# Chapter 6: Research Issues

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## Introduction

In the previous chapters we summarized various data sets collected from 41TV163. The site was excavated over thirty years ago using a variety of field techniques that were designed to collect information primarily for the investigation of cultural chronology. As such, data sets commonly collected today in order to address current research questions were only of incidental interest. In addition, some records (e.g., field journal and original profiles) have been lost over the last three decades. Nevertheless, the data from 41TV163 can make a significant contribution to understanding selected aspects of Texas prehistory. This chapter outlines several current research domains that can be addressed with extant data from the site of Millican Bench.

The first two research issues are explicitly concerned with diachronic change. Specifically, we proposed to investigate changes in subsistence patterns and changes in lithic technology. For this component of the investigation, it was necessary to identify deposits that can be assigned to a given temporal period. The temporal analytical units defined at 41TV163 are broad relative to traditional "component-based" analysis. They frequently consist of selected levels from clusters of excavated units identified on the basis of diagnostic projectile points that reflect a single period. The individual analytical units span a temporal range from the Early Archaic through the Late Prehistoric. The material associated with these analytical units, which primarily consists of chipped stone and faunal material, was specifically used to investigate changes in subsistence patterns from the Late Archaic through the Late Prehistoric periods, and changes in lithic technology from the Early Archaic through the Late Prehistoric.

The third research area considered focuses more on a specific feature type represented at the site. This research domain is more synchronic in focus. Specifically, it centers on the investigation of the possible structure (Feature 3) at this site. Few houses have been reported for the prehistoric record in central Texas. If Feature 3 at the Millican Bench site does represent a structure, a number of implications, both for the use of the site as well as the nature of the overall Late Prehistoric adaptation, follow. Note that in our original assessment of this site (Mahoney et al. 2003a) we had proposed a fourth research domain which involved the investigation of the "veneer" hypotheses for burned rock midden formation (see Collins 1994). That investigation hinged on having two data sets from specific contexts. We had proposed to use fluoride dating of animal bones (see Ezzo 1992; Gregory and Schurr 2000) and radiocarbon dating from several areas of the site in order to more finely date the deposits in several of the burned rock midden features. Unfortunately, we were unable to isolate sufficient charcoal for the radiocarbon dating. In addition, the condition of the faunal material was such that we could not isolate faunal samples representing the same species and same element (see Gregory and Schurr 2000; Schurr 1989) from the appropriate contexts. We were, then, unable to pursue this fourth research domain.

## Diachronic Research Issues: Changes in Subsistence Patterns and Lithic Technology

As outlined in the previous chapters, 41TV163 contains an abundant material record generated over a significant time span. Diagnostic projectile points span several thousand years and suggest occupation of the site, at some level, from the Early Archaic through the Late Prehistoric. Sites generated by repeated occupations over long periods of time, such as 41TV163, dominate the record in Texas. While such sites contain an extremely complex archeological assemblage that makes it difficult to isolate clear temporal analytical units, they also provide the opportunity to study specific research questions, many of which are focused on documenting and understanding diachronic changes in adaptation while holding site location constant. That is, in these situations it can be assumed that whatever differences are seen in subsistence or technological aspects of distinct analytical units is likely due to different adaptive strategies rather than simply changes in site location.

### Definition of Analytical Unit

One of the initial problems that must be considered when investigating diachronic issues at sites generated over long periods of time is how to isolate distinct analytical units for comparison. In part because of the limitations of the available records, and in part because the site was excavated in arbitrary, six-inch levels, the analytical units we propose for 41TV163 are not at the phase or interval scale, but rather at the broader, period temporal scale (e.g., Early Archaic, Late Prehistoric). The boundaries between periods traditionally used in Texas archeology are assumed by most researchers to represent points in time at which significant changes occurred in subsistence and technological practices. The periods themselves (e.g., Late Archaic) are assumed to reflect relatively consistent adaptations internally relative to other periods. Therefore, assuming that period-level designations can be made, certain analytical comparisons (e.g., technological organization) between periods can yield significant research results, especially when, as is the present case, only a single site is being compared.

As discussed in the previous chapter, over 400 projectile points were recovered from 41TV163. The projectile point styles were identified based primarily on Turner and Hester (1999) and supplemented by H. J. Shafer's typological assessments. In order to divide the 41TV163 temporal record into period-level analytical units, we initially searched for vertical clusters of like projectile points in the various excavation areas identified at the site. The vertical provenience unit in which material was collected during the excavation at the site consisted of six-inch levels. While the original excavators tried to place these arbitrary levels into larger zone designations that were potentially indicative of natural stratigraphic units, our review of these data suggest that this attempt is not useful for our purposes. Using these thicker "zonal" assignments, which were often several levels thick and occasionally assigned a given level to more than one zone (e.g., Zone II/III), grouping material failed to produce results that reflected consistent temporal periods. Consequently, we used the smallest available vertical designation, the six-inch level, as a starting point to search for period-level analytical units. Relying on these six-inch levels for vertical control, we investigated each of the five spatial areas designated at the site. The point distributions were compared, where appropriate, to the radiocarbon dates available from the site (see Table 5-4).

Our investigation suggests that Area A and Area D contain deposits with little or no temporal integrity based on the distribution of temporally diagnostic projectile points. However, making the assumption that the material associated with temporally diagnostic points reflects a similar age as those points, we can isolate assemblages for comparison in each of the remaining areas. We can isolate two different analytical units in Area B, one of which represents primarily Late Archaic material and a second that represents Middle Archaic material. For Area C, we can isolate a series of excavation units and levels that reflect primarily Late Prehistoric material. Area E contains units that can be assigned to the Late Archaic, while Area F appears to be primarily Early Archaic in age. We discuss our investigation of each of these five spatial areas below.

### Area A

As outlined in the previous chapter, 38 temporally diagnostic projectile points were collected and identified from this area of the site. There are 19 Late Archaic point types, which span the entire period. Seventeen points date to the Middle Archaic period. In addition, two Early Archaic points are present. Table 6-1 presents the distribution of each point type by unit and level, with the types grouped chronologically. The Middle Archaic section of the table is shaded. Examination of the table clearly demonstrates that there is considerable overlap within the deposit. Each of the five levels with points has both Late Archaic and Middle Archaic specimens present. None of the components appear to be separated vertically. The percentage of Late Archaic diagnostics by level fluctuates substantially, with the two lowest percentages occurring in Level 5 (25%) and Level 1 (44%). In addition, note that the Early Archaic Wells points appear in the two highest levels. No spatial clustering of levels with point types reflecting a consistent period assignment is apparent. Based on the distribution of point types in Table 5-1, our assessment is that the deposits in Area A lack integrity. We cannot define an artifact sample that would even broadly represent a temporal period.

### Area B

The sample of diagnostic points from Area B consists of 59 specimens that primarily reflect Late (n=34) and Middle (n=22) Archaic production, although three Early Archaic points are also present. Three of the 59 points were collected from the backhoe trench at the south end of this area, and the precise provenience of two other points is not known. Table 6-2 presents the vertical distribution of the remaining 54 points by type and level. As with Table 6-1, the Middle Archaic point types are shaded. Within this area, excavation was only conducted along the E200 line. Figure 6-1 is a schematic of the distribution of diagnostics along E200 from S145 through S175 that reflects all 54 diagnostics recovered. Comparison of the percentages of Late Archaic point types by level, presented to the right of the schematic in Figure 6-1, clearly suggests that good vertical separation is present between the Late and Middle Archaic in Area B. All of the 15 diagnostic points from the upper four levels reflect a Late Archaic age. Conversely, Late Archaic points make up only 27.3% of the 33 points found below Level 5, and these lower levels are dominated by Middle Archaic point forms (66.7%).

Table 6-1. Projectile Point Distributions by Unit and Level, Area A

| **Unit** | **Level** | **Darl** | **Lange** | **Langtry** | **Pedernales** | **Bulverde** | **Nolan** | **Travis** | **Wells** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|
| S105/E165 | 1 | | | | | 1 | | | | 1 |
| S115/E170 | 1 | 1 | | | | | | | | 1 |
| S115/E175 | 1 | | | | 1 | | | 2 | | 3 |
| S115/E180 | 1 | | | | 1 | | | | | 1 |
| S115/E185 | 1 | | | | | | 1 | | 1 | 2 |
| S120/E185 | 1 | | | | | | 1 | | | 1 |
| **Level 1 Total** | | **1** | **0** | **0** | **2** | **1** | **2** | **2** | **1** | **9** |
| S110/E185 | 2 | | | | | 1 | | | | 1 |
| S115/E170 | 2 | | | | | | | | 1 | 1 |
| S115/E180 | 2 | | | | 1 | | | 2 | | 3 |
| S115/E185 | 2 | | | 1 | 1 | | | | | 2 |
| S120/E185 | 2 | | | | 2 | | | | | 2 |
| S120/E200 | 2 | | | | | | 1 | | | 1 |
| **Level 2 Total** | | **0** | **0** | **1** | **4** | **1** | **1** | **2** | **1** | **10** |
| S105/E165 | 3 | | | | 1 | | | | | 1 |
| S110/E185 | 3 | | 1 | | 1 | | | | | 2 |
| S115/E160 | 3 | | | | | 1 | | | | 1 |
| S115/E165 | 3 | | | | | | | 1 | | 1 |
| S115/E170 | 3 | | 1 | | | | | | | 1 |
| S115/E175 | 3 | | | | | | | 1 | | 1 |
| S120/E185 | 3 | | | | | | | 2 | | 2 |
| S125/E185 | 3 | | | | 1 | | | | | 1 |
| S135/E185 | 3 | | | | | | 1 | | | 1 |
| **Level 3 Total** | | **0** | **2** | **0** | **3** | **1** | **1** | **4** | **0** | **11** |
| S100/E165 | 4 | | | | | | 1 | | | 1 |
| S105/E185 | 4 | | | | 2 | | | | | |
| S115/E180 | 4 | | | | | | | 1 | | 1 |
| **Level 4 Total** | | **0** | **0** | **0** | **2** | **0** | **1** | **1** | **0** | **4** |
| S110/E185 | 5 | | | | | | 1 | | | 1 |
| S115/E165 | 5 | | | | | | 1 | | | 1 |
| S115/E170 | 5 | | 1 | | | | | 1 | | 2 |
| **Level 5 Total** | | **0** | **1** | **0** | **0** | **0** | **2** | **1** | **0** | **4** |

Overall, then, the Late Archaic forms are higher in the excavation relative to the Middle Archaic forms. The point distribution data also suggests several concentrations of period-level diagnostics in certain excavation units. It is possible to define two analytical units (AUs), identified in Figure 6-1 by hatching, that reflect Late and Middle Archaic point concentrations. The Late Archaic analytical unit consists of a block of nine proveniences confined to the upper three levels of three excavation units. Only Late Archaic points (n=11) are present, and this analytical unit is separated vertically from any Middle Archaic points by one six-inch level. The Middle Archaic analytical unit consists of eight proveniences, located in Levels 6, 7, and 8. Middle Archaic point forms account for 21 of the 24 points (87.5%). Note that much of this Middle Archaic material is associated with Feature 6, the concentration of points and debitage described in the previous chapter (see Figure 5-14 and Figure 5-16).

Table 6-2. Projectile Point Distributions by Unit and Level, Area B*

| Unit | Level | Darl | Ensor | Montell | Castroville | Marshall | Lange | Williams | Pedernales | Bulverde | Nolan | Travis | Early Triangular | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S170/E200 | 1 | | 1 | | | | | | | | | | | 1 |
| S175/E200 | 1 | | | 1 | | | 2 | | 1 | | | | | 4 |
| **Level 1 Total** | | **0** | **1** | **1** | **0** | **0** | **2** | **0** | **1** | **0** | **0** | **0** | **0** | **5** |
| S170/E200 | 2 | | | | | | | | 1 | | | | | 1 |
| S175/E200 | 2 | | | | | | | 1 | | | | | | 1 |
| **Level 2 Total** | | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **1** | **0** | **0** | **0** | **0** | **2** |
| S150/E200 | 3 | | | | | | | | | 1 | | | | 1 |
| S155/E200 | 3 | | | 1 | | | | | | | | | | 1 |
| S165/E200 | 3 | | | | | 1 | | | 2 | | | | | 3 |
| S170/E200 | 3 | | | | 1 | | | | | | | | | 1 |
| **Level 3 Total** | | **0** | **0** | **1** | **1** | **1** | **0** | **0** | **2** | **1** | **0** | **0** | **0** | **6** |
| S175/E200 | 4 | | | 1 | | | 1 | | | | | | | 2 |
| **Level 4 Total** | | **0** | **0** | **1** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **2** |
| S150/E200 | 5 | | | | | | | | | 1 | | | | 1 |
| S170/E200 | 5 | | | | | 2 | | | 1 | | 1 | | | 4 |
| S175/E200 | 5 | | | | | 1 | | | | | | | | 1 |
| **Level 5 Total** | | **0** | **0** | **0** | **0** | **3** | **0** | **0** | **1** | **1** | **1** | **0** | **0** | **6** |
| S160/E200 | 6 | | | | | | | | | | 1 | | | 1 |
| S165/E200 | 6 | | | | | | | | | 1 | 2 | 2 | | 5 |
| S170/E200 | 6 | | | | | | | | | | 4 | 2 | 1 | 7 |
| S175/E200 | 6 | 1 | | | | | | | 3 | 1 | 1 | | | 6 |
| **Level 6 Total** | | **1** | **0** | **0** | **0** | **0** | **0** | **0** | **3** | **2** | **8** | **4** | **1** | **19** |
| S160/E200 | 7 | | | | | | | | | | | 1 | | 1 |
| S165/E200 | 7 | | | | | | | | | 1 | 4 | | | 5 |
| S175/E200 | 7 | | | | | | | | 2 | 1 | | | | 3 |
| **Level 7 Total** | | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **2** | **2** | **4** | **1** | **0** | **9** |
| S165/E200 | 8 | | | | | | | | | | 4 | | 1 | 5 |
| **Level 8 Total** | | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **4** | **0** | **1** | **5** |

*Five points lacking detailed proveniences not included in table.

We assume, given the dominance of Late Archaic points, that the upper nine levels in Figure 6-1 contain associated Late Archaic deposits. A similar assumption is made for the eight Middle Archaic levels identified in Figure 6-1. Two radiocarbon dates are available from Area B (see Table 5-4). Unfortunately, neither is directly associated with either of the two AUs. One, UGA #12301, comes from S175/E200, Level 7, a location just to the south of our Middle Archaic AU. A second, UGA #12300, appears to be associated with the north face of the backhoe trench (S180/E200), and is associated with "Zone 5" though no level is indicated. While the precise provenience is not clear, we estimate, given the location of Zone V, that this sample is equivalent to Levels 9 or 10. The location associated with UGA #12301 contained two Late Archaic Pedernales points and a Late Archaic Bulverde point. The associated deposits should, therefore, date to sometime between about 2500 BP and 4000 BP (Collins 1995:376). UGA# 12301 returned a corrected date of 2840 ± 110 BP, within the expected time range. UGA #12300, from roughly 1.5 feet below UGA # 2301, returned a date of 3050 ± 80 BP (see Table 5-4).

## *Area C*

The projectile point sample from Area C consisted of 142 points that could be assigned to specific types. Late Prehistoric projectile points, primarily Scallorn in type,

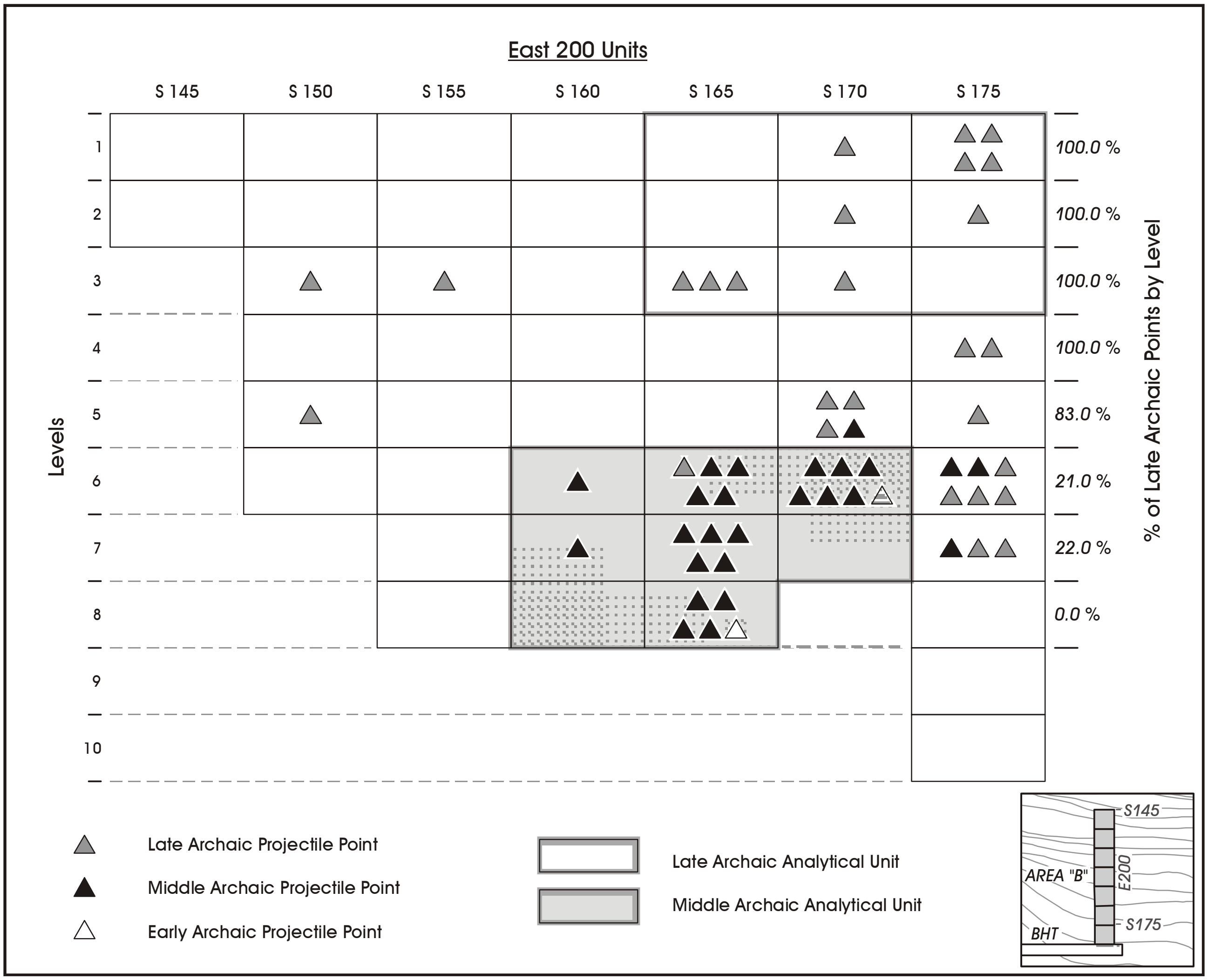

Figure 6-1. *Schematic cross-section of Area B, 41TV163, with diagnostic point types and analytical units identified.*

accounted for 49 items, and the remaining 93 diagnostic types were Late Archaic in age. Eight of the 142 typed points were from the backhoe trench, and six others lacked detailed provenience. Table 6-3 summarizes the distribution of 128 of the diagnostic projectile points by unit and level. Shading in Table 6-3 identifies the Late Prehistoric forms. The data presented in Table 6-3 clearly show that Late Prehistoric points are confined to the upper three levels, and only Late Archaic forms are present below Level 3. However, the vertical distribution of projectile points also shows that the upper three levels contain a substantial number of Late Archaic point forms. Level 1 contains 68 diagnostic points, 38 (59%) of which are Late Prehistoric in age. Of the 35 diagnostic points in Level 2, roughly 23% are Late Prehistoric in age, and Late Prehistoric points also make up 8% of the Level 3 material. While we can certainly isolate a Late Archaic assemblage based on the data presented in Table 6-3, the Late Prehistoric material in the upper three levels appears mixed with Late Archaic remains.

Figure 6-2 presents a schematic of point distributions for two areas, however, that suggest a predominately Late Prehistoric assemblage may be present in one portion of Area C. The schematic, which covers the eastern end of excavation units placed off the backhoe trench, encompasses units along the S175 (top) and S185 (bottom) squares from E150 through E170. Note that three proveniences, all representing Level 1, are stippled as a Late Prehistoric analytical unit. Sixteen typed Late Prehistoric points are in these three levels. While four Late Archaic points are also present in this Late Prehistoric AU, Late Prehistoric forms account for 80% of the diagnostic points. Also identified in

Table 6-3. Projectile Point Distributions by Unit and Level, Area C

| Unit | Level | Alba | Bonham | Scallorn | Darl | Ensor | Fairland | Montell | Castroville | Marcos | Marshall | Lange | Pedernales | Bulverde | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S165/E170 | 1 | | | 1 | | | | | | | | 1 | | | 2 |
| S170/E170 | 1 | | 1 | 8 | 5 | | 2 | | | | | | | | 16 |
| S175/E145 | 1 | | | 1 | 1 | | | | | | | | | | 2 |
| S175/E150 | 1 | | | 1 | 1 | 1 | | | | | | | | | 3 |
| S175/E155 | 1 | | | 9 | 1 | | | | | 1 | | | | | 11 |
| S175/E160 | 1 | | | 4 | 1 | | | | | | | | | | 5 |
| S175/E170 | 1 | | | 1 | 1 | | | | | | | | | | 2 |
| S185/E140 | 1 | | | | | | 1 | | | | | | 1 | | 2 |
| S185/E145 | 1 | | | 1 | | | 1 | | | | | | | | 2 |
| S185/E150 | 1 | | | 2 | 1 | | | | | | | | | | 3 |
| S185/E155 | 1 | | | | 2 | | | | | | | | | | 2 |
| S185/E160 | 1 | | | 3 | | | 1 | | | | | | | | 4 |
| S185/E165 | 1 | 1 | | 2 | 1 | | 2 | | | | | | | | 6 |
| S185/E170 | 1 | | | | | | 1 | | | | | | | | 1 |
| S185/E175 | 1 | | | 3 | 2 | | 1 | | | | | | 1 | | 7 |
| **Level 1 Total** | | **1** | **1** | **36** | **16** | **1** | **9** | **0** | **0** | **1** | **0** | **1** | **2** | **0** | **68** |
| S165/E170 | 2 | | | 3 | | | | | | | | | | 1 | 4 |
| S170/E170 | 2 | | | 1 | 2 | | | | | | | | | | 3 |
| S175/E145 | 2 | | | | 1 | | 3 | | | | | | | | 4 |
| S175/E150 | 2 | | | 1 | 2 | | 1 | | | | | | | | 4 |
| S175/E155 | 2 | | | 1 | 3 | 1 | 1 | | | | | | | | 6 |
| S175/E160 | 2 | | | 2 | | | 1 | | | | | | | | 3 |
| S175/E165 | 2 | | | | 2 | | 1 | | | | | | | | 3 |
| S175/E170 | 2 | | | | 2 | 1 | 1 | | | | | | | | 4 |
| S185/E165 | 2 | | | | 3 | | | | | | | | | | 3 |
| S185/E170 | 2 | | | | | | 1 | | | | | | | | 1 |
| **Level 2 Total** | | **0** | **0** | **8** | **15** | **2** | **9** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **35** |
| S165/E170 | 3 | | | | | | | | | | | 1 | | | 1 |
| S170/E170 | 3 | | | | | | 1 | | | | | 2 | | | 3 |
| S175/E145 | 3 | | | | | | | | | | | | 1 | | 1 |
| S175/E150 | 3 | | | | | | 1 | | | | | | | | 1 |
| S175/E155 | 3 | | | | 1 | | 1 | | | | | | | | 2 |
| S175/E160 | 3 | | | 1 | | | | | | | | | | | 1 |
| S175/E170 | 3 | | | | | 1 | | 1 | | | | | | | 2 |
| S185/E165 | 3 | | | | | 1 | | | | | | | | | 1 |
| **Level 3 Total** | | **0** | **0** | **1** | **1** | **2** | **3** | **1** | **0** | **0** | **0** | **3** | **1** | **0** | **12** |
| S165/E170 | 4 | | | | | | | | | 1 | | | | | 1 |
| S170/E170 | 4 | | | | | | | | | | | 1 | | | 1 |
| S175/E165 | 4 | | | | 1 | | | | | | | | | | 1 |
| S175/E170 | 4 | | | | | | 1 | | | | | | | | 1 |
| **Level 4 Total** | | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **4** |

Table 6-3. continued…

| Unit | Level | Alba | Bonham | Scallorn | Darl | Ensor | Fairland | Montell | Castroville | Marcos | Marshall | Lange | Pedernales | Bulverde | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S165/E170 | 5 | | | | | | | | | | | | 1 | | 1 |
| S175/E170 | 5 | | | | | | | | | | | 1 | | | 1 |
| S185/E165 | 5 | | | | | | | | | | | 1 | | | 1 |
| S185/E170 | 5 | | | | | 1 | | | | | | | | | 1 |
| **Level 5 Total** | | **0** | **0** | **0** | **0** | **1** | **0** | **0** | **0** | **0** | **0** | **2** | **1** | **0** | **4** |
| S170/E170 | 6 | | | | | | | | | | | | 1 | | 1 |
| S175/E170 | 6 | | | | | | | | | | | 2 | | | 2 |
| **Level 6 Total** | | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **2** | **1** | **0** | **3** |
| S175/E165 | 7 | | | | | | | | 1 | | 1 | | | | 2 |
| **Level 7 Total** | | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **1** | **0** | **1** | **0** | **0** | **0** | **2** |

the figure are 11 proveniences that form a Late Archaic analytical unit. These proveniences, which contained nine Late Archaic diagnostic projectile points, lack any Late Prehistoric forms and are separated from the Late Prehistoric AU by two six-inch levels.

Four radiocarbon dates exist which are relevant to assessing the integrity of these AUs. Three of these were submitted by CAR (see Table 5-4), and the forth was obtained in the early 1970s. This last sample was collected from the north edge of square S175/E155, roughly 18 inches from the eastern grid wall, at the base of Level 2. It sits below our Late Prehistoric AU, and is associated with a single Late Prehistoric point and five Late Archaic forms (Figure 6-2). The date, run by the Radiocarbon Laboratory at the University of Texas (TX #1511), is reported at 500 ± 80 BP. Note that the UT Radiocarbon Laboratory reported dates using a $^{14}$C half-life of 5,568 years (M. Collins, personal communication February 2003), shorter than the established half-life of 5,730 years. This would result in a slightly more recent date relative to other laboratories. In addition, the date is not corrected for carbon fractionation, and details of the sample are not known. Nevertheless, the Oxcal calibration program (Ramsey 2000) produced a calibrated age range of A.D. 1310–1490 for this assay. The three dates submitted by CAR are UGA #12305, #12306, and #12307 (see Table 5-4; Appendix C). UGA #12305 comes from Level 1 of S175/E160, a level assigned to our Late Prehistoric AU. The corrected, calibrated date is A.D. 1300–1430, a date range within the Late Prehistoric period. UGA #12306 was from Level 1 within S185/E160, another Late Prehistoric level. This date was essentially modern. The final date, UGA #12307, was from Level 3 of S175/E155, below the Late Prehistoric AU levels, and below the date run by UT. That sample, associated with a Darl and a Fairland point which are late in the long Late Archaic period, produced a corrected, calibrated date of A.D. 380–570 (see Table 5-4; Appendix C). Considering these radiocarbon dates as a group, it appears that the UT date is clearly too young given the Level 2 location. UGA #12305 is consistent with the Late Prehistoric AU designation, though the date is slightly more recent than the associated Scallorn points would suggest. UGA #12307 is consistent with the Late Archaic points recovered. The modern date of UGA #12306 from Level 1 is difficult to evaluate given that we lack any details regarding where, within the 5-x-5-foot unit, the sample was obtained.

## *Area D*

Only a single typed projectile point, a Late Archaic Ensor, was recovered from the excavation of the single unit in Area D. In addition, an untyped arrow point fragment was present. Two other typed points were associated with the backhoe trench. Given the co-occurrence of arrow and darts points, the limited excavation, and the minimal sample size of points, a Late Prehistoric or Late Archaic component could not be separated in this Area. Consequently, we cannot define any clear analytical units in this area.

## *Area E*

Late Archaic point types dominated Area E, with 51 of the 59 diagnostics falling within this period. Eight Late Prehistoric Scallorn points were also present. Table 6-4 presents the distribution of 58 of these points by unit and

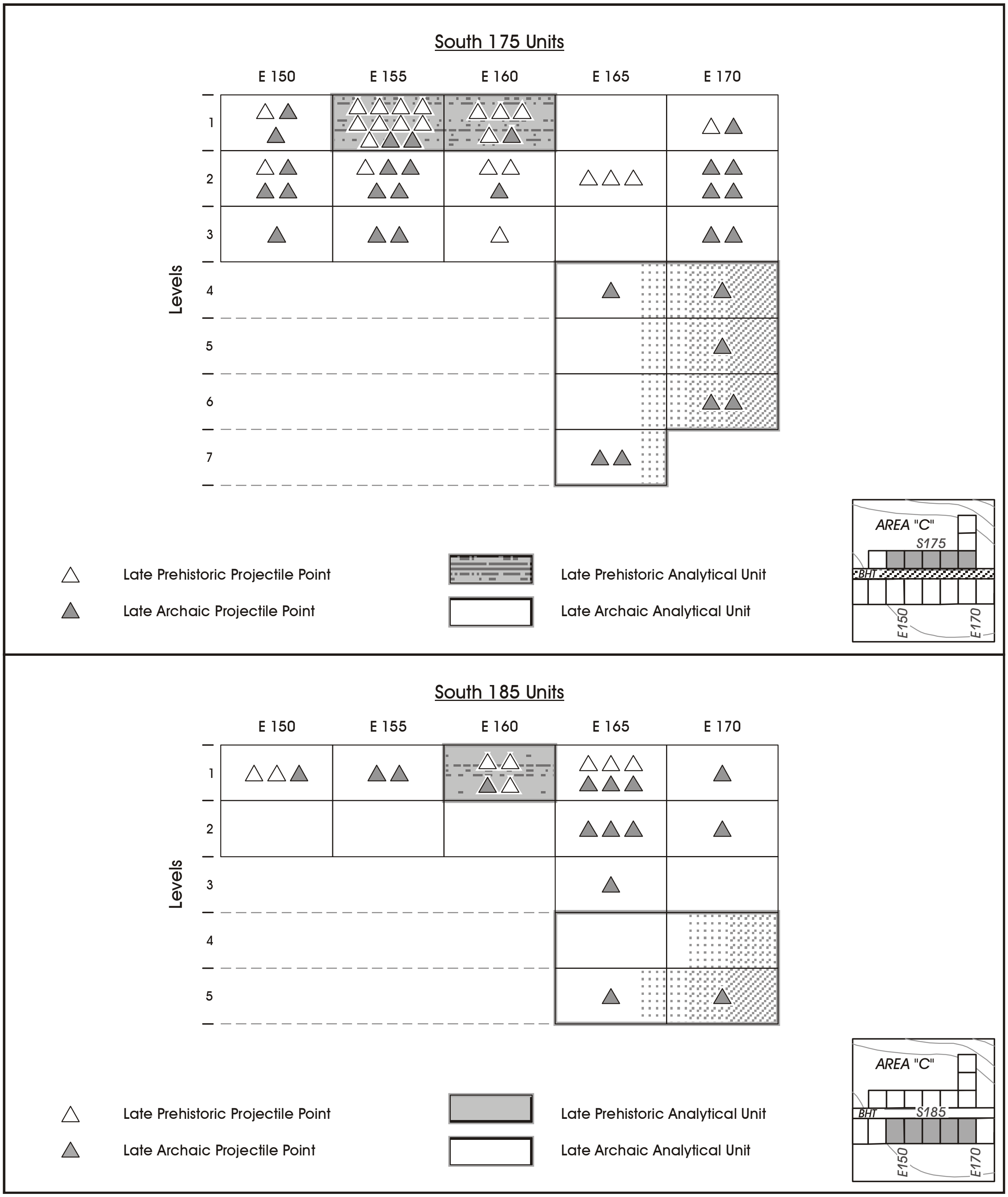

Figure 6-2. *Schematic cross-section of Area C, 41TV163, with diagnostic point types and analytical units identified. Top, South 175 units. Bottom, South 185 units.*

level. Note that one point was recovered from the surface, and is not included in the table. All Late Prehistoric points were recovered from Level 1 in this area, with the lower levels containing only Late Archaic forms (Table 6-4). Given the essentially unmixed nature of these two deeper levels across the units in the area, we can clearly define a Late Archaic analysis unit in the bottom two levels. However, note that only two units were hand-excavated in this area. Other samples from this area were collected from units excavated with a Gradall. As it is likely that these samples represent biased collections when compared both to the hand-excavated units from this area, as well as with other material at this site, we proposed to limit any detailed consideration of the material from these two units. Levels 2 and 3 from excavation unit 1+95/S+0 and unit 2+00/S+00 will, then, form our Late Archaic analytical unit in Area E.

As discussed in the previous chapter, Area E also had extensive modern/historic debris present, including metal and glass fragments down to Level 3 (1.0–1.5 feet). However, a review of the distribution of these items in the two hand-excavated squares shows that this historic/modern material is limited to Level 1. Levels 2 and 3 have no such material recorded. Furthermore, note that a single radiocarbon sample (UGA #12308, Table 5-4 and Appendix C) was collected from this area. The sample, from Level 1,

Table 6-4. Projectile Point Distribution by Unit and Level, Area E

| Unit | Level | Scallorn | Darl | Ensor | Frio | Montell | Castroville | Marshall | Marcos | Lange | Pedernales* | Bulverde | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1+70/N+2.50 | I | | | | | | | | | 2 | | | 2 |
| 1+80/N+2.50 | I | | | | | 2 | | | | | | | 2 |
| 1+90/N+2.50 | I | 1 | | | | 1 | | | | | | | 2 |
| 1+95/N+5.00 | I | 1 | | | | 1 | | | | | 1 | | 3 |
| 1+95/S+0 | I | 5 | | | | | 1 | | | | 1 | | 7 |
| 2+00/N+5.00 | I | | 1 | | | | | | | | | | 1 |
| 2+05/S+0 | I | 1 | | | | | | | | | 1 | | 2 |
| 2+25/S+0 | I | | 1 | | | | | | | | 1 | | 2 |
| 2+10/S+0 | I | | | | 1 | | 1 | | | | | | 2 |
| **Level 1 Total** | | **8** | **2** | **0** | **1** | **4** | **2** | **0** | **0** | **2** | **4** | **0** | **23** |
| 1+80/N+2.50 | II | | | | | 1 | | | | | | | 1 |
| 1+85/N+2.50 | II | | | | | | | | | | 1 | | 1 |
| 1+90/N+2.50 | II | | | | | | | | | | 3 | 1 | 4 |
| 1+95/N+5.00 | II | | 1 | | | | 1 | | | | 3 | | 5 |
| 1+95/S+0 | II | | | | | 1 | | | | 1 | 1 | | 3 |
| 2+00/N+5.00 | II | | | | 1 | | | | | 2 | | | 3 |
| 2+00/S+00 | II | | | | | | | | | | 1 | | 1 |
| 2+05/S+0 | II | | | | | 1 | | 1 | 1 | 1 | 1 | | 5 |
| 2+10/S+0 | II | | | | | | | | | | 1 | | 1 |
| **Level 2 Total** | | **0** | **1** | **0** | **1** | **3** | **1** | **1** | **1** | **4** | **11** | **1** | **24** |
| 1+85/N+2.50 | III | | | | | | | | | | 2 | | 2 |
| 1+95/S+0 | III | | | | | | | | | | 2 | | 2 |
| 2+00/N+5.00 | III | | | | | | | | | | 1 | | 1 |
| 2+05/S+0 | III | | | 1 | | 1 | | | | 1 | | | 3 |
| 2+10/S+0 | III | | | | | 1 | | | | | | | 1 |
| 2+15/S+10 | III | | | | | | 1 | | | | | | 1 |
| 2+20/S+0 | III | | | | | | | | | | | 1 | 1 |
| **Level 3 Total** | | **0** | **0** | **1** | **0** | **2** | **1** | **0** | **0** | **1** | **5** | **1** | **11** |

* One surface find not included.

produced a modern date. This sample was, however, located in 1+70/N+2.50, over 20 feet away from the two hand-excavated units that form our Late Archaic AU.

## Area F

While the sample of diagnostic points from this area is small, Early Archaic points account for six of the seven points recovered from excavations in this area. The six points consist of three Early Split Stem, two Uvalde, and one Martindale. One Andice point, which Collins (1995:376) places at the beginning of the Middle Archaic, is the only point that does not reflect an Early Archaic production date. Area F, then, seems to be predominately Early Archaic. Like Area E, however, only a small portion of this area was excavated by hand. Other samples were collected from units excavated with a Gradall. As these samples are probably biased relative to hand-excavated units, we will define a single Early Archaic analytical unit focused only on the hand-excavated sample. This Early Archaic AU consists of all levels from excavation units 2+70/S+5.50, 2+75/S+5.50, and 2+77.5/S5.50.

## Summary of Analytical Units

Excavations at 41TV163 produced abundant remains. Our review of the projectile point assemblage clearly indicates that the material from the site has been generated over thousands of years. Archaic presence is shown in every area excavated. Early Archaic diagnostics are found in Area F. Middle Archaic occupation of the site is represented in Areas A and B and, to a minimal extent, Area F. The most intensive period of site occupation appears to be during the Late Archaic, with some material from this time period present in most areas of the site. Finally, Late Prehistoric occupation is represented in both Areas C and E. The long period of site use, coupled with the nature of some of that use, clearly has resulted in reduced integrity for portions of the assemblage. In addition, excavation procedures, including the use of arbitrary, six-inch levels and reliance on a Gradall to investigate two areas of the site, have compromised aspects of the collected assemblage. Finally, in the three decades since the work was conducted, documentation of aspects of the excavation has been lost. Despite these problems, we have isolated a series of analytical units that have good temporal integrity. Specifically, we can isolate analytical units representing the Early (Area F), Middle (Area B), and Late Archaic (Areas B, C, and E), as well as the Late Prehistoric (Area C) material at site 41TV163. Radiocarbon dates from the site tend to support these temporal assignments, though samples were not directly available from most of the AUs identified by clusters of points.

Table 6-5 summarizes the available data, by temporal period, for the various analytical units. These data will be used in subsequent chapters to investigate two diachronic research issues. The AUs designated for 41TV163, and which will be used to investigate diachronic changes in both subsistence and lithic technology, are at the period level (e.g., Late Prehistoric). While a review of the history of the period, as well as the phase concepts, is clearly beyond the present chapter, it is the case that these have grown out of a need to have some temporal order to the record at a large scale. While several researchers recognized a clear distinction between what has become known as the Late Prehistoric and the Archaic based, in part, on the presence of ceramics and arrow points (e.g., Kelley 1947, 1959; Wilson 1930), Kelley's (1947, 1959) Edwards Plateau Aspect, which was essentially equivalent with the Archaic, defied attempts at more detailed divisions (see Suhm 1960). Johnson et al. (1962) proposed one of the earliest divisions of the Archaic by suggesting an Early, Middle, Late, and Transitional Archaic distinction (see also Johnson 1964). A variety of finer-scale classifications followed over the next few decades. These were primarily attempts to define more limited spatially and temporally constricted units designed to isolate cultural traditions in a restricted area (see Prewitt 1981, 1985; Sorrow et al. 1967; Weir 1976). As perhaps most explicitly stated in Weir (1976:106–118), these early attempts at division of the record were clearly tied to cultural historical concerns, with different projectile point types, and associated artifacts, being equated with different cultural groups. More recently, several researchers have attempted

Table 6-5. Artifact Types by Analytical Unit for 41TV163

| Type | Early Archaic | Middle Archaic | Late Archaic | Late Prehistoric | Totals |
|---|---|---|---|---|---|
| Faunal Remains | n/a | 7 | 252 | 577 | 836 |
| Debitage | 225 | 1975 | 3696 | 2751 | 8647 |
| Cores | 3 | 9 | 13 | 13 | 38 |
| Bifaces | 20 | 39 | 72 | 67 | 198 |
| Other Tools | 8 | 21 | 33 | 18 | 80 |

to more explicitly link archeological periods with alterations in climate. For example, Johnson and Goode (1994) have divided the central Texas record into six broad periods or "eras," including four in the Archaic, that are linked, to some degree, to changes in Holocene climate (see also Collins 1995).

## Investigating Subsistence Change

These recent schemes have the potential to more clearly focus research into hunter-gatherer subsistence. Many of these climatic changes, such as the potential alterations between woodland/shrub and grasslands outlined in Chapter 2, directly impact the resource base available to hunters and gatherers. For example, there is ample evidence (see Collins 1995; Dillehay 1974; Johnson and Goode 1994) that the abundance of large grazers, such as bison, fluctuated dramatically through time. This fluctuating resource base should have implications both for subsistence, as well as aspects of lithic technology directly involved with subsistence acquisition.

As these large, potentially high-return animals moved in and out of the diets of hunter-gatherers, it is probable that the use of other, potentially lower-return plants and animals, also fluctuated in complex ways. For example, there is evidence that during much of the Late Archaic, bison were available in central Texas. Conversely, during the early part of the Late Prehistoric, the period apparently covered by our Late Prehistoric AU, bison were not in the region (see Collins 1995). Given the high return rates on bison, we would expect that when encountered, they would be pursued. During bison absence, conversely, we would expect that a wider variety of species would enter the diet. We might expect, for example, hunters to shift toward deer as a replacement for bison, as well as the use of smaller animals and increased dependence on plants. Overlain on these long-term changes in resource structure are short-term changes, including yearly and seasonal changes in resource availability and quality, that will further complicate patterns at many sites. We also expect spatial variability in resource structure as a function of differential climatic regimes. These yearly or seasonal fluctuations, as well as spatial variability in resources, clearly mean that subsistence during any one period will certainly vary between sites. For example, Late Archaic sites will not necessarily have bison present, but many probably will, and the presence of these high-return resources should result in a reduction in diet breadth relative to the early Late Prehistoric.

Investigating the subsistence resources at a period level, then, involves both the recognition that long-term changes in resources impact overall subsistence, such as obvious examples like the presence or absence of bison in a region, as well as the recognition that short-term variation at a variety of smaller spatial and temporal scales will produce variability in subsistence remains. The site of 41TV163 was occupied, as some level, throughout much of the prehistoric sequence, with the earliest point types suggesting that occupation may have begun roughly 8,000 years ago. The occupation length assures that the inhabitants of the site were involved with dramatically different subsistence regimes through time. The site, then, potentially provides the opportunity to document the long-term changes in subsistence while holding the site location constant. That is, in these situations it can be assumed that whatever differences are seen in subsistence when comparing material from distinct analytical units is likely due to different adaptive strategies rather than simply changes in site location. While short-term fluctuations can certainly complicate any direct interpretation, we can hold spatial variability relatively constant.

We previously proposed that two data sets, faunal material and ethnobotanical remains, could be used in such an investigation of subsistence (Mahoney et al. 2003a). Unfortunately, reference to Table 6-5 will demonstrate that for the Early and Middle Archaic AUs we lack several sets of critical subsistence data. There are, for example, no faunal remains from the Early Archaic, and the Middle Archaic sample size is extremely small. In addition, only eight flotation samples and a single macrobotanical sample exist from the site. As presented in Appendix D, these produced only a single burned item, a geophyte. While the recovery of this bulb, which is probably associated with the burned rock midden in Area A, expands the number of sites at which this apparently important resource has been documented, the low frequency of recovery renders this data class virtually useless for comparative purposes.

We are left, then, with faunal material from both the Late Archaic and Late Prehistoric analytical units. Recall that bison were present in central Texas during much of the Late Archaic, and absent during the early portion of the Late Prehistoric period (see Collins 1995). We would expect these two AUs to have different faunal sets represented, with a wider diversity of species and smaller body sized species present in the Late Prehistoric relative to the Late Archaic. We also expect that the Late Prehistoric material might evidence higher rates of bone processing relative to the Late Archaic assemblage. In Chapter 5, we noted that our initial inspection of the fauna from 41TV163 indicated that butchering and impact marks, probably derived from bone breakage, were common in the sample, especially on the shafts of long bones of deer-sized animals. Many of the deer-sized remains are splinters of long bone diaphyses, with the bone broken while it was fresh. This splintering suggests intensive processing of the long bones of deer-sized mammals. Our initial impressions of the faunal assemblage as a whole, then, suggests that some level of subsistence stress may be indicated. We suggest that the level of stress is likely to be more acute during the Late Prehistoric.

