ARCHAEOLOGICAL INVESTIGATIONS ALONG OWL CREEK: RESULTS OF THE 1992 SUMMER ARCHAEOLOGICAL FIELD SCHOOL

David L. Carlson, editor

with contributions by

Barry W. Baker   John E. Dockall
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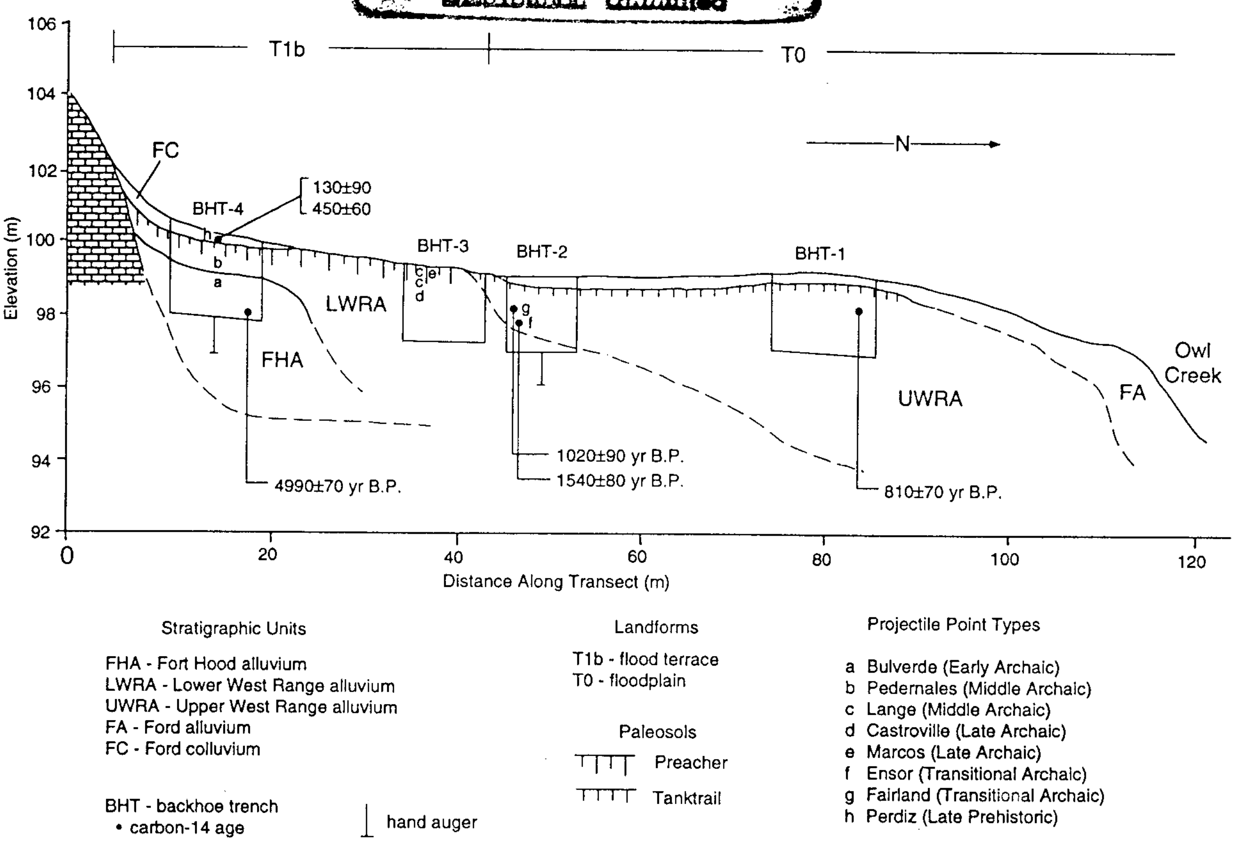

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In June 1992, Texas A&M University conducted archaeological investigations at Fort Hood, Texas, as part of a collaborative research project with the Department of the Army at Fort Hood. The purpose of the field school was to train undergraduate and graduate students in archaeological field techniques while providing the army with information regarding significance of its cultural resource base, as required by law. Over a six-week period, two sites were investigated. The research design for the

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered) field school focused on raw material use and geoarchaeology of alluvial midden deposits. Two sites were tested for National Register eligibility: 41CV111, a large vandalized midden site containing Middle through Late Prehistoric occupational materials, and 41BL148, an alluvial fan midden site containing Archaic and possible Late Prehistoric period materials. Most of the investigation focused on 41CV111 with the testing of 41BL148 limited to two test pits because of time considerations. Geoarchaeological investigations consisted of nine backhoe trenches oriented perpendicular to Owl Creek to identify the sequence of depositional environments under which the sites accumulated.

ABSTRACT

In June, 1992 Texas A&M University conducted archaeological investigations at Fort Hood, Texas as part of a collaborative research project with the Department of the Army at Fort Hood. The purpose of the field school was to train undergraduate and graduate students in archaeological field techniques while providing the army with information regarding the significance of its cultural resource base, as required by law. Over a six-week period, two sites were investigated. The research design for the field school focused on three topics: geoarchaeology of the Owl Creek floodplain and secondary creek alluvial fan deposits and the use of lithic materials at the sites, and evaluation of the potential eligibility of the sites for the National Register. Both sites are recommended as eligible. Site 41CV111 contains intact Terminal Archaic deposits including faunal material, carbonized floral material, features, and abundant chipped stone. The site will help to identify the relative roles of open Terminal Archaic sites and the well-known ones from large rockshelters. The Middle Archaic portion of the site has been extensively disturbed, but six test pits recovered eight *Pedernales* points. The abundant sample of points on the site should permit more detailed typological studies than are possible on smaller samples. A Late Archaic deposit is indicated by the recovery of eight *Lange* ponts which could also be the subject of typological studies. Site 41BL148 was tested in a limited fashion as a result of time constraints. The limited test suggests that potentially significant cultural materials are present around the burned rock middens which have been the subject of intensive pothunting. As such, they provide an opportunity to explore extra-feature activities. The site is on an alluvial fan and the evidence of extra-feature activities has not been exposed on the surface since abandonment.

MANAGEMENT SUMMARY

In June, 1992 Texas A&M University conducted archaeological investigations at Fort Hood, Texas as part of a collaborative research project with the Department of the Army at Fort Hood. Texas A&M provided expertise and students to conduct the investigations while the army provided housing and funding for subsequent analysis and report preparation. The purpose of the field school was to train undergraduate and graduate students in archaeological field techniques while providing the army with information regarding the significance of its cultural resource base, as required by law. Over a six-week period, two sites were investigated. Site 41CV111 has been heavily vandalized, but contains evidence of Middle Archaic through Late Prehistoric occupations. In particular, the site was occupied during the Transitional Archaic between 1000 and 1500 years ago (based on radiocarbon age estimates on the midden). The vandalized portions of the site have the potential to provide significant samples of *Pedernales* and *Lange* points for detailed typological studies from a single location. Site 41BL148 was tested to a limited degree. It consists of badly vandalized burned rock middens on either side of a seasonal drainage. We were unable to determine if the two sides are contemporaneous. The site does have cultural deposits located outside the disturbed burned rock midden areas that could provide an opportunity to study the organization of activities and the camp structure surrounding the middens.

For these reasons we recommend that both sites are eligible for the National Register.

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ACKNOWLEDGMENTS

The field school would not have been possible without the daily help and assistance of my teaching assistants, Bill Dickens and John Dockall. They helped to organize the trip and were busy from before dawn when we loaded equipment and students into the vehicles until we finished our lab work after dinner in the evening. I could not have asked for better assistants or better companions during those six weeks.

The students who conducted the excavations described here included Margaret Bruchez, Gail Colby, Graves Cowden, Sharon Derrick, G-Young Gang, Kella Kunz, Lee Ann Lovett, Holly Nicholson, Kimberly O'Connor, Eric Owen, Mary Ann Paul. Their spirits remained high despite vehicle breakdowns and the hazards of crossing Owl Creek every day.

On the post Dr. Jack Jackson and Mr. Kimball Smith provided us with their archaeological advice and their detailed knowledge of the ins and outs of military red tape. We surely would have given up trying to get housed and fed without their assistance. Once we were part of the system, the U.S. Army treated us as guests. The logistics of the field school were simplified tremendously by our use of military housing and mess halls. This allowed us to spend all of our time on archaeology.

In the laboratory, Tiffany Hachmann and Nina Burks cataloged artifacts and proofed the summary tables. Pat Clabaugh oversaw the final laboratory processing and curation preparations. Barry Baker carefully proofed the final draft and made editorial improvements.

Funding for this report was provided by the U. S. Army as well. This has made it possible to report on our excavations in greater detail than many field schools are able to accomplish.

INTRODUCTION

David L. Carlson

In June, 1992 the Anthropology Department at Texas A&M University conducted an archaeological field school at Fort Hood (Figure 1). One purpose of the field school was to train undergraduate and graduate students in basic field methods on actual archaeological sites. The field school was a model for cooperation between the federal government and the university. The university provided students, the salary for the instructor and a graduate teaching assistant, and laboratory space on campus for the subsequent analyses. The government provided housing in the post officers' quarters and access to the post mess hall and waived the surcharge usually expected of civilians eating on the post. Furthermore, the government provided financial assistance for analysis and the preparation of this report.

Over 2000 archaeological sites have been recorded at Fort Hood but systematic testing of those sites had only just begun in 1992 (Trierweiler 1994). During the six weeks of the field school, Texas A&M tested two sites along Owl Creek near the northeast border of the post (41BL148 and 41CV111). Although we originally planned to continue testing rockshelters in the eastern training area (Carlson 1993a, 1993b), heavy rains and the high level of Belton Reservoir made it impossible for us to reach those sites. As a result we identified as an alternate, two midden sites along Owl Creek. Both sites had been subjected to heavy pothunting in the past. One of our goals was to determine whether any intact deposits remained at either site. A second goal was to expand our understanding of alluvial deposition along Owl Creek. We were also interested in examining the role of lithic procurement at the sites since we had already explored rockshelter (Carlson 1993a; 1993b) and near quarry sites (Carlson 1993c). The original recordings for the the sites indicated the potential for earlier deposits (Middle Archaic) than we had encountered in the rockshelters excavated during previous years and created an opportunity to tie our investigations directly into the geoarchaeological research that Nordt was doing on the post (Nordt 1992, 1993).

Despite the substantial disturbance that each site has suffered, both are potentially eligible for the National Register of Historic Places. Site 41CV111 contains disturbed and intact deposits spanning the Middle Archaic though Late Prehistoric periods. The Transitional Archaic deposits include intact features, faunal remains, and extensive lithic debitage. Radiocarbon age estimates place the Transisitonal Archaic occupation at the site between 1000 and 1500 years ago. The Transitional Archic deposits are horizontally separated from the earlier deposits and have not been the subject of nearly as much vandalism. The Late and Middle Archaic deposits are disturbed and do not contain preserved faunal remains. Potential features from these site areas did not contain sufficient charcoal for radiocarbon age estimates. The primary significance of these parts of the site are their potential for typological studies of *Lange* and *Pedernales* points. In six test units (five 1x1 m and one 1x2 m) excavated at the site, we recovered parts of eight *Lange* points and parts of eight *Pedernales* points. The Late Prehistoric deposits were indicated by the recovery of an arrowpoint fragment and by radiocarbon age estimates on hearth features of 130, 450, and 810 years ago.

The significance of site 41BL148 is more difficult to demonstrate since we had time to excavate only 2 test units. The potential for a Late Archaic component is suggested by the recovery of a *Lange* point at 50-60 cm in one unit which was placed away from the most heavily vandalized portion of the site. The test unit on the other side of the site contained substantial debitage and a dart point fragment. In both units, the cultural materials extended to at least 60 cm below surface. The end of the field school prevented us from reaching the bottom of the cultural deposits in these units. No faunal materials or features were identified in these two units, but the presence of two *Ensor* points on the surface suggests a Transitional Archaic component as well.

