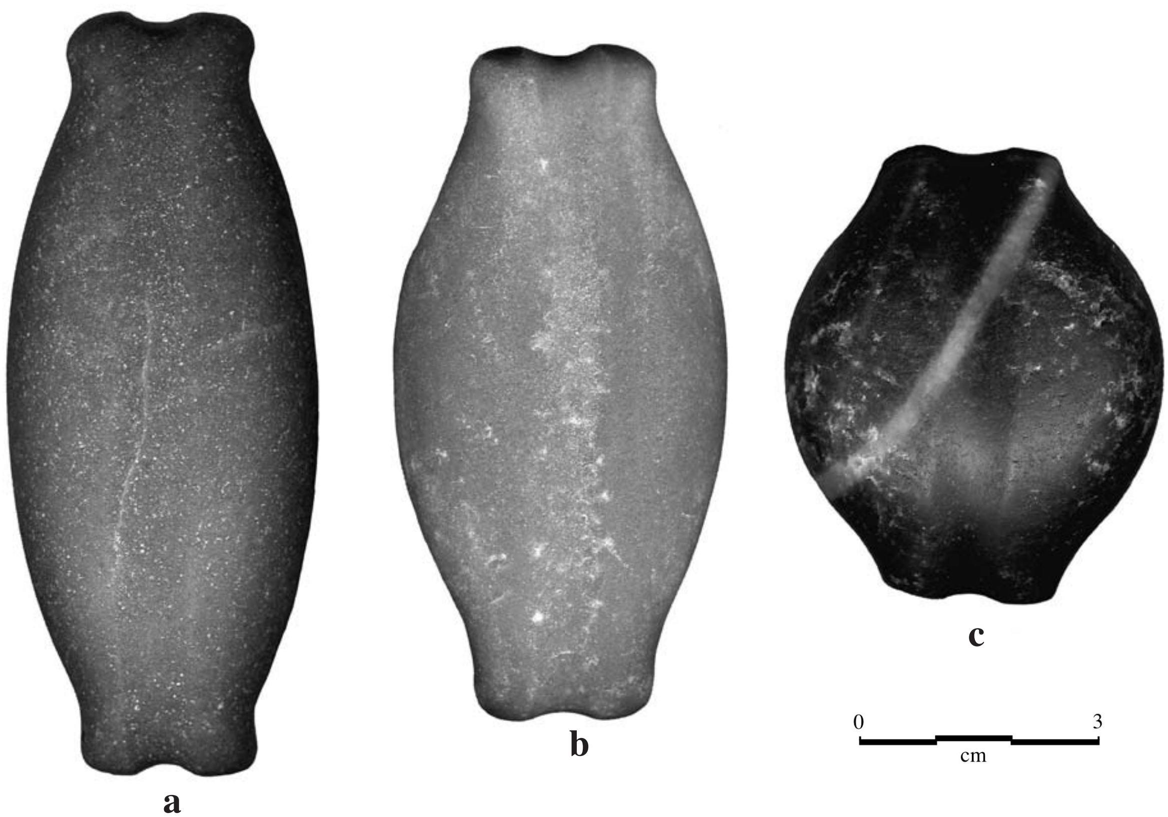


Figure 17-20. Replications of the quartzite grooved stones from Buckeye Knoll made from local quartzite cobbles by Mr. Bill Birmingham, Victoria, Texas. Note the inclusive band of white quartz grains in example c.

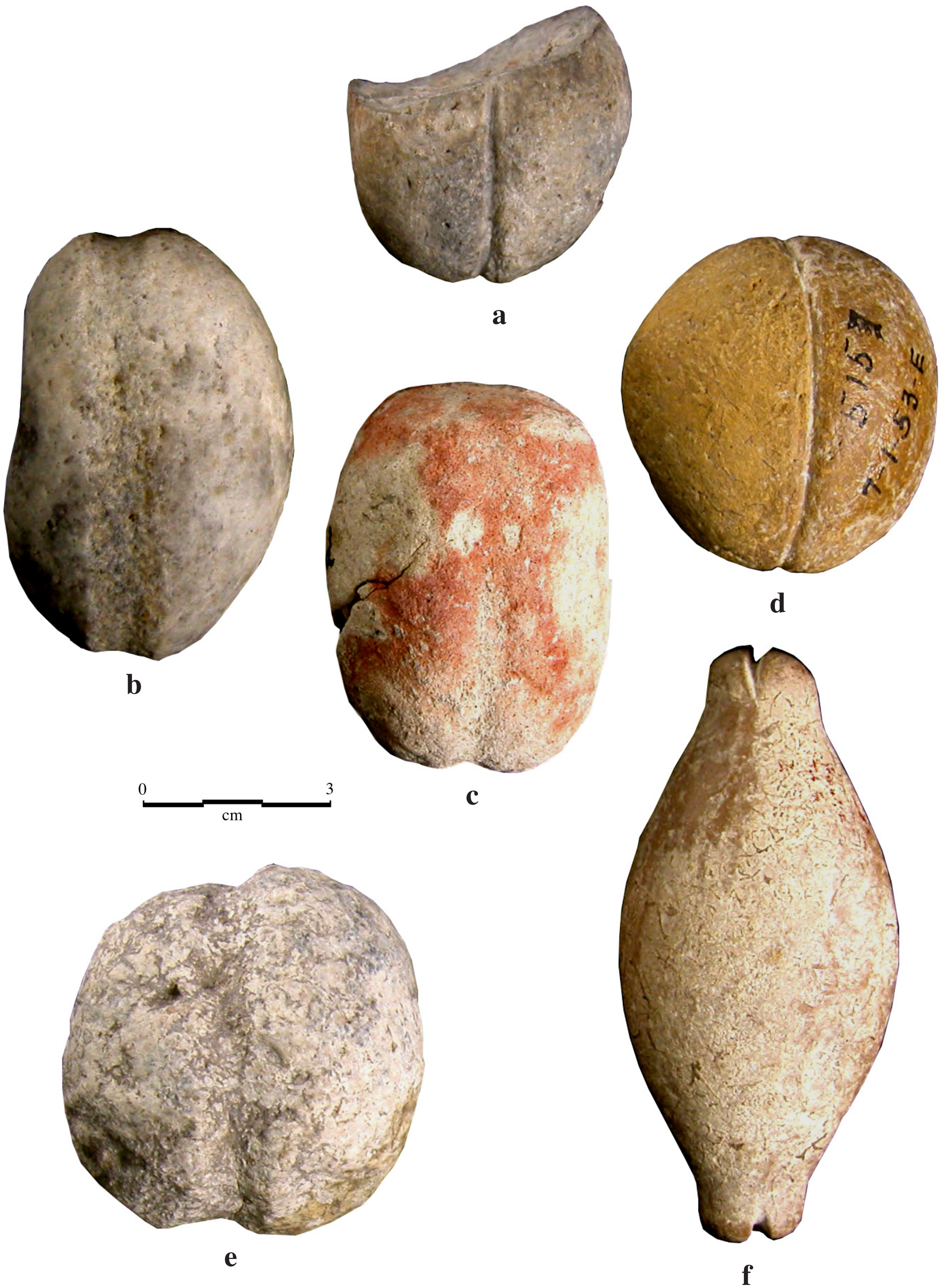


Figure 17-21. Waco sinkers and grooved stones from the Morhiss site (41VT1). (Artifact photographs courtesy Ms. Laura Nightengale, Texas Archeological Research Laboratory, Austin.)

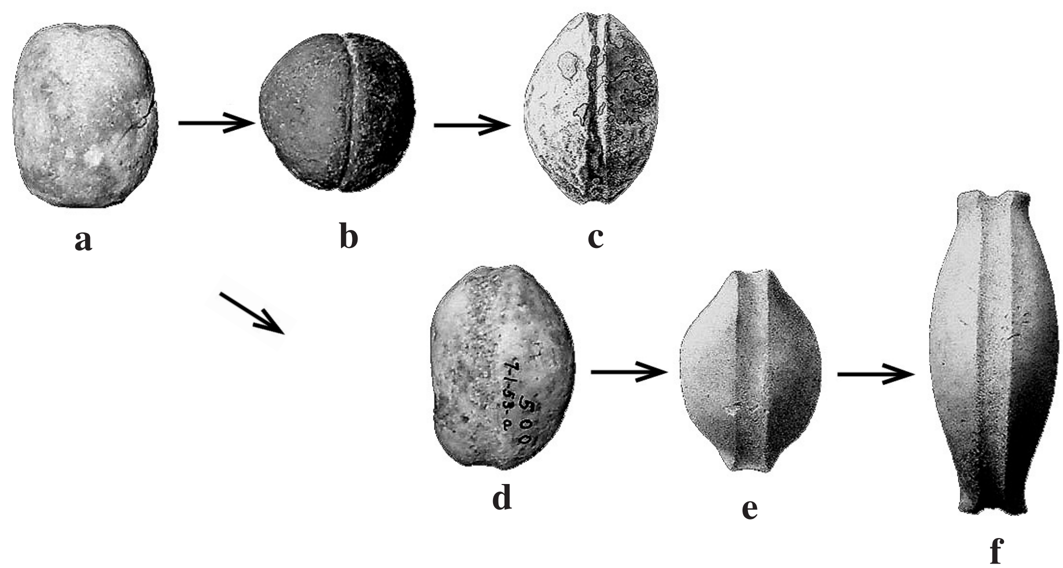


Figure 17-22. A selection of grooved stones showing the apparent continuity in form between Waco sinkers (a) and specimens made from limestone (a-c) and quartzite (d-f): a-b, d, from the Morhiss site; c, e-f, from Early Archaic burials at Buckeye Knoll.

limestone examples from Buckeye Knoll. This variety has been found over a wide area, from the Lower Pecos region (see Prewitt 1966), through Central Texas (Watt 1938; Sullivan 1998), into Southern Texas (Hester 1980:119), and onto the coastal plain (Birmingham n.d.; see also Figure 17-21, a, d, herein, showing specimens from the Morhiss site).

In his initial study of Waco sinkers, Watt (1938) defined a series of varieties. Although these range greatly in quality of workmanship, none were as finely shaped or finished as the quartzite specimens from Buckeye Knoll. However, while the Buckeye Knoll grooved stones are not, strictly speaking, Waco sinkers, they are probably a generically related artifact type. This inference is based on (a) the early date of the Buckeye Knoll specimens, which seems to agree with an Early Archaic placement for Waco sinkers, (b) the location of Buckeye Knoll within the known distribution of Waco sinkers and/or similar fully grooved artifacts, and (c) the close similarity in the shape, including the flared/noded ends of the Buckeye Knoll artifacts and certain varieties of Waco sinkers.

Indeed, the similarities between Waco sinkers and the Buckeye Knoll grooved stones are notable enough, with the variations in attributes falling along a morphological continuum, to suggest a relationship between the various forms, illustrated here in Figure 17-22. This diagram is intended only to show the continuity of attributes between varieties, and is not meant to suggest a time-dependant evolution of forms, although intuitively it seems likely that the more elaborate forms did develop from the simpler ones over time.

The most striking difference between the Buckeye Knoll quartzite grooved stones and Waco sinkers and similar artifacts is in the high level of workmanship in the Buckeye Knoll sample. The virtually perfect symmetry, the fine smoothing or even polish on the surfaces, and the even, controlled lines of the grooves, combine to highlight the excellence of the workmanship. Based on this, it can be inferred that the Buckeye Knoll grooved stones represent one end of a continuum in labor investment and skill in production of a generic Early Archaic artifact form, and that these items were reserved for, and perhaps explicitly made for, use in mortuary ritual contexts. Whatever the technoeconomic function of Waco sinkers and related grooved stones may have been, their finely made counterparts buried with the dead may have been special symbolic, ideotechnic items imbued with a supramundane significance that befitted the cognitive importance placed on the passage from life, through death, and into an afterlife, however it was conceived.

It is interesting (and perhaps significant) to note that comparable specimens have, to date, been reported only from the area around Buckeye Knoll. A specimen virtually identical to those from the site, made of purple quartzite, was found by Ed Vogt at the nearby Vic Urban site (41VT12) near Victoria (Figure 17-23, b-b[1]). A second specimen from that site, made of limestone, is identical to the limestone specimens from Buckeye Knoll in having a V-shaped groove around the entire long circumference and in its well-executed bilateral symmetry (see Figure 17-23, a-a[1]). A number of similar specimens have been found in adjacent counties (e.g., Jackson and Refugio Counties) (Figure 17-24), but none of these fully match the Buckeye Knoll forms in their elaboration of shape or in quality of workmanship.

Plummets

Four plummets, all made of limestone, were found with early burials (Figure 17-25). Two were associated with Burial 8, resting next to the left femur of that adult male individual (see Figure 10-4), and two were with Burial 62 (see Figure 10-8), also an adult male. All specimens were of the same type, having an elongated teardrop shape with a drilled perforation at the narrower end. Lengths ranged from 67.8 to 84.5 mm, widths from 28.7 to 36.9 mm, and maximum thickness from 16.8 to 28.0 mm. The perforations in three cases (the two specimens from Burial 62 and one from Burial 8) (see Figure 17-25, a-a[1], c-d[1]) were bi-conically drilled with the actual holes being 3 to 4 mm in diameter. The other plummet from Burial 8 had a wider, straight-bored hole with a diameter of 9 mm (see Figure 17-25, b-b[1]). The surfaces of all four specimens were rather rough and, in one case, severely weathered, probably the result of millennia of exposure to the corrosive effect of groundwater. The plummets were, however, nicely symmetrical in shape, and their surfaces originally were presumably smooth and perhaps polished.

Plummets have not been previously reported from this portion of the Texas coastal plain, or from southern Texas in general. Similar specimens are known from locales to the northeast in Southeast Texas and the Upper Texas Coast regions (Story 1990:221). Several perforated, teardrop-shaped specimens, mostly made of limestone, were recently found at the Eagle's Ridge site (41CH252) near the mouth of the Trinity River in Chambers County. These came, however, from a much later context, pertaining to the Late Archaic or Early Ceramic deposits at that site (Ensor 1998:380). Thus, those specimens are approximately contemporaneous with ones from Poverty Point, Tchula, and Marksville cultural contexts in the Lower Mississippi Valley (Ford and Quimby 1945; Webb 1982). Similar specimens have been reported, however, from Middle Archaic burials in the Middle Mississippi Valley, along with winged bannerstones (Charles, Leigh, and Buikstra 1988). The latter finds are comparable in age and associations to the Buckeye Knoll plummets and are the best reported extra-regional counterparts for these findings.

Rough Stone

Hammerstones

Two hammerstones were associated with Burial 6 (see Figure 10-3). One (Figure 17-26, b-b[1]) was a somewhat flat, round quartzite cobble measuring 55 by 45 by 25 mm that exhibited pitting, as caused by repeated impacts, along the edges. The other (see Figure 17-26, a-a[1]) was one end of split chert cobble, 44 mm long, which displayed pitting on its narrow end.

Abraders

A thin slab of gray, coarse-grained sandstone (Figure 17-27, a-a[1]) was found within the cluster of artifacts resting near the pelvis of Burial 8 (see Figure 10-4). This context, among a group of bone and antler flint knapping tools, suggests that this slab was meant to serve as an abrader for smoothing the edges of chert bifaces during the thinning process. It measured 111 long, 79.9 mm wide, and 10.2 mm thick.

A second small slab of similar gray, coarse-grained sandstone (see Figure 17-27, b-b[1]) was found immediately under the disarticulated skull designated as Burial 73. This piece was roughly crescent shaped, presumably naturally, as there was no evidence of pecking, abrasion, or grinding to indicate any modification. The piece was similar in size to the abrader associated with Burial 8, measuring 110.4 mm long, 62.7 mm wide, and 20.0 mm in maximum thickness.

Bone and Antler

Tools and Other Items

A total of 14 artifacts of non-human bone and deer antler were found associated with burials in the Early Archaic cemetery at Buckeye Knoll. All

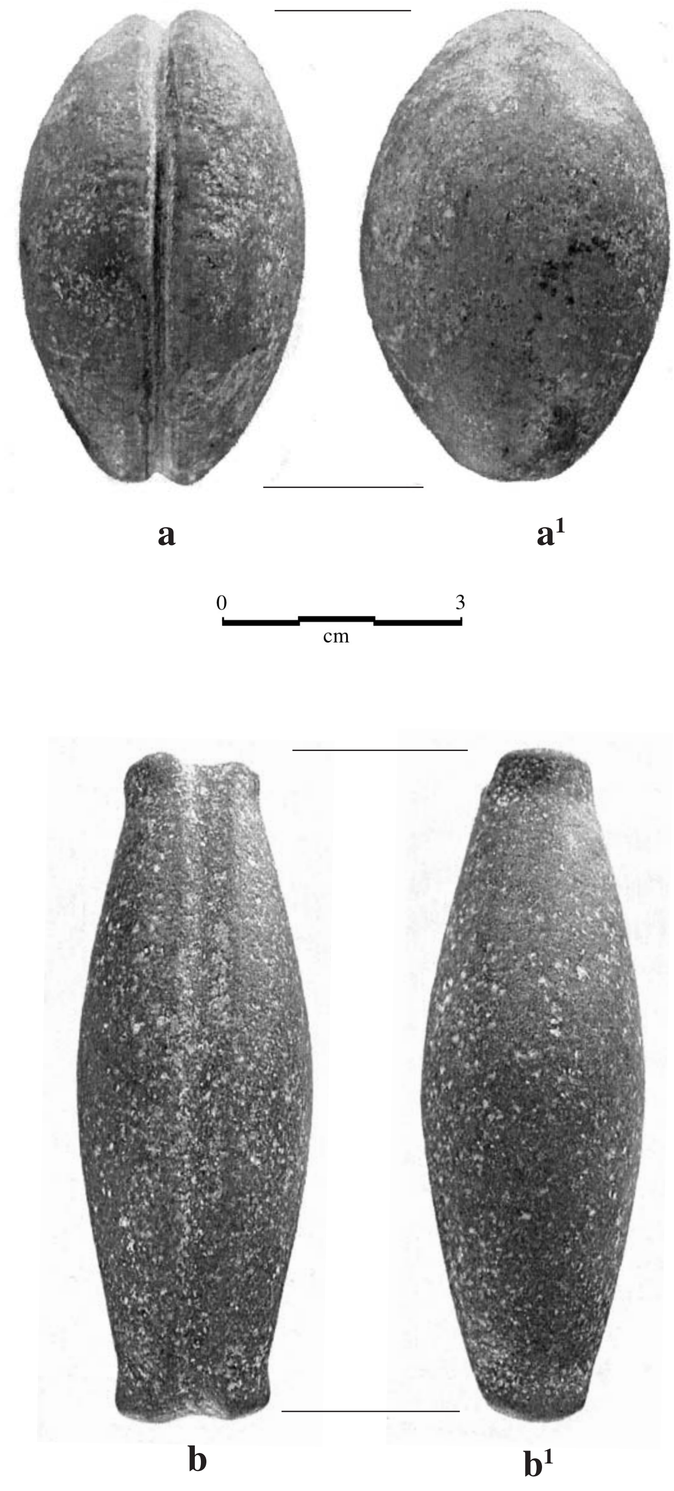


Figure 17-23. Limestone (a-a^{1}) and quartzite (b-b^{1}) grooved stones from the Vic Urban site (41VT12). Note the close similarity in forms to the quartzite and limestone specimens associated with the Buckeye Knoll burials. Photographs courtesy of Mr. Bill Birmingham, Victoria, Texas.

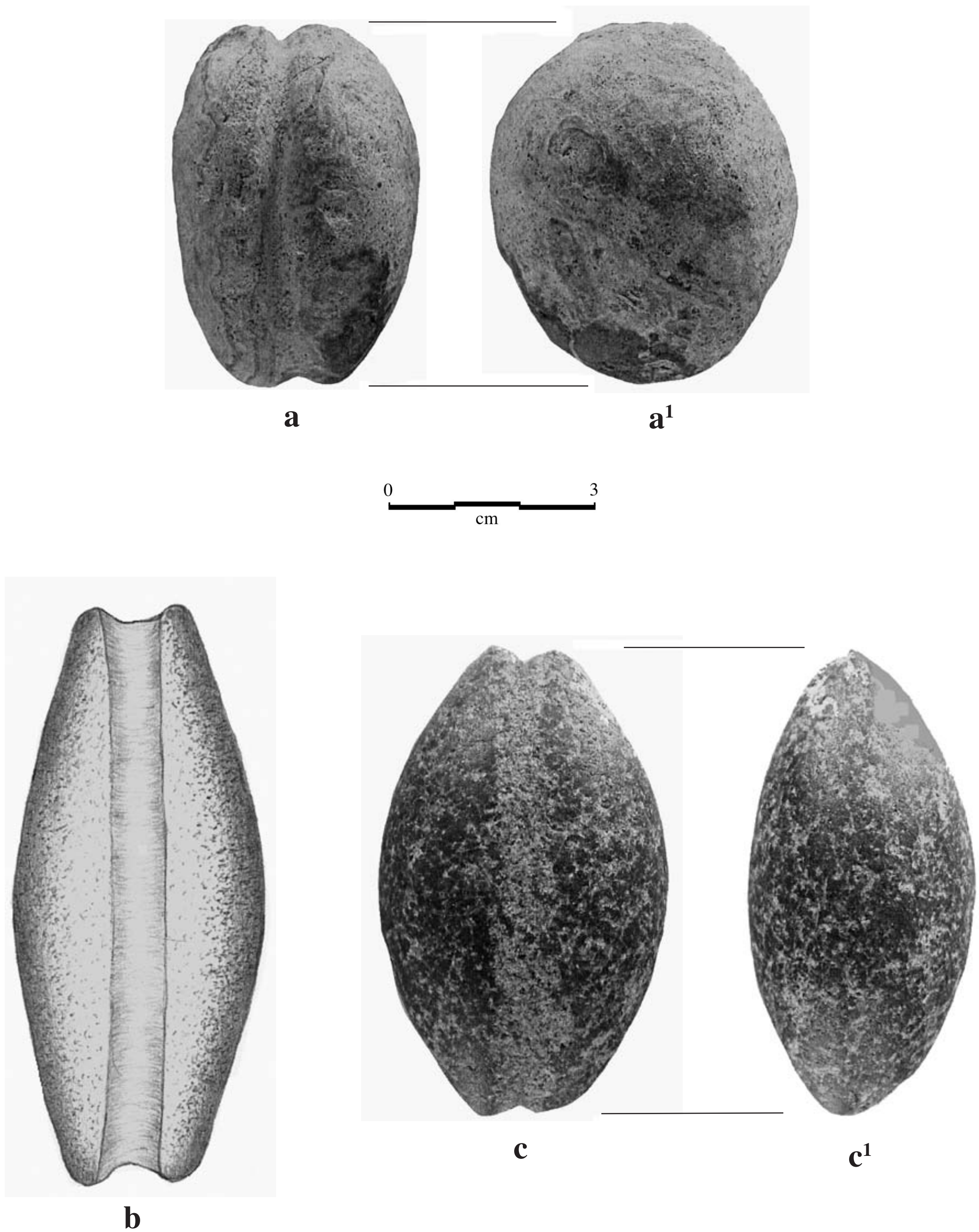


Figure 17-24. Grooved stones from counties adjacent to Victoria County, Texas: a-a[1], limestone, Ratcliff Property (no site number), DeWitt County; b, quartzite, Wells site (41JK146), Jackson County; c-c[1], quartzite, Hooper's Landing (41RF11), Refugio County. Photographs and drawing courtesy of Mr. Bill Birmingham, Victoria, Texas.

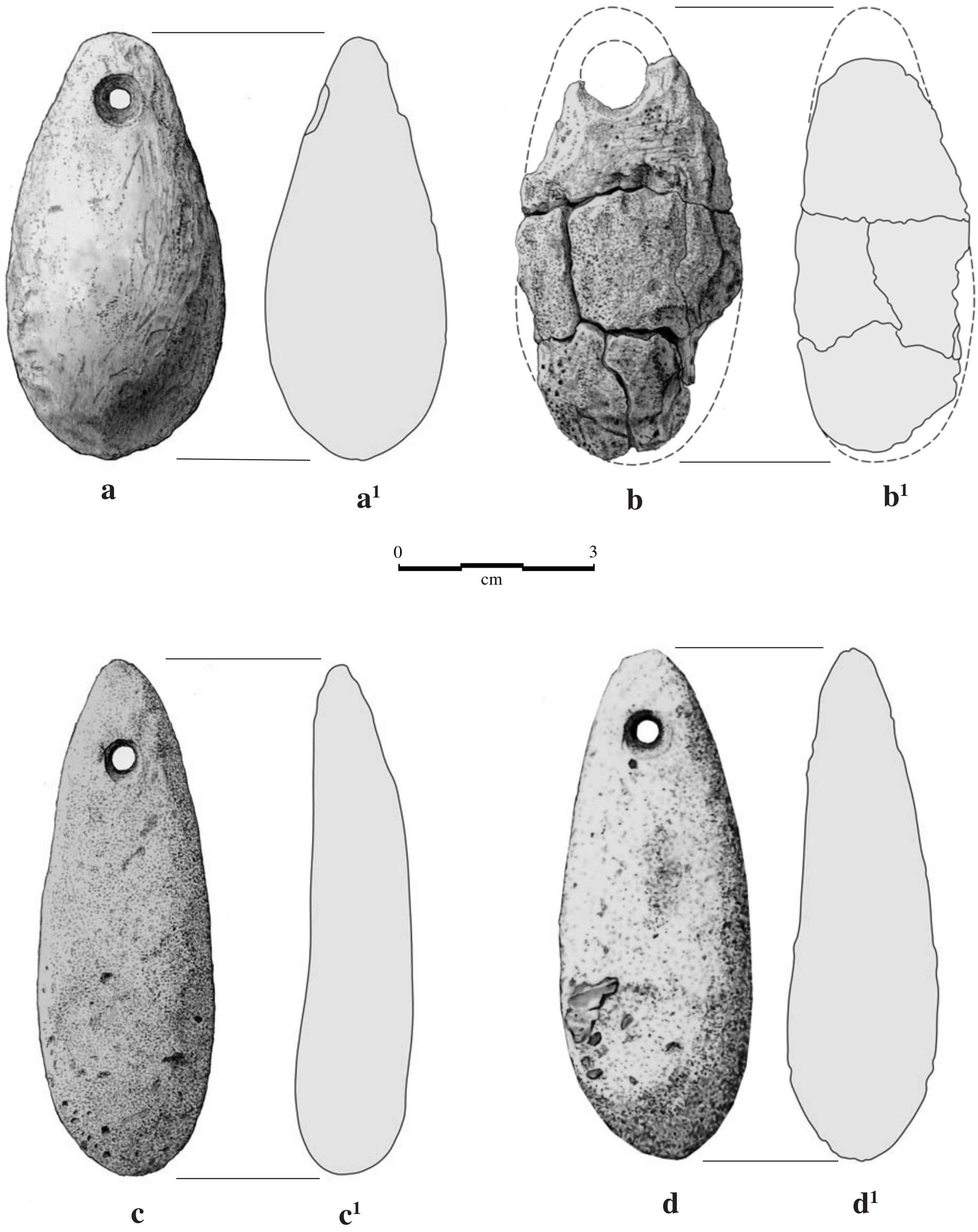


Figure 17-25. Perforated limestone plummets associated with burials at Buckeye Knoll: a-b[1], Burial 8; c-d[1], Burial 62.

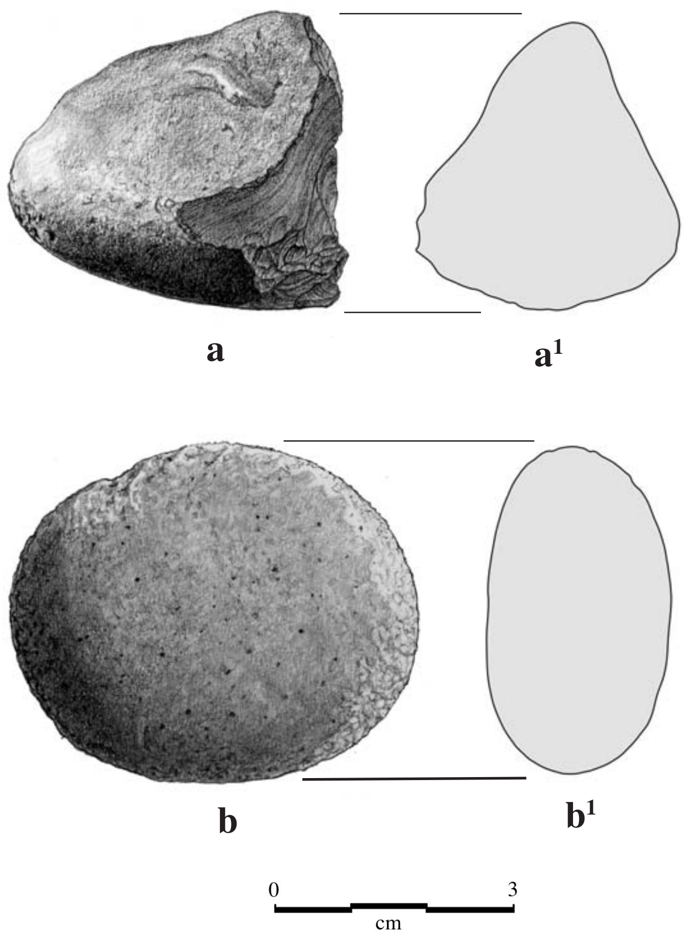


Figure 17-26. Two hammerstones associated with Burial 6 at Buckeye Knoll: a-a[1], split chert cobble with battering on the end; b-b[1], quartzite cobble with battering around its circumference.

of the bone/antler artifacts were associated with adult males.

An array of eight bone and antler implements was included in the tool kit associated with Burial 8, an adult male. As already noted, this kit consisted of bone, antler, and stone artifacts resting in a tight cluster near the pelvis of this individual (see Figure 10-4). The bone and antler artifacts included (1) a large deer-antler billet (Figure 17-28, f), 259.1 mm long, with a proximal end that was slightly rounded from apparent use; (2) two billets with use-rounded ends made of long bone (deer?) sections (see Figure 17-28, b, e); (3) two narrow-ended antler sections with cut and rounded ends, possibly small billets (see Figure 17-28, c-d); (4) an antler tine section with the distal end ground to a beveled edge, possibly a flaking tool (see Figure 17-28, g); (5) a probable pressure-flaking tool made from a long bone (probably deer) cortical splinter with a pointed tip (see Figure 17-28, a); and (6) a larger piece of thick cortical long bone, also with an artificially pointed end, possibly another flaking tool (see Figure 17-28, h). Table 17-4 lists these items along with their dimensions in millimeters.

Also included within the Burial 8 tool kit were two unmodified dog radii (Figure 17-29, e-f). Both bones were of the same size and from left and right forelegs and could represent a single animal. The bones, in fragmentary condition, showed no signs of having been worked. They came from a fair-sized domesticated dog (*Canis familiaris*). Since they were not modified to serve as tools, it can be inferred that their inclusion with the burial may represent the importance of dogs, perhaps this particular dog, as a hunting partner and/or companion.