Our analysis of the Late Archaic and Late Prehistoric faunal assemblages from the selected analytical units, presented in Chapter 7, was designed to gather information on the species represented as well as on processing methods. Unfortunately, the highly fragmented assemblages from the site are not easily classified to the species level. Nevertheless, we focus on a series of faunal attributes that are designed, to the degree possible, to illicit information on the range of animals used and information on processing methods. Specifically, we focus on the identification of each faunal element to the most detailed taxonomic unit possible. While we can, on occasion, identify a specific order (e.g., Artiodactyla) or genus (e.g., *Odocoileus*), often we are only able to place remains into groups based on animal body size (e.g., bison-sized, deer-sized, rabbit-sized). Nevertheless, these body size groups permit the identification of the most likely animals represented in the faunal collections from the two time periods. Second, we consider several variables designed to monitor, in part, processing of animals as well as discard and post-depositional damage to faunal material. These include traditional measures such as butchering marks and burning. We also monitored the frequency and potential causes of bone breakage. The examination of bone breakage was specifically concerned with identifying butchering or consumption activities, as well as monitoring the damage unrelated to dietary bone modification. We recorded if a given bone was likely broken while fresh or after it was dry. We also recorded obvious excavator breaks. In conjunction with the bone breakage assignment, we also recorded the maximum bone length and the weight of each fragment. Size was compared with other observations of bone damage as an additional measure of the degree of processing.

Finally, as a complementary aspect to the site-specific subsistence patterns analysis, we compare the information gleaned from the 41TV163 analytical units to 18 components from 13 other Texas sites containing Late Archaic and Late Prehistoric faunal remains.

## Changes in Lithic Technology

Since we perceive the technological aspects of a cultural system to be directly involved in cultural adaptation, we expect that any changes in the land-use strategies and subsistence practices of a group will be reflected in the technological organization of the group. By technological organization we mean the combination of how peoples organize, in space and time, activities associated with the manufacture, repair and replacement of tools and weapons, and how the design of tools and weapons is conditioned by such factors as tool function, raw material availability, and reliability and maintainability considerations. In Chapter 8 we investigate three specific aspects of lithic technology using the analysis units defined earlier in this chapter. These topics are (1) changes in raw material procurement and reduction strategies; (2) changes in tool assemblage composition; and (3) changes in projectile point technology. The importance of these research issues as well as the data types employed to answer them are developed below.

The significant paleoenvironmental chances outlined in Chapter 2 clearly resulted in changes in the resources available for exploitation by hunters and gatherers. We expect that these changes should be reflected not only in subsistence data, but also in some aspect of the technological organization of the hunter-gatherers that visited 41TV163. It is probable that during the lengthy use of this location, aspects of the surrounding landscape such as raw material quality, abundance, and distribution remained relatively constant. If our assumption that these aspects of the lithic resource base remained constant is correct, then any changes in technological organization through time should be related to other conditioning factors such as changes in prey species and their distribution or changes in the organization of procurement strategies. Reference to Table 6-5 will suggest that unlike the faunal data, a relatively large assemblage of chipped stone material, including adequate samples from all AUs, are present. The period-level AUs from 41TV163 are potentially well suited for the investigation of the three topics noted previously.

To investigate raw material procurement practices through time, we focused on categorizing the cherts into color and texture groupings. The color/texture categories were defined based on the debitage since this data type is likely to contain examples of all raw materials brought onto and reduced at the site. Twenty-five different categories of chert were defined. Lacking details on the distribution of these raw materials in the natural environment, we rely primarily on a theoretical argument to examine this variable. The comparative sample of chert categories was used to classify all chipped lithics from the analytical units. The comparison of the color texture categories within the tools and the debitage provides a good indication of which categories are present in what chipped lithic artifact group. We suggest that color-texture categories represented only by formal tools (i.e., projectile points) or small numbers of only decorticate debitage are likely to be non-local in origin. Conversely, color-texture categories represented in both the tools and the debitage are likely to be of local origin as long as the debitage contains moderate to high proportions of corticated specimens.

Lithic reduction strategies may also vary in response to changes in organizational aspects of technology including raw material distribution and the need for retooling. For instance, it has been suggested that raw material availability will influence raw material reduction strategies (Andrefsky 1994a, 1994b; Parry and Kelly 1987). In addition, the bulk procurement and processing of seasonally available resources should favor the manufacture of formal tools preceding the actual need of these tools (see Hayden and Gargett 1988; Tomka 2001). With this in mind, we proposed to define the reduction strategies represented in the defined analytical units by establishing the stages of reduction represented in each chert color-texture category to relate reduction processes to raw material procurement strategies (see Mahoney et al. 2003b). To accomplish this aspect of the analysis, we recorded two attributes—cortex and size—on each piece of debitage. Estimates of dorsal cortex on debitage were made and grouped for analysis into four categories: (1) no cortex; (2) 1-50% cortex; (3) 51-99% cortex; and (4) 100% cortex. Size of debitage was measured by maximum dimension with a digital caliper. Patterns in cortex categories within small and large debitage classes within each color-texture category should be a good indicator of whether the debitage derives from the reduction of decorticate-stage reduced raw materials (i.e., artifacts) or from the reduction of locally available unprepared resources (see Tomka and Fields 1990). We expected that some variability in reduction strategies should be apparent given the reduction of a mix of what we think are local and non-local raw materials. Unfortunately, we lack any independent measure of the local and non-local tool stone.

As part of the investigation of lithic reduction strategies, we also studied the cores present in the five analytical units and quantified both the type of reduction they represent (i.e., unidirectional, multi-directional, bifacial) and their degree of reduction. While the type of reduction is easily monitored on a given core by investigating the flaking patterns, the degree of reduction is more difficult to quantify. We monitored the number of flake scars, the maximum size (mm), the weight (grams), and the presence/absence of cortex in order to provide some quantifiable measure of the degree of core reduction.

One of the more promising aspects of the lithic assemblages from the analytical units is the large number of chipped stone tools. Both expediently made tools (i.e., use-modified flakes) as well as formal tools (i.e., bifacial knives, unifacial scrapers) are present. Parry and Kelly (1987) have proposed that whether tools are expediently made or represent the products of extensive labor input is conditioned by degree of mobility. Conversely, Hayden and Gargett (1988) and Tomka (2001) have suggested that the design of tools is influenced more directly by expected processing requirements. The observation that the exploited resource base shifted between the Early Archaic and the Late Prehistoric, and in particular that bison may have been a significant resource during the Late Archaic, suggests that differences in resource procurement existed during the use of the site. At the same time, the mobility of the hunter-gatherer groups should have remained relatively high while the raw material landscape in the vicinity of the site should have remained constant. Given these aspects of land use, subsistence, and material availability, we investigate whether the tool assemblages from the five AUs reflect changes in the proportion of formal and expediently manufactured tools over time. We would expect a higher proportion of formal tools during the Late Archaic than the Early and Middle Archaic. Formal tool use may also have been dominant during the Late Prehistoric period if bison hunting was replaced by the intensive hunting of deer. However, if subsistence emphasis shifted to the procurement of plant resources, the frequencies of formal tools related to hunting and game processing should have decreased.

To investigate these suggestions, we first scanned all debitage from the analytical units and removed all use-modified tools. All chipped lithic tools were categorized into formal and expedient functional varieties (i.e., formal knife, expedient knife, etc.). All tools that represent the product of extensive chipping to achieve either a desired shape for hafting or a specific working edge shape were categorized as formal tools. All tools that exhibit little flaking to achieve a working edge have been classified as minimally retouched. All tools that represent flakes modified simply by use (i.e., no retouch) were categorized as expedient. Ratios of these three categories were then used to investigate changes through time.

Projectile point technology, including the design characteristics of a specimen and the refurbishing strategies followed by the users of the weapon systems, are critical aspects of technological organization since they are responsive to overall conditioning factors such as prey type, subsistence strategies, and raw material availability. The large sample of projectile points offers an excellent opportunity to investigate aspects of projectile technology, and specifically the reasons for projectile point discard, and the strategies of projectile point refurbishing. Given that points frequently can be classified into periods regardless of the context of recovery, all typed points are used in this analysis.

In order to investigate the manufacture, use, rejuvenation, and discard of projectile points, a systematic classification of projectile point types into categories of discard (i.e., use breakage, manufacture failure, postdepositional breakage) and the measurement of the remnant blade length and remnant blade width were made. The use of these attributes, in combination, can suggest the different causes of discard and remnant use-lives still present on discarded projectile points.

## Synchronic Research Issues: Investigating Feature 3

The final area of investigation that we conducted with the 41TV163 data is more synchronic in nature. This analysis, discussed in Chapter 9, concerns the investigation of the possible Late Prehistoric structure at Millican Bench. As noted in the previous chapter, excavations in Area C at 41TV163 produced evidence, associated with Levels 1 and 2, of a possible ephemeral structure, Feature 3. Though bisected by a backhoe trench, the possible structure is primarily confined to four excavation units. If Feature 3 does represent a structure, the character of the Late Prehistoric period at this site is clearly distinct from the preceding occupations. The archeological evidence for prehistoric structures among central Texas hunter-gatherer groups is limited. Ethnohistoric data from Texas document that ephemeral structures, essentially consisting of pole frameworks covered with matting and hides, were built by native inhabitants in the central part of the state (Campbell 1983; Foster 1998). Feature 3 possibly represents such a structure. As outlined in Chapter 9, we used a combination of ethnohistoric and ethnographic sources to explore what either documented or suspected structures would look like. This exploration included investigating the conditions of structure use. We also conducted a comparative study of sites in central Texas with known or suspected structures reported in the archeological record. We used these sources to define possible direct and indirect archeological evidence of structures among hunter-gatherers. Finally, we looked at the archeological evidence from 41TV163 in order to clarify the nature of this feature. While critical data are lacking to definitively classify the feature as a structure, we focused on both distributional data and artifact size in the immediate area of the feature to investigate the likelihood that the feature represented a maintained space.

# Chapter 7: Late Prehistoric and Late Archaic Subsistence Practices A Comparative Analysis

**Steve A. Tomka, Raymond P. Mauldin, and Russell D. Greaves**

In the original research design that accompanied the assessment of the Millican Bench archeological collection (Mahoney et al. 2003a), we proposed to compare bone assemblages from Middle and Late Archaic contexts with a Late Prehistoric assemblage to identify trends in subsistence strategies, seasonality, butchering and processing trajectories through time. We proposed to study two specific aspects of the faunal collections: (1) the identification of taxa and broad body size of the animals harvested; and (2) butchering practices, as they were manifested in bone breakage patterns. We also proposed to investigate the use of plants as exemplified within macrobotanical samples derived from distinct analytical units within the site. Unfortunately, flotation of soil samples from the site returned minimal results (see Appendix D). Consequently, in this chapter we focus primarily on faunal material. We demonstrate that within 41TV163 there are differences in subsistence between the Late Archaic and Late Prehistoric analytical units. We then consider faunal material from a variety of other sites throughout the state in order to explore spatial and temporal variability in subsistence at different scales.

## Fluctuating Climates, Resources and Subsistence Strategies

Based on the paleoenvironmental reconstructions for Texas, it is clear that climatic conditions fluctuated in broad terms between cool and moist and warm and dry environments during the past 12,000 years (Bousman 1998; Johnson and Goode 1994). These climatic fluctuations, some of which were explored in Chapter 2, are likely to have affected the types and structure of the resources across the state both in terms of primary as well as secondary biomass. One of the major impacts of these fluctuations in terms of resources available to hunters and gatherers is likely to have been the fluctuations in bison population. Although there is some disagreement regarding what climatic conditions drove bison oscillations in Texas, it is clear that bison densities fluctuated through time in Texas (see Bousman 1998; Collins 1995; Dillehay 1974; Huebner 1991; Johnson and Goode 1994). Dillehay's (1974) research identifies clear periods of bison presence and absence in the state. Collins (1995:Table 2) revised Dillehay's scheme. Collins suggests the following:

Presence Period I: 10,000 B.C. to 7000 B.C.

Absence Period I: 7000 B.C. to 4000 B.C.

Presence Period II: 4000 B.C. to 3000 B.C.

Absence Period II: 3000 B.C. to 2000 B.C. with a gradual increase until 1000 B.C.

Presence Period III: 2000 B.C. to A.D. 800

Absence Period III: A.D. 800 to A.D. 1300

Presence Period IV: A.D. 1300 to A.D. 1650

The first presence period occurs during the Paleoindian period, while the second occurs during the first half of the Middle Archaic period. The third presence period spans the Late Archaic period, while the fourth begins during the Late Prehistoric Toyah Phase and extends into the Historic period.

The degree of involvement and the strategies used to hunt bison would depend on whether bison migrations brought varying densities of these animals into the vicinity of hunter-gatherer territories. The distribution of bison is conditioned by the availability and distribution of favorable grass species and water. According to Johnson (1951), in the Great Plains bison are adapted to a shortgrass environment. A number of authors indicate that bison prefer C4 grasses in all seasons, except in the spring when C4 grasses are not actively growing (Peden et al. 1974; Schwartz and Ellis 1981). Shortgrass species, well adapted to arid and semi-arid settings, tend to consist of C4 grasses. Currently in Texas, approximately 68% of the grass species have C4 pathways of photosynthesis (Terri and Stowe 1976). In such shortgrass prairies, roughly 80% of the diet of bison consists of C4 grasses. Species of shortgrasses are common on the mixed prairies of the Edwards Plateau, the Rolling Plains, and the subtropical savannas of South Texas. The Blackland and the Coastal Prairies are tallgrass prairies consisting of a mix of shortgrass and tallgrass species dominated by the latter. At least in terms of grass species, much of the state, with the possible exception of the oak woodlands of East Texas, may have provided abundant food resources for bison.

Water is another critical resource among ruminants. As bison have to drink on a daily basis, water availability is a key limiting factor in the distribution of bison populations. A large portion of south Texas between the Nueces River and the Rio Grande currently has few perennial streams. Although it is likely that in prehistoric times water tables were higher, it is not expected that this would have substantially increased the number of perennial streams in the region. While bison may have moved into these areas on a limited or seasonal basis, the scarcity of predictable perennial water in south Texas would have been a significant hindrance to the migration, and by extension, the exploitation of bison. Based on the distribution of shortgrass species and water within the state, then, it is possible that when bison herds were in Texas, they would have been present throughout much of the state, with the possible exception of the east Texas Post Oak Woodlands and a portion of south Texas between the Rio Grande and the Nueces River drainages. This pattern seems to be reflected in the distribution of bison in the state between 1830 and 1860, noted by Weniger (1997:Map 1).

While these general expectations are of some use, they do not provide a framework for considering specific ways in which changes in the presence, absence, and density of bison may have influenced subsistence strategies. Several specific suggestions can be made regarding the potential impact of bison population distributions across the state and changes in bison population densities through time. Following theoretical expectations derived from Optimal Foraging Theory, we suggest that the presence or absence of bison within the state would have significantly affected subsistence strategies. It is also likely that even when bison populations were present, seasonal or spatial fluctuations in their densities within a region would have impacted the subsistence and land-use strategies employed by hunter-gatherers exploiting the resources of that region.

As a result of their larger body size, we suggest that when bison were encountered, they would have been pursued. Specifically, we propose that:

1) Extended periods of bison availability would narrow diet breadth, measured in terms of number of species used, among central Texas hunter-gatherers;

2) The diet breadth of south and east Texas hunter gatherers may have remained relatively broad even during periods of bison presence because low bison population densities would result in low encounter rates;

3) Seasonal fluctuations in bison population densities lead to seasonal changes in diet breadth among central Texas hunter-gatherers;

4) Seasonal availability of bison, if documented, may have promoted the extensive processing of skeletal remains as a form of seasonal storage of excess nutrients and to reduce subsistence stress; such processing may be reflected in the form of bone grease rendering and predominance of small (<3 cm) bone fragments within the assemblage; This need for extensive processing may have been lessened in areas with year-round availability of deer and antelope; and

5) Absence of bison within the state would result in increased reliance on the next highest ranked prey, which is probably deer/antelope-sized animals, and a widening of the diet breadth with the inclusion of lower ranked species.

To address these research issues, we begin with the bone assemblage and macrobotanical samples from the Late Prehistoric Austin Phase and the Late Archaic analytical units from 41TV163 (see Chapter 6). Because plant remains are less likely to preserve in archeological deposits and macrobotanical sampling has become a standard archeological practice only relatively recently, the discussion will focus primarily on patterns identified in faunal assemblages.

At some point after the completion of the field work and prior to the arrival of the materials at CAR, Billy Davidson of TxDOT compiled a list of the numbers and types of skeletal elements by species identified in the Millican Bench collection. This list is curated with the site documentation. To ensure analytical consistency, the faunal collection that could be attributed to specific analytical units was re-analyzed by CAR personnel.

## The Faunal Assemblage from 41TV163

Table 7-1 presents the breakdown of the Millican Bench faunal material by class and analytical unit. The largest sample derives from the Late Prehistoric AU, and sample sizes decrease with increasing assemblage age. This pattern may be the result of differential preservation. The breakdown of the sample by class indicates that deer-sized specimens constitute the highest proportion of both the Late Prehistoric

Table 7-1. Breakdown of Faunal Assemblage by Class and Analytical Unit

| Class | Late Prehistoric (Austin Phase) | Late Archaic | Middle Archaic | Grand Total |
|---|---|---|---|---|
| Artiodactyl | 26 | 6 | | 32 |
| Avian | 20 | 9 | 1 | 30 |
| Canid | | 1 | | 1 |
| Beaver | 1 | | | 1 |
| Deer | 11 | 5 | | 16 |
| Rabbit-sized | 4 | 1 | | 5 |
| Rodent-sized | 5 | | | 5 |
| Cottontail Rabbit | 7 | | | 7 |
| Turtle | 2 | | | 2 |
| Deer-sized | 187 | 111 | 1 | 299 |
| Bison-sized | | 8 | | 8 |
| Dog-sized | 4 | 2 | 1 | 7 |
| Unidentified frags. | 310 | 109 | 4 | 423 |
| **Grand Total** | **577** | **252** | **7** | **836** |

(34%) and Late Archaic (46%) assemblages. The higher proportion of deer in the Late Archaic sample may be the indirect result of the differential preservation of skeletal elements from deer compared to smaller body sized species in this older period. Both rabbit-sized animals and birds appear to have played a role in the diet of the Late Prehistoric inhabitants of the site. Birds are also present in the Late Archaic sample but an added aspect of this collection is the presence of bison-sized bones. Eight long bone pieces were identified as having the cortical bone thickness characteristic of bison. These specimens come from Area E, where one of the more common projectile points recovered was the Pedernales type. While we lack information on the number of individual animals represented, deer and deer-sized bones constitute 74% of all bone identified to class (n=267) within the Late Prehistoric collection. Eighty-one percent of the identifiable bone (n=143) from the Late Archaic assemblage consists of deer-sized specimens. Overall, eight classes of animals are present in the Late Prehistoric Austin Phase assemblage while only five are present in the Late Archaic assemblage.

Considering deer-sized elements, only 14 (2.4%) of the Late Prehistoric specimens exhibited butchering marks, a level equal to the five (2%) Late Archaic pieces that retain such indicators. Cut marks are present on two Late Prehistoric items and one Late Archaic specimen. Four Late Prehistoric pieces have cut marks derived from chopping while eight others have impact scars. Two Late Archaic bone fragments have chopping scars and two others have been fragmented through impact. Although butchering marks are uncommon in the two samples, it is likely that bone grease rendering or bone marrow extraction may have been responsible for the small mean size of the 41TV163 bone samples.

The breakdown of the deer-sized skeletal elements by analytical unit (Table 7-2) indicates that long bone fragments are the most common in both samples. This pattern may also be the result of differential preservation given that such cortical bones are significantly denser than cancellous fragments. While a similar pattern may be obtained from off-site butchering and the transport of high meat utility elements to the site, such a pattern would be likely to introduce complete long bones into the assemblage and would also yield cancellous fragments. Unfortunately, the cancellous bone fragments that would need to be present to investigate this procurement strategy are the ones that would be removed by rapid degradation.

To investigate our suggestion that during periods of bison absence, inhabitants of central Texas may have experienced periods of dietary stress, we recorded the maximum dimension and weight of each bone recovered from the Late Prehistoric and Late Archaic analytical units. We also recorded breakage patterns on the remains. Bone breakage was classified into one of four types. There were (1) breakage while the bone was fresh, (2) dry breaks, (3) recent breaks, and (4) indeterminate breaks. Note also that a small number of bones were not fractured. Breakage on fresh bone probably indicates processing for either marrow or bone grease. Dry breaks, occurring well after the bone has lost grease, reflect postdepositional damage. Excavators

Table 7-2. Breakdown of Deer-sized Elements by Analytical Unit

| Element | Late Prehistoric (Austin Phase) | Late Archaic | Middle Archaic | Grand Total |
|---|---|---|---|---|
| astragalus | 2 | | | 2 |
| atlas | 1 | | | 1 |
| caudal vertebra | 1 | 1 | | 2 |
| unid. cancellous bone | 2 | 1 | | 3 |
| cranium | 1 | | | 1 |
| unid. flat bone | 7 | 4 | | 11 |
| unid. long bone | 146 | 103 | 1 | 250 |
| mandible | 1 | 1 | | 2 |
| metatarsal | 1 | 2 | | 3 |
| maxilla | 1 | | | 1 |
| 1st phalanx | 1 | | | 1 |
| 3rd phalanx | 1 | | | 1 |
| rib | 1 | | | 1 |
| radius | | 1 | | 1 |
| scapula | 1 | | | 1 |
| fused tarsals | 1 | | | 1 |
| unspec. segment | 30 | 3 | | 33 |
| **Grand Total** | **198** | **116** | **1** | **315** |

Table 7-3. Late Prehistoric and Late Archaic Fresh-broken Deer Bone Size*

| Statistics | Late Prehistoric | Late Archaic |
|---|---|---|
| Mean | 32.45 | 28.97 |
| Median | 30 | 25 |
| Mode | 21 | 21 |
| Standard Deviation | 12.84 | 14.15 |
| Range | 72 | 56 |
| Minimum | 14 | 16 |
| Maximum | 86 | 72 |
| Count | 78 | 29 |

* Includes specimens identified as deer-sized and deer.

probably caused recent breaks. Note that more than one type of breakage is sometimes present on a given specimen. To ensure that we were gauging prehistoric behavior rather than postdepositional factors and/or excavator induced size reduction, we first sought to define patterns only among specimens broken during butchering and food processing.

Table 7-3 presents descriptive statistics for fresh-broken deer-sized bones recovered from the Late Prehistoric and Late Archaic analytical units. A review of the data will show that Late Prehistoric deer bone fragments are on the average slightly larger (mean=32.4 mm) than their Late Archaic counterparts (mean=28.9 mm). This pattern is also reflected in the mean weight of the bone fragments with Late Prehistoric specimens being slightly heavier (mean=1.5 g) than the Late Archaic pieces (mean=1.3 g). The mean size of all deer-sized bones within the two collections is very similar (LP mean=27.5 mm; LA mean=26.9 mm) regardless of break cause. Both the length and the weight are similar, suggesting that in the case of deer-sized fragments, there is no significant difference between the degree of bone processing as indicated by size.

Table 7-4. Bone Breakage by Analytical Unit

| **Break Type** | | **Late Archaic** | **Late Prehistoric** | **Total** |
|---|---|---|---|---|
| Recent or not broken | Count | 18 | 16 | 34 |
| | Adjusted Residual | 2.92 | -2.92 | |
| | | | | |
| Fresh Break Present | Count | 71 | 205 | 276 |
| | Adjusted Residual | -2.07 | 2.07 | |
| | | | | |
| Indeterminate | Count | 38 | 118 | 156 |
| | Adjusted Residual | -1.82 | 1.82 | |
| | | | | |
| Dry break | Count | 125 | 238 | 363 |
| | Adjusted Residual | 2.23 | -2.23 | |
| | | | | |
| Total | | 252 | 577 | 829 |

Table 7-4 presents a comparison of the frequency of break types for the two AUs using all available specimens. Note that we have combined the small number of recent and not broken specimens in the table. Below each count we present standardized adjusted residuals for the cell. As discussed by several authors (see Everitt 1977; Haberman 1973), standardized adjusted residuals provide information on the contribution of the individual cell to the overall chi-square total. Standardized adjusted residuals are analogous to Z scores such that an adjusted residual score exceeding an absolute value of 1.96 suggests that the cell difference is significant at a probability beyond the level of .05. Within Table 7-4, there are several significant cells. Of specific note is that fresh breaks are significantly over-represented in the Late Prehistoric cell relative to the Late Archaic. The increased frequency of bone breakage in the Late Prehistoric is consistent with our expectations that higher frequencies of processing should be occurring in assemblages during this period were bison are absent. Finally, note that indeterminate breaks are also over-represented in the Late Prehistoric. While not significant at the .05 level, the standardized adjusted residual value of 1.82 has a probability of .069. These are extremely small fragments as is evidenced by the mean weight of only 0.36 grams. It is possible that these specimens are the result of processing to a point where identification is no longer possible. The observation that they are also more frequent in the Late Prehistoric is consistent with greater degrees of processing of faunal material during this period.

## Regional Comparisons

To define broad trends in subsistence practices and investigate the suggestions presented earlier, we compiled comparable data on 18 archeological components from 14 archeological sites (Table 7-5). The Toyah Phase is represented by six components, while the Austin Phase by two components, and the Late Archaic by nine components. Finally, while the 41TV163 Middle Archaic sample is very small and not discussed, we included a faunal assemblage representative of this period as a point of reference. Seven of the sites are from central Texas and three are from the southern edge of central Texas (Table 7-6). The remaining four sites are peripheral to the region, with one each from west-central Texas, east-central Texas, south Texas, and the Panhandle. The locations of the 14 sites are shown in Figure 7-1. The raw data, including the number of skeletal elements within each genus by site, is provided in Appendix A (Table A-1).

Before engaging in this comparative analysis, several cautionary notes are warranted. Differences in bone density will significantly impact not only the representation of different species within an assemblage but will also influence the survivability of different elements within the skeletal remains of a single species. In general, the bones of smaller-sized animals are less dense than larger animals. Similarly, the ribs and vertebrae are less dense than humeri mid-shaft bone within a single skeleton. Therefore, it is likely that differential preservation will tend to decrease the number

Table 7-5. The Ages of Archeological Components with Bone Assemblages Used for Regional Comparison

| | **Time Periods** | | | |
|---|---|---|---|---|
| **Sites** | **Toyah** | **Austin** | **Late Archaic** | **Middle Archaic** |
| 41TV163 | | 1 | 1 | |
| 41WM230 | | | 1 | |
| 41WM267 | | | 1 | |
| 41WM56 | | | 1 | |
| 41HY209-T | 1 | 1 | 1 | |
| 41HY209-M | 1 | | | |
| 41HY202-A | 1 | | 1 | |
| 41MM340 | | | 1 | |
| 41TG346 | 1 | | | |
| 41HF128 | | | 1 | |
| 41BX228 | | | 1 | |
| 41LK28 | | | | 1 |
| 41LK201 | 1 | | | |
| 41JW8 | 1 | | | |
| Total | 6 | 2 | 9 | 1 |

Table 7-6. Archeological Sites with Bone Assemblages Used for Regional Comparison

| | **Geographic Region** | | | | | |
|---|---|---|---|---|---|---|
| **Sites** | **Central Texas** | **West-central Texas** | **East-central Texas** | **South-central Texas** | **South Texas** | **Panhandle** |
| 41TV163 | 1 | | | | | |
| 41WM230 | 1 | | | | | |
| 41WM267 | 1 | | | | | |
| 41WM56 | 1 | | | | | |
| 41HY209-T | 1 | | | | | |
| 41HY209-M | 1 | | | | | |
| 41HY202-A | 1 | | | | | |
| 41MM340 | | | 1 | | | |
| 41TG346 | | 1 | | | | |
| 41HF128 | | | | | | 1 |
| 41BX228 | | | | 1 | | |
| 41LK28 | | | | 1 | | |
| 41LK201 | | | | 1 | | |
| 41JW8 | | | | | 1 | |
| Total | 7 | 1 | 1 | 3 | 1 | 1 |

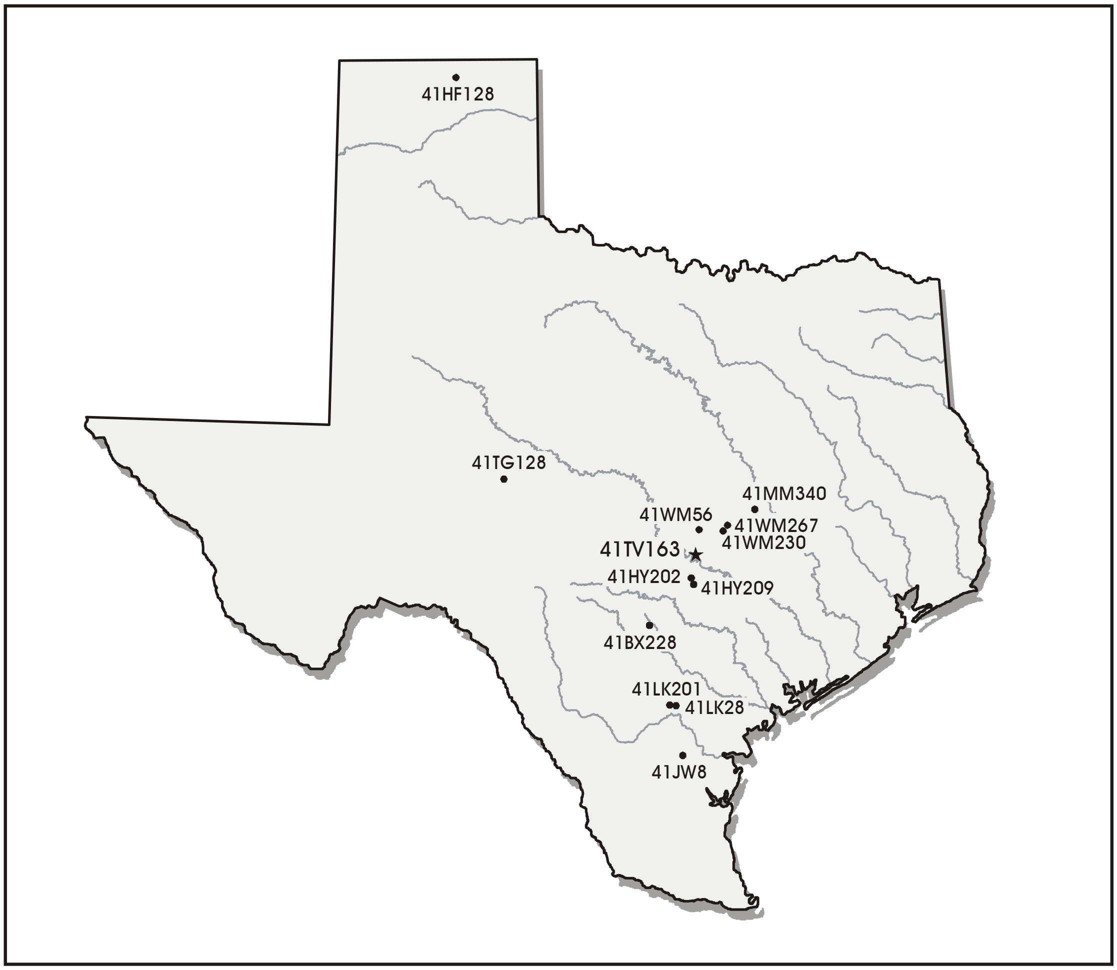

Figure 7-1. *Location of archeological sites mentioned in the comparative faunal analysis discussion.*

of softer bones within the same skeleton and/or species with less dense bone. Different climatic and soil conditions will also impact the survival of faunal elements as will the age of the assemblage. Finally, we lack data on the number of individual animals represented by the faunal material for most cases. Note also that faunal sample sizes vary dramatically between assemblages ranging from a high of 24,448 bones in the case of the Middle Archaic 41LK28 sample to a low of 149 in the case of the Toyah Phase materials from 41HY202-A (Table 7-7). The variable sample sizes further complicate the interpretations, as we would expect that larger sample sizes would contain more species simply as a function of their larger size. The relationship between number of faunal remains and number of genera is further complicated by differences in the body size of the animals represented. As many of the assemblages are highly fragmented, those assemblages with bison present will tend to have increased numbers of items as a function of the significant body size of the animal. Given the variable nature of the data, as well as the potential for differential impacts on faunal elements, and the different contributions of animals of various body sizes to the overall number of bone present, we are forced to essentially use presence/absence data of genera as a measure of diet breadth.

As shown in Table 7-7, the average number of genera for the six Toyah Phase components, a period of bison presence, is 19, though a wide range of from 5 to 36 genera is present during this time period. The two Austin Phase components, representing a period when bison is absent or at very low densities, average 12 genera. The nine Late Archaic components, a period where bison is again present, have a mean of 17 genera, but a wide range is again present with a low of only 2 and a high of 34. The single Middle Archaic

Table 7-7. Number of Genera Identified by Component within the Comparative Faunal Assemblage

| Age of Component | Site/Component | Sample size | # of Genera |
|---|---|---|---|
| Toyah | 41TG346 | 11197 | 7 |
| Toyah | 41HY209-T | 14234 | 24 |
| Toyah | 41HY209-M | 4334 | 12 |
| Toyah | 41HY202-A | 149 | 5 |
| Toyah | 41JW8 | 3041 | 29 |
| Toyah | 41LK201 | 9650 | 36 |
| Austin | 41HY209-T | 265 | 16 |
| Austin | 41TV163 | 577 | 8 |
| Late Archaic | 41TV163 | 252 | 5 |
| Late Archaic | 41HY209-T | 468 | 13 |
| Late Archaic | 41HF128 | 20295 | 4 |
| Late Archaic | 41MM340 | 3378 | 22 |
| Late Archaic | 41HY202-A | 315 | 2 |
| Late Archaic | 41WM230 | 1852 | 34 |
| Late Archaic | 41WM267 | 1625 | 32 |
| Late Archaic | 41WM56 | 463 | 19 |
| Late Archaic | 41BX228 | 19,795 | 21 |
| Middle Archaic | 41LK28 | 24448 | 19 |

sample, created during a period when bison may have been present, has 19 genera represented. While the number of components in our comparative data set is small, and while we lack comparative data on plant remains, these data do not support our suggestions that wider diet breadth should be reflected when bison are absent.

To explore this pattern further, we attempt to more clearly define the presence of bison in a component by considering components that are dominated by bison remains. We realize, as noted earlier, that body size will certainly impact this measure, and that the "dominance" of bison in a given assemblage may only reflect a small number of animals. Nevertheless, the faunal samples by genus and species within each site and/or component are presented in Appendix A (Table A-1). It is evident from that table that deer and deer/antelope-sized faunal remains dominate the majority of the collections regardless of the age and location of the site. Two sites, 41TG346 (Late Prehistoric) and 41HF128 (Late Archaic), do not fit this pattern in that both assemblages are overwhelmingly composed of bison remains. Both are located on the Llano Estacado. No other sites exist in our sample that have large faunal assemblages dominated by bison remains. However, at least two additional sites have small to moderate sample sizes dominated by bison, 41HY202-A (n=232) with 99% bison, and the Toyah component at 41HY209-M (n=1,066) with 68% bison. Both of these are in central Texas. Deer and deer-sized faunal remains tend to dominate the majority of the other assemblages throughout the state, regardless of the age of the components. However, there are at least three sites in central Texas, 41WM230, 41WM267, and 41WM56, where rodents tend to outnumber deer, antelope, and similarly sized species.

Among the faunal assemblages dominated by bison bones (41TG346, 41HF128, 41HY202-A Late Archaic, and 41HY202-A Toyah; see Table A-1), the number of species represented ranges between 2 and 7, with a mean of 4.5 species (see Table 7-7). The only assemblage that does not fit this pattern is 41HY209-M where bison bones are relatively common (68%) but 12 genera are present. Including all five components where bison is frequent, the average number of genera is 6. In contrast, for the remaining 13 sites that are not dominated by bison, the average number of genera represented is 21.4, with a range from a low of 8 to a high of 36. These patterns suggest that when bison skeletal elements dominate the faunal assemblage, overall diet breadth, as indicated by the presence of skeletal remains of other genera, is narrower when contrasted to assemblages when bison is not the dominant species.

As a final component of the investigation into faunal remains, we further explore this pattern by combining the genera-level faunal data for each site into three body size categories. The body size classifications for each genus present within the faunal collections are presented in Appendix A, Table A-2. Table 7-8 shows the breakdown of the faunal assemblages by body size category within each site. Note that the samples sizes are reduced from the Table 7-7 totals as not all fragments could be assigned to a body size group. The results of this analysis parallel those discussed previously. Within three sites (41TG346, 41HF128, and 41HY202-A Late Archaic), large body sized prey constitute 99% of the skeletal elements recovered, and in two other instances (41HY209-M Toyah and 41HY202-A Toyah) large body sized animals (i.e., bison) constitute more than 50% of the fragments. Note that these are the same five sites discussed previously, and they had an average number of six genera. Within five sites/components (41HY209-T Toyah, 41TV163 Austin, 41TV163 Late Archaic, 41MM340, and 41LK28), the medium body sized prey contributes more than 50% of the skeletal elements (Table 7-8). The number of genera for these sites is 24, 8, 5, 22, and 19, respectively, with an average of 15.6. Finally, four sites (41HY209-T Austin, 41WM230, 41WM267, and 41WM56) have faunal assemblages within which small to very small body sized species constitute the largest percentage of the skeletal remains. The genus richness of these faunal assemblages is 16, 34, 32, and 19, with an average of 25.25. Assemblages dominated by bison elements have the lowest number of genera. Those dominated by deer and deer/antelope-sized elements have moderate numbers of genera. Finally, those dominated by small to very small sized bone have the highest mean number of genera.

These patterns in body size, as well as those discussed previously, are consistent with our expectations that diet breadth would be relatively narrow in situations where bison are present, and wide in situations where bison are absent. While the period-level comparisons are not supported, these site-specific patterns reflect relationships between prey size and diet breadth at the site component level. It is likely, then, that while the faunal assemblage at one Toyah Phase site may be dominated by bison and the diet breadth may be very narrow (i.e., 41TG346 and 41HF128), at another Toyah Phase site, occupied at a different time of the year or within a different ecological setting, the assemblage may be dominated by medium body sized animals and may have a higher number of genera (i.e., 41JW8 and 41HY209-T). Such variability is to be expected as hunter-gatherers reposition themselves constantly across the landscape in search of resources.

Table 7-8. Breakdown of Faunal Assemblages by Phase/Time Period and Body Size

| | | **Large** | | **Medium** | | **Total Small-Very Small** | | |
|---|---|---|---|---|---|---|---|---|
| **Phase/Period** | **Site** | **Count** | **Percent** | **Count** | **Percent** | **Count** | **Percent** | **Total** |
| Toyah | 41TG346 | 11,022 | 98.6 | 53 | 0.5 | 104 | 0.9 | 11,179 |
| Toyah | 41HY209-T | 1770 | 19.6 | 6031 | 66.8 | 1227 | 13.6 | 9,028 |
| Toyah | 41HY209-M | 729 | 68.4 | 290 | 27.2 | 47 | 4.4 | 1,066 |
| Toyah | 41HY202-A | 83 | 55.7 | 52 | 34.9 | 14 | 9.4 | 149 |
| Austin | 41TV163 | 0 | 0.0 | 203 | 84.2 | 38 | 15.8 | 241 |
| Austin | 41HY209-T | 61 | 31.1 | 55 | 28.1 | 80 | 40.8 | 196 |
| Late Archaic | 41TV163 | 8 | 5.8 | 119 | 86.9 | 10 | 7.3 | 137 |
| Late Archaic | 41HY209-T | 103 | 37.7 | 88 | 32.2 | 82 | 30.0 | 273 |
| Late Archaic | 41HF128 | 20,160 | 99.3 | | 0.0 | 135 | 0.7 | 20,295 |
| Late Archaic | 41MM340 | 315 | 9.9 | 2308 | 72.5 | 560 | 17.6 | 3,183 |
| Late Archaic | 41HY202-A | 230 | 99.1 | 2 | 0.9 | 0 | 0.0 | 232 |
| Late Archaic | 41WM230 | 5 | 0.3 | 311 | 16.8 | 1536 | 82.9 | 1,852 |
| Late Archaic | 41WM267 | 0 | 0.0 | 215 | 6.8 | 2946 | 93.2 | 3,161 |
| Late Archaic | 41WM56 | 8 | 1.7 | 172 | 37.1 | 283 | 61.1 | 463 |
| Middle Archaic | 41LK28 | 0 | 0.0 | 15,314 | 71.4 | 6141 | 28.6 | 21,455 |

## Plant Remains and their Role in Subsistence

Although we have focused on faunal remains in the previous sections of this chapter, it cannot be ignored that plant remains were probably a significant element of the prehistoric hunter-gatherer diet. Based on the general ethnographic and ethnoarcheological literature and ethnohistoric accounts from Texas, it is clear that resources such as nuts (walnuts, pecans, acorns), tubers and bulbs (sotol, camas, wild onions), and prickly pear leaves and fruit played an important role in hunter-gatherer diet. It is likely that it was the distribution and variability in plant resources that most directly conditioned hunter-gatherer mobility much of the time, especially when groups were not involved in pursuing bison.

Unfortunately, of the nine macrobotanical samples submitted for analysis, only one (Cat. No. 333-001) from unit S175/E200, Zone III-B, a Late Archaic analytical unit, returned evidence of a potentially edible plant species, an onion bulb (*Allium* sp.). The results of the macrobotanical analysis are described in detail in Appendix D, authored by Dr. Phil Dering.

The recovery of a single onion bulb is not much on which to base a reconstruction of the role of plant resources in Late Prehistoric and Late Archaic diets. Nonetheless, recently unearthed evidence from a series of archeological sites with burned rock middens (see Brownlow 2003; Mauldin et al. 2003; Mehalchick et al. 2003) strongly suggests that bulbs and other plant resources that needed long periods of cooking to render them digestible by humans were extensively exploited by prehistoric groups. Even more intriguing than the finds of charred plant remains are the radiocarbon dates that have been obtained from numerous middens. Numerous dates compiled on middens from a number of projects (i.e., see Black and Creel 1997:Figure 134, 135; Mauldin et al. 2003:Figure 7-2) suggest that even if rock oven technology had an early beginning, the use of these cooking features seemed to have flourished during the Late Prehistoric period, and in particular during the Austin Phase (A.D. 700–1250).

The use of high carbohydrate plant resources increases at the end of the Late Archaic and during the Transitional Archaic as indicated by midden use dates. Rock oven cooking flourished during the Austin Phase, as bison is a lesser component of the diet and medium body sized animals are more intensively hunted. Interestingly, rock oven cooking continues well into the Toyah Phase, if the series of late dates actually indicate oven use rather than an overprinting of Toyah materials and organics onto abandoned facilities and features.

## Summary and Conclusions

We began this chapter noting that differences in subsistence between major periods of bison presence or absence could be expected. We suggested several patterns that might be anticipated, including a reduction in diet breadth when bison were abundant, and a widening of diet breadth when bison were absent or at extremely low densities. We also suggested that increased processing of bone might be anticipated under conditions of bison absence. Using data from 41TV163, our contrast between the Late Prehistoric Austin Phase analytical unit and assemblages from the Late Archaic found evidence consistent with those expectations. While the numbers of genera present in the assemblages are only slightly increased in the Late Prehistoric Austin Phase analytical units relative to those of the Late Archaic, bone processing seems to have been more frequent in the Late Prehistoric material. While the 41TV163 macrobotanical samples yielded only one edible plant species, an onion that may have come from a Late Archaic context, plant resources were probably a significant dietary component. The rapid increase in rock oven cooking facilities during the Late Archaic and their fluorescence during the Austin Phase and through the Toyah Phase suggests that plant resources that required lengthy cooking times may have been regular components of the diet.

We then conducted a regional comparison using faunal material from a number of sites. We had suggested that bison availability will impact the diet breadth of hunter-gatherers and expected a narrowing of diet breadth when bison were present. While hampered by the quality of available data, our analysis shows that when bison constitutes a large proportion of the faunal remains within an assemblage, the number of genera represented tends to be low. When medium body sized species dominate the faunal collections, more genera are present. Finally, the highest number of genera tends to be noted in assemblages dominated by elements derived from small to very small prey species. That analysis also suggests that variation rather than homogeneity characterized any given period. For example, the comparison of Toyah Phase faunal assemblages shows that they vary within central Texas as a group both in terms of genera richness, as well as in terms of the proportional contribution of large body sized mammals to the diet. Interestingly, there are two large archeological faunal assemblages that are composed nearly entirely of bison remains. Both of these assemblages, 41TG346 and 41HF128, are outside of central Texas. They reflect an adaptive stance similar to central and northern plains bison hunters. Toyah Phase faunal assemblages from central Texas tend to have moderate numbers of species/genus represented. This may reflect diversification of hunting strategies rather than specialization on bison. The two Toyah Phase assemblages from south-central (41LK201) and south Texas (41JW8) have high numbers of genera reflecting extreme hunting diversification. The Hinojosa Site (41JW8) is particularly interesting in that it is found south of the riverine portion of south Texas, in an area that is assumed to have been somewhat marginal to bison. The high number of genera of that assemblage may be reflective of this marginal location. The trend may also reflect an emphasis on plant resources as suggested by historic accounts of prickly pear exploitation in portions of south Texas (Campbell 1988:50). Variability in subsistence strategies also seems to be exemplified in the two Austin Phase assemblages but the small sample sizes make it difficult to rely too heavily on the results. The presence of the large body sized fauna within one assemblage suggests that the Austin Phase was a time of bison scarcity rather than total absence, although some degree of mixing of materials from other components may also account for the pattern. Late Archaic faunal assemblages also show a great degree of subsistence variability. The assemblage from 41HF128 is similar to 41TG346 and indicates a high degree of specialization in bison procurement. Whether this occurred on a seasonal basis or throughout the year is difficult to tell, although the kill site appears to have been used in March (Quigg 1997:118). With the exception of 41HF128, only one other Late Archaic site (41HY202-A) has a faunal assemblage dominated by large body sized prey species. Even within the remainder of the components, however, subsistence variability exists as noted by the fact that some site faunal assemblages are dominated by medium body sized prey (i.e., deer/antelope; 411MM340), while other assemblages are dominated by small to very small body sized species.