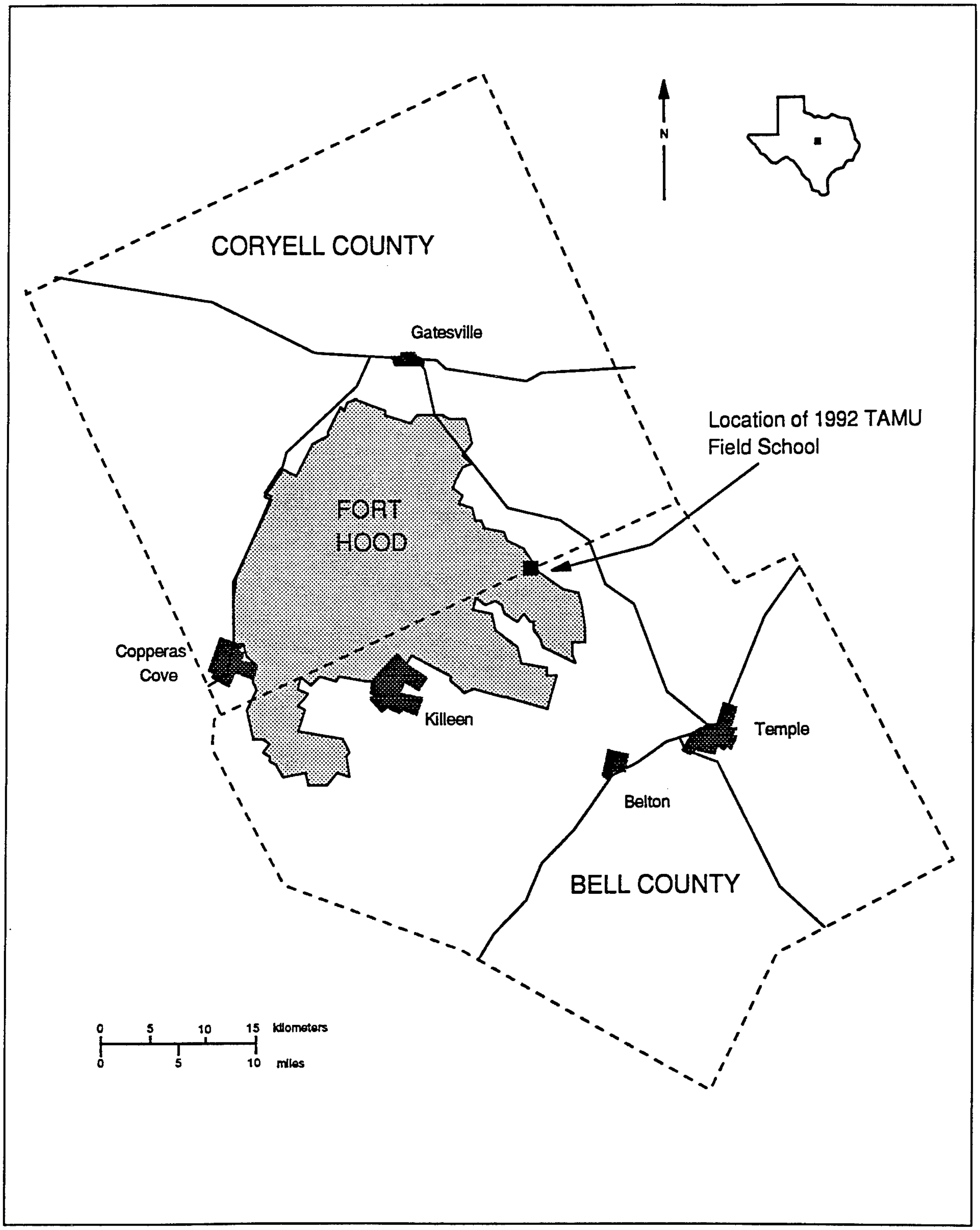

Figure 1. General Location of the 1992 Archaeological Field School.

RESEARCH DESIGN

INTRODUCTION

Cultural resources investigations began at Fort Hood in 1978 (Skinner, et. al. 1981). From 1978 to 1991 surface surveys of 95 percent of the surveyable area of the post are complete. Unsurveyable areas include the artillery impact areas, the permanently dudded area, and the cantonment. These areas are either heavily disturbed or too dangerous to survey. The total number of sites recorded by post archaeologists and contractors is 2,150. Since 1992, systematic shovel testing and geomorphic investigations have been conducted at 571 prehistoric sites and National Register eligibility testing has been conducted at approximately 100 sites.

PREHISTORY

The prehistory of Fort Hood may be broadly divided into six periods spanning the last 12,500 years:

Paleoindian (12,500-8,500 yr B.P.). The Paleoindian period includes the earliest inhabitants of the Texas. During the beginning of this period, central Texas was cooler and moister than todays climate. Extinct animals such as mammoth, mastodon, horse, and camel occupied the area. The earliest people in the area made a distinctive projectile point called the *Clovis* point. The sites occupied by these people often contain extinct fauna. Later Paleoindian people where hunters and gatherers who adapted to changing environmental conditions as the last Ice Age ended about 12,000 yr B.P. This period is poorly studiedbecause sites of this age are very rare. Prewitt (1983: 210) lists only three sites in central Texas with radiocarbon dates falling into this period.

Early Archaic (8,500-5,000 yr B.P.). The Early Archaic represents as shift in projectile point styles from the lanceolate styles of the Paleoindian to a variety of barbed and notched styles. Population is assumed to have been low, but many sites have undoubtedly been destroyed over the years by geomorphic processes. This period spans the Altithermal, a climatic period during which the environment was apparently warmer and drier than today. The specific details of environmental change during the Altithermal are unknown. This period is only slightly better understood than the Paleoindian. Prewitt (1983: 209-210) lists only six sites in central Texas with radiocarbon dates falling into this period.

Middle Archaic (5,000-2,600 yr B.P.). While the initial appearance of burned rock features begins in the Early Archaic, they are abundant and extensive during the Middle Archaic. These large accumulations of burned rock called burned rock mounds or middens appear throughout central Texas. The burned rock was apparently used repeated over a considerable period of time. Whether the burned rock mounds represent the cooking of root foods, the processing of acorns, or some other purpose is still unknown. Some archaeologists believe that the Middle Archaic represents a peak in the population of the hunter-gatherers who occupied central Texas (Weir 1976). Plant gathering may have become more important during this period. At Fort Hood there are more Middle Archaic than Early Archaic sites, but there are considerable more Terminal Archaic sites. Bison which had been absent during the Altithermal move back into central and even southern Texas. Eight sites in central Texas are reported by Prewitt to have radiocarbon ages within this period (1983: 206-208).

Late Archaic (2,600-1,750 yr B.P.). Burned rock accumulations are fewer in number. Bison reinvade Texas from the southern Plains and were hunted although their importance may not have been that great in the Fort Hood area. The Late Archaic is slightly better studied than the previous periods, but only nine sites in central Texas have radiocarbon ages within this period (Prewitt 1983: 207-208).

Terminal or Transitional Archaic (1,750-1,250 yr B.P.). This period has the highest site density at Fort Hood. Rockshelters often contain evidence of Terminal Archaic occupations, which may indicate a change in settlement pattern. Bison are absent from central Texas during this period and foodgathering probably shifted toward dispersed animals such as deer and heavy dependence on plant foods. Fourteen sites in central Texas have radiocarbon dates falling in this range (Prewitt 1983: 206-207).

Late Prehistoric (1,250-170 yr B.P.). The Late Prehistoric (called the Neoarchaic) is associated with the introduction of the bow and arrow into the area. There may be little or no change in hunting and gathering practices. At Fort Hood and other parts of central Texas this period contains substantially fewer sites which may reflect a population shift out of the area. Alternatively it could reflect a shift in settlement location. Small rockshelters often have Late Prehistoric occupations, but these sites rarely have artifacts on the surface which would allow their assignment to a period. Much of the Late Prehistoric occupation may be hidden in small rockshelters and in the now flooded floodplain of the Leon River. The Late Prehistoric is divided into the Austin and Toyah phases. The Toyah phase may represent a migration of Bison hunters from the southern Plains of Oklahoma and the Texas panhandle into the area. The introduction of ceramic into the area indicates interaction and trade with the Caddo to the east. Twenty sites with radiocarbon ages falling into this period are known from central Texas (Prewitt 1983: 203-206).

RESEARCH QUESTIONS

Since 1990 Texas A&M University, though field schools and cultural resources investigations, had begun to examine a series of questions concerning hunter-gatherer adaptations in central Texas. These investigations included a series of rockshelters and quarry localities, but until 1992 did not include systematic excavations in any of the midden sites. The 1992 field school provided an opportunity to examine two topics:

1. Evaluation of the quarry-campsite model developed by Dockall and Dickson (in Carlson 1993c) by recovering controlled samples of lithic debitage and tools from Owl Creek for comparison with the controlled samples recovered from Henson Creek. Sites 41CV111 and 41BL148 are located in proximity to several lithic resources (including Owl Creek Black), but the sites potentially contained stratified deposits in contrast the the Henson Creek sites tested earlier (Carlson 1993c).

2. Testing and evaluation of Nordt's geomorphic model for Fort Hood (Nordt 1992, 1993) by combining his stratigraphic analysis of backhoe trenches in the sites, with the results of archaeological investigations. The field school also provided the opportunity to obtain additional radiocarbon age estimates on West Range alluvium, particularly the timing of the upper and lower units of the West Range.

FIELD METHODS AND RESULTS

Our basic goals for the field school were to evaluate sites 41CV111 and 41BL148 in terms of their potential to provide significant information regarding the prehistory of central Texas. In order to do that, we had to evaluate the extent of the vandalism at each site and determine whether intact deposits were present at the site. We also wanted to identify when the sites were occupied and what evidence of those occupations such as artifacts, ecofacts, and features was still present. These investigations were conducted by hand and by the excavation of backhoe trenches in each site. Each site was probed with several test pits to detemine how much cultural material the sited contains and what condition it is in. The test pits were excavated with shovels and trowels in 10-cm arbitrary levels and all fill was screened through 1/4-in hardware cloth. For each level, students completed a Unit Level Form which recorded basic information about the level.

41CV111

The site was first recorded by the Fort Hood Archaeological Society. The earliest site form is dated October, 1977. At that time, the site was recorded as "extensively looted." The site was re-recorded in 1984 (Carlson et al. 1986: 273-274) when it was estimated that pot holes had adversely affected 60% of the site surface. No chronologically diagnostic artifacts were discovered during the resurvey, but the site had been classified as Middle Archaic in the original recording. When we arrived at the site, the evidence of vandalism was substantial (Figure 2), but none of it appeared to be recent.

We began our investigation of the site by excavating four backhoe trenches (Figures 3 and 4) from Owl Creek to the foot of the talus slope. The total difference in elevation along this transect is slightly more than two meters. Further description of these trenches is provided in the next chapter. Cultural evidence was recovered from all of the backhoe trenches and Test Units 5 and 6 were placed adjacent to Trenches 2 and 3 respectively to recover additional information about the nature of the site in those locations.

Examination of Figure 4 indicates the extensive nature of the vandalism at the site. We were not convinced that any intact deposits remained at first. Fifty-five distinct potholes are plotted on the map although there were others that were not as well defined. Others may have been hidden by backdirt piles. Given a rough average of two meters as the diameter of these potholes, about 173 square meters have been excavated. As the map also shows, the potholes cluster into groups. We focused our attention on the western group of potholes. Time considerations did not permit us to investigate the central (except along the backhoe trenches) or eastern clusters. Table 1 summarizes the lithic materials recovered.

Figure 2. Vandalism at 41CV111.

Figure 3. Site 41CV111 Showing Vegetation and Backhoe Trench.

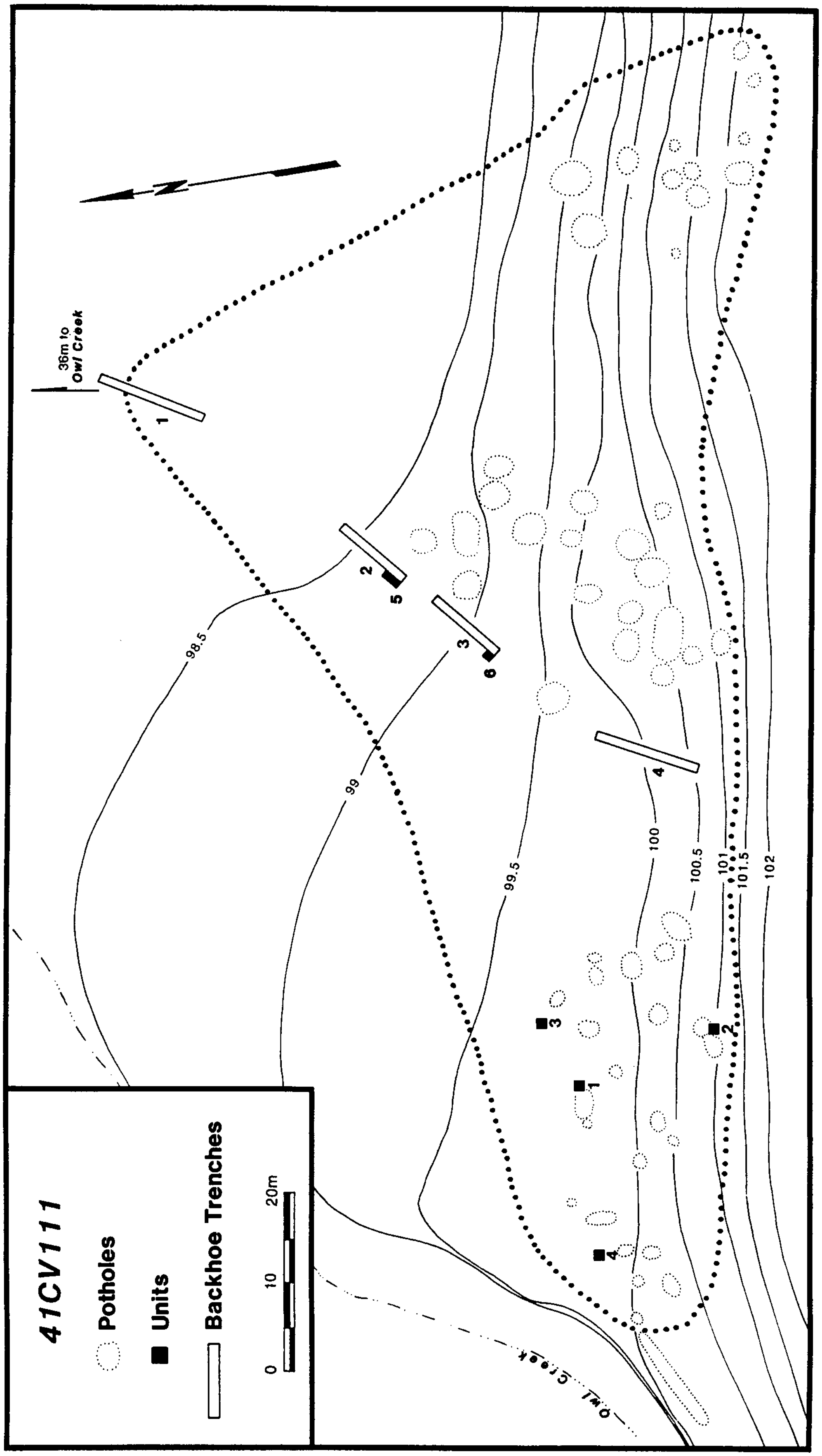

Figure 4. Location of Backhoe Trenches and Test Units, 41CV111.