Another bone tool, a thin, finely sharpened splinter of mammalian cortical long bone (see Figure 17-29, b-b[1]), was found with Burial 7, also an adult male (see Figure 10-3). It was recovered from a patch of dark gray, ash-stained soil in front of the individual's face and was classified as a needle, on the basis of its thinness and fine, narrow point. It was a distal frag-

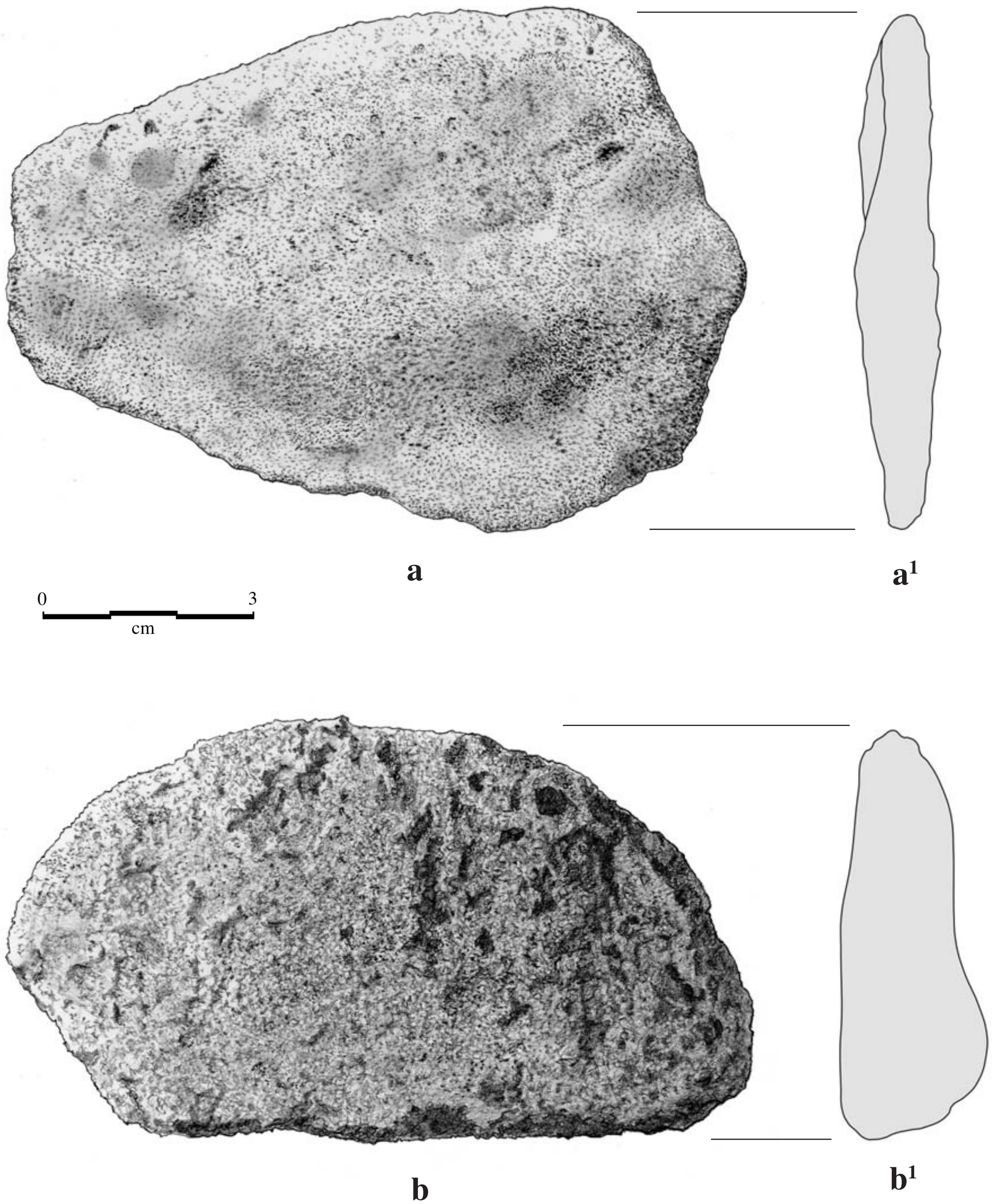


Figure 17-27. Thin slabs of sandstone associated with burials at Buckeye Knoll: a-a[1], Burial 8 tool kit; b-b[1], adjacent to skull of Burial 73.

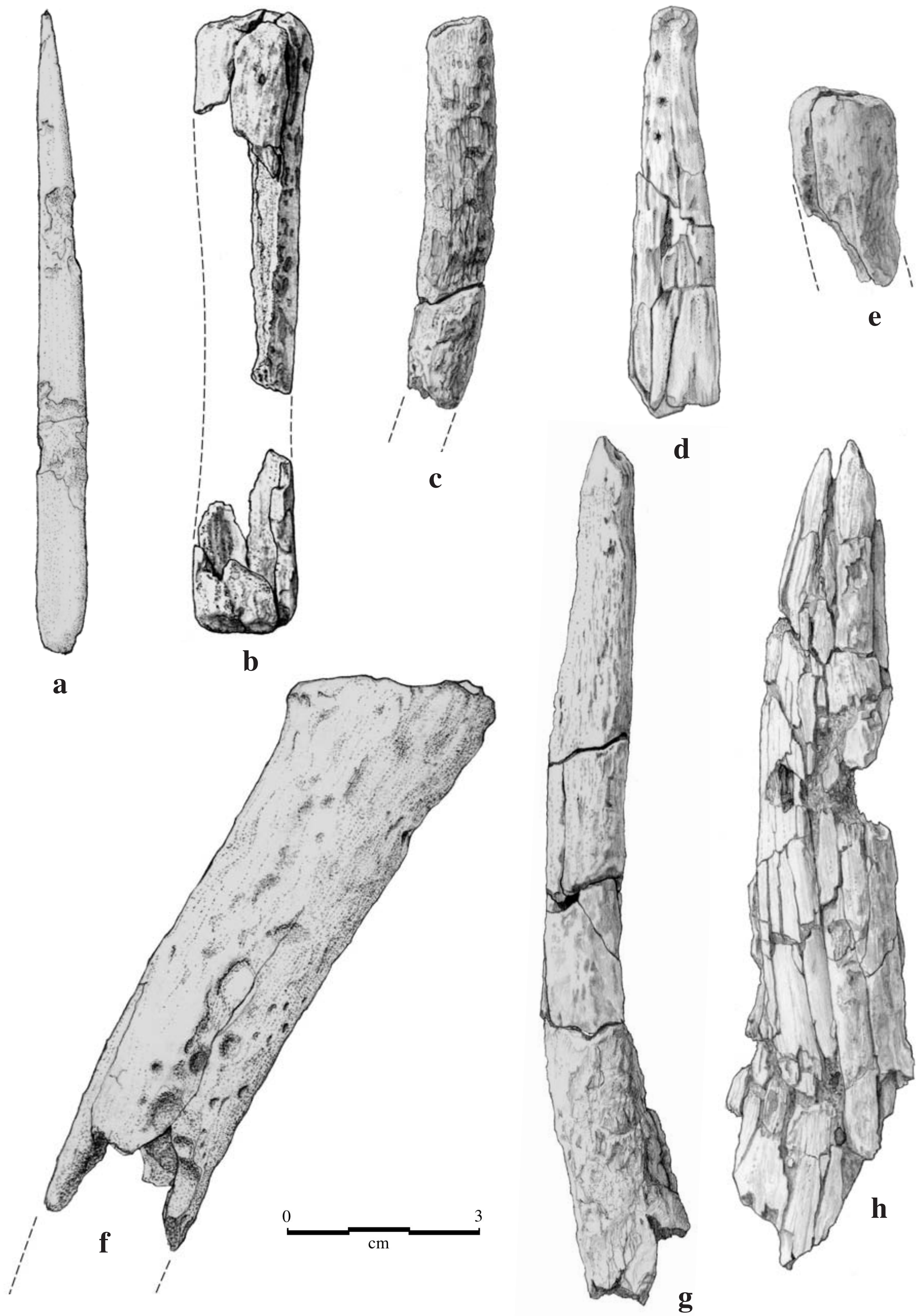


Figure 17-28. Bone and antler tools from the tool kit associated with Burial 8 at Buckeye Knoll: a, h, bone flaking tools; b, e, bone billets; c-d, small antler billets; f, proximal end of an antler billet; g, antler flaking tool.

Table 17-4. Metric Data on Bone and Antler Tools from the Burial 8 Tool Kit at Buckeye Knoll.

Item	Lot No.	Length	Max. Width/ Thickness	Remarks
Large Antler Billet	3021	259.1	27.84	—
Small Antler Billet	3046	63.8+	11.2	Incomplete
Small Antler Billet	3048	65.8+	13.2	Incomplete
Bone Billet	3055	50.3+	17.5	Incomplete
Bone Billet	3058	123.0±	20.6	Length Estimated
Antler Flaker	3042	137.6	16.4	—
Thin Bone Flaker	3057	105.0	7.8	—
Large Bone Flaker	3060	136.4	24.6	—

Note: All measurements are in millimeters.

ment, so the length (69 mm) is incomplete. The maximum width was 5 mm, and the thickness over most of the length was an even 3 mm.

A small group of artifacts resting near the pelvis of Burial 49 (see Figure 10-9), another adult male, included two lanceolate chert dart points, a blade-like chert flake, an antler fragment, and a deer metapodial bone artificially pointed at one end. The antler fragment (see Figure 17-29, c), which was broken at both ends, was 58.4 mm long and had a diameter of 18.2 mm. Possibly, it was part of a flint knapping billet, although this is uncertain because the distal end, which would show use wear, was missing. Found immediately next to this possible tool was the pointed deer metapodial tool (see Figure 17-29, a), possibly a pressure flaker. It measured 164 mm in length.

The proximal end of a deer antler (Figure 17-29, d) was found under the skull of Burial 45, another adult male. This fragment was 79 mm long and had a diameter of 29 mm at the proximal or basal end where it was originally attached to the deer's skull. The end showed no wear, so it can be concluded that it was not used as a billet for flint knapping. It is possible, however, that it was placed within the grave for such use in the individual's afterlife.

Beads

Five canid canine tooth beads (Figure 17-30) were recovered with, or near, Burial 55, an adult female. One specimen was found among the ribs of this sitting burial, while the other four were found scattered within Zone 3 matrix to the west of, and within 60 cm of, the skeleton (see Figure 10-9). Given that the one specimen was in close association with the bones, it is reasonable to conclude that all five were intentionally placed with this burial. No other artifacts of this kind were found at the site, which supports the deduction that all five specimens were associated with one another, perhaps as parts of a necklace or other piece of personal adornment. All five beads were made from the canine teeth of a moderately large canid, perhaps a coyote or sizeable dog. Each had a biconically drilled hole near the proximal, root end of the tooth.

Shell

All of the shell artifacts associated with burials were ornamental, including small marine gastropod beads (Marginella, Nerite, and Oliva shells); a single, heavily weathered whelk columella bead; and perforated marine (*Macrocallista nimbosa*) and freshwater (mussel) bivalve pendants.

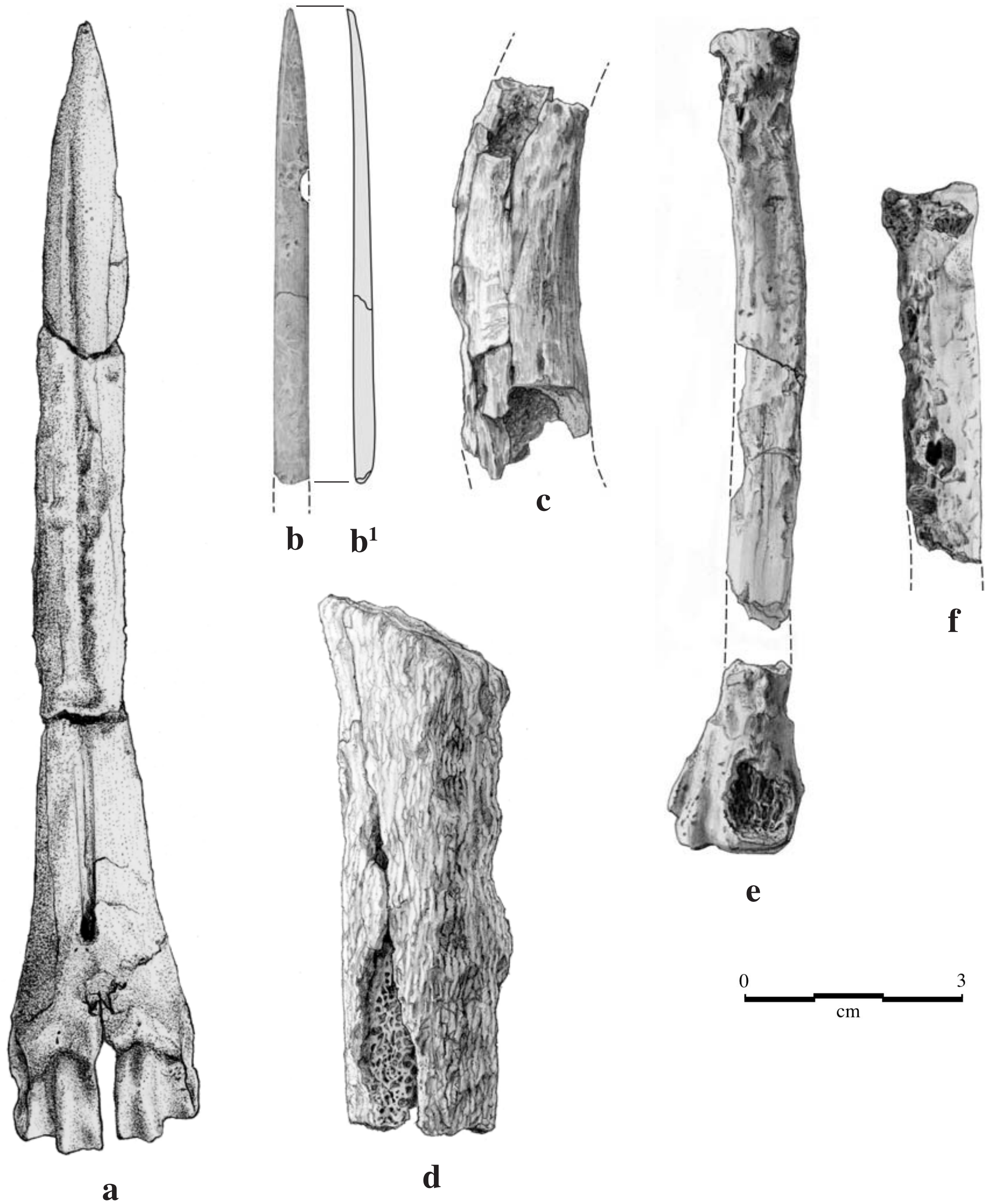


Figure 17-29. Additional bone and antler tools associated with burials at Buckeye Knoll: a, deer metapodial pointed tool (flaker), Burial 49 small tool kit; b-b[1], bone needle (distal fragment), Burial 7; c, antler (billet?) section, Burial 49 small tool kit; d, antler section, Burial 45; e-f, unmodified canid (coyote) radii, Burial 8 tool kit.

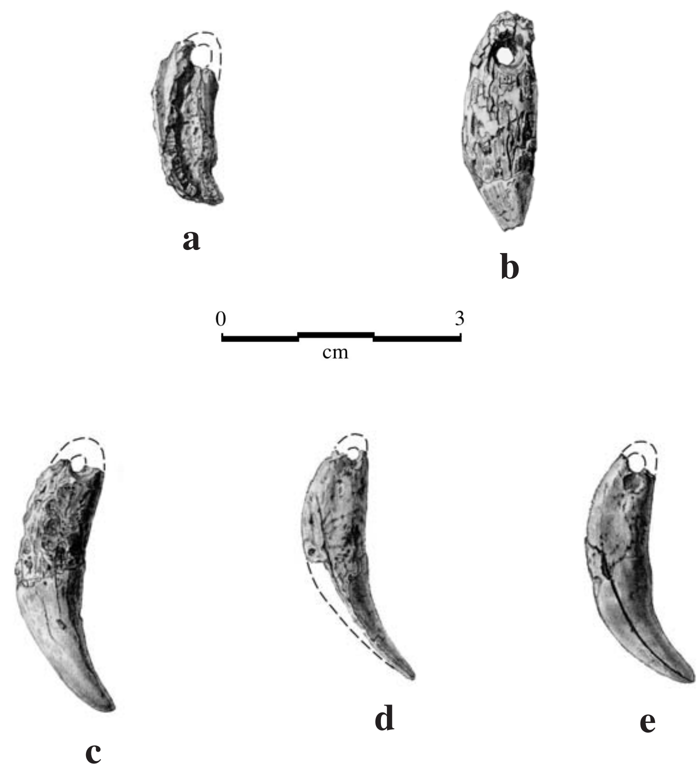


Figure 17-30. Perforated canid canine-tooth beads associated with Burial 55 at Buckeye Knoll.

Beads

Beads made of marginella shells (Figure 17-31, b-d) were the most abundant single class of artifact found in the Early Archaic cemetery. A total of 1,306 specimens made from the shells of *Marginella apicina* were found in direct and clear association with 20 burials, and an additional 419 specimens were recovered from the surrounding Zone 3 matrix, mostly during water screening. Because of the large number of beads in direct association with graves, and the absence of marginella beads in other components at the site, it is confidently believed that all 1,725 specimens were originally placed in Early Archaic graves and that the 419 beads from the matrix were displaced by bioturbation over the millennia since their burial.

Marginella apicina shells are typically about 10-12 mm in length. When the gastropod is alive, the shells are a polished cream, yellowish, or grayish tan color. The species lives in shallow, grassy, inlet-influenced areas along the Gulf Coast southward to Yucatan and the West Indies (Andrews 1992:61).

The small marginella beads from Buckeye Knoll were made by grinding the outer surface of the body whorl to create a small hole some 2-3 mm in diameter. Presumably, this permitted the insertion of a strand that could be then pulled out from the natural aperture of the shell, thus permitting stringing, as on a necklace, or perhaps alternatively, sewing onto clothing.

The burials with associated marginella beads are listed in Table 17-5, which also shows the number of specimens with each grave. In most cases, only one or a few beads were found resting amongst the skeletal remains. In a few cases, however, sizeable numbers of beads were present as either a cluster or in linear patterns suggestive of necklaces, bracelets, or patterned attachments to clothing. The largest number was found with Burial 74, immediately next to which was a mass or pile of 628 marginella beads; these rested between the leg bones and the pair of winged bannerstones described above (see Figure 10-8). A similar mass of beads was found under the cranium of Burial 45, wherein 439 beads were clustered within the sediment matrix (see Figure 10-9). Both Burials 45 and 74 were identified as the remains of adult males. Burial 60, a subadult of indeterminate sex, was accompanied by 83 marginella beads. As may be seen in Figure 10-10, these were arranged in a quasi-linear pattern below the mandible, suggesting a necklace, and also

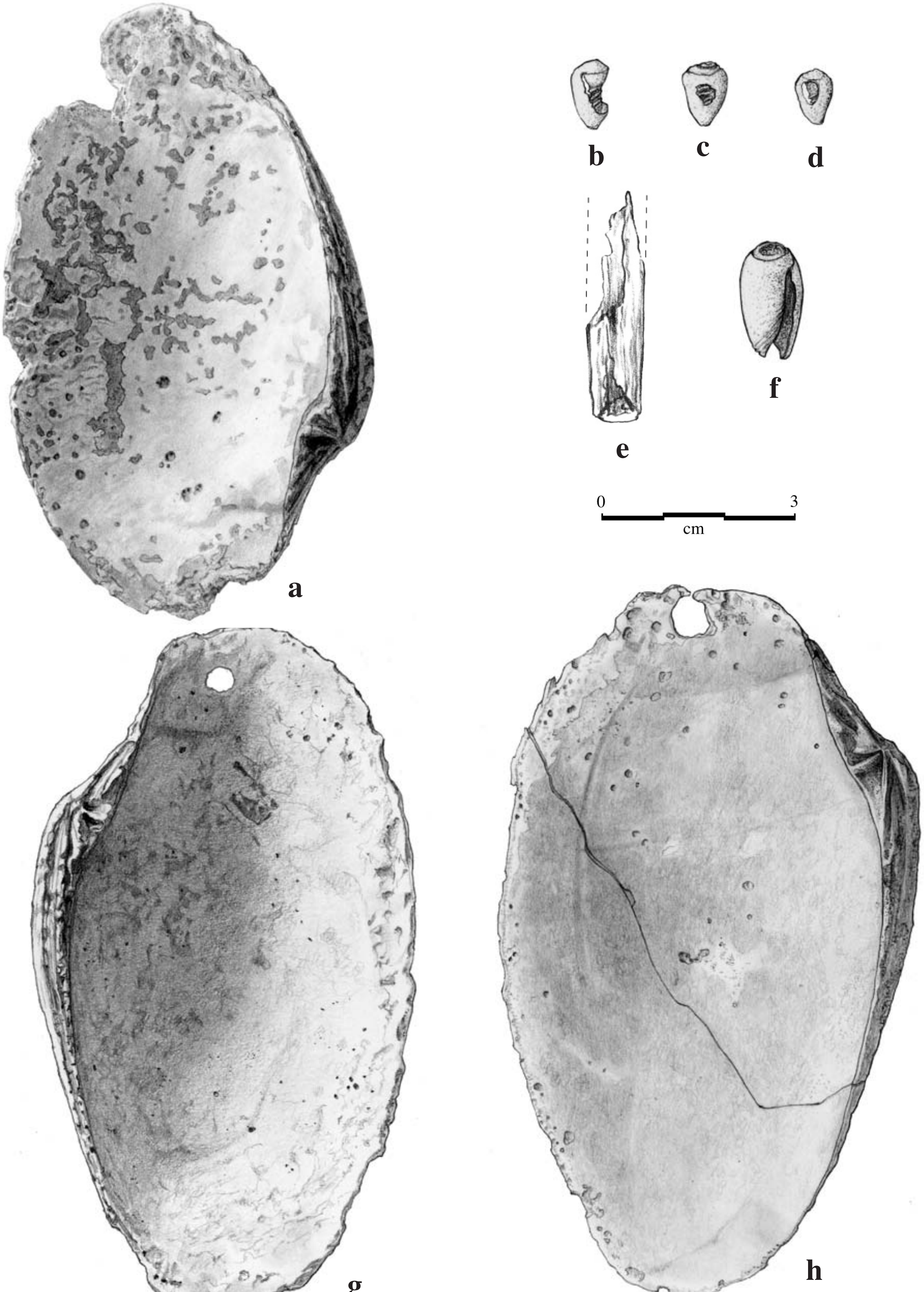


Figure 17-31. Marine shell ornaments associated with Early Archaic burials at Buckeye Knoll: a, probable sunray venus pendant on which the perforated area has weathered away (Burial 55); b-d, marginella beads (Burial 42); e, weathered portion of a conch-columella cylindrical bead (Zone 3 matrix); f, olive shell bead (Zone 3 matrix); g-h, sunray venus clamshell pendants (Burial 46).

Table 17-5. Proveniences of Shell Ornaments Associated with the Burials in the Early Archaic Cemetery at Buckeye Knoll.

Burial No.	Marginella Beads	Nerite Beads	Oliva Beads	Whelk Columella Bead	Sunray Venus Pendants	Freshwater Mussel Pendants	Totals
10	9	3	—	—	—	—	12
11	—	3	—	—	—	—	3
13	7	1	—	—	—	—	8
16	1	—	—	—	—	—	1
17	2	—	—	—	—	—	2
18	2	—	—	—	—	—	2
22	1	—	—	—	—	—	1
34	17	—	—	—	—	—	17
37	1	—	—	—	—	—	1
38	1	—	—	—	—	—	1
42	20	—	—	—	—	—	20
43	2	—	—	—	—	—	2
45	439	—	—	—	—	—	439
46	—	—	—	—	6	—	6
53	1	—	—	—	—	—	1
55	—	—	—	—	1	3	4
56	6	—	—	—	—	—	6
59	78	—	—	—	—	—	78
60	83	—	—	—	—	—	83
67	3	—	—	—	—	—	3
72	1	—	—	—	—	—	1
74	628	—	—	—	—	—	628
75	4	—	—	—	—	—	4
Zone 3 Matrix	419	25	2	1	—	—	447
Totals	**1,725**	**32**	**2**	**1**	**7**	**3**	**1,770**

in an oval linear pattern near the leg bones, suggesting a possible leg bracelet or anklet. In Burial 59, a subadult of indeterminate sex, a cluster of 78 beads was found near the skull (see Figure 10-8). Finally, a line of 20 beads was found near the pelvic region of Burial 42 (see Figure 10-8), possibly representing linear decoration applied to a garment such as some sort of shirt.

Thirty-two beads made of shells of the Virgin Nerite (*Neritina virginea*) were also found within the cemetery. Seven specimens were in close association with three specific burials (see Table 17-5), while the remaining 25 were found in the Zone 3 fill. This species is approximately the same size as *Marginella apicina*, and the beads were made the same way (i.e., grinding the whorl to produce a small hole). The Virgin Nerite's habitat is grassy shallows in estuarine bays along the Gulf Coast and southward to the Brazilian coast (Andrews 1992:8).

Two Oliva beads (probably Lettered Olive [*Oliva sayana*]) were recovered from the Zone 3 matrix. Both appear to have been used as beads, because they were modified by grinding their spires just above the shoulders, which would have allowed them to have been strung together (see Figure 17-31, f). Although neither could be associated with a particular burial, their occurrence in the Zone 3 matrix suggests that the were related to the Early Archaic mortuary complex at the site.

Small marine-gastropod beads have been reported from mortuary contexts at only two other sites on the Texas coastal plain. Nineteen nerite beads were found with a Late Archaic burial at the Ferguson site (41WH42), located in Fort Bend County, some 120 km north of Buckeye Knoll (Gregg 1993). At the Morhiss site, 41VT1, located only some 8 km from Buckeye Knoll, both nerite and marginella beads were found with burials (Dockall and Dockall 1994), at least some of which are contemporaneous with the Early Archaic cemetery at Buckeye Knoll. At Morhiss, as at Buckeye Knoll, marginella beads greatly outnumbered nerite beads (nerite constituted, overall, only 5.1 percent of the small gastropod beads at Morhiss [Dockall and Dockall 1994:18] and accounted for an even smaller 1.8 percent at Buckeye Knoll). The fact that both gastropods were used as beads in approximately similar proportions, along with the partial contemporaneity of Morhiss and Buckeye Knoll burials (see discussion in Chapter 7, herein), suggests a similar cultural practice of shell bead production and burial with the dead in the Early Archaic of the lower Guadalupe River valley.

As single fragmentary and quite weathered tubular bead made from a rather large gastropod (Busycon?) columella (see Figure 17-31, e) was found during the water screening of excavated Zone 3 matrix. While this specimen cannot be attributed to inclusion in any particular burial, it is likely that it was a mortuary object, given its context in Zone 3.

Pendants

Seven whole sunray venus (*Macrocallista nimbosa*) valves were (or appeared to have been) perforated at one end and probably were used as pendants. Six were associated with Burial 46 and one with Burial 55. The specimen with Burial 55 (see Figure 17-31, a), an adult female, was found near the mandible (see Figure 10-9) along with three perforated freshwater mussel shell pendants; all four specimens may have been parts of a necklace. A cluster of six sunray venus valves with Burial 46, a probable adult female, may also have been a necklace (see Figures 10-9, 17-31, g-h). The perforations consisted of conical holes, drilled from the interiors of the shells. Some of the shells in the Burial 46 cluster were so eroded/weathered that the perforated parts appear to have been destroyed; the presence of perforations is inferred because these specimens were in direct association with those that still retained perforated portions. All of the shells were otherwise unmodified.

Sunray venus valves, or fragments thereof, were commonly utilized for making scraping/cutting tools on the Central Texas Coast in Archaic and Late Prehistoric times (e.g., Dreiss 2002; Prewitt et al. 1987; Ricklis 1995, 1996). Shells of this species have not been, however, reported as raw material for ornaments. The presently described specimens are the only examples reported to date of the valves being perforated for ornamental use. Thus, it is inferred, pending future findings to the contrary, that perforated Sunray venus valve pendants are a trait unique to the Early Archaic material culture assemblage represented in the Buckeye Knoll cemetery.

Three freshwater shell pendants (Figure 17-32, a-c) were similar to the sunray venus pendants just described, insofar as the elongated whole valves of this bivalve, the freshwater mussel *(Strophitus undulatus),* were perforated at one end, presumably for suspension as an item of personal adornment. Indeed, the same function is suggested by the fact that the three recovered specimens were found together with one of the sunray pendants in Burial 55. The shells of both species were of similar size and shape, which would seem to support the assumption that both were used in the same way. The perforations were biconically drilled.

Asphaltum Nodules

Asphaltum is a natural petroleum substance that emerges from seeps in the floor of the Gulf of Mexico and washes ashore along the coastal beaches. Asphaltum was widely used by aboriginal peoples of the Texas coast as a hafting mastic, as well as to coat basketry and, in Late Prehistoric times, pottery (e.g., Campbell 1947, 1961; Ricklis 1995, 1996).