The results of these comparative analyses suggest that productive research may be pursued with existing faunal assemblages even when the original analyses are decades old and fragmentary in nature. The research highlighted one critical aspect of previously analyzed faunal assemblages: the variability in what and how it was analyzed. A number of other faunal assemblages exist curated in various facilities across the state. Some of these assemblages could not be used either because reporting was inadequate or only a small sample of the specimens was analyzed. A great deal more could have been done at the regional scale if some of the temporally isolable assemblages could have been more fully analyzed. Given the critical importance of reconstructing and understanding variability in hunter-gatherer subsistence practices across the state, it is suggested that the many existing faunal collections from isolable sites be re-analyzed to increase sample sizes and standardize analysis attributes and reporting criteria. It is also recommended that minimal analysis standards be sought and adopted to ensure that future faunal analyses record a set of usable attributes in identical manner so that the data resulting from multiple disparate projects can be comparable with other analyses and used for regional-scale investigations.

# Chapter 8: Technological Organization at 41TV163

**Raymond P. Mauldin, Steve A. Tomka, Harry J. Shafer, and Jason D. Weston**

In this chapter we investigate selected aspects of technological organization. Technological organization concerns how people organized activities associated with the design, manufacture, repair, and replacement of tools, and how these activities may have been conditioned by factors such as the availability and form of tool stone, as well as reliability and maintainability considerations of the tool itself. The chapter contains two primary sections. The first section is concerned with how raw material was acquired and used at the site. Using the lithic material from the six analytical units (AUs) that represent four temporal periods (see Chapter 6), we use several measures to identify raw materials that may have been locally obtained and distinguish these from stone that may have been brought to 41TV163. We then consider what these local and non-local material types were used to produce. Finally, we investigate changes between the four temporal periods in raw material procurement, aspects of reduction strategies, and tool assemblages. The second section of this chapter focuses on changes in aspects of projectile point technology. The design characteristics of projectile points, as well as refurbishing strategies, are critical aspects of technological organization because they are responsive to factors such as available prey type, mobility strategies, and raw material access. Relying on data collected from 428 projectile points, 212 of which can be assigned to one of the four temporal periods, this second section investigates categories of discard (e.g., use breakage, manufacture failure, postdepositional breakage), as well as measures of remnant use life (i.e., blade length and width).

## Raw Material Acquisition and Use at 41TV163

The six analytical units at 41TV163 will form the initial data set used in this discussion. As outlined in Chapter 6, the AUs contain 8,647 pieces of lithic debitage, 38 cores, 103 projectile points, and 198 bifaces. In addition, 80 other chipped stone tools, including 52 items that we suggest were used as scrapers, three battered/chopping tools, eight knives, a drill, four multifunction tools, and 12 gravers, several of which are on bifaces or points, are present. The AUs represent roughly 20% of the debitage collected from the site, 18% of all cores, 24% of the projectile points, 21% of the bifaces, and 17% of the other tools. All four temporal periods are represented in the sample, with the smallest samples sizes coming from the Early Archaic period, with 256 chipped stone items. While petrified wood and quartzite are present in the sample, over 99% of all material in the AUs was classified as chert.

### Identifying Local and Non-Local Material Groups

The initial aspect of technological organization investigated in this chapter concerns the acquisition of chert by the inhabitants of 41TV163. Like many areas along the Balcones Escarpment, 41TV163 appears to have been located with access to a variety of abundant, good-quality chert sources. As discussed in Chapter 2, the geology within the general area of 41TV163 is dominated by a variety of chalk, limestone, marl, and dolomite deposits, including deposits associated with the Fredericksburg Group. These Fredericksburg deposits contain abundant white to gray colored chert nodules (see Barnes 1974). During the various occupations of 41TV163, then, we assume that raw material was abundant, and that while the distribution and quality of stone may have varied from source to source on a small scale, good-quality cherts were probably consistently available to the occupants of the site. As good-quality cherts are still common in this area today, this assumption seems reasonable. The vast majority of stone found at the site, then, was probably acquired locally.

A cursory review of the site level assemblage clearly suggests that a few chert colors, falling within the gray and white color ranges of the Fredericksburg deposits, dominate the assemblage. However, other chert colors are also represented in small quantities that are not within this color range. This appears to especially be the case with the projectile points. While it is certainly possible that some of these chert colors are local, their presence suggests that some component of the tool stone may have been transported to the site from outside of the immediate area. If groups of materials that are likely to be local and non-local can be identified, and given the assumption that local material access was relatively constant, changes in the percentage of non-local stone through time may provide a rough measure of changes in the way that raw material acquisition was organized.

As it is explained in more detail below, our distribution between local and non-local raw materials is established on patterning in the debitage in terms of both variability in size range and corticate/decorticate specimens. Therefore, the derived patterns will reflect differences in what degree of reduction do raw materials arrive at the site and the length of the reduction sequence carried out on site. As long as variability in these two aspects of raw material reduction are conditioned by distances of raw material from 41TV163, the patterns will reflect differences in the procurement of local versus non-local materials. In a more theoretical sense, we expect that local materials may be thought of as those that can be accessed with one day's foraging distance while those resources falling outside of this may be considered non-local. However, there may be situations when some degree of raw material field-reduction may occur prior to transport even when the resource is found within the limits of one day's foraging distance.

To investigate raw material procurement practices through time we focused on categorizing the cherts into color and texture groupings. The color/texture categories were defined based on the debitage within the AUs because this data type is likely to contain examples of all raw materials brought onto and reduced at the site. Initially, 26 different categories of chert were defined for the 8,647 pieces of debitage, though several of the 26 categories were represented by only a handful of items. After an examination of the number of items in each group, these 26 categories were reduced to 14 by combining 13 groups with small samples (min.=1; max.=34) into a single category. Table 8-1 presents the raw material group numbers, a brief color description of the material, and information on the number and relative frequency of these materials in the combined AU debitage. The combined material category is material Group 8. The scheme in Table 8-1 was used to classify all chipped lithics from the analytical units. The comparison of the material groups within the tools and the debitage provides a good indication of which categories are present in what chipped lithic artifact group.

Unfortunately, we lack details on the distribution of these raw material groups in the natural environment. That is, while we suspect that the majority of debitage in a given white or gray chert is local, and that at least some of the other materials are not local, we lack any samples from the environment that would allow us to verify these suspicions. We rely, then, primarily on theoretical argument to begin to explore local materials relative to non-local materials at 41TV163. Specifically, we suggest that locally available materials would tend to be used primarily to produce new tools, as well as bifaces and points for use away from 41TV163. Local materials would, then, be subject to longer manufacture sequence potentially involving decortication of nodules, thinning, and shaping of a variety of different tools. Debitage from local materials should be characterized by large numbers of items and, as a group, should have high variability in debitage size. While all cortex categories should be present in local material groups, the debitage is likely to be dominated by non-cortical flakes, especially in situations with long reduction sequences and large nodule sizes. Cores should be frequently represented among local materials, and reflect a variety of sizes. Conversely, material categories overly represented primarily by formal tools,

Table 8-1. Raw Material Groups Represented in Debitage.

| Material Group No. | Color Description | Debitage Sample Size | Percent of Sample |
|---|---|---|---|
| 1 | pale to light gray | 1195 | 13.8 |
| 2 | brownish-gray | 1202 | 13.9 |
| 3 | dark gray to black | 320 | 3.7 |
| 4 | dark brown | 114 | 1.3 |
| 5 | dark gray-brown | 690 | 8.0 |
| 6 | gray-brown | 1766 | 20.4 |
| 7 | light brown | 65 | 0.8 |
| 8 | various | 186 | 2.2 |
| 10 | pinkish-beige | 194 | 2.2 |
| 11 | beige | 1489 | 17.2 |
| 12 | pinkish-gray | 202 | 2.3 |
| 15 | dark-beige | 723 | 8.4 |
| 17 | gray-red to beige-red | 106 | 1.2 |
| 18 | light-beige | 395 | 4.6 |

bifaces, and/or having low numbers of debitage, are likely to be non-local in origin. The rejuvenation of tools made of these non-local materials, and transported to Millican Bench in a more finished form, would represent much shorter reduction sequences relative to the sequences characteristic of local materials. These sequences should produce fewer numbers of debitage and debitage with a more limited size range. Primary flakes should be infrequent, especially in larger size ranges, though, like the local materials, tertiary flakes will dominate non-local debitage. Non-local cores should be infrequent, and when present, should be small.

In order to investigate these suggestions, we first focus on debitage. We recorded two attributes on all debitage within the AUs. Estimates of dorsal cortex on debitage were made and grouped for analysis into four categories: (1) no cortex; (2) 1-50% cortex; (3) 51-99% cortex; and (4) 100% cortex. Size of debitage was measured by maximum dimension with a digital caliper.

Figure 8-1 presents an initial consideration of the 14 raw material groups using two debitage attributes designed to measure overall raw material size and variability in debitage size. On the Y-axis is the range (maximum size – minimum size) of debitage in a given raw material group. While the ¼-inch screens used on the project limit the minimum size, the maximum size of a flake is probably limited by core size. Larger ranges, then, probably reflect larger initial core or biface size. On the X-axis, we plot the coefficient of variation for flakes in a material group. The coefficient of variation (C.V.) measures the variability in the size of flakes and is calculated as mean flake size divided by the standard deviation of the group.

Several different clusters are apparent in Figure 8-1. There is a group of four materials (4, 8, 12, 17), designated by triangles, which have low variability and are probably produced from smaller parent pieces given the low ranges. Reference to Table 8-1 will suggest that these four material types all have lower numbers of items, with an average sample size of 152 pieces. Referencing our previous discussion, these four types have characteristics consistent with groups dominated by non-local materials. A second cluster of seven materials (1, 2, 3, 5, 6, 10, 18) has higher variability. Flakes in these groups probably come from larger cores and/or bifaces. Sample sizes for these materials are much higher,

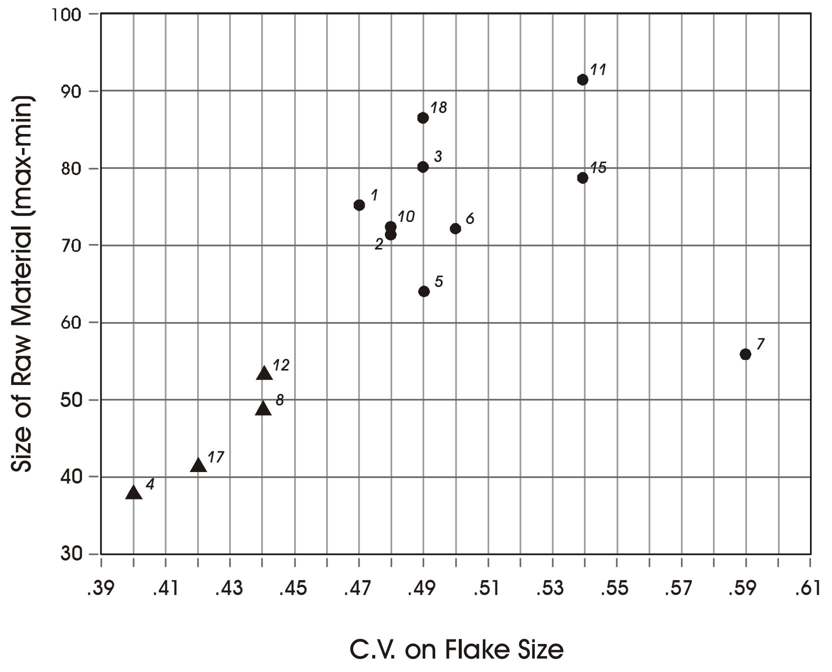

Figure 8-1. *Range of raw material groups and the coefficient of variation on flake size.*

with an average of 823 items per group (Table 8-1). Two other raw material types, numbers 11 and 15, could be collapsed into the a third group as they have similar size ranges, but slightly higher variability than Group 2. These two cases have samples sizes of 1,489 (Group 11), and 723 (Group 15). All of these nine cases (Groups 1, 2, 3, 5, 6, 10, 11, 15, 18) are consistent with our initial expectations for local materials. Finally, raw material Group 7, with only 65 cases, has high variation in flake size, but comes from smaller cores or bifaces (Figure 8-1). This material group has characteristics of both a local raw material (high variability) and non-local source (small size, smaller numbers).

At a group level, we can contrast cortex occurrence and percentage for those raw material types suspected to be dominated by non-local stone (Groups 4, 8, 12, 17, and 7) with those that are thought to be primarily local (Groups 1, 2, 3, 5, 6, 10, 11, 15, and 18). Recall that we suggested that while non-cortical flakes should dominate both non-local and local materials, non-local raw materials should lack large primary flakes, while local materials should contain these specimens. In order to consider this suggestion, we broke up maximum flake length of all 8,647 items into roughly equal size groups. The largest size group contains 1,730 items, all of which exceed 26.8 mm in size. Table 8-2 presents these 1,730 items. Included are the number of primary flakes (100% dorsal cortex), the percentage of primary flakes, and the number of flakes by raw material group. The materials are ranked by suspected core size based on the Y-axis in Figure 8-1. As such, the top four cases are those material groups that we suspect are dominated by non-local raw materials, while the fifth case, material type 7, is thought to contain some non-local tool stone.

Examination of the table will show that of these top five cases, large primary flakes are rare. Only one (20%) of the five groups has primary flakes present, and although just 106 large items are in these five cases, the percentage of primary flakes is only 1.89% for all five cases. Seven of the remaining nine types (77.8%) have large primary flakes. While this fits our overall expectations regarding the presence of large primary flakes in local raw materials, the percentage of large primary flakes within the 1,624 items in these nine groups, 1.85%, is virtually identical to the 1.89% of the flakes in the previous five groups. This is not consistent with our expectations.

One possibility is that we have dramatically different core sizes and reduction trajectory lengths in these two groups. That is, if the types dominated by local material are significantly larger to start with, then the percentage of large primary flakes should be quite low. In situations with high availability of large local materials, then, the percentage of large primary flakes may not be a useful measure in considering material origin. Nonetheless, it is the cases that these data are only partially consistent with our expectations.

As a final exploration of this question within the debitage, we constructed Table 8-3. Here, we grouped those types that potentially contain high frequencies of non-local materials (Groups 4, 7, 8, 12, and 17) and contrasted them to a group containing the remaining nine material types. These two groups contained 675 and 7,972 pieces of debitage, respectively. We then contrasted the number of items per pieces of debitage for bifaces (n=198), points (n=108), and other tools (n=80) by raw material group. For the three ratios in the table, the frequency of local debitage

Table 8-2. Primary Flakes by Raw Material Type for Large Debitage

| Raw Material Type | Primary Flakes | Total Large Flakes | Percent Primary Flakes |
|---|---|---|---|
| 4 | 0 | 11 | 0% |
| 17 | 0 | 15 | 0% |
| 8 | 2 | 39 | 5.10% |
| 12 | 0 | 30 | 0% |
| 7 | 0 | 11 | 0% |
| 5 | 0 | 110 | 0% |
| 2 | 3 | 196 | 1.53% |
| 6 | 4 | 313 | 1.28% |
| 10 | 1 | 35 | 2.86% |
| 1 | 1 | 304 | 0.33% |
| 15 | 2 | 114 | 1.75% |
| 3 | 0 | 36 | 0% |
| 18 | 5 | 109 | 4.59% |
| 11 | 14 | 377 | 3.71% |
| **Total** | 32 | 1700 | 1.88% |

Table 8-3. Comparison of Potentially Non-local and Local Stone Debitage to Tools and Cores

| **Ratios** | **Non-local Materials** | **Local Materials** |
|---|---|---|
| Debitage / Other Tools | 27.0/1 | 144.95/1 |
| Debitage / Cores | n/a | 209.79/1 |
| Debitage / Misc. Bifaces | 8.04/1 | 69.9/1 |
| Debitage / Points | 17.78/1 | 135.12/1 |

per other tool, biface, and point always dramatically outnumbered the ratios for non-local materials. That is, non-local materials are over-represented in bifaces, points, and other tools relative to the number of non-local debitage. These patterns are consistent with the importation of non-local materials in an already reduced or finished form (i.e., bifaces, points, finished tools). Though not shown in Table 8-3, only a single core from non-local materials was present among the 38 cores in the four AUs. There were, then, roughly 675 pieces of non-local debitage per core, compared to 215 pieces of debitage for local cores. Given that we suggested that local cores are likely to be substantially larger, these ratios further suggest that much of the non-local debitage is being produced from the reduction or rejuvenation of bifaces and projectile points. Although this pattern may also be interpreted as reflecting longer reduction sequences among non-local materials compared to local ones, it is more likely to be due to the fact that non-local materials were rarely introduced to 41TV163 in the form of cores, but more likely as finished tools.

## Debitage in Analytical Units

While the precise designation of local and non-local raw materials remains unconfirmed given that we lack independent geological information on the distribution of the materials, much of the previous analysis of the raw material groups is consistent with our expectations for what local and non-local material should look like within this site. We will assume, then, that non-local stone dominates material types 4, 7, 8, 12, and 17, while the remaining types represent primarily local stone sources. Using these designations, as well as information on cortex percentages and flake size, we now turn to summarizing the changes in raw material use through time at 41TV163.

Table 8-4 presents a breakdown of the percentage of cortex by temporal period. For this table we have combined all primary flakes (100% cortex) and those flakes with between 51% and 99% cortex into a single category. With the possible exception of the Early Archaic, the percentages are quite similar. Non-cortical flakes are highest in the Late Archaic, though the differences between the three late periods are minimal.

Finally, Table 8-5 presents the distribution of debitage by local and non-local raw material types for the four temporal periods. Note that in both the Early and Middle Archaic, the contribution of the non-local materials hovers around 4% of the total raw materials. In the Late Archaic, 8.1% of the material in use has been classified as non-local, while this figure climbs to almost 10% during the Late Prehistoric. The increasing use of probable non-local materials late in the sequence may reflect changes in the level of mobility, the way that mobility was organized, or changes in the nature of site use at 41TV163. While we currently lack methods to identify which of these suggestions should be pursued in future research, the patterns in Table 8-5 suggest that material acquisition patterns varied through time at 41TV163.

Table 8-4. Percentage of Cortex Groups for Four Temporal Periods at 41TV163

| **Analytical Unit** | **No Cortex** | **1–50% Cortex** | **51–100%** | **Total Number of Items** |
|---|---|---|---|---|
| Early Archaic | 77.33% | 18.67% | 4.00% | 225 |
| Middle Archaic | 84.76% | 12.96% | 2.28% | 1975 |
| Late Archaic | 85.50% | 11.66% | 2.84% | 3696 |
| Late Prehistoric | 82.99% | 13.92% | 3.09% | 2751 |
| Total Number of Items | 7291 | 1112 | 244 | 8647 |

Table 8-5. Frequency of Debitage by Raw Material Groups for Four Temporal Periods at 41TV163

| **Analytical Units** | **Local Materials** | **Percentage** | **Non-local Materials** | **Percentage** | **Total** |
|---|---|---|---|---|---|
| Early Archaic | 216 | 96.0% | 9 | 4.0% | 225 |
| Middle Archaic | 1903 | 96.4% | 72 | 3.6% | 1975 |
| Late Archaic | 3398 | 91.9% | 298 | 8.1% | 3696 |
| Late Prehistoric | 2478 | 90.1% | 273 | 9.9% | 2751 |
| Totals | 7995 | 92.5% | 652 | 7.5% | 8647 |

## Cores in Analytical Units

As part of the investigation of lithic reduction strategies we also studied the cores present in the analytical units and quantified both the type of reduction they represent (i.e., unidirectional, multidirectional, bifacial) and their degree of reduction. To monitor degree of reduction, we counted the number of flake scars, recorded the weight (grams) of cores, and noted the presence/absence of cortex on cores. Only a single core was made on a non-local material group. No comparisons are made, then, between local and non-local patterns.

Overall, most cores were classified as multidirectional, with this group making up 60.5%. Bidirectional cores were the second most common type, with nine cases. The average core weight of the 38 specimens was 53.3 grams, with a range of between 6.1 grams and 202.4 grams. Cortex was present on 42.1% (n=16) of the cores, and those cores with cortex were substantially heavier (mean wt.=73.1 g) than those without cortex (mean=38.9 g). The number of flake scars ranged from 1 to 29, with most cores having less than 10 scars present.

Figure 8-2, a histogram of the number of scars per core, clearly suggests that three groups are present. The first group, with a mode of three scars and a range of from 1 to 7, consists of 24 of the 38 cores. A second group, with a mode at 11 scars and a range of between 8 and 14, contains 12 cores. Finally, two cores, designated Group 3, have more than 17 scars. Initially, we suspected that the number of scars would be inversely related to core weight. That is, the more scars present on a core, the more flake removals and the lighter the core. Figure 8-3, a box plot of the weights of cores by the three groups, suggests that this is not the case. In fact, those cores with less than eight flake scars are substantially smaller than the two cores in Group 3, the latter having more than 17 scars present.

Figure 8-4 suggests a possible reason for this unexpected relationship. We suggest that, initially, this relationship holds as suggested by the upper part of the curve. However, at some point, new removals begin to take off previous removals. That is, new removals, at some point, will contain previous removals on their dorsal surface. This should result in both a reduction of weight and a reduction of flake scars, as more removals occur. As indicated in the graphic, if this is the case, we should expect that multidirectional cores, defined as cores with removals from several different directions, should increasingly characterize the Groups 2 and 3 cores shown in Figure 8-2. Of the 24 cores within Group 1, multidirectional cores make up 42%. For the 14 cores classified as Groups 2 and 3, multidirectional cores make up 93%. Note that in situations with low raw material availability, most cores will probably end up near the bottom of the reduction trajectory shown in Figure 8-4. That is, most cores should be multidirectional, have small weights, and have a moderate number of flake scars. Only in situations with high raw material availability, such as 41TV163, might we have the opportunity to more clearly define this core reduction trajectory.

Table 8-6 presents summary data on cores by the four temporal periods. Note that for all four cases, sample sizes are small. This is especially the case for the Early Archaic, were only three cores are present. In addition, given the discussion in the previous paragraph, the number of flake scars is difficult to interpret clearly in terms of reduction. However, note that most other indicators suggest that cores were more completely reduced in the Late Prehistoric. It is during this period that we have the highest percentage of cores with no cortex, the highest percentage of multi-directional cores, and the lowest median core weight. This period is clearly different from the three earlier periods.

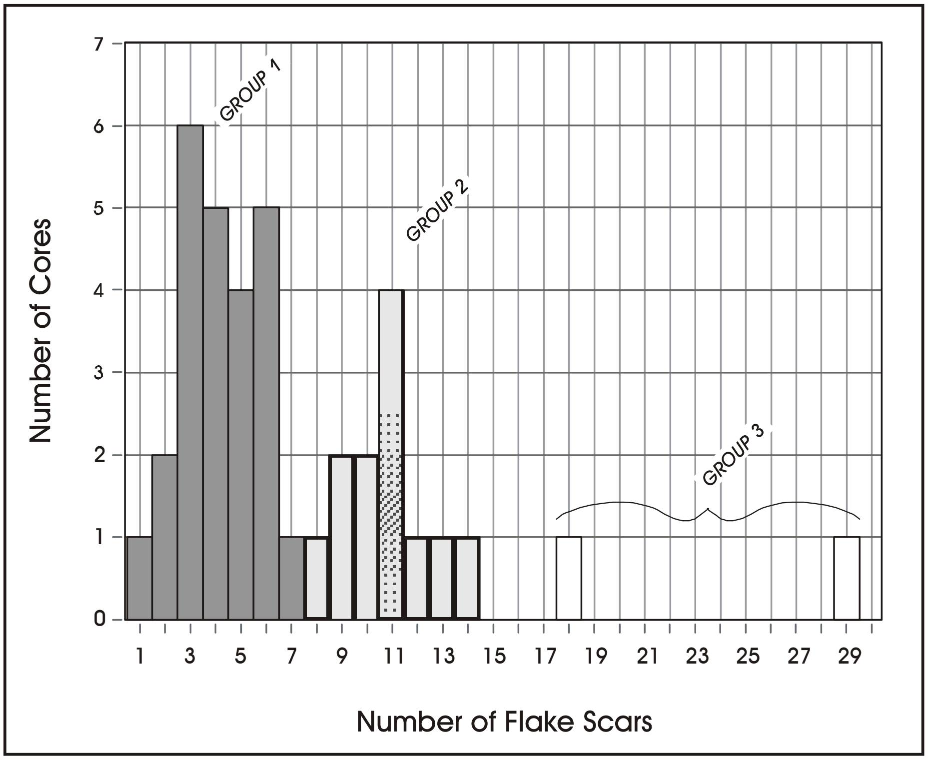

Figure 8-2. *Number of flake scars on cores.*

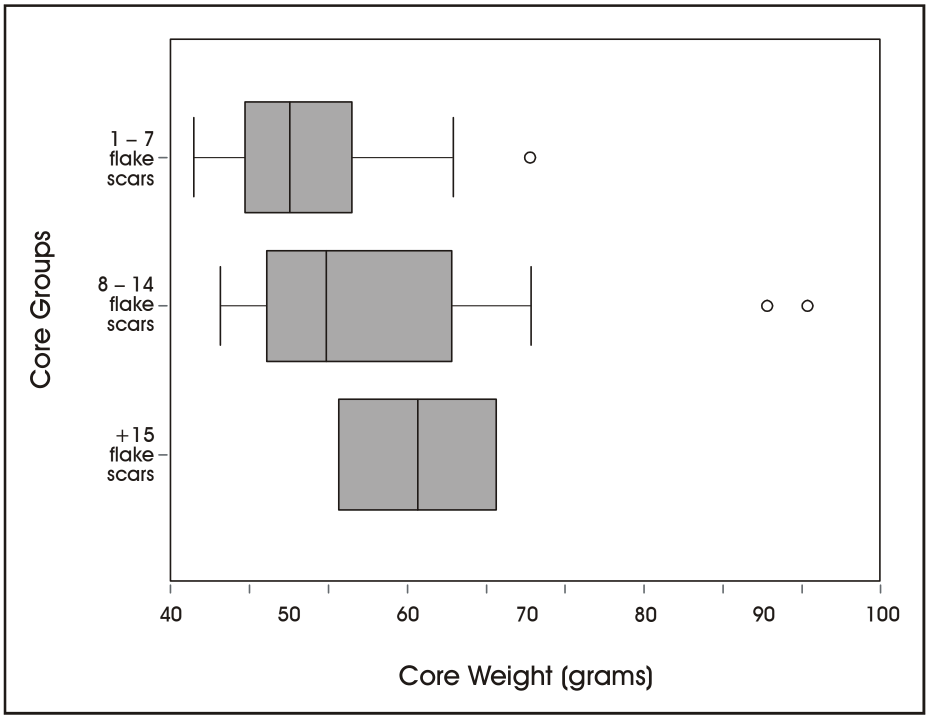

Figure 8-3. *Weight of cores by flake scar group.*

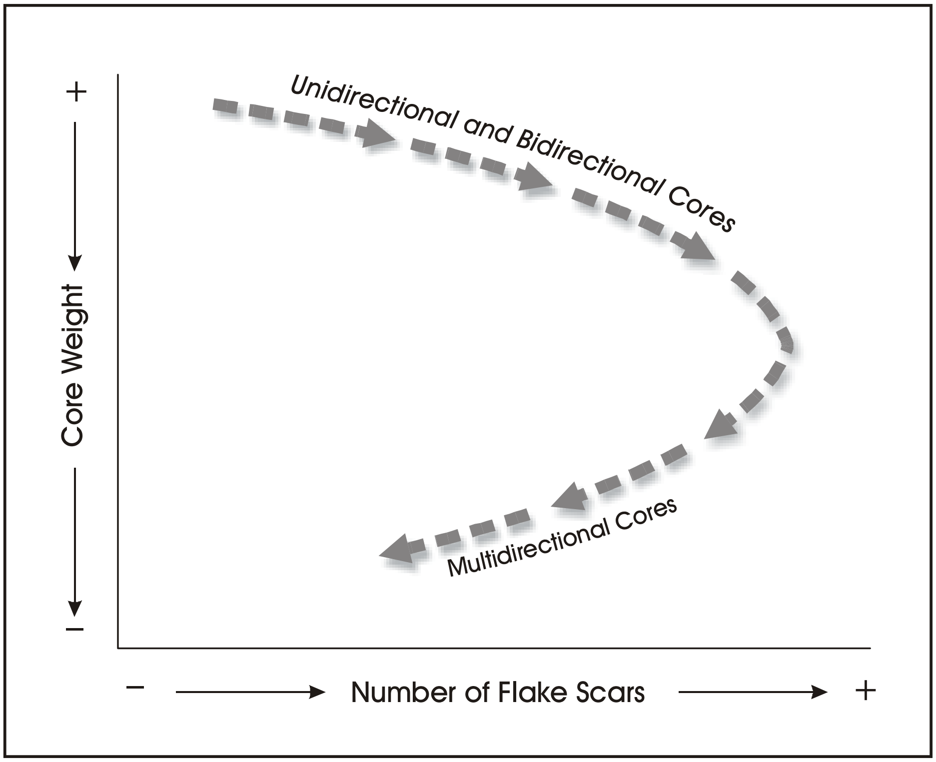

Figure 8-4. *Suggested relationship between core weight and number of flake scars.*

## Technological Organization: Tool Design and Projectile Point Technology at 41TV163

The resources exploited by hunter-gatherers and the strategies employed are in part conditioned by the primary and secondary biomass productivity of the environment and the structure and distribution of resources. The success with which hunter-gatherers exploit these resources depends in part on the strategies employed in their procurement and the effectiveness of the weapons and tools used in procurement and processing activities and tasks. A number of factors may constrain tool manufacture and morphology including function, raw materials, manufacture technology, and the economics of production and use (Hayden et al. 1996). Desired improvements in labor efficiency also can lead to the adoption of new or improved tool forms (Aldenderfer 1990:63–65).

Parry and Kelly (1987) have previously suggested that the manufacture of tools is in part conditioned by raw material availability and group mobility. They have argued, however, that once raw material availability is not a constraining factor, the more mobile a group is the more likely that it will be equipped with formal tool forms and the less mobile, the more likely that expedient tool forms will dominate its tool assemblages. Tomka (2001) on the other hand, suggested that the design of a tool is most likely conditioned

Table 8-6. Core Attributes by Four Temporal Periods at 41TV163

| Analytical Unit | % Non-cortical | % Multidirectional | Median Wt. (gr.) | Median # of Scars | Number of Cores |
|---|---|---|---|---|---|
| Early Archaic | 33% | 66% | 51.8 | 11 | 3 |
| Middle Archaic | 22% | 44% | 41.1 | 4 | 9 |
| Late Archaic | 46% | 46% | 49.3 | 4 | 13 |
| Late Prehistoric | 54% | 85% | 35.7 | 8 | 13 |

not by mobility per say but the amount of work that needs to be carried out with the tool and the time constraints within which these activities have to be carried out. That is, low to moderate levels of activities that occur on a daily basis (i.e., food processing) and have no time constraints can be carried out with expedient tools that are in many instances very effective in short duration tasks. The performance of repetitive tasks for an extended time is more effectively carried out with hafted tools that allow exertion of greater force for longer periods and with less hand/finger strain.

The two theoretical approaches have different implications for interpreting hunter-gatherer mobility, labor organization, and subsistence strategies based on the ratios of formal versus expedient tool forms noted in archeological assemblages. In the first instance (Parry and Kelly 1987), and assuming readily available raw materials, high proportions of expedient tool forms should suggest a high degree of sedentism, while a high proportion of formal tools would indicate high rates of mobility (i.e., distance and number of moves). In the second instance (Tomka 2001), high proportions of expedient tools would suggest low processing rates that are dispersed over time, while high numbers of formal tool forms would indicate increased levels of activity and greater temporal constraints.

Artifact discard and replacement strategies represent an additional aspect of technological organization that is conditioned by broader aspects of land use. Binford (1979) has suggested that within contexts of bulk resource procurement constrained by the temporary seasonal availability of high ranking resources, there is such a premium on resource acquisition that hunter-gatherers will gear up, that is, manufacture replacement gear, in advance of the need for this gear to allow greater expenditure of time and energy into resource acquisition rather than tool repair and/or replacement. Such a strategy manifests not only in terms of the timing of the manufacture and repair activities but also the design of the tools and tool repair strategies such as the use of over-designed reliable tools and tools composed of multiple modular components that facilitate the removal and replacement of failed components (Bleed 1986). In contrast, in contexts where resource procurement occurs on a daily basis, in part because the resources being procured are not seasonal and acquisition is not concentrated into a single season, there are ample opportunities to repair and/or replace failed weapon parts at the end of each day's hunt. These two approaches to tool replacement and repair should have dramatically different archeological manifestations, particularly in terms of projectile point technology since these artifacts/components are the ones that are most likely to fail within compound weapon systems.

Based on these general propositions, we assume that under conditions of time stress, tool repair will consist of the discard of failed points and their replacement with new specimens rather than the rejuvenation of failed specimens. It is also possible that under these circumstances, some degree of preventive tool replacement may also be practiced. That is, tools that are already heavily rejuvenated and/or near "exhaustion" may be replaced even if they have not yet failed in order to prevent their failure at a time when their repair and/or replacement takes away time from more important activities such as resource procurement. In contrast, within the context of daily procurement of resources available year-round, we assume that it is likely that failed components such as projectile points will be rejuvenated rather than discarded. Therefore, we would expect that under the first instance, we should recover projectile points with longer remaining use life as well as heavily rejuvenated but complete projectile points discarded prior to failure. In the second instance, we expect to recover projectile points with shorter remaining use lives (i.e., heavily rejuvenated) and fewer complete points discarded before failure.

To investigate the aforementioned aspects of technological organization and projectile technology, we first categorized all chipped lithic tools identified within the lithic collections from the analytical units into functional (i.e., projectile point, chopper, drill, graver, knife, scraper, multi-functional) and formal (i.e., bifaces, cores) categories. The classification of the sample into functional categories was based on a combination of macroscopic and low-power (20X–40X) microscopic analysis. Use-modified flakes (i.e., some expedient tools) were categorized into scrapers, knives, and/or gravers based on the location of edge modification and characteristics of microflake scarring (Tringham et al. 1974). Retouched tools (i.e., unifacial and bifacial knives, scrapers) were classified into functional categories following the detailed scan of the working edges of the tools under 20X and 40X magnification. A Southern Precision Instruments binocular microscope (Model 1892-TL) was employed. On incomplete specimens, break cause was also assessed and considered as an indicator of whether a tool had been used or not. Break cause (i.e., use break, manufacture break, postdepositional break) was assessed through a comparison of the archeological specimens with a comparative collection.

Table 8-7 presents the composition of the lithic assemblages within the four analytical units (AUs) defined in Chapter 6.

Miscellaneous bifaces are the single most common artifact category in each analytical unit. Dart points are the second most common tool type in all analytical units except AU 4 (Early Archaic) where scrapers are more common than projectile points. Scrapers are the third most numerous artifact category in all AUs except AU 1 (Late Prehistoric) where cores are slightly more common. With the exception of gravers that occur in three of the four AUs, other tool categories are infrequent. Overall, the diversity of functional classes is very limited although the overall sample sizes of chipped lithic artifacts is relatively small within the AUs.

To address issues of technological organization, next we categorized each tool into one of three categories reflective of the degree of reduction of the parent material or core used in tool manufacture. Formal tools are made through the extensive retouch of parent materials or cores. Minimally retouched tools are made by the removal of few flakes from and minimal alteration of the parent material or core. Expedient tools represent the use of unmodified lithic debitage. All projectile points are classified as formal tools; the classification of all other tools recovered from the site is presented in Table 8-8.

A look at the table indicates that formal tools are absent from AU 1 and are infrequent in the collections from the other AUs. The majority of the few formal tools are scrapers. Minimally retouched tools outnumber all other forms in AU 1, while expedient tools outnumber all others in AU 3. In contrast, minimally retouched and expedient tools occur in equal or nearly equal frequencies in AUs 2 and 4. These figures seem to suggest some changes in the amount of time and energy invested in non-projectile point tool manufacture through time, especially as it involved the making of scrapers. The sample size in the earliest of the analytical units (AU 4, Early Archaic) is too small for adequate interpretation, however, it appears that during the Middle Archaic (AU 3) the emphasis was on the use of unmodified debitage for expedient tools. During the Late Archaic (AU 2) nearly as many tools were made through minimal retouch as expedient tools being used. By the Late Prehistoric period, minimally retouched tools (i.e., scrapers) were fulfilling most tool needs, at least in terms of scraping tasks. Although formal tools are infrequent, the aforementioned pattern does suggest a trend through time of greater investment in tool manufacture during the Late Archaic and Late Prehistoric periods compared to preceding times.

To further explore these patterns, we calculated ratios for several artifact categories by analytical unit (Table 8-9). The ratio of expedient to formal tools, not including projectile points, ranges from a low of 1.5:1 in AU 4 to a high of 15:1 in AU 3 (Table 8-9). The Middle Archaic assemblage has the highest expedient to formal tool ratio, although AU 1, the Late Prehistoric unit, has no formal tools other than projectile points. The trend in expedient and minimally retouched tools was mentioned above and is reaffirmed in the ratio of expedient and minimally retouched tools by analytical unit. The ratio of projectile points to other formal tools is highest in the Middle Archaic analytical unit (AU 3) but projectile points significantly outnumber other formal tools in all AUs except AU 4. This predominance of projectile points suggests heavy emphasis on hunting activities or at least the discard of failed components of the hunting weaponry while at the site. The ratio of miscellaneous bifaces to cores is indicative of the proportion of bifacial reduction versus core reduction at the site. As indicated earlier (Table 8-6), the majority of the core reduction is multidirectional. It is clear from the ratios that bifacial core reduction, or the manufacture of bifaces, was

Table 8-7. Lithic Assemblage Composition by Analytical Unit

| **Artifact Class** | **AU 1 (Late Prehistoric)** | **AU 2 (Late Archaic)** | **AU 3 (Middle Archaic)** | **AU 4 (Early Archaic)** | **Total** |
|---|---|---|---|---|---|
| Projectile Points | 30 | 40 | 30 | 3 | 103 |
| Other Tools | | | | | |
| choppers | 2 | 1 | | | 3 |
| drill | | 1 | | | 1 |
| graver | 5 | 2 | 5 | | 12 |
| knives | | 4 | 3 | 1 | 8 |
| scraper | 11 | 23 | 12 | 6 | 52 |
| multi-functional | | 2 | 1 | 1 | 4 |
| Misc. Bifaces | 67 | 72 | 39 | 20 | 198 |
| Cores | 13 | 13 | 9 | 3 | 38 |

Table 8-8. Breakdown of Non-projectile Point Tools by Manufacture Type within Analytical Units

| **AU/Manufacture Type** | **Chopper** | **Graver** | **Scraper** | **Knife** | **Drill** | **Multi-functional** | **Total** |
|---|---|---|---|---|---|---|---|
| **AU 1 (Late Prehistoric)** | | | | | | | |
| Formal | | | | | | | 0 |
| Minimally Retouched | 2 | 1 | 10 | | | | 13 |
| Expedient | | 4 | 1 | | | | 5 |
| **AU 2 (Late Archaic)** | | | | | | | |
| Formal | | | 3 | | 1 | | 4 |
| Minimally Retouched | 1 | 1 | 11 | | | 1 | 14 |
| Expedient | | 1 | 9 | 4 | | 1 | 15 |
| **AU 3 (Middle Archaic)** | | | | | | | |
| Formal | | | 1 | | | | 1 |
| Minimally Retouched | | 1 | 3 | 1 | | | 5 |
| Expedient | | 4 | 8 | 2 | | 1 | 15 |
| **AU 4 (Early Archaic)** | | | | | | | |
| Formal | | | 2 | | | | 2 |
| Minimally Retouched | | | 1 | 1 | | 1 | 3 |
| Expedient | | | 3 | | | | 3 |
| Total | 3 | 12 | 52 | 8 | 1 | 4 | 80 |

Table 8-9. Selected Artifact Ratios by Analytical Units

| **Artifact/Tool Category** | **AU 1** | **AU 2** | **AU 3** | **AU 4** |
|---|---|---|---|---|
| expedient : formal tools | - | 3.75:1 | 15:1 | 1.5:1 |
| expedient : minimally retouched tools | .38:1 | 1.1:1 | 3:1 | 1:1 |
| projectile points : formal tools | - | 10:1 | 30:1 | 1.5:1 |
| miscellaneous bifaces : cores | 5.2:1 | 5.5:1 | 4.3:1 | 6.7:1 |
| miscellaneous bifaces : projectile points | 2.2:1 | 1.8:1 | 1.3:1 | 6.7:1 |

much more common than the reduction of cores for the production of flake blanks. This pattern may be explainable for the Archaic analytical units since most of the projectile points are made through bifacial reduction of nodular or flake cores. However, the arrow points that make up the bulk of the Late Prehistoric (AU 1) projectile points could be made on flake blanks removed from multidirectional cores. Therefore, the high ratio of bifaces to cores suggests that the miscellaneous bifaces recovered in AU 1 may represent the manufacture of large bifacial tool forms such as knives. However, no bifacial knives have been recovered from this AU.

Even more interesting is the pattern in the miscellaneous biface to projectile point ratios (Table 8-9). Miscellaneous bifaces (i.e., those that broke during manufacture and/or could not be classified into a functional category) outnumber projectile points in all analytical units. The ratio of bifaces to projectile points is highest in AU 4 where nearly seven bifaces are present for every projectile point. The ratio of bifaces to points is only slightly in favor of bifaces in AU 3, however, bifaces outnumber points almost 2:1 in AU 2 and more than 2:1 in AU 1.

To further investigate this pattern, we sought to classify the miscellaneous biface sample into stages of reduction based on width/thickness (w/t) ratios and mean edge angle measurements (Callahan 1979). Only 131 of the 198 miscellaneous bifaces from AUs were sufficiently complete to measure maximum width and thickness and both edge angles (right and left edges). Of these, 10 came from AU 4, 26 came from AU 3, 49 were from AU 2, and 46 were from AU 1. Based on patterning within the width/thickness ratio and the mean of the two edge angles, the 131 bifaces were grouped into early, middle, and late reduction stage specimens. The early reduction stage specimens have w/t ratios of less than 3 and mean edge angles that are greater than or equal to 40. Middle reduction stage specimens have mean edge angles that are less than 40 and w/t ratios from 3–4.4. Late reduction stage specimens have w/t ratios that exceed 4.5.

Table 8-10 presents the breakdown of the bifaces into reduction stages by analytical unit. It also compares the distributions using adjusted residuals (Everitt 1977). Adjusted residual values that are higher than 1.96 or lower than -1.96 are statistically significant at the .05 level of significance and appear in bold in the table. It is evident that early reduction stage bifaces are over-represented in AU 4 indicating that more than expected early reduction stage bifaces were discarded in this analytical unit. Recall that bifaces outnumber projectile points more than 6:1 in this AU. On the other hand, fewer than expected late reduction stage bifaces were discarded in AU 3, the Middle Archaic analytical unit. Here the number of miscellaneous bifaces is only slightly more than the number of projectile points (39 to 30). Finally, in contrast to AU 3, late reduction stage bifaces are over-represented in AU 2, the Late Archaic analytical unit, where nearly two bifaces are present for every projectile point (72 to 40).

Given that no formal bifacial knives have been recovered from the AUs examined, could it be that all miscellaneous bifaces represent the replacement of failed projectile points or is their numeric abundance an indicator of gearing up manufacture for future use? The answer to this question is difficult to determine. However, when we consider that in AUs 1 and 2 nearly twice as many bifaces are being manufactured than points, it is likely that many more points are being made than necessary for projectile point replacement. We cannot determine the reason for the large number of bifaces, however, it is likely that while some were intended to replace failed points, others were likely taken off site either in the form of curated projectile points or some other bifacial tool form.

We mentioned earlier that the strategies employed in tool replacement and rejuvenation, and specifically projectile point rejuvenation and replacement, may be related to broader aspects of land use and subsistence. To investigate this possibility, we measured the blade length and maximum blade width of each projectile point that could be assigned to a specific period. Blade length was measured on both complete and fragmentary specimens to ascertain how much of the blade was present on the specimen at the time of discard. Maximum blade width also was measured on each specimen. It was assumed that points broken during seasonal bulk procurement hunts would not be refurbished but rather discarded and replaced with new specimens. On the other hand, we assumed that other points broken on day-to-day hunts would be refurbished daily so that when finally discarded, such points would have both shorter and narrower blades.