Table 1. Lithic Artifacts from 41CV111

Unit	Level	Flakes	Bifaces	Unifaces	Ground Stone	Cores	Hammer-stones	Points
Surface			2		1			*Ensor*, *Pedernales*
1	1	119		2				
	2	81						
	3	327	1	2				Dart point
	4	842	1	1				*Pedernales*
	5	356	1	2				*Pedernales*
	6	61	1					
	7	71	1					*Bulverde*
2	1	1						
	2	10	1					Arrowpoint
	3	8						
	4	3						
	5	66						
	6	107	2					*Pedernales*
	7	157						
	8	336	2					
	9	115						
	10	387	1					*Pedernales*
3	1	31		1				
	2	215		6				
	3	177	1	2				
	4	815	4	5				*Lange*, *Pedernales* (2)
	5	44						
	6	0						
	7	13						
4	1	13		1				
	2	47						
	3	454						
	4	1795	3	1				Dart point, *Lange*, *Pedernales*
	5	144						
	6	78						
	7	67						
5	1	0						
	2	2						
	3	1		1				
	4	88	1					*Fairland*
	5	183		2				
	6	112						
	7	249	1	1				

Unit	Level	Flakes	Bifaces	Unifaces	Ground Stone	Cores	Hammer-stones	Points
	8	363		1				
	9	444	2	4				*Darl*
	10	508	5	3				*Ensor*, *Lange*
	11	587	1	2	2			
	12	1257						
6	1	468	1					*Lange*
	2	320	1	4				*Marshall*, *Ensor*, *Lange*
	3	1076	2	2				*Ensor*, *Lange*
	4	896	2	3				
	5	1710	3	1		1	1	*Lange* (2)
	6	1152	2	1		1	1	*Castroville*, *Lange*
	7	1490	3					Dart points (2), *Ensor*
	8	4	1					
	9	26						
	10	7						

Units 1-4

Test Units 1-4 (all 1x1m) were placed on the western side of the site to identify undisturbed cultural deposits. Units 1 and 2 were placed adjacent to potholes. Unit 2 is located just at the foot of the colluvial fan adjacent to a large boulder. Unit 3 was placed north of any potholes to see if the site extended beyond the area that had attracted the vandals. Unit 4 was placed on the western side of the site near Owl Creek. Each of the test units produced enormous quantities of debitage and diagnostic artifacts. This portion of the site has apparently been occupied repeatedly over a long period of time. Each unit contained at least one *Pedernales* (Middle Archaic) point and two of the units contained *Lange* (Middle to Late Archaic) points. Prewitt (1981) places *Lange* points after *Pedernales* points. In Units 3 and 4, the *Lange* points were found in levels that also contained *Pedernales* points so there is no clear evidence of stratigraphic separation between the two types. Unit 1 also contained a *Bulverde* (Early Archaic) point in Level 7, well below the depth at which the *Pedernales* points occurred. The density of the cultural deposits drops dramatically at about 50cm. Unit 2 sits in a colluvial fan deposit, so it started a meter higher in absolute elevation than the other units. It was the only one of the first four units to contain evidence of a Late Prehistoric component. Based on the debitage, the main cultural deposit lies between 20cm and 50cm on the terrace and between 50cm and 100cm at the foot of the colluvial fan.

Burned rock was scattered throughout the units, but occasionally we were able to identify clusters. An area of burned soil and ash in Unit 1 was identified as a hearth feature in Level 3 (Feature 1, not illustrated). A charcoal sample taken from the hearth returned an adjusted date of only 450$\pm$60 B.P., substantially younger than we expected given the dart point that was recovered from the same level and the *Pedernales* points that were recovered in Levels 4 and 5. A sloping cluster of burned rock in Unit 2 beginning in Level 6 was also identified as a hearth feature (Feature 2, Figure 5). An adjusted radiocarbon age of 130$\pm$90 B.P., was also younger than expected. These two age estimates and the arrowpoint from Unit 2, Level 2 indicate that there is a Late Prehistoric occupation near the surface of the site (0-30cm).

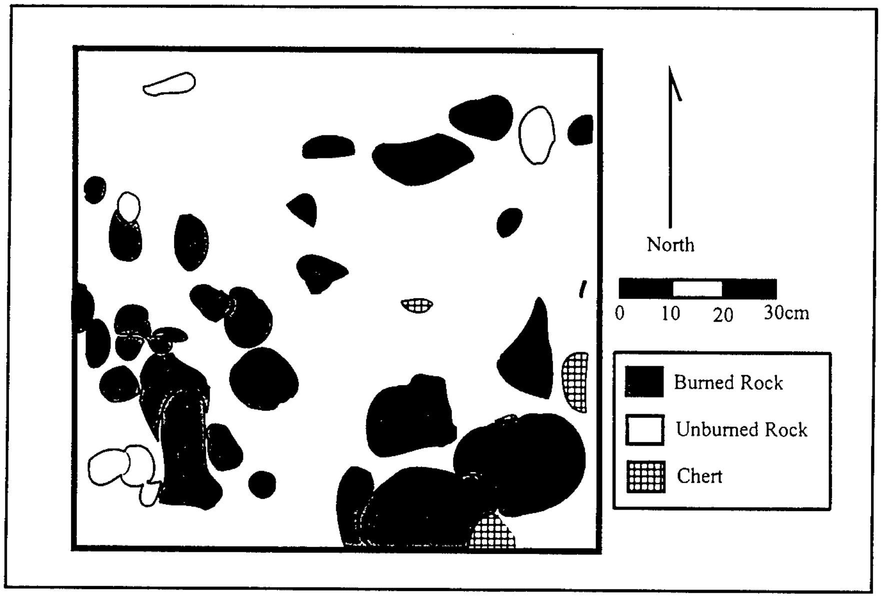

Figure 5. Feature 2 at 41CV111.

A few fragments of freshwater mussel shell were recovered from Units 1 and 2. A few vertebrate fragments were recovered from the first levels of Units 3 and 4, but no vertebrate faunal remains can be associated with the Middle Archaic levels at the site.

Unit 5

Unit 5 (1x2m) was placed adjacent to Backhoe Trench 2 to record and excavate a large burned rock pit feature (Feature 4) that was identified in the trench (Figure 6). Debitage densities are somewhat lower in this unit (since it is twice as large. Diagnostic artifacts recovered from the unit include *Fairland*, *Darl*, and *Ensor* points (Transitional Archaic) and a *Lange* point (Late Archaic). The upper limit of the feature was not clearly definable in the profile, but concentrations of burned rock and charcoal appear first in Level 6 and increase steadily until they terminate at Level 12. The unit was completed on the last day of the field school so we were unable to continue excavation below the feature. Two radiocarbon age estimates were obtained on charcoal from the feature. Charcoal from Level 7 (top of the feature) returned an adjusted age of 1020±90 B.P. while charcoal from Level 12 (bottom of the feature) returned an adjusted age of 1520±80. Since the ages do not overlap, we seem to have a Late Prehistoric/Transitional Archaic midden overlying a Transitional Archaic cooking feature.

Most of the vertebrate faunal remains come from Unit 5. Levels 3 through 12 contained bone fragments. Most of this is indeterminate medium/large mammal, but most of the identifiable material is deer/antelope.

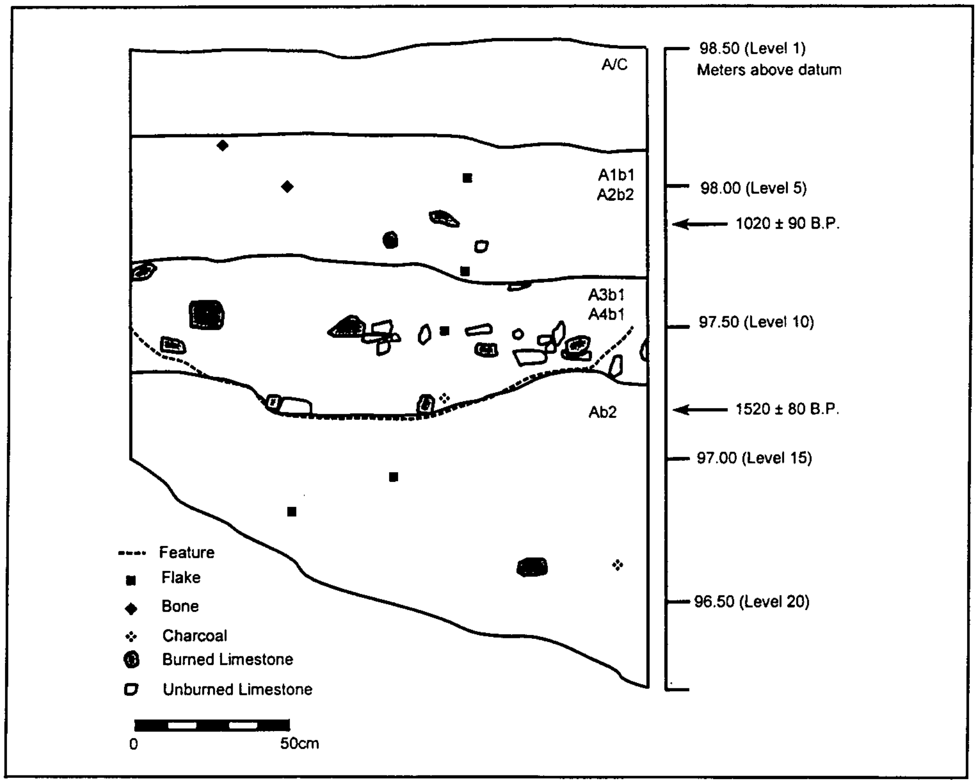

Figure 6. Feature 4 at 41CV111.

Unit 6

Test Unit 6 (1x1m) was placed adjacent to Backhoe Trench 3 where a dart point (later classified as *Ensor*) was recovered at a depth of about 30cm and a dark-stained area that appeared to be a hearth at about 100cm (Feature 3). This portion of the site seemed to be less heavily potted so we suspected that there might be little there. Instead it produced our most problematic sample and our highest debitage densities. Debitage densities exceed 300 flakes/level in the first 7 levels and exceed 1000 flakes/level in four of those levels. The Unit also contained 13 dart points, eleven of which could be classified. A look at Table 1 will immediately reveal the problem, however. A Middle Archaic point (*Marshall*) is intermixed with Middle to Late Archaic points (6 *Lange*), a Late Archaic point (1 *Castroville*), and Transitional Archaic points (3 *Ensor*). The simplest conclusion would be that Unit 6 has been disturbed by pothunting and represents backdirt from several potholes. However, examination of the Backhoe Trench 3 provided no evidence that this deposit had recently been disturbed. Alternatively, the disturbance could be prehistoric (i.e. Transitional Archaic disturbance of an earlier occupation). In terms of the geomorphic evidence, Unit 6 lies between Units 1-4 (Middle Archaic component) and Unit 5 (Transitional Archaic component), so it should fall between them in age. This would suggest that Unit 6 is Late Archaic in age.

Scattered burned rock was recovered throughout the unit. In Level 9, the dark-stained, ashy area first noted in the backhoe trench was identified and mapped. Samples of the fill were collected and returned to the lab, but no pieces of charcoal were located within the sample.

Vertebrate faunal remains were present in Unit 6 from Levels 3 though 8. Most of the bone is indeterminate medium/large mammal, but deer/antelope (two metapodials and a carpal) and coyote (one tibia) were identified. The preservation of fauna supports an age estimate of Late/Transitional Archaic for this portion of the site.