Five lumps or nodules of asphaltum were found in direct association with Burial 45 in the Buckeye Knoll Early Archaic cemetery. Three specimens (Figure 17-33, a-c[1]) displayed impressions that must have been made when the soft or semi-molten material was pressed against another material. In two cases, the impressions featured patterned repetition of what looked like strands of fibrous material. These may be the result of pressing the soft asphaltum against bas-

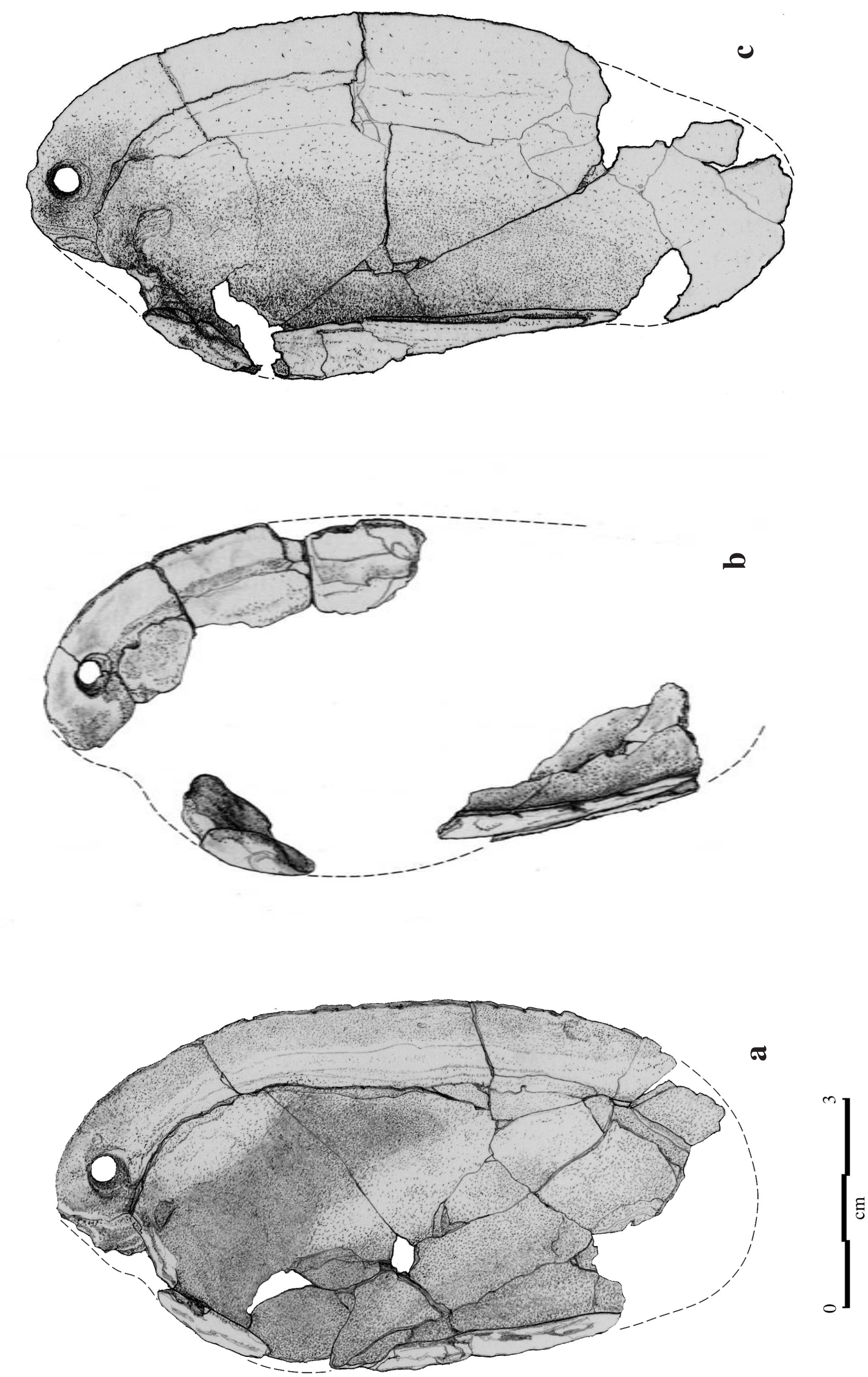


Figure 17-32. Freshwater mussel shell pendants associated with Burial 55 at Buckeye Knoll.

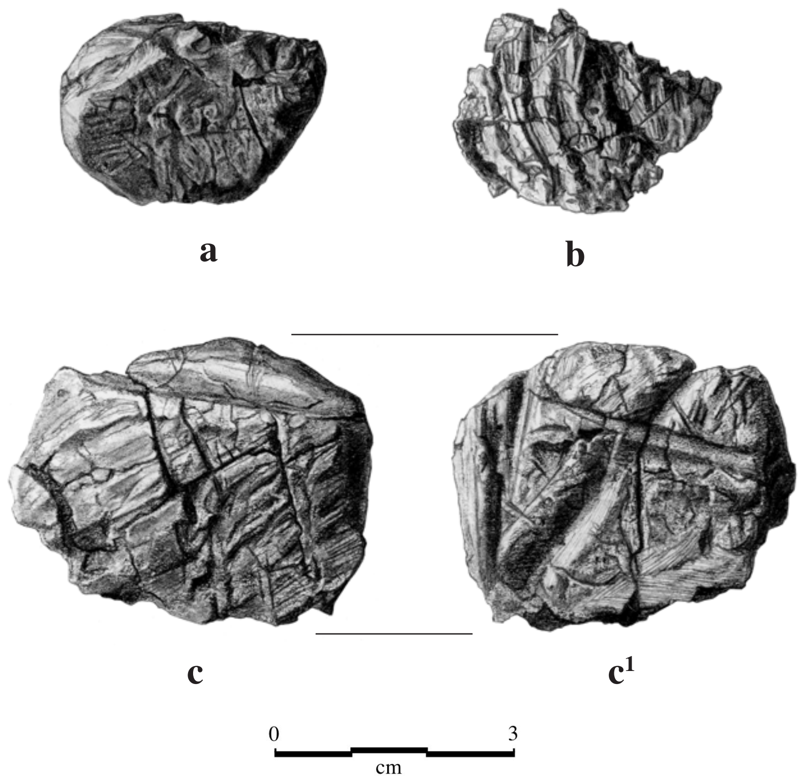


Figure 17-33. Asphaltum nodules associated with Burial 45 at Buckeye Knoll. Note the basketry impressions on examples b-c[1].

ketry woven from strands of twisted fiber. Single occurrences of asphaltum were also recorded in Burials 40, 47, and 49, all of which are believed to date to the Early Archaic period. It is uncertain whether these were intentional offerings.

Ochre

Ochre, a naturally occurring iron oxide, was a fairly common burial association in the Early Archaic cemetery at Buckeye Knoll (see Table 7-1). It usually occurred as small nodules or as ochre-stained patches of soil. Most commonly, these were red in color, but Burial 61 had two yellow ochre nodules in addition to three that were red. Ochre was found in apparent association with 15 of the Early Archaic burials, usually as single occurrences.

The Early Archaic Mortuary Assemblage

The excavations into the Early Archaic cemetery at Buckeye Knoll have produced significant insights in regard to this segment of Texas prehistory and demonstrate the need to reconsider some basic concepts that have developed through time. For example, a relatively high percentage of burials at Buckeye Knoll contained artifacts buried with the dead. Forty-three of the 71 burials ascribed to the Early Archaic cemetery, or 60.5 percent, had one or more items accompanying the interred individual. This is, in fact, a higher percentage than recorded for most later cemeteries on the Texas coastal plain, as shown graphically in Figure 5-10. Existing assumptions that coastal plain cemeteries emerged initially during the Late Archaic, and that concomitant cultural features (such as group territorialities and growing population) were the result of long-term trends during the Archaic (e.g., Story 1985), must be reconsidered on the basis of the Buckeye Knoll evidence. The same must be said concerning the presence of accompanying grave goods, which previously were thought to have reached a peak in Late Archaic times in the region of the Texas coastal plain.

In the aggregate, the artifact assemblage represents a unique conglomeration of material culture. While some of the diagnostic elements of the series of traits, such as slender lanceolate Buckeye points and grooved stones, are reported from non-mortuary contexts in the Texas Early Archaic, no archaeological site components are on record as producing this particular assemblage of artifactual traits. The numerous grooved stones, bannerstones, plummets, and profuse shell ornaments offer a unique view on the material culture of the period.

The traits in the assemblage are also distinctly different from their counterparts in Late Archaic cemeteries in the region. As described in Chapter 5, the Late Archaic cemeteries in the Lower Brazos-Colorado River area also contain flaked-stone, ground-stone, bone, and shell artifacts, but they are of completely different forms and styles that show no apparent relationship to the materials from Buckeye Knoll. Aside from different dart point types in burials, Late Archaic ground stone artifacts include boatstones and gorgets. Shell ornaments are primarily large whelk body-whorl pendants and beads or dangles made from conch columellae. Bone pins with engraved geometric decorations are also diagnostic of the Late Archaic mortuary complex in the Lower Brazos-Colorado section of the coastal plain; whereas, such items are absent in the early Buckeye Knoll cemetery, where bone and antler artifacts are mainly undecorated items within flint knapping tool kits. The Late Archaic cemetery at the Loma Sandia site in southern Texas has also produced shell ornaments (whelk body-whorl pendants), a limited number of engraved bone pins, and ground stone artifacts in the forms of tubular stone pipes and sandstone grinding slabs, all notably different in form from anything in the early Archaic cemetery at Buckeye Knoll. In short, the Buckeye Knoll early mortuary assemblage is a material culture expression that is confined to the seventh millennium B.P., judging from currently available information.

Some of the artifacts in the Early Archaic mortuary assemblage suggest relationships and/or interactions with regions beyond the Texas coastal plain. The Semi-Lunar Winged bannerstones are exceptional in a Texas context and have a far more common presence beginning in the contemporaneous Middle Archaic to the north and northeast in Arkansas, the middle Mississippi Valley, and the Ohio River area. Perforated plummets are also reported from the Mississippi Valley for this general time period; whereas, their presence on the Texas coastal plain is so far only reported for the Upper Texas Coast area at a much later time (i.e., the Late Archaic and/or Early Ceramic Periods). The large, fluted-stem biface from Burial 74 appears to be an oversized version of a Fluted Fishtail Point, which suggests the importation of an ancient (at the time of burial) artifact from far to the south where this type of point was indigenous during Paleo-Indian times.

Raw materials, in a few cases, were imported from outside the coastal plain region. The large uniface from Burial 58 was made of tabular Georgetown chert from Central Texas, and the oversize stemmed biface from Burial 74 was flaked from a large piece of resilicified brecciated chert altogether different form the cobble cherts available in alluvial gravels within the coastal plain. The marine shells for pendants and beads, as well as the asphaltum, would have been obtained along the Gulf of Mexico coastline.

Late Archaic Artifacts

A total of six burials were assigned to the Late Archaic, based on their stratigraphic position, body positions, kinds of associated artifacts, and, in two cases, AMS dates. These include Burials 23, 25, 30, 32, 34, and 37. Burial 23 rested at the contact between Zones 2 and 3, suggesting that this grave had been dug from a surface higher than Zone 3. Therefore, it post-dates the erosional episode that deflated that stratum. The Late Archaic assignment is affirmed by the presence of a Lange dart point as an associated grave inclusion, plus a calibrated AMS age range of 2130-2050 B.P. (180-100 B.C.). Burial 25 was in a grave pit that was clearly definable by virtue of it originating in, and being filled with, the black, organic-rich sediment of Zone 2. The associated grave goods are of known Late Archaic forms. Burial 34 produced a calibrated AMS age range of 3810-3730 B.P., which places it in the early centuries of the Late Archaic, as defined here. Burial 30 rested in the lower part of Zone 2 on the West Slope, and the body position was supine and extended, as is common in Late Archaic cemeteries in the Lower Colorado-Brazos Valleys area. Burial 32, only a small part of which was exposed in the south wall of the Knoll Top Excavation (for that reason the remains were not removed) appeared to be in the bottom of Zone 2 and is assumed to post-date the Early Archaic cemetery. Finally, Burial 37 was a loosely flexed individual, completely contained within the lower part of Zone 2 on the Knoll Top. The stratigraphic position and the relatively good condition of the bones, make the burial appear relatively recent, perhaps dating to the Late Archaic or even Late Prehistoric periods.

Chipped Stone

Bifaces

Eight chert bifaces were found with Burial 23 (Figure 17-34, a-d^{1}, f-i^{1}). Seven, including a large Lange point (see Figure 17-34, f-f^{1}), were found around the pelvic area (see Figure 10-5). Aside from the Lange point, all were unstemmed and triangular or lanceolate in shape.

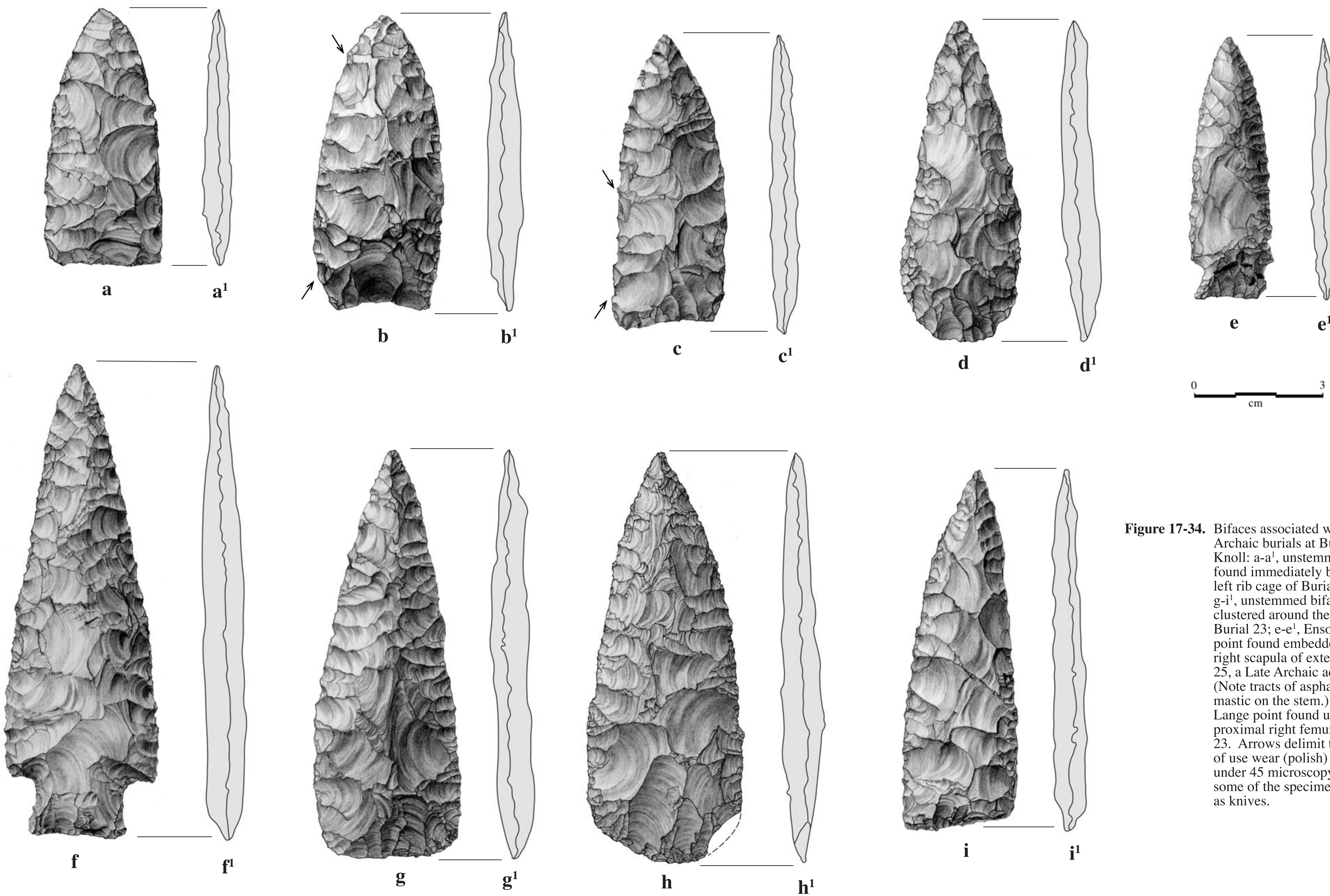


Figure 17-34. Bifaces associated with Late Archaic burials at Buckeye Knoll: a-a^1, unstemmed biface found immediately beneath the left rib cage of Burial 23; b-d^1, g-i^1, unstemmed bifaces found clustered around the pelvis of Burial 23; e-e^1, Ensor-like dart point found embedded in the right scapula of extended Burial 25, a Late Archaic adult male (Note tracts of asphaltum hafting mastic on the stem.); f-f^1, large Lange point found under the proximal right femur of Burial 23. Arrows delimit the extent of use wear (polish) discernible under 45 microscopy, suggesting some of the specimens were used as knives.

They were well thinned and displayed careful edge flaking, suggesting they were finished tools rather than performs. In fact, two specimens (Figure 17-34, b-c[1]) had edge polish visible under low-power (45X) miscroscopy, suggesting use as knives. Additionally, high-power (SEM) microscopy revealed edge polish and/or silica sheen on three other specimens (Figure 17-34, c-c[1], g-g[1], i-i[1]), also suggesting use as knives. In contrast, two specimens (Figure 17-34, a-a[1], b-b[1]) did not exhibit edge wear under SEM examination. These, however, rather showed dulling of the distal tip, suggesting use as either projectile points or as daggers or points on thrusting spears. The Lange point, found resting under the proximal right femur, is an especially large example of the type, and may also have served as a dagger or thrusting knife. This is suggested both by its size and dulling of the distal tip (see Barrett report, Appendix D).

Dart Point

A rather long and narrow (relative to its width) dart point (see Figure 17-34, e-e[1]) was associated with Burial 25. It had an expanding stem and very slightly concave base. Traces of apshaltum hafting mastic remained on the stem. This point resembled the Ensor type in having a side notched stem, but differed from classic examples of the type insofar as the notches were less discrete and more elongated (cf. Turner and Hester 1999).

This dart point was found embedded in the right scapula of the adult male in Burial 25 (see Figure 10-6). The point had completely penetrated the bone and the tip protruded 3 mm from the back surface of the bone. The angle of penetration suggests that the projectile entered the front of the chest and passed at a rightward angle through the chest cavity and was stopped when it impacted the right shoulder blade. The resultant wound would almost surely have been fatal, since the dart would have penetrated the right lung and possibly the heart as well.

Ochre

A nodule of bright yellow ochre, 6 cm in diameter, was found resting immediately under the left rib cage of the supine skeleton of Burial 23 (see Figure 10-5). The individual must have been placed immediately on top of the ochre, which presumably was an intentional grave inclusion.

Pebbles

A cluster of small, pea-sized chert and quartzite pebbles was found near the top of the skull in Burial 30 (see Figure 10-7). This interment was that of an older adult female whose body was fully extended, resting on the back, with the head toward the southeast. Since such clusters of pebbles were not observed as natural occurrences within the sediment matrix, it can be assumed that these had been placed in the grave or that perhaps they were within some kind of perishable container to form a rattle that was attached to the hair.

Shell

Two pendants made from body-whorl portions of large lightning whelk (*Busycon perversum*) shells accompanied the adult male, Burial 25. The larger of the two (Figure 17-35) had been placed within the grasp of the deceased's left hand, as is clearly indicated by its position within the phalanges of the left hand (see Figure 10-6). The smaller specimen (Figure 17-36) was found resting against the left side of the skull (the left temporal bone) and may have been attached to the hair.

The large pendant (see Figure 17-35), which measured 198.9 long, 93.7 mm wide, and 9.2 mm in maximum thickness, was made from the part of the shell that extends from the penultimate whorl above the shoulder to the base of the body whorl near the anterior canal. The shoulder spines, which are naturally prominent on the shell, were ground smooth. The cut edges of the pendant were also smoothed by abrasion. Two bi-conically drilled perforations were located near one edge. This specimen is closely similar to "Form 3" whelk shell pendants from the Ernest Witte site in the lower Brazos River area (Hall 1981:199), which are of comparable size, are made from the same part of the whelk shell, and also have two bi-conically drilled holes near the edges.

The smaller pendant, ovoid to rectanguloid in shape, measured 96.3 long, 56.3 mm wide, and 5.8 mm thick. It was shaped by grinding and abrading the edges. A single bi-conically drilled suspension hole was near the center of one edge. Similar round and rectangular pendants with single holes near one edge have been reported from Late Archaic mortuary contexts at the Ernest Witte and Crestmont sites (Hall 1981:203, 2002:49, 79).

The Late Archaic Mortuary Assemblage

Four of the artifacts described above are diagnostic of the Late Archaic period on the Texas coastal plain. These include the Lange point with Burial 23 and the whelk shell pendants with Burial 25. The Ensor-like point embedded in the right scapula of Burial 25 may also be considered a diagnostic of the period. Although

Figure 17-35. A large whelk-shell pendant found grasped in the left hand of the adult male in Burial 25 at Buckeye Knoll. This specimen is similar to others from Late Archaic cemeteries in the Lower Brazos and lower Colorado River areas at sites such as Ernest Witte and Crestmont.

Figure 17-36. A whelk-shell pendant found next to the left side of the skull of Burial 25 at Buckeye Knoll. This is also similar to specimens from Late Archaic burials in the Lower Brazos-Colorado River area.

it is not a very good example of that type, its similarity to Ensor points suggests a placement within a generic grouping of rather small, Late Archaic side-notched dart point types.

The placement of these artifacts with burials has close counterparts at other sites on the Texas Coastal Plain. Lange points were a redundant occurrence with burials at the Loma Sandia site in Live Oak County (Taylor and Highley 1995), dated to ca. 800-500 B.C. The similarities in material and form of the whelk shell pendants from Burial 25 with pendants from the Ernest Witte and other Late Archaic burial sites in the lower Brazos-Colorado valleys have already been mentioned. Indeed, Burials 23, 25, and 30 are also reminiscent of Late Archaic interments in that area by virtue of their supine, extended body positions and consistent headward orientation. The Late Archaic burials at Buckeye Knoll were, however, oriented toward the southeast. In the cemetery at Ernest Witte [Late Archaic Group 2 Burials; Hall 1981:50], the heads were commonly oriented to the northeast. At the Crestmont site in the lower Colorado River area [Hall 2002]) the heads were usually oriented to the east. The extended burials at Buckeye Knoll are in contrast to the predominance of flexed body positions to the south at sites such as Loma Sandia and large cemeteries along the south central coast, such as Callo del Oso (41NU2) and Oso Dune (41NU37). Seemingly, then, the Late Archaic burials at Buckeye Knoll had a stronger cultural affinity with the contemporaneous mortuary tradition of the lower Brazos-Colorado River valleys than to mortuary patterns farther south.

Chapter 18

Sociocultural Implications

Robert A. Ricklis

In attempting to interpret the findings in the early cemetery at Buckeye Knoll, one is immediately confronted by two primary facts. First, there is a wealth of bioarchaeological and cultural information contained in the burials and the artifacts that were interred with them, which ought to provide multiple lines for interpreting key aspects of prehistoric human adaptation and sociocultural patterns. Second, these findings are currently unique, meaning that there are little or no comparative data for this relatively early time period in the surrounding region with which to define a cultural context for the Buckeye Knoll materials. As a result of this, interpreting the cemetery findings must rest on (1) site-specific observations that can be interpreted using appropriate theory, and (2) comparisons with findings pertaining to more or less contemporaneous cultural patterns outside the Texas area.

General Significance

As reviewed in Chapter 5, numerous prehistoric mortuary sites have been documented within the region of the Texas coastal plain. The great majority of these, many of which are sizeable cemeteries, pertain to the Late Archaic and Initial Late Prehistoric periods. The only mortuary remains dating to the Early Archaic in the region are an undefined fraction of the many burials ($n \approx 250$) documented at the Morhiss site some seven decades ago. Currently, six AMS dates have been obtained on human bone from as many burials at Morhiss, and two of these are contemporaneous with the early cemetery at Buckeye Knoll. In short, mortuary remains predating the Late Archaic are extremely scarce in the region, and the Buckeye Knoll cemetery is unique.

Formal Ritual Precinct

A primary fact is that the Buckeye Knoll cemetery was a true formal cemetery; that is, a space set aside for exclusive use as a burial ground and a place for performing mortuary ritual. The many human burials clustered on the Knoll Top are not simply the result of repeatedly interring the dead within the bounds of a residential campsite over a long period of time, as is apparently the case with certain other known and relatively early sites in eastern North America where numerous human burials have been found within domestic midden deposits and/or within the spatial confines of contemporaneous camp sites (e.g., the Black Earth site near Carrier Mills, southern Illinois [Jeffries and Lynch 1983], and the Ensworth School site in Tennessee [Deter-Wolf 2004], both dating to the Middle Archaic period as defined in the eastern U.S.). As discussed in Chapter 6, the Knoll Top cemetery dates to a time frame between 7000 and 6200 B.P., calibrated, during which the Buckeye Knoll site apparently was not occupied as a domestic campsite, despite repeated occupation both before and after this period. Relevant to this, it is worth repeating that no artifacts of the kinds found in the cemetery were recovered from domestic debris at the site, and none of the radiocarbon or AMS dates obtained on domestic organic debris fall into the period of cemetery use. These factors are interpreted as meaning that the site was reserved by the people who used it as a special precinct for burial and attendant mortuary ritual, and it is reasonable to infer that ordinary daily (secular) activities were, probably by ideological imperative, carried out at other locations.

Locational Considerations

The Macroscale

At the geographic scale of the surrounding region, the Buckeye Knoll site is situated at a key location on the landscape. The site is on the prairie upland margin overlooking the east bank of the Guadalupe River, just a few kilometers upstream from the confluence of the Guadalupe and San Antonio rivers. Several kilometers farther downstream, the Guadalupe discharged into San Antonio Bay, a major, biotically highly productive coastal estuary system. The headward shore of the bay may have been somewhat closer to Buckeye Knoll in the seventh millennium B.P. than it is today, since later Holocene seaward progression of the Guadalupe delta, resulting from ongoing sedimentation, had not yet taken place. In any case, as discussed earlier, the stable isotope data from Buckeye Knoll human skeletal remains show that the people buried in the cemetery had a diet that included a significant amount of marine resources, strongly suggesting that the society that produced the cemetery had incorporated the coastline, along with part of the interior, into its economic operational area.

With reference to these factors of hydrological geography, it can be inferred that the location established for the Buckeye Knoll cemetery was highly significant for the relevant human society, since it represented access to, and perhaps control of, the rich resource zones of the Guadalupe and San Antonio floodplains, the adjacent upland prairie environments, and the adjoining portion of the central Texas coastline. In consideration of the stable-isotopic findings, it is reasonable to conclude that the cemetery represents a hunter-gatherer society whose operational area was defined as an ecotonal territory that encompassed portions of both the coastal and the interior prairie-riverine environments, and whose members were able to move between those two environmental zones to procure food resources. As noted earlier, this is a pattern distinctly different from the ecologically rooted coastal-inland territorial dichotomy that had become established by Late Archaic times and that persisted into the historic Colonial period among the region's indigenous coastal Karankawa and various inland groups (Ricklis 1996a).

A further implication is that this sort of ecologically-based territoriality must have had distinct social correlates. A number of researchers (Charles and Buikstra 1983; Goldstein 1976; Saxe 1970) have suggested that formal cemeteries tend to be maintained by people who are organized as corporate groups. Cemeteries will be located within the territory used by the corporate group, and will be the places reserved for burial of deceased group members (Charles and Buikstra 1983:121). The cemetery thus becomes the resting place of the ancestors, affording the group an ideologically based claim on the territory in which it operates. This significance of cemeteries has been noted by Dee Ann Story (1985) and Grant Hall (1981, 1995), who have suggested that the emergence of cemeteries in the Late Archaic must have been one end result of gradual, long-term population growth on the Texas coastal plain, and the concomitant emergence of discrete territorial boundaries as the human environment became more densely populated. Buckeye Knoll indicates that the human-ecological and demographic conditions for the establishment of cemeteries were in place much earlier than anticipated by these authors. With the emergence of exploitable coastal estuaries after ca. 9,000 B.P. (e.g., Ricklis and Blum 1997; Ricklis 2004a), groups who were able to combine coastal resource procurement with access to inland resources would have had an adaptive advantage that fostered a growing population that, in turn, encouraged establishment of territorial boundaries and sanctioning of territorial control through the establishment of formal cemeteries. The geographical layout of this hypothesized ecotonal territory is depicted in Figure 18-1.

The Microscale

The Early Archaic cemetery at Buckeye Knoll is situated on the top of the prominent knoll at the west end of the site. As mentioned repeatedly in previous pages, this remnant landform is the result of erosion along the Guadalupe River's eastern valley wall that occurred as the river downcut through the massive, thick clays of the Pleistocene-age Beaumont Formation. Capping the knoll are silty-sand deposits of late Pleistocene and Holocene ages. Although much of these later deposits post-date the formation of the cemetery, the local topography was then probably similar to that of today, since the silty sand in which the burials rested was covered at that time by sediment that was later deflated by erosion during the middle Holocene, probably after ca. 6,000 B.P. By ca. 4,000 B.P., new eolian deposition of silt and sand replaced the sediment lost during the previous two millennia.

Thus, the distinctly mound-like configuration today represented by the west knoll would also have existed in Early Archaic times. That this natural landform was selected for a formal cemetery is likely due to its prominent, mounded form. The burials revealed by our excavation are tightly clustered at what would

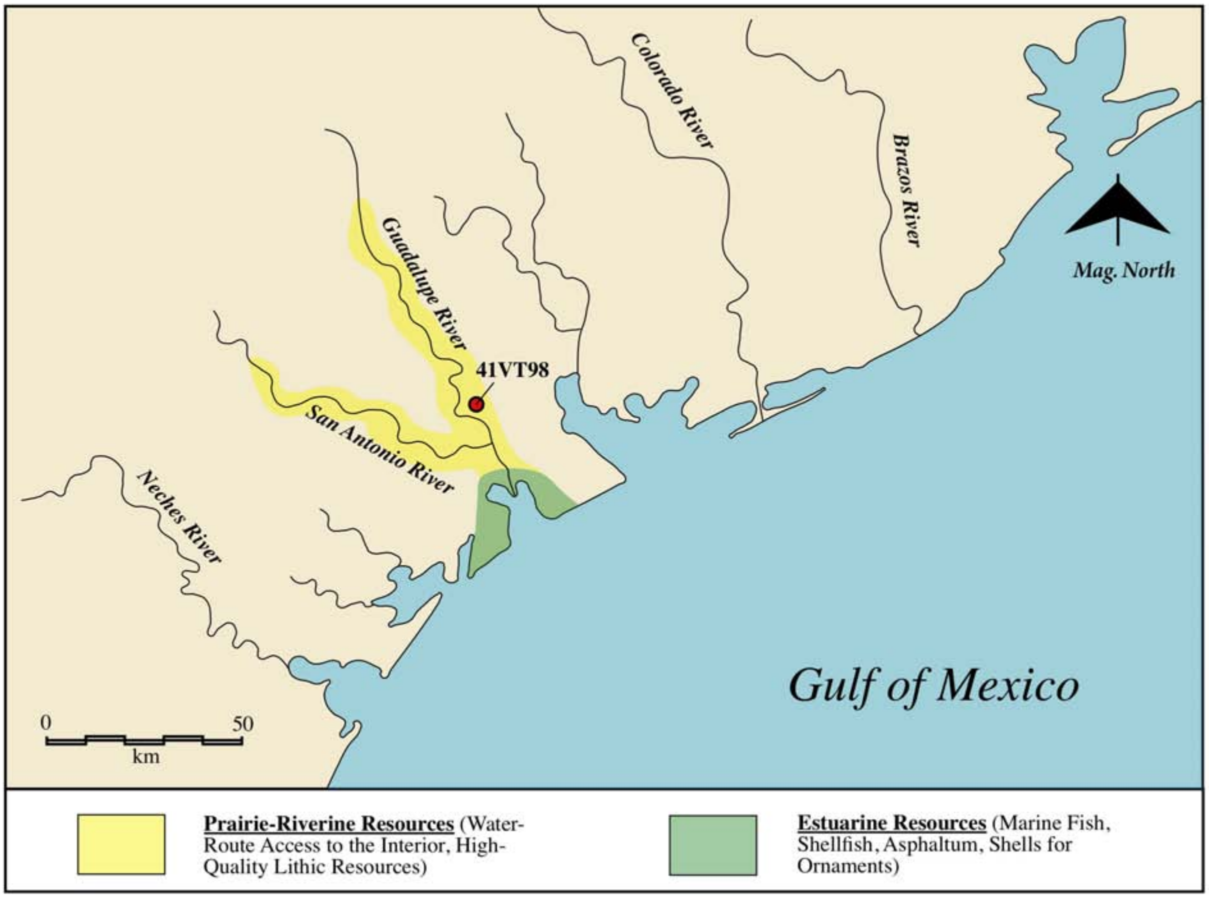


Figure 18-1. Map showing a schematic geographical outline of a hypothesized ecotonal territory that would have been the operational area of the society that created the Buckeye Knoll cemetery in the seventh millennium B.P. Note the inclusion of a part of the coastline as well the lower Guadalupe and San Antonio River valleys and adjacent upland prairies. This map is based on locational considerations as well as empirical stable isotope evidence indicating that the Buckeye Knoll people incorporated marine foods into their diet. The extent of territory inland along the two rivers is shown arbitrarily, since the actual distance is unknown.

have been, prior to modern spoil deposition, essentially the exact central high point of the knoll (Figure 18-2). This positioning suggests that the elevated location was chosen to emphasize the importance of the spot as a place for mortuary ritual, with the mound-like configuration of the landform being a key factor in its selection.