Table 8-11 shows the mean remnant blade length and mean remnant blade width of projectile points by analytical unit. It is evident that Middle Archaic points have the longest remnant blade lengths, while not surprisingly, that Late Prehistoric arrow points have the shortest remnant blade lengths. Middle and Late Archaic points have the broadest remnant blades at discard, while arrow points have the narrowest blades at the time of discard. The longer remnant blade length and wider remnant blade of Middle Archaic points suggests that they were discarded without extensive rejuvenation perhaps in the context of rapid replacement of failed specimens. On the other hand, the significantly shorter-bladed Late Archaic specimens suggests that these points were rejuvenated repeatedly to reduce their remnant blade length.

Because several distinct projectile point types are lumped as Late Archaic, we decided to explore remnant blade lengths at the type level to establish any differences between types. Table 8-12 lists mean remnant blade length and mean remnant blade width for several of the Late Archaic and two Middle Archaic types found at 41TV163. It is clear that the three youngest point types (Darl, Ensor, and Fairland) have the shortest combined remnant blade lengths (19.4 mm). The seven next oldest Late Archaic points (Marcos–Bulverde) have a combined mean remnant blade

Table 8-10. Breakdown of Bifaces by Reduction Stage and Adjusted Residual Values

| | Late Prehistoric | | Late Archaic | | Middle Archaic | | Early Archaic | | |
|---|---|---|---|---|---|---|---|---|---|
| **Reduction Stage** | **Count** | **Adjusted Residual** | **Count** | **Adjusted Residual** | **Count** | **Adjusted Residual** | **Count** | **Adjusted Residual** | **Total** |
| Early | 9 | -1.23 | 11 | -0.71 | 8 | 0.63 | 6 | **2.56** | 34 |
| Middle | 25 | 1.31 | 19 | -1.38 | 15 | 1.27 | 2 | -1.75 | 61 |
| Late | 12 | -0.26 | 19 | **2.24*** | 3 | **-2.03** | 2 | -0.55 | 36 |
| Total | 46 | | 49 | | 26 | | 10 | | 131 |

* Bolded values are statistically significant at the .05 level of significance.

Table 8-11. Mean Blade Length and Blade Width by Temporal Period

| Period | Mean Remnant Blade Length | Sample Size | Mean Remnant Blade Width | Sample Size |
|---|---|---|---|---|
| Early Archaic | 33.9 | 11 | 25.5 | 11 |
| Middle Archaic | 40.5 | 39 | 28.1 | 37 |
| Late Archaic | 30.7 | 189 | 28 | 184 |
| Late Prehistoric | 14.6 | 85 | 14.2 | 72 |

length of 32.8 mm. The two Middle Archaic points (Nolan and Travis) have a combined mean remnant blade length of 40.2 mm. The mean remnant blade width of the three youngest types (Darl, Ensor, and Fairland) is 21.6 mm, while the seven next oldest Late Archaic points (Marcos–Bulverde) have a combined mean remnant blade width of 31.7 mm. Finally, the two Middle Archaic points in the table have a combined mean remnant blade length of 27.6 mm. Again, the combined pattern obtained from the mean remnant blade lengths is that Middle Archaic as well as early Late Archaic points in general are discarded while retaining longer use lives than their later counterparts. Although early Late Archaic specimens are generally discarded with narrower blade lengths than their later counterparts, Middle Archaic specimens in general have broader blades at the time of discard than at least some of their Late Archaic counterparts. While the broad-bladed point types such as Marshall, Montell, Castroville, and Marcos have longer and broader blades than the later Late Archaic types (i.e., Ensor), we do not see a technological or functional reason why they would not be reduced to the same degree as the smaller types, especially since the presence of the smaller forms demonstrate that they also were effective weapon components. Rather, we assume that the differences in remnant blade lengths and widths indicates different approaches to projectile point rejuvenation conditioned by differences in resource availability and structure.

The final two aspects of projectile technology concern the proportion of complete projectile points and stem fragments being discarded by time period and within selected point types. Table 8-13 shows the breakdown of complete specimens and stem fragments by time period. The first aspect bespeaks of the rate of preventive discard that may be practiced by a group, while the second aspect documents a design weakness in a projectile point (i.e., the neck). It is evident that the Middle Archaic has the highest rates of complete point discard, while Late Archaic and Late Prehistoric collections retain the lowest rates among the three largest samples. The small Early Archaic collection has no stem fragments but the percentage of stem fragments increases in each of the subsequent time periods.

Table 8-12. Mean Blade Length and Blade Width for Selected Point Types

| Type | Mean Remnant Blade Length | Sample Size | Mean Remnant Blade Width | Sample Size |
|---|---|---|---|---|
| Darl | 22.7 | 42 | 18.3 | 39 |
| Ensor | 22 | 13 | 24.2 | 12 |
| Fairland | 13.4 | 23 | 22.2 | 16 |
| Marcos | 35.3 | 4 | 33.8 | 4 |
| Castroville | 35.5 | 7 | 37.8 | 7 |
| Montell | 35.7 | 11 | 29 | 11 |
| Marshall | 28.4 | 6 | 28.9 | 4 |
| Lang | 33.5 | 23 | 32.4 | 23 |
| Pedernales | 34.4 | 50 | 31.7 | 46 |
| Bulverde | 26.8 | 13 | 28.7 | 11 |
| Nolan | 44.1 | 24 | 29.5 | 24 |
| Travis | 36.3 | 14 | 25.8 | 13 |

Table 8-14 presents the numbers and percentages of complete points and stem fragments within selected Late Archaic (Darl, Ensor, Fairland, Marcos, Castroville, Montell, Marshall, Lange, Pedernales, and Bulverde) and Middle Archaic (Nolan and Travis) points. An examination of the table will show that, on average, few complete specimens are discarded among the three youngest Late Archaic point types (mean=9%). On the other hand, among the next seven Late Archaic types (Marcos–Bulverde), an average of 16% of the specimens discarded are complete. The highest percentages occur among the Marcos and Pedernales points. Finally, among the Middle Archaic points, an average of 26% of the projectile points are complete at the time of discard. The pattern of projectile point failure at the neck suggests that Darl and Fairland points tend to be structurally weak at the neck with 7% to 30% of these points, respectively, failing at the neck during use. The neck failure rates among older Late Archaic points tend to be similar to Darl points.

Overall, the study of remnant blade lengths at discard, as well as the percentages of discarded points suggests that younger Late Archaic points tend to be discarded more heavily reduced than older Late Archaic types, which in turn tend to be complete or to have longer blade remnants than their Middle Archaic counterparts. This pattern matches expectations within the Late Archaic sample since we tend to see a correlation between the exploitation of medium body sized animals during the later part of the Late Archaic correlating with well-used (i.e., reduced, rejuvenated) projectile points and less rejuvenation of projectile points and preventive maintenance through the discard of complete points earlier in the Late Archaic when bison were present within the state. However, the fact that Middle Archaic points show an even higher degree of preventive discard of complete points and have higher mean remnant blade lengths than all Late Archaic types suggests that tool replacement strategies may have had a gearing up component and, therefore, animal procurement may have had a seasonal component not hitherto suspected.

Table 8-13. Complete Specimens and Stem Fragments by Time Period

| **Period** | **Number of Complete Points** | **Percent of Total Sample** | **Number of Stem Fragments** | **Percent of Total Sample** | **Total Sample Size** |
|---|---|---|---|---|---|
| Early Archaic | 1 | 9.1 | 0 | 0.0 | 11 |
| Middle Archaic | 10 | 25.6 | 2 | 5.1 | 39 |
| Late Archaic | 25 | 12.3 | 16 | 7.8 | 204 |
| Late Prehistoric | 12 | 14.3 | 12 | 14.3 | 84 |

Table 8-14. Number and Percent of Complete Points and Stem Fragments for Selected Point Types

| **Type** | **Number of Complete Points** | **Percent of Total Sample** | **Number of Stem Fragments** | **Percent of Total Sample** | **Total Sample Size** |
|---|---|---|---|---|---|
| Darl | 7 | 16.7 | 3 | 7.1 | 42 |
| Ensor | 0 | 0.0 | 0 | 0.0 | 13 |
| Fairland | 0 | 0.0 | 7 | 30.4 | 23 |
| Marcos | 1 | 25.0 | 0 | 0.0 | 4 |
| Castroville | 1 | 14.3 | 0 | 0.0 | 7 |
| Montell | 2 | 18.2 | 0 | 0.0 | 11 |
| Marshall | 1 | 16.7 | 0 | 0.0 | 6 |
| Lange | 1 | 4.3 | 0 | 0.0 | 23 |
| Pedernales | 11 | 22.0 | 4 | 8.0 | 50 |
| Bulverde | 1 | 7.7 | 1 | 7.7 | 13 |
| Nolan | 8 | 33.3 | 0 | 0.0 | 24 |
| Travis | 2 | 14.3 | 1 | 7.1 | 14 |

## Summary and Conclusions

In this chapter, our goal was to examine two aspects of the chipped lithic technology in the large collection of unmodified debitage, tools, and projectile points identified in the 41TV163 collection: raw material procurement and technological organization. To reconstruct raw material procurement strategies, we first defined local versus non-local materials based a series of attributes and broad debitage size classes in the 14 raw material groups represented in the debitage. Five raw material groups (4, 7, 8, 12, and 17) appear to primarily represent non-local materials. An additional nine raw material groups (1, 2, 3, 5, 6, 10, 11, 15, and 18) are of probable local origin. In general, the raw material procurement patterns indicate that non-local materials are over-represented in bifaces, points, and other tools relative to the number of non-local debitage. These patterns are consistent with the importation of non-local materials in an already reduced or finished form (i.e., bifaces, points, finished tools). In addition, the use of non-local materials also changes through time. Relatively low percentages of non-local materials are noted in the Early and Middle Archaic analytical units (4% and 3.6%, respectively). In contrast, the percentage of non-local materials more than doubles during the Late Archaic and Late Prehistoric periods.

The study of technological organization focused on two aspects of lithic technology, the composition of the tool assemblages and projectile point technology. Overall, expedient and minimally retouched tools dominate the tool assemblages. Formal tools, with the exception of projectile points, are infrequent. This aspect of the assemblage may be conditioned by the abundant availability of local materials and the even distribution of resource processing tasks within the broad-spectrum generalized foraging system practiced by the site's inhabitants. The large number of miscellaneous bifaces in contrast to the cores and projectile points present within the analytical units suggests that some tool manufacture may have been intended for purposes other than the on-site replacement of failed bifacial tools.

The analysis of the projectile technology indicates that there are significant differences in mean remnant blade length and the percentages of complete specimens within the Late Archaic and between the Late Archaic and Middle Archaic. Projectile point use tends to be relatively intensive around the end of the Late Archaic but it tends to exhibit a move toward greater preventive maintenance and less intensive rejuvenation during the earlier portion of the Late Archaic and the Middle Archaic. These patterns suggest that projectile technology and hunting patterns were changing through time, likely in response to changes in resource type and structure.

Finally, while the lithic assemblages discussed here derive from a type of site that is notorious for mixed contexts, and the materials were excavated over three decades ago, this analysis shows that productive research and new insights into prehistoric technology and human behavior can be gained from working with such materials.

# Chapter 9: Exploration of Feature 3
# A Possible Late Prehistoric Structure at Millican Bench

**Harry J. Shafer, Steve A. Tomka, and Raymond P. Mauldin**

In summarizing the data recovered from Millican Bench in Chapter 5, we briefly reviewed the characteristics of Feature 3, the possible Late Prehistoric structure. A more detailed consideration and analysis of the evidence will be presented in the second part of this chapter. However, because the excavations occurred more than 30 years ago, we felt that relying purely on the archeological evidence at hand may severely limit the analytical potential of this possible structure. In consultation with TxDOT staff archeologists, it was decided that a more fruitful approach would consist of first summarizing the available ethnohistoric descriptions of residences and/or structures noted by early travelers among hunter-gathers inhabiting Texas and the surrounding regions. This information would, in turn, be used to define potential archeologically visible indicators of structures. Following the consideration of these two topics, we then summarize the existing evidence for archeologically excavated features interpreted as structures in the state. In the last section of the chapter, we review the characteristics of Feature 3 to ascertain whether it could represent the remains of a habitation structure.

## Dwellings among Hunter-Gatherers

### Theory and Expectations

What kinds of land-use and subsistence strategies practiced among traditional societies result in the construction and use of features and facilities that can be interpreted as residences? In pursuing answers to this question, Flannery (1972, 2002) defined three general patterns within the ethnographic record: (1) hunter-gatherers that built circular huts; (2) horticulturalists that also built circular huts; and (3) horticulturalists that built and resided in rectangular structures. Interestingly, these three patterns appear to be exemplified within the Texas ethnohistoric record. Cabeza de Vaca describes the use of circular huts among some of the highly mobile groups he encountered in south Texas, while the southern and prairie Caddo horticulturalists were using more substantial circular huts at the time of the Spanish entradas and first French contacts (Martin and Bruseth 1987; Perttula 1999; Peter and McGregor 1988). Finally, the Pueblo-like horticulturalist societies in the Jornada (Whalen 1980) and La Junta regions (Kelley 1986:72–77) constructed rectangular dwellings.

Although a multitude of constructed and naturally occurring facilities are likely to be used among hunter-gatherers as shelters, how substantial and durable a structure is may depend on the anticipated length of time the structure is to be used (Kent 1991:42; Smith 2003). Anticipated mobility may in turn be influenced by several factors including the abundance of foods within the area and perhaps factors such as group size and composition (Diehl and Gilman 1996). Therefore, it is likely that the architecture of highly mobile people exploiting a broad spectrum of low-productivity seasonal resources may be virtually invisible archeologically. However, the presence of highly productive r-selected resources (see Pianka 1970) and/or new technological means to intensively exploit such resources may lead to longer periods of seasonal sedentism within certain resource patches (c.f. Flannery 1969, 1986; Henry 1985), construction of more durable architecture, and greater archeological visibility. We would expect shelter use to be ubiquitous among hunter-gatherers. However, if the above generalizations are applicable, we would expect shelters to be more durable and of higher archeological visibility in regions of the state characterized by highly-productive r-selected resources (e.g., acorns, pecans) and succulents (prickly pears), and/or in areas where a variety of resources co-occur to form highly varied but productive resource patches. Portions of central Texas, south-central Texas, and perhaps the Lower Pecos may have offered such resources or combinations of resources as suggested by the apparent "broad spectrum" adaptation (Collins 1995:387–389) and of incipient territoriality characteristic in these regions (Hall 1998).

### The Ethnohistoric Evidence: Texas and the Surrounding Region

While we offer some general expectations related to the use and archeological visibility of structures across the state, the primary archeological challenge of recognizing what archeological features represent shelters as opposed to other facilities (e.g., windbreaks, outdoor activity areas) still remains. In this section we provide an overview of ethnohistoric mentions of structures among hunter-gatherers in Texas and surrounding regions. From this overview, we derive a summary of the potential archeological indicators of structures that may aid in identifying the nature of Feature 3 at 41TV163.

Fleeting references to architecture among hunter-gatherers of Texas and adjacent regions to the south and west provide only a hint of how these people lived (Berlandier 1969; Campbell 1988; Foster 1998; Griffen 1968; John 1989; Newcomb 1961; Ricklis 1988, 1994b; Wade 2003). For example, in the north-central Texas prairies, substantial circular structures with implanted posts were constructed in historic times among Caddoan speaking Wichita groups (Berlandier 1969:42–47; Davis et al. 1967; Newcomb 1961: 255; Smith et al. 1993). These structures, grouped into small villages, were occupied by groups who practiced mixed hunting and gardening subsistence (Newcomb 1961:253, 254). The mobility practiced by such groups constrained them to fixed residences that in turn were linked to productive garden patches of domesticated resources.

In contrast to these residentially constrained mobile groups (Graham 1994), it is likely that the structures constructed and used by hunter-gatherers not dependent on domesticated resources were much less durable. Based on the earlier generalizations, it is possible that at least in certain seasons mobile hunting and gathering groups in Texas and adjacent areas in northern Mexico may have not constructed structures when establishing encampments, but rather simply used the shade of trees (Fowler and Fowler 1971:Figures 12 and 21; Griffen 1968:106, 107). This would be especially true for groups who occupied an encampment for only a few days. Temporary structures involving hardly more than pole frameworks arranged in a semi-circle and covered with brush, mats, or hides have been described ethnographically for many groups in Texas, the Southwest, and northern Mexico (Berlandier 1969:42, 43; Campbell 1988; Griffen 1968:106–107; John 1989:58; Newcomb 1961:43; 68; and illustrated by Fowler and Fowler 1971:Figures 12 and 21; see Figure 9-1). In some instances, these structures were collapsible and moved from camp to camp (Newcomb 1961:43, 68). In others, the ends of poles were stuck in the ground, bent, and tied with thongs (Newcomb 1961:68). Interiors were variously floored with mats, Spanish moss (where available), and skins. Hearths for warming and heating were placed in the approximate center or toward the entrance. Trash was discarded and apparently accumulated directly on the floors (De Mésières' description of Wichita houses in Bolton 1914:294; Dyer 1917 cited in Newcomb 1961:325).

Griffen (1968:106) reports on the various tribes and bands of seventeenth- and early-eighteenth-century Native Americans living in present-day states of Nuevo León, Coahuila, and Chihuahua. Apparently little information on specific house types is contained in the various Spanish archives reviewed by Griffen (Archivo General de la Nación, México, D.F.; Archivo de Hidalgo del Parral, Parral, Chihuahua; and Documentos para la Historía de México). Brief descriptions include skin-covered huts (jacales) of the Cocoyomes and Sisimbles, "little" huts (jacalillos) of the Salineros, and "small huts in the form of caves" (chosuelas a manera de cuebas) of an unnamed band (Griffen 1968:106). Kirchhoff (1944:138) similarly indicates that some hunter-gatherer groups in northern Mexico did not construct shelters but slept in the open or in caves. At least some hunter-gathers in Nuevo León erected beehive-shaped shelters covered with grass and these huts were grouped in semi-circles within camps. Saldivar (1943:12) also describes Tamaulipan hunter-gatherers as having no built shelters.

## Diagnostic Indicators of Prehistoric Structures

Based on the preceding review of the meager evidence, and supplemented by additional observations on hunter-gatherer site structure from the general hunter-gatherer literature, we may surmise that a mobile hunter-gatherer structure may possess one or more of the following elements: postholes or other indicators of superstructure elements; central hearths; wattle-impressed daub; burials; differential distributions of artifacts within and outside structures; activity area maintenance; and distinct household trash/ midden deposits. Any one of these elements could alert the archeologist to the possible presence of a structure.

### *Postholes and Other Indicators of Superstructure*

It is possible that dome-shaped huts constructed by the bending of poles together at the center of the hut may require the placement of poles into the ground or may require securing of the poles since lateral tension may otherwise force these poles apart. Such constraints may result in postholes and concentrations of support rocks encircling each post. The groupings of postholes and/or support rocks would tend to form an oval pattern. However, the poles of A-frame structures may be placed on the surface of the ground because little lateral tension exists on these elements to separate them under the weight of covers. In this case, at best only concentrations of support rocks may exist in association with each pole. The support stones may form a circular pattern. Exceptions to this pattern may exist under windy conditions since without the stabilization of support poles heavy winds may push over A-frame conical structures.

In addition, superstructure elements that consist of skins may require the support of the bottoms of the hides at ground level. This may be best accomplished by a series of rocks placed at regular distances from each other around the outer edge of the structure. Conversely, such support may be provided by a ring of soil piled on the skins around the outside of the structure.

Although the construction of windbreaks and "lean-to" facilities can result in postholes, it is likely that the arrangement of the holes and/or support rocks will not be in full circles and oval shapes but would rather be semi-circular in arrangement.

## Central Hearth Features

Although by no means a universal pattern (Yellen 1977), hearth features often occur within shelters built and used by hunter-gatherers (Fisher and Strickland 1991). Interior hearths may be necessary to keep warm during inclement weather and/or for food preparation when this cannot be accomplished outdoors. Depending on the extent of indoor activities, interior hearths may be rather small and circumscribed either within basins or stone-lined depressions to confine ash and charcoal and reduce the chances of accidental fires and injury. Because of frequent use, these interior hearths often contain white wood ash that is regularly cleaned and removed to refuse middens often located on the perimeter of camps (Fisher and Strickland 1991).

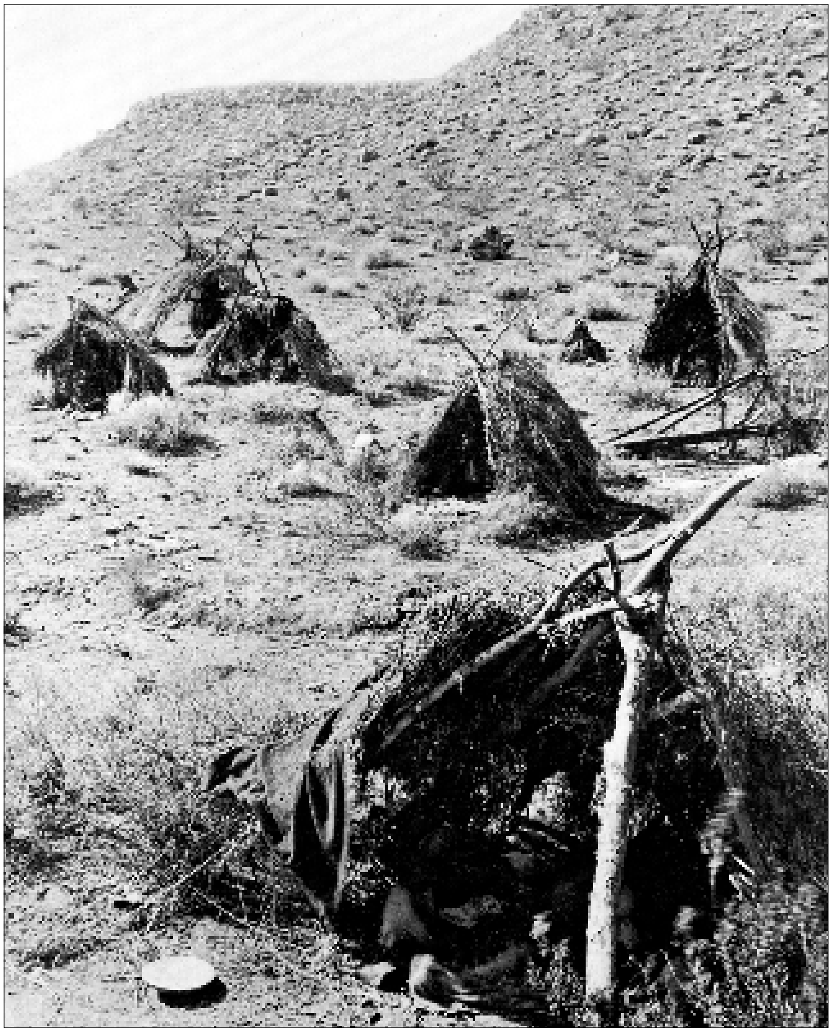

Figure 9-1. *Numa encampment of brush shelters near St. George, Utah, 1873.* (J. K. Hillars photograph, 1873; Smithsonian Institution, National Anthropological Archives, George V. Allen Photographic Collection, Photo Lot 90-1, No. 279.)

It is assumed that because these hearths are within circumscribed intensively used spaces, they would be systematically maintained and the space around them would be kept relatively free of refuse, charcoal and ash. Conversely, isolated outdoor hearths or hearths associated with windbreaks tend to be larger in size and use-related refuse tends to be less systematically removed due to less interference with hearth-associated and other activities. Because such hearths would tend to be the focal points for many activities including food preparation, consumption, and tool repair, it is likely that artifacts associated with these activities would be commonly found in the immediate vicinity of such outdoor hearths. A variant of outdoor hearths was described by Berlandier (1969) in proximity to structure entrances. These hearths were used during the summer to control insects.

Finally, indoor hearths may be distinguished from outdoor features based on their white ash content. It is suggested that indoor hearths provide a slow, complete combustion and reduce the fuel to a white ash. Outdoor fires, fed with ample oxygen, burn quicker and are more likely to leave dark ash and charcoal residue.

## Wattle-impressed Daub

It is not expected that highly mobile hunter-gatherers constructed shelters with wattle insulated walls unless they operated within a residentially constrained land-use system. Such labor output would be out of line with the length of anticipated site use under most subsistence strategies reliant on wild resources. It should, therefore, not be surprising that the use of clay as insulation in brush and grass-covered structures is documented ethnohistorically only among east Texas horticulturalists (Bell et al. 1967:320). When such structures burn, the clay is fired to create daub with stick and grass impressions. The existence of a structure is suggested by the presence of wattle-impressed daub (Brewington et al. 1995:54–56; Story 1965). Wattle-impressed daub was recovered at the Baylor Site in McClennen County (Story and Shafer 1965), and Shafer (personal notes) recorded a burned daub structure exposed in the bank of Elm Creek east of Troy, Texas in northern Bell County. La Harpe, in 1719, described Wichita houses constructed of grass and reeds and plastered with earth (Margry 1888:Part 6, 294–295, cited in Bell et al. 1967:320). De Mésières also mentions Wichita houses as being made of earth (Bolton 1914:294).

### *Burials*

Burials have not been characteristically associated with habitation space in central Texas except for rockshelters. The Late Prehistoric mortuary pattern generally involves isolated interments placed beneath rock cairns in a flexed or semi-flexed position in rockshelters or open-air sites. Formal open-air cemeteries were excavated at Loeve-Fox (Prewitt 1974) and Pat Parker (Greer and Benfer 1975). Sinkholes also were apparently extensively used throughout the karstic limestone region of the Edwards Plateau (Bement 1994; Benfer and Benfer 1981). Burials do occur within round structures in the southern Caddo area (e.g., Brewington et al. 1995; Good 1982; Kelley 1994).

### *Differential Patterns in Artifact Distributions Within and Outside Structures*

Because a variety of activities may be carried out within the confined space of a shelter, it is assumed that the floor surface is regularly maintained or swept to remove refuse that may interfere with the performance of activities. Whether such maintenance is simply the picking up of the larger trash by hand or the sweeping of the floor, it is likely that it will tend to result in the removal of the majority of the larger size classes of refuse. Either practice may leave behind the majority of a wide variety of small refuse that escapes notice or may be buried in the soft matrix of the floor. In addition, areas adjacent the wall of the structure may be incompletely cleaned because of interference from temporarily stored items. Therefore, it is expected that interior spaces surrounding hearths should be relatively free of large refuse and dominated by small debris. A range of debris sizes may be present at some distance from the central hearth indicative of debris accumulated against the wall of the shelter.

Outdoor activity areas immediately adjacent to structures should exhibit a wide variety of refuse, a range of refuse sizes, and general lack of maintenance, depending on the length of occupation and the nature of that outside use. Outdoor activity areas with hearths may exhibit a drop zone-toss zone refuse distribution pattern with minimal formal activity area maintenance (Binford 1978).

### *Household Middens or Sheet Scatters*

The patterns of household trash disposal vary according to site type and socio-cultural complexity. These patterns range from formally depositing trash in specifically designated midden deposits, informally sweeping trash off of residential platforms, to merely tossing trash adjacent to the activity area.

For hunters and gatherers, however, the situation is much different. Campsites are often temporary, and disposal of household trash and garbage is casual and in the immediate vicinity of the activity (Binford 1983:144–192). In outdoor activity areas, debris resulting from household activities is tossed away from the seated activity area forming a semi-circular or circular toss zone. When indoor or outdoor activity areas and/or facilities are maintained, the resulting debris is disposed of in proximity of the dwellings and on the perimeter of the camp (Fisher and Strickland 1991:Figure 2, 220). For rockshelters, this deposition often occurred out in front of the shelter, but not always (e.g., Henderson 2001). At Hinds Cave, extensive latrine deposits were found inside the sheltered area downslope from the main habitation area. Grass beds and white ash deposits were found in the main habitation area (Shafer 1986:97, 98; Shafer and Bryant 1977). Midden accumulations would be concentrated in the vicinity of the dwellings and at the periphery of the camp. With the absence of physical evidence for dwellings, the location of dwellings can be inferred by the presence and distribution of household trash, especially bone scraps, formal and expedient tools, and evidence of tool refurbishing (broken and discarded points and retouch debitage).

## Archeological Examples of Structures

Archeological evidence for hunter-gatherer structures is found across several areas of the state, from north-central Texas (Peter and McGregor 1988), the southern Plains (Boyd 1993), and the Trans-Pecos region (Mallouf 1999; Ohl and Cloud 2001; Seymour 2003; Turpin 1995). Unequivocal evidence from central Texas, however, is elusive. Features interpreted as structures have been documented at the Lion Creek Site (Johnson 1997), the Graham/Applegate Site (Hixson 2003), the Slab Site

(Patterson 1987), and the Turkey Bend Site (Lintz et al. 1995). Ash-filled central hearth features, postholes, and debris patterns were interpreted as evidence for structures at the Longhorn Site (Boyd 1993). Patterns of midden accumulation also have been used to argue the presence of structures at Buckhollow (Johnson 1994), Rowe Valley and Loeve-Fox sites (Prewitt 1982:188–208, 1984).

Johnson (1997) and Lintz et al. (1995) have provided summaries of extant data on possible house structures in central Texas and in the surrounding region. The summary of archeological examples of house structures follows the outline provided by Lintz et al. (1995). These authors define four types of archeological signatures indicative of structures. Type 1 structures lack physical evidence such as postholes, central hearth features, and cobble alignments. Instead, Type 1 structures are inferred on the basis of artifact and material distributions. Type 2 structures have posthole patterns, wall trenches, and central hearth features with ash. Type 3 structures consist of circular alignments of cobbles consistent with tipi or wiki-up rings documented historically. Type 4 structures consist of rock-paved central hearth features surrounded by rock piles or clusters. Archeological examples of each of these proposed structure types will now be presented.

## *Type 1*

Artifact scatters on possible living surfaces presumed to be the locations of structures have been posited by Johnson (1994) at Buck Hollow and Prewitt (1982, 1984) at Rowe Valley and Loeve-Fox sites. In each case, the assumption is based on the distribution or scatter of bone, debitage, and ceramic sherds in proximity to large, stone-paved hearths. At the Currie Site, Treece et al. (1993a) describe five "family" hearths located near a large, stone-paved hearth. Johnson (1994:264) interprets this as indicative of five family occupied structures sharing a large communal hearth feature. Type 1 structures might simply include brush arbors or shade trees used for summer camps. Examples of these types of warm-season camps are documented by J. E. Powell among the Kiabab Paiute and illustrated in Figures 12 and 21 in Fowler and Fowler (1971; Figure 9-2).

## *Type 2*

Evidence in the form of postholes, wall trenches, ash-filled central hearth features, and wattle-impressed daub identify Type 2 structures. Postholes have been documented at the Cobb-Pool (Peter and McGregor 1988), Bird Point Island (Martin and Bruseth 1987), and Hurricane Hill sites (Perttula 1999). Wall trenches were documented at the Rocky Branch (Treece et al. 1993b) and Currie (Treece et al. 1993a) sites at O.H. Ivie Reservoir. Also, postholes that may be associated with structures have been recorded at the Zapotec Site (41HY163; Garber 1987), the Means Site (41NU82; Ricklis and Gunter 1986), the McKenzie Site (41NU221; Ricklis 1988), and the Longhorn Site (41KT53; Boyd 1993). Only at Lake Joe Pool and Cooper Reservoir did these postholes form circular patterns identifiable as houses (Peter and McGregor 1988).

## *Type 3*

Circular alignments of cobbles or tipi rings marking the location of structures have been documented at the Squawteat Peak Site, Pecos County (Young 1981), in the lower Pecos River region (Turpin 1995), and in the upper Colorado River area of west-central Texas (Shafer 1967:Figure 5). Infierno Complex structures are described as "tipi rings" (Turpin 1995), and consist of circular or oval rings of cobbles, sometimes paired. Only one structure has been excavated, and was found to contain no internal features. In each case, the structures are located on promontories located near a water source, with as few as one to over 100 structures. A tipi ring was recorded at 41CK65 in the Robert Lee Reservoir basin during the course of an archeological survey (Shafer 1967:Fig. 5).

## *Type 4*

Two Late Prehistoric, and possibly related, archeological complexes were defined for this cultural pattern. The Cielo Complex is defined west of Big Bend (Mallouf 1999; Ohl and Cloud 2001) and the Cerro Rojo site is in the Hueco Mountains (Seymour 2003). As with the Infierno Complex, these sites also are located on promontories near water.

Cielo Complex structures occur singly or in clusters of 20 or more. These structures are small with circular to oval stacked stone house foundations with interior diameters varying from 1.7 m to 3.4 m. No preparation was evident in shaping the stone used in construction. Presumably the purpose of the stones was two-fold: to anchor the pole framework on a landscape devoid of soil, and to aid in deflecting the wind when the structures were occupied. In each case, the settlements were established on elevated landforms with extended views of the horizon. Such locations were windy, and some effort was made to anchor the base of the structures for stability. Cielo Complex site material culture includes Perdiz arrow points, ceramics, end scrapers, and beveled knives.

Figure 9-2. *Southern Paiute encampment near Kanab, Utah, in 1873, showing the use of a shade tree for a temporary encampment. The image is from Fowler and Fowler 1971:Figure 21 and entitled "Summer Home Under a Cedar Tree."* (J. K. Hillars photograph, 1873; Smithsonian Institution, National Anthropological Archives, Bureau of American Ethnology Collection, BAE GN 10600A 06279100.)

Cerro Rojo is an unusually large promontory that contains 275 structural features. These range from circles of stacked slabs, circles of cobbles or small boulders, circles of smaller stones resembling tipi rings, and structure clearings. The material culture associated with these structures includes Soto, Harrell, and triangular arrow points, bi-pointed bifacial knives, flake awls, and various plain wares (Seymour 2003). The structures at Cerro Rojo occurred isolated and in clusters, but no particular village pattern was observed. These material assemblages did vary from one part of the promontory to another, suggesting to Seymour (2003) that the site was multi-ethnic, occupied by both Apache and Manso.

None of the examples reviewed above describe the kinds of features documented at Lion Creek (Johnson 1997), Slab (Patterson 1987), and Turkey Bend Ranch sites (Lintz et al. 1995). Because these interesting and perplexing features are described as structures, and date anywhere from the Early Archaic to the Late Prehistoric, a brief overview of this feature type is provided.

Johnson (1997) describes one possible and two suspected prehistoric structures at the Lion Creek site in Burnet County. "House 1" consisted of a very large rock-lined thermal feature approximately 2 m in diameter surrounded by a cleared space approximately 1 m wide. The cleared space was defined by an oval concentration of stones measuring approximately 5 m in diameter. The oval concentration was not a continuous line of stones, but rather was a series of clusters arranged in an oval pattern. The clusters measured up to a meter across in places. This structure was dated to the Late Archaic (Pedernales interval) based on diagnostics associated with the feature.

"House 2" was less well-defined in Johnson's view, but was very similar to "House 1." This feature was smaller that "House 1" as was its central hearth feature. The central hearth feature was basin-shaped and lined with sandstone slabs; it measured from 1.0 m to 1.2 m in diameter, and was again surrounded by an open space averaging about 1 m wide. A circular arrangement of some eight clusters of stones surrounded the open space. Johnson was unable to provide a convincing date for the feature, but assigned it to the Middle Archaic Nolan interval based on a preponderance of Nolan points from the matrix surrounding the feature.

"House 3" yielded the only radiocarbon date from any of the suspected house features. This one-sigma date was A.D. 982–1045, consistent with the Scallorn arrow points associated with the structure. This feature, like those mentioned above, consisted of a large, rock-lined central thermal feature surrounded by an open space. The open space was defined by an oval pattern of 11 rock clusters, with an additional rock-lined thermal feature and rock clusters north of the main feature. The central hearth feature measured about 1.5 m in diameter. The feature, or house outline, was slightly under 5 m east-west and slightly over 5 m north-south.

A similar feature, albeit Early Archaic in age, also interpreted as a structure, was recorded at the Turkey Bend Ranch Site (41CC112) by Lintz et al. (1995). This feature measured approximately 5 m by 6 m and consisted of a very large rock-paved hearth feature surrounded by a 1-m-wide, donut-shaped path containing at least two small rock concentrations. Beyond this path was a circular pattern of intermittent clusters which Lintz et al. (1995) took to be anchors for posts.

Recent investigations at the Graham/Applegate Site (41LL419) conducted by the Llano Uplift Archeological Society (Hixson 2003) revealed four features similar to those reported at the Lion Creek and Turkey Bend Ranch sites. Hixson follows the lead of Johnson and Lintz and classified these features as "houses," and concludes that they fit Lintz et al.'s (1995) Type 4 structure. The features at Graham/Applegate probably date to the Late Prehistoric.

Patterson (1987) has argued that features at the Slab Site, similar to those at Lion Creek and Turkey Bend, also were the remains of structures. Other similar features have been documented at Lake Buchanan in Llano County (Johnson 1997:58, 59).

A common element to each of these donut-shaped features and presumed structures at the Slab Site, Lion Creek, Turkey Bend, Graham/Applegate, and Lake Buchanan sites is a large, slab-lined central rock feature. The central rock features are surrounded by a cleared space outlined by clusters of rock concentrations or smaller thermal features. Lintz et al. (1995) argue that these cobble concentrations were placed to anchor posts. Alternatively, these may have been work stations used by various family groups involved in the use of a communal central rock feature (Johnson 1997:32). The pattern of these structures is certainly intriguing. That such a pattern occurred over such a long period of time (from the Early Archaic at the Turkey Bend Site to the Late Prehistoric—"House 1"—at the Lion Creek Site) suggests that these features were the result of rather highly structured behaviors that must have provided some adaptive advantages. However, they can hardly be interpreted as structures for the simple reason that the heat from such large thermal features would preclude human presence when activated, especially if it was used as an earth oven as Johnson (1997:32, 33) hinted.

Instead, the donut-shaped features fit precisely the structure of the "outside hearth model" for hunter-gatherers described by Binford (1983:Figure 89, 158). In each of these cases, the hearth feature was surrounded by a cleared space that was used as the work area. A toss zone lay outside of the cleared area, creating a donut-shaped concentration. If indeed these central rock features were fired up within an enclosed brush structure, the structure would surely burn and anyone inside would be charred from the heat generated, a point that apparently bothered Johnson (1997:32, 33). In all likelihood, the donut-shaped thermal features are the foundations or centers for burned rock middens. Many burned rock middens have large, central hearth features identical to those reported in each of the donut-shaped features as a central or underlying element. The Higgins Site is an excellent example (Black et al. 1998a:Figure 61a). Features at Lion Creek, Turkey Bend Ranch, Graham/Applegate, and other reported sites may be single-use localities for the same structured activities that were repeated and resulted in burned rock middens at other localities such as Higgins Site.

## Feature 3: The Possible Structure at 41TV163

As outlined in Chapter 5, Feature 3 was a possible structure located in excavation Area C. The feature was marked by a roughly circular pattern of medium-sized cobbles. The circular pattern was roughly 2.4–3 m (8–10 ft.) in diameter. As shown in Figure 9-3, the feature was bisected with the excavation of the backhoe trench through this area. The pattern of stone did not become apparent until manual excavations exposed the cobbles in Level 2 (0.5–1.0 ft. below surface). The feature was encountered in portions of units S185/E155, S185/E160, S175/E155, and S175/E160, with the approximate center of the proposed structure at S183/E155.

The pattern of cobbles appeared intact and no evidence of significant disturbance was noted according to Frank Weir (personal communication 2002). A cobble scree deposit (Feature 4), originating from the bench above the terrace, caps the back part of the terrace that contained the feature. In pursuit of the possibility that the cobble alignment may be fortuitous and part of this scree deposit, photographic archives were examined closely along with an interview with Weir regarding his recollections. Weir recalled that the area of the alignment was suspicious because the area appeared to have been cleared of cobbles. In Weir's opinion, the pattern was not fortuitous. As discussed in Chapter 5, two additional features, numbers 7 and 9, may represent the continuation of the scree deposit to the east.

The deposits that contained the possible structure yielded predominately Late Prehistoric Scallorn arrow points, though some Late Archaic materials, including Darl and

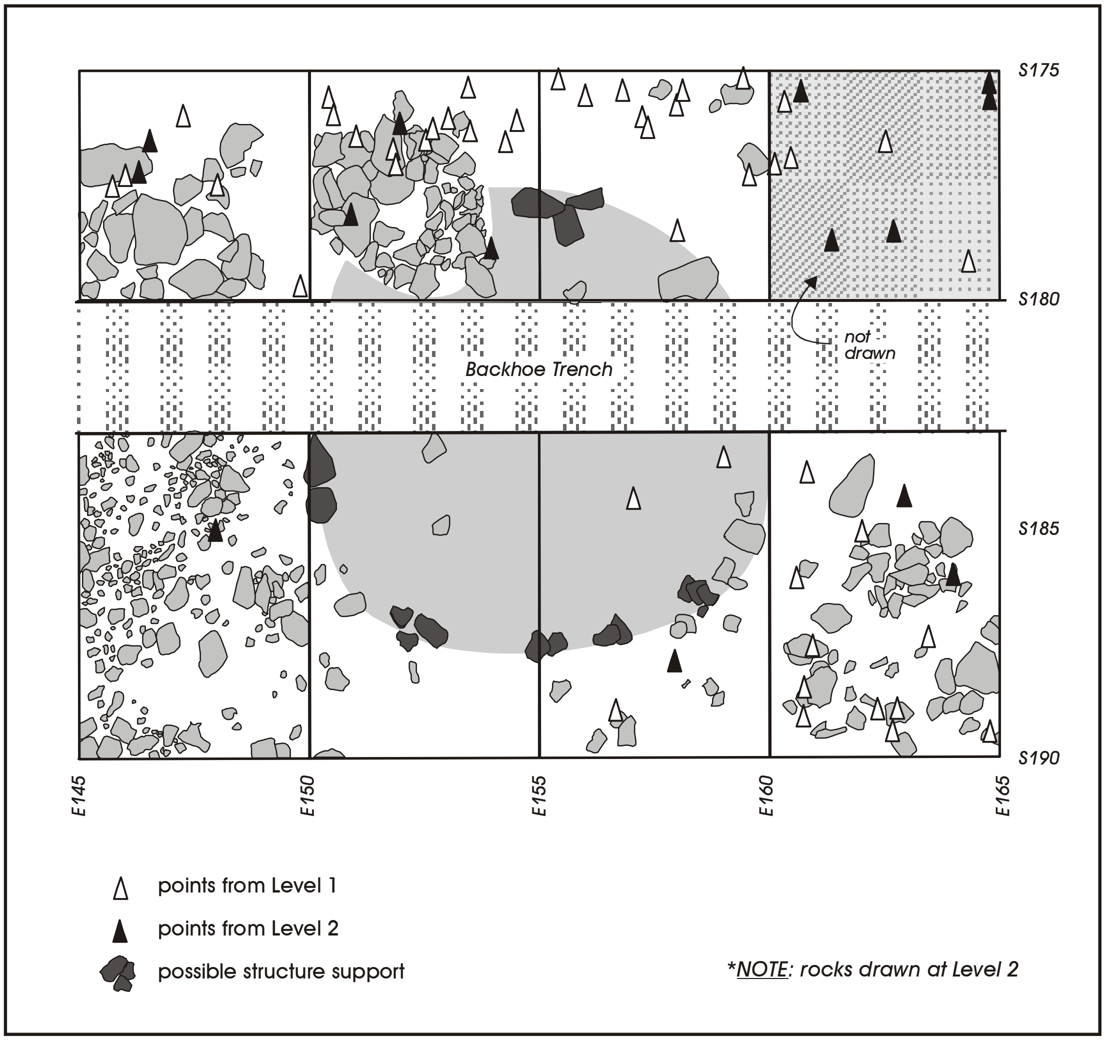

Figure 9-3. *Feature 3 at 41TV163.*

Fairland dart points, were also recovered. A radiocarbon date obtained soon after the 1970–1971 excavation, TX #1511, was from a sample collected just outside of this structure at Level 2 in unit S175/E155. This uncorrected date calibrates to A.D. 1310–1490. As discussed in Chapter 5, CAR obtained an additional date, from Level 1 (0–0.5 ft.) of square S175/E160 (see Table 5-4; UGA #12305). That calibrated, corrected date had a two-sigma range of A.D. 1300–1430. A second CAR obtained date, UGA #12306 from Level 1 of S185/E160 returned a modern date. The within-unit provenience of these two dates, however, is not known, and it is unclear if either the modern date, or the A.D. 1300–1430 date, was from within the structure. Nevertheless, two Late Prehistoric dates, along with the predominance of Late Prehistoric points, suggests that the feature was probably used during the Late Prehistoric period, although earlier dart points are present at low frequencies.

## Evidence of a Structure

Does this feature represent the remains of a structure? As outlined previously in this chapter, our review of ethnographic, ethnohistoric, and archeological occurrences of structures suggests several elements that might be expected to be present in some situations with structures. In the case of the hunting and gathering adaptation represented at 41TV163, we expect that a structure, if present, would be circular in form. In specific structures, and depending on the season of occupation, environmental conditions, and abandonment context, we might also expect one of more of the following elements: (1) postholes or rock supports; (2) a central hearth, possibly with distinctive ash deposits; (3) presence of chunks of wattle and daub; (4) a maintained living surface within the structure; (5) higher artifact densities around the structure; (6) presence of burials associated with the structure; (7) associated trash midden deposits; and (8) associated outside features or activity areas. We briefly consider each of these below in the context of Feature 3.