Summary

Site 41CV111 obviously provides an interesting and complicated vertical and horizonal stratigraphic setting. Middle Archaic through Late Prehistoric activities are involved. In the succeeding chapter, Nordt shows that Units 1-4 (Middle Archaic) containing the Pedernales materials lie within the Lower West Range Alluvium. Unit 5 (Transitional Archaic) lies within the Upper West Range Alluvium and Unit 5 lies along the boundary between these two deposits. Importantly, while there has been substantial disturbance to the site, it contains intact artifact assemblages and offers the potential to recover unmixed samples from the Middle Archaic (Pedernales, Units 1-4, 30-50cm), Transitional Archaic (Unit 5, 60-120cm), and Late Prehistoric (Units 1-2, 0-20cm). There may also be an opportunity to recover an intact Late Archaic assemblage (Unit 6, 30-70cm). The Transitional Archaic assemblage is the best preserved and includes charcoal and faunal materials. The Middle Archaic component can provide an opportunity to study variability in the *Pedernales* point from a single locality. Assuming that the portion of the site containing the Middle Archaic component lies from the 101m contour interval to half the distance between the 100 and 99.5m contour intervals (Figure 4), there are about 600 square meters of Middle Archaic deposits west of backhoe trench 4. Assuming about 100 square meters is disturbed, there are still 500 square meters of intact deposits. Given the density of *Pedernales* points in Units 1-4 of 7 points in 4 square meters, there could be over 800 *Pedernales* points left at the site.

41BL148

The site was first recorded by the Fort Hood Archaeological Society. The earliest site form is dated October, 1972. A map of the site shows no indication of 41CV111 about 250 meters away. At that time the site was listed as "potted." Projectile points observed on the site included *Darl*, *Pedernales*, and *Castroville*. The site was re-recorded in 1984 (Carlson et. al., 1986: 259-260) and again in 1987 (Mueller-Wille and Carlson 1990: 110). During these recordings a keeled end scraper and a *Scallorn* arrowpoint were recovered. As a result, the site was identified as containing a Late Prehistoric component. The site consists of two areas separated by a seasonal drainage. It was not clear if the two areas were contemporaneous or represented different occupations. Between 5 and 20 percent of the site appeared to be destroyed by vandalism. When we arrived at the site, the evidence of vandalism was substantial (Figure 7), but none of it appeared to be recent.

We began our investigation of the site by excavating five backhoe trenches (Figure 8) from the modern Owl Creek floodplain up the alluvial fan adjacent to the site. The total difference in elevation along this transect is slightly more than six meters. Further discussion of these trenches is included in the next chapter. None of the trenches contained cultural material.

Examination of Figure 8 shows the extensive nature of the vandalism at the site. Potholes are confined to two areas separated by a seasonal drainage. Forty potholes are identified on the site and additional ones were almost certainly present beneath backdirt piles or were hidden by thick brush. About 126 square meters of the site have been affected. We originally laid out three test pits in the site, but the additional time we had spent at 41CV111 left us with even less time to evaluate 41BL148. As a result, Test Unit 2 was never excavated. Test Units 1 and 3 were placed adjacent to the two areas of vandalism to see if any intact cultural deposits remained in the site. Table 2 summarizes the lithic materials recovered.

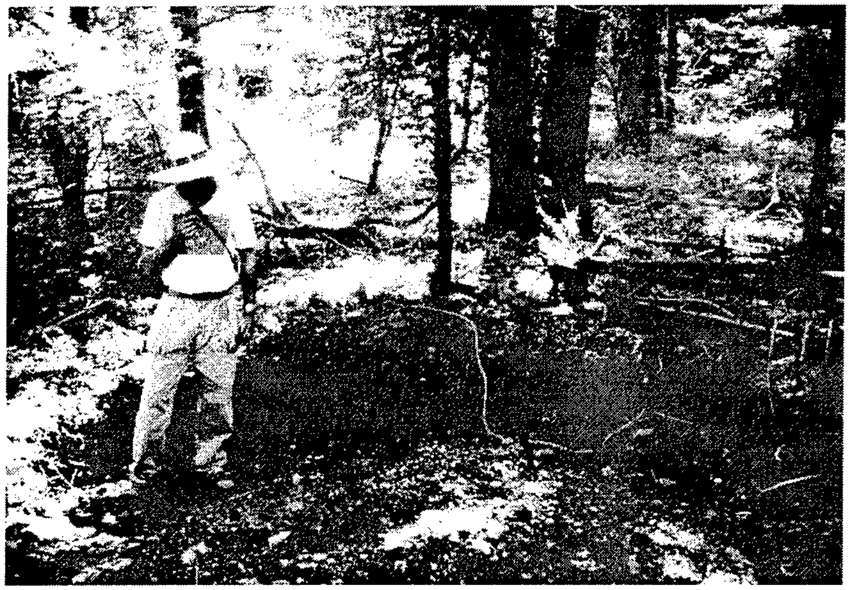

Figure 7. Vandalism at 41BL148.

Table 2. Lithic Artifacts from 41BL148

Unit	Level	Flakes	Bifaces	Unifaces	Ground Stone	Cores	Hammer-stones	Points
Surface		10	10		2	2	1	*Ensor* (2)
1	1	10						
	2	13		1				
	3	43						
	4	19						
	5	48						
	6	74	2	1				*Lange*
3	1	117	4			1		
	2	287		1				
	3	479	1	1				Dart point
	4	117	1			1		
	5	279						
	6	116						

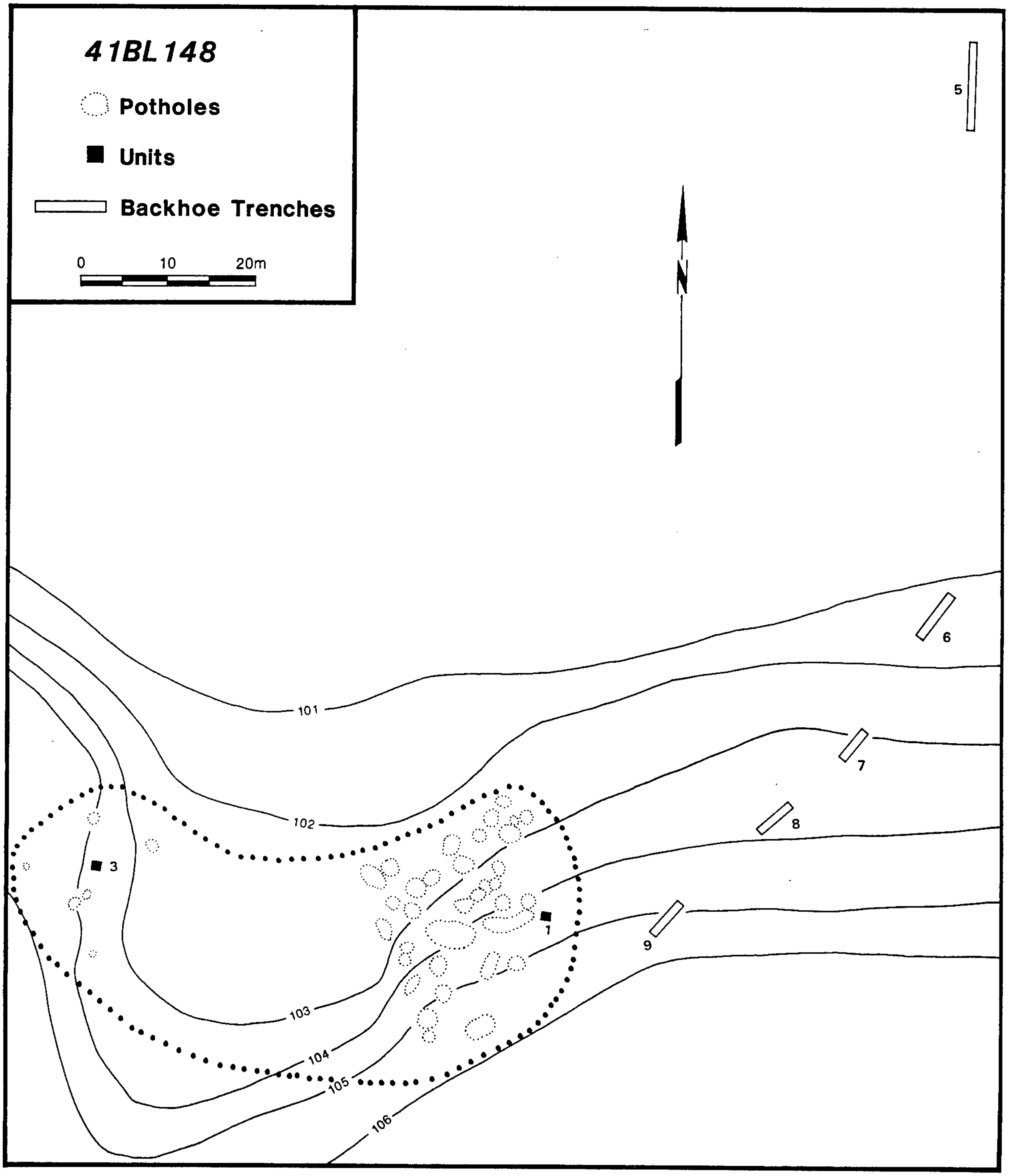

Figure 8. Location of Backhoe Trenches and Test Units, 41BL148.

Test Unit 1

Test Unit 1 (1x1m) was placed adjacent to the larger cluster of potholes at the site in order to see if the site extended east of the potholes. The debitage density of this unit is low to moderate, especially compared to the units at 41CV111. The density generally increases with depth, but at 60cm a large limestone boulder filled half of the square. It is unlikely that we would have been able to excavate much further in the unit although the end of the field school forced us to stop excavation before completing the square. The unit also contained scatters of burned rock but no charcoal. A *Lange* projectile point was found in level six. Level 3 contained five freshwater mussel shell fragments. Gastropods were recovered from all levels, but were concentrated in levels 2 and 3. Test Unit 1 appears to represent secondary refuse adjacent to the more intensively used part of the site (where the vandalism is greatest). Since this area has not been affected by pothunting and since the artifact densities are lower, there is some potential to locate discrete features or activity areas in this portion of the site.

Test Unit 3

Test Unit 3 (1x1m) was placed adjacent to the smaller cluster of potholes at the site in order to see if any portions of the site were intact on the west side of the seasonal drainage that divides the site. We were also interested in finding evidence that would allow us to determine if this side of the site was occupied at the same time as the east side of the site. Unfortunately, the only diagnostic artifact recovered was a dart point from level 3. Burned limestone was present in every level, including a loose cluster in the first level. No charcoal was recovered from the unit. Debitage densities are substantially higher in this unit. While only 207 flakes were recovered from Unit 1, 1405 flakes were recovered from Unit3. Also the flake densities peak in the third level in Unit 3, whereas in Unit 1 they peak at the bottom of the unit. Raw material usage is similar in the two units, but Unit 1 is less diverse. While in Unit 1, 60.3% of the debitage is Fort Hood Gray or Tan, only 50.3% of the debitage in Unit 3 is. Unit 3 is also distinguished from Unit 1 in the presence of numerous *Rabdotus* shells in level 3. No freshwater mussel shells were recovered from this unit and no vertebrate fauna were recovered from either unit. This limited information about the site suggests that the activities on either side of the drainage were different, but it does not allow us to answer the question of contemporaneity. The limited nature of the vandalism in this part of the site provides an opportunity to explore several questions about prehistoric adaptations to the area.

GEOARCHAEOLOGY

Lee Nordt

INTRODUCTION

Geomorphic and soil-stratigraphic analyses were conducted at sites 41CV111 and 41BL148 of Owl Creek to study site forming processes and preservation potentials for the prehistoric cultural record. Site 41CV111 is situated on a low-lying alluvial flood terrace, while site 41BL148 is in an alluvial fan setting emanating from the steep slopes from the south of the valley (Figure 1).

Owl Creek is a low sinuosity bedload stream flowing into the Leon River just east of the Fort Hood Military Reservation. The drainage basin covers approximately 70 km^2 of lower Cretaceous shales and limestones (Barnes 1979). Late Quaternary alluvial stratigraphic and temporal relations of Owl Creek in the project area were established with exposures provided by nine backhoe trenches (BHT) and numerous excavation units (EU), time-diagnostic projectile points, and radiocarbon datable material. Soil horizon nomenclature follows that of the Soil Survey Staff (1981), while the cultural chronology follows that of Turner and Hester (1993). Soil-stratigraphic descriptions are provided in Appendix I.

In an earlier basin-wide fluvial geomorphic investigation along Owl Creek, Nordt (1992) identified six late Quaternary alluvial units, four alluvial landforms, and one buried paleosol. A second paleosol was recognized in a later report along Henson Creek (Nordt 1995a). In addition to the establishment of a fluvial stratigraphic framework, three alluvial fan units were also identified along both Owl Creek (1995b) and Henson Creek (Nordt 1995a). In the current Owl Creek project area, correlations will be made to the previously established fluvial and alluvial fan stratigraphic frameworks (Table 3).