Mortuary Data Implications

It is archaeologically axiomatic that the variability in the treatment of individuals within a mortuary population reflects a parallel variability in the social roles and/or statuses of individuals during life (e.g., Brown 1971, 1981; Binford 1971; Chapman and Randsborg 1981; O'Shea 1984; Wason 1994). Patterned differences in the locations of graves, the differential labor investment in grave preparation, and the variable wealth represented by materials placed within graves have all been used as archaeological bases for inferring differences in social statuses and/or affiliations within societal subsets. In his extensive study of the linkages between archaeologically observable patterning in mortuary remains and the social patterns they represent, John O'Shea notes that "extensive research has demonstrated the existence of regularities linking aspects of the living society and its procedure for disposal of the dead." He lists three such linkages that he considers being of foremost importance (O'Shea 1984:21). The first is that mortuary differentiation is patterned, and its elements are integrated with other aspects of the sociocultural system. Second, the mortuary differentiation accorded an individual, although not necessarily isomorphic with social patterns, is

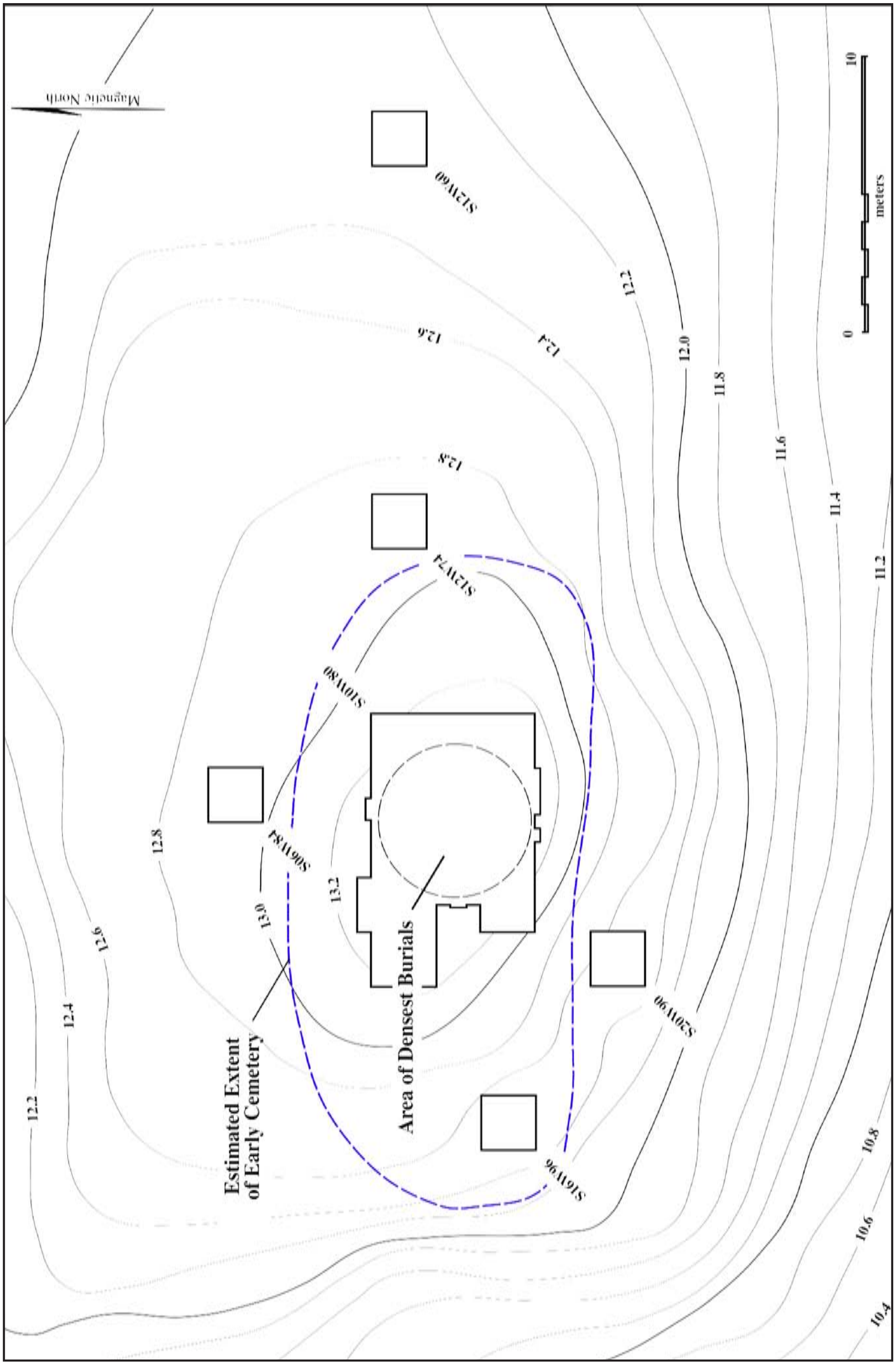


Figure 18-2. A topographic map of the Knoll Top Area at the Buckeye Knoll site showing the topography approximately as it would have been prior to the addition of modern sand spoil along the southern margin of the knoll. Note that the area of densest burials in the Early Archaic cemetery is situated near the center and highest point of the knoll.

reflective of his social position in the living society. Finally, the complexity of the system of mortuary differentiation will increase with the complexity of the society at large.

The third point above would imply that patterned variability in the graves at Buckeye Knoll should not be expected to be pronounced, given that the remains represent an early population of Archaic hunter gatherers who presumably did not operate within a highly complex sociocultural system with pronounced status differentiations between individuals or societal segments. Nonetheless, there are discernible patterns of variability manifest in the Buckeye Knoll cemetery that merit review and consideration. These patterns include 1) patterning in the horizontal spatial distributions of different classes of artifacts placed in graves and 2) a marked variability in the quantity of artifacts with individual graves and a corresponding variability in the summed values of those artifacts in terms of the cost in time and energy required for their production. The latter translates into rather marked differences in the material wealth placed with individuals that, in turn, merits inquiry into whether such differences correspond to discernible differences in age or sex, or rather, may reflect other inferable social distinctions.

Mortuary Artifact Spatial Patterning

A review of the distributions of major classes of grave artifacts was undertaken in order to determine if such were random or if they occurred according to definable spatial patterns within the Early Archaic cemetery. To be meaningfully considered in this context, a given artifact class must be present in sufficient abundance to show a discernible distributional pattern. One-of-a-kind items (e.g., the oversized fluted-stem biface) or artifacts of which only a few specimens were found (e.g., bannerstones and plummets) will not exhibit definable patterning in their spatial occurrences, simply by virtue of their scarcity, since each specimen constitutes a single point in space and there are too few such points with which to define a discernible distributional pattern.

The following classes of artifacts were considered to be potentially informative for these purposes, based on their relative abundances: 1) dart points and dart point fragments, 2) grooved stones, 3) ochre, either as powder or nodules, and 4) shell ornaments. The nine dart points and point fragments were found throughout the excavated portion of the cemetery and show no spatial clustering in any one part of the area. The grooved stones were concentrated in the northern portion of the excavated part of the cemetery (Figure 18-3). All but one of the 22 specimens, or 95 percent, were found north of grid line S14, while 77 percent, of the specimens were recovered north of grid line S12. Ochre nodules and powder were in graves scattered throughout the excavated cemetery area. No pattern was discernible in their distribution.

Shell ornaments were the most numerous artifact class that accompanied the Early Archaic burials. This group includes pendants made from bivalve shells of sunray venus (*Macrocallista nimbosa*), a marine species, and freshwater mussels, as well as beads made from tiny marginella and nerite marine gastropods. In total, 1,770 shell ornaments were found in association with the early cemetery. Of these, 447 were small beads "floating" in the sediment matrix, presumably through bioturbational displacement since their original interment in the seventh millennium B.P.; these cannot be ascribed to any particular burial. The remaining 1,323 specimens, or 75 percent of the total, were found with 23 individual burials AMS dated, or ascribed on the basis of stratigraphic context, to the Early Archaic cemetery.

The burials to which these 1,323 shell beads and pendants can be ascribed with some confidence, either on the basis of their being clustered near bones as clear concentrations, or resting in a linear arrangement believed to reflect the beads' original positions within the burial, were all located in the southern part of the excavation. As may be seen in Figure 18-3, clusters of relatively large numbers of marginella beads were found with Burials 34, 42, 45, 59, 60, and 74, all of which were also within the southern part of the excavated area of the cemetery. All of the bivalve-shell pendants, both those made of freshwater mussel and marine sunray venus clams, were also found in this area.

Discussion

There is a spatial dichotomy in the locations of grooved stones as opposed to shell ornaments, with the two artifact classes showing strong tendencies to cluster in the northern and southern parts of the cemetery, respectively (see Figure 18-3). Given that both classes of artifacts are relatively abundant in the cemetery, it is possible that their almost mutually exclusive distributions reflect some recognized social attributes of the interred individuals. Whatever these may have been, it would seem that the individuals in the southern part of the cemetery were distinguished from those in the northern part on a systematic ba-

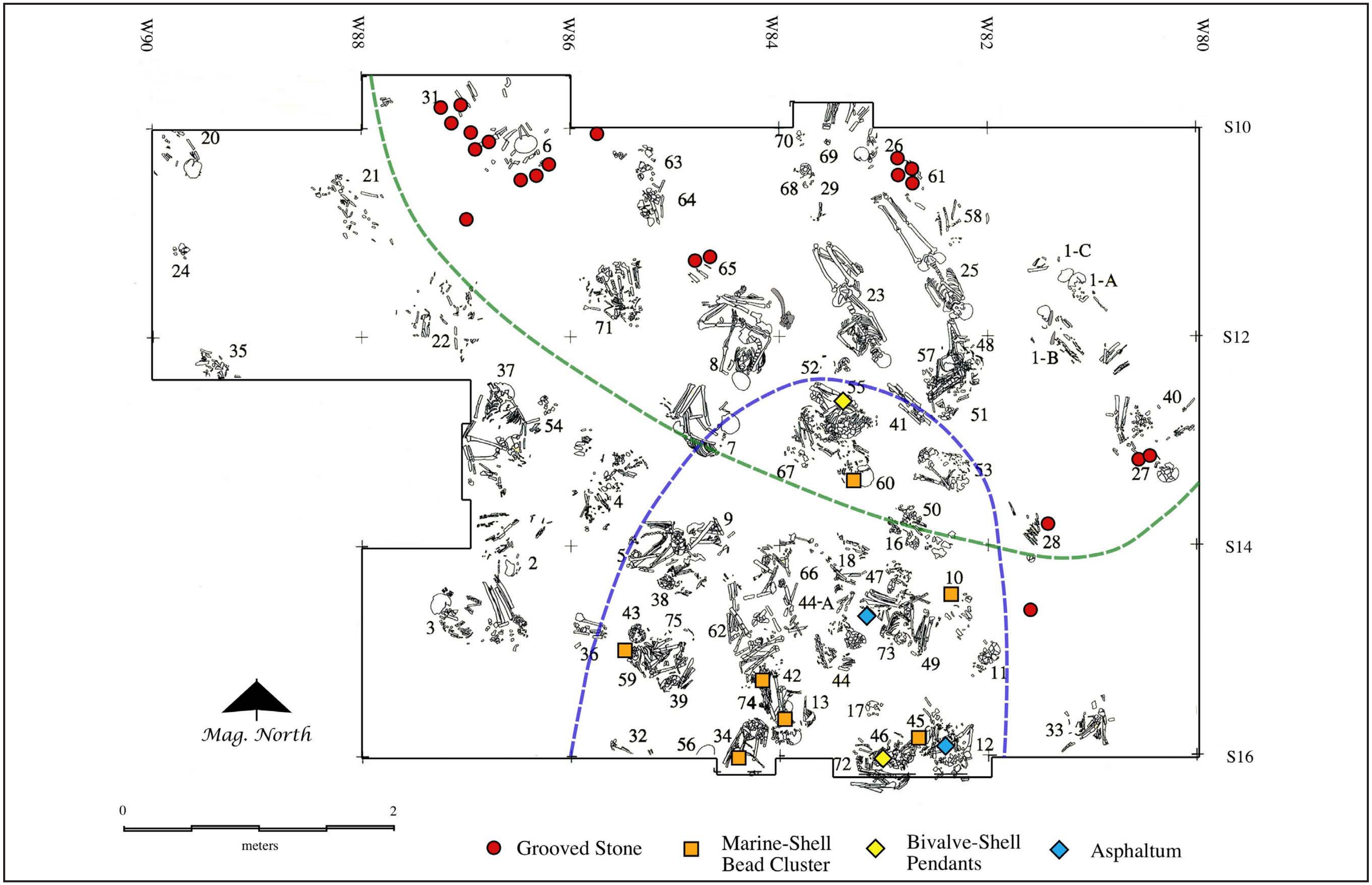


Figure 18-3. A map of the main excavation block in the Knoll Top Area showing the distributions of certain kinds of Early Archaic mortuary artifacts, including grooved stones (quartzite and limestone varieties combined), shell ornaments, and asphaltum nodules. Dashed lines highlight the apparent north-south dichotomy in the respective distribution of the grooved stones and the shell ornaments.

sis. The biological factors of age and sex were not the relevant differences, since adult males, adult females, and subadults were all buried throughout the cemetery without any corresponding spatial clustering (as may be seen in Figure 18-4, which shows locations of the graves of adult males, adult females, and sexually indeterminate subadults).

Ruling out these variables, then, we may infer that the distinguishing characteristics were essentially sociocultural and that the north-south dichotomy in the variable distributions of the two major classes of mortuary artifacts reflects a corresponding dichotomy or duality within the social structure, perhaps a moiety in which part of the societal whole involved individuals who were socially distinguishable from other members of the society.

At this point we enter a rather speculative arena of inquiry, but the formulation of hypotheses that can be tested by future regional research should not be eschewed (tested, for example, by determining if such a pattern was replicated at other mortuary sites of this period in the region, which would strongly support the reality of the apparent pattern). There are several correlations between the north-south dichotomy in grooved stones vs. shell ornaments and other variables that may provide information that sheds light on this pattern.

First, the headward orientations of the burials in the Early Archaic cemetery exhibit a tendency to be toward the south (see Fig. 10-59), perhaps correlating with a perceived importance of that direction as the source for coastal/estuarine resources. Second, in the environment of the Buckeye Knoll site, north equates with the inland direction, while south equates with the direction of the Gulf coast. Hypothetically, then, a north-south dichotomy mirrors the fundamental environmental and human-ecological duality between the coastal and the interior prairie-riverine environments as major zones of resource extraction along a broad ecotone.

Third, all but three of the 1,770 shell ornaments (namely the three freshwater mussel shell pendants with Burial 55) are made of shell species that had to have been obtained along the Gulf of Mexico shoreline. Thus, the southward/coastward orientation of the shell artifacts aligns with the direction from which these items came, and *may* align with the geographic variability in the resource mosaic of the operational area of the Buckeye Knoll population.

Fourth, the grooved stones, almost all from the northern part of the cemetery excavation, inferably express an inland orientation. As noted earlier, these artifacts are closely related to the Waco sinkers found most commonly in inland areas, particularly to the north along the Brazos River in the area around present-day Waco, Texas (Watt 1938). It is thus reasonable to infer that these objects to some degree denoted that aspect of the environmental-ecological duality. Moreover, the actual stone from which these items were made had to have come from upstream (inland, north) of the Buckeye Knoll site, where gravel bars are exposed in the coastal plain river channels from which the material could be collected (e.g., see Collins 2002; Hunter 2002; Ricklis and Cox 1993).

Finally, asphaltum nodules, which must have been brought to the site from the coast where they can be gathered from Gulf beaches, were found with Burials 45 and 47, both located in the southern part of the cemetery excavation. Although the sample is too small for any conclusions, it suggests that this coastal material was found in the same part of the cemetery that contained marine-shell ornaments.

The north-south/interior-coastal duality that seems to be expressed by the above-listed variables in the Buckeye Knoll cemetery may reflect something of the fundamental way in which the pertinent society conceptualized its world. Given that the artifact-distribution dichotomy is in a mortuary setting, it may also be hypothesized that some individuals within the societal group had greater affinity for, or connection to, the coastal (southern sector) of the environment than did others, while others had a closer relationship to the interior (northern sector). Perhaps the two sets of individuals represent two lineages, one with a traditional linkage to the coastline and the other with a similar linkage to the interior.

Status Differences

As mentioned above, there is marked variability in the amounts of material wealth that were placed within individual graves, a fact that suggests correspondingly variable social statuses for the interred individuals. As Tainter (1977) pointed out, there is an ethnographically supported positive correlation between the social status of the deceased and the amount of energy expended in his or her burial. Such energy expenditure may be devoted to preparation of the grave, as well as to the production of mortuary artifacts that are placed with the deceased within the grave (e.g., Wason 1994). Since the various kinds of artifacts placed within burials exhibit a wide range of skill and input of labor in their production, it is fair to assume that different

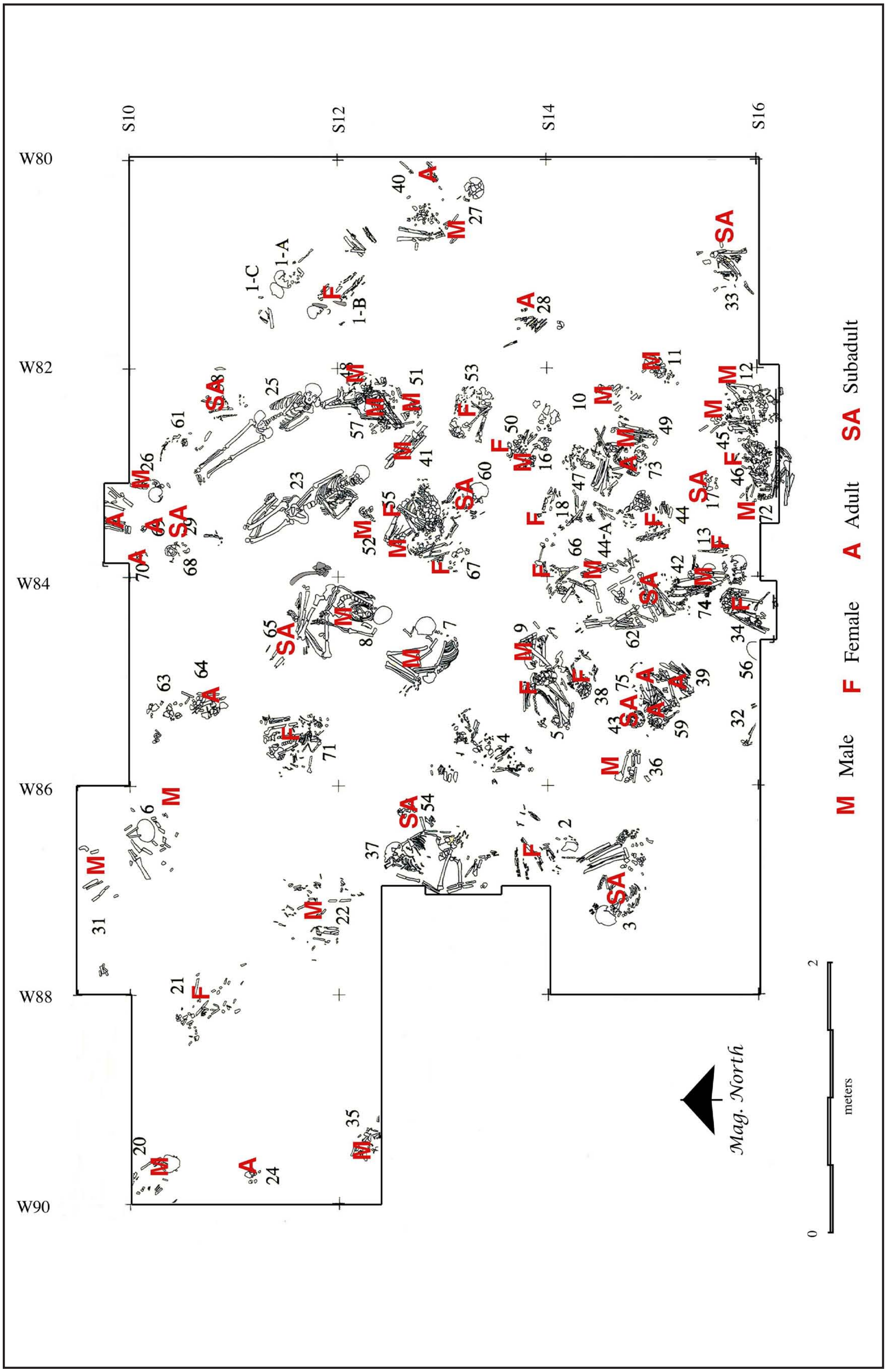


Figure 18-4. A map of the main excavation block in the Knoll Top Area showing the distributions of male, female, subadult, and unsexed adult burials in the Early Archaic cemetery. Note that none of the four categories was placed according to any discernible spatial patterning.

items had correspondingly different values within the prehistoric society. It has been noted, for example, that about 30 hours of skilled labor are required to produce a single quartzite grooved stone (see discussion in Chapter 17). A similar input of labor and skill (representing the sum of previously expended energy in learning to produce an artifact) was probably needed to make a winged bannerstone; especially demanding would have been boring of the central perforations on these items. Such artifacts must have had a value that exceeded that of other items such as flaked chert pieces (e.g., dart points and, especially, preforms). Also, artifacts made from exotic materials, that must have been brought into the Buckeye Knoll area from considerable distances (e.g., the large uniface of tabular Georgetown chert from Burial 58 and the oversize stemmed biface from Burial 74, made of an exotic, brecciated tabular chert), may have had an intrinsically higher value than pieces requiring similar labor input but made from local materials. Heirloom pieces, such as the oversized fluted-stem biface from Burial 74, are suggested to likely have had tremendous value by virtue of the long-term investment in curating the objects, not to mention the intangible value inherent in their uniqueness and, possibly, their linkage with ancestors and/or ancestral spirits.

Any emic ascription of relative values to the classes of mortuary artifacts is fraught with risk, insofar as we have no direct insight into the importance ascribed to objects by the Buckeye Knoll people. However, since we can assess, with reasonable certainty, an approximate relative value based on a rough understanding of the different levels of labor and skill required to bring an object to a grave (including time and energy costs of material acquisition, manufacture, maintenance/curation) we are not without some means for at least a roughly reliable comparison of the “wealth” interred within different individual graves.

Table 18-1. Categories of Mortuary Artifacts from the Early Archaic Cemetery at Buckeye Knoll and Assigned Numerical Values.*

Item	Assigned Value
Quartzite Grooved Stone	10
Limestone Grooved Stone	3
Bannerstone	10
Plummet	3
Oversize Stemmed Biface	15
Dart Point	2
Biface (Possible Knife/Dagger)	2
Preform	1
Guadalupe Tool	2
Large Uniface	3
Flake	0.1
Hammerstone	1
Abrader	1
Ochre	0.5
Asphaltum	0.5
Bone/Antler Tool	2
Perforated Canine Tooth	1
Shell Pendant	1
Marginella/Nerite Bead	0.1
Unmodified Bivalve Shell	0.5

* Based on estimations of labor input in artifact production.

Table 18-1 lists the different kinds of mortuary artifacts found in the Early Archaic cemetery, along with arbitrarily assigned numerical values for each. These values range from 0.1 for individual marginella/nerite beads to 15.0 for the oversized stemmed biface. The actual values are, as already stated, arbitrary, and are not expected to actually reflect any precisely quantifiable energy/time input in artifact production. While we do know from experimental reproduction that quartzite grooved stones (value=10) require about 30 hours to make. A dart point, on the other hand, might require approximately an hour to produce. The time required to acquire the chert raw material for dart point production cannot be known with similar reliability, since it would depend on factors such as distance to a lithic source location from the place where the point is made, search time at the source for suitable material, and so on. The numerical values, thus, are relatively higher or lower based only on a general idea of actual manufacture time, and a very general sense of differing time and effort in material acquisition relative to other kinds of artifacts.

Burial Ranking

With the caveat that the assigned artifact values are only approximations based on estimations of labor inputs (time and energy) in material acquisition and artifact production, the total value of the artifacts found with a given grave establishes its rank in terms of accompanying material "wealth," where an individual grave's inclusive wealth equals the summed numerical value of its accompanying artifacts. It should be noted that there were no other criteria in the observable evidence by which to rank the burials (e.g., no evidence for variation in the expenditure of time and energy in preparation of the grave itself; all graves were simple inhumations in the Zone 3 matrix, presumably consisting only of holes dug into the ground without any discernible elaboration in grave preparation; nor can we account for the value of perishable items that are no longer present within the graves).

Table 18-2 lists all burials ascribed on the basis of AMS dating and/or stratigraphic position to the Early Archaic cemetery. Also shown are the numbers and kinds of artifacts in each grave along with their total numerical value. The burials are listed in an order that accords with the resultant number, with the highest number assigned to Burial 74, ranked No. 1 (numerical value of its artifacts = 99.8), and the lowest-ranked burials (all without grave artifacts and thus with numerical totals of 0) accounting for the last 23 burials listed.

Figure 18-5 is a graphic presentation of the comparative ranking of all burials. As a glance at this figure clearly shows, there is great variation in the values assigned to individual burials. The two with the highest values, Burials 74 and 6, have values of 99.8 and 89.0, respectively. The next three burials in rank order, Burials 8, 45, and 61, have values in the 40s, after which the values for the remaining burials decline precipitously to less than 10.

These fairly pronounced differences strongly suggest that individuals in the living society were accorded variable treatment in death which, assuming that O'Shea's key points (listed above) have essential validity, means that members of the society represented at Buckeye Knoll had recognizably different statuses. Importantly, it must be noted that the significant differences in wealth buried with different individuals is not the result of diachronic change as would be the case if, for example, there was a trend, over the millennium or so during which the cemetery was used, toward placing increasing (or decreasing) amounts of material goods with burials. This can be readily seen in Figure 18-6, which shows the calibrated AMS age ranges for the 12 dated Early Archaic burials aligned along the horizontal axis according to ranks. It can be seen that there is no time-dependent correlation between greater or lesser chronological age and increasing or decreasing rank, thus indicating that the value of materials placed in a grave is not time-dependent. Therefore, in the context of variable placement of material goods, the entire cemetery can be interpreted as an essentially synchronic phenomenon, meaning that the ranking of the burials can be assumed to reflect social factors that were in place during the span of time the cemetery was in use.

Status and Age

The age at death could be determined for most of the burials pertaining to the Early Archaic cemetery through examination of dentition (see Chapter 13). The estimated ages at death are included with the list of burials presented in Table 18-2.

If individual status was strictly or largely based on age, there should be a positive correlation between the rank of a given burial and that individual's age at death, with increasing age corresponding to higher rank. This is not the case, as is apparent in the graph shown in Figure 18-7. In this graph it will be seen that the highest-ranked group of burials (ranks 1 through 10) does not have a significantly older average age at death than lower-ranked groupings of ten burials. The second-highest ranked group (ranks 11 through 20) has, in fact, a slightly greater average age. The difference is probably quite insignificant, consisting of only an estimated 1.8 years in average ages. Indeed, average ages for each rank grouping (by groups of 10 burials) fluctuate closely around an age at death of 30 years. Moreover, the ages of the highest-ranked burials (ranks 1 through 10) and all burials combined (including all ranked and unranked individuals, with unranked consisting of those with no accompanying artifacts and thus with a value of 0) are almost identical, at 32.1 and 32.3 years, respectively. It is concluded, therefore, that status in the Buckeye Knoll population was not achieved simply by virtue of increasing age of the individual.

Status and Gender

Quite a different picture emerges from an examination of the possibility of a correlation between status and gender. The data overwhelmingly point to the conclusion that a person's sex was a key factor in their social status, and that highest status tended to be accorded to some, but not all, adult males. This is supported by the following factors.

First, all but one of the highest ranked burials, as measured by the numerical values assigned on the basis

Table 18-2. Ranking of the Early Archaic Burials at Buckeye Knoll According to Summed Values of Accompanying Mortuary Artifacts.

Rank	Burial No.	Number of Artifacts	Number of Artifact Classes	Value*	Items/Comments	Sex	Age
1	74	632	4	99.8	2 winged bannerstones; oversize stemmed biface; 628 marginella beads; 1 distal dart point fragment. A range of exotic, labor-intensive items. Bannerstones and oversize biface may be non-utilitarian status objects.	M	45
2	6	22	4	89.0	7 polished quartzite grooved stones (1 "killed") are all labor-intensive, high-skilled items; 2 limestone grooved stones; 11 chert preforms (in a cluster); 2 hammerstones.	M	Edentulous
3	8	23	6	49.0	2 limestone plummets; clustered tool kit with 2 lanceolate dart points; chert flakes; sandstone abrader and bone/antler billets and flaking tools; 2 canid radii may symbolize a dog as a hunting companion. This individual may have been a part-time specialist in flint knapping.	M	46
4	45	438	4	46.0	430 marginella-shell beads; 6 lumps asphaltum (some with basketry impressions); 1 freshwater mussel shell; 1 antler billet.	M	30
5	61	10	3	43.5	4 quartzite grooved stones; 1 dart point preform; 3 nodules red ochre; 2 nodules yellow ochre.	M	32
6	27	4	3	20.0	2 quartzite grooved stones; 1 chert preform; 1 chert drill (last 2 items may be intrusive).	M	56
7	65	6	3	13.4	1 quartzite grooved stone; 1 limestone grooved stone; 4 chert flakes (2 retouched).	SA	15
8	11	3	2	10.3	1 quartzite grooved stone (possibly not associated); 3 nerite-shell beads.	M	Adult

Note: Sex/age ascriptions refer to the individuals believed to be the primary person buried in a given grave. M (Adult Male), F (Adult Female), A (Adult, Indeterminate Sex), SA (Sub-Adult, Indeterminate Sex). * Values are assigned on the basis of numerical scores for each class of mortuary artifact as listed in Table 18-1.

continued.