Feature 3 does have several of these attributes. The feature is round, and was defined on the basis of an apparently cleared area of stone. This suggests some potential for a maintained surface. In addition, while no postholes or floors were defined during excavation, the feature may have evidence of rock supports, suggested by several smaller concentrations of stone (shown in black on Figure 9-3) that outline the feature. A human burial, Feature 10, was beneath the feature. There was a dense concentration of debris, including bone, charcoal, and stone, in the immediate area of the feature, along with several additional features that could represent an outside activity area.

The feature also lacks several of these attributes, including wattle and daub remains and evidence of postholes. There was no central hearth feature, though the backhoe trench, which destroyed a significant section of the central area, could have removed all evidence of such a central feature. A closer look at those attributes that are present also suggests that the evidence for their association with Feature 3 is tenuous. Feature 10, the burial, probably predates the possible structure by roughly 800 years suggesting that at least two overlapping activity episodes may be responsible for the spatial patterns. Based on the radiocarbon dates and the distribution of diagnostic points, all of the associated features, as well as much of the accumulated trash midden deposits, seems to predate the feature. When seen in full, we are primarily left with two sets of remains—the clustering of rocks along the feature outline that may reflect supports for posts and the apparent cleared area within the feature.

While we are unable to assess the validity of the post supports, additional information on the maintained surface is available from two sources, the point-provenienced information on some artifacts and the size of artifacts recovered in squares that are predominantly inside and outside the feature. Figure 9-3 shows the distribution of projectile points in Level 1 (white) and Level 2 (black) for the four squares containing the feature, as well as four squares surrounding the feature. These data were taken from a drawing and notes on the artifact bags. While not all points were recorded in this manner, the distribution does suggest that most points from both levels were located outside of the structure. Within the confines of Feature 3, only three points were present, and the drawing suggests clusters of points to the north and southeast of the feature. This pattern is consistent with the idea of the feature area representing a maintained space, with larger artifacts removed to the boundaries of the feature.

Additional information on this topic is presented in Table 9-1. Here we present information on the number and size of artifacts in Levels 1 and 2 for the eight units shown in Figure 9-3. For the purpose of this discussion, squares are either assigned to outside of the feature (n=4) or inside of the feature (n=4). That is, no designation of within feature was made for the artifacts collected. Consequently, even though, as shown in Figure 9-3, much of S175/E160 is outside of the structure, we consider all artifacts from this square as being within Feature 3. Artifact size was obtained by using a series of nested screens with ¼-, ½-, and 1-inch mesh. Over 8,900 items were present in the two levels from these eight squares. We suggest that if the area of Feature 3 represents a maintained surface, then (1) squares classified as being within the proposed structure should have lower artifact frequencies relative to the surrounding squares; (2) artifacts in the two largest size grades (>/=1 inch, ½–1 inch) should have a much lower frequency within the feature relative to surrounding squares, and this should especially be the case for the larger size grade; and (3) items in the smallest size grade which consisted of small flakes that passed through the ¼-inch mesh after several minutes of shaking the screen, should have either a lower frequency within the possible structure, or a roughly equivalent density, when compared to outside units. That is, we expect that these smaller flakes would be increasingly likely to be missed by maintenance activities.

Turning first to overall frequency, the external squares have 4,758 items, a density of roughly 1,196 items per square. Within-structure frequency is lower, with an overall total of 4,148 items and a density of 1,037 items per square. While these differences are slight, they do trend in the anticipated direction. Artifacts in the 1 inch or greater size range also are more common outside of the feature with a density of 14.75 per square compared to 12 within the feature. Artifacts in the ½–1 inch size range also pattern as anticipated, with an average of just over 113 items per external square, and

Table 9-1. The Distribution of Artifacts, by Size, In and Around Feature 3

| South | East | Level | Total Artifacts | ≥1inch | 0.5–1 inches | < 1/4 inch | Location |
|---|---|---|---|---|---|---|---|
| 175 | 150 | 1 | 992 | 28 | 203 | 105 | out |
| 175 | 150 | 2 | 289 | 15 | 98 | 14 | out |
| 175 | 165 | 1 | 696 | 20 | 156 | 57 | out |
| 175 | 165 | 2 | 412 | 12 | 77 | 28 | out |
| 185 | 150 | 1 | 446 | 13 | 123 | 37 | out |
| 185 | 150 | 2 | 128 | 1 | 19 | 13 | out |
| 185 | 165 | 1 | 1216 | 20 | 173 | 340 | out |
| 185 | 165 | 2 | 579 | 9 | 58 | 175 | out |
| 175 | 155 | 1 | 1194 | 26 | 177 | 173 | in |
| 175 | 155 | 2 | 610 | 14 | 133 | 88 | in |
| 175 | 160 | 1 | 1164 | 24 | 201 | 138 | in |
| 175 | 160 | 2 | 371 | 10 | 131 | 25 | in |
| 185 | 155 | 1 | 192 | 6 | 56 | 11 | in |
| 185 | 155 | 2 | 74 | 3 | 14 | 2 | in |
| 185 | 160 | 1 | 451 | 11 | 103 | 47 | in |
| 185 | 160 | 2 | 92 | 2 | 28 | 5 | in |

105 items per internal square. However, the density of smaller items does not follow the anticipated pattern. In this size grade, just over 96 items per square were present outside of the feature, while 61 items per square were present within the feature. While several of the data sets trend as predicted, the overall pattern is not strong, and the patterning in the smallest size range is counter to expectation.

Does Feature 3 reflect a structure? We do not know. No direct evidence for a superstructure, in the form of postholes or pieces of wattle and daub, are present. And, while the concentrations of rock may reflect post supports, it is just as probable that they do not. A central hearth could have been present, but given the location of the backhoe trench, we cannot confirm that it was, or was not, there. We can suggest that there is a moderate possibility, based on the lack of large cobbles, the projectile point distributions, the lower overall artifact densities, and the lower densities of larger-sized items, that the area identified as Feature 3 represents some sort of maintained space. This suggestion is of some interest, in that maintenance of space certainly suggests that occupation at 41TV163 during the Late Prehistoric period was probably of a different character than earlier use of the site.

## Summary

The archeological evidence that Feature 3 was, in fact, the outline of a structure is inconclusive. As both the ethnographic and ethnohistorical overviews suggest, it is likely that hunters and gatherers occupying sites such as 41TV163 had structures, at least during some portion of the year. However, the archeological visibility of these features would have been extremely low. Our review of the evidence does suggest that it is possible that Feature 3 represented some sort of maintained location. This, in itself, is of interest, for this suggests that either the length of occupation or perhaps the nature of the occupation at site 41TV163 during the Late Prehistoric was substantially different than during earlier uses of the site.

# Chapter 10: Summary and Conclusions

### Steve A. Tomka and Raymond P. Mauldin

## Report Summary

The Center for Archaeological Research (CAR) at The University of Texas at San Antonio, under contract with the Texas Department of Transportation (Work Authorization #57014PD004), conducted an inventory and assessment of the archeological collections and documentation associated with site 41TV163, located in north-central Travis County, Texas. The excavations at the site were conducted between September of 1970 and February of 1971 under the direction of Frank Weir, then of the Texas Highway Department. The excavation is of historical interest, as 41TV163 was the first archeological site excavated by the then Texas Highway Department (THD) under their archeological program established in 1970 in an effort to comply with the National Environmental Protection Act (NEPA).

The inventory of collections, and the assessment of the documentation were conducted in 2002 (Mahoney et al. 2003a). Based on that assessment, and in consultation with TxDOT Environmental Division staff, a series of possible research questions were developed that could be pursued with the site data. Following agreement on the general research directions and specific analyses, CAR was instructed to produce a final report and to prepare the project material for permanent curation. This document constitutes the final report on the TxDOT work at 41TV163. Included in this report are a description of the site, excavation procedures, and an analysis of cultural materials collected from selected components.

The initial three chapters of this document provided background to the project, including an overview of the physical and cultural setting of the site. Chapter 4 outlined the field and laboratory methods used in 1970–1971 and 2002–2003, and Chapter 5 provided a summary of the data recovered in 1970–1971. Chapter 6, which summarized aspects of the research perspective, also identified several analytical units. Based on the distribution and clustering of diagnostic projectile points, and supported by recently acquired radiocarbon dates, four different analytical units were identified. These analytical units covered four temporal periods, spanning much of the known prehistoric sequence from Early Archaic through the Austin Phase of the Late Prehistoric. While the quantity and type of data varied, these analytical units were subsequently used to address a series of contemporary research questions. Chapters 7 and 8 addressed two diachronic research topics, changes in subsistence practices and changes in chipped stone technology. Chapter 9 addressed a synchronic research topic, the evaluation of Feature 3, a possible structure within the Late Prehistoric analytical unit defined at the site.

Chapter 7 used primarily faunal data from the Late Prehistoric Austin Phase analytical unit and assemblages from the Late Archaic analytical units to investigate changes in subsistence. Operating from the perspective of optimal foraging theory, we outlined a series of expectations regarding the potential impact of changes in the availability and density of higher-ranked bison on the diet. These expectations were partially supported by the 41TV163 data, as we found evidence for both a slight increase in the number of genera during the Late Prehistoric Austin Phase, when bison were absent or at low densities, and the Late Archaic, when bison were more common. We also found some support for differences in the frequency of fresh bone breakage, with bone processing occurring more often in the Late Prehistoric material. We then conducted a regional comparison using faunal material from a number of sites. While hampered by the quality of available data at this regional scale, our analysis shows that when bison constitutes a large proportion of the faunal remains within an assemblage, the number of genera represented tends to be low. Conversely, when assemblage elements are primarily derived from small to very small prey species, the numbers of genera tends to be high. These patterns are consistent with our expectation, but they do not seem to hold for the period level (e.g., Early Archaic, Late Archaic). That is, the analysis suggests that variation rather than homogeneity in subsistence characterized any given period.

In Chapter 8, we examined several aspects of chipped stone technology. Using data from the Early, Middle, and Late Archaic, along with information from the Late Prehistoric, we focused on documenting two aspects of the lithic technology, raw material procurement and technological organization. To reconstruct raw material procurement strategies, we attempted to identify local relative to non-local tool stone based on a series of variables. While hampered by the lack of a geological survey, we suggested that five raw material types, identified primarily on the basis of color, appear to represent primarily non-local stone. Nine other raw material types appear to be dominated by local stone. The raw material patterns indicate that non-local materials are over-represented in bifaces, points, and other tools relative to the number of non-local debitage. These patterns are consistent with the importation of non-local materials in an already partially reduced or finished form (i.e., bifaces, points, finished tools). In addition, relatively low percentages of non-local materials were noted in the Early and Middle Archaic analytical units, while relatively high percentages of non-local materials were present during the Late Archaic and Late Prehistoric periods. The study of technological organization focused on two aspects of the assemblage, the composition of the tools and an investigation into projectile point technology. Overall, expedient and minimally retouched tools dominate the tool assemblages. Formal tools, with the exception of projectile points, are infrequent. We suggested that these patterns may be conditioned by the abundant availability of local materials and the even distribution of resource processing tasks. We also suggested that some on-site production of tools was probably intended for purposes other than the on-site replacement of failed bifacial tools. Finally, the analysis of the projectile technology indicates that there are significant differences in mean remnant blade length and the percentages of complete specimens within the Late Archaic and between the Late Archaic and the Middle Archaic. Projectile point use tends to be relatively intensive around the end of the Late Archaic but it tends to exhibit a move toward greater preventive maintenance and less intensive rejuvenation during the earlier portion of the Late Archaic and the Middle Archaic. These patterns suggest that projectile technology and hunting patterns were changing through time in likely response to changes in resource type and structure.

In Chapter 9, we investigated the possibility that Feature 3 was a house structure. After a review of both the ethnographic and ethnohistorical discussions of structures, we outlined several characteristics that hunting and gathering structures might possess. We then assessed the Feature 3 data in that context. While we were unable to confirm that the feature was a structure, we can suggest that the feature may represent some sort of maintained area. The presence of this maintained area suggests that either the length of occupation, or the nature of the occupation, at site 41TV163 during the Late Prehistoric may have been substantially different than use of the site during earlier periods.

## Conclusions

In each of the three analytical chapters, we struggled with using old data, collected for different purposes and collected with different methods, to address modern questions. For example, our investigation into subsistence in Chapter 7 was limited primarily to faunal remains as flotation samples were not routinely collected in Texas in the early 1970s. Our investigation of lithic technology necessarily operated at the period (e.g., Early Archaic, Late Archaic) level as the collection of data in six-inch levels simply did not allow us to more finely separate these long blocks of time into finer units. The resulting conclusions of this investigation, then, were somewhat limited due, in part, to the fact that the site was excavated some three decades ago.

The age of the excavations provided two different yet related challenges. On the one hand, we were faced with the challenge of compiling and reviewing all of the artifacts and records produced by the excavations to reconstruct what was done at the site, what had been recovered, how it was recovered, and where it was recovered. This challenge is not unlike that faced by any project archeologist returning from a field season full of notes, photographs, profiles, and boxes of artifacts and samples. What compounded this first challenge for us is that the field methods employed were unlike those in use today and would not be appropriate for addressing fine-scale research issues. This was further complicated by the fact that many of the detailed field notes were lost shortly after the completion of the excavation.

Perhaps the more interesting challenge was that of defining research topics that were relevant to contemporary hunter-gatherer investigations while using collections excavated for the purpose of investigating culture historical concerns of the late 1960s and early 1970s. In our initial assessment of the excavations, we were overly critical of the methods employed. Fortunately, two of the collaborators on this project, Dr. Shafer and Dr. Weir, quickly helped us realize that in the 1960s and early 1970s, six-inch levels and large mechanical excavations were a proven standard in Texas. Many of these methods grew out of the large-scale excavation projects sponsored by the WPA. It was, after all, these excavation projects that provided a wealth of material that laid the foundation for subsequent archeological studies in the state. Finally, we should recall that while current archeological investigations are research design oriented and data recovery plans dictate the kinds and quantities of artifacts to be recovered to address specific research questions, the excavations of the 1960s and early 1970s in the state clearly had different goals. Archeologists working in Texas were wrestling with issues of chronology and culture history building, and gathering the basic building blocks of this framework. Radiocarbon dating was not widely used and one of the biggest challenges faced by archeologists in this period was to define some temporal framework that would allow the ordering of the large quantity of materials. In that context, it is no surprise that the principal goal of the Millican Bench excavations was to confirm the broad outlines of the regional chronology and perhaps even help divide it into finer units through the excavation of a deeply stratified central Texas site. In the end, we used their data for a different purpose than they intended. While limited at times, our results do suggest that old collections, collections gathered under different theoretical goals and using different methods, can be used to successfully investigate current research questions.

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# Appendix A

# Vertebrate Faunal Remains

## Table A-1. Composition of Faunal Assemblages Employed in the Comparative Faunal Analysis Section of Chapter 7

| | | | | Archeological Sites/Components | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Taxa | 41TG346 Toyah | 41HY209-T Toyah | 41HY209-M Toyah | 41HY202-A Toyah | 41HY209-T Austin | 41HY209-T LA | 41HF128 LA | 41MM340 LA | 41HY202-A LA | 41WM230 LA | 41WM267 LA | 41WM56 LA | 41LK28 MA |
| **Class** | **Order** | **Family** | **Genus/species (common name)** | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count |
| **Mammalia** | **Artiodactyla** | | | | | | | | | | | | | | | |
| | | Antilocapridae | *Antilocapra americana* (pronghorn antelope) | | 475 | 10 | | 3 | 2 | | | | 2 | 2 | 7 | |
| | | Bovidae | *Bison bison* (bison) | 11,022 | 188 | 288 | 48 | 3 | 6 | 20,160 | 315 | 136 | 5 | | 8 | |
| | | Cervidae | *Odocoileus virginianus* (white-tailed deer) | | 947 | 100 | 14 | 11 | 12 | | 149 | 2 | 235 | 175 | 121 | 112 |
| | | Tayassuidae | *Pecari (Dicotyles) tajacu* (peccary) | | | | | | | | | | | | | |
| | **Carnivora** | | | | | | | | | | | | | | | |
| | | Canidae | *Canis* sp. (dogs, wolves, coyotes) | | | | | | | | 29 | | 12 | 10 | 3 | 6 |
| | | Canidae | *Canis latrans* (coyote) | | 1 | 3 | | 3 | 1 | | | | | | | |
| | | Canidae | *Canis lupus* (gray wolf) | | | | | | | | | | | | | |
| | | Canidae | *Urocyon cinereoargenteus* (gray fox) | | | | | | | | 1 | | | | | |
| | | Felidae | *Felis concolor* (mountain lion) | | | | | | | | | | | | | |
| | | Felidae | *Felis rufus* (bobcat) | | | | | | | | | | | | | |
| | | Mustelidae | *Mephitis mephitis* (striped skunk) | | | | | | | | 1 | | | | | |
| | | Mustelidae | *Conepatus mesoleucus* (hog-nosed skunk) | | | | | | | | 5 | | | | | |
| | | Mustelidae | *Taxidae taxus* (badger) | | | | | | | | | | | 3 | | |
| | | Procyonidae | *Procyon lotor* (raccoon) | | | | | | | | 3 | | 1 | 3 | | |
| | **Insectivora** | | | | | | | | | | | | | | | |
| | | Soricidae | *Cryptotis parva* (least shrew) | | | | | | | | | | 8 | | 1 | |
| | | Talpidae | *Scalopus aquaticus* (esatern mole) | | | | | | | | | | | | | |
| | **Lagamorpha** | | | | | | | 3 | | | | | | | | |
| | | Leporidae | *Lepus californicus (* black-tailed jackrabbit*)* | | 15 | 2 | | | 1 | | 67 | | 6 | 19 | 12 | 181 |
| | | Leporidae | *Sylvilagus* audubonii (desert cottontail rabbit) | 1 | | | | | | | 73 | | 41 | 43 | 45 | 128 |
| | | Leporidae | *Sylvilagus floridanus* (eastern cottontail) | | 69 | 6 | | 4 | 3 | | | | | | | |
| | **Marsupialia** | | | | | | | | | | | | | | | |
| | | Didelphidae | *Didelphis virginiana* (Virginia opossum) | | 15 | | | | | | 3 | | 65 | 2 | | |
| | **Rodentia** | | | | 40 | 3 | | 4 | 5 | 3 | | | | | | |
| | | Castoridae | *Castor canadensis* (American beaver) | | | | | | | | 17 | | 7 | 1 | | |
| | | Geomyidae | *Geomys bursarius* (pocket gopher) | | 6 | | | 1 | | | | | | | | 62 |
| | | Geomyidae | *Geomys personatus* (Texas pocket gopher) | | | | | | | | | | 159 | 214 | 30 | 3 |
| | | Heteromyidae | *Perognathus* sp. (pocket mice) | | | | | | | | | | | 5 | | |
| | | Heteromyidae | *Perognathus hispidus* (hispid pocket mouse) | | 2 | | | | | | | | 31 | | | |
| | | Heteromyidae | *Liomys irroratus* (Mexican spiny pocket mouse) | | | | | | | | | | | | | 1 |
| | | Muridae | *Sigmodon hispidus* (hispid cotton rat) | | 27 | 1 | | 4 | 3 | | 2 | | 135 | 140 | 3 | 9 |
| | | Muridae | *Neotoma micropus* (Mexican wood rat) | 12 | 6 | | | | | | | | 4 | 12 | 17 | 4 |
| | | Muridae | *Microtus pinetorum* (pine vole) | | | | | | | | | | 46 | 38 | | |
| | | Muridae | *Baiomys taylori* (northern pygmy mouse) | | | | | | | | | | 5 | 2 | | |
| | | Muridae | *Onychomys torridus (* grasshopper mouse*)* | | | | | | | | | | 4 | | | |
| | | Muridae | *Ondatra zibethicus* (muskrat) | | | | | | | | | | | | | |
| | | Muridae | *Reithrodontomys* sp. (harvest mouse) | | | | | | | | | | 3 | 3 | | |
| | | Muridae | *Peromyscus leucopus* (white-footed mouse) | | | | | | | | | | | | | 1 |
| | | Muridae | *Peromyscus maniculatos* (deer mouse) | | | | | | | | | | 19 | 9 | | |
| | | Sciuridae | *Sciurus niger* (fox squirrel) | | | | | 1 | 1 | | | | 13 | 2 | 2 | |
| | | Sciuridae | *Sciurus citellus* (ground squirrel) | | 2 | | | | | | | | | | | |
| | | Sciuridae | *Spermophilus* sp. (ground squirrel) | | | | | | | | | | | 11 | | |
| | **Unidentified R.** | | Unidentified rodent (no size) | | | | | | | | | | 445 | 390 | 47 | 301 |
| | | | Small Rodents | | | | | | | | | | 40 | 1 | 20 | |
| | | | Medium Rodents | | | | | | | | | | 8 | 23 | 20 | |
| | | | Large Rodents | | | | | | | | | | 55 | 27 | 41 | |
| | **Xenarthra** | | | | | | | | | | | | | | | |
| | | Dasypodidae | *Dasypus novemcinctus* (nine-banded armadillo) | | 8 | 1 | 6 | | | | | | | | | |
| **Unidentified M.** | | | Very small mammals (mouse, rat) | 24 | | | | | | | 2 | | | | | |
| | | | Small mammals (dog, rabbit) | | 24 | 1 | 1 | 2 | | | 125 | | | | | 5123 |
| | | | Medium mammals (deer, antelope) | 53 | 4608 | 177 | 38 | 38 | 73 | | 2308 | | | | | 15,196 |
| | | | Large mammals | | 1582 | 441 | 35 | 58 | 97 | | | 94 | | | | |
| | | | Indeterminate-sized mammal | | 5206 | 3268 | | 66 | 195 | | | 83 | | | | 2993 |

Table A-1. continued…

| | | | Taxa | 41TG346 Toyah | 41HY209-T Toyah | 41HY209-M Toyah | 41HY202-A Toyah | 41HY209-T Austin | 41HY209-T LA | 41HF128 LA | 41MM340 LA | 41HY202-A LA | 41WM230 LA | 41WM267 LA | 41WM56 LA | 41LK28 MA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Class** | **Order** | **Family** | **Genus/species (common name)** | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count | Count |
| **Aves** | | | (birds) | 18 | 132 | 2 | | 3 | | | | | | | | |
| | **Anseriformes** | | | | | | | | | | | | | | | |
| | | Anatidae | *Anas* sp. (ducks, geese, swans) | | | | | | | | 2 | | | | | |
| | **Ciconiiformes** | | | | | | | | | | | | | | | |
| | | Ardeidae | (herons) | | | | | | | | 1 | | | | | |
| | | Acciptridae | *Buteo* sp. (hawks) | | | | | | | | 2 | | | 1 | | |
| | | Ciconiidae (Cathartidae) | (vultures) | | | | | | | | | | | | | |
| | **Galliformes** | | | | | | | | | | | | | | | |
| | | Odontophoridea | *Colinus virginianus* (northern bobwhite) | | 11 | | | | 1 | | | | 1 | 1 | | 1 |
| | | Meleagridae | *Meleagris gallopavo* (wild turkey) | | 73 | 1 | 6 | | 1 | | 1 | | 1 | | | |
| | | Phasianidae | (turkey, quail, grouse) | | | | | | | | 1 | | | | | |
| | | | *Tympanuchus cupido attwateri* (prairie chicken) | | | | | | | | | | 5 | 3 | | |
| | **Cuculiformes** | | | | | | | | | | | | | | | |
| | | Cuculidea | *Geococcyx californianus* (roadrunner) | | | | | | | | | | | | | |
| **Unidentified A.** | | | Aves Large | | 70 | | | 1 | | | 184 | | 7 | 3 | | |
| | | | Aves Medium | | 19 | | | | | | 12 | | 5 | 10 | | |
| | | | Aves Small | | 7 | | | 2 | | | | | 8 | | 2 | |
| **Reptilia** | | | | | | | | | | | | | | | | |
| | **Squamata** | | (snakes, lizards) | 1 | 134 | | | 5 | 6 | | | | 103 | 76 | 10 | 138 |
| | | Colubridae | (racers) | | 84 | 2 | | 32 | 2 | 79 | 1 | | 136 | 234 | 4 | |
| | | Crotalidae | *Crotalus* sp. (rattlesnakes) | | | | | | | | 3 | | | | | 149 |
| | | Viperidae | unidentified | | 8 | | | 1 | | | | | 63 | 61 | 3 | |
| | | Colubridae | *Elaphe* sp. (rat snake) | | | | | | | | | | | 2 | | |
| | | Colubridae | *Nerodia (Natrix)* sp. (water snakes) | | | | | | | | | | | | | |
| | | Colubridae | *Agkistrodon contortrix* (copperhead) | | | | | | | | | | | | | 6 |
| | | Colubridae | *Pituophis melanoleucus* (pine snake) | | | | | | | | | | | | | |
| | | Phrynosomatidae | *Sceloporus* sp. (spiny lizards) | | | | | | | | | | | | | |
| | **Testudines** | | (turtles) | 17 | 347 | 27 | 1 | 18 | 35 | | | | 56 | 43 | 43 | |
| | | Emydidae | (emydid turtles, pond turles, terrapins) | | 78 | 1 | | | 23 | | 6 | | | | | |
| | | Emydidae | *Trachemys sp.* (sliders) | | | | | | | | 1 | | 7 | 6 | 5 | |
| | | Emydidae | *Terrapene ornata* (ornate box turtle) | | | | | | | | | | | | | |
| | | Emydidae | *Terrapene carolina* (box turtle) | | 1 | | | | | | | | 2 | 6 | | |
| | | Emydidae | *Chrysemys* sp. (painted turtles) | | 32 | | | | | | | | | | | |
| | | Emydidae | *Pseudemys sp. (cooters)* | | 13 | | | | | 53 | | | | | | |
| | | Kinosternidae | *Kinosternon* sp. (mud turtles) | | | | | | | | | | 3 | | | |
| | | Testudinidae | *Gopherus berlandieri* (Texas tortoise) | | | | | | | | | | | | | |
| | | Trionychidae | *Trionyx sp.* (softshell turtles) | | | | | | | | 64 | | 3 | | 1 | |
| | | Trionychidae | *Apalone spinifera* (spiny softshell turtle) | | | | | | | | | | | | | |
| | **Crocodilia** | | | | | | | | | | | | | | | |
| | | Alligatoridae | *Alligator mississippiensis* (American alligator) | | | | | | | | | | | | | |
| **Amphibia** | | | | | | | | | | | | | | | | |
| | **Anura** | | (frogs, toads) | | | | | | | | | | 24 | 25 | | |
| | | Ranidae | *Rana* sp. (true frogs) | | 1 | | | | | | | | | | | |
| **Osteichthyes** | | | (bony fishes) | 49 | 3 | | | | | | | | 76 | 18 | 10 | |
| | **Siluriformes** | Ictaluridae | (catfish) | | | | | 1 | 1 | | | | 2 | | 5 | 5 |
| | **Cypriniformes** | | (minnows, suckers) | | | | | | | | | | | | | |
| | **Perciformes** | Sciaenidae | *Aplodinotus grunniens* (freshwater drum) | | | | | | | | | | | | | |
| | | Centrarchidae | *Pomoxis* sp. (crappies) | | | | | | | | | | | | | |
| | **Semionotiformes** | Lepisosteidea | *Lepisosteus* sp. (gar) | | | | | 1 | | | | | 1 | 1 | 3 | 29 |
| | | | **Totals** | 11197 | 14234 | 4334 | 149 | 265 | 468 | 20295 | 3378 | 315 | 1852 | 1625 | 463 | 24448 |

Table A-2. Size Classification of Animal Species Encountered in the Archeological Assemblage Consulted

| Taxa | | | |
|---|---|---|---|
| **Order** | **Family** | **Genus/species (common name)** | **Body Size** |
| **Artiodactyla** | | | |
| | Antilocapridae | *Antilocapra americana* (pronghorn antelope) | M |
| | Bovidae | *Bison bison* (bison) | L |
| | Cervidae | *Odocoileus virginianus* (white-tailed deer) | M |
| | Tayassuidae | *Pecari (Dicotyles) tajacu* (peccary) | M |
| **Carnivora** | | | |
| | Canidae | *Canis* sp. (dogs, wolves, coyotes) | M |
| | Canidae | *Canis latrans* (coyote) | M |
| | Canidae | *Canis lupus* (gray wolf) | M |
| | Canidae | *Urocyon cinereoargenteus* (gray fox) | S |
| | Felidae | *Felis concolor* (mountain lion) | L |
| | Felidae | *Felis rufus* (bobcat) | S |
| | Mustelidae | *Mephitis mephitis* (striped skunk) | S |
| | Mustelidae | *Conepatus mesoleucus* (hog-nosed skunk) | S |
| | Mustelidae | *Taxidae taxus* (badger) | S |
| | Procyonidae | *Procyon lotor* (raccoon) | S |
| **Insectivora** | | | |
| | Soricidae | *Cryptotis parva* (least shrew) | VS |
| | Talpidae | *Scalopus aquaticus* (esatern mole) | VS |
| **Lagamorpha** | | | |
| | Leporidae | *Lepus californicus (* black-tailed jackrabbit*)* | S |
| | Leporidae | *Sylvilagus* audubonii (desert cottontail rabbit) | S |
| | Leporidae | *Sylvilagus floridanus* (eastern cottontail) | S |
| **Marsupialia** | | | |
| | Didelphidae | *Didelphis virginiana* (Virginia opossum) | S |
| **Rodentia** | | | |
| | Castoridae | *Castor canadensis* (American beaver) | M |
| | Geomyidae | *Geomys bursarius* (pocket gopher) | VS |
| | Geomyidae | *Geomys personatus* (Texas pocket gopher) | VS |
| | Heteromyidae | *Perognathus* sp. (pocket mice) | VS |
| | Heteromyidae | *Perognathus hispidus* (hispid pocket mouse) | VS |
| | Heteromyidae | *Liomys irroratus* (Mexican spiny pocket mouse) | VS |
| | Muridae | *Sigmodon hispidus* (hispid cotton rat) | VS |
| | Muridae | *Neotoma micropus* (Mexican wood rat) | VS |
| | Muridae | *Microtus pinetorum* (pine vole) | VS |
| | Muridae | *Baiomys taylori* (northern pygmy mouse) | VS |
| | Muridae | *Onychomys torridus (* grasshopper mouse*)* | VS |
| | Muridae | *Ondatra zibethicus* (muskrat) | S |
| | Muridae | *Reithrodontomys* sp. (harvest mouse) | VS |
| | Muridae | *Peromyscus leucopus* (white-footed mouse) | VS |
| | Muridae | *Peromyscus maniculatos* (deer mouse) | VS |
| | Sciuridae | *Sciurus niger* (fox squirrel) | S |
| | Sciuridae | *Sciurus citellus* (ground squirrel) | S |
| | Sciuridae | *Spermophilus* sp. (ground squirrel) | S |

Table A-2. continued…

| **Taxa** | | | **Body Size** |
|---|---|---|---|
| **Order** | **Family** | **Genus/species (common name)** | |
| **Unidentified R.** | | Unidentified rodent (no size) | |
| | | Small Rodents | VS |
| | | Medium Rodents | S |
| | | Large Rodents | S |
| **Xenarthra** | | | |
| | Dasypodidae | *Dasypus novemcinctus* (nine-banded armadillo) | S |
| | | Very small mammals (mouse, rat) | VS |
| | | Small mammals (dog-size) | S |
| | | Medium mammals (deer/antelope) | M |
| | | Large mammals | L |
| **Anseriformes** | | | |
| | Anatidae | *Anas* sp. (ducks, geese, swans) | S |
| **Ciconiiformes** | | | |
| | Ardeidae | (herons) | S |
| | Acciptridae | *Buteo* sp. (hawks) | S |
| | Ciconiidae (Cathartidae) | (vultures) | S |
| **Galliformes** | | | |
| | Odontophoridea | *Colinus virginianus* (northern bobwhite) | VS |
| | Meleagridae | *Meleagris gallopavo* (wild turkey) | S |
| | Phasianidae | (turkey, quail, grouse) | S |
| | | *Tympanuchus cupido attwateri* (prairie chicken) | S |
| **Cuculiformes** | | | |
| | Cuculidea | *Geococcyx californianus* (roadrunner) | VS |
| | | Aves Large | S |
| | | Aves Medium | VS |
| | | Aves Small | VS |
| | | | |
| **Squamata** | | (snakes, lizards) | VS |
| | Colubridae | (racers) | VS |
| | Crotalidae | *Crotalus* sp. (rattlesnakes) | VS |
| | Viperidae | unidentified | VS |
| | Colubridae | *Elaphe* sp. (rat snake) | VS |
| | Colubridae | *Nerodia (Natrix)* sp. (water snakes) | VS |
| | Colubridae | *Agkistrodon contortrix* (copperhead) | VS |
| | Colubridae | *Pituophis melanoleucus* (pine snake) | VS |
| | Phrynosomatidae | *Sceloporus* sp. (spiny lizards) | VS |
| **Testudines** | | (turtles) | VS |
| | Emydidae | (emydid turtles, pond turles, terrapins) | VS |
| | Emydidae | *Trachemys sp.* (sliders) | VS |
| | Emydidae | *Terrapene ornata* (ornate box turtle) | VS |
| | Emydidae | *Terrapene carolina* (box turtle) | VS |
| | Emydidae | *Chrysemys* sp. (painted turtles) | VS |
| | Emydidae | *Pseudemys sp. (cooters)* | VS |
| | Kinosternidae | *Kinosternon* sp. (mud turtles) | VS |
| | Testudinidae | *Gopherus berlandieri* (Texas tortoise) | VS |
| | Trionychidae | *Trionyx sp.* (softshell turtles) | VS |
| | Trionychidae | *Apalone spinifera* (spiny softshell turtle) | VS |

Table A-2. continued…

| Taxa | | | Body Size |
|---|---|---|---|
| **Order** | **Family** | **Genus/species (common name)** | |
| **Crocodilia** | | | |
| | Alligatoridae | *Alligator mississippiensis* (American alligator) | M |
| | | | |
| **Anura** | | (frogs, toads) | VS |
| | Ranidae | *Rana* sp. (true frogs) | VS |
| | | (bony fishes) | VS |
| **Siluriformes** | Ictaluridae | (catfish) | VS |
| **Cypriniformes** | | (minnows, suckers) | VS |
| **Perciformes** | Sciaenidae | *Aplodinotus grunniens* (freshwater drum) | S |
| | Centrarchidae | *Pomoxis* sp. (crappies) | VS |
| **Semionotiformes** | Lepisosteidea | *Lepisosteus* sp. (gar) | S |

| | |
|---|---|
| L=Large | S=Small |
| M=Medium | VS=Very Small |

# Appendix B

# Human Remains

# Appendix B: Human Remains

### Richard B. Mahoney

The partial remains of a single burial were encountered in Area C (Feature 10) at 41TV163. The remains are represented primarily by fragmented elements of the skull and arms (see Figure 5-4). Specific cranial elements present include the frontal, both parietals, the temporals, the occipital, both malars, a portion of the palatine and maxilla, the left half of the mandible, two sphenoid fragments, and five teeth. Postcranial elements include both humeri, the left ulna, the left radius, 13 hand phalanges, four metacarpals of the left hand (MC-1 through MC-4), one metacarpal of the right hand (MC-1), two carpals of the right hand, 10 vertebral fragments, two rib fragments, and a portion of the right scapula. The feature notes and numerous photographs document that only the upper portion of the individual was well represented in the feature. Approximately 40 grams of small (<1 cm in diameter) unidentifiable fragments comprise the balance of human skeletal material recovered. No duplication exists in the collection, and the remains appear to be from a single individual.

## Sex Determination

Due to the lack of the more confident sexing pelvic elements, sex is based on non-metric traits of the partially reconstructed cranium. Six traits were used to determine the sex of this individual, including observations of the nuchal crest, mastoid processes, supraorbital margins, glabella, mental eminence, and zygomatic arches. Four of these observations indicate a probable female, one observation indicates ambiguous sex, and one observation indicates a probable male. As such, the sex of this individual cannot be determined with absolute certainty. However, given the greater number of observed female traits, this individual is classified as a probable female.

## Age Determination

Specific age range determination was not possible due to the lack of requisite skeletal elements. Several morphologic traits were observed, however, to indicate that these remains are that of an adult. Specifically, the two long bone articular surfaces present (proximal left ulna and distal left humerus) exhibit complete epiphyseal fusion. Moreover, lipping and pitting along the ulna joint surface, indicative of osteoarthritis, is evident, further suggesting advanced adult age. Alveolar resorption of the posterior portion of the mandible in combination with the extreme dental attrition similarly suggests advanced adulthood.

## Biological Affiliation

No skeletal elements outwardly signaling biological affiliation are contained in the human remains assemblage. The recovery of the remains in context with a prehistoric campsite in central Texas, however, demonstrates the remains are of Native American affiliation.

## Stature Estimation

Estimation of stature is not possible due to the fragmented nature of the long bones.

## Circumstances Surrounding the Manner of Death

Due to the fragmentary and incomplete nature of the remains, it is not possible to determine the circumstances surrounding the manner of death. All bone present was inspected for evidence of perimortem trauma or pathologies that may have contributed to the death of this individual, but none were indicated.

## Taphonomy

Several natural, postdepositional factors have affected the human remains assemblage, including chemical, rodent, and carnivore activities. Chemical weathering has affected the cortical surfaces of the majority of the assemblage. Rodent gnawing is present on most of the long bones, most notable along the humeral diaphyses. Carnivore tooth marks are visible along the proximal portion of the left humerus and articular ends of the lone right metacarpal. It is possible that the latter natural force is responsible for the absence of the majority of the postcranial skeleton.

## Pathology

Two pathologies were noted during examination of the skeletal remains. Osteoarthritis, a relatively common degenerative bone disorder typically occurring in load bearing joints, was noted along the extant portion of the left ulna proximal articular surface. Lipping and pitting along this joint surface is evident, although no eburnation was present here or along the trochlea of the left humerus. Porotic hypertosis, a hematopoietic disorder wherein the diploë of the cranium becomes thickened and sponge-like, was noted on the posterior of the occipital, superior to the nuchal crest.

## Summary

Age at Death: >35
Sex: Probable Female
Ethnicity: Native American
Manner of Death: Indeterminate
Temporal Affiliation: Late Archaic

# INVENTORY RECORDING FORM FOR COMPLETE SKELETONS

Site Name/Number Millican Bench/41TV163 Observer RB Mahoney

Feature/Burial Number 10/1 Date 12-03

Burial/Skeleton Number 1/1

Present Location of Collection UTSA-CAR

## CRANIAL BONES AND JOINT SURFACES

| | L(left) | R(right) | | L | R |
|---|---|---|---|---|---|
| Frontal | 1 | 1 | Sphenoid | 3 | 3 |
| Parietal | 1 | 1 | Zygomatic | 2 | 1 |
| Occipital | 2 | 2 | Maxilla | 3 | 2 |
| Temporal | 1 | 2 | Palatine | | |
| TMJ | 1 | 1 | Mandible | 1 | |

## POSTCRANIAL BONES AND JOINT SURFACES

| | L | R | | L | R |
|---|---|---|---|---|---|
| Clavicle | | | Os Coxae | | |
| Scapula | | | Ilium | | |
| Body | | 3 | lschium | | |
| Glenoid f. | | 1 | Pubis | | |
| Patella | | | Acetabulum | | |
| Sacrum | | | Auric. Surface | | |

### VERTEBRAE (individual)

| | Centrum | Neural Arch |
|---|---|---|
| C1 | 1 | 1 |
| C2 | | |
| C7 | | |
| T10 | | |
| T11 | | |
| T12 | | |
| L1 | | |
| L2 | | |
| L3 | | |
| L4 | | |
| L5 | | |

### VERTEBRAE (grouped)

#Present# Complete

| | Centra | Neural Arches |
|---|---|---|
| C3-6 | / | / |
| T1-T9 | 1/1 | 1/1 |

Sternum: Manubrium ____ Body ____

### RIBS (individual)

| | L | R |
|---|---|---|
| 1 St | | |
| 2nd | | |
| 11th | | |
| 12th | | |

### RIBS (grouped)

#Present/# Complete

| | L | R | Unsided |
|---|---|---|---|
| 3-10 | / | / | 2/ |

Series/Burial/Skeleton 41TV163/1/1
Observer/Date RB Mahoney/12-03

**LONG BONES**

| | Proximal Epiphysis | Diaphysis | | | Distal Epiphysis |
|---|---|---|---|---|---|
| | | Proximal Third | Middle Third | Distal Third | |
| Left Humerus | | 2 | 1 | 1 | 2 |
| Right Humerus | | 2 | 1 | 2 | |
| Left Radius | | 2 | 1 | 2 | |
| Right Radius | | | | | |
| Left Ulna | 3 | 2 | 1 | 2 | |
| Right Ulna | | | | | |
| Left Femur | | | | | |
| Right Femur | | | | | |
| Left Tibia | | | | | |
| Right Tibia | | | | | |
| Left Fibula | | | | | |
| Right Fibula | | | | | |

Left Talus ______
Right Talus ______
Left Calcaneus ______
Right Calcaneus ______

**HAND** (**# Present/# Complete)**

| | L | R | Unsided |
|---|---|---|---|
| Unsided | | | |
| # Carpals | / | 2/2 | / |
| #Metacarpals | 4/4 | 1/1 | / |
| #Phalanges | 1/1 | / | 12/10 |

**FOOT** (**# Present/# Complete)**

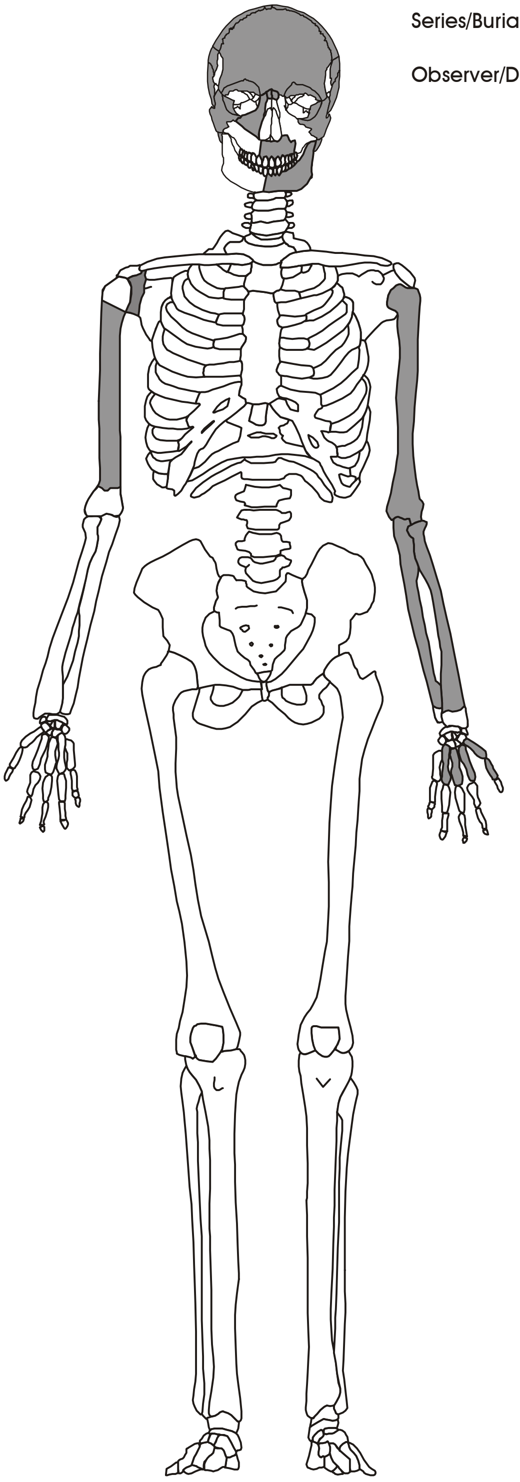
| | L | R | |
|---|---|---|---|
| #Tarsals | / | / | / |
| #Metatarsals | / | / | / |
| #Phalanges | / | / | / |

Comments:

## ADULT SKELETON RECORDING FORM : ANTERIOR VIEW

Series/Burial/Skeleton 41TV163 / Burial #1

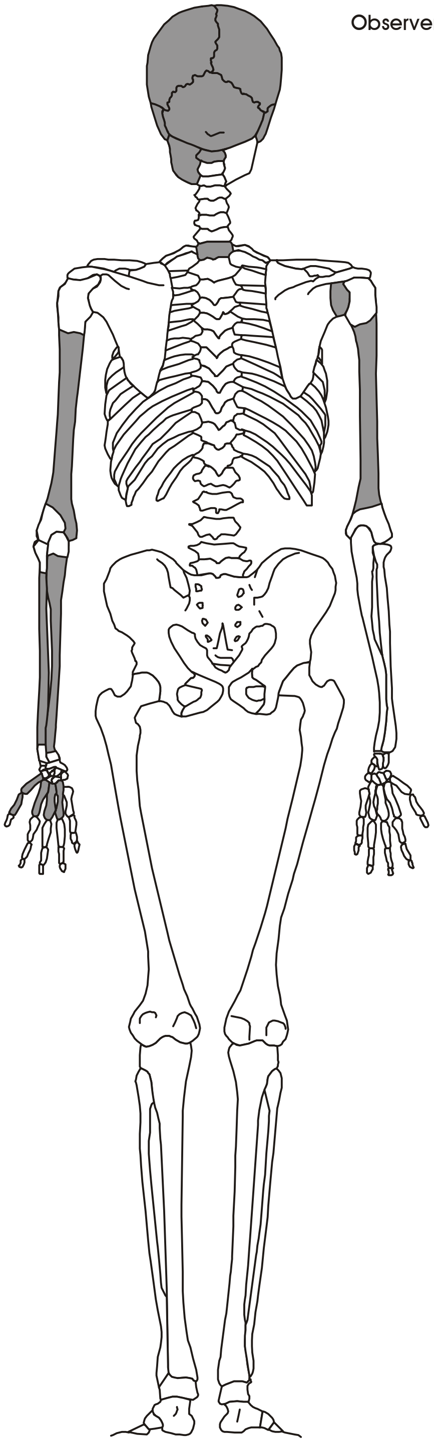
Observer/Date RB Mahoney / 12-03



# ADULT SKELETON RECORDING FORM : POSTERIOR VIEW

Series/Burial/Skeleton 41TV163 / Burial #1

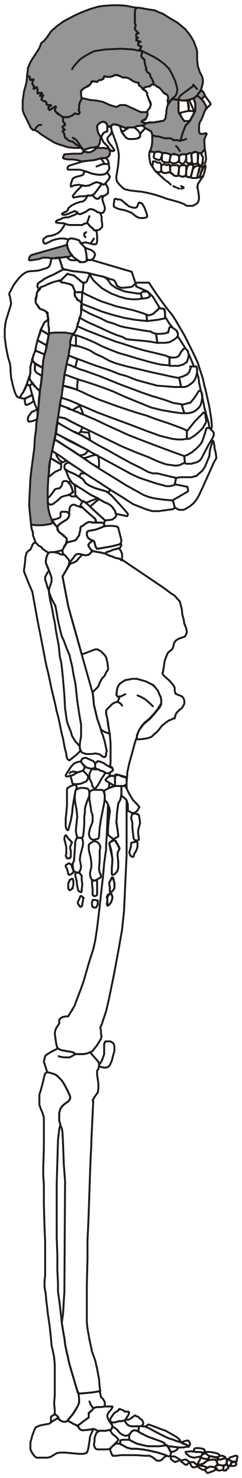
Observer/Date RB Mahoney / 12-03



# ADULT SKELETON RECORDING FORM : RIGHT LATERAL VIEW

**Series/Burial/Skeleton** 41TV163 / Burial #1

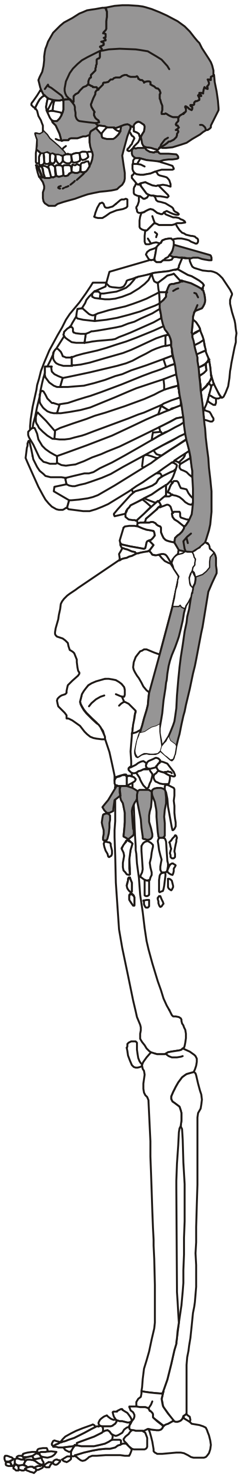
**Observer/Date** RB Mahoney / 12-03



## ADULT SKELETON RECORDING FORM : LEFT LATERAL VIEW

Series/Burial/Skeleton 41TV163 / Burial #1

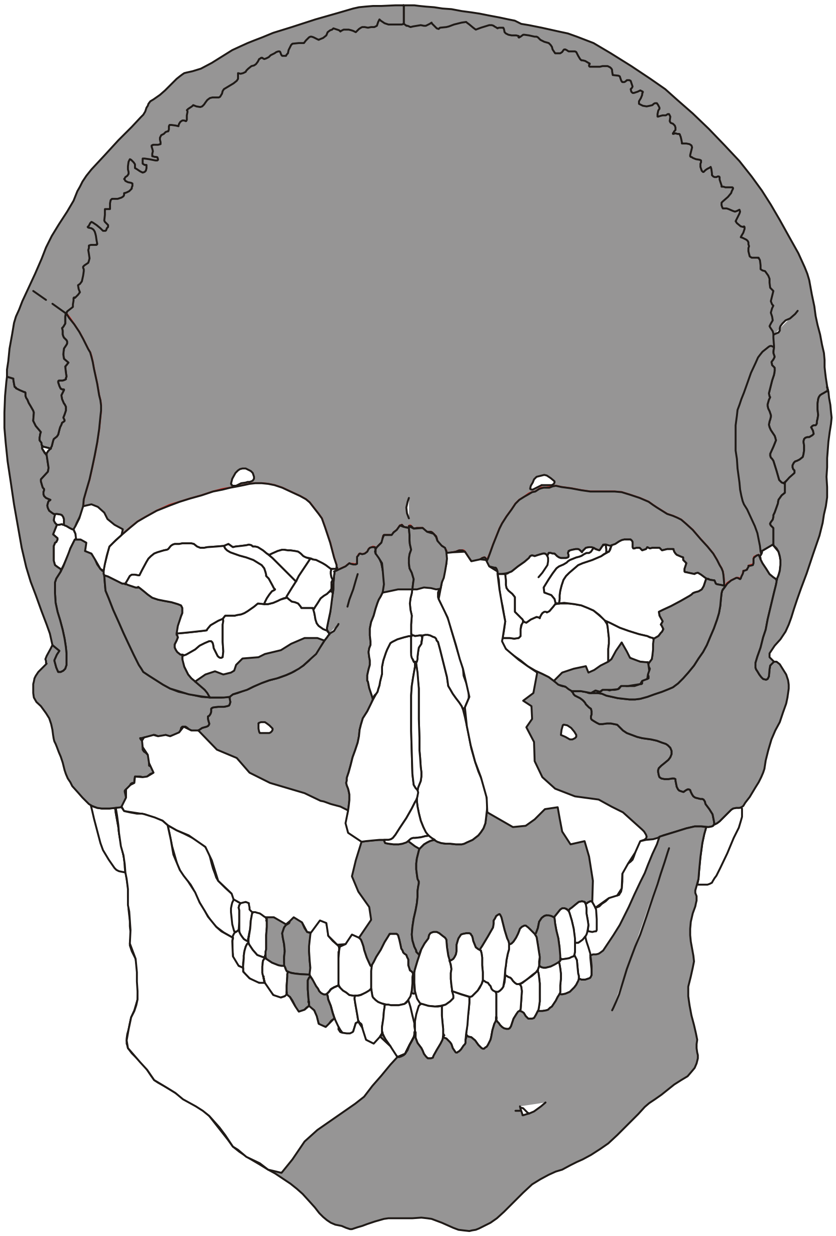
Observer/Date RB Mahoney / 12-03



## SKULL RECORDING FORM : ANTERIOR VIEW

**Series/Burial/Skeleton** 41TV163 / Burial #1

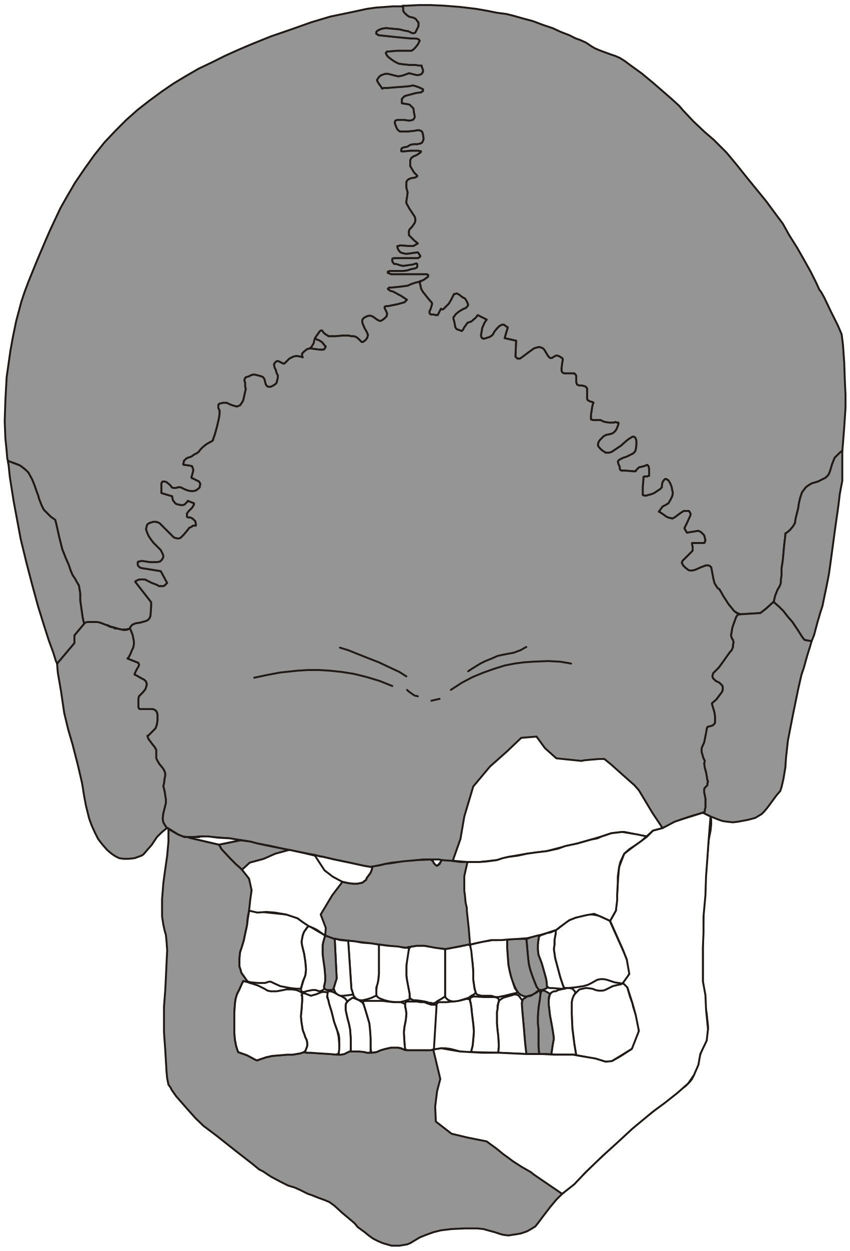
**Observer/Date** RB Mahoney / 12-03



# SKULL RECORDING FORM : POSTERIOR VIEW

**Series/Burial/Skeleton** 41TV163 / Burial #1

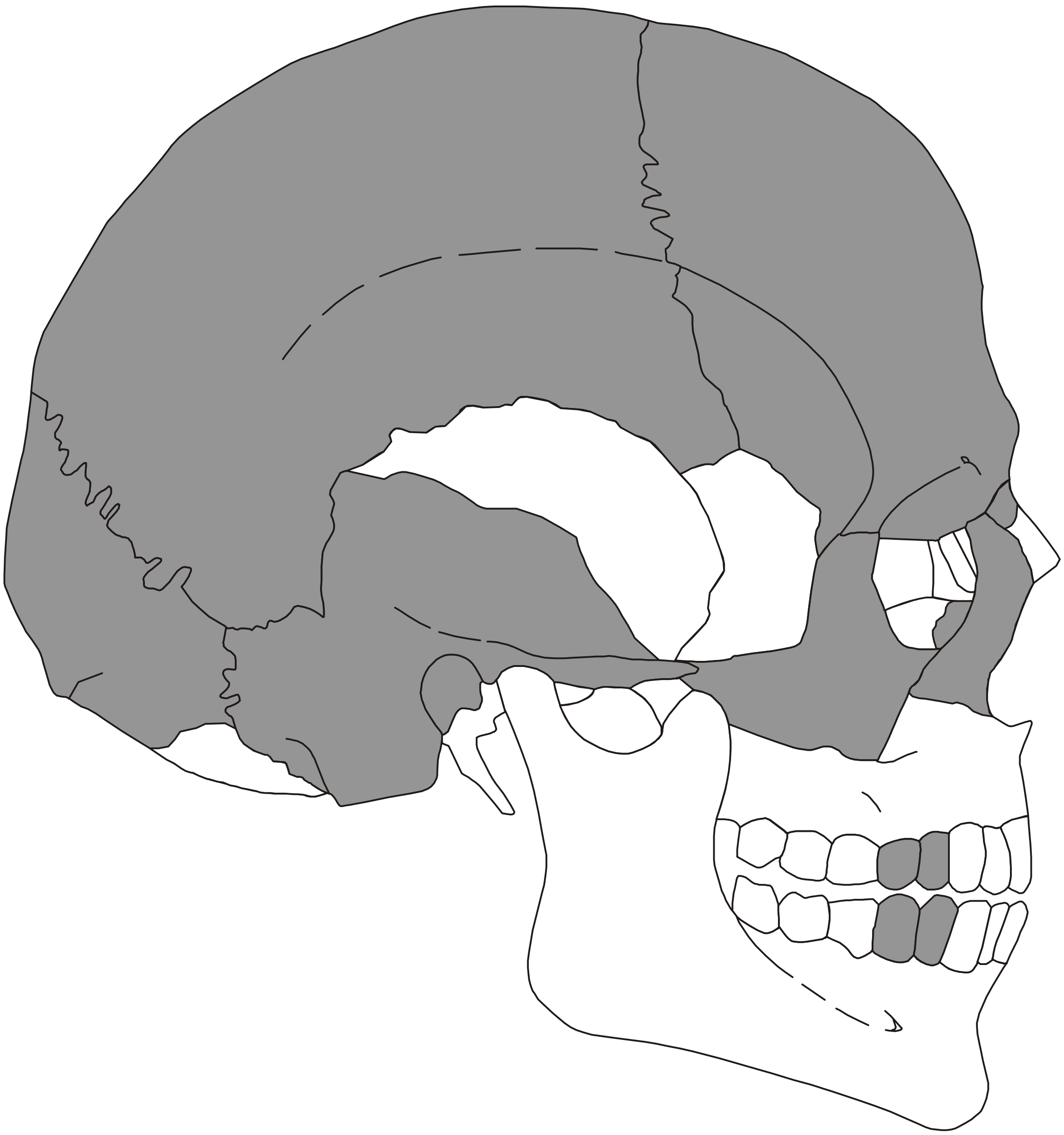
**Observer/Date** RB Mahoney / 12-03



# SKULL RECORDING FORM : RIGHT LATERAL VIEW

Series/Burial/Skeleton 41TV163 / Burial #1

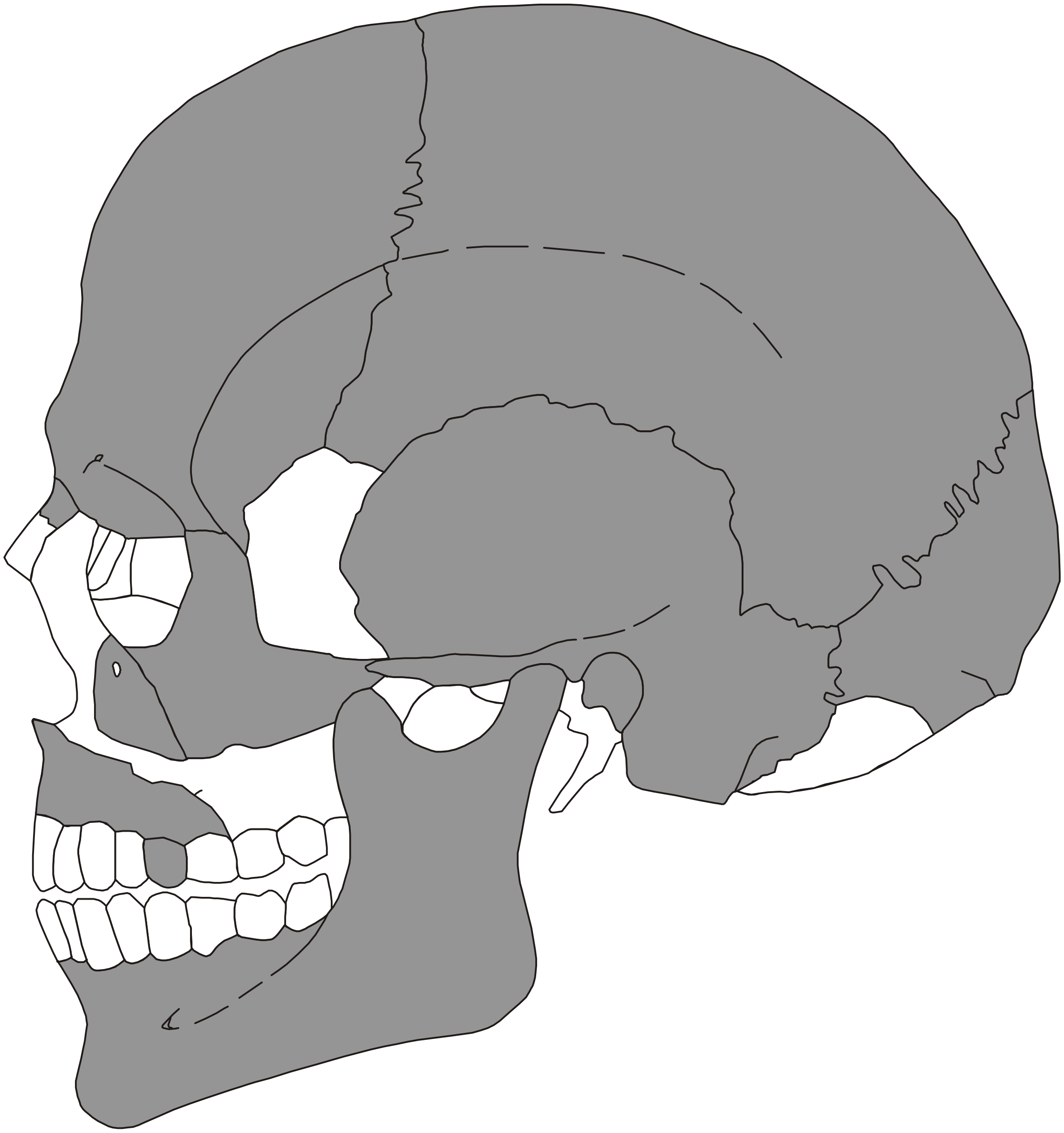
Observer/Date RB Mahoney / 12-03



## SKULL RECORDING FORM : LEFT LATERAL VIEW

**Series/Burial/Skeleton** 41TV163 / Burial #1

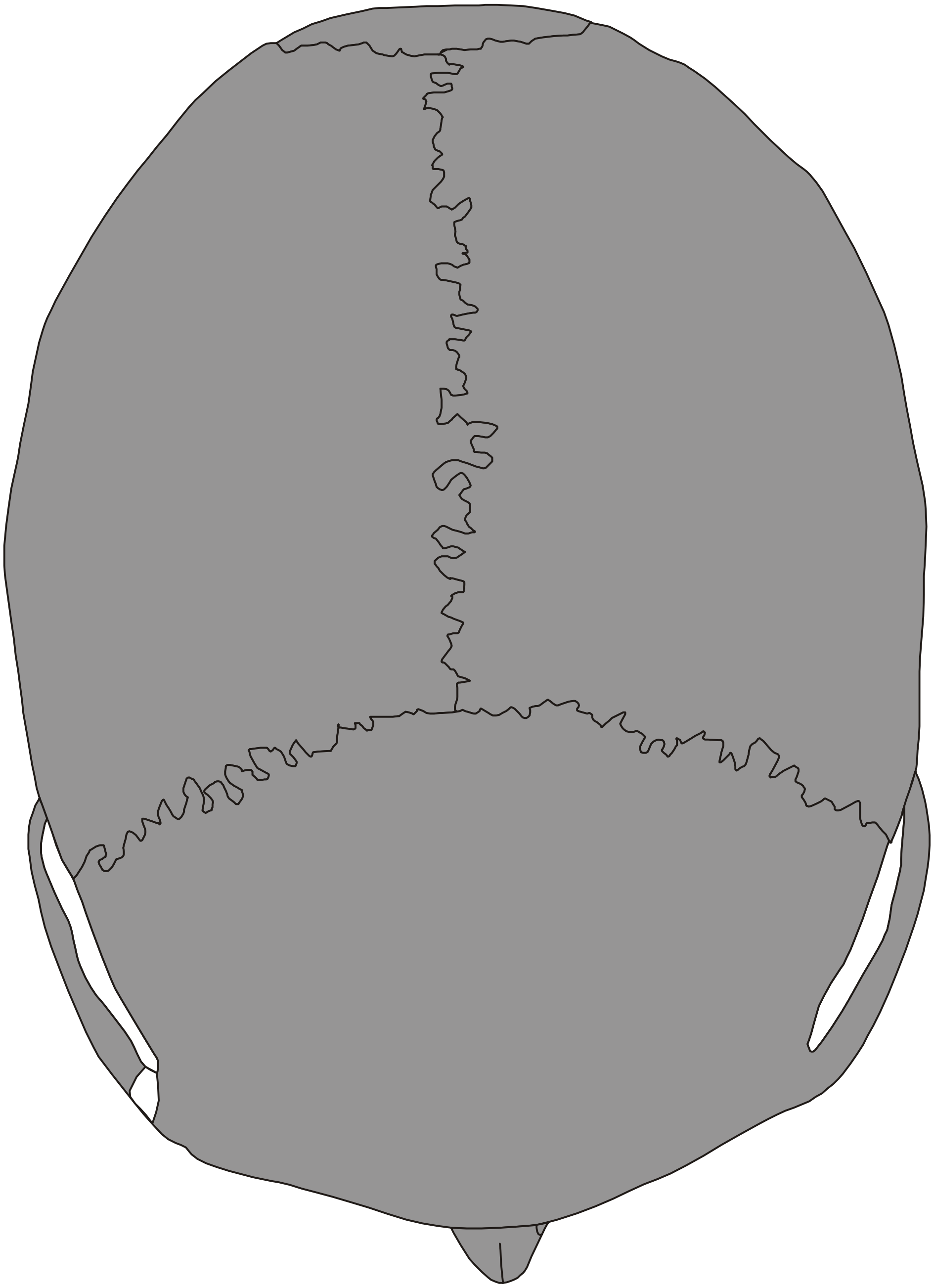
**Observer/Date** RB Mahoney / 12-03



## SKULL RECORDING FORM : SUPERIOR VIEW

Series/Burial/Skeleton 41TV163 / Burial #1

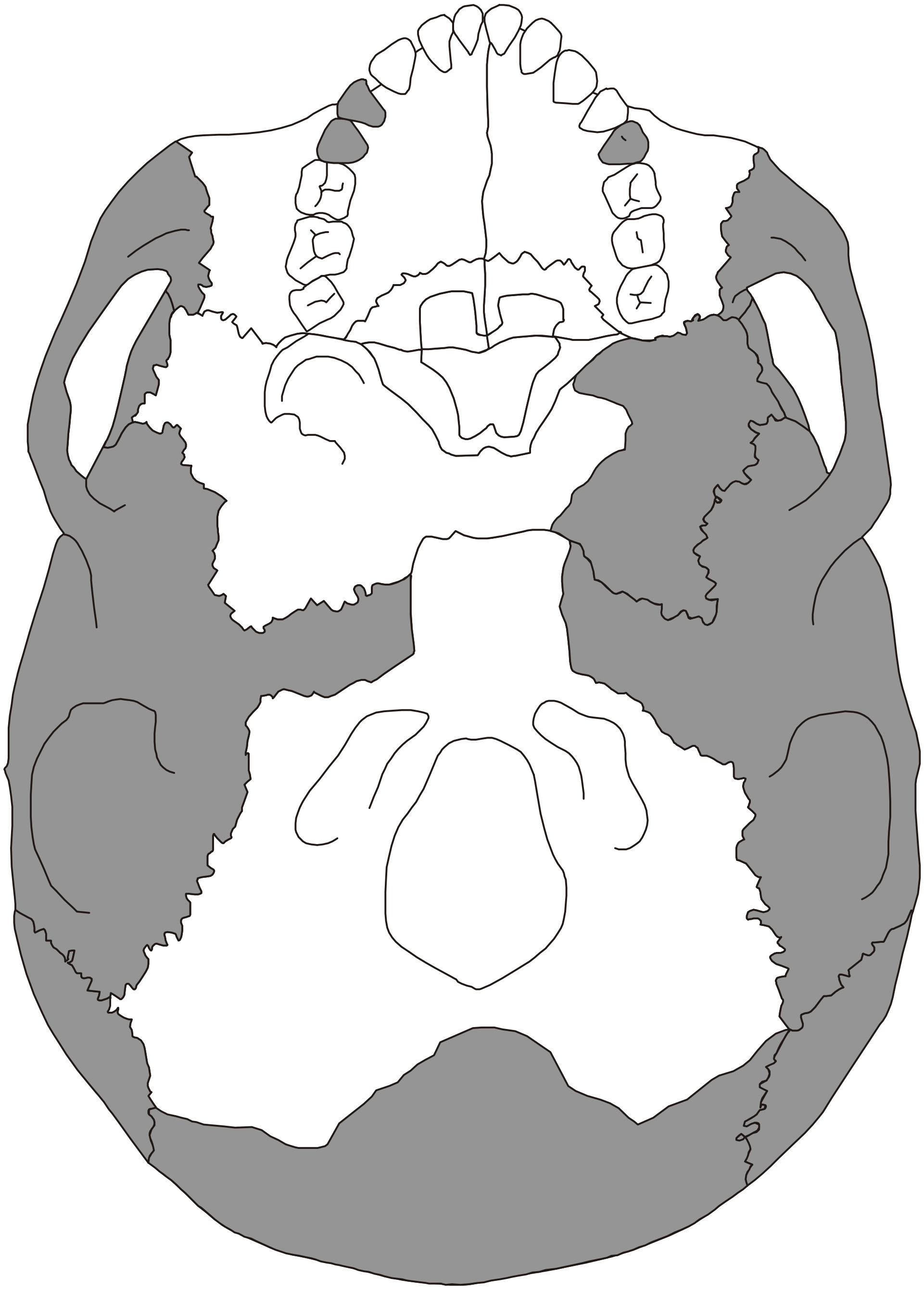
Observer/Date RB Mahoney / 12-03



## SKULL RECORDING FORM : BASILAR VIEW

**Series/Burial/Skeleton** 41TV163 / Burial #1

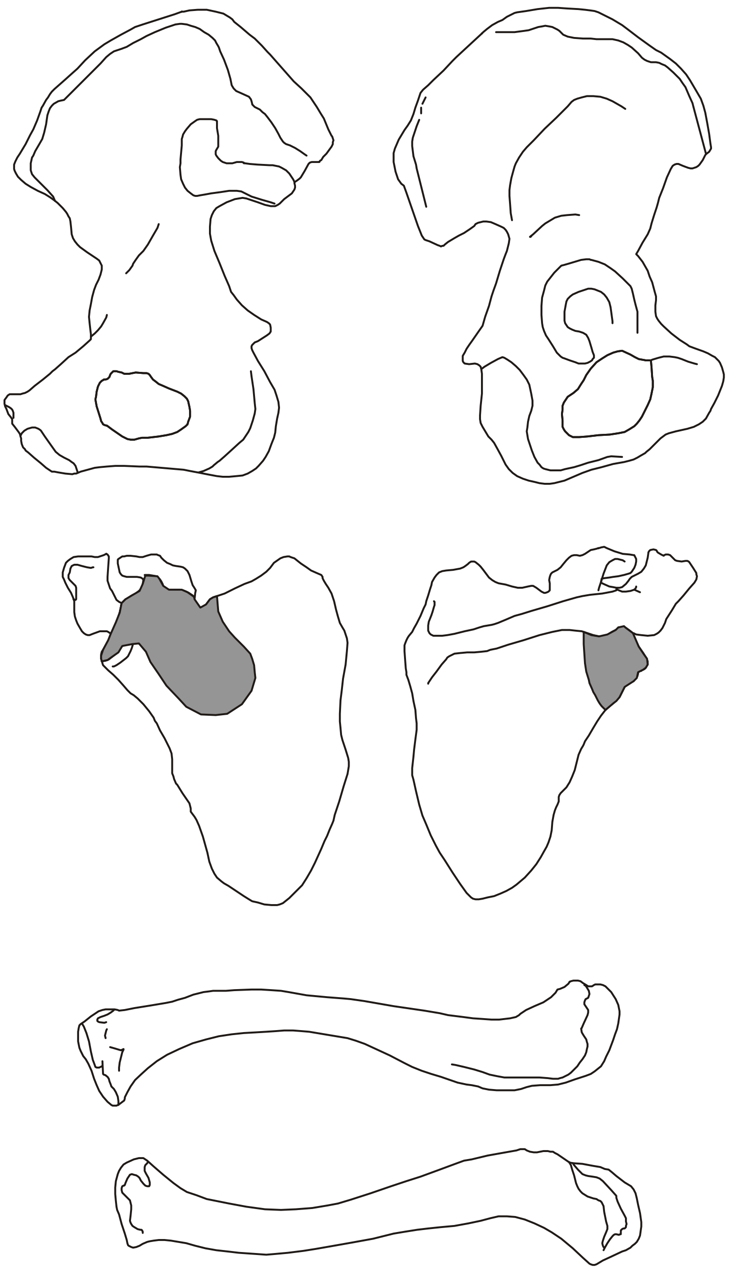
**Observer/Date** RB Mahoney / 12-03



# POSTCRANIAL BONES VISUAL RECORDING FORM
# RIGHT OS COXAE, SCAPULA, CLAVICLE

**Series/Burial/Skeleton** 41TV163 / Burial #1

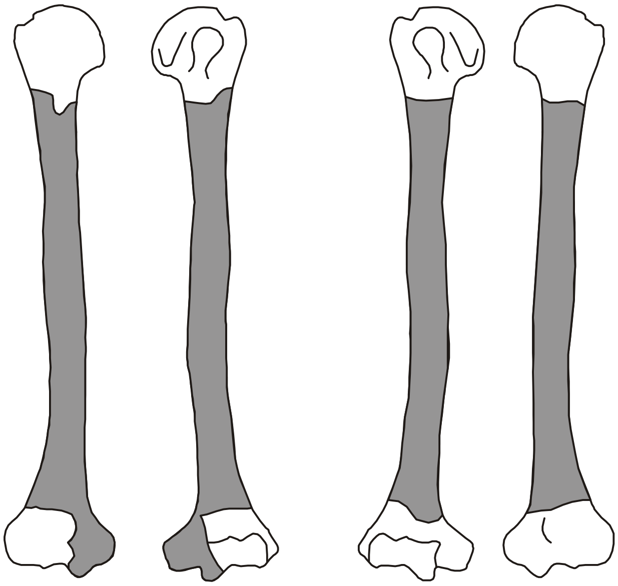
**Observer/Date** RB Mahoney / 12-03

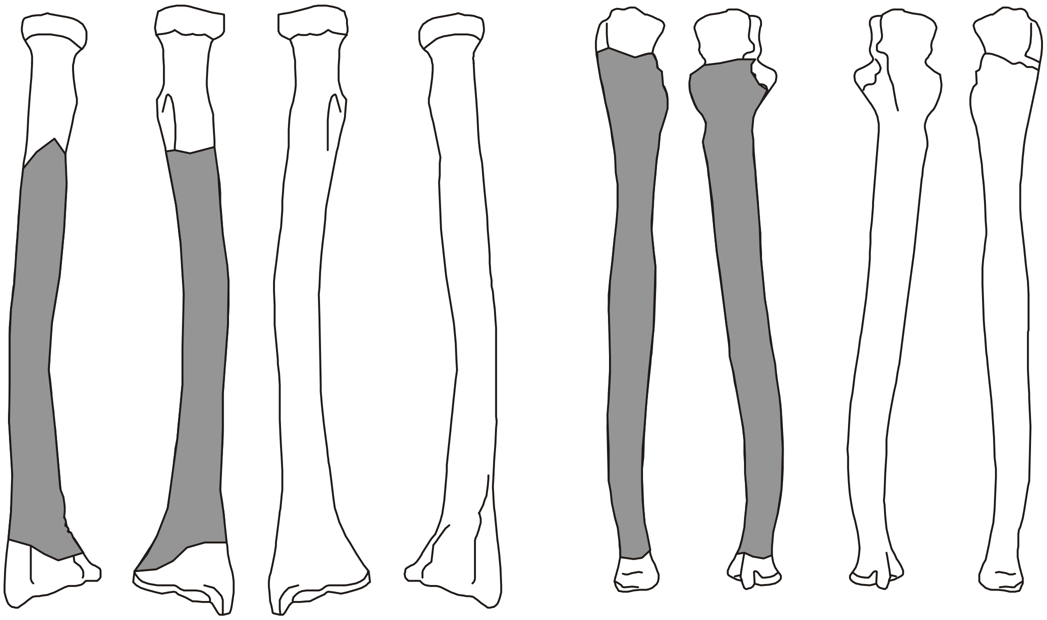


# POSTCRANIAL BONES VISUAL RECORDING FORM
# HUMERUS, ULNA, RADIUS

**Series/Burial/Skeleton** 41TV163 / Burial #1

**Observer/Date** RB Mahoney / 12-03





# ADULT SEX/AGE RECORDING FORM

Site Name/Number Millican / 41TV163 Observer RB Mahoney

Feature/Burial Number 10 / 1 Date 12-03

Burial/Skeleton Number 1 / 1

Present Location of Collection UTSA-CAR

## SEX

| Pelvis | L | R | Skull | L | M | R |
|---|---|---|---|---|---|---|
| Ventral Arc (1 -3) | | | Nuchal Crest (1 -5) | | 2 | |
| Subpubic Concavity (1 -3) | | | Mastoid Process (1 -5) | 2 | | 2 |
| Ischiopubic Ramus Ridge (1 -3) | | | Supraorbital Margin (1-5) | 4 | | 4 |
| Greater Sciatic Notch (1 -5) | | | Glabella (1 -5) | 2 | | 2 |
| Preauricular Sulcus (0-4) | | | Mental Eminence (1 -5) | | 3 | |
| Estimated Sex, Pelvis (0-5) | | | Estimated Sex, Skull (0-5) | 3 | 3 | 3 |

Comments:

Zygomatic arch does not extend posterior of external auditory meatus.

Series/Burial/Skeleton Millican Bench / 1 / 1

Observer/Date RB Mahoney / 12-03

# AGE

| | L | R | | L | R |
|---|---|---|---|---|---|
| **Pubic Symphysis** | | | | | |
| Todd (1-10) | | | **Auricular Surface** (1 -8) | | |
| Suchey-Brooks (1 -6) | | | | | |

**Suture Closure** (blank = unobservable; 0 = open; 1= minimal; 2 = significant; 3 = complete)

| | | | | | |
|---|---|---|---|---|---|
| **External Cranial Vault** | 1. Midlambdoid | | **Palate** | 11. Incisive | 3 |
| | 2. Lambda | | | 12. Anterior Median Palatine | 1 |
| | 3. Obelion | | | 13. Posterior Median Palatine | |
| | 4. Anterior Sagittal | | | 14. Transverse Palatine | |
| | 5. Bregma | | **Internal Cranial Vault** | 15. Sagittal | |
| | 6. Midcoronal | | | 16. Left Lambdoid | |
| | 7. Pterion | | | 17. Left Coronal | |
| | 8. Sphenofrontal | | | | |
| | 9. Inferior Sphenotemporal | | | | |
| | 10. Superior Sphenotemporal | | | | |

Estimated Age: Young Adult (20-35 years) ________
Middle Adult (35-50 years) ________
Old Adult (50+ years) ________

Comments:

Fragmentary condition of majority of cranial vault precluded observation of sutural closure. Specifically, taphonomic forces have fractured the vault into numerous pieces, and although the cranium has been partially recontructed, the fractures lines along the sutures have obscured the development of closure. The lack of the innominates in concert with only two scores for sutural closure have resluted in an indeterminate age using the above methods.

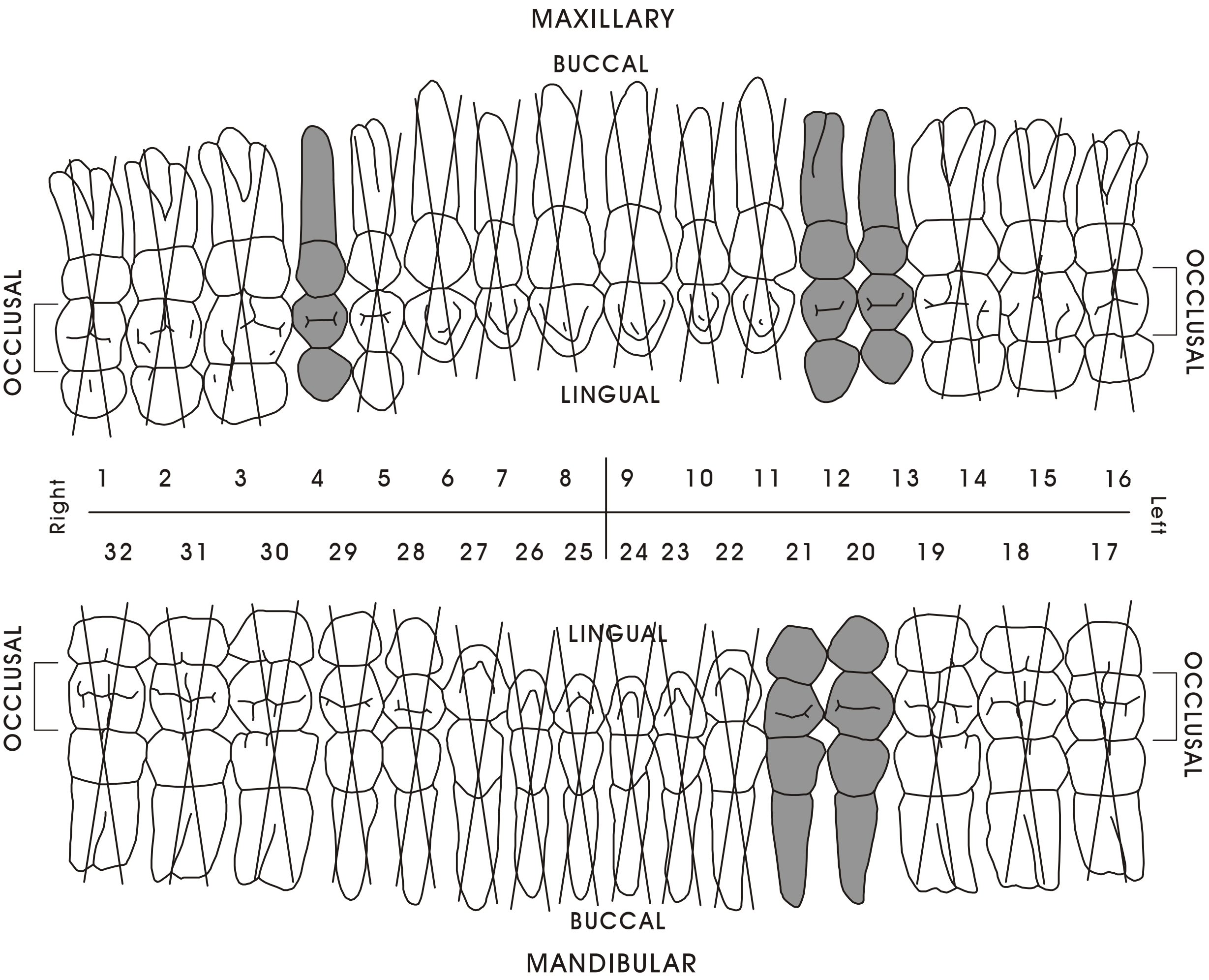
# DENTAL INVENTORY
# VISUAL RECORDING FORM: PERMANENT DENTITION

Site Name/Numer Millican Bench / 41TV163 Observer RB Mahoney

Feature/Burial Number / Date 12-03

Burial/Skeleton Number /

Present Location of Collection UTSA-CAR



# DENTAL INVENTORY RECORDING FORM
## DEVELOPMENT, WEAR, AND PATHOLOGY: PERMANENT TEETH

Site Name/Number Millican / 41TV163 Observer RB Mahoney

Feature/Burial Number 10 / 1 Date 12-03

Burial/Skeleton Number 1 / 1

Present Location of Collection UTSA-CAR

**Tooth presence and development:** code 1-8. For teeth entered as 'l" (present, but not in occlusion), record stage of crown/root formation under "Development." **Occlusal surface wear:** use left teeth, following Smith (1984) for anterior teeth (code l-8) and Scott (1979) for molars (code O-10). If marked asymmetry is present, record both sides. Record each molar quadrant separate in the spaces provided (+) and the total for all four quadrants under 'Total." **Caries:** code each carious lesion separately (1 -7); **Abscesses:** code location (1 -2). **Calculus:** code 0-3, 9. Note surface affected (buccal/labial or lingual).