Table 3. Alluvial stratigraphic chronology of late Quaternary stream deposits in the Fort Hood Military Reservation (Nordt 1992, 1995a, 1995b).

Landform	Fluvial Unit	Fan/Colluvial Unit	Paleosol	Radiocarbon yr B.P.
T2	Jackson			≈15,000
T1a	Georgetown (buried)	Georgetown (buried)	Royalty	11,000 to 8000
T1a	Fort Hood	Fort Hood		7000 to 4500
T1b	Lower West Range			4000 to 2000
T0	Upper West Range (buried)		Tanktrail	2000 to 600
T0	Ford	Ford		≤400

SITE 41CV111

Site 41CV111 is situated within a modern meanderbelt of Owl Creek (Figure 4). BHT-1 through 4 and numerous excavation units were opened at this site, which consists mainly of dense burned rock accumulations on the surface and in the shallow subsurface. Five stratigraphic units, two alluvial landforms, and two paleosols were identified at site 41CV111 and correlated with the work of Nordt (1992, 1995a, 1995b). From oldest to youngest the alluvial units are the: Fort Hood alluvium (FHA), Lower West Range alluvium (LWRA), Upper West Range alluvium (UWRA), and Ford alluvium (FA). One colluvial unit, the Ford colluvium (FC), was also identified. The Tanktrail paleosol is associated with the UWRA. Developed in top of the LWRA is the newly recognized Preacher paleosol. The alluvial landform T1b forms a flood terrace, while T0 delineates the actively aggrading modern floodplain.

Fort Hood Alluvium (FHA)

The oldest stratigraphic unit at site 41CV111 consists of a truncated and buried Bk-C soil horizon sequence exposed in the lower part of both BHT-4 and the excavation units (Figures 4 and 9; Appendix I). This unit consists of yellowish brown clays and silty clays, representative of a floodbasin facies. These deposits are also visible in a cutbank just west of the site and across Owl Creek to the north. The age of this unit was inferred by: a radiocarbon age of 4990$\pm$70 yr B.P. (Table 4) obtained on charcoal from a depth of 206 cm in BHT-4, and a *Bulverde* point (5000-4500 yr B.P.; Table 5) discovered at a depth of 60 to70 cm in EU 1, and extrapolated to BHT-4 (Figure 3). These ages are consistent with regional ages for termination of deposition of the FHA near 4500 yr B.P. (Table 3).

In other parts of the Owl Creek drainage basin, the FHA forms the constructional T1a terrace, although in the project area the FHA is truncated and buried by sediments constructing the T1b terrace. It also appears that the FHA channel cut through the project area, thus forming the steep valley wall to the south, just prior to deposition of the floodbasin facies.

West Range Alluvium

The undivided West Range alluvium was deposited between 4000 to 600 yr B.P. in the Fort Hood Military Reservation (Table 1). However, in some areas this unit is subdivided into a Lower and Upper member, which is separated by an erosional unconformity. This twofold stratigraphic division for the West Range alluvium is tentatively proposed for site 41CV111.

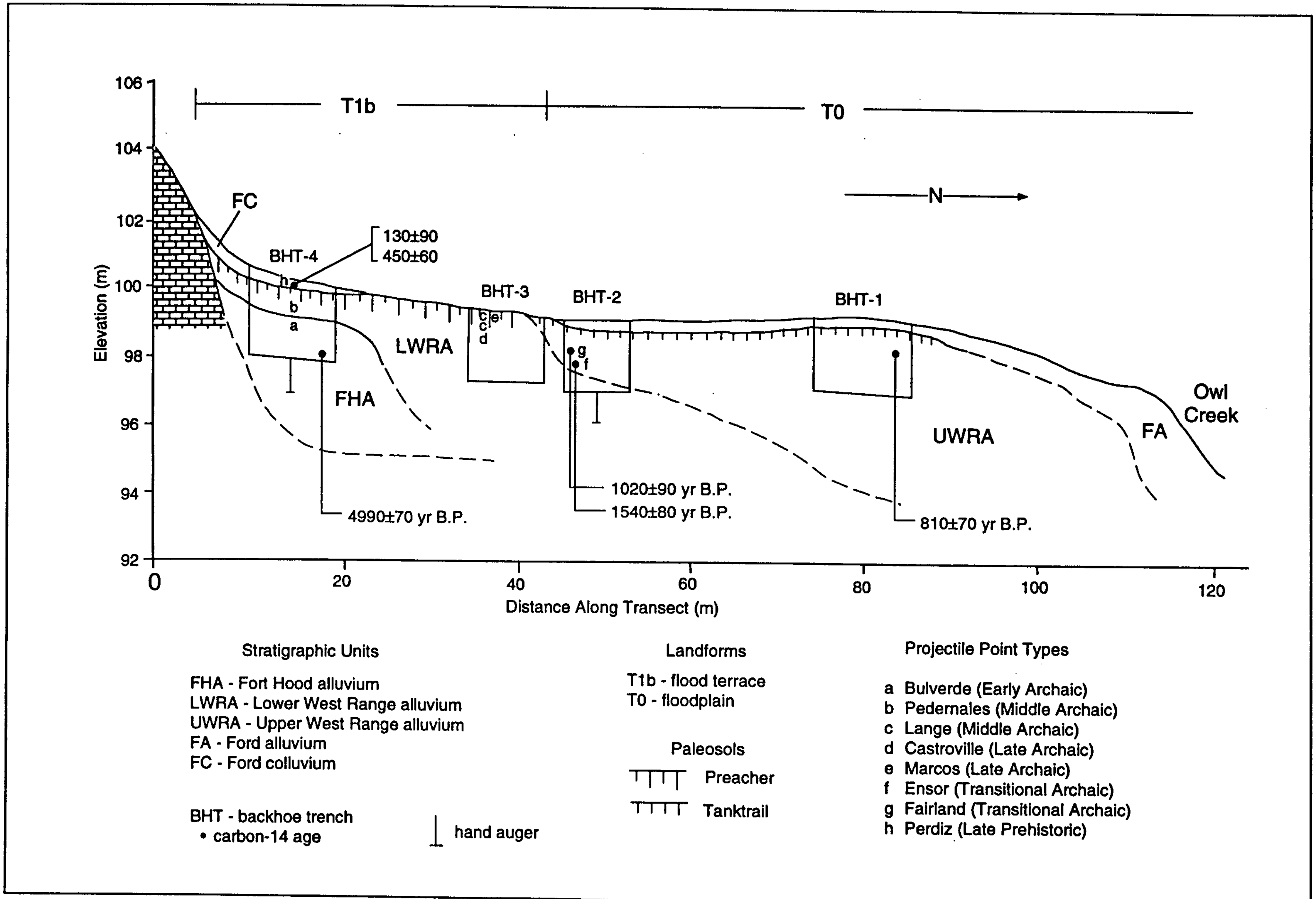

Figure 9. Alluvial Stratigraphic Cross Section of Site 41CV111.

Table 4. Radiocarbon Age Estimates

Beta No.	TAMU No.	Age (B.P.)	C13/C12 (o/oo)	Adjusted Age (B.P.)	Provenience
41CV111					
63001	OWTR4SA4	460±60	-25.7	450 ± 60	Unit 1, Level 3
63002	OWTR4SA6	140±90	-25.7	130 ± 90	Unit 2, Level 6
69870	OWTR2SA12	1060 ± 90	-27.4	1020 ± 90	Unit 5, Level 7
63003	OWTR2SA7	1540±80	-26.2	1520 ± 80	Unit 5, Level 12
63004	OWTR1SA8	840±70	-26.4	810 ± 70	Trench 1, 72-87 cm, Hearth
63000	OWTR4SA1	4940±70	-22.1	4990 ± 70	Trench 4, 216 cm
41BL148					
63005	OWTR5SA9	6910±70	-24.9	6910 ± 70	Trench 5, 204 cm
63006	OWTR8SA11	10470±90	-20.5	10540 ± 90	Trench 8, 215-225 cm

Table 5. Diagnostic Artifact types

Unit	Level	Count	Type	Turner and Hester 1993	Prewitt 1981, 1983
41CV111					
Surface		1	*Ensor*	2300 - 1250 B.P.	1800 - 1400 B.P.
		1	*Pedernales*	4500 - 3000 B.P.	3500 - 2600 B.P.
1	3	1	Dart point	10000 - 1250 B.P.	10000 - 1250 B.P.
	4	1	*Pedernales*	4500 - 3000 B.P.	3500 - 2600 B.P.
	5	1	*Pedernales*	4500 - 3000 B.P.	3500 - 2600 B.P.
	7	1	*Bulverde*	5000 - 4500 B.P.	4100 - 3500 B.P.
2	2	1	Arrowpoint	1250 - 250 B.P.	1250 - 250 B.P.
	6	1	*Pedernales*	4500 - 3000 B.P.	3500 - 2600 B.P.
	10	1	*Pedernales*	4500 - 3000 B.P.	3500 - 2600 B.P.
3	4	1	*Lange*	3000 - 2300 B.P.	2600 - 2250 B.P.
		2	*Pedernales*	4500 - 3000 B.P.	3500 - 2600 B.P.
4	4	1	Dart point	10000 - 1250 B.P.	10000 - 1250 B.P.

Unit	Level	Count	Type	Turner and Hester 1993	Prewitt 1981, 1983
		1	*Lange*	3000 - 2300 B.P.	2600 - 2250 B.P.
		1	*Pedernales*	4500 - 3000 B.P.	3500 - 2600 B.P.
5	4	1	*Fairland*	2300 - 1250 B.P.	2250 - 1800 B.P.
	9	1	*Darl*	2300 - 1250 B.P.	1400 - 1250 B.P.
	10	1	*Ensor*	2300 - 1250 B.P.	1800 - 1400 B.P.
		1	*Lange*	3000 - 2300 B.P.	2600 - 2250 B.P.
6	1	1	*Lange*	3000 - 2300 B.P.	2600 - 2250 B.P.
	2	1	*Marshall*	4500 - 3000 B.P.	2600 - 2250 B.P.
	3	1	*Ensor* (Trench 3)	2300 - 1250 B.P.	1800 - 1400 B.P.
		1	*Lange*	3000 - 2300 B.P.	2600 - 2250 B.P.
	5	2	*Lange*	3000 - 2300 B.P.	2600 - 2250 B.P.
	6	1	*Castroville*	2800 - 2400 B.P.	2250 - 1800 B.P.
		1	*Lange*	3000 - 2300 B.P.	2600 - 2250 B.P.
	7	2	Dart point	10000 - 1250 B.P.	10000 - 1250 B.P.
		1	*Ensor*	2300 - 1250 B.P.	1800 - 1400 B.P.
41BL148					
Surface		2	*Ensor*	2300 - 1250 B.P.	1800 - 1400 B.P.
1	6	1	*Lange*	3000 - 2300 B.P.	2600 - 2250 B.P.
3	3	1	Dart Point	10000 - 1250 B.P.	10000 - 1250 B.P.

Note: Excavation levels were 10cm thick (i.e. level 20 was from 10 to 20 cm below surface).

Lower West Range Alluvium (LWRA)

A second alluvial unit was exposed in the middle of BHT-4, in all of BHT-3, and in the lower part of BHT-2 (Figures 4 and 9; Appendix I). This unit forms the T1b flood terrace along the outer valley wall, but is truncated and buried beneath the T0 floodplain. Numerous Middle Archaic points (*Pedernales*; Table 3) were identified in black humified clay loam material between a depth of 40 and 50 cm in EU 1, and extrapolated to BHT-4. Here, the entire sediment package consists of a thick A horizon that formed cumulicly with slow fluvial aggradation. The boundary separating the dark colored surface material containing the *Pedernales* points and the underlying yellowish brown sediment containing the *Bulverde* point (FHA) is abrupt and appears to be erosional.

BHT-3 exposed a weakly developed A-Bw-Bk soil profile consisting of black clay loams overlying yellowish brown clay loams (Figure 9; Appendix I). The A horizon is thick and cumulic, similar to the A horizon exposed in the middle of BHT-4. At the base of BHT-3 the sediments become sandier, probably representing an upper point bar deposit. Between a depth of 10 and 70 cm in BHT-3, numerous Middle to Late Archaic points were also discovered (Table 5). Furthermore, in BHT-2 there appears to be an erosional unconformity separating the LWRA from an overlying deposit dating to 1520±80 yr B.P. (Table 4).

In sum, carbon-14 ages from BHT-4 and BHT-2, and time-diagnostic artifacts in BHT-3, indicate that this unit was deposited between 4990 and 1520 yr B.P. These ages and stratigraphic position are similar to that of the LWRA, which was deposited between approximately 4000 and 2000 yr B.P. (Table 3). The LWRA in the project area is finer-grained than in upstream settings along Owl Creek, probably because of the proximity of the project area to the confluence of Owl and Preachers Creek. The LWRA channel during this time was migrating toward the north as it truncated the older FHA.