Table 18-2. (continued.)

Rank	Burial No.	Number of Artifacts	Number of Artifact Classes	Value*	Items/Comments	Sex	Age
9	5	1	1	10.0	1 quartzite grooved stone.	F	55
10	44	1	1	10.0	1 bannerstone (in 2 pieces); 3 possible bannerstone fragments.	F	24
11	55	12	5	9.4	4 marginella beads; 3 freshwater mussel pendants; 1 sunray venus shell pendant; 3 perforated canid canine-teeth; 1 small nodule red ochre.	F	56
12	49	7	5	9.1	tool kit cluster containing 2 dart points, 1 bone flaker, 1 antler (billet) fragment; 1 blade-like chert flake; 1 red ochre nodule; 1 lump asphaltum. Another flint knapper?	M	55
13	60	83	1	8.3	83 marginella shell beads (alignments suggest 1 necklace and 1 bracelet).	SA	8
14	58	7	4	8.0	1 chert Guadalupe Tool; 1 dart point preform; 1 large uniface of imported Georgetown flint; 4 small nodules red ochre.	SA	5
15	59	78	1	7.8	78 marginella beads.	A	Adult
16	62	4	2	7.0	2 limestone plummets; 2 small red ochre nodules.	M	31
17	46	6	1	6.0	2 sunray venus shell pendants; 4 sunray venus shells (could also be pendants).	F	26
18	52	5	4	4.1	1 dart point; 1 perforated canid canine-tooth; 2 small nodules red ochre; 1 marginella bead.	M	48
19	1B	2	1	4.0	2 lanceolate bifaces (too big to be dart points, maybe daggers or lance heads).	F	56

Note: Sex/age ascriptions refer to the individuals believed to be the primary person buried in a given grave. M (Adult Male), F (Adult Female), A (Adult, Indeterminate Sex), SA (Sub-Adult, Indeterminate Sex). * Values are assigned on the basis of numerical scores for each class of mortuary artifact as listed in Table 18-1.

continued.

Table 18-2. (continued.)

Rank	Burial No.	Number of Artifacts	Number of Artifact Classes	Value*	Items/Comments	Sex	Age
20	12	8	1	4.0	8 unmodified freshwater mussel shells.	M	20
21	72	4	4	3.6	1 biface fragment; 1 freshwater mussel shell; 20 pieces asphaltum; 1 marginella bead.	M	38
22	22	2	2	3.1	1 limestone grooved stone; 1 marginella bead.	M	17
23	28	1	1	3.1	1 limestone grooved stone; 1 marginella bead.	SA	13
24	7	2	2	3.0	1 biface fragment; 1 bone needle distal fragment.	M	56
25	21	1-2	1-2	3.0	1 bi-pointed biface (possible knife); red-ochre-stained chert preform (latter may not be associated).	F	Adult
26	43	3	3	2.7	1 lanceolate dart point; 1 mass powdered red ochre; 2 marginella beads.	SA	14
27	26	1	1	2.0	1 distal dart point fragment.	M	32
28	42-A	23	2	2.0	20 marginella beads.	SA	0.75
29	4	1	1	2.0	1 corner-notched dart point.	F	54
30	66	2	2	1.5	1 canid canine frag (possible bead); red ochre powder.	F	39
31	67	5	2	1.3	3 marginella beads; 2 small nodules red ochre.	F	31

Note: Sex/age ascriptions refer to the individuals believed to be the primary person buried in a given grave. M (Adult Male), F (Adult Female), A (Adult, Indeterminate Sex), SA (Sub-Adult, Indeterminate Sex). * Values are assigned on the basis of numerical scores for each class of mortuary artifact as listed in Table 18-1.

continued.

Table 18-2. (continued.)

Rank	Burial No.	Number of Artifacts	Number of Artifact Classes	Value*	Items/Comments	Sex	Age
32	73	3	2	1.2	1 piece tabular sandstone; 2 chert flakes.	?	30
33	47	7	2	1.0	5 chert flakes; 1 asphaltum nodule.	M	24
34	10	1	1	1.0	9 marginella and 3 nerite beads.	M	38
35	13	8	1	0.8	7 marginella and 1 nerite bead.	F	48
36	2	1	1	0.5	1 small nodule yellow ochre.	F	38
37	53	1	1	0.5	1 small nodule red ochre.	F	Adult
38	68	1	1	0.5	1 small nodule red ochre.	SA	6
39	75	4	1	0.4	4 marginella beads.	A	30
40	20	4	1	0.4	4 marginella beads.	M	Adult
41	18	2	1	0.2	2 marginella beads.	F	56
42	57	2	1	0.2	2 small nodules red ochre.	M	Adult
43	16	1	1	0.1	1 marginella bead.	A	Adult

Note: Sex/age ascriptions refer to the individuals believed to be the primary person buried in a given grave. M (Adult Male), F (Adult Female), A (Adult, Indeterminate Sex), SA (Sub-Adult, Indeterminate Sex). * Values are assigned on the basis of numerical scores for each class of mortuary artifact as listed in Table 18-1.

continued.

Table 18-2. (continued.)

Rank	Burial No.	Number of Artifacts	Number of Artifact Classes	Value*	Items/Comments	Sex	Age
44	38	1?	1?	0.1	1 marginella bead; may not be associated.	F	Young Adult
0	19	0	0	0	—	A	?
0	69	0	0	0	—	A	56
0	70	0	0	0	—	A	Adult
0	71	0	0	0	—	F	21
0	3	0	0	0	—	F	51
0	1A	0	0	0	—	A	?
0	9	0	0	0	—	M	56
0	29	0	0	0	—	A	Adult
0	31	0	0	0	—	M	56
0	33	0	0	0	—	SA	6.5
0	40	0	0	0	—	A	50
0	41	0	0	0	—	M	32

Note: Sex/age ascriptions refer to the individuals believed to be the primary person buried in a given grave. M (Adult Male), F (Adult Female), A (Adult, Indeterminate Sex), SA (Sub-Adult, Indeterminate Sex). * Values are assigned on the basis of numerical scores for each class of mortuary artifact as listed in Table 18-1.

continued.

Table 18-2. (concluded.)

Rank	Burial No.	Number of Artifacts	Number of Artifact Classes	Value*	Items/Comments	Sex	Age
0	42	0	0	0	—	SA	0.75
0	35	0	0	0	—	M	Adult
0	14	0	0	0	—	M	Adult
0	15	0	0	0	—	F	40
0	17	0	0	0	—	SA	9
0	24	0	0	0	—	A	Adult
0	36	0	0	0	—	M	29
0	39	0	0	0	—	A	24
0	48	0	0	0	—	M	46
0	51	0	0	0	—	M	25
0	54	0	0	0	—	SA	14

Note: Sex/age ascriptions refer to the individuals believed to be the primary person buried in a given grave. M (Adult Male), F (Adult Female), A (Adult, Indeterminate Sex), SA (Sub-Adult, Indeterminate Sex). * Values are assigned on the basis of numerical scores for each class of mortuary artifact as listed in Table 18-1.

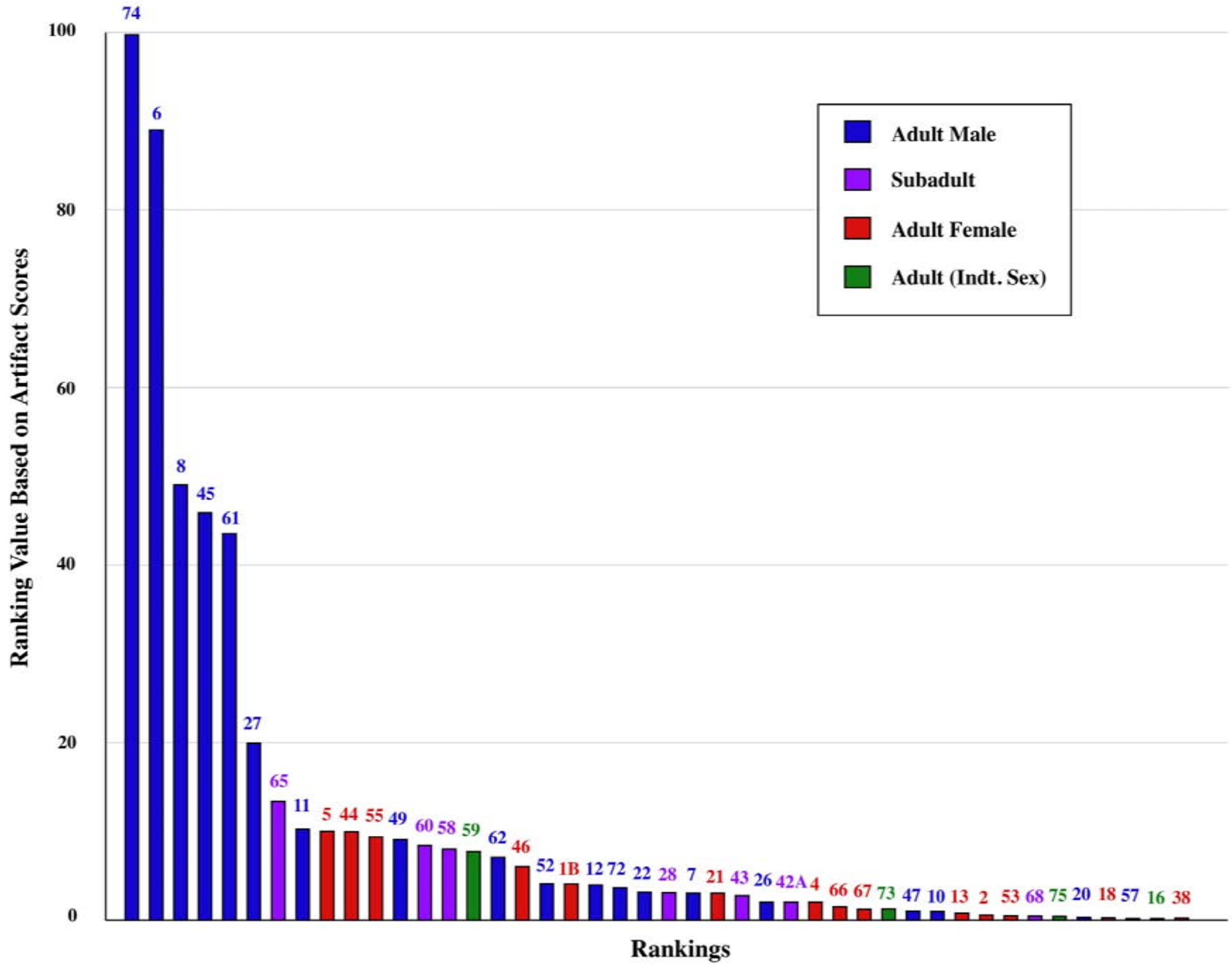


Figure 18-5. Bar graph illustrating the artifact values of all the burials in the Early Archaic cemetery at Buckeye Knoll. Small numbers at the top of individual bars indicate burial numbers, which are arranged in order (from left to right) according to the resultant ranking. Note that all of the highest-ranked burials of identifiable sex are adult males.

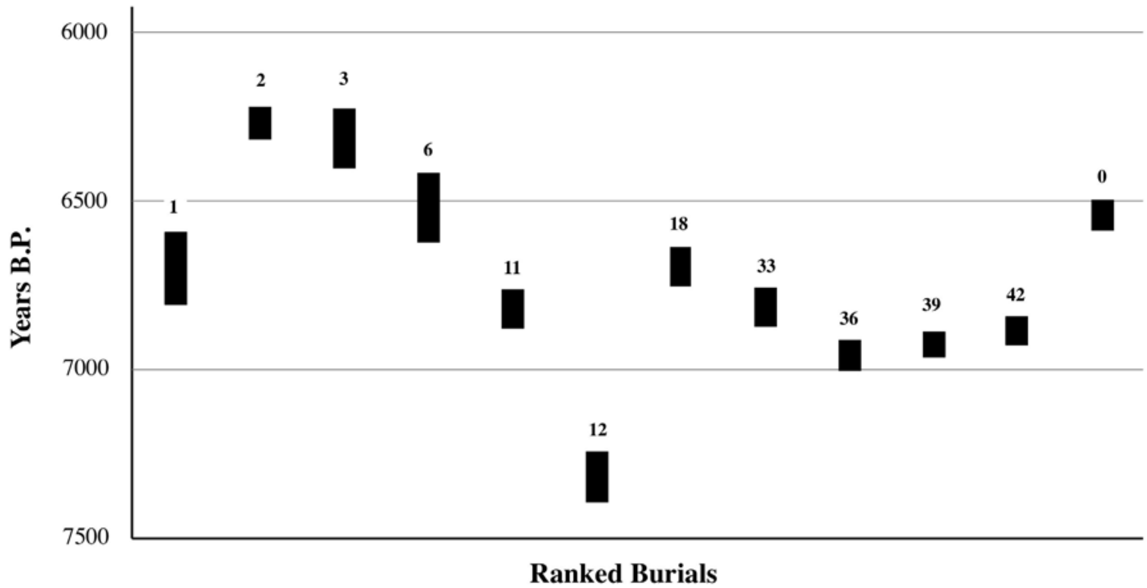


Figure 18-6. Calibrated AMS age ranges for ranked burials from the Early Archaic cemetery at Buckeye Knoll. The burials are ranked from left to right. Note that there is no apparent correlation between ranking and age.

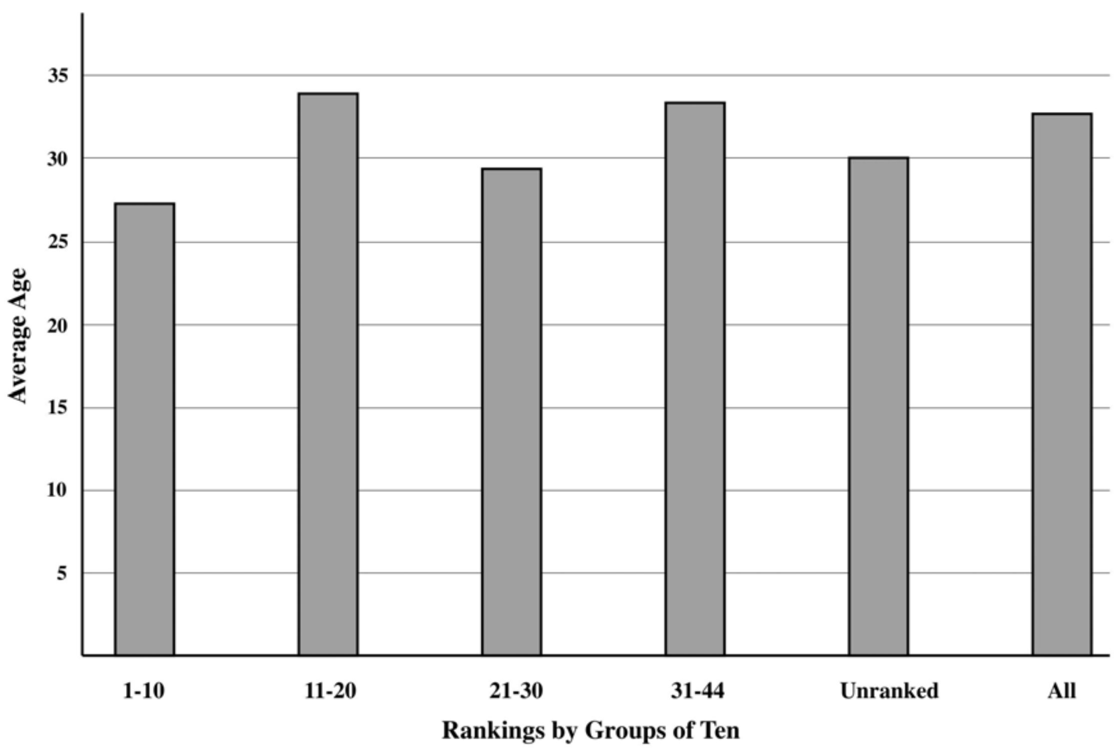


Figure 18-7. Average age at death of individuals in the Early Archaic cemetery at Buckeye Knoll ranked by groups of ten. Each column represents the average age at the time of death for ten individuals. The age averages are also shown for unranked burials (all individuals without any mortuary goods) and all burials combined.

of accompanying artifacts, are adult males. The four highest-ranked burials, with numerical values ranging from 46.0 to 99.8, are adult males with the exception of the second-highest ranked individual (Burial 6), for which sex could not be determined (though the high number of grooved stones with this individual tends to suggest that he/she was an adult male). The highest-ranked burial, No. 74, was accompanied by a series of non-utilitarian items (the oversized fluted-stem biface, over 600 marginella-shell beads, two winged bannerstones) that probably had non-mundane, perhaps ceremonial significance. This suggests that this adult male had a special status as a shaman or person otherwise imbued with special power and/or supramundane characteristics and perhaps authority. Among lower-ranked burials, the numerical value declines dramatically (see Figure 18-5), highlighting an especially high status for certain adult males as compared to the remainder of the population.

Second, in terms of simply the raw numbers of artifacts, by far the greater proportion was placed in graves of adult males as compared to adult females and subadults (individuals too young for reliable sex identification). Male graves contained fully 86.7 percent of all mortuary artifacts in the cemetery. Subadult burials contained 10.2 percent of the artifacts, and adult female graves had only 3 percent (Figure 18-8).

On the other hand, when mortuary artifacts are considered in terms of their assigned *values*, the disproportion is somewhat mitigated (see Figure 18-8). The value of all the artifacts in male graves is 73 percent of the total value of all artifacts in the cemetery, while the values of artifacts with adult female and subadult graves are 16.9 percent and 10.2 percent, respectively. Thus the same pattern of higher status for adult males is maintained, though adult females, as a group, become higher ranked than subadults, suggesting a *secondary* significance for age as a factor relating to status. The fact that highest ranking is among males and females, and that subadults (children) have lowest ranks, strongly suggests that social status was achieved during the course of an individual's lifetime rather than ascribed according to membership in an institutionalized ranking of social groupings. While this would generally be expected for a society of non-sedentary hunter-gatherers, in which hereditary statuses would be outside the norm, the fact remains that the fifth-highest ranked burial (No.61) was that of a subadult. This may suggest that not all high ranks were strictly achieved and that some may have been inherited.

North American Cultural Developments

The Buckeye Knoll cemetery provides several heretofore unexpected insights into prehistoric hunter-gatherer culture of the Texas coastal plain. First was the establishment, by 7,000 B.P., of a special place on the landscape for mortuary activity and attendant ritual. Also unexpected was the emergence of human territoriality that was sufficiently well defined to be a catalyst for creating a cemetery as a marker of corporate-group entitlement to the resources found within its territorial boundaries. In the case of Buckeye Knoll, the critical resources included (a) the estuarine resources of the nearby coast as well as (b) the terrestrial and aquatic (freshwater riverine) foods that abounded in the Guadalupe and San Antonio rivers and on their floodplains, which supported important plant resources such as pecan, plus (c) the prairie environment on the uplands that bordered the river valleys.

As a corollary, we might posit that human population was larger and more densely distributed on the landscape than previously suspected for the Early Archaic in Texas, for which relatively low-density and relatively highly mobile populations have usually been assumed and/or implied (e.g., Prewitt 1985; Story 1985). Whether this was a general phenomenon or, rather, an essentially localized concentration of people where resources were especially plentiful, cannot be determined with our presently limited information.

Additionally, there appears to have been at least incipient differentiation in status among members of the society, with higher status afforded to adult males, and a particularly elevated status enjoyed by a small portion of the adult male population. These factors hint at an emergent social inegalitarianism within the Texas Early Archaic. The data are presently too limited to elaborate on this point, although it might be reasonable to assume that high-status males were individuals who attained their positions through personal ability and achievement rather than through inheritance, given that hereditary high status would imply the existence of institutionalized social ranking that was probably not supported or required by a non-sedentary mode of hunter-gatherer adaptation. It should be emphasized, however, that until contemporaneous habitation sites in the Guadalupe Valley are found and carefully investigated, the possibility of residential sedentism or semi-sedentism cannot be entirely ruled out.

Previously unsuspected was the exchange of cultural information over long distances, as suggested by

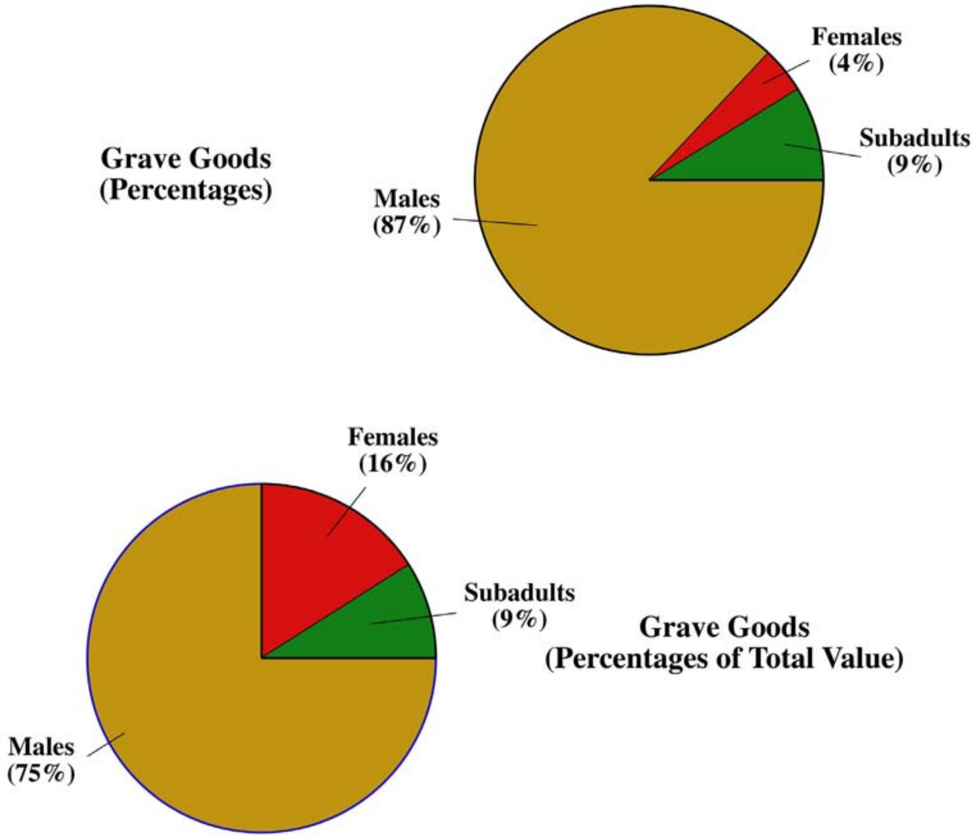


Figure 18-8. Pie charts showing the percentages of mortuary artifacts found with adult males, adult females, and subadults (top) and the percentages of total artifact values found with each of these three categories (bottom). Note that when the percentages are expressed in terms of artifact values instead of raw numbers of artifacts, the adult females were buried with more wealth than subadults.

the presence of certain artifact forms that are exceptional for the Texas coastal plain (i.e., bannerstones and perforated plummets) that have virtually identical counterparts far afield in the Mississippi Valley area and beyond. Such artifacts are reported from mortuary contexts in the Midwest and the greater Southeast for the Eastern Middle Archaic (8,000-5,000 B.P., calibrated; e.g. Charles et al. 1988; Lutz 2000:160-161), strongly suggesting exchange of information and/or artifacts with that area, either directly or *via* a down-the-line mode of interaction. From less far away were obtained high-quality Georgetown chert from the Edwards Plateau (the large uniface with Burial 58) and the profusion of marine shells for bead production, as well as sunray venus clamshells and asphaltum, from the Gulf of Mexico shoreline. As discussed earlier, the large fluted-stem biface from Burial 74 may be linked to technically and stylistically similar bifacial Paleo-Indian dart points from Central America, suggesting at least some kind of interaction or cultural orientation in that direction, as well, perhaps by ancestors of the Buckeye Knoll cemetery population. Given that this artifact may pre-date the Buckeye Knoll cemetery by several thousand years, such interactions probably took place long before the cemetery was established, suggesting that the biface was kept for many generations as a highly valued heirloom piece.

In sum, our findings suggest an emergent, incipient sociocultural complexity in the Texas Early Archaic. If cultural complexity is understood to involve the appearance of more components within the systemic whole (e.g., Price and Brown 1985:7-8; Service 1978:3), then the cultural system that produced the Buckeye Knoll cemetery was at least tending toward increased complexity, given that it inferably involved (a) a division of the landscape into definable aspects, beyond those afforded and directly influenced by the natural environmental mosaic (i.e., cultural definitions of boundaries/territory and specialized sacred/ritual space); (b) status differentiation among societal members (albeit probably some sort of formal recognition of achieved rather than inherited statuses); (c) production of non-mundane ideotechnic and sociotechnic artifacts by skilled and possibly specialized or semi-specialized craftspersons; and (d) long-distance exchange of information and possibly material objects by persons with specialized knowledge about such undertakings.

These cultural factors are strikingly divergent from the rather mundane picture of human life that has resulted from the study of numerous domestic campsites of the period in Texas. They are, however, more nearly congruent with recent thinking about the contemporaneous *Middle* Archaic in the greater southeastern United States, where archaeological research is providing a cumulative body of information that supports the idea that there was emergent and developing cultural complexity by, and shortly after, ca. 6,500 B.P. (see Kidder and Sassaman 2009).

Most striking is the fairly recent discovery that sizeable artificial mounds and associated enclosed plazas, thought until recently to date no earlier than the Late Archaic Poverty Point culture (ca. 3,500 B.P.) were being constructed in the later Middle Archaic, ca 6,500-5,000 B.P. (Brookes and Twaroski n.d.; Saunders et al. 2005). It has been demonstrated that mound groups such as Watson Brake, Frenchman's Bend, Caney Mounds, and others in Louisiana (Clark 2004; Gibson and Carr 2004; Saunders 2004), and probably several comparable sites in Mississippi (Brookes 2004:111), were all constructed during this early period. While investigations of these sites have, to date, been limited and the functions of the mounds are as yet poorly understood, they are chronometrically dated and precisely mapped, and their existence has prompted energetic discussion of implications for an early emergence of a degree of cultural complexity in the southeastern Middle Archaic (Brookes 2005; Gibson and Carr 2004). Although these mounds apparently post-date the Buckeye Knoll cemetery by 500 or more years, they may express a culmination of developments in the Southeast toward sociocultural complexity that was of comparable antiquity.

Samuel O. Brookes (2004, 2005) argues that the Middle Archaic in Mississippi saw the emergence of sociocultural complexity, as manifested in the production by craft specialists of ideotechnic and/or sociotechnic artifacts that symbolized and carried inherent power, such as stone effigy beads, bannerstones, quartzite grooved stones, plummets, and oversized ceremonial flaked-stone bifaces. Brookes suggests that the raw materials for zoomorphic effigy beads were obtained through exchange networks, and the finished beads were also distributed over a wide area through comparably extensive exchange networks (Brookes 2005). Oversize Benton-type and Turkey-tail bifaces were exchanged widely in northeastern and eastern Mississippi, and these are suggested to have been non-utilitarian/ceremonial artifacts that were placed within caches that sometimes contained bannerstones (Johnson and Brookes 1989). Brookes notes that the early mound groups signal a period of complexity that preceded, by several millennia, the much later Mississippian culture, for which temple mounds, plazas, and richly accoutered graves have long been thought to reflect complex chiefdom-level social organization (Brookes 2004:111). He further hypothesizes (Brookes 2005) that the oversized Benton bifaces found within Middle Archaic burials signify an early expression of the swords, or *atassas* (ritual dance knives) documented ethnohistorically as ceremonial objects in the Southeast, and probably represented in the iconography and in actual flaked-stone artifacts of Mississippian times. In short, Brookes believes that the archaeological evidence points to the emergence of various traditions that were to carry through into later periods, and which were fundamental elements in aboriginal southeastern chiefdom-level societies.

Brookes concludes his 2005 paper by implying that the range of new artifact forms that appear in the Middle Archaic of Mississippi is, in itself, indicative of the emergence of new and more complex lifeways, and he furthermore hints that much of this was in response to a shift to drier climate during the Middle Holocene:

> *Finally with all the innovations of the Middle Archaic period: new artifact categories, especially the ground and polished pieces, exchange networks, mound building, oversize bifaces, miniature specimens, ceremonial breakage, ritual placement of artifacts, etc., we should ask was anything else going on at this time? The answer is yes, the Hypsithermal had begun and most likely a lot of the rather strange behavior we are observing is a result of that momentous event* [Brookes 2005:4; see also Brookes and Twaroski n.d.].

In the Middle Mississippi Valley region, Middle Archaic hunter-gatherers were creating mortuary sites containing burials accompanied by projectile points, shell beads, bannerstones, and perforated plummets (Albertson and Charles 1983; Brookes 2005; Charles and Buikstra 1983). As climate became drier during the Middle Holocene, human populations tended to concentrate within well-watered, larger stream valleys. Burials were placed on topographic promontories, erosional remnants along riverine valley walls. These are the same locations—strikingly similar to the location of the Buckeye Knoll cemetery—at which later Woodland period burial mounds were constructed (Charles and Buikstra 1983). Charles and Buikstra (1983) suggest that these valley-margin promontories were selected for their eminence and high visibility on the landscape, factors which strengthened their function as markers of the territories of corporate groups, very much as suggested above for the Buckeye Knoll cemetery.

At the Black Earth site in the Carrier Mills archaeological district of southern Illinois, 154 Middle Archaic burials, dating to between ca. 6,600 and 6,000 B.P., were placed within the confines of an intensively occupied residential camp. Supported by a rich mix of aquatic and terrestrial resources, this may have been a year-round occupation. Jeffries (1983) has identified stylistic variability in bone pins found at Black Earth and other sites within and/or near the Ohio Valley that he believes are markers for distinct social groupings operating within the region.

There are, then, various lines of evidence from the southeastern and the lower mid-western United Stated suggesting an emergent, incipient cultural complexity in the Middle Archaic. The establishment of the Buckeye Knoll cemetery, by ca. 7,000 B.P., predates all of these extraregional developments by at least several hundred years, and may precede by about 1,500 years the start of mound construction at Watson Brake and other contemporaneous Archaic mound sites in Louisiana and Mississippi. Thus, we should not automatically look to these outside areas as sources of direct cultural stimuli that catalyzed the Buckeye Knoll mortuary pattern. Rather, the Buckeye Knoll folk were participating in a general and fundamental way in cultural patterns and processes similar to those thus far identified for a slightly later date in the Mississippi Valley and adjoining areas. While it is apparent that the society that created the Buckeye Knoll cemetery shared cultural information with peoples in eastern North America, the catalyzing factors for establishing a formal cemetery and incorporating widespread cultural factors, are perhaps best sought intraregionally within the resident human ecosystem.