Maxillary Right

| | Tooth Presence | Development | Wear/ Total | | | Caries | | Abscess | | Calculus/Affected |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 M$^3$ | | | + | | | | | | | |
| 2 M$^2$ | | | + | | | | | | | |
| 3 M$^1$ | | | + | | | | | | | |
| 4 P$^2$ | 2 | 14 | | 8 | | | | | | |
| 5 P$^1$ | | | | | | | | | | |
| 6 C | | | | | | | | | | |
| 7 I$^2$ | | | | | | | | | | |
| 8 I$^1$ | | | | | | | | | | |

Maxillary Left

| | Tooth Presence | Development | Wear/ Total | | | Caries | | Abscess | | Calculus/Affected |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 I$^1$ | | | | | | | | | | |
| 10 1$^2$ | | | | | | | | | | |
| 11 C | | | | | | | | | | |
| 12 P$^I$ | 2 | 14 | | 8 | | | | | | |
| 13 P$^2$ | 2 | 14 | | 8 | | | | | | |
| 14 M$^1$ | | | + | | | | | | | |
| 15 M$^2$ | | | + | | | | | | | |
| 16 M$^3$ | | | + | | | | | | | |

Series/Burial/Skeleton 41TV163/1/1
Observer/Date RB Mahoney/12-03

| | | Tooth Presence | Development | Wear/ | Total | | Caries | | Abscess | Calculus/ | Affected |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Mandibular Left | 17 $M_3$ | | | | | | | | | | |
| | 18 $M_2$ | | | | | | | | | | |
| | 19 $M_1$ | | | | | | | | | | |
| | 20 $P_2$ | 2 | 14 | | 8 | | | | | | |
| | 21 $P_1$ | 2 | 14 | | 8 | | | | | | |
| | 22 C | | | | | | | | | | |
| | 23 $I_2$ | | | | | | | | | | |
| | 24 $I_1$ | | | | | | | | | | |
| Mandibular Right | 25 $I_1$ | | | | | | | | | | |
| | 26 $I_2$ | | | | | | | | | | |
| | 27 C | | | | | | | | | | |
| | 28 $P_1$ | | | | | | | | | | |
| | 29$P_2$ | | | | | | | | | | |
| | 30 $M_1$ | | | | | | | | | | |
| | 31 $M_2$ | | | | | | | | | | |
| | 32 $M_3$ | | | | | | | | | | |

**Estimated dental age (juveniles only)** ____________________

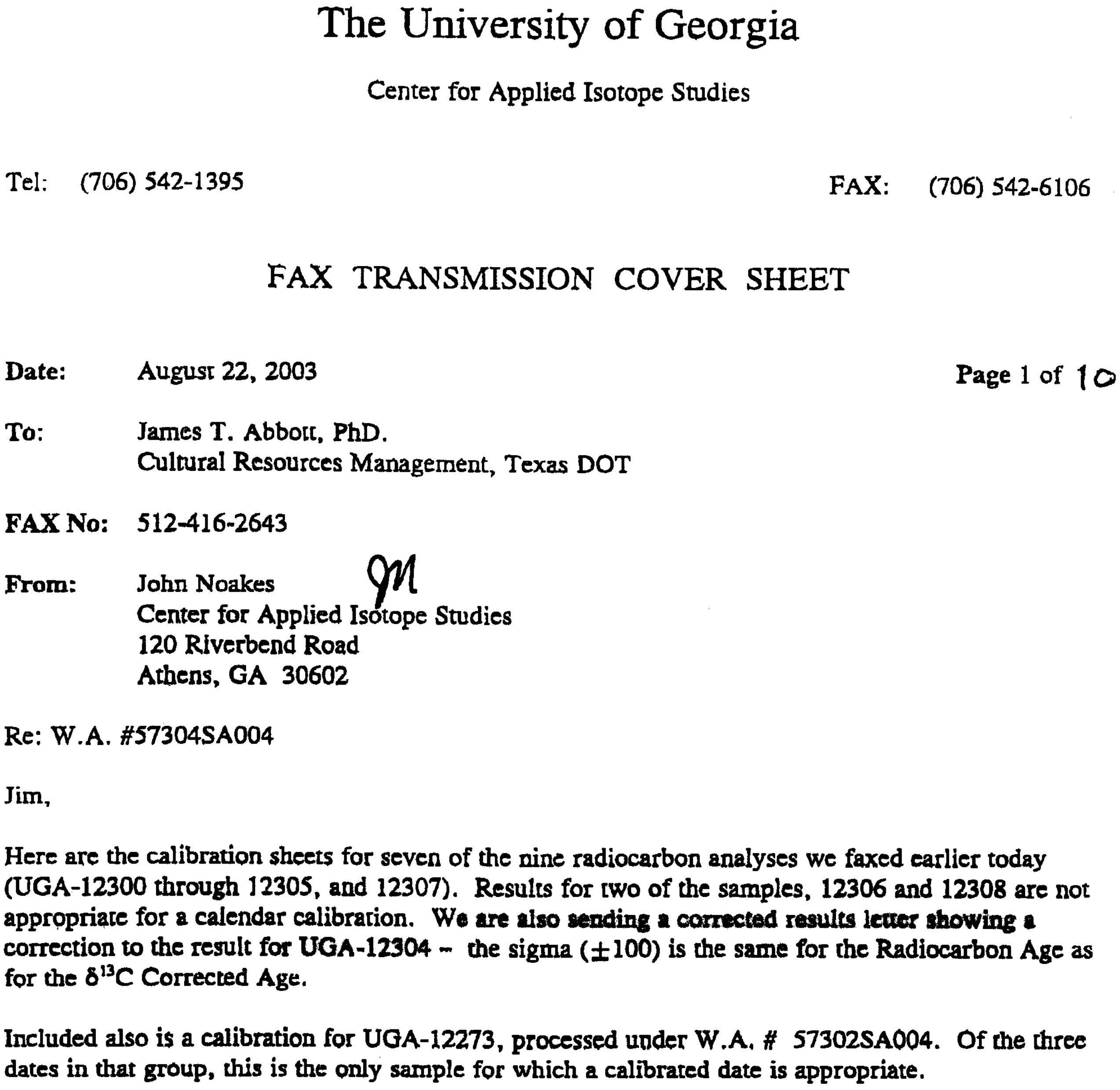
**Supernumerary Teeth:**

| Position between teeth | Location (1-4) | Position between teeth | Location (1-4) | Position between teeth | Location (1-4) |
|---|---|---|---|---|---|
| / | | / | | / | |
| / | | / | | / | |

Comments:
Extreme dietary and probable nondietary wear along the occlusal and lingual surfaces has all but obliterated the crown in each of the five teeth present. The pulp cavity has been exposed in each

# Appendix C

# Radiocarbon Results



# The University of Georgia

Center for Applied Isotope Studies

Tel: (706) 542-1395 FAX: (706) 542-6106

## FAX TRANSMISSION COVER SHEET

**Date:** August 22, 2003 **Page 1 of 10**

**To:** James T. Abbott, PhD.
Cultural Resources Management, Texas DOT

**FAX No:** 512-416-2643

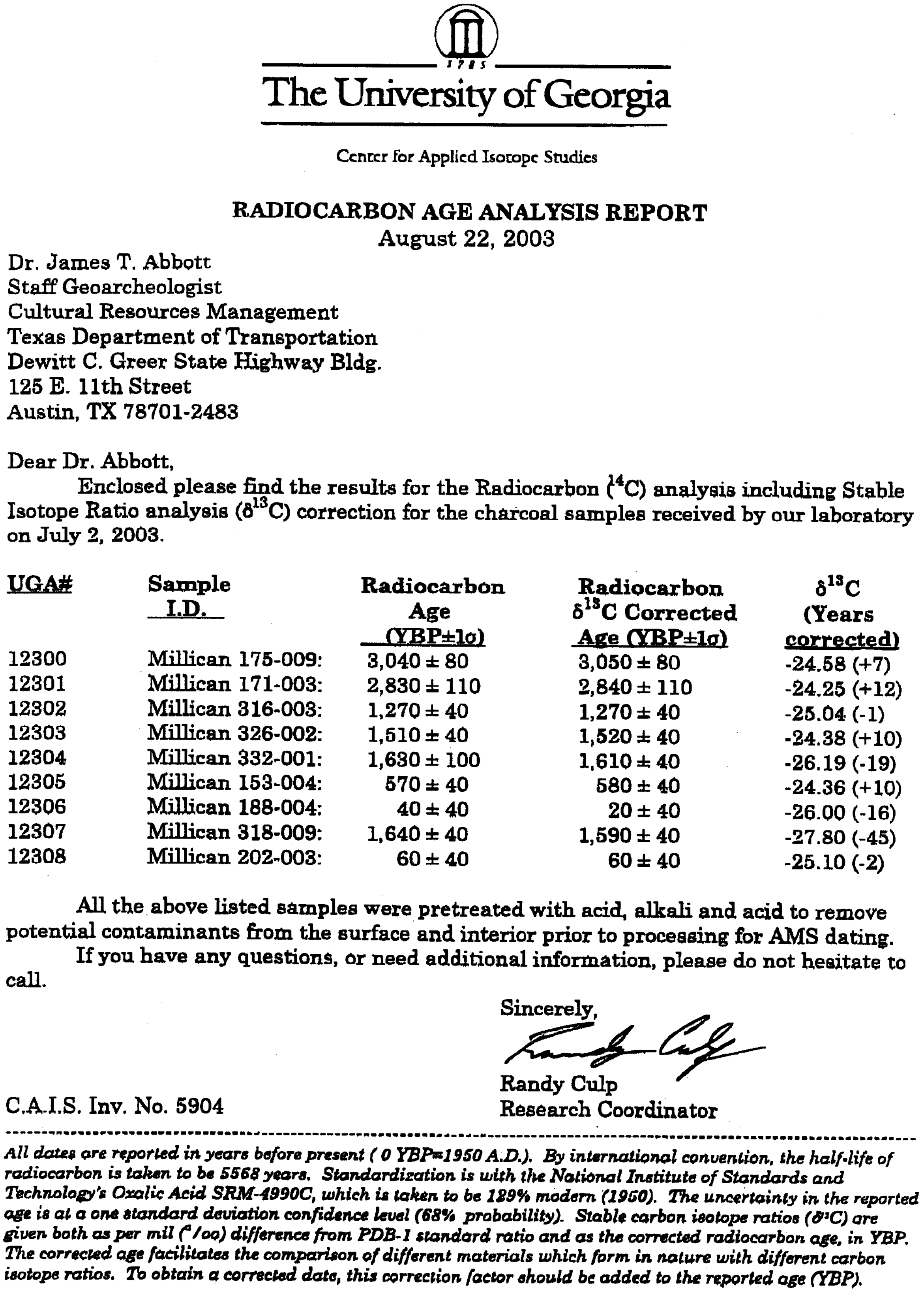
**From:** John Noakes JN
Center for Applied Isotope Studies
120 Riverbend Road
Athens, GA 30602

Re: W.A. #57304SA004

Jim,

Here are the calibration sheets for seven of the nine radiocarbon analyses we faxed earlier today (UGA-12300 through 12305, and 12307). Results for two of the samples, 12306 and 12308 are not appropriate for a calendar calibration. We are also sending a corrected results letter showing a correction to the result for UGA-12304 – the sigma (±100) is the same for the Radiocarbon Age as for the $\delta^{13}$C Corrected Age.

Included also is a calibration for UGA-12273, processed under W.A. # 57302SA004. Of the three dates in that group, this is the only sample for which a calibrated date is appropriate.



1785

The University of Georgia

Center for Applied Isotope Studies

## RADIOCARBON AGE ANALYSIS REPORT

August 22, 2003

Dr. James T. Abbott
Staff Geoarcheologist
Cultural Resources Management
Texas Department of Transportation
Dewitt C. Greer State Highway Bldg.
125 E. 11th Street
Austin, TX 78701-2483

Dear Dr. Abbott,

Enclosed please find the results for the Radiocarbon ($^{14}C$) analysis including Stable Isotope Ratio analysis ($\delta^{13}C$) correction for the charcoal samples received by our laboratory on July 2, 2003.

| UGA# | Sample I.D. | Radiocarbon Age (YBP±1σ) | Radiocarbon $\delta^{13}C$ Corrected Age (YBP±1σ) | $\delta^{13}C$ (Years corrected) |
|---|---|---|---|---|
| 12300 | Millican 175-009: | 3,040 ± 80 | 3,050 ± 80 | -24.58 (+7) |
| 12301 | Millican 171-003: | 2,830 ± 110 | 2,840 ± 110 | -24.25 (+12) |
| 12302 | Millican 316-003: | 1,270 ± 40 | 1,270 ± 40 | -25.04 (-1) |
| 12303 | Millican 326-002: | 1,510 ± 40 | 1,520 ± 40 | -24.38 (+10) |
| 12304 | Millican 332-001: | 1,630 ± 100 | 1,610 ± 40 | -26.19 (-19) |
| 12305 | Millican 153-004: | 570 ± 40 | 580 ± 40 | -24.36 (+10) |
| 12306 | Millican 188-004: | 40 ± 40 | 20 ± 40 | -26.00 (-16) |
| 12307 | Millican 318-009: | 1,640 ± 40 | 1,590 ± 40 | -27.80 (-45) |
| 12308 | Millican 202-003: | 60 ± 40 | 60 ± 40 | -25.10 (-2) |

All the above listed samples were pretreated with acid, alkali and acid to remove potential contaminants from the surface and interior prior to processing for AMS dating.

If you have any questions, or need additional information, please do not hesitate to call.

Sincerely,

Randy Culp
Research Coordinator

C.A.I.S. Inv. No. 5904

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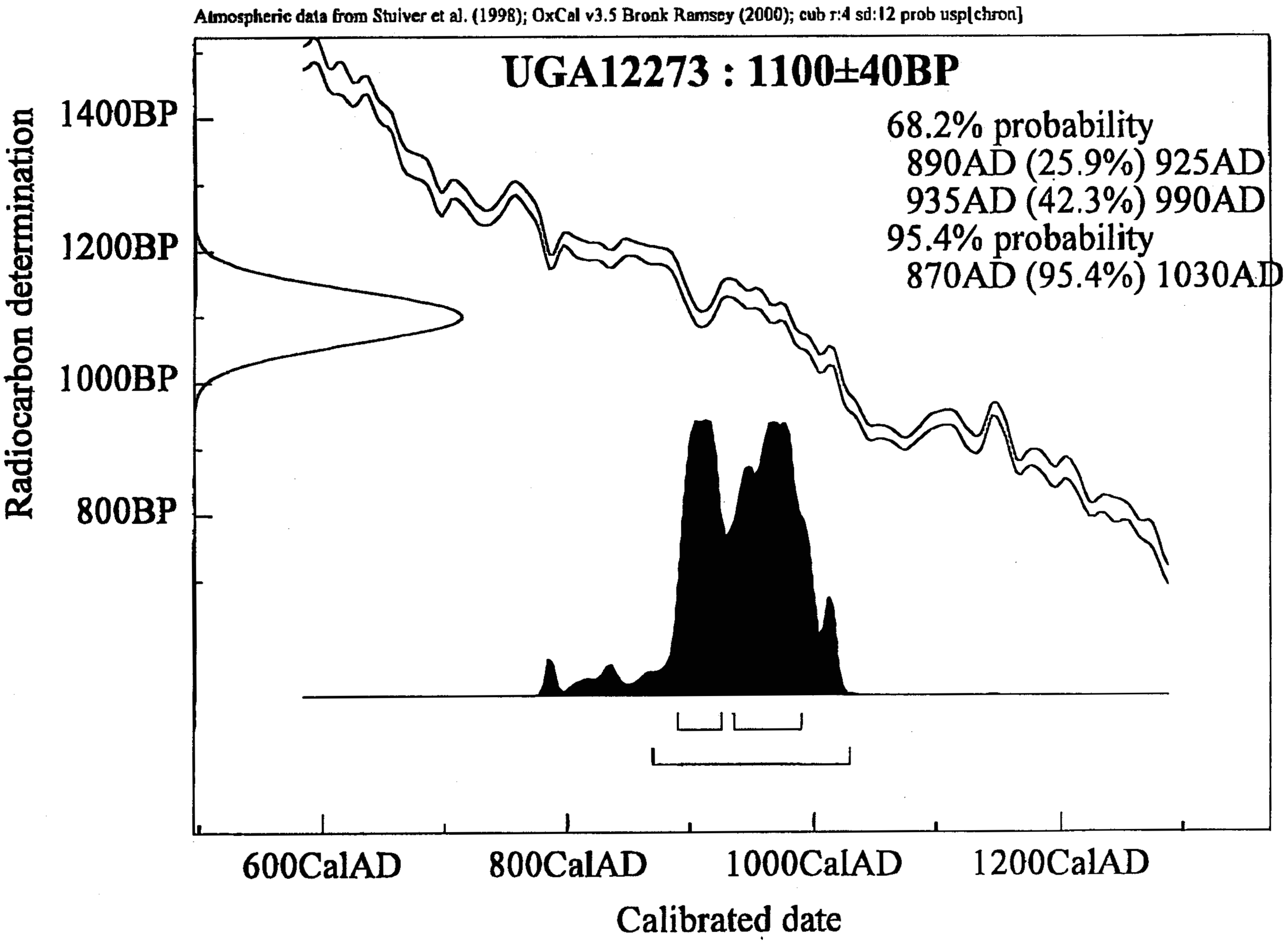
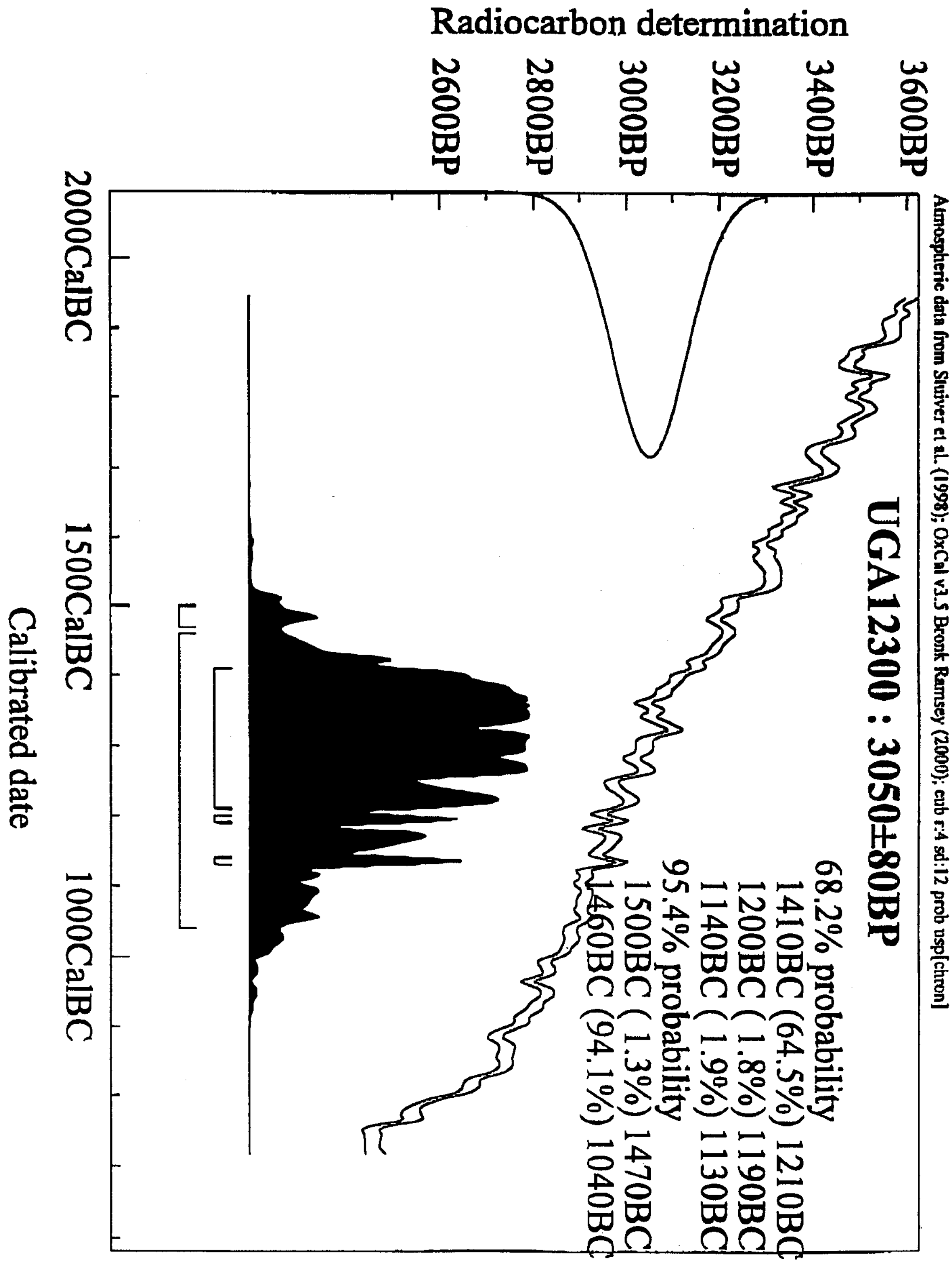
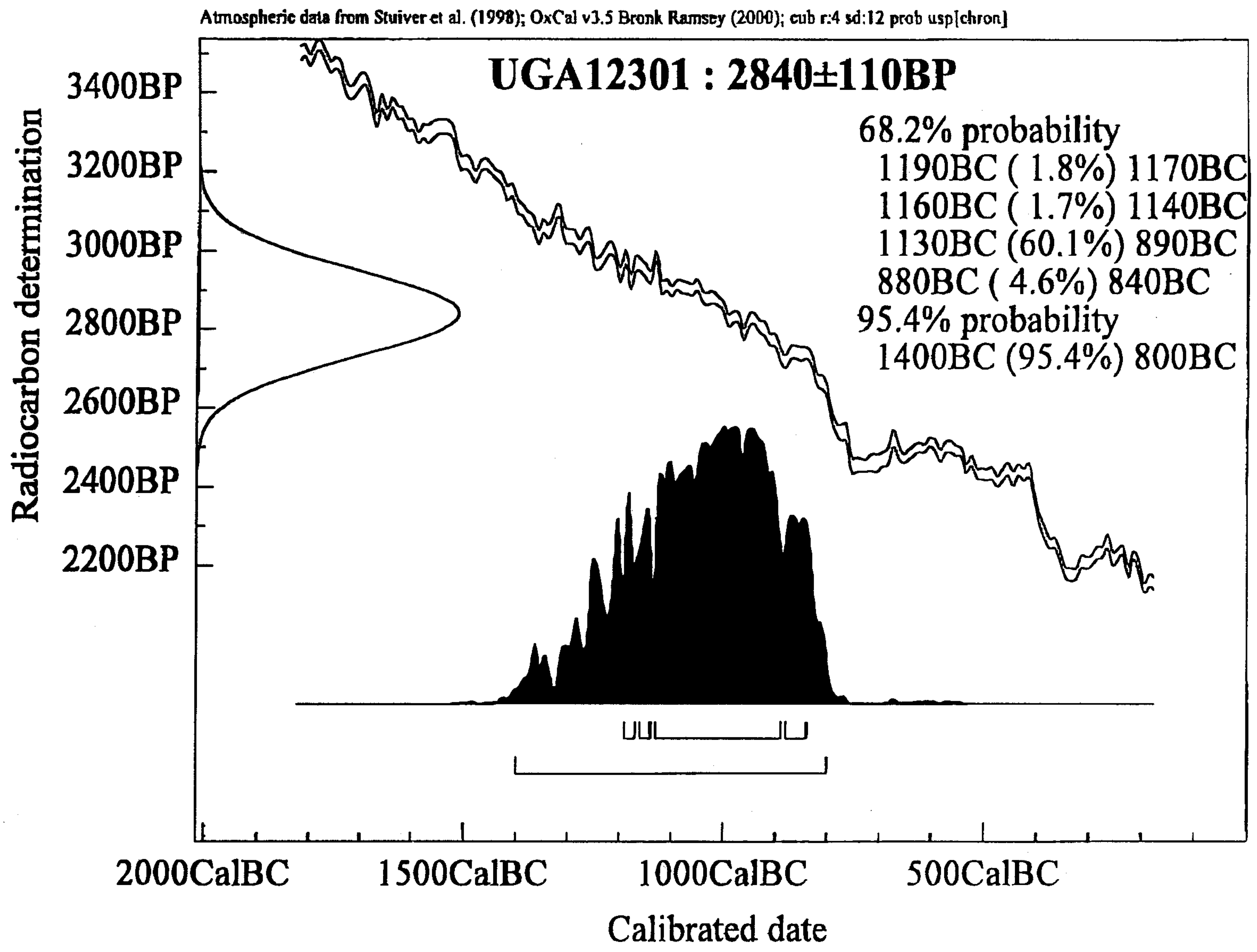
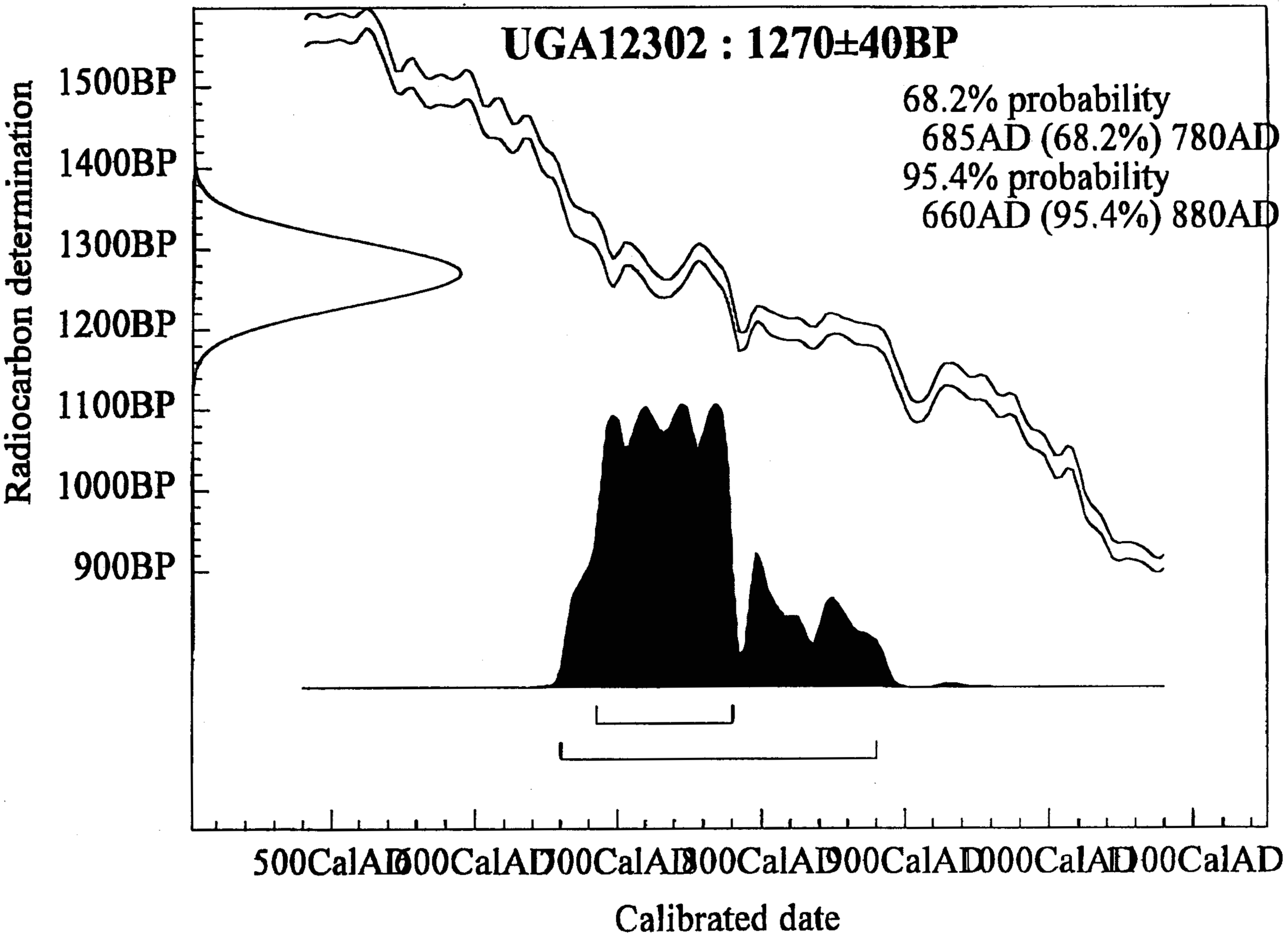
*All dates are reported in years before present ( 0 YBP=1950 A.D.). By international convention, the half-life of radiocarbon is taken to be 5568 years. Standardization is with the National Institute of Standards and Technology's Oxalic Acid SRM-4990C, which is taken to be 129% modern (1950). The uncertainty in the reported age is at a one standard deviation confidence level (68% probability). Stable carbon isotope ratios ($\delta^{13}C$) are given both as per mil ($^{o}$/oo) difference from PDB-1 standard ratio and as the corrected radiocarbon age, in YBP. The corrected age facilitates the comparison of different materials which form in nature with different carbon isotope ratios. To obtain a corrected date, this correction factor should be added to the reported age (YBP).*

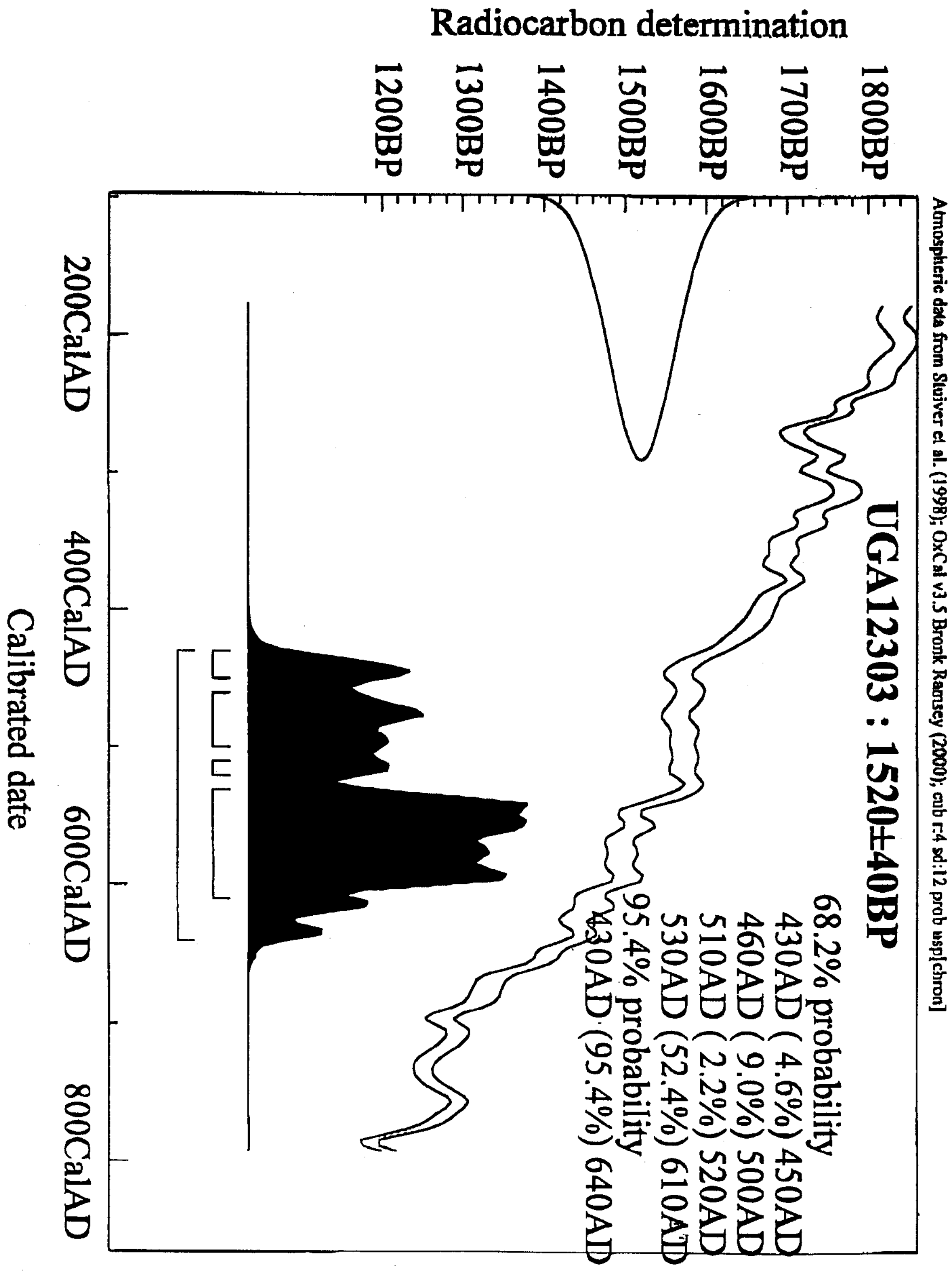

Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
UGA12273 : 1100±40BP
68.2% probability
890AD (25.9%) 925AD
935AD (42.3%) 990AD
95.4% probability
870AD (95.4%) 1030AD
Radiocarbon determination
1400BP
1200BP
1000BP
800BP
600CalAD
800CalAD
1000CalAD
1200CalAD
Calibrated date

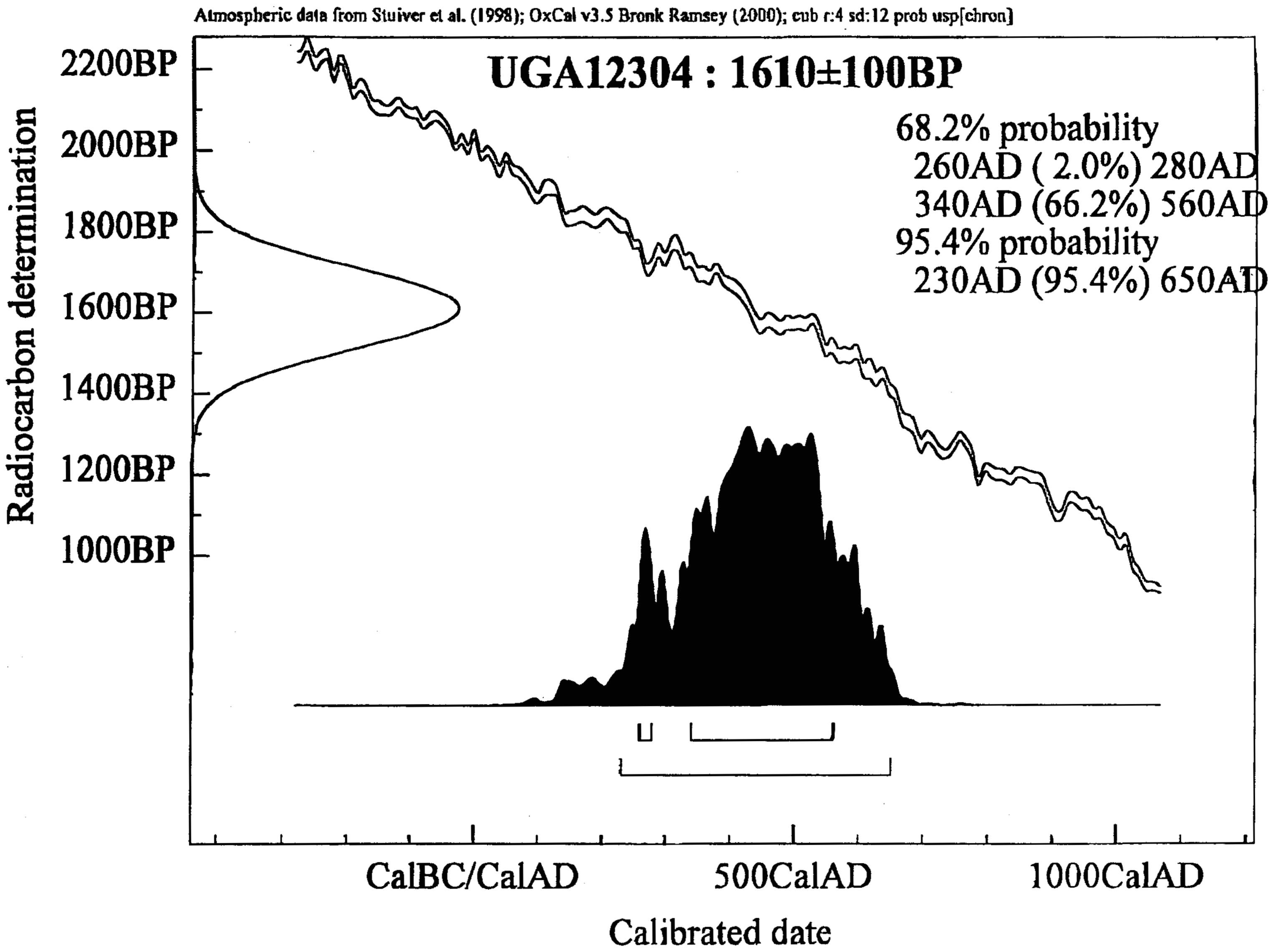

Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
UGA12300 : 3050±80BP
68.2% probability
1410BC (64.5%) 1210BC
1200BC ( 1.8%) 1190BC
1140BC ( 1.9%) 1130BC
95.4% probability
1500BC ( 1.3%) 1470BC
1460BC (94.1%) 1040BC
Radiocarbon determination
3600BP
3400BP
3200BP
3000BP
2800BP
2600BP
2000CalBC
1500CalBC
1000CalBC
Calibrated date

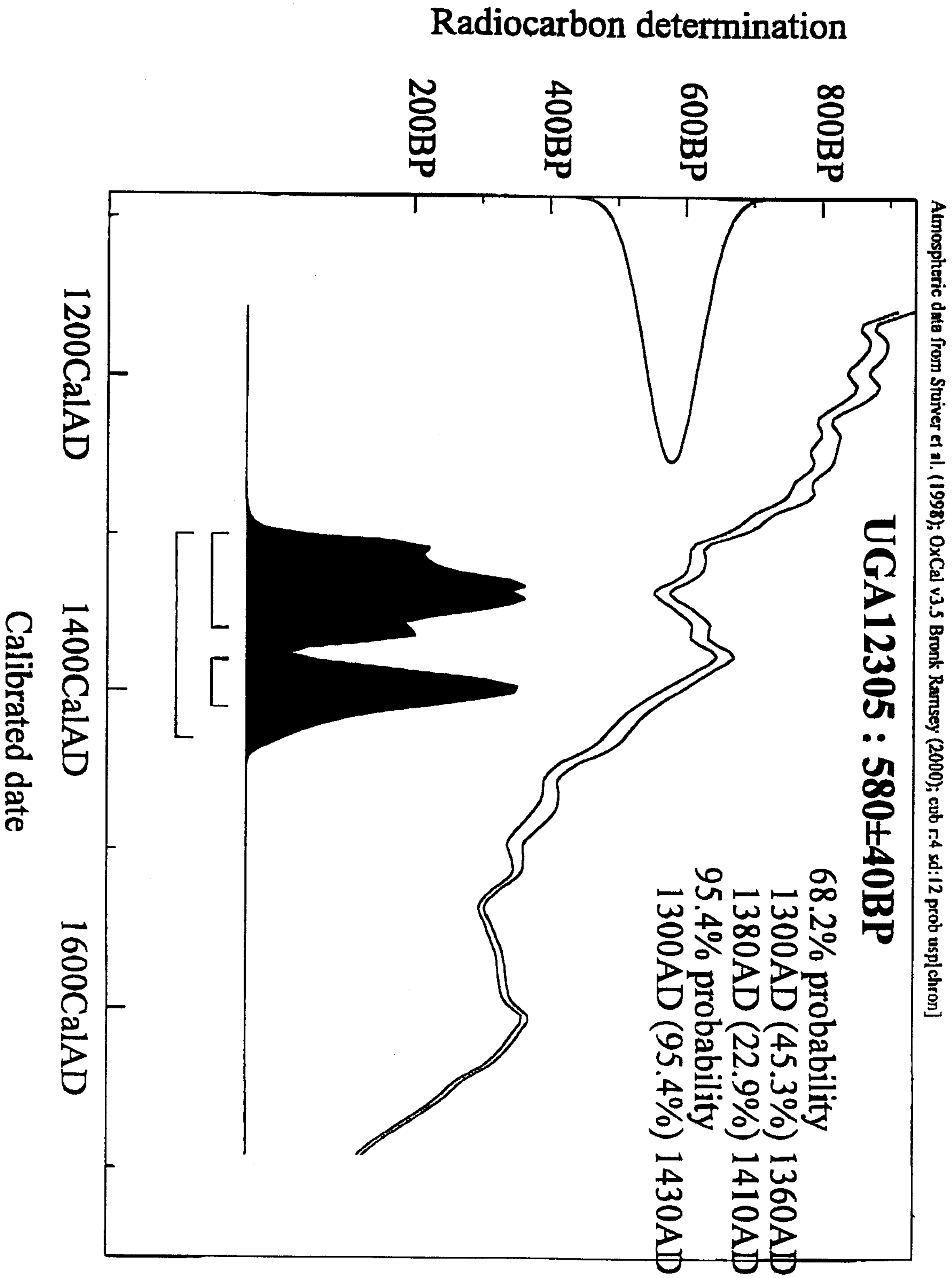

Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
UGA12301 : 2840±110BP
68.2% probability
1190BC ( 1.8%) 1170BC
1160BC ( 1.7%) 1140BC
1130BC (60.1%) 890BC
880BC ( 4.6%) 840BC
95.4% probability
1400BC (95.4%) 800BC
Radiocarbon determination
3400BP
3200BP
3000BP
2800BP
2600BP
2400BP
2200BP
2000CalBC
1500CalBC
1000CalBC
500CalBC
Calibrated date

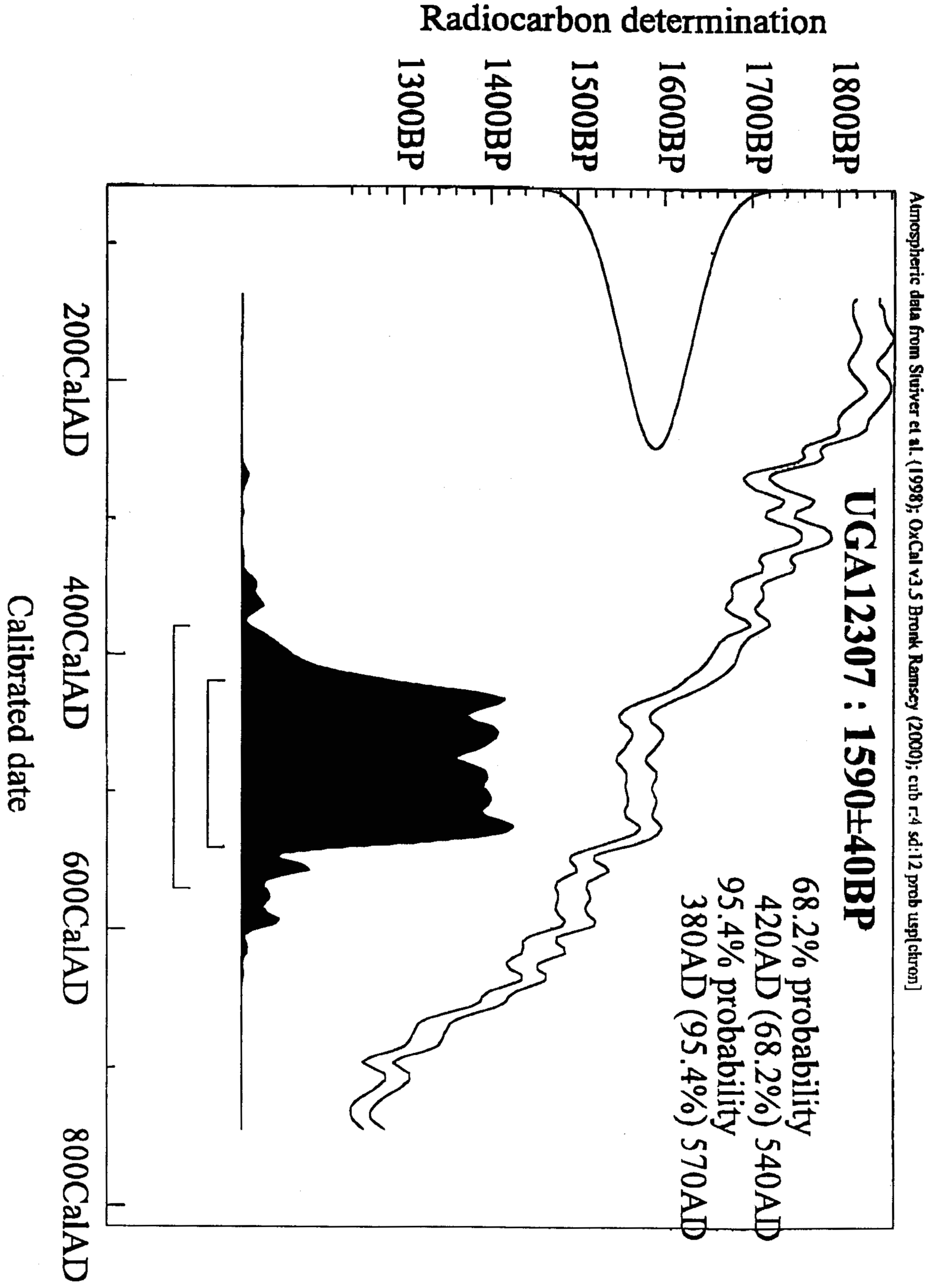
Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]




Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
UGA12303 : 1520±40BP
68.2% probability
430AD ( 4.6%) 450AD
460AD ( 9.0%) 500AD
510AD ( 2.2%) 520AD
530AD (52.4%) 610AD
95.4% probability
430AD (95.4%) 640AD
Radiocarbon determination
1800BP
1700BP
1600BP
1500BP
1400BP
1300BP
1200BP
200CalAD
400CalAD
600CalAD
800CalAD
Calibrated date


Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
UGA12304 : 1610±100BP
68.2% probability
260AD ( 2.0%) 280AD
340AD (66.2%) 560AD
95.4% probability
230AD (95.4%) 650AD
Radiocarbon determination
2200BP
2000BP
1800BP
1600BP
1400BP
1200BP
1000BP
CalBC/CalAD
500CalAD
1000CalAD
Calibrated date


Radiocarbon determination
Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
UGA12305 : 580±40BP
68.2% probability
1300AD (45.3%) 1360AD
1380AD (22.9%) 1410AD
95.4% probability
1300AD (95.4%) 1430AD
800BP
600BP
400BP
200BP
1200CalAD
1400CalAD
1600CalAD
Calibrated date


Radiocarbon determination
1800BP
1700BP
1600BP
1500BP
1400BP
1300BP
Atmospheric data from Stuiver et al. (1998); OxCal v3.5 Bronk Ramsey (2000); cub r:4 sd:12 prob usp[chron]
UGA12307 : 1590±40BP
68.2% probability
420AD (68.2%) 540AD
95.4% probability
380AD (95.4%) 570AD
200CalAD
400CalAD
600CalAD
800CalAD
Calibrated date

# Appendix D

# Plant Remains from 41TV163

# Appendix D: Plant Remains from 41TV163

J. Philip Dering

The Center for Archaeological Research submitted nine flotation samples and one macrobotanical sample from 41TV163 to Shumla Archeobotanical Services for analysis. The nine samples were recovered during the 1970–1971 TxDOT sponsored excavations. The flotation samples varied in size from 0.05 liters to 8.0 liters, and totaled 35.15 liters.

## Methods

There are two types of samples in the current study—flotation samples and macrobotanical samples. Flotation is a method of recovering organic remains from archeological sediments by using water to separate heavy or soluble inorganic particles from plant parts and small animal bone. The material floating to the surface is called the light fraction, and this is caught on a fine mesh screen or strainer. The material that sinks to the bottom is the heavy fraction and it is also caught on a fine mesh screen. Most of the soil, including clay and silt, is dissolved or suspended in the water that passes through the screens and is either recycled or discarded. In most cases, only the light fraction is submitted for analysis after the heavy fraction has been examined for plant materials.

Macrobotanical samples are carbonized plant remains that are separated from the rest of the archeological material by hand. Macrobotanical samples are collected either from an excavator's screen, are point-collected and plotted individually in the field, or picked from laboratory samples. They are often labeled $^{14}$C or radiocarbon samples.

At the vast majority of open sites, only carbonized plant remains are considered to be potentially a part of the archeological record. In some rare cases, certain durable and easily identifiable wood types such as juniper may survive in a partially carbonized state, but only at younger sites in relatively dry conditions. Submerged sites in which deposits have remained in anaerobic conditions can also preserve uncarbonized plant remains quite well. Deposits in the current study have been exposed to the elements for a sufficient time period that, with few exceptions, only carbonized plant material is considered to be included in the archeological record.