In addition, the soil developed in top of the LWRA in the project area, is the newly recognized Preacher paleosol (Figure 9). It formed during landscape stability during the last 2000 years near BHT-3 and between 4000 and 450 yr B.P. in the vicinity of BHT-4 where it is buried.

Upper West Range Alluvium (UWRA)

An episode of channel erosion occurred in the project area sometime between 4990 yr B.P. and 1520 yr B.P., based on carbon-14 ages from BHT-4 and BHT-2, respectively (Figures 4 and 9; Appendix I). Carbon-14 ages from other parts of Owl Creek confine this period of erosion to near 2000 yr B.P. (Table 3). This erosional event truncated the LWRA as the channel continued to migrate to the north, and formed a cobble line at the erosional contact in BHT-2.

Alluvial deposition proceeded again between 1520 yr B.P. and 810±70 yr B.P., according to carbon-14 ages from BHT-2 and BHT-1, respectively (Figure 9; Table 4). Transitional Archaic projectile points from EU 5 are consistent with carbon-14 ages from BHT-2 (Figures 4 and 9; Table 5). The sediments within this depositional unit fine upward from lower stratified pebbles dipping towards the modern channel, to sandy clay loams and clay loams near the top. An A-Bw soil profile consisting of black to very dark grayish brown silty clay loams developed in the upper part of this deposit.

The temporal range of this depositional unit and the characteristics of the buried soil, warrant correlation with the UWRA and Tanktrail paleosol (Table 3). The Tanktrail paleosol formed from about 800 to 400 yr B.P. in the project area before being buried by modern flood deposits.

Ford Alluvium (FA) and Colluvium (FC)

The youngest alluvial unit identified at site 41CV111 occurs as a laminated and dark brown flood veneer burying the URWA and Tanktrail paleosol in the vicinity of BHT-1 and 2 (Figures 4 and 9; Appendix I). These sediments comprise a floodbasin facies deposited after 810 yr B.P. by the modern Owl Creek channel. Consequently, the modern flood sediments are correlated with the FA and actively aggrading T0 floodplain. Deposition of this unit occurred during the last 400 years along Owl Creek (Table 3).

A charcoal sample collected from a feature in EU 1 (20-30 cm depth) dated to 450±60 yr B.P. (Figures 4 and 9; Table 4). Furthermore, an age of 130±90 yr B.P. was obtained from charcoal from a feature in the upper 10 cm of EU 2 (Figures 4 and 9; Table 4). These ages, along with a *Perdiz* point (Table 5) recovered from a depth of 20 to 30 cm in EU1, came from sediments unconformably overlying the LWRA (as extrapolated to BHT-4). Because this deposit occurs only along the outer valley wall, it is probably of colluvial origin. Based on age and stratigraphic position, this unit is correlated with the Ford colluvium (FC) (Table 3).

Georchaeological Interpretations

Based on the stratigraphic chronological sequence at site 41CV111, there are no sediments older than 7000 yr B.P. Therefore, there is no potential for discovering cultural components dating to Paleoindian times. The Early Archaic record, however, may be preserved within truncated remnants of the FHA along the outer valley wall beneath T1b (Figure 10; BHT-4). Here, the FHA consists of a fine-grained floodbasin facies that aggraded without punctuating intervals of landscape stability and soil formation. Consequently, Early Archaic components may be buried as discrete short-term occupation sites. A brief period of channel erosion (El) occurred between 5000 and 4500 yr B.P. that removed part of the FHA and the Early Archaic in the northern part of the site.

The Middle Archaic at site 41CV111 may be buried within the LWRA beneath T1b and beneath part of T0 (Fig. 4; BHT-2, BHT-3, BHT-4). While 2000 years of sediment-time may be spread throughout a depth of several meters in BHT-3, this same time interval is confined within sediments only 1m thick in BHT-4. As a result, the Middle Archaic may be compressed within floodbasin deposits along the outer valley wall, but vertically separated into more discrete occupation zones throughout both floodbasin and upper point bar facies in the middle of T1b. At the contact between T1b and T0, an erosional unconformity (E2) dating to approximately 2000 and 1500 yr B.P. truncated, and removed part of the Middle Archaic record.

Preservation potentials for the cultural record will vary considerably for the Late Archaic through Late Prehistoric across site 41CV111. Parts of the Late Archaic through Late Prehistoric may be buried within the UWRA, or on the Tanktrail paleosol, beneath T0 (Figure 10; BHT-1 and BHT-2). Greater mixing of cultural components will occur where the Tanktrail paleosol is thickest, and the UWRA the thinnest, on the the outer margin of T0. Along the outer valley wall beneath T1b, mixed Late Archaic through Late Prehistoric components may occur on the Preacher paleosol where developed into the LWRA (Figure 10; BHT-4). Here, the Preacher paleosol developed between 2000 and 450 yr B.P. before being buried by the Ford colluvium. In the middle of T1b, the Preacher paleosol has not been buried. Consequently, pedogenesis has been proceeding continuously in the LWRA for the last 2000 years (Figure 10; BHT-3). As a result, the Late Archaic through Late Prehistoric may be compressed onto the subaerial surface.

After development of the Tranktrail paleosol between approximately 800 and 400 yr B.P., deposition of the modern FA and FC proceeded. Both the FA and FC may contain buried Late Prehistoric and Historic sites (Figure 10; BHT-4, BHT-2, BHT-1). The Historic record may also be scattered across the surface of the entire site, but mixed with older components in the middle portion of T1b where modern deposition has not occurred.

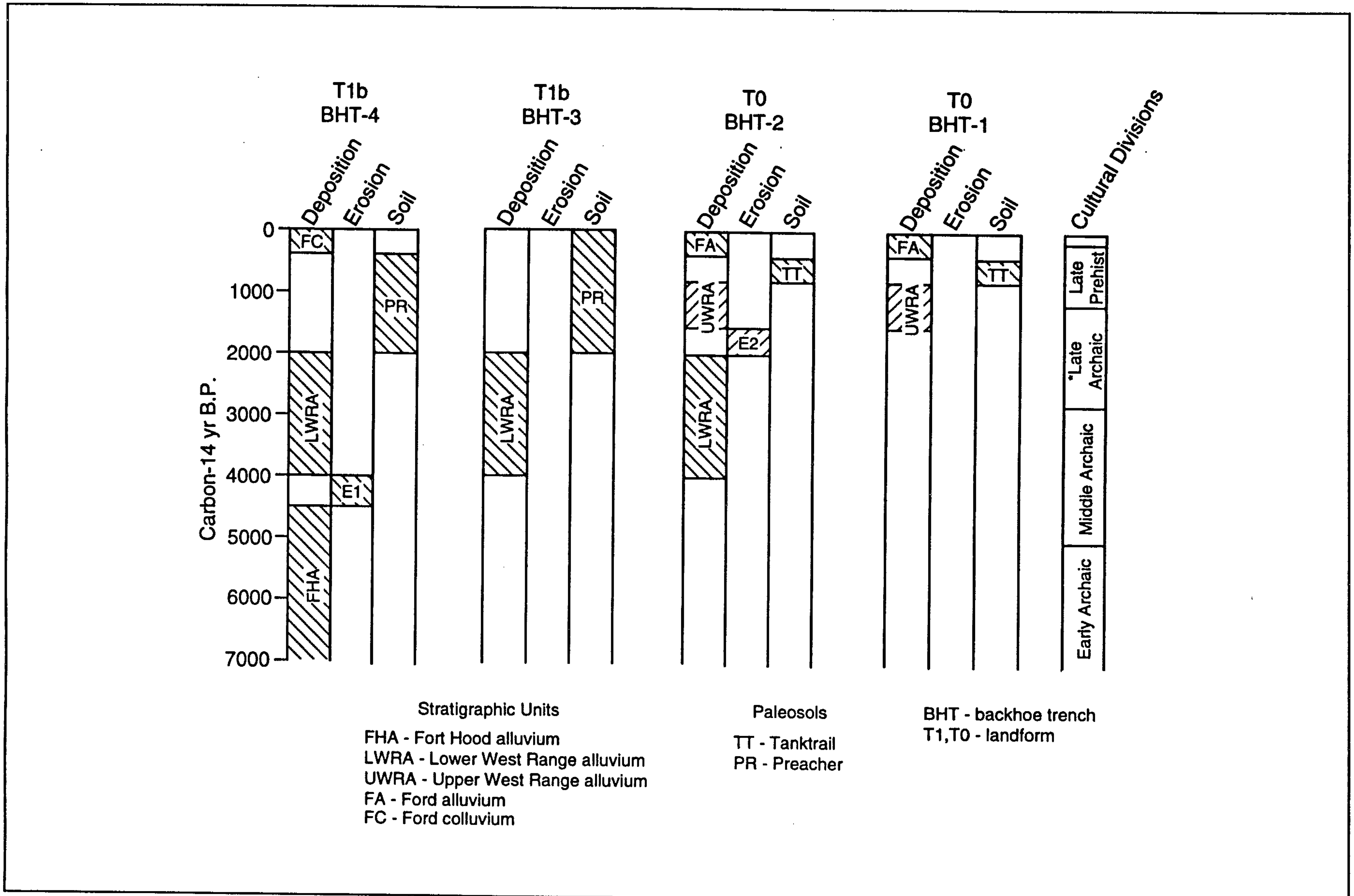

Figure 10. Alluvial Stratigraphic Columns Showing Periods of Deposition, Erosion, and Soil Development in Relation to the Cultural Record (*The Transitional and Late Prehistoric are combined).

SITE 41BL148

Site 41BL148 is situated on an alluvial fan entering the Owl Creek T1a terrace from the south (Figures 8 and 11). This site consists of dense burned rock accumulations on both the east and west sides of the fan trunk channel. Where the fan enters the fluvial valley, its surface is about 1 m higher than the surrounding T1a terrace surface. BHT 5-9 roughly parallel the fan channel on its east axis on the the steep north-facing sideslope. Based on exposures provided by these trenches, the fan deposit contains vestiges of at least three, if not four, periods of fan deposition correlative with periods of floodplain construction. The fan units are the Georgetown fan alluvium (GTFA) and associated Royalty paleosol, Fort Hood fan alluvium (FHFA), Undifferentiated fan alluvium, and the newly recognized West Range fan alluvium (WRFA). The Fort Hood alluvium (FHA) was recognized beneath the T1a terrace.

Georgetown Fan Alluvium (GTFA)

The lowermost stratigraphic unit at site 41BL148 was exposed in the lower part of BHT-9 through BHT-7 (Figures 8 and 11; Appendix I). The upper part of this unit consists of a truncated Bk horizon with 4 to 10 % filaments of calcium carbonate. This buried soil grades down to pale brown to grayish brown loam containing 10 to 20 % poorly sorted and angular pebbles. Coarse fragment content and size gradually increase with depth.

A carbon-14 age of 10,450±90 (Table 2) was obtained from bulk humates in the lower part of the buried soil (Figure 11). This stratigraphic unit and soil is correlated with the Georgetown Fan Alluvium (GTFA) and Royalty paleosol based on age, stratigraphic position, and sedimentological character (Table 3). This unit is observable along tributaries entering both Owl Creek (Nordt 1995b) and Henson Creek (Nordt 1995a) from the south.

Fort Hood Alluvium (FHA) and Fan Alluvium (FHFA)

Although not visible in the subsurface at site 41BL148, there is apparently a lateral erosional unconformity between BHT-7 and BHT-6 that separates the GTFA and a younger inset fan unit (Figures 8 and 11; Appendix I). The younger inset fan alluvium was exposed in the lower half of BHT-6 and consists of reddish brown to strong brown loams and clay loams with many angular and poorly sorted cobbles and pebbles. The upper part has been weathered to a Bkm horizon with a thin, discontinuous calcium carbonate laminar cap. Beneath this horizon is a Bk horizon with both filaments and nodules of calcium carbonate.

The fan deposits in the lower part of BHT-6 conformably grade into fluvial deposits beneath the T1a terrace of Owl Creek. These fluvial deposits are exposed in BHT-5 and consist of strong brown loams and clay loams with horizontal beds of poorly sorted and angular to subrounded pebbles and cobbles. A carbon-14 age of 6910±70 yr B.P. (Table 4) was obtained from dispersed charcoal associated with small burned rock fragments near the base of this fill (Figure 11). This age and stratigraphic position permits correlation of this unit to the FHA (Table 3). Because the fan deposits in BHT-6 conformably grade into the FHA, their depositional timing is coeval. Consequently, the fan deposits are correlated with the FHFA of both Henson Creek (Nordt 1995a) and Owl Creek (Nordt 1995b).