Already noted is the evidence that the Buckeye Knoll population was practicing a broad-based and varied subsistence economy, with major sources of food resources being present at the ecozones of the inland prairie-riverine environment and the coastal estuaries along the Gulf of Mexico shoreline. Indeed, we have suggested that the combined aquatic and terrestrial resources from these environmental zones were sufficiently rich to support a successful adaptation by a healthy population that comprised a corporate group controlling access to this ecotonal resource base and operating within a territorial range that encompassed both the coast and some portion of the adjacent prairie-riverine interior.

Early Holocene sea-level rise had resulted in inundation of Pleistocene stream valleys and the resultant formation of the early prototypes of the modern coastal bay systems by ca. 9,000 B.P. By 8,200-7,500 B.P., these early estuaries had reached sufficient biotic maturity to provide shellfish and fish resources that attracted at least part-time, perhaps seasonal, human exploitation and occupation of the shoreline. Thin shell midden deposits near the shorelines of Lavaca Bay (Weinstein 1994) and Corpus Christi Bay (Ricklis and Cox 1992; Ricklis and Blum 1997) are radiocarbon dated to a period between 8,200 and 6,800 B.P., (calibrated), demonstrating clearly that this was the case. It is reasonable to assume that similar exploitation of the San Antonio Bay estuary took place at this time, though direct archaeological evidence of such has yet to be found.

At the same time, the palynological data from the Guadalupe floodplain next to the Buckeye Knoll site shows that by around 7,000 B.P., climate had become markedly drier, with a resultant decline in arboreal vegetation on the floodplain and perhaps a concomitant reduction of terrestrial biomass. Under these new conditions, local populations may have shifted their subsistence strategy to include increased use of the fish and shellfish foods of the coast. An attendant factor may have been a need to demarcate a territory that bracketed the broad coastal-inland ecotone, thus reinforcing group entitlement to exploit the different ecozones within the territory. A social corollary would have been that the human population became organized as a corporate group, with the group's identity linked to participation in a subsistence economy that operated within the ecotonal territory, and whose claim to that territory was reinforced by establishment of a formal cemetery wherein would rest the remains and perhaps the spirits of the deceased ancestors of the living people.

Chapter 19

Cultural and Ecological Change

Robert A. Ricklis

Culture History

Clarification of the culture chronology of the lower Guadalupe River valley was one of the stated goals of our investigations, as articulated in our original research design (Ricklis 2000) submitted to the Corps of Engineers, Galveston District, as well as in the Treatment Plan (Ricklis and Doran 2003) that was written as a revised research design in response to the discovery and partial excavation of the Early Archaic cemetery on the Knoll Top. Since the primary chronological data recovered at the site have been presented in detail in Chapter 6, the current discussion need only present a summary overview, which serves, to the extent possible, as a framework for the cultural-chronological evidence at Buckeye Knoll. This chronology can be assumed to apply to the surrounding area of the lower Guadalupe and San Antonio River valleys and the adjoining prairie uplands.

The term "culture chronology," in its most elementary definition, means simply the temporal sequence of time-diagnostic and other artifact forms. Shifts in diagnostic artifacts, most usually stone projectile points, are, in effect, the basis for almost all of the prehistoric cultural sequences that have been developed for the larger surrounding Texas region (e.g., Hall et al. 1986:396-404; Hester 1980b; Prewitt 1981, 1985; Turner and Hester 1999). Figure 19-1 visually summarizes the chronology discussed in the following pages. With time periods formulated as chronological units, issues of long-term human adaptation and questions of continuity and/or change in adaptive patterns, can be examined within a temporal framework.

Environmental Change

An additional prerequisite of any attempt to model long-term changes in human-ecological patterns is some knowledge of basic trends in environmental change. For interpretive purposes at Buckeye Knoll, we have the palynological data base provided by Bruce Albert's analysis of pollen grain samples from two sediment cores taken from the Guadalupe River floodplain adjacent to the site. The interested reader will find Albert's findings presented in detail in Appendix B.

Albert's analysis provides a nearly continuous record of changing vegetation from the early Holocene, ca. 9,000 B.P., up to early Historic times. Based on his defined contractions and expansions of mesic vs. xeric plant communities, it is possible to construct a long-term model of climatic shifts between periods of relative wetness and comparatively dry intervals. Figure 19-2 is a graphic summation of the secular shifts in annual precipitation, based on the data presented in Appendix B for the various "pollen zones."

Several factors are readily apparent. First, the pollen data indicate that, overall, the Early Holocene, prior to ca. 7,000 B.P., calibrated, was relatively moist. Relatively dry conditions prevailed during much of the Middle Holocene, between around 7,000 and 4,000 years ago, although there was a marked interval of relatively wet climate around 5,500-5,000 B.P. Finally, during the Late Holocene, after ca. 3,000 B.P., there was a return to more mesic conditions, which persisted until Late Prehistoric times, after ca. 1,000

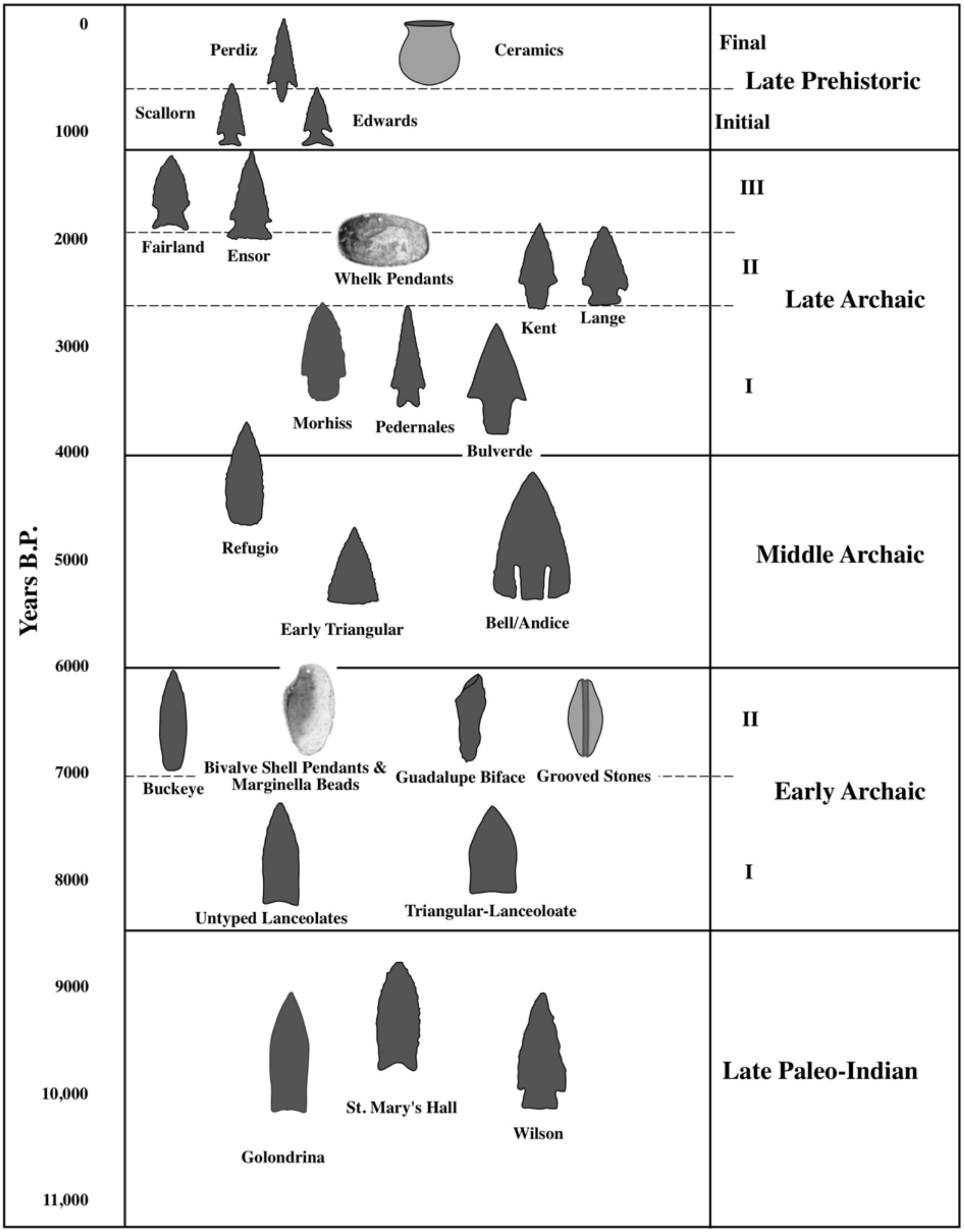


Figure 19-1. Chart showing the culture chronology at the Buckeye Knoll site as discussed in the text.

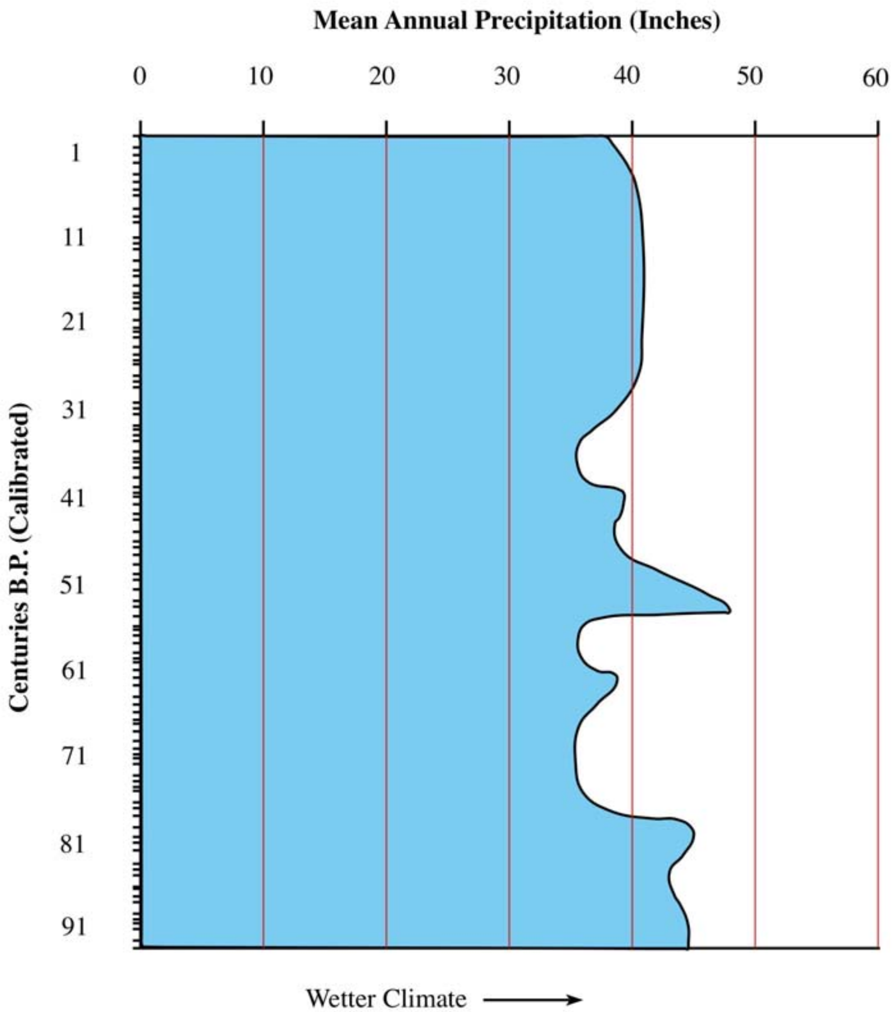


Figure 19-2. A graph showing shifts from relatively dry to relatively wet climatic regimes starting ca. 9,100 years B.P. in the environs of the Buckeye Knoll site based on pollen analysis by B. Albert (see Appendix B).

years ago. At a general level, this model of long-term climatic change agrees with that proposed by Johnson and Goode (1994) for central Texas, insofar as a relatively moist Early Holocene is followed by a largely drier Middle Holocene that then gives way to a shift back to relatively moist conditions after around 3,000 B.P. (see Figure 2-3, Chapter 2).

On the whole, the zooarchaeological data from the site, presented by Susan Scott in Chapter 8**,** agrees rather well with, and tends to support, this climatic model. Scott notes an increase in the proportional representation of swamp rabbits in AU 1 on the Knoll Top, suggesting moister habitat conditions during the Late Holocene than during earlier eras. This finds additional support in an increase in the representation of tree squirrels at that late period, suggesting the environmental corollary of expanded woodlands, as also suggested by the pollen data. It must be remembered that analogous, relatively moist conditions during the early Holocene will not be represented in the faunal data, given that there is no faunal bone preservation at the site for the earlier periods of occupation.

Late Paleo-Indian Period (ca. 11,500-9,500 B.P.)

This cultural-chronological interval is represented at Buckeye Knoll by specimens of established Late Paleo-Indian dart point types, namely, Golondrina, St.

Mary's Hall, and Wilson. Most of these are from AU 4 in the Knoll Top Area, suggesting that this high point on the local landscape was the location preferred for habitation by Late Paleo-Indian people. Based on the suggested age ranges for these diagnostic point types, this period at Buckeye Knoll can be estimated to have fallen between ca. 11,500 and 9,500 B.P., calibrated, or ca. 9500 to 7500 B.C. The earliest of the radiocarbon dates on estuarine shell (*Rangia cuneata*) from the Knoll Top Excavation produced a calibrated 2-sigma age range of 8,500-8,390 B.P., a millennium later than the recent end of the time range for St. Mary's Hall points, which date to an estimated range of 11,000 to 9,500 B.P., calibrated (Bousman et al. 2004:27). However, the dated rangia might be contemporaneous with the most recent end of the Late Paleo-Indian habitation at Buckeye Knoll, given the limited chronological control for Late Paleo-Indian point types.

If this were the case, it would mean that people possessing a terminal Paleo-Indian culture were already exploiting the emergent estuarine environment along the Gulf Coast. The coastward portions of coastal-plain stream valleys were inundated by ca. 9,500 B.P. (ca. 10,500 B.P., calibrated) by rising sea level (McGowen et al. 1976:16). The Buckeye Knoll data suggest that by ca. cal. 8,500 B.P. sediment infilling of the newly emergent bays had created shallow water estuarine conditions conducive to the establishment of oyster and rangia beds and/or reefs accessible to human exploitation.

A single human tooth from Zone 3 on the Knoll Top—the same area on the site that produced the just discussed rangia shell sample—provided a sample of collagen that yielded a calibrated AMS age range of 8,510-8,400 B.P., essentially identical to the calibrated age of the rangia sample. This is the oldest date on human remains from the site, predating the formal Early Archaic cemetery by at least 1,000 years. As noted previously, this tooth was not directly associated with any of the excavated burials, though it was presumably displaced from a burial either within, or outside of, our excavation block. Assuming this to be the case, prehistoric hunter-gatherers had started to occasionally use the knoll for burying their dead by ca. 8,500 B.P., although the presence of radiocarbon-dated domestic debris (rangia shells) at the site during this period suggests that the western knoll was not yet set aside as restricted cemetery space.

As discussed earlier, the faunal bone found in Zone 3 (AU 4), the stratum that contained Paleo-Indian diagnostic artifacts, appears to be much younger material that was translocated downward by bioturbation. Calibrated AMS age ranges on two samples of deer bone from Knoll Top Zone 3 (AU 4) are 4,570-4,410 B.P. and 2,340-2,130 B.P., Middle Archaic and Late Archaic ages, respectively, are clearly temporally incongruent with the Paleo-Indian artifacts from the same stratum. It is thus concluded that whatever faunal bones the Paleo-Indian occupants left behind at the site have long since decayed. For this reason, along with an absence of macrobotanical materials in flotation samples from pertinent strata, we have no direct evidence for Paleo-Indian subsistence patterns at the site, other than the possibility that terminal Paleo-Indian folk were exploiting estuarine shellfish along the coast and, at least in some instances, bringing rangia clams and oysters back to Buckeye Knoll for consumption and discard of the shells.

The kinds of lithic artifacts found in Paleo-Indian strata at the site offer limited insight into on-site activities during that period. Dart points and dart point fragments are by far the most common tool forms, indicating a relative importance of hunting in the Late Paleo-Indian subsistence economy. Conversely, tools that would have inferably been used to process plant foods, such as milling stones and manos, are nearly absent (consisting of only one milling stone fragment from AU 4 on the Knoll Top). This suggests that plant gathering/processing was less intensive than in the subsequent Archaic periods, or at least that grinding of hard plant parts (seeds, nuts) was done infrequently (an inference supported by a complete absence of carbonized seeds in AU 4) or, alternatively, with wooden tools. Intuitively, it seems unlikely that plant foods were insignificant in the diet, given that they would have provided essential nutrients and fiber and that a diet restricted to meats would be too rich in protein to provide the human population with long-term health.

Debitage is abundant in the Knoll Top AU 4, and early-stage bifaces and dart point preforms are well represented, indicating that flaked-stone tool/point production was being carried out at the site, as was the case in later periods. The presence of hammerstones, which would have been used in early-stage reduction of chert in tool production, supports this inference. The recovery of unifacial scrapers from the Knoll Top AU 4 suggests that hides were worked on the site.

In sum, the limited data offer only a very sketchy picture of Late Paleo-Indian life at Buckeye Knoll. Hunting was of some importance. The species of game taken are unknown, due to the lack of faunal preservation, although Susan Scott's zooarchaeological analysis (see Chapter 8) suggests a broad trend toward increased use of smaller game, turtles, and fish during the Archaic. Accordingly, if this trend were projected back in time, it may be supposed that the Late Paleo-Indian inhabitants of the site placed a heavier reliance on the hunting of larger mammals (large ungulates) than did later, Archaic folk. Determining whether or not such a projection has merit will depend on obtaining faunal data for early periods from other sites in the area, if in fact sites can be found that have soil chemistry favorable for such long-term preservation of bone materials.

Early Archaic Period

Early Archaic I (ca. 9,500-7,000 B.P.)

Although this cultural period is not in very clear focus at Buckeye Knoll, there is evidence for occupation that is chronologically intermediate between the terminal Paleo-Indian and the period of cemetery use in what is here defined as the Early Archaic II. Chronologically, the Early Archaic I period is approximately coeval (overlaps) with Prewitt's (1981, 1985) central Texas Circleville phase, which he places at ca. 8,500-6,800 B.P. Four non-mortuary radiocarbon dates from Buckeye Knoll fall into this time range (Table 19-1).

As can be seen in Table 19-1, all four dates for this period were obtained on shells of *Rangia cuneata* clams. This brackish-water species must have been gathered from the emergent shallow water estuary of the Early Holocene prototype of San Antonio Bay or from the lowest brackish-water reaches of the Guadalupe River. That area would not have been far downstream from the Buckeye Knoll site at this time, prior to seaward extension of the river delta due to ongoing alluvial sedimentation. Two of the samples are from the upper part of Zone 3, or Zone 3A. The other two are from the basal portion of Zone 2, probably originally deposited in Zone 3A and left as lag material after the Middle Holocene deflation of the upper part of that stratum, later to become incorporated into the base the Zone 2 cumulic sediment. Despite coming from two different strata, the essential contemporaneity of the samples supports the interpretation that the two from the bottom of Zone 2 are older lag materials produced by the deflation of what was once the upper part of Zone 3, these shells having become mixed with Zone 2 time-diagnostic artifacts representing Middle Archaic or early Late Archaic periods.

Inferably associated with these dated rangia samples are the various lanceolate and triangular-lanceolate dart points from Knoll Top Zone 3A (see Figure 7-12) that cannot be placed within any of the currently established types of either the Late Paleo-Indian or Early Archaic periods in Texas. Thus, it can at least be suggested that these points represent an as-yet poorly understood development of forms that are transitional between established Late Paleo-Indian lanceolate point types and the slender lanceolate Buckeye points identified in the Knoll Top cemetery and assigned here to the Early Archaic II period.

In the Circleville phase of central Texas, Angostura is the diagnostic point type (Prewitt 1981, 1985). This type is represented at Buckeye Knoll by only a single fragmentary (medial) specimen from the heavily disturbed West Canal Bank Area, reported here in Chapter 3 (Figure 3-17, a). The data from Buckeye Knoll suggest that, on the Texas central coastal plain, Late Paleo-Indian lanceolate forms may have given way to a variety of unstemmed/un-notched, lanceolate and triangular-lanceolate forms. Only the acquisition of more data from well-dated contexts at additional sites will permit determination of possible systematic variation in morphology and perhaps the identification and definition of additional Early Archaic unstemmed/un-notched point types for this region.

Regarding human ecology and on-site activities during the Early Archaic I, inferences must be the same as those made above for the Late Paleo-Indian, since the data are from the same stratigraphic context (Knoll Top Zone 3, or AU 4). Key attributes of human adaptation during this period are inferred to have been an emphasis on hunting of larger mammals, limited plant gathering, and collection of estuarine food resources, such as rangia clams and oysters, from the coast. The unambiguous presence of the common rangia (*Rangia cuneata)* and oyster (*Crassostrea virginica*) shells clearly shows that people were exploiting the bayshore and discarding shells at Buckeye Knoll, thus moving between the inland riverine-prairie environment and the estuarine environment of coastal bays.

Early Archaic II (ca. 7000-6000 B.P.)

This later part of the Early Archaic is represented at Buckeye Knoll only in the Knoll Top cemetery. As repeatedly stated earlier, none of the radiocarbon-dated organic samples from non-mortuary contexts yielded a calibrated age range that falls into this period. Additionally, none of the artifact forms that are diagnostic of the cemetery (such as slender lanceolate dart points, "split-stem" dart points, limestone and quartz-

Table 19-1. Radiocarbon Dates from Non-Mortuary Contexts at Buckeye Knoll.

Material	Lab No.	Stratum	C14 Age B.P.	Cal. Range B.P.
R. cuneata	Beta 191099	Zone 3A	7340+/-60	8500-8390
R. cuneata	Beta 191098	Zone 2 (bottom)	6910+/-60	8150-8030
R. cuneata	Beta 191101	Zone 3A	6610+/-50	7850-7720
R. cuneata	Beta 191097	Zone 2 (bottom)	6180+/-50	7490-7380

Note: All samples were taken from the Knoll Top Excavation.

ite grooved stones, Guadalupe bifaces, or marginella shell beads) were found in any of the rather extensive excavations elsewhere on the site. Therefore, it is concluded that during the seventh millennium B.P. the Buckeye Knoll site saw restricted use as a cemetery and place of mortuary ritual and was not occupied as a domestic habitation locale.

Interestingly, and perhaps very significantly, some of the diagnostic artifact forms from the cemetery that characterize this period were also recovered during the unpublished, early WPA excavations at the nearby Morhiss site, located only 8 km upstream from Buckeye Knoll. These artifacts include slender lanceolate dart points (ascribed to the Angostura type but in some cases perhaps actually pertaining to the similarly-shaped Buckeye point type tentatively defined in Chapter 17), a fragmentary Semi-Lunar Winged bannerstone made of an exotic greenstone, grooved stones, a number of Guadalupe Bifaces (all from non-mortuary contexts), and marginella- and nerite-shell beads (Dockall and Dockall 1994). The occurrence of these items at Morhiss strongly suggests that the site was one of the habitation locales occupied by the people who buried their dead at Buckeye Knoll during the Early Archaic II. As noted earlier, human presence at that site during this period is demonstrated by the fact that two of the several radiocarbon-dated human burials at Morhiss (Hard et al. 2002) fall into the same time period as the Buckeye Knoll cemetery. This fact accords with the suggestion made below that not all of the relevant society's dead were interred in the formal cemetery at Buckeye Knoll.

The Buckeye Knoll cemetery and its contents stand out in a prominent way in the context of the Texas Early Archaic. This is clear at the most basic level, insofar as a sizeable formal cemetery was not expected (and has not previously been discovered) for this early period on the Texas coastal plain. Previous discussions of Archaic mortuary patterns for this region have emphasized the assumption that formal cemeteries did not appear until later Archaic times, reflecting a presumed long, gradual growth of population, ultimately leading to the corollary of cemeteries that formalized territorial claims on the resources of corresponding human operational areas (e.g., Story 1985).

Inferably, by 7,000 B.P. population in the area had reached a density sufficient to catalyze the emergence of distinct territories, an adaptive response that allowed societies organized as corporate groups to claim territorial rights and to demarcate such claims by the establishment of cemeteries as resting places for their dead. In this way, the economic operational areas of the population became isomorphic with the spiritual realm of the ancestors, thus deepening and reinforcing the group's identification with its operational area.

Whether or not the Buckeye Knoll cemetery was unique during this period is another question that can only be answered through future investigations. Such an assumption, however, would seem to be counterintuitive, given that the Texas coastal plain is an extensive region with numerous subparallel rivers that empty into coastal bays. The broad ecotonal coastal-interior environment that supported the Buckeye Knoll population may well have sustained other groups, living within other territorial boundaries, and having similar population densities and, thus, the same basic need for territorial claims on their economic ecumenes. Also, the number of individuals buried in the Buckeye Knoll cemetery, conservatively estimated at a minimum of around 200, cannot account for the all deaths in the entire population over a period of at least 800 years, suggesting that either only a fraction of the population was buried in this cemetery, and/or that other cemeteries of the period, representing the same society, must be located within the lower Guadalupe River valley area. Indeed, as just mentioned above, two of the radiocarbon-dated burials from the nearby Morhiss site pertain to this period, as may more of the mostly undated 250 burials found there.

While the Early Archaic cemetery at Buckeye Knoll may be viewed as a result of local and/or regional population growth and increasing population density, it is also apparent that the pertinent society was not provincially isolated. In fact, there is striking evidence to the contrary. The Semi-Lunar Winged bannerstones, while made of limestone that could have been obtained from the Edwards Plateau of central Texas, have identical morphological/stylistic counterparts far to the north and/or northeast, from Arkansas (Frank Schambach, personal communication 2005) into the Central Mississippi Valley and farther, into the Midwest and even to the Atlantic seaboard (Lutz 2002). Likewise, the perforated plummets, while again made of limestone that could easily be from the Edwards Plateau of central Texas, are an artifact form that occurs in the Middle Archaic of the Mississippi Valley (e.g., Charles and Buikstra 1983) and has no known counterpart in Texas until much later, during the Late Archaic of the upper Texas coast and adjacent inland southeast Texas (Story 1990; Ensor 1998).

These findings indicate that the Buckeye Knoll people were interacting and/or sharing in sociocultural patterns and perhaps belief systems with people in the greater Southeast and/or the Midwest. It should not be assumed that people in what is now Texas were simply the recipients of a unidirectional flow of ideas and influences from those areas, because extant information suggests that Buckeye Knoll predates comparable developments in those other areas by as much as half a millennium. What seems to link the developments in the Southeast, Midwest, and Texas coastal plain is that they are all regional representations of an emergent/incipient cultural complexity during a time period known as the Middle Archaic in the East and here referred to as the Early Archaic II on the Texas central coastal plain. In the Buckeye Knoll cemetery, we see a formal division of space into ritual and domestic, and inferably, sacred and profane, sectors, as well as considerable diversity in the amounts of material goods placed within graves, interpreted as reflecting a corresponding differentiation in the statuses of individuals within the society. Similar developments are suggested in the Southeast and Midwest, where burials containing bannerstones, plummets, and oversize bifaces, as well as projectile points and shell ornaments, are found slightly later, after ca. 6,000 B.P., during the more recent part of the Middle Archaic of those regions (Jeffries 1996; Sassaman 1996). The construction of large mound-plaza complexes in Louisiana and Mississippi was taking place at about this time, suggesting a widespread and fundamental process of emergent sociocultural complexity in the southeastern Middle Archaic (Brookes 2004, 2005), along with the later part of the Texas Early Archaic. In short, the cemetery at Buckeye Knoll is but one example of widespread and interconnected cultural developments taking place during the period defined as the Middle Archaic in the eastern United States.

Since there was no domestic habitation of Buckeye Knoll during this period, we have no zooarchaeological or paleobotanical data with which to begin to reconstruct subsistence patterns. The stable isotope data from human tooth/bone collagen do, however, provide important insight into how the Buckeye Knoll folk met their subsistence needs. The values of ^{13}C and ^{15}N indicate a significant contribution of marine foods to the diet, albeit less so than in the case of later, more fully coastal adaptations. Since the ecofactual evidence indicates that oysters, rangia clams, and marine fish were all taken from the coastal bay/lagoonal estuaries both earlier and later than the cemetery period, it is reasonable to assume that the marine component in the diet of the Early Archaic II folk buried at the site consisted of those same commonly exploited shellfish (oysters and rangia clams) and fish species (primarily marine catfish). Furthermore, it can be concluded that the exploitation of the coastline was done on a recurrent and significant basis, given its pronounced affect on the stable isotopic signatures in human tooth and bone collagen. At the same time, the isotope data show that interior riverine and terrestrial resources remained a major component in the human diet. Along with the fact that the cemetery is located in a prairie-river floodplain setting away from the coast, these data indicate that the lifeway did not involve a fully coastal adaptation, and that people must have moved, in their subsistence pursuits, more or less regularly between the interior and the estuarine-shoreline environments.

The chronometric data suggest that use of the Early Archaic cemetery ceased by ca. 6,200 B.P. It can be inferred that this also reflects the dissolution or reformulation of the human adaptive system of which the cemetery was one component. While there are later dated burials on the Knoll Top, they are relatively few, in contrast to the far more numerous and temporally clustered ones that fall between 7,000 and 6,200 B.P., suggesting only occasional burial at the cemetery and other parts of the site (e.g., Burial 30 on the West Slope) in conjunction with use of the site for domestic habitation. It can be inferred that by around 6,200 B.P., changes in adaptive patterns resulted in a breakdown, or at least a restructuring, of the existing subsistence strategy, which in turn led to a redefinition of group territoriality and a concomitant abandonment of the Buckeye Knoll cemetery. Perhaps not coincidentally, occupation of the coastal zone increased markedly around 6,000 B.P. (see Ricklis 1995a; Ricklis and Blum 1997; Ricklis and Weinstein 2005), when larger, thicker, and more numerous shoreline shell middens appeared. Perhaps this suggests that a significant portion of the hunter-gatherer population in the adjacent interior had shifted their primary residential habitations and the focus of their economic activities to the coast, reducing the adjacent inland population density with a resultant restructuring of mobility patterns and operational areas and an attendant redefinition of territories.