The analysis followed standard archeobotanical laboratory procedures. The light fraction of each flotation sample was passed through a nested set of screens of 4-mm, 2-mm, 1-mm, and 0.450-mm mesh and examined for charred material that was separated for identification. Carbonized wood from the 4-mm and 2-mm screens (smaller pieces are seldom identifiable) was separated in a 25-piece grab sample and identified. However, the charred material caught on all of the sieve levels, including the bottom pan, was scanned for floral parts, fruits, seeds, and other potentially edible plant parts such as bulb fragments, agave, or maize fragments. All of the potentially edible plant parts were counted and examined for identification. Screen- or point-collected macrobotanical samples (radiocarbon samples, etc.) were also sorted, identified, counted, and weighed.

Identification of carbonized wood was accomplished by using the snap technique, examining them at 8 to 45 magnifications with a hand lens or a binocular dissecting microscope. Identifications were made using wood or seed identification manuals and wood, seed, and plant voucher reference collections in the laboratory at Shumla Archeobotanical Services.

Seeds and fruit fragments were identified using reference specimens in the Shumla Archeobotanical Services laboratory. Some seeds are so similar that they are grouped into types that include more than one taxonomic category. For example, the term cheno-am is used to refer to the charred seeds (achenes) of either the genus *Chenopodium* (goosefoot) or *Amaranthus* (pigweed). Although it may be possible to distinguish these seeds when they are fresh and uncharred, quite often they swell and distort when exposed to heat. Therefore, these are referred to as the seed type "cheno-am," which is a category that refers to both genera.

## Results

The quantity of carbonized plant material from the 41TV163 samples was low. The archeobotanical assemblage consisted of 44 charred plant fragments weighing 1.55 g. Carbonized plant materials were not recovered from the 4 mm screen, and all of the identified wood charcoal was picked from the

2-mm screen. One bulb fragment and one seed (hackberry nutlet) were the only edible plant parts recovered from the samples. Wood charcoal fragments were identified as oak and juniper. Some of the fragments were not identifiable primarily because of their small size. Results of the analysis are presented in Table D-1.

Eight fragments of juniper weighing 0.3 g were recovered from four samples. Oak occurred in three samples, but in slightly greater abundance, totaling 28 fragments weighing 0.4 g. Two types of potentially edible plant resources were identified in the samples. A hackberry nutlet was noted in Cat. #120-027-1, a flotation sample recovered from Level 6 of S165/E200. Hackberry nutlets or seeds are often recovered from open archeological sites in North America, and because they are composed of calcium carbonate they resist deterioration. Therefore, hackberry nutlets have the potential to be part of the archeological record. Hackberry was consumed by Native Americans throughout its extensive range, especially the species *Celtis laevigata*, known as sugarberry. The small fruit was usually pounded or ground into sweet meal which was combined with other foods. For example, the Comanche combined the pulp of sugarberry with fat, rolled it into balls and roasted it (Carlson and Jones 1940:521).

The only macrobotanical sample submitted for analysis contained a fairly complete bulb fragment that compares favorably to an onion bulb. The bulb specimen (Cat. No. 333-001) measures 12.9 mm long by 8.6 mm and weighs 0.1 g. Several other fragments that have separated from the specimen bring the total weight to 0.3 g.

A bulb has a shortened stem termed a basal plate that has one or more apical meristems, and is enclosed by several fleshy scales, usually in a rosette pattern. The basal plate also contains adventitous root initials. The scales are the primary storage tissue in true bulbs. Depending on the species, scales consist of either modified leaves or leaf bases. Both types of structures are enlarged with fleshy tissue that stores food and water.

The specimen from 41TV163 consists of what appears to be a single relatively thick leaf scale encircled by thinner leaf scales. The central stem is missing, presumably it has broken away from the specimen, leaving a hollow space at the center of the specimen. This condition is not unusual in archeological material, but it does not make identification easy. The sample most closely resembles wild onion or *Allium* sp., which can have a relatively thick (<2 mm), spongy leaf scale surrounded by thinner leaf scales.

## Discussion and Conclusions

Table D-2 lists the archeological sites along the northern, southern, and eastern and periphery of the Edwards Plateau from which onion remains have been identified. Onions have been recovered from at least five sites along the southern and eastern periphery of the Edwards Plateau, and from three sites in Brown County, located on the northern periphery.

In the Edwards Plateau region, there are over 30 prehistoric archeological sites from which all types of bulb remains have been recovered, including eastern camas, dog's-tooth

Table D-1. Plant Materials Recovered from 41TV163

| Cat # | Unit | Zone | Area | Level | Taxon | Common Name | Part | Count | Weight (grams) |
|---|---|---|---|---|---|---|---|---|---|
| 165-018-1 | S175/E200 | B | -- | I / II (0-0.5) | *Juniperus* sp. | Juniper | Wood | 2 | 0.05 |
| 167-010-1 | S175/E200 | B | | II/III (1.0-1.5) | Indeterminate | -- | Wood | 1 | 0.05 |
| 116-012-1 | S165/E200 | B | -- | II (0.5-1.0) | *Juniperus* sp. | Juniper | Wood | 3 | 0.1 |
| 120-027-1 | S165/E200 | B | -- | IV/V (2.5-3.0) | *Quercus* sp. | Oak | Wood | 1 | 0.05 |
| 120-027-1 | S165/E200 | B | -- | IV/V (2.5-3.0) | *Celtis* sp. | Hackberry | Seed | 1 | -- |
| 117-025-1 | S165/E200 | B | | II.III (1.0-1.5) | Indeterminate | -- | Wood | 6 | 0.1 |
| 150-061-1 | S150/E200 | C | | I (0.0-0.5) | *Quercus* sp. | Oak | Wood | 1 | 0.05 |
| 219-007-1 | I+95/N5.0 | IIA | E | III (1.0-1.5) | *Juniperus* sp. | Juniper | Wood | 2 | 0.1 |
| 218-037-1 | I+95/N5.0 | IIA | E | II (0.5-1.0) | *Juniperus* sp. | Juniper | Wood | 1 | 0.05 |
| 328-010-1 | Burial F-10 | C | | III | *Quercus* sp. | Oak | Wood | 26 | 0.3 |
| 333-001 | S175/E200 | III | B | III | cf. *Allium* sp. | Onion | Bulb | 1 | 0.7 |

Table D-2. Overview of *Allium* Finds from Sites Located along the Northern and Eastern Periphery of the Edwards Plateau

| County | Site Name (Number) | References | Est. Age of Bulb Remains (Years B.P.) |
|---|---|---|---|
| Bosque | Horn Shelter No. 1 (41BQ47) | Phil Dering, personal communication 2001; Watt 1978 | 510 +/- 30 |
| Brown | 41BR250, 41BR253, 41BR493 | Dering 2003 | 730 +/- 40 to 790 +/- 40 (41BR250 and 41BR253)<br>220 +/- 40 to 970 +/- 40 (41BR493)<br>e.g., primarily Late Prehistoric |
| Coryell | Firebreak Site (41CV595) | Dering 2002 | 2180 to 1050; 1910+/-70 on Feature 15 |
| Hays | Onion Creek (41HY209) | | 660 +/- 50, to 790 +/- 50 |
| Travis | Toyah Bluff (41TV441) | Dering 2001 | 860 to 460 |
| Williamson | Block House Creek (41WM632) | Dering 1999 | 1790 to 900<br>1242 to 530 |

violet, rain lily, and unidentified bulbs. All of the current finds are located within the context of burned rock features, and most are associated with burned rock middens. The number continues to grow annually.

The accumulating evidence points to the probability that root foods were one of the primary food resources prepared in earth ovens. Prior to these discoveries, the debate regarding the types of food prepared in earth ovens revolved around the possibility that acorns (Creel 1986, 1991) or sotol (Prewitt 1974) were the dominant resources prepared at these facilities. The list was expanded by Black and Creel (1997: 294) to include other resources such as prickly pear fruits and various types of bulbs. The authors maintain correctly that burned rock middens resulted from repeated earth oven use, and that earth ovens were facilities that did not represent "a single, functionally specific entity except in the general sense" (Black and Creel 1997:294). The facilities were instead utilized to prepare many types of food, including bulbs, prickly pear tunas, and perhaps even acorns.

Over the previous decade the importance of geophytes in prehistoric land-use strategies has been emerging slowly from the archeological record. It is becoming clear that geophytes ("root" foods), especially bulbs, may have constituted a very important part of prehistoric subsistence throughout central Texas, and perhaps throughout most of Texas. What is interesting is the lack of corroboration of the archeological record with early historic observations, which often provide details of hunting trips or use of other more easily observable resources, overlooking the lowly root.

Even more interesting is the fact that the utilization of root foods is described for southern Texas, where no remains of roots have been recovered. Campbell and Campbell (1981: 18) provide the best summary of the earliest European observations of the use of root foods. Cabeza de Vaca, who has given us the earliest accounts, noted two or three kinds of roots were dug in the region during winter months when other foods were not available. These roots did not occur in dense stands, were difficult to collect, and required fairly long foraging trips to secure sufficient quantities for daily subsistence. These roots were baked for two days in what was probably an earth oven. The description of the baking facility is poor, but an earth oven is the only type of facility in which such a process could take place.

However, I believe that the real picture, and the importance, of geophytes is beginning to emerge as flotation efforts have expanded. It is becoming apparent that the use of root foods not only was important within the range of burned rock midden sites, but also extended beyond the range of burned rock middens into areas in which smaller rock features are noted, but large accumulations are lacking. For example, onion bulbs were identified from burned rock features in Grimes County, far east of the Edwards Plateau (Dering 1994:D1). The current study contributes more evidence toward the argument that root foods were an important staple in for the forager in southern-central North America.

# References Cited

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# Appendix E

# Selected Projectile Points from 41TV163

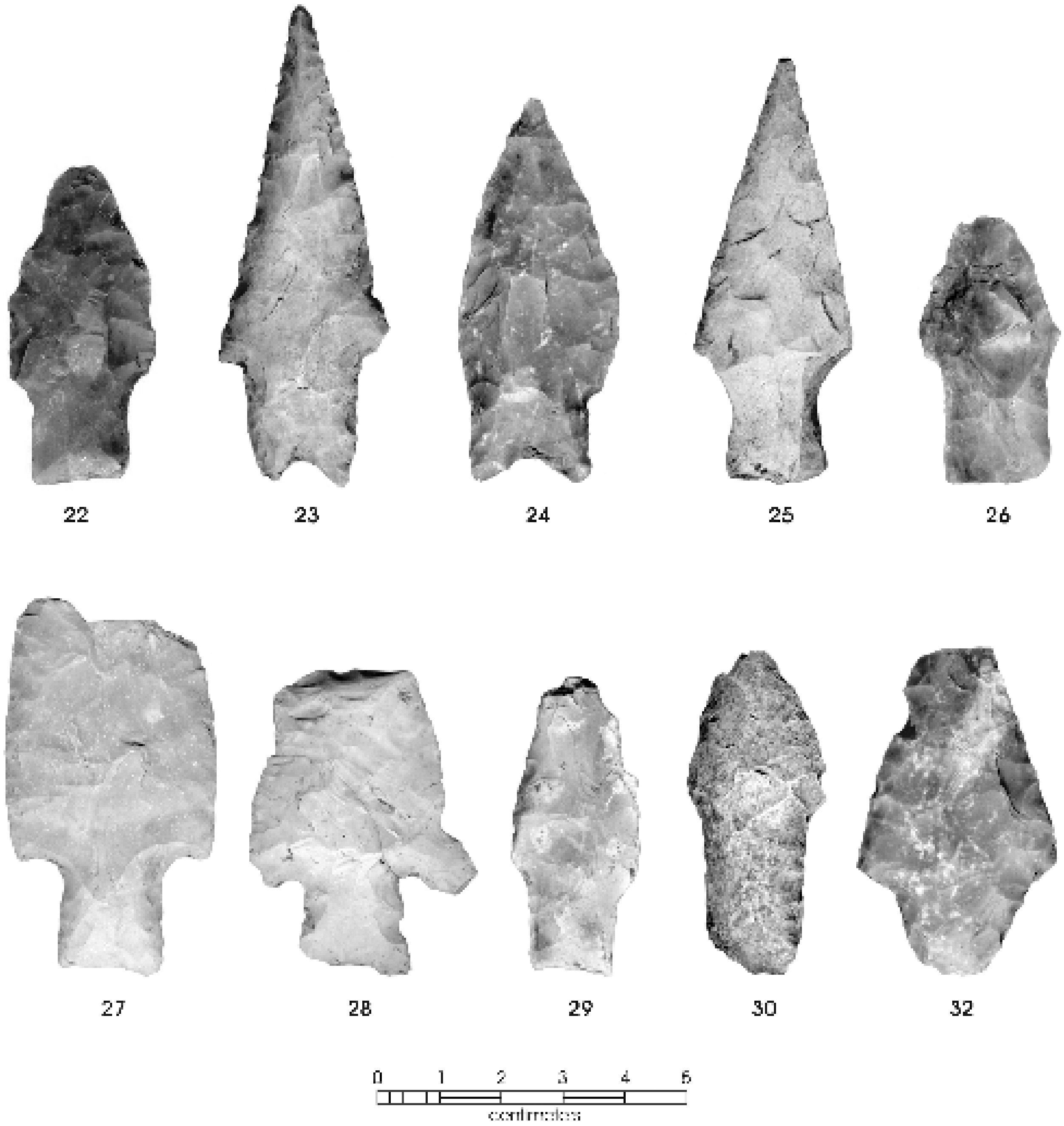

Figure E-1. *Selected projectile points from Area A. Numbers identify specimen within database.* 22) Nolan; 23, 24) Pedernales; 25, 26) Nolan; 27) possible Lange; 28) Lange; 29) possible Travis; 30) Wells; 32) Langtry.

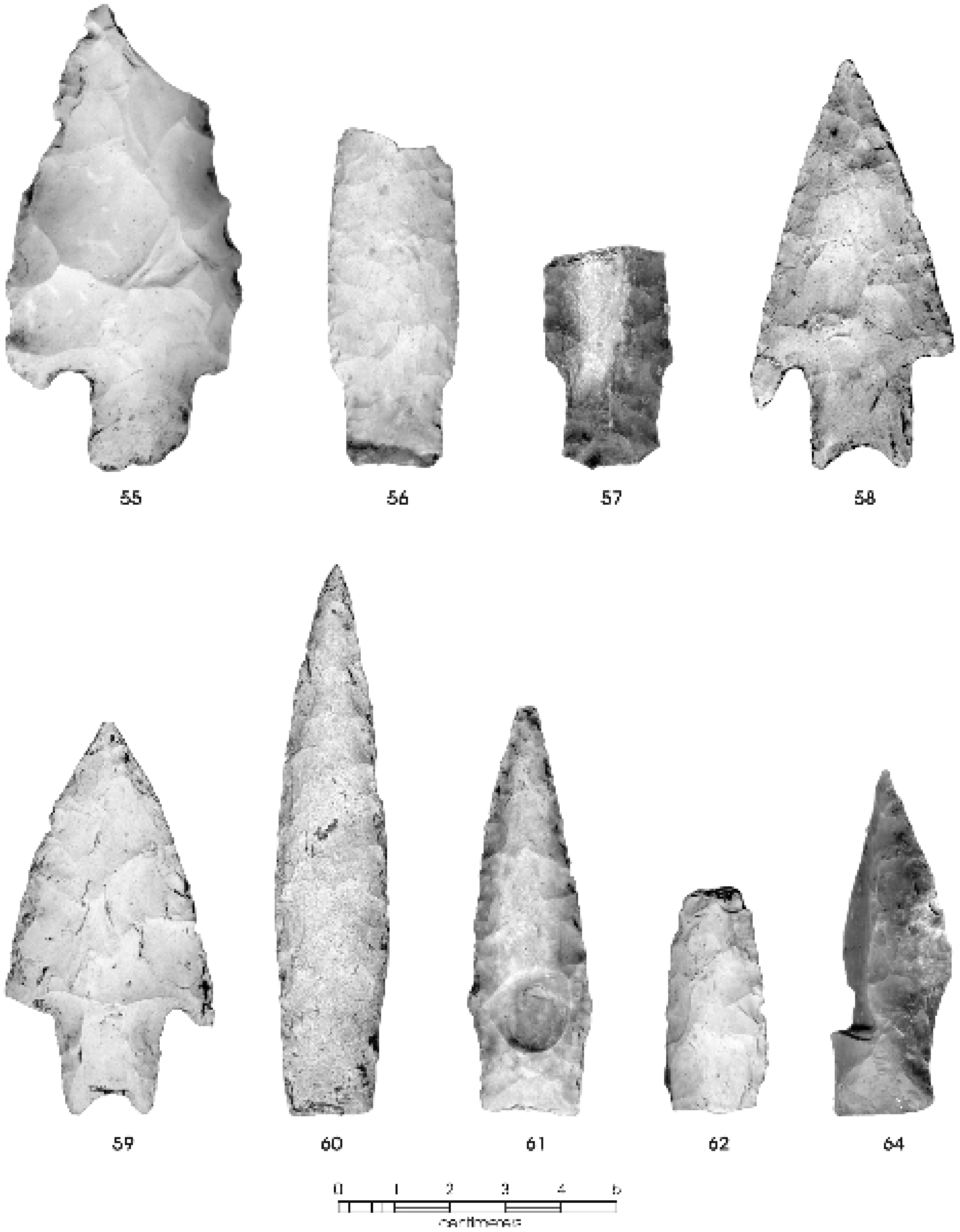

Figure E-1. *continued... Selected projectile points from Area A.* 55) Pedernales preform; 56, 57) Travis; 58, 59) Pedernales; 60) Nolan; 61) Travis; 62) possible Wells; 64) Nolan.

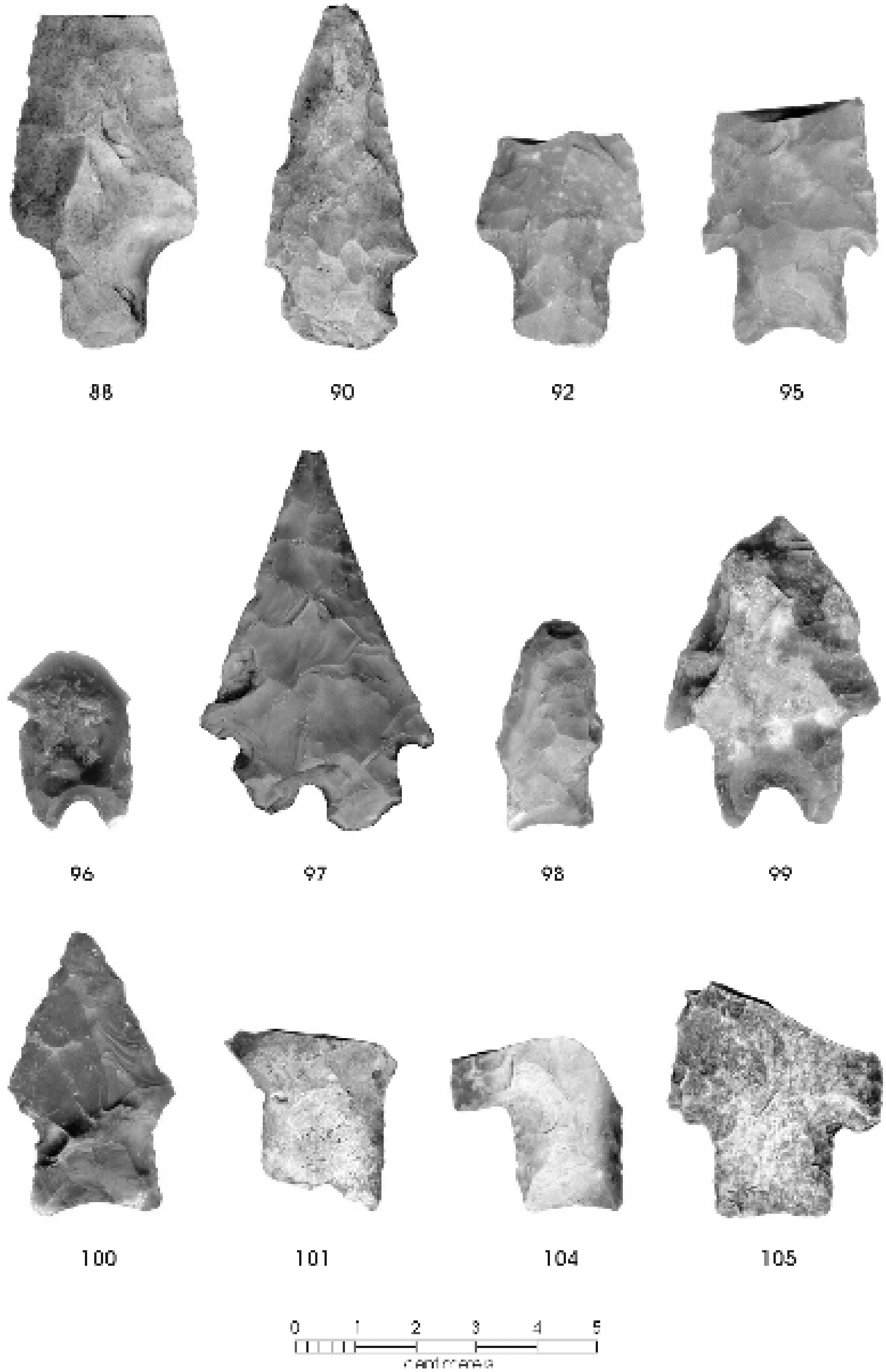

Figure E-2. *Selected projectile points from Area B.* 88) Nolan; 90) Williams; 92, 95, 96) Travis; 97) Montell; 98) Darl; 99) Pedernales; 100) Marshall; 101) Pedernales; 104, 105) Bulverde.

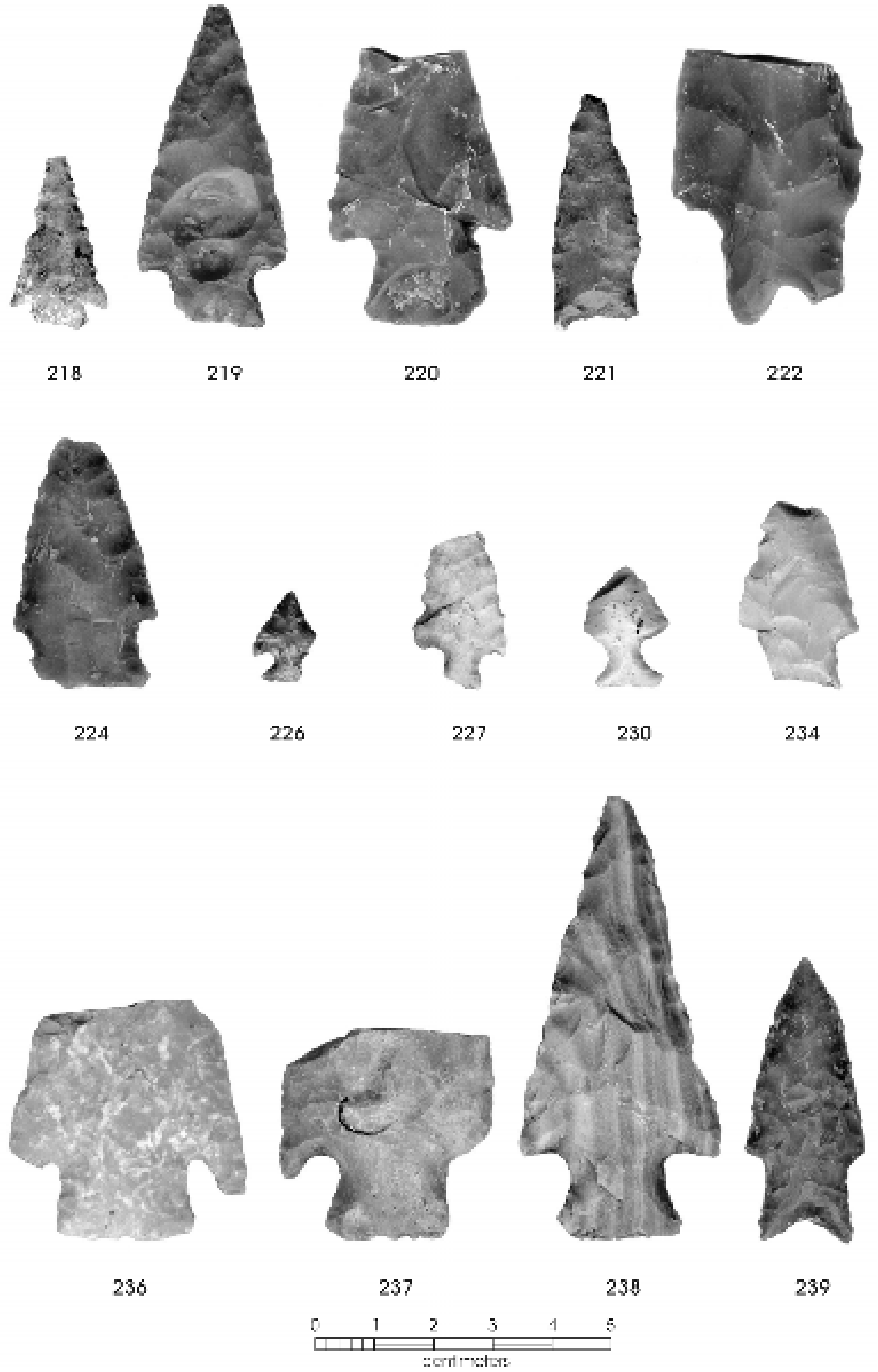

Figure E-3. *Selected projectile points from Area C.* 218) Scallorn; 219) Fairland; 220) Lange; 221) Darl; 222) Pedernales; 224) Ensor; 226, 227, 230) Scallorn; 234) Darl; 236) Castroville; 237, 238) Lange; 239) Darl.

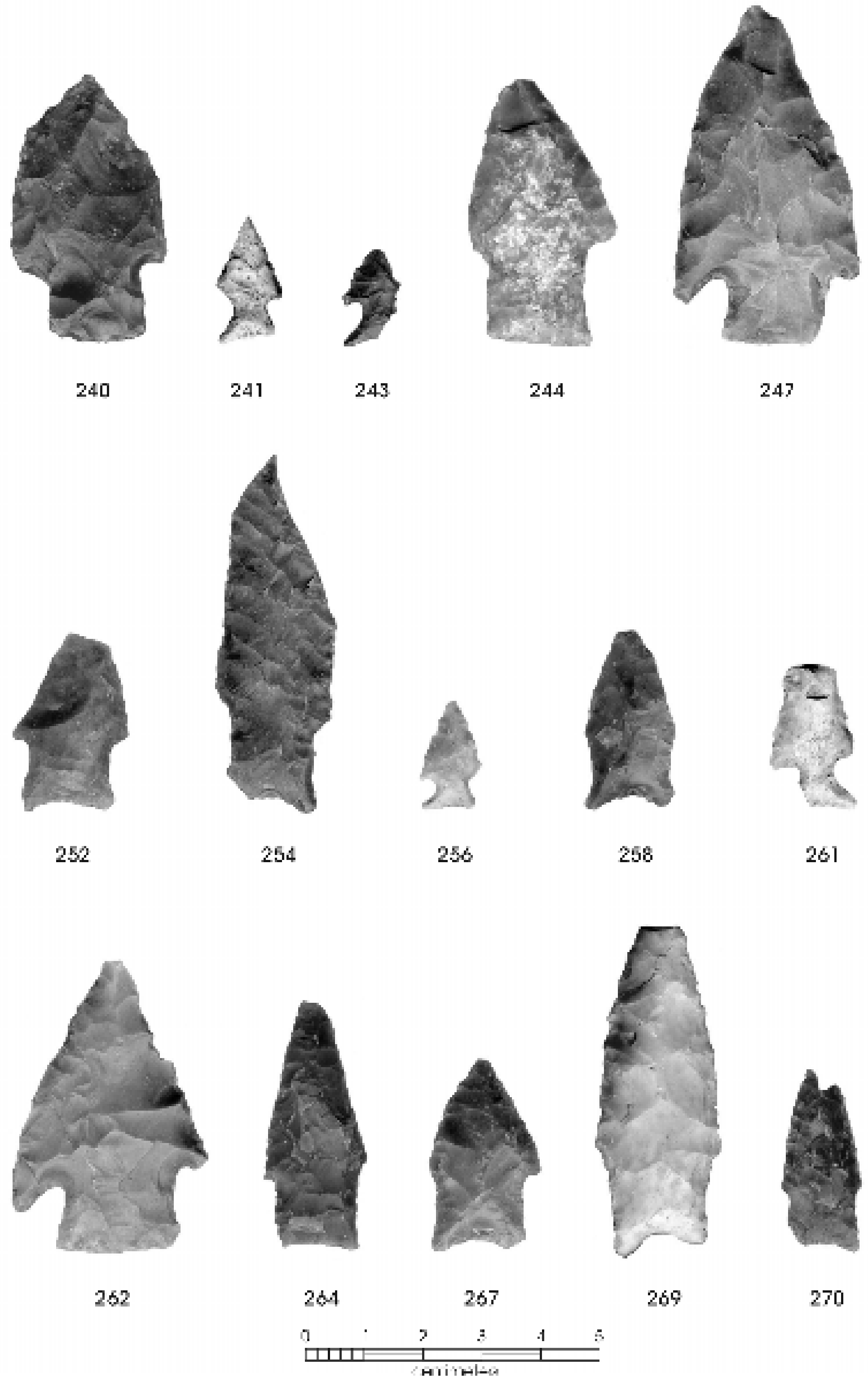

Figure E-3. *continued... Selected projectile points from Area C.* 240) Lange; 241, 243) Scallorn; 244) Bulverde; 247) Lange; 252, 254) Darl; 256) Scallorn; 258) Darl; 261) Scallorn; 262) Marcos; 264, 267, 269, 270) Darl.

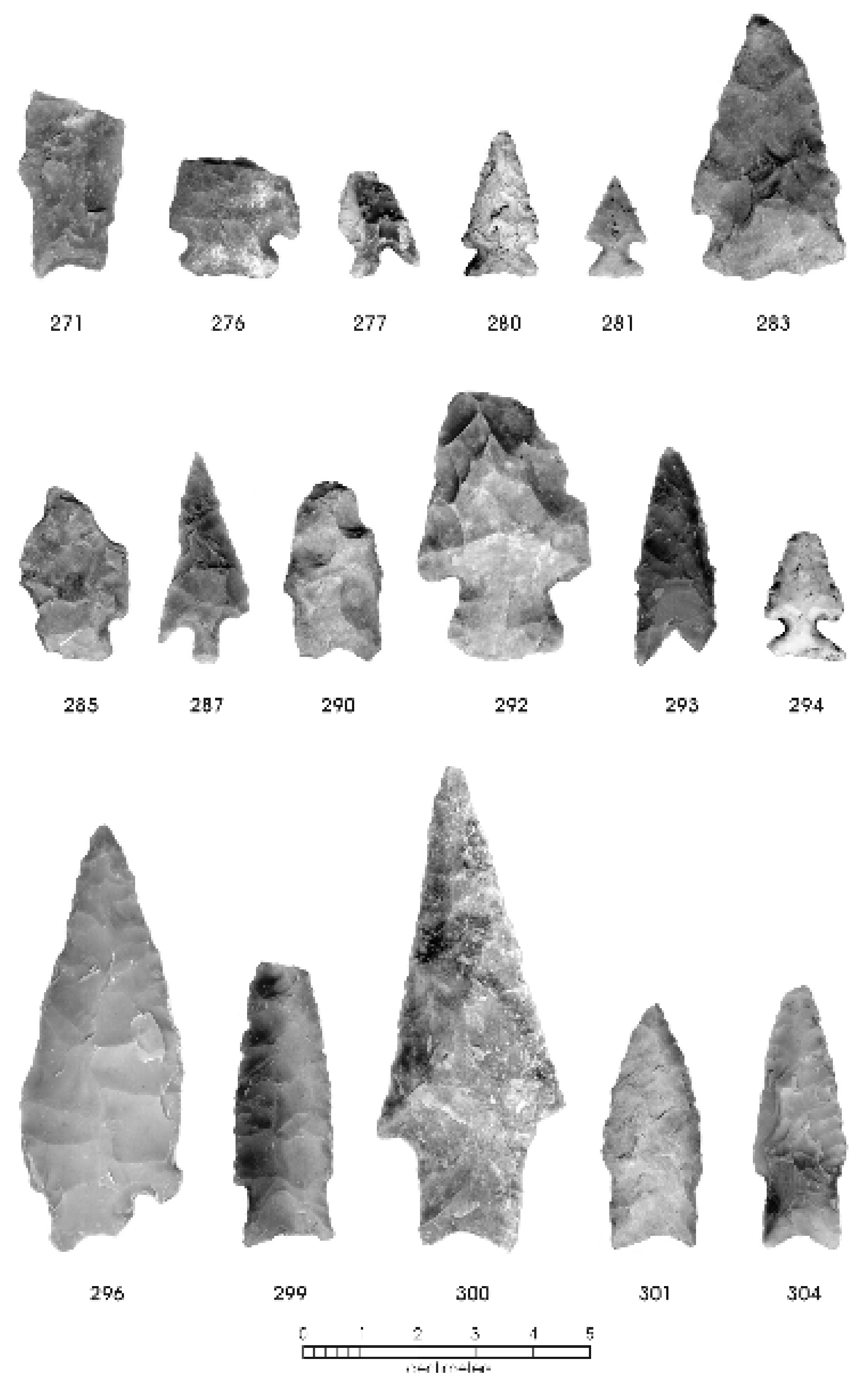

Figure E-3. *continued... Selected projectile points from Area C.* 271) Darl; 276) Fairland; 277, 280, 281) Scallorn; 283, 285) Ensor; 287) Bonham; 290) Darl; 292) Lange; 293) Darl; 294) Scallorn; 296) Pedernales; 299) Darl; 300) Pedernales; 301, 304) Darl.

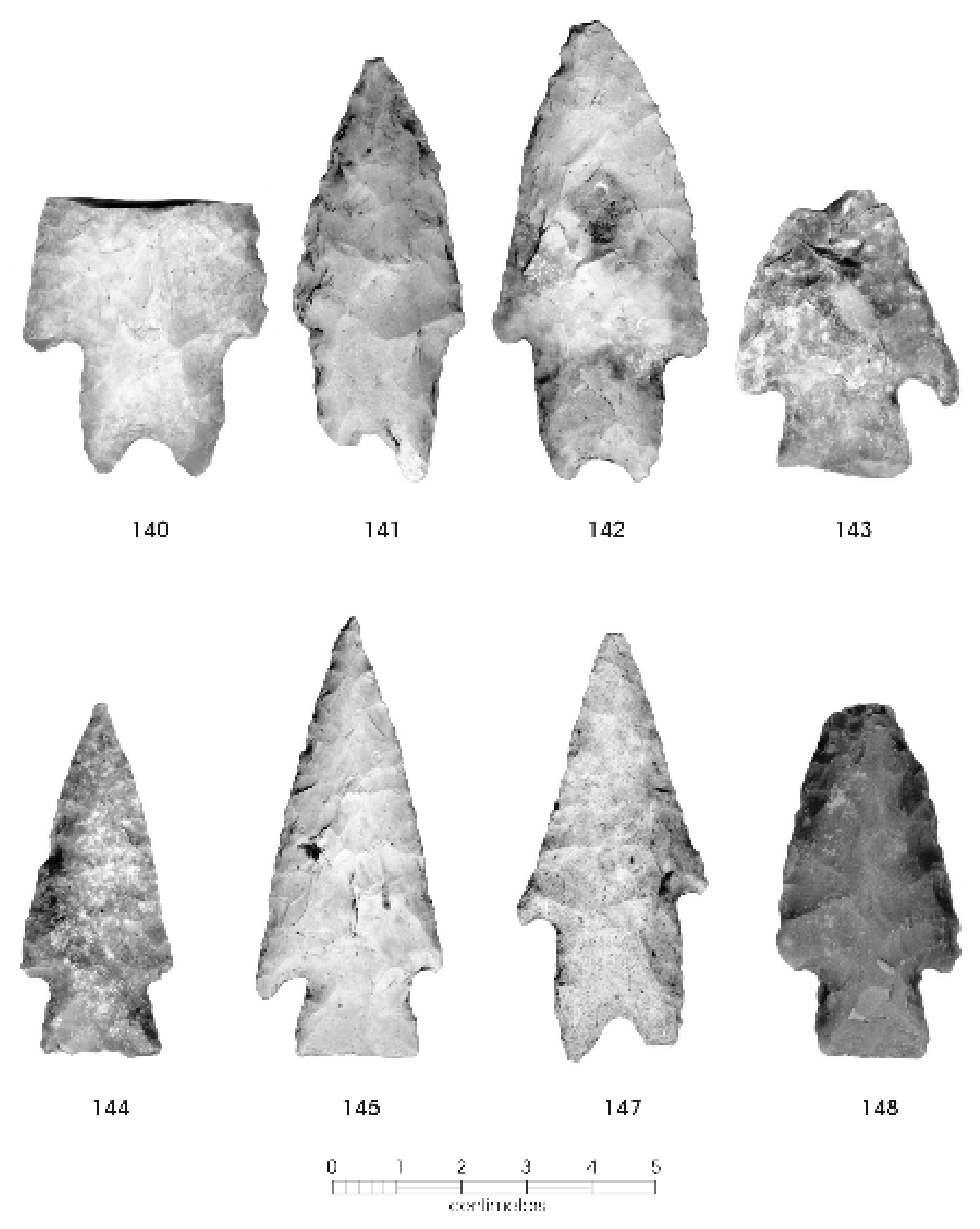

Figure E-4. *Selected projectile points from Area E.* 140–142) Pedernales; 143) Lange; 144) Darl; 145) Lange; 147) Pedernales; 148) Lange.

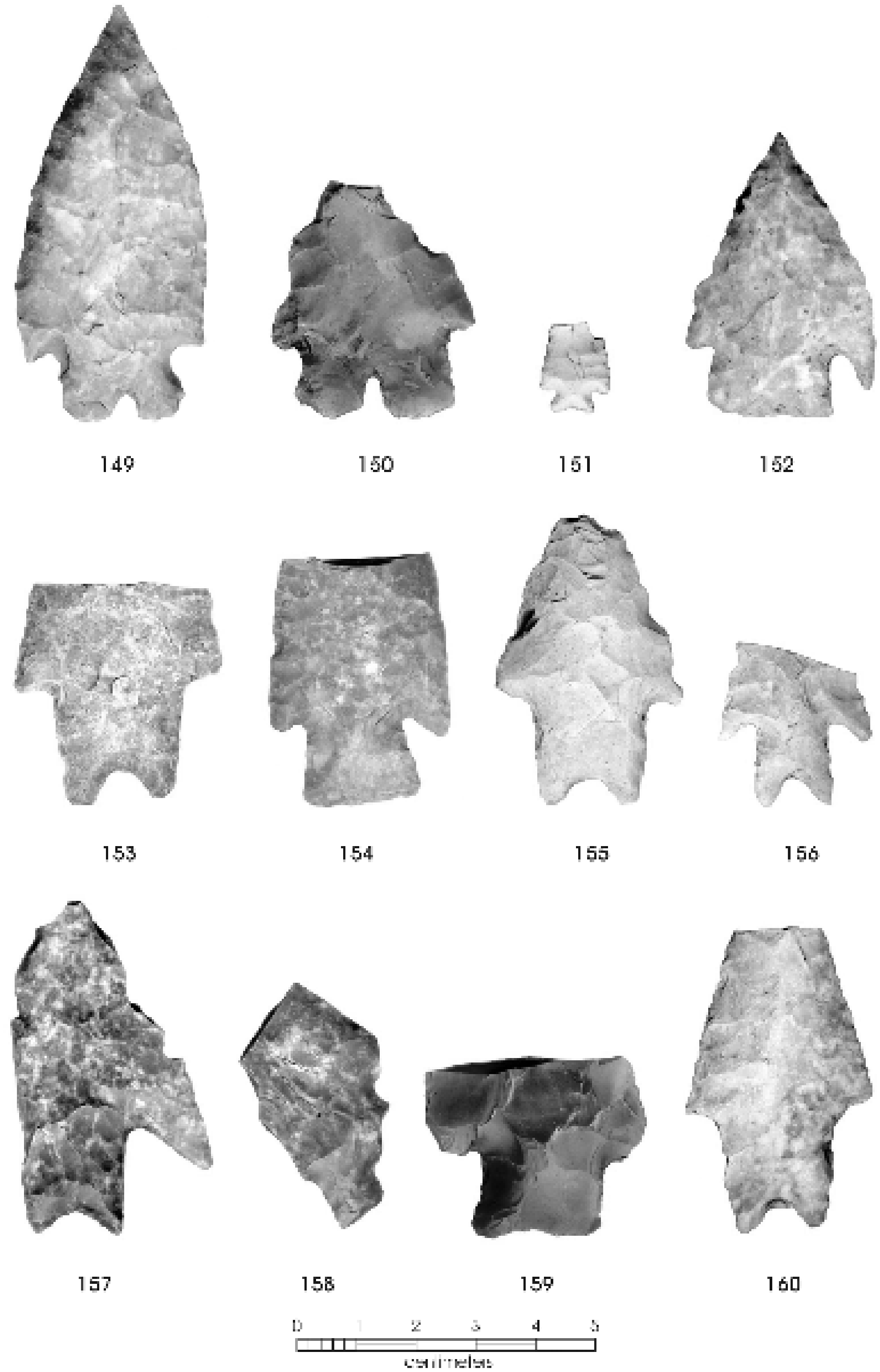

Figure E-4. *continued... Selected projectile points from Area E.* 149, 150) Montell; 151) Scallorn; 152) Castroville; 153) Pedernales; 154) Lange; 155–157) Pedernales; 158) Montell; 159) Lange; 160) Pedernales.

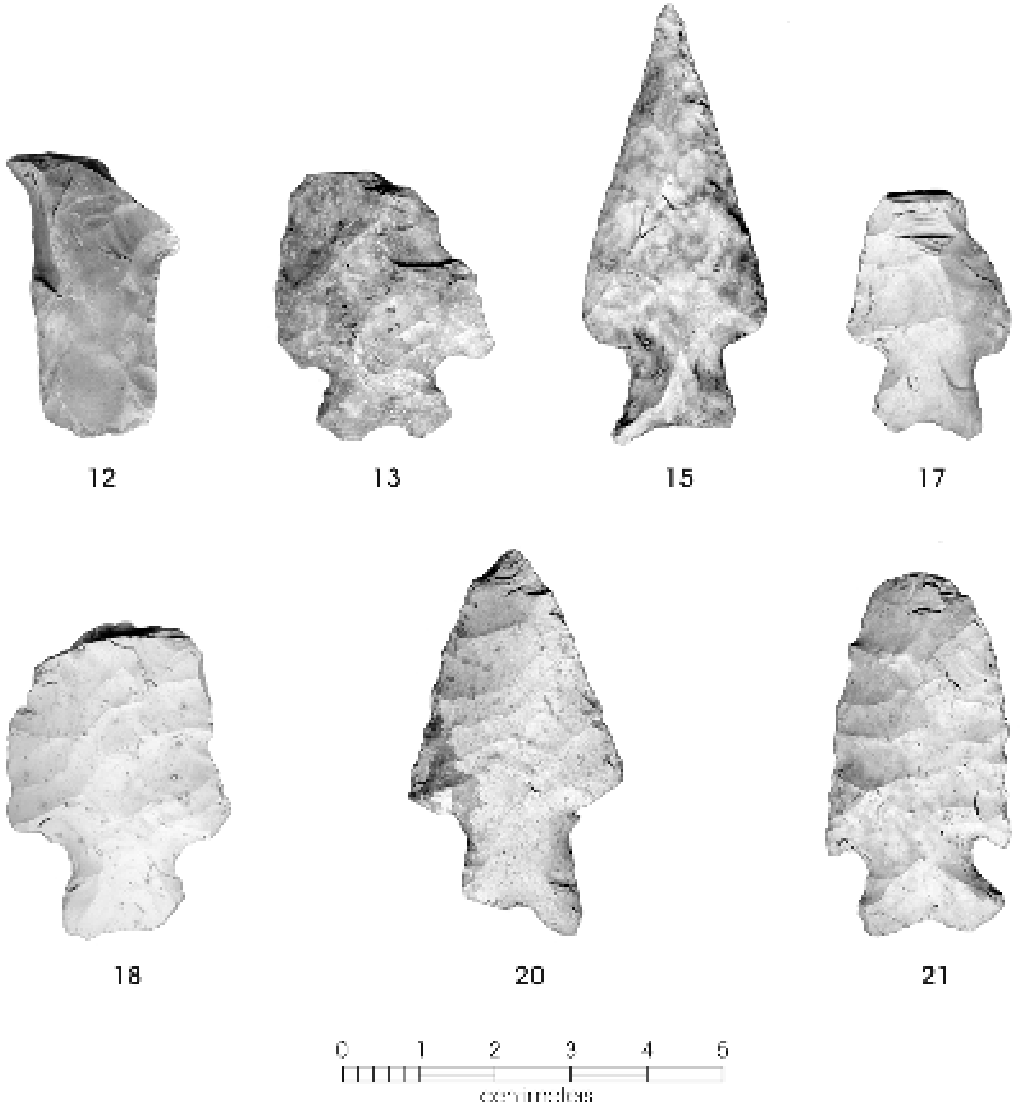

Figure E-5. *Selected projectile points from Area F.* 12) Andice; 13) Early Split Stem; 15) Uvalde; 17) Early Split Stem; 18) Uvalde; 20) Early Split Stem; 21) Martindale.