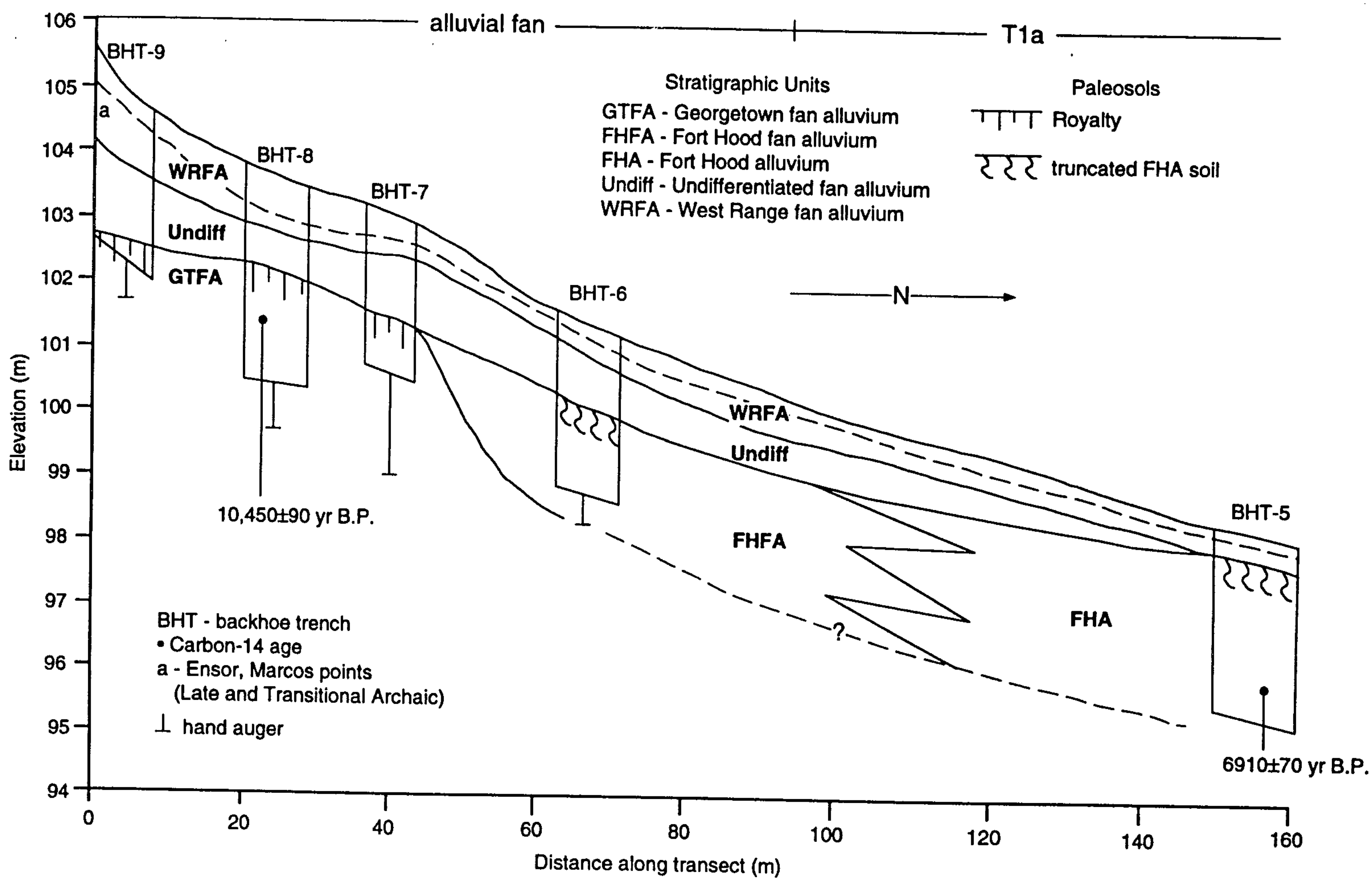

Figure 11. Alluvial Stratigraphic Cross Section of Site 41BL148.

Undifferentiated Fan Alluvium

The GTFA and Royalty paleosol are unconformably overlain by cobbly fan alluvium exposed in the middle of BHT-9 through BHT-6 (Figures 8 and 11; Appendix I). This upper fan unit has been pedogenically altered to a Bk horizon with 1 to 5 % calcium carbonate filaments. It is made up primarily of angular and poorly sorted pebbles and cobbles in a brown to yellowish brown loam to sandy clay loam matrix. The age of this stratum must be younger than 6910 yr B.P. based on a charcoal age from BHT-5, but younger than 3000 yr B.P. based on time-diagnostic projectile points stratigraphically above this layer (see next section). Colors are similar to the FHFA described at the base of BHT-6 and to the FHA in BHT-5. In addition to color, stratigraphic position indicates that the unit may be correlative with the FHFA observed in other part of the Owl Creek basin (Nordt 1995b) and Henson Creek (Nordt 1995a). It is possible that the contact between the fan deposits above and below the Bkm horizon in BHT-6 represent localized gully activity during FHFA times. However, the possibility that these fan deposits date to West Range times cannot be excluded. Until further temporal data is available this fan unit will be designated the Undifferentiated fan alluvium.

West Range Fan Alluvium (WRFA)

Two alluvial fan strata were recognized above the Undifferentiated fan alluvium in BHT-9 through BHT-5 at site 41BL148 (Figures 8 and 11; Appendix I). The lower stratum consists of coarse cobbles contained within a very dark grayish brown loam matrix. Above this, is a second stratum that forms the ground surface of the fan. It consists of very dark grayish brown loams with few angular and moderately well sorted pebbles. Because both of these upper fan units overlie the FHA in BHT-5, they must be younger than 4500 yr B.P. The actual age of the fan strata, however, is based on the presence of Marcos and Ensor points (Table 5) discovered at a depth of 50 to 60 cm in EU 1 (Figures 8 and 11; extrapolated to BHT-9). These points range in age from 3000 to 1400 yr B.P., which coincides with deposition of the LWRA identified at site 41CV111. However, is it is unknown whether these deposits aggraded into URWA times. Consequently, this fan deposit is recognized simply as the West Range fan alluvium (WRFA). A veneer of fan alluvium dating to deposition of the FA and FC may occur across the site as well.

Uplands

On the broad upland ridge south of the project area, the soil survey of Coryell County shows patchy delineations of the Evant series (McCaleb 1985). This soil classifies as a Mollisol with reddish brown Bt horizons. Erosion of this soil during the early to middle Holocene is probably the source of the strong brown and reddish yellow colors of the FHA and FHFA. The valley sideslopes immediately above the fan deposits are mapped as part of the Eckrant/Rock outcrop complex. These soils are shallow to rock, probably resulting from middle Holocene stripping of the late Pleistocene and early Holocene Evant soils. This material has provided a source of cobbly fan alluvium during the Late Holocene.

Geoarchaeological Interpretations

Activation of alluvial fans at site 41BL148 began in the early Holocene with deposition of the GTFA, continued into the middle Holocene with deposition of the FHFA and Undifferentiated fan alluvium, and terminated in the late Holocene with deposition of the WRFA (Figure 11). Consequently, both the Paleoindian and Archaic cultural records may be preserved in the fan fill. However, preservation potentials in primary contexts may be low because of the high energy depositional environments associated with alluvial fans.

As with other settings in the Fort Hood Military Reservation, the Royalty paleosol, which developed in top of the GTFA, has been truncated at site 41BL148. This erosional event probably removed part of the Paleoindian and Early Archaic record. It is possible that site preservation occurs below the Royalty paleosol in the unweathered GTFA, although the deposits become more gravely with depth. Site preservation potentials are probably low as a result.

Widespread fan and fluvial aggradation was ongoing along Owl Creek during the middle Holocene between about 7000 and 4500 yr B.P., resulting deposition of the FHA and FHFA (Nordt 1995b). These deposits are also present in the project area and may contain buried Early Archaic components (Figure 11). However, deposition probably occurred episodically as debris flows, making site preservation potentials in primary contexts low. Preservation potentials in the fluvial deposits of the FHA may be somewhat higher.

The Undifferentiated fan alluvium was deposited sometime between 5000 and 3000 yr B.P. according to bracketing ages obtained from the FHFA and WRFA. This unit may therefore contain buried Middle Archaic components. Recovery from primary contexts will be low, however. It is also possible that the Undifferentiated fan alluvium represents a continuation of deposition of the FHFA. Under these conditions, this unit would contain Early Archaic components.

The exact timing of the deposition of the West Range fan alluvium is unknown. However, based on the recovery of a limited number of time-diagnostic artifacts, deposition was underway by 3000 yr B.P. and proceeded until perhaps as late as 1400 yr B.P. Accordingly, this fan deposit may contain Middle Archaic through Late Prehistoric components. As with the FHFA, preservation will probably be low because of the high energy depositional environment. The WRFA could contain a veneer of FC in some areas.

ZOOARCHAEOLOGY

Barry Baker

INTRODUCTION

Results from the faunal analysis of 41BL148 and 41CV111 are presented. Faunal data are summarized in Tables 6-9. Site 41BL148 yielded only snails (NISP=1,835) and several mussell shell fragments (NISP=5). Site 41CV111 yielded snails (NISP=3,479), mussell shell (NISP=14), as well as bone (NISP=278). The major concentrations of bone were from Units 5 and 6 of 41CV111. A systematic description of the fauna is presented in the "Taxa Descriptions" section below.

METHODS

The faunal analysis was facilitated through use of the Zooarchaeological Research Collection, Department of Anthropology, Texas A&M University. Specimens were identified as precisely as possible based on structural features and regional biogeography. Faunal remains were collected in the field with 1/4" screens. This biased the sample against smaller specimens, especially many snail species, and precluded a detailed microenvironmental analysis of the snails.

Gastropod analysis and identification followed methods outlined by Allen and Cheatum (1961), Baerreis (1973), Barber (1983), Bobrowsky (1984), Burch (1984), Cameron (1978), Cheatum and Fullington (1971a, 1971b, 1973), Fullington and Pratt (1974), Hubricht (1985), Jaehnig (1971), Pilsbry (1939, 1940, 1946, 1948), Turgeon et al. (1988) and Vaught (1989). In addition to complete snails, incomplete fragments including the apex, lip and body whorls were also identified and used in calculating MNI (minimum number of individuals). MNI was calculated for each unit level and then summed for each respective site.

Specimens were coded using a modified version of Shaffer and Baker (1992). Data were manipulated in Dbase (III+) following Carlson and Shaffer (1992). The following information was recorded for each specimen where applicable: field sack number, quantity, taxon, element, portion of element, side, age, age criteria, breakage pattern, and burning. Additional observations were recorded in a "Comments" field. A listing of all fauna recovered by provenience is provided in Appendix II.

DISCUSSION

Previous Investigations

Previous investigations of Fort Hood archaeofaunas include studies by Sanchez (1993), Sanchez and Shaffer (1993a, 1993b) and Neck (1993). Amino acid racemization studies of archaeological *Rabdotus* from Fort Hood have been conducted by Ellis (1994), Ellis and Goodfriend (1994), and Ellis et al. (1994). Though not from Fort Hood, Simmons (1956) reported one of the earliest archaeological studies of snails from Coryell county. In addition, Baker (1993) summarized general prehistoric subsistence data for the area.

Gastropods

Seven species of snails were identified from 41BL148 (Tables 6 and 8). The sample is dominated by *Oligyra orbiculata*, *Rabdotus morreanus*, and *Polygyra morreana*. Site 41CV111 yielded nine gastropod species, dominated by *Oligyra orbiculata*, *Rabdotus morreanus*, and *Anguispira strongylodes* (Tables 7 and 9). All snails identified from both sites are terrestrial species. All species identified are common in the area today and are found primarily in wooded, rocky areas. The dominate snail, *Oligyra orbiculata* is restricted to such areas, and does not occur in grassland habitats.

Interestingly, *Rabdotus dealbatus* was identified primarily in upper levels of 41CV111, with *R. mooreanus* occurring throughout this site (Table 4). The prairie snail (*R. mooreanus*) is more common in grassland and open woodland habitats, while *R. dealbatus* is more commonly associated with woodland areas (Fullington and Pratt 1974:18). Both species, however, may overlap in their ecological ranges and form hybrid populations (Fullington and Pratt 1974:18). In some cases, the two species may become mixed in floodplain areas from fluvial activity (Fullington and Pratt 1974:18). It appears then that either recent flooding brought these two species together, or the area recently became more wooded, allowing for the penetration of *R. dealbatus* into the area.

Though snails are known to have served as prehistoric food items (e.g. Klippel and Morey 1986), there is no evidence to suggest that they played such a role at these sites. See Baker (1993) for a review of *Rabdotus* as a food item in Texas prehistory.

Mussels

Five freshwater mussel fragments were recovered from 41BL148, though these could not be identified to genus. Fourteen specimens were recovered from 41CV111, representing at least 10 individuals (Table 7). Species identified include *Amblema plicata*, *Quadrula* cf. *Q. apiculata*, and *Tritogonia verrucosa*. Neck (1993) also identified these species is his study of prehistoric mussels from Fort Hood. The taphonomic history of the mussel shells from these two sites remains unclear. None of the specimens from 41BL148 or 41CV111 appeared burned. Many of the specimens in Neck's study were burned. See Parmalee and Klippel (1974) for a review of freshwater mussels as a prehistoric food source.