The palynological evidence from the floodplain alluvial sediments near Buckeye Knoll (see Albert's report, Appendix B) suggests that the climate was becoming drier ca. 7,000 B.P. and that a relatively dry interval persisted until just after 6,000 B.P. It is possible that a concomitant reduction in exploitable biomass along the Guadalupe floodplain and the adjacent upland prairies encouraged exploitation of the coastal estuaries and the attendant development of an ecotonal territory that is here suggested to have been linked to the establishment of the Buckeye Knoll cemetery. Increasing moisture after 6,000 B.P. may have resulted in enough increase in floodplain and upland-prairie biomass that the postulated system of ecotonal territoriality became unnecessary and, thus, effectively obsolete, a change also leading to the dissolution of the particular adaptive system that supported and fostered the maintenance of the formal cemetery. Combined with increasing productivity of the coastal bay-lagoon environment by 6,000 B.P., the constraints on human-adaptive options were sufficiently relaxed that a marked reformulation of adaptive strategies was undertaken, a change that may have involved, as mentioned, a significant relocation of much of the regional population to the coastline.

Middle Archaic Period (ca. 6,000-4,000 B.P.)

This period is marked by a series of diagnostic dart point types such as Bell/Andice, Early Triangular, and Refugio. Several Bell and/or Andice points, all fragmentary, were recovered from AU 3 on the Knoll Top. AU 3, the bottom third of Zone 2, is ascribed to the early part of the Late Archaic, and the Bell/Andice specimens are believed to be remnant lag materials from the deflated upper part of Zone 3 that became incorporated into Zone 2 when it started to accumulate. Also from this context are an Early Triangular point and three Refugio points.

The Middle Archaic component on the West Slope is much more clearly isolable in terms of its stratigraphic position. In that area, Zone 3, or AU 3, yielded almost exclusively Middle Archaic diagnostics, consisting of 14 Early Triangular points, 4 Refugio points, and an Andice barb fragment. Refugio points are also rather abundant (*n*=6) in overlying Zone 2, which suggests that this type persisted into the early part of the Late Archaic, beginning ca. 4,000 B.P.

Subsistence patterns during the Middle Archaic show the beginning of an apparent trend toward hunting of smaller game and greater reliance on more and smaller fish, a trajectory that continues into and through the Late Archaic (see Figure 8-4). Our data provide little information on plant gathering/processing during the Middle Archaic. The relevant stratum on the Knoll Top had been eroded away, thus eliminating any possibility for flotation of Middle Archaic midden deposits in that area. On the West Slope, Zone 3 was an intact Middle Archaic stratum, but it contained little in the way of preserved, carbonized plant remains. The sole identifiable macrofloral taxon in that stratum was Anacua-wood charcoal, which is interpreted to represent use of that species of wood as fuel (see Puseman and Cummings report, Appendix C).

The data appear to reflect relatively intensive occupation of the Buckeye Knoll site during the Middle Archaic, which coincides with Albert's suggestion of an optimally productive biotic environment after ca. 5,500 B.P., based on his palynological analyses (see Appendix B). Middle Archaic diagnostic point types, Early Triangular and Refugio, are the most abundantly represented of any at the site. The abundant impressed burned clay, probably daub, concentrated in the West Slope AU 3 suggests that some form of wattle-and-daub construction dates to this period. The relative durability of wattle-and-daub construction, as compared to the light and quickly built pole-frame structures with skin or mat coverings (reported ethnohistorically and generally thought to have been the norm among south Texas hunter-gatherers) may reflect a more nearly sedentary, or at least less mobile, residence pattern than generally has been postulated for prehistoric hunter-gatherers in the region. This may be supported by the long-lived pattern of multi-seasonal occupation of the site that is indicated by seasonality analyses performed on fish otoliths and oysters (see discussion in Chapter 9).

The palynological findings for Buckeye Knoll, presented by Bruce Albert (see Appendix B), are interesting in suggesting that the extended Middle Holocene dry climatic interval, widely postulated for Texas (e.g., Collins 1995; Johnson and Goode 1994), was interrupted in approximately the middle of its duration by a period of wetter climate, ca. 5,500-5,000 B.P. This relatively short mesic interval appears to match one posited by Johnson and Goode (1994) for the mid-sixth millennium B.P., though Albert's data suggest that it was rather wetter than the interval posited by these authors, a difference that may be explained by the proximity of Buckeye Knoll to coastal weather patterns. Possibly, this relatively wet interval resulted in an increase in terrestrial biomass that provided the human-ecological basis for reduced mobility and a shift from a forager to a collector subsistence strategy (*sensu* Binford 1980) with more intensive occupation of Buckeye Knoll that involved the building of wattle-and-daub structures as well as occasional burial of the dead within the bounds of the residential encampments. Unfortunately, the chronometric control of the archaeological and palynological records is not at a high enough resolution to determine with finality if there is a temporal concordance between the possible reduced mobility and more mesic climate. Two burials on the Knoll Top date to the estimated time of the mesic interval. Burial 50-A produced a calibrated age range (AMS on human tooth collagen) of 5,570-5,480 B.P., and Burial 74-B yielded a calibrated range of 5,550-5,350 B.P., showing that at this time the site was occupied intensively enough that the dead were at times buried there in conjunction with domestic habitation.

Late Archaic Period

As noted in Chapter 2, it can be suggested that the Late Archaic on the Texas coastal plain should be seen as beginning ca. 4,000 B.P., since this better aligns with the broad cultural chronology for the eastern United States. The patterns of culture change in coastal Texas mirror those in the East to a significant degree, and the need to recognize the inter-regional links is summarized in Chapter 2 (see also discussion in Johnson and Goode 1994). Given that this shift in taxonomic definition makes the Late Archaic significantly longer than previously interpreted in Texas, it is reasonable to divide it into subperiods that can be identified on the basis of recognizable changes in material culture and/or definable patterns of human behavior.

Late Archaic I (ca. 4,000-2,600 B.P.)

This period is represented at Buckeye Knoll by AU 3 on the Knoll Top and AU 2 on the West Slope. A key period diagnostic is the Morhiss dart point. Morhiss points occur in Zone 2 (AU 2) on the West Slope, which is dated to 4,000-2,800 B.P., calibrated. Based on co-occurrence with Morhiss points in Zone 2, or AU 2, on the West Slope, Pedernales and Bulverde points also appear to date to this period. In Prewitt's central Texas chronology, Bulverde points are placed at 4,100-3,500 B.P. and Pedernales points date to 3,500-2,600 B.P. This fits quite well into the Late Archaic I as here defined, and as also formulated as the early Late Archaic for central Texas by LeRoy Johnson, Jr. (Johnson and Goode 1994) and Michael B. Collins (1995, 2004).

Late Archaic II (ca. 2,600-1,800 B.P.)

A key time marker for this period is the Lange dart point. This type was found in AU 3 on the Knoll Top, dated to 3,780-2,200 B.P., calibrated, but was absent in AU 2 on the West Slope, dated to 4,000-2,800 B.P. Thus, Prewitt's placement of the type at 2,600 to 2,250 B.P. fits well into the early part of the presently suggested age range for the Late Archaic II. The presence of a large Lange point in Burial 23, dated to 2,130-2,050 B.P., permits us to extend the age range of the type to at least that slightly more recent age.

This cultural time period saw the establishment of numerous sizeable cemeteries and relatively elaborate mortuary traditions on the Texas coastal plain. The age range of the large Loma Sandia cemetery in Live Oak County overlaps with this period, and the large cemeteries in the lower Brazos/Colorado River area, at sites such as Ernest Witte and Crestmont, also date to this interval. Burials at the large coastal cemeteries at 41NU2 and 41NU37, both associated with the Oso Creek/Bay drainage near Corpus Christi, have been dated to around the beginning of this period (Cox and deFrance 1997; Ricklis 1997).

The emergent emphasis on mortuary ritual during this period should not be viewed as an isolated phenomenon. The Late Archaic II is contemporaneous with Early and Middle Woodland manifestations in the eastern United States., cultural patterns characterized by highly elaborate mortuary patterns, including, in the Adena and Hopewellian manifestations, interments within artificial burial mounds. Indeed, the Jonas Short Mound in easternmost Texas is generally considered to be a representation of an attenuated Hopewellian manifestation in that region (e.g., Johnson and Goode 1994).

Grant Hall has discussed the linkages between the Texas coastal plain and regions to the north and east during this period, suggesting that Late Archaic Texas hunter-gatherers were participating in an extensive "Import-Export Sphere." This resulted in boatstones and stone gorgets, many made from exotic rock materials (often from Arkansas), being placed within graves on the Texas coastal plain (Hall 1981). Hall also suggested that the large whelk-shell pendants found in the Texas cemeteries may have been made in Florida, arriving on the Texas coastal plain through exchange within this interaction sphere. LeRoy Johnson has noted the contemporaneity of the Late Archaic cemeteries on the Texas coastal plain with the mortuary elaboration of Middle Woodland culture in the eastern United States and has suggested that the hunter-gatherers in the former area were sharing the same belief system that accompanied the developments in the East. He suggests that:

> *To explain the appearance of elaborate ceremonial goods in Texas just in terms of local economic developments, the growth of far-flung trading networks, an increase in human population, the development of a hierarchical social organization or power structure, or the rise of a more sedentary lifestyle (e.g. Hall 1981) is to misunderstand the issue. It may be true that a complex cult with a rich material expression only evolves within a complex social system like that of the Hopewell people, but it is also true that such a belief system can spread to almost any kind of society. Hence one finds whelk ornaments and atlatl weights [i.e., boatstones] of foreign stone in cremations of Southern Plains hunting people, and very occasionally in sites of the hunting-and-gathering aborigines of the Edwards Plateau* [Johnson 1994:97].

Two burials on the Knoll Top at Buckeye Knoll, Burials 23 and 25, are similar to Late Archaic burials in the lower Brazos-Colorado River area, and appear to pertain to the same, or a closely related, basic mortuary tradition. Both burials rested in extended, supine positions, as is typical of Late Archaic burials in the Lower Brazos-Colorado drainages, with body orientations parallel to one another and heads toward the southeast (also the case with Burial 30, a Late Archaic interment in the West Slope Excavation). Burial 23 produced a calibrated age range on an AMS date on tooth collagen of 2,130 to 2,050 B.P., and Burial 25 contained two large whelk-shell pendants virtually identical to specimens from burials in the lower Brazos-Colorado River area dated to this same time period. Thus, the lower Guadalupe River area was apparently closely linked to the Lower Brazos-Colorado area to the north, with people in both areas participating in essentially the same mortuary tradition during the Late Archaic II.

Late Archaic III (ca. 1,800-1,200 B.P.)

This final Archaic period is represented at Buckeye Knoll by AU 2 on the Knoll Top. Material representing this period was also recovered from Zone 1 (AU 1) on the West Slope (along with an admixture of earlier Late Archaic and later Late Prehistoric artifacts) and sporadically in the East Area. Diagnostic artifacts are Godley, Ensor, Fairland, Darl and Matamoros dart points.

The Late Archaic III saw a broadening of the resource base utilized by the inhabitants of Buckeye Knoll. The zooarchaeological data indicate an increasing reliance on fish and smaller birds and a corresponding reduction in procurement of large mammals. This began in Late Archaic I times and continued through Late Archaic III. The change in faunal remains is first discernible in Level 13, in Zone 2 [AU 2] in the West Slope and becomes more pronounced in Level 10, at the base of Zone 1 [early AU 1]. This is maintained throughout the superior levels. Susan Scott (Chapter 8) suggests that this represents a diversification of the resource base resulting from growing population and the corollary of increasing pressure on resources. This interpretation finds a parallel in the increasingly intensive reliance on fish among coastal populations of this period and the subsequent Late Prehistoric (Ricklis 1995a; Ricklis and Weinstein 2005).

Logically in line with the growing range of exploited faunal resources, and a trend of increasing emphasis on smaller species, is the fact that this period shows the greatest quantity and diversity in use of plant resources at Buckeye Knoll. Macrobotanical remains recovered by flotation include charred seeds of goosefoot (*Chenopodium*), hackberry (*Celtis*), wild grape (*Vitis)*, grasses (unidentified species), and *Phytolacca* (pokeweed?). This represents a marked increase over the macrobotanical remains from the Late Archaic I and II (i.e., AU 3) flotation samples, which produced only a single *Chenopodium* seed (Table 19-2 and Figure 19-3; see also the data presentation in the report by Puseman and Cummings, Appendix C). While preserved macrobotanicals are too limited in number to inspire great confidence in the overall results, the data do at least suggest a trend toward intensification of plant gathering in the Late Archaic. The reality of such a trend should be tested by additional flotation and macrobotanical analyses at other long-term occupation sites on the Texas coastal plain.

Overall, the increased use of small mammals, fish, and birds, as well as the possible increasing importance of plant resources, suggests a diversification in resource extraction that represents an intensification of land-use by Late Archaic III times. Inferably, increasing population density during the Late Archaic placed pressure on the environmental resource base, and an adaptive response of human populations was to broaden their adaptive niche by increasing exploitation of species from lower on the food chain.

An increasing reliance on plant resources during the Late Archaic may also be represented by the sizeable pits, possibly storage facilities, recognized as Features 13 and 17 (described in Chapter 4). Both of these features pertain to the Late Archaic. Feature 13 was found in an outlying 2-by-2-m excavation unit (S6W82) on the Knoll Top. The pit originated in Zone 2, although lack of any color or textural contrast between pit fill and Zone 2 matrix precluded determination in the field of the precise level within that stratum at which the pit originated. The same situation was encountered with Feature 17, which originated in Zone 2 in the West Slope Excavation. In short, both of these presumed storage facilities pertain to the Late Archaic, although the subperiod cannot be ascertained. In any case, these features suggest that by Late Archaic times, plant gathering was sufficiently intensive to promote the use of subterranean storage facilities.

Table 19-2. Charred Macrobotanical Remains Recovered by Flotation from the Knoll Top Excavation Analytical Units at Buckeye Knoll.

Knoll Top AU	Chenopod.	Celtis	Vitis	Grasses (undifferemtoated)	Phytolacca
1	5	2	–	0	0
2	6	1	2	2	1
3	1	0	0	0	0
4	0	0	0	—	0

The absence of preserved, carbonized nutshell remains, especially pecans, in the flotation samples is somewhat surprising, given the presence of pecan trees in the Guadalupe floodplain and the known importance of pecan nuts for the ethnohistorically documented hunter-gatherer groups in the area (e.g., Campbell 1988). Most likely, pecans were a targeted subsistence resource at Buckeye Knoll, and Albert's palyonological analysis (see Appendix A) certainly indicates their presence throughout the Holocene. Their absence among the preserved macrobotanical remains presumably reflects the generally extremely limited preservation of carbonized plant materials, including wood charcoal, at the site.

Gathering, processing, and, presumably, eating pecans is suggested by microfloral data obtained from the Knoll Top (see Puseman and Cummings, Appendix C). A variety of pollen grains was found on a milling stone fragment from AU 2, pertaining to the Late Archaic II. Included are pecan (*Carya*), cattail (*Typha*), and possibly sunflower (Asteraceae). A wide range of micro-floral remains were found on two burned clay nodules from Feature 15, a hearth in Zone 2. This feature rested within AU 2, but could have been in a dug basin originating in AU 1. Either way, the plant use suggested pertains to either the latter part of the Late Archaic (AU 2) or the Initial Late Prehistoric (AU 1). One burned clay nodule from this hearth feature yielded lotus-root (*Nelumbo*) starch residue and cattail

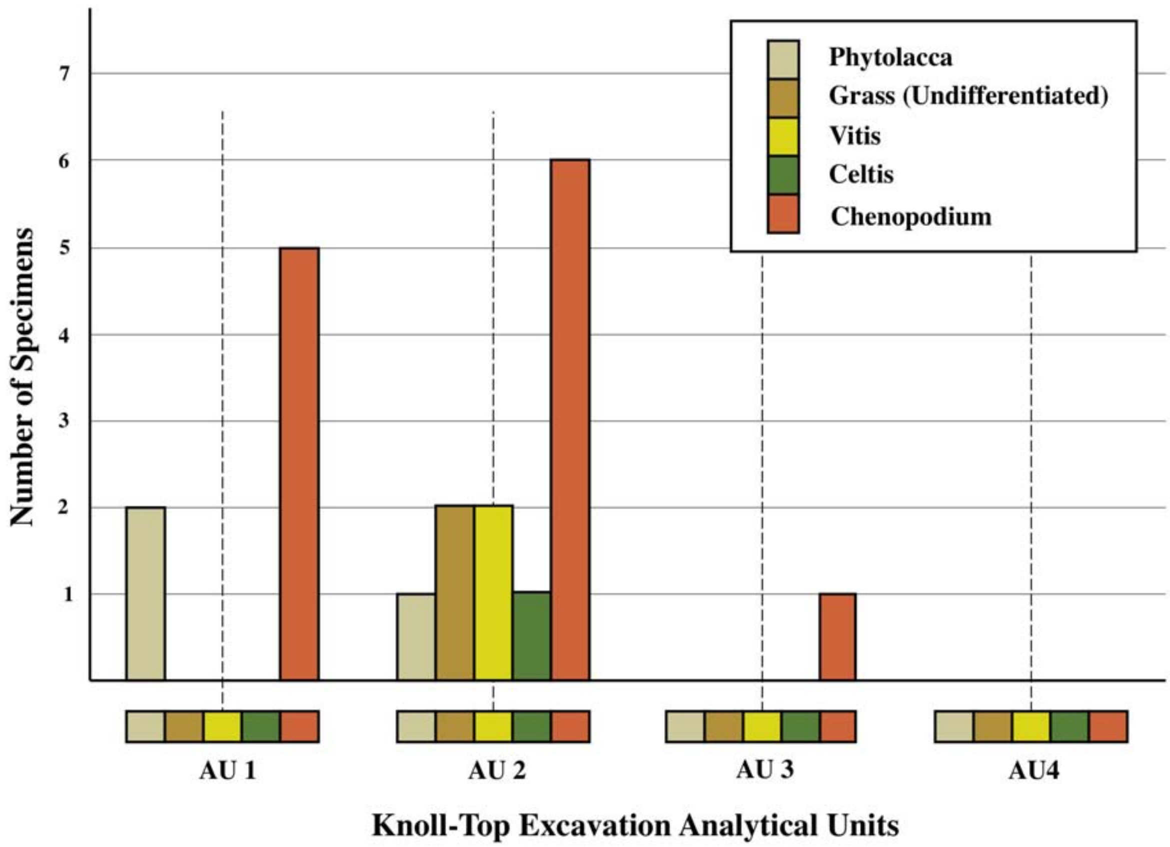


Figure 19-3. A bar graph showing the number of specimens of charred seeds of several plant species found in flotation samples from various analytical units on the Knoll Top at Buckeye Knoll (see Table 19-1 and Appendix C). Note the dramatic increase of specimens in Late Archaic III (AU 2) and Initial Late Prehistoric (AU 1) contexts.

(*Typha*) root raphids, suggesting that the edible roots of these plants were cooked. The second clay nodule from Feature 15 produced a wide range of plant pollens (see Puseman and Cummings, Appendix C for a complete listing), including *Carya* (pecan) and an abundance of Rosaceae pollen (suggesting cooking or boiling of wild rose hips).

Late Prehistoric Period

This writer has suggested elsewhere (Ricklis 1995a, 2004) that the Late Prehistoric period on the central Texas coast be divided into two subperiods, the Initial Late Prehistoric (A.D. 800-1250/1300) and the Final Late Prehistoric (A.D. 1250/1300-1700). This division is called for because around A.D. 1250 or 1300 there were significant changes in the lithic assemblage, and ceramics became a significant part of the artifact assemblage. Additionally, an abundance of bison appeared on the coastal prairies (Dillehay 1974) and became an important resource within the native subsistence economy. This, in fact, may have precipitated the changes in the lithic assemblage, which can be viewed as a technocomplex suited to procurement and processing of large game animals (e.g., Black 1986; Ricklis 1992b, 1996a). Since the interior south and central Texas areas each have two equivalent subperiods in the Late Prehistoric (Hall et al. 1986; Prewitt 1985), indicating pervasive changes at ca. A.D. 1250/1300, such divisions can and should be used in reference to the Late Prehistoric at Buckeye Knoll.

Initial Late Prehistoric (ca. 1,200-700 B.P.)

At this time the dart and atlatl were replaced by the bow and arrow as the primary weapon for hunting and warfare. Relatively heavy and thick dart points were, correspondingly, supplanted by much thinner and lighter arrow points. Although this technological change has been generally accepted as marking the end of the Archaic and beginning of the Late Prehistoric, basic hunter-gatherer lifeways seemingly did not undergo any sudden or dramatic changes (cf. Hall et al. 1986; Prewitt 1985).

The key diagnostic of this period at Buckeye Knoll is the Scallorn arrow point, the overwhelmingly dominant point type found in AU 1 on the Knoll Top. This point is the most diagnostic time marker for the early Late Prehistoric, Austin Phase of central Texas (Prewitt 1981, 1985), and it is widely recognized as a horizon marker for the period in much of the rest of the state. Also falling into the Initial Late Prehistoric on the central coastal plain are Edwards and Bonham arrow points (Turner and Hester 1999) and triangular Fresno arrow points (Ricklis 1995a). These are all also found in the Knoll Top AU 1, although in far less abundance than the Scallorn points.

Sixty-nine potsherds, representing an estimated 13 individual vessels, were recovered from the Knoll Top, mostly in AU 1. The vessel represented by the most sherds (Sherd Group 1, *n*=44) was a bone-tempered jar with a burnished exterior surface that fits into the Leon Plain type. Generally, this type of pottery is considered to represent the Final Late Prehistoric, Toyah Horizon of central and southern Texas (Black 1986a; Johnson 1994; Prewitt 1981; Ricklis 1995b), and this vessel may, in fact, pertain to a Toyah occupation at Buckeye Knoll. However, since the predominant point type in AU 1 is the earlier Scallorn arrow point, it is possible that these sherds are associated with that point type and that they pertain to the Initial Late Prehistoric period. Bone-tempered plainware pottery has been found in association with Scallorn and Edwards arrow points in the Choke Canyon area of southern Texas (Black 1986b:387-390) and in Bexar County (Black and McGraw 1985), so it is not unreasonable to postulate such an association at Buckeye Knoll. On the other hand, a small number of Perdiz arrow point fragments were recovered from Knoll Top AU 1, and it may well be that the bone-tempered pottery is associated with those Final Late Prehistoric artifacts.

The zooarchaeological data from AU 1 on the Knoll Top show the same faunal taxa, with similar proportional representations, as were recovered from Late Archaic components. Also, plant processing similar to that in the Late Archaic was being carried out, judging from the recovery of carbonized chenopodium and hackberry (celtis) seeds in the Knoll Top AU 1 (see Figure 19-3). As was apparently the case in central Texas, the beginning of the Late Prehistoric period at Buckeye Knoll saw more continuity than change, in terms of basic lifeways and adaptive strategies, from the Late Archaic.

Final Late Prehistoric (ca. 700-300 B.P.)

The later part of the Late Prehistoric at Buckeye Knoll is represented by Perdiz arrow points, dated to after A.D. 1250/1300 (Hall et al. 1986; Johnson 1995; Prewitt 1985; Ricklis 1989), and Rockport and Leon Plain ceramics. The presence of both kinds of pottery suggests that the site saw occupation by both distinctly interior and coastal groups during this period. Based on what is known about the distance from the coast of the coastal-interior cultural boundary zone, the use of the site by groups from both areas is expectable. The scant representation of artifacts that are diagnostic of the period (five Perdiz points, or fragments thereof, and 107 potsherds) suggests that occupations of the site during this period were short-term and infrequent, probably involving only small groups of people. The absence of the typical beveled knives of the period, and the lack of an abundance of unifacial end scrapers, also prevalent at this time (e.g., Black 1986a; Highley 1986; Johnson 1994; Prewitt 1985; Ricklis 1992b, 1994b), may reflect a limited range of activities at the site. Alternatively, these absences could simply be a factor of the small sample size that is not completely representative of the full range of artifacts of this period.

The top three 10-cm levels in the East Area produced a few bison-size long bone fragments (see Susan Scott's zooarchaeological report, Chapter 8). These same levels also yielded potsherds and Perdiz arrow points. Twelve of the 14 sherd groups, or 86 percent, from the East Area that can be placed within a major ceramic tradition, are identified as definite or probable Rockport ware. Only two sherd groups are assigned to the Leon Plain type, the generic typological grouping for interior bone-tempered plainware ceramics of this period. Thus, it is tentatively concluded that at least one occupation by coastal Karankawa (i.e., Rockport phase) people took place within the eastern part of the site during the Final Late Prehistoric. The presence of probable bison bone in that area, along with bones of deer and other game, along with relatively scant remains of estuarine fish or shellfish, suggests that this occupation was of the nature of a more or less typical "Group 2" campsite. Group 2 sites have been defined on the basis of fieldwork along the coastal-plain streams of the central Texas coast as small, warm-season camps, occupied by small bands of Rockport phase (Karankawa) folk, who were focused on hunting bison and other game on the coastal prairie, as well as gathering edible plants (Ricklis 1992a; 1996a).

Environmental Exploitation

In preceding pages, the significant use of coastal-estuarine resources by Early Archaic II people buried at Buckeye Knoll has been noted, and it has been suggested that these people also subsisted by significant exploitation of inland, prairie-riverine resources. The latter inference is premised, in part, on the assumption that the location of the Buckeye Knoll cemetery, on the upland margin overlooking the floodplain of the Guadalupe River, essentially marks and symbolizes the relevant group's home territory. During this Early Archaic period, then, the Buckeye Knoll folk operated primarily within a slightly inland prairie-riverine setting and moved to the coast on some kind of fairly regular basis to extract estuarine fish and shellfish. Judging by the fact that components at Buckeye Knoll immediately preceding (Early Archaic I) and following (Middle Archaic) the period of the cemetery produced shells of oyster, *Rangia cuneata*, and marine fish otoliths, it is clear that these food resources were at times brought back to the site. Presumably, this also was the case for the period of cemetery use, during the time interval referred to here as Early Archaic II, although these items would have been brought to a residential location other than the Buckeye Knoll site (such as, perhaps, the nearby Morhiss site, since Buckeye Knoll saw restricted use as a cemetery at this time). Certainly, the presence of marginella and nerite shell beads, sunray venus shell pendants, and impressed asphaltum nodules indicates that non-food resources from the coast were carried inland at least as far as the Buckeye Knoll site. Similar findings at the slightly more inland Morhiss site show that such materials were transported even farther from the coast (see Dockall and Dockall 1994).

Also mentioned earlier is the fact that this pattern of movement and resource procurement in the Early Archaic II was not maintained throughout the entire prehistoric cultural sequence. A combination of archaeological and ethnohistorical data indicates that by the time of the Rockport phase in Final Late Prehistoric and early Historic times, distinctly coastal groups were primarily inhabiting the shoreline and operating within a narrow strip of coastal territory that had a definite inland boundary (see Ricklis 1996a). Stable isotope data from human bone collagen show that this dichotomy in coastal-inland adaptations and populations, and the correlative territorial boundary, had emerged by the Late Archaic (Hard et al. 2002).

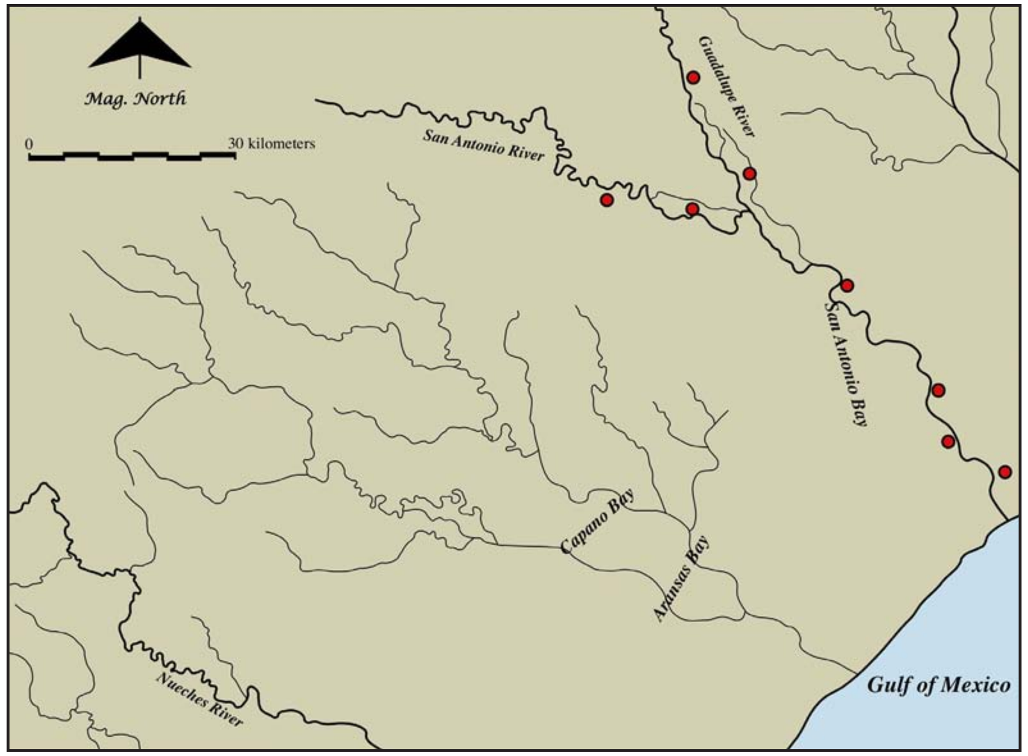
Drawing on available information from Buckeye Knoll and other archaeological locales, a coherent series of stages in the emergence of coastal adaptation and settlement can be defined. First, terminal Pleistocene to earliest Holocene (Figure 19-4) corresponds to the Late Paleo-Indian cultural period, prior to ca. 8,500 B.P. This stage predates the exploitation and occupation of the coastal zone. No estuarine shell samples were recovered at Buckeye Knoll that produced radiocarbon dates of this age, and no shell-midden sites have been documented along the coastal bay shorelines that are this old. Geologic evidence for Holocene sea-level rise suggests that, prior to around 10,000 years ago, sea level was still too low to have inundated the lower reaches of coastal-plain rivers to create the early forms of the Holocene estuarine bays that were the source for exploitable fish and shellfish resources (Brown et al. 1976). At that time, Late Paleo-Indian groups camped along upland margins overlooking floodplains and presumably subsisted by hunting and gathering the diverse, locally available animal and plant resources.

By around 10,000 years ago, rising sea level inundated the lower reaches of the Guadalupe and other rivers that had downcut their channels during the time of lower sea level during the final glacial maximum of the late Pleistocene. This flooding created the prototypes of San Antonio Bay and other bay systems along the Texas coast.

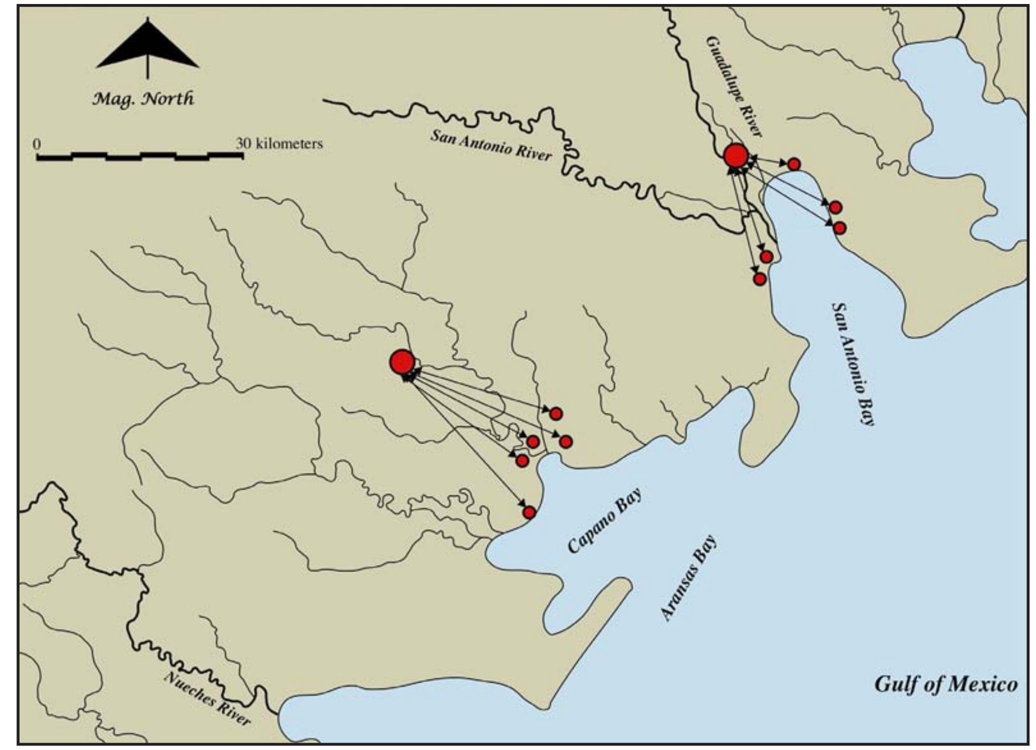
A significant body of archaeological information indicates that there was appreciable human exploitation of these early bays by ca. 8,200-7,500 B.P., calibrated (see Figure 19-4). At the Kendrick's Hill site (41JK35) on the upland edge overlooking the lower Lavaca River floodplain, Richard Weinstein was a thin shell midden stratum comprised of *Rangia cuneata* shells that yielded a calibrated age of 8,200 B.P. (Weinstein 1994). Although this site is presently several kilometers upstream from the head of Lavaca Bay, 8,200 years ago (prior to seaward progression of the river delta) it would have been in a bayshore setting.

Investigations along the headward portion of Nueces Bay have resulted in the identification of several early shell midden sites dating to ca. 7,500-6,800 B.P. These all consist of very thin (<10 cm thick) deposits of oyster (*Crassostrea virginica*) shells on upland margins immediately overlooking the bay. Sites include 41SP136, 41SP153, 41NU266, and 41NU281 (Ricklis 1993, 1995a, 2004; Ricklis and Weinstein 2005).

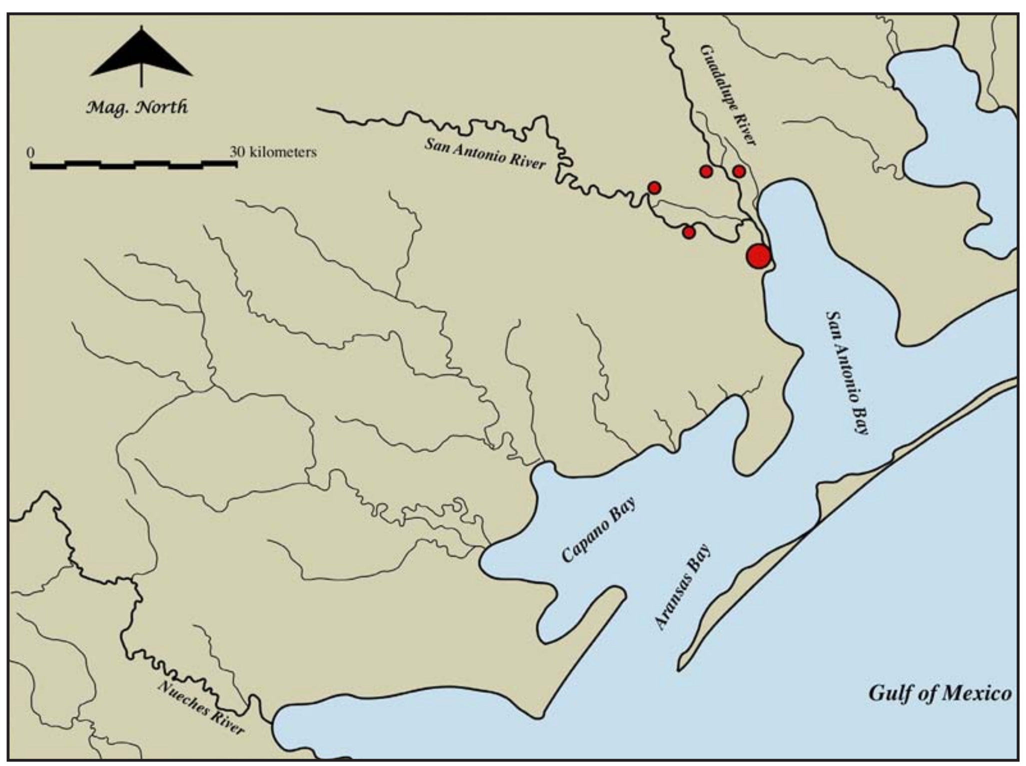
Artifacts from these early shell strata are few, consisting only of sparsely scattered chert debitage and a few simple bivalve-shell scraping/cutting tools. Faunal material is absent, presumably due to complete



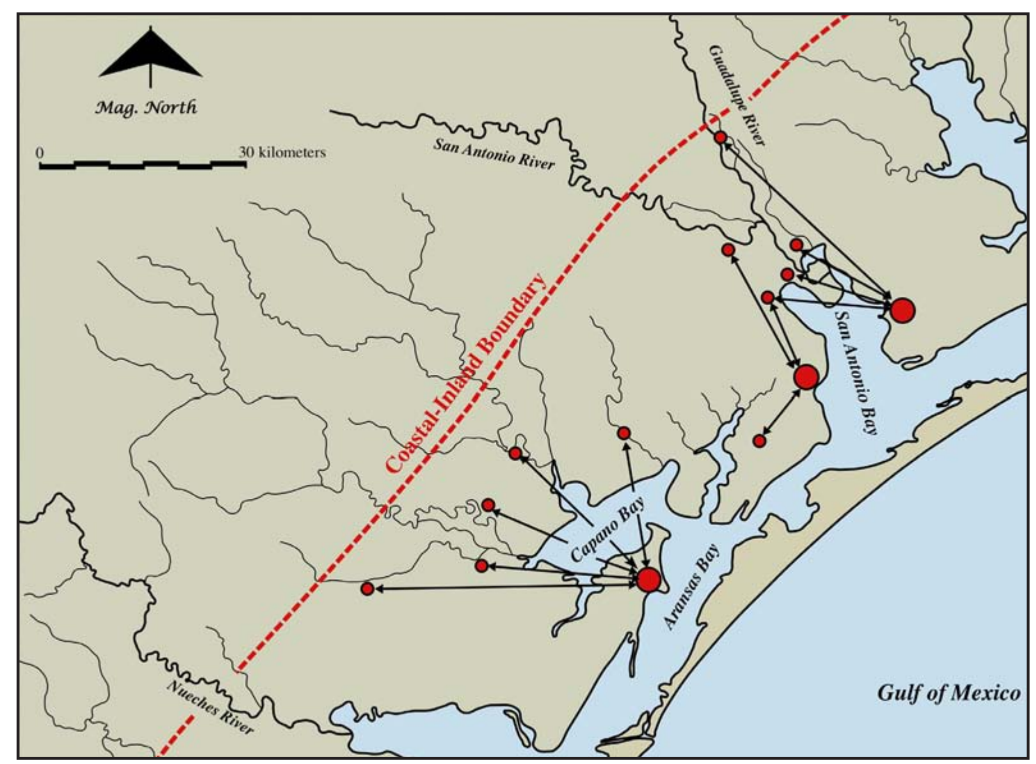
Late Pleistocene, ca. 10,000 B.P.



ca. 8,000 B.P.



ca. 6,000-5,000 B.P.



ca. 3,000 B.P.

Figure 19-4. Maps showing the four major stages in the evolution of prehistoric human adaptation of the Texas Coastal Zone during the Holocene epoch: ca. 10,000 B.P., Late Paleo-Indian hunting and gathering; ca. 8,000 B.P., river valleys are inundated by rising sea level with prehistoric populations inhabiting inland base camps and short-term bayshore extraction locales; ca. 6,000-5,000 B.P., increased Middle Archaic occupation of the coastline and intensification of fishing and shell fishing in the first coastal base camps; ca. 3,000 B.P., Late Archaic to Late Prehistoric population growth in the Coastal Zone with intensification of fishing and shellfishing, major fall-winter shoreline base camps, spring-summer prairie-riverine hunting camps, and the emergence of coastal-inland cultural boundary. Larger red circles represent base camps while smaller ones indicate small camps. Arrows show patterns of subsistence-related movements of people between the coast and the interior.

decay. Combined with the thinness of the deposits, the low artifact densities strongly suggest short-term, limited-function activities that included shellfish gathering and, as indicated by a single marine fish otolith at 41NU266, only very limited fishing.

Given the thin and artifactually sparse nature of these early deposits, it can be inferred that, while the coast was extensively exploited during Early Archaic I times, shoreline occupation was not intensive. This in turn suggests that the early people who utilized the shoreline must have carried out significant resource extraction in other environmental zones. The data from Buckeye Knoll provide, for the first time, strong evidence that these people were residing on, and exploiting resources of, the inland floodplains and adjacent upland prairies. They were also using the coast on only a part-time basis to extract shellfish and a limited supply of marine fish from the newly established bay shallows. Following inundation of the coastal valleys at ca. 9,000 B.P., approximately a millennium of infilling with river-discharged sediments had created bay-head shallows. These were suited to high photosynthesis and the emergence of an aquatic biomass sufficient to attract people who subsisted largely inland but who moved in an oscillatory fashion from interior camps to the shorelines of the bays to gather rangia and oysters, and engage in limited fishing. Much, perhaps most, of the shell detritus from these activities was discarded at the shoreline campsites, but some fraction of the gathered bivalves was carried inland, presumably with the meat still in the shells, back to what may have been base camps located along interior floodplains. Assuming that the rangia and oyster meats were transported inland in their shells, the movements between the shore and inland camps must have been accomplished directly and quickly so that the oysters and clams did not spoil before they could be eaten. The relatively high artifact counts from Early Archaic I contexts at Buckeye Knoll suggest that the inland camps saw considerably more intensive occupation than did the shoreline locations. Additionally, the scarcity of fish otoliths at the earliest shoreline sites may reflect the frequent transport of fish to inland base camps for processing and consumption.

During the Middle Holocene, between 6,000 and 4,200 B.P. (see Figure 19-4), occupation of the shoreline intensified. Shell midden deposits become more numerous and thicker (Ricklis 2004; Ricklis and Weinstein 2005; Weinstein 2002), and some sites of this period produce markedly more artifacts than any shoreline sites of the earlier period (e.g., the McKinzie site, 41NU221 [Ricklis 1988], and 41NU184 [Ricklis and Gunter 1986; Ricklis 1995a]). Projectile point types of the period from these sites include Bell, Andice, Early Triangular, and Tortugas. While it is possible that some of the shoreline sites may have been base camps, the coastal zone may not yet have reached its human carrying capacity, as the coastal-inland dichotomy with a definite territorial boundary apparently had not yet emerged. The stable isotope data reported by Hard et al. (2002) do not yet show the strict distinction between inland people who subsisted exclusively on prairie-riverine food resources and coastal people who lived largely on estuarine-marine resources. Also, rangia and oyster shells (along with marine fish otoliths) from Middle Archaic through Late Archaic II strata at Buckeye Knoll indicate that people living at that interior location still had access to coastal food resources and still brought them inland where shells and fish bones were discarded. Since these materials were not, on the other hand, abundantly associated with Late Archaic III or Late Prehistoric components at Buckeye Knoll, it is a fair conclusion that the later boundary between coastal and interior culture was not yet established, or at least not so rigidly maintained, in the Middle Archaic.

Around 3,000 B.P., sea level reached modern stillstand, and wave action and longshore drift deposited offshore sand sediment to form the modern chain of barrier islands (see Figure 19-4). The bay-lagoon estuaries behind the barriers became extensive, moderate-salinity shallows that were ideal for the emergence of a high aquatic biomass that was readily exploitable by prehistoric hunter-gatherers. Thus, by ca. 2,800-2,700 B.P. (ca. 800-700 B.C.), very large, thick, and relatively artifact-rich shell middens, such as the Kent-Crane site (41AS3) on Copano Bay, and the Mustang Lake site (41CL3) on San Antonio Bay, began to form (see chronometric data in Ricklis 1995a, 2004), reflecting a marked intensification of human occupation and exploitation of the shoreline environment. Zooarchaeological data from a number of shoreline sites spanning the Late Archaic into the Late Prehistoric indicate that after this time fishing gradually intensified, to reach its apogee in Late Prehistoric times (Ricklis 1995a, 2004; Ricklis and Weinstein 2005).

The large shoreline sites of this period produce high densities of artifacts, in addition to profusions of fish remains and massive quantities of oyster and a range of other bivalve and gastropod shells. Clearly, fishing and shell fishing were primary subsistence activities on the coast after around 3,000 B.P. At least by the Final Late Prehistoric period, estuarine resource extraction was sufficiently productive to support large base camps occupied for a significant part of the annual cycle by hundreds of people (Ricklis 1996b). A sedentary lifeway, however, did not develop on the Texas coast. Seasonality data from Final Late Prehistoric, Rockport phase archaeological sites, along with ethnohistoric data concerning the Karankawa groups found in archival records of the Colonial period, indicate that shoreline base camps were occupied mainly during the fall through late winter/early spring months to optimize fishing productivity during major fish spawning seasons. During the spring and summer most, if not all, of the population dispersed into small bands to move inland along streams to exploit plant resources found on floodplains and upland margins and to hunt deer and bison (Ricklis 1992a, 1996a).

In early Historic times, a clear coastal-inland boundary existed between the operational areas/territories of the coastal Karankawa groups and of the various inland populations of southern Texas, as shown by a combination of archaeological and ethnohistorical information (Ricklis 1996a:95-100). The combined evidence suggests that this boundary was some 40 km from the mainland shoreline, based in large measure on the fact that Late Prehistoric, Rockport-ware pottery gives way to the bone-tempered plainware of the inland Toyah horizon at this point in geographical space.

The Buckeye Knoll site is approximately 44 km from the mainland shoreline at the mouth of San Antonio Bay. Thus, the site is just inland of, and very near to, the identified boundary between inland and coastal culture areas during Late Prehistoric and early Historic times. In this light, the fact that the site produced both coastal (Rockport) and interior (Leon Plain) pottery makes sense, insofar as the location was probably accessible to both coastal and inland groups operating within their respective territories; archaeological studies at other points along this boundary show that the zone was used in a complementary fashion by both coastal and inland peoples (Ricklis 1996a:95-100).

At the terminal Archaic to Initial Late Prehistoric Blue Bayou cemetery site (41VT94), located on the upland margin above the Guadalupe valley, around 2 km farther inland than Buckeye Knoll, stable isotope analysis on human bone indicated a non-marine dietary pattern, suggesting that this cemetery was used by inland people (Huebner and Comuzzie 1992). The very limited isotope data for the Late Archaic II period at Buckeye Knoll, recovered from a single burial of that period (Burial 25), showed that individual to have the same 13C and 15N values as inland-adapted individuals from other burial sites of the period on the Texas coastal plain (cf., see Figure 11-6, herein; Hard et al. 2002).

Seemingly then, the boundary zone in question was established in Late Archaic times and maintained through the Late Prehistoric and into the early historic colonial era. Inferably, the emergence of this boundary and its correlative territorialities was the result of population growth in the coastal zone in response to increased estuarine biomass after modern sea-level stillstand was reached ca. 3,000 B.P. (see discussion in Ricklis and Blum 1997; Ricklis and Weinstein 2005). Given that the ecofactual data from Buckeye Knoll suggest a Late Archaic trend toward the use of smaller animal species, increased reliance on fish, as well as intensification of plant collecting (all suggesting population pressure on the resource base) it is likely that a parallel increase in population was taking place on the inland coastal plain. By the Late Archaic, the coastal zone had become sufficiently productive of biotic resources that it had attracted a full-time resident population that claimed territorial prerogatives over the area, including hunting grounds in the immediately adjacent portion of the coastal prairies. Thus, inland peoples would have had only very limited access to coastal resources, restricted probably to use of the brackish water lower reaches of rivers during the cool months, when coastal people were concentrated at more seaward shoreline fishing camps (note that a Toyah, or inland, Final Late Prehistoric artifact assemblage has been found in association with sparse deposits of rangia shells at sites on the lower Aransas River in San Patricio County, as well as at 41RF21 in Refugio County, all situated along the coastal-inland boundary; see Ricklis 1996a). By that time, Buckeye Knoll was on the immediate inland side of the boundary, and if the stable isotope data from Burial 25 are representative, people buried there were members of an inland population or populations. Nonetheless, the boundary zone was shared by both inland and coastal peoples, as suggested by the mixed ceramics at the site, and Buckeye Knoll was visited by Karankawan (Rockport phase) people who used the locale as a hunting camp from which to procure larger game animals such as deer and bison. This inference is in keeping with evidence from elsewhere in the region that indicates a shared and somewhat permeable boundary zone in Final Late Prehistoric times (Ricklis 1996a:95-100).

Interaction Spheres

In the preceding pages, it has been shown that the evidence from Buckeye Knoll suggests that people on the Texas coastal plain were participating in geographically widespread cultural-developmental processes during the Early Archaic II period. The Early Archaic II cemetery at Buckeye Knoll shows specific traits that have counterparts in the Southeast and Midwest; namely, elaborate mortuary artifacts that include ground- and polished-stone items such as bannerstones and plummets, along with oversize and presumably ceremonial bifaces. Some of these objects, such as one each of the quartzite and limestone grooved stones with Burial 6 and the small bannerstone with Burial 44, were apparently intentionally broken or "killed" at the gravesite, a ritual behavior also documented in Middle Archaic burials in the Southeast (Brookes 2005). Additionally, the cemetery was a distinct ritual space, differentiated from the surrounding environment, a cognitive and behavioral expression that inferably has a counterpart in the partitioning of communal space evidenced by Middle Archaic mound and plaza complexes such as Watson Brake and other early mound sites in Louisiana and Mississippi. The Buckeye Knoll cemetery was established on a distinctly mound-like landform which, though a natural feature, may have had a special and even archetypal ideological/cognitive significance fundamentally similar to that represented by artificial mounds at Watson Brake, Frenchman's Bend, Monte Sano, and other more-or-less contemporaneous sites in the Southeast.

While the apparent linkages between Buckeye Knoll and eastern sites are without known precedent in the Texas Early Archaic, they are in fact broadly analogous to the pattern previously recognized for the Late Archaic. The relatively elaborate Late Archaic mortuary pattern in the lower Brazos and Colorado River area shows notable similarities in terms of associated mortuary goods to those of the Early and Middle Woodland cultures of the eastern woodlands, including boatstones, two-hole stone gorgets, large whelk-shell pendants, and a native-copper pin from the Bowser site, 41FB3 (Patterson 2000). As noted above, Grant Hall (1981, 1995) has suggested that these shared traits reflect an "Eastern Import-Export Sphere" in which hunter-gatherers in Texas participated, by receiving boatstones and gorgets made of exotic stone, sometimes from the Ouachita Mountains of Arkansas, as well as shell ornaments made from large whelk shells that Hall postulates may have come from Florida. Hall further suggests that the necessary factors responsible for relatively dense populations relying on rich biotic resource bases within definite territories were in place as preconditions for the establishment of sizeable cemeteries, and that exchange of high-value items (such as the boatstones, gorgets, and shell pendants) established connections between local "big men" and their extralocal counterparts, thus reinforcing the status and prestige of such individuals within their societies.

LeRoy Johnson, Jr. (1994), has suggested that Texas coastal plain populations of the Late Archaic actually shared the same basic belief system held by the relatively more complex contemporaneous societies to the north and east. In Johnson's view, the Late Archaic people on the Texas coastal plain, while operating within a less complex sociocultural milieu than contemporaneous Early and Middle Woodland peoples of the East, were quite capable of sharing in the same fundamental world view, one that underlay the mortuary ritual and, thus, imparted, to some degree, similar behavior in the disposal of the dead.

Regardless of how the commonalities between the Archaic of the Texas coastal plain and the Early/Middle Woodland cultures of the East are interpreted, the Buckeye Knoll findings indicate that the cultural linkage between these areas was not a temporally limited phenomenon but one that had great time depth, beginning by the Early Archaic II period in Texas, ca. 7,000 B.P. At present, there is no convincing evidence to indicate that this connection was maintained through the Texas Middle Archaic; rather, the available evidence suggests that the linkage between Texas and the East varied in intensity through time, manifesting strongly in the Early Archaic II, apparently then waning during the Middle Archaic (a period for which, however, we presently have very limited mortuary evidence), to become reestablished in Late Archaic times. The earlier period of interrelationship was one of emergent sociocultural complexity throughout much of the Southeast and Midwest. This included the Texas coastal plain, where the Buckeye Knoll cemetery actually preceded relevant developments to the north and east. At the time of the Late Archaic in Texas, on the other hand, the systemic energy of socially and ideologically complex Early and Middle Woodland cultures in the East underlay the spread of cultural patterns (and actual exchange of material goods) over a vast area encompassing virtually the entire eastern half of North America from the Gulf of Mexico northward to the Great Lakes and the Saint Lawrence River valley (e.g., Fitting 1970; Ritchie and Dragoo 1959; Stoltman 1980).

To infer the specific mechanisms by which these long-distance linkages were effected would stretch the data beyond reasonable limits. Too little is understood about how cultural information flowed between these diverse regional populations. The recurrence of such interrelations over millennia does suggest, however, that the connections were persistent and fundamental, and that the Texas coastal plain should not be viewed as a region occupied by simple hunter-gatherers operating in a cultural milieu that was isolated from developments in the East. On the contrary, connections to developing cultures far to the east and north now appears to have been a very long-lasting phenomenon, albeit one that fluctuated in intensity. It appears to have peaked in the Early Archaic II, then again some 4,500 or more years later in Late Archaic II and III. It waned in Late Archaic III and in the Initial Late Prehistoric as the eastern Middle Woodland mortuary ceremonialism and associated long-distance exchange systems gave way to what were probably quite different socioeconomic and ideological patterns of Late Woodland and Mississippian times. The resurgent, albeit very different, sociocultural complexity of subsequent Mississippian cultures did not reach into Texas any farther than the Caddo area of the northeastern corner of the state, perhaps because it was inextricably linked to sedentary maize-horticultural lifeways and attendant communal sedentism that were never established on the coastal plain south or west of the Caddo area.

In sum, then, the Texas coastal plain was persistently linked with cultural patterns and developments to the north and east during the Archaic, prior to the emergence of agricultural economies in Mississippian and/or Late Woodland times. Therefore, it is here suggested that this region should be included in the Trans-Mississippi South as defined by Schambach (1998) for the western and southwestern margins of the eastern woodlands, west of the Mississippi valley and east of the Great Plains (Figure 19-5).

Schambach (1998) has defined the Trans-Mississippi South (TMS) as a biogeographical province that was the setting for diverse pre-Caddoan cultures, some ancestral to Caddo culture and some not. While the area is essentially defined on the basis of its oak-hickory forest cover and concomitant ecosystems, its prehistoric cultures were interconnected and produced artifact traits shared with the Southeast and Midwest, such as ground-stone gorgets, grooved axes, boatstones (Schambach 1998), and bannerstones (Frank F. Schambach, personal communication 2005). Furthermore, Schambach explicitly noted that because the eastern woodlands gave way to the central prairies gradually in Texas, the southwestern limit of the TMS would ultimately have to be defined on the basis of cultural criteria (Schambach 1998:9), meaning that the extent of cultural traits and patterns similar to those of the greater Southeast and Midwest would define the farthest extent of the TMS. Accordingly, Figure 19-5 shows the extent of the TMS as defined by Schambach (1998), along with a southwestward extension, proposed here, that is intended to include the central coastal plain of Texas. Given that all the available evidence suggests that eastern cultural traits/patterns did not penetrate this far in post-Archaic times, it is suggested that the southwestern boundary of the TMS withdrew to what is now northeast Texas after the Late Archaic. The boundary should, therefore, be conceptualized as dynamic and fluctuating through time.

It is significant that the traces of these fundamental interconnections rest largely within the material-culture expressions placed in graves. The key traits at Buckeye Knoll and in the coastal plain Late Archaic that are techno-stylistically similar to eastern counterparts (e.g., bannerstones, plummets, oversized bifaces, boatstones, gorgets, rare copper artifacts, and large marine-shell ornaments), and attendant signs of emergent sociocultural complexity, have generally not been recognizable in the archaeological record of domestic habitation locales. Rather, they appear (and make some degree of coherent sense) only in the mortuary assemblages found in cemeteries. Thus, it may be postulated that cultural information flowed at different component "levels" within cultural systems, some within the technoeconomic dimension, and some only at the non-mundane level of ideological belief systems which had material manifestation largely, or perhaps exclusively, in the sphere of ritual activity. Based on presently available evidence, it would seem that, at the southwestern periphery of the TMS, information reaching the Texas coastal plain was rooted in the ideo-cognitive dimension of fundamental beliefs and world views which found material expression in mortuary ritual.

In light of all this, the very long-lived Archaic of the Texas coastal plain may be viewed as part of a widespread set of patterns and processes, as opposed to an isolated cultural pattern in a marginal region. Future research may further explore the broad interlinkages revealed here by the Buckeye Knoll findings. The role of the Texas coastal plain in transmission of cultural information between the eastern United States and Mesoamerica has long been speculated upon (see

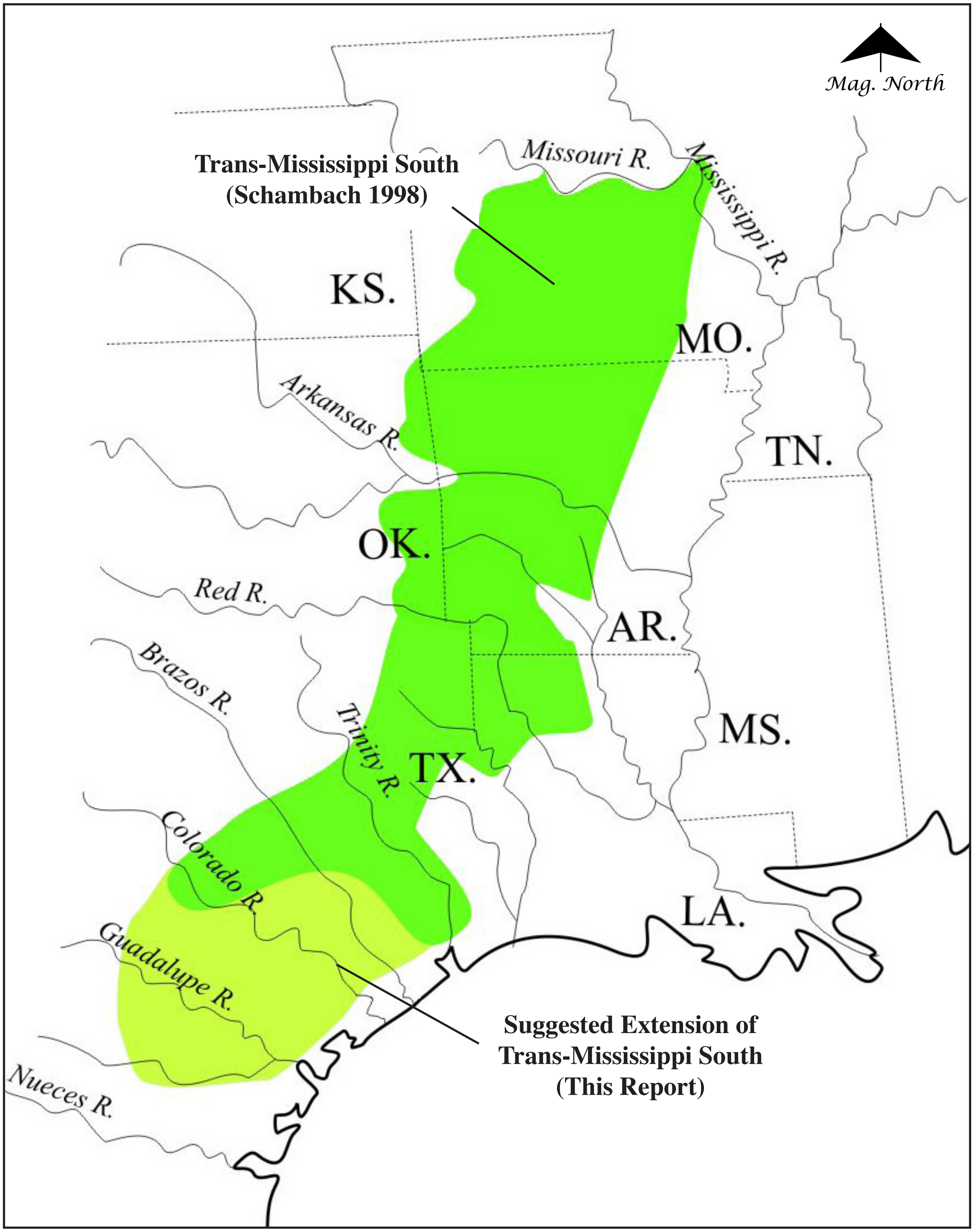


Figure 19-5. A map showing the extent of Schambach's Trans-Mississippi South (TMS) and the presently suggested southwestward extension onto the central coastal plain of Texas during the Texas Archaic.

Story 1985; Kibler 2005; Ricklis and Weinstein 2005; White 2005; White and Weinstein 2008), and, indeed, Dee Ann Story suggested over 30 years ago that the archaeological key to better comprehending such long-distance interrelations might reside in the Early Archaic of the lower Guadalupe valley (Story 1985:55). The remarkable record revealed at Buckeye Knoll supports this prognostication. By understanding the regional Archaic as a long-lived part of the Trans-Mississippi South, we may step "out of the box" of viewing the early hunter-gatherers of the area as culturally isolated, or at best as marginal populations eking out an existence in a "cultural sink" and only struggling for mere survival. By this simple shift of perspective, we obviate the need to find or identify a hypothesized, but so far quite elusive, geographic conduit of cultural transmission between regions of presumably more "advanced" societies (e.g., Krieger's [1948] "Gilmore Corridor") and can thereby shift our focus of interest to the study of broad cultural processes in which information flow was a constant principle, although a factor that fluctuated in intensity over the long run, and that perhaps saw potentially profound processual transformations through time.

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