Vertebrates

All of the bone was recovered from 41CV111 (N=278). The majority was from Units 5 and 6 (Table II-2). Mammals dominate the sample (N=178; 64%) (Table 7). The cardinal and squirrel appear intrusive (see Taxa Descriptions section for interpretation). No cut marks or bone tools were identified in the sample. Twenty-seven burned bones (9.7%) and 21 (7.6%) spirally fractured bones were identified. The majority of the burned bone was recovered from Unit 5, Level 12 (N=23, 85.2%).

Provenience for the burned bones is as follows:

Unit 5, Level 4	N=1
Unit 5, Level 6	N=1
Unit 5, Level 11	N=1
Unit 5, Level 12	N=23
Unit 6, Level 8	N=1

Table 6. Gastropods and Mussel Shell from 41BL148 by Taxon (No Vertebrates Recovered).

Taxon	Common Name	NISP	MNI
Gastropods (NISP=1,835)			
Anguispira strongylodes	Southeastern disc	360	316
Mesodon roemeri	Texas oval	3	3
Oligyra orbiculata	Globular drop	670	670
Polygyra morreana	Grassland liptooth	183	169
Polygyra texasiana	Texas toothlip	9	9
Practicolella berlanderiana	Banded scrubsnail	3	3
Rabdotus morreanus	Prairie rabdotus	607	605
Mussel Shell (NISP=5)			
Unionidae	Freshwater mussels	5	1
Totals		1,840	1,776

Table 7. Gastropods, Mussel Shell and Vertebrate Fauna from 41CV111 by Taxon.

Taxon	Common Name	NISP	MNI
Gastropods (NISP=3,479)			
Anguispira strongylodes	Southeastern disc	764	702
Euglandina singleyana	Striate wolfsnail	2	2
Mesodon roemeri	Texas oval	24	21
Oligyra orbiculata	Globular drop	1,512	1,507
Polygyra morreana	Grassland liptooth	122	119
Polygyra texasiana	Texas toothlip	1	1
Practicolella berlanderiana	Banded scrubsnail	32	32
Rabdotus dealbatus	Striped rabdotus	32	27
Rabdotus morreanus	Prairie rabdotus	990	803

<table>
<tr><th>Taxon</th><th>Common Name</th><th>NISP</th><th>MNI</th></tr>
<tr><td colspan="4">Mussell Shell (NISP=14)</td></tr>
<tr><td>Unionidae</td><td>Freshwater mussels</td><td>11</td><td>7</td></tr>
<tr><td>Amblema plicata</td><td>Three-ridge</td><td>1</td><td>1</td></tr>
<tr><td>Quadrula cf. Q. apiculata</td><td>Southern mapleleaf</td><td>1</td><td>1</td></tr>
<tr><td>Tritogonia verrucosa</td><td>Pistolgrip</td><td>1</td><td>1</td></tr>
<tr><td colspan="4">Vertebrates (NISP=278)</td></tr>
<tr><td>Vertebrata</td><td>Vertebrates</td><td colspan="2">95</td></tr>
<tr><td>Small/Medium Vertebrata</td><td>Small/medium-sized vertebrate</td><td colspan="2">3</td></tr>
<tr><td>Aves (Medium)</td><td>Medium birds</td><td colspan="2">1</td></tr>
<tr><td>Cardinalis cardinalis</td><td>Cardinals</td><td>1</td><td>1</td></tr>
<tr><td>Mammalia (Medium)</td><td>Medium-sized mammal</td><td colspan="2">1</td></tr>
<tr><td>Mammalia (Medium/large)</td><td>Medium/large mammal</td><td colspan="2">136</td></tr>
<tr><td>Mammalia (Large)</td><td>Large mammal</td><td colspan="2">19</td></tr>
<tr><td>Sciurus sp.</td><td>Tree squirrels</td><td>1</td><td>1</td></tr>
<tr><td>Carnivora</td><td>Carnivores</td><td colspan="2">1</td></tr>
<tr><td>Canis latrans</td><td>Coyote</td><td>1</td><td>1</td></tr>
<tr><td>Odocoileus sp.</td><td>Deer</td><td>8</td><td>3</td></tr>
<tr><td>cf. Odocoileus sp.</td><td>Deer</td><td colspan="2">1</td></tr>
<tr><td>Antilocapra/Odocoileus</td><td>Pronghorn/deer</td><td colspan="2">10</td></tr>
<tr><td colspan="2">Totals</td><td>3,771</td><td>3,230</td></tr>
</table>

Table 8. Molluscan Taxa from 41BL148 by Excavation Unit and Level. If the NISP for a Given Unit/Level Differs from the MNI, it is listed as NISP (MNI).

Taxa	Unit 1						Unit 3				Total MNI
	1	2	3	4	5	6	3	4	5	6	
Anguispira strongylodes	30 (27)	238 (211)	70 (56)	2	4	2	9	2		3	316
Mesodon roemeri		2				1					3
Oligyra orbiculata	33	286	225	3	34	46	30	5	4	4	670
Polygyra morreana	6	55	42	9	1		7	63 (49)			169
Polygyra texasiana					2	6			1		9
Practicolella berlanderiana			2			1					3
Rabdotus morreanus		14 (13)	15 (14)	1	3	9	417	41	65	42	605
Unionidae			5 (1)								1
MNI	66	567	340	15	44	65	463	97	70	49	1,776

Table 9. Molluscan Taxa from 41CV111 by Excavation Unit and Level. If the NISP for a Given Unit/Level Differs from the MNI, it is listed as NISP (MNI).

Taxa	Unit 1							Unit 2						Unit 3						
	1	2	3	4	5	6	7	0	1	2	6	7	8	1	2	3	4	5	6	7
Anguispira strongylodes	58 (48)	4	17	10	5	1			14	30 (20)		1		294 (282)	58 (47)	12	3	1	1	
Euglandina singleyana														2						
Mesodon roemeri		1	1				1					2		5	7 (5)					
Oligyra orbiculata	159	29	40	19	7	8	7		16	60		1		308	481	8	11	5		1
Polygyra morreana	10	4	4	3	1	2	4	1		11				9	26		1	19 (16)	1	
Practicolella berlanderiana	1			2	1		4			1				5	1				4	2
Rabdotus dealbatus					2									7	8 (6)					
Rabdotus morreanus	11 (3)		7	61 (56)	85 (65)	92 (77)	59 (48)	2		2 (1)	3 (2)	7	3 (2)	7	3		118 (70)		77 (44)	94 (76)
Unionidae					1								1							
Quadrula cf. *Q. apiculata*													1							
MNI	221	38	69	90	82	88	64	3	30	93	2	11	4	625	569	20	85	22	50	79

Table 9 Continued.

Taxa	Unit 4	Unit 5							Unit 6								Total Site MNI
	1	4	5	6	7	8	11	12	1	2	3	4	5	6	7	10	
Anguispira strongylodes	233 (216)	4 (2)	1		1				3	5	1	5	2				702
Euglandina singleyana																	2
Mesodon roemeri	2	3 (2)													2		21
Oligyra orbiculata	324 (319)	4	6						7	1	7		2		1		1,507
Polygyra morreana	26																119
Polygyra texasiana	1																1
Practicolella berlanderiana	10												1				32
Rabdotus dealbatus	14 (11)									1							27
Rabdotus morreanus	2	1	3			14		14		5	39 (21)	35 (27)	36 (28)	81 (79)	134 (130)	9	803
Unionidae				2 (1)	2 (1)		1	3 (1)				1					7
Amblema plicata						1											1
Quadrula cf. *Q. apiculata*																	1
Tritogonia verrucosa											1						1
MNI	587	9	10	1	2	15	1	15	10	12	30	33	33	79	133	9	3,224

Only two of the spirally fractured bones were identifiable to element. These include the middle phalange of a deer (Unit 5, Level 2), and a proximal phalange from a pronghorn or deer (Unit 5, Level 11). Detailed provenience information for the vertebrates is presented below and in Appendix II (Table II-2).

TAXA DESCRIPTIONS

Snail taxonomy follows Hubricht (1985), except for the globular drop, which is recognized here as the genus *Oligyra* (Turgeon et al. 1988:58). Bivalve taxonomy follows Turgeon et al. (1988).

Phylum MOLLUSCA (Molluscs)
Class GASTROPODA (Gastropods)
Subclass PROSOBRANCHIATA
Order ARCHAEOGASTROPODA
Superfamily NERITACEA
Family HELICINIDAE

Oligyra orbiculata (Say, 1818)
Globular drop

Material: 41BL148 (NISP=670; MNI=670); 41CV111 (NISP=1,512; MNI=1,507).

Remarks: *Oligyra orbiculata*, commonly known as the globular drop (Turgeon et al. 1988:58), represents the only member of the Helicinidae occurring in Texas, though at least two additional tropical Mexican species have been recovered from Texas coastal beach drift (Fullington and Pratt 1974:8). This species was formerly placed in the genus *Helicina*. This terrestrial snail is gregarious, with individuals often occurring together in large numbers. *O. orbiculata* is easily recognized by its globose form and often thickened lip. This hardy semi-arboreal snail can be found in both moist shaded areas and exposed sunny areas (Fullington and Pratt 1974:8; Hubricht 1985:3). It is most common in limestone regions and can be found in deciduous or juniper woodlands with an open canopy (Fullington and Pratt 1974:8; Neck 1987b:169). The snail is not found in grassland habitats. It hibernates during winter in the soil at the base of rocks and trees (Fullington and Pratt 1974:8).

Two subspecies of *O. orbiculata* are recognized, both occurring in central Texas. *O. o. tropica* has a heavily thickened lip and is the most common of the two *Oligyra* subspecies in Texas. The shell of *O. o. orbiculata* is thinner, more translucent, and shows less thickening of the lip than does *O. o. tropica* (Fullington and Pratt 1974:8-9; Hubricht 1985:3). Hubricht (1985:3) reported that both subspecies are known from central Texas. Though not quantified, both subspecies were observed in this analysis. The presence of *O. orbiculata* at 41BL148 and 41CV111 is expected, given the limestone setting and present-day juniper woodland habitat.

Order SIGMURETHRA
Suborder AULACOPODA
Superfamily ARIONACEA
Family DISCIDAE

Anguispira strongylodes (Pfeiffer, 1854)
Southeastern disc

Material: 41BL148 (NISP=360; MNI=316); 41CV111 (NISP=764; MNI=702).

Remarks: *A. strongylodes*, the southeastern disc (Turgeon et al. 1988:131), represents the only member of the genus *Anguispira* currently recognized as occurring in Texas (Hubricht 1985:18-19, 104-106). Earlier reference works more commonly known to Texas archaeologists, including Allen and Cheatum (1961:307) and Cheatum and Fullington (1971b:8), listed this snail as *A. alternata* and as a member of the Family Endodontidae. Hubricht (1985:18, 104-106) viewed *A. strongylodes* as a distinct species from *A. alternata*, with only *A. strongylodes* occurring in Texas.

In their analysis of the fauna from archaeological site 41BL670, also on Fort Hood, Sanchez and Shaffer (1993:55) recognized the more recent designation of *A. strongylodes*, though they continued to place this species in the family Endodontidae (incorrectly listed by them as Endontidae). Their discussion of *A. strongylodes* from 41BL671 also incorrectly listed this and all other gastropod species from the site as members of the family Helicinidae (Sanchez and Shaffer 1993:57-58).

A. strongylodes is recognized by its depressed shell and reddish-brown splotches (Cheatum and Fullington 1971b:8). Allen and Cheatum (1961:294, 307) reported this is a woodland snail, also found in upland areas. Hubricht (1985:18) noted that *A. strongylodes* lives in habitats similar to *A. alternata*, including woods, logs, hollow trees, and rocky areas.

Suborder HOLOPODOPES
Superfamily OLEACINACEA
Family OLEACINIDAE

Euglandina singleyana W. G. Binney, 1892
Striate wolfsnail

Material: 41BL148 (NISP=0; MNI=0); 41CV111 (NISP=2; MNI=2).

Remarks: Three species of *Euglandina* occur in the eastern United States, all of which can be found in Texas. These include *E. singleyana*, *E. texasiana*, and *E. rosea* (Hubricht 1985:34, 144). Turgeon et al. (1988:129) placed the genus *Euglandina* in the family Spiraxidae. These snails are predatory on other land snails and can grow fairly large (Neck 1986:108). *E. texasiana* is native to northeastern Mexico and portions of Cameron, Hidalgo and Willacy counties in Texas (Neck 1981, 1986b; Pilsbry 1946:196; Pratt 1965). Neck (1985) reported an introduced population of this species from San Antonio, Texas. *E. rosea* is known from areas along the Texas coast, including Cameron, Nueces, and Harris counties (Hubricht 1985:144). *E. singleyana*, the striate wolfsnail (Turgeon et al. 1988:129), is more common, and is most frequent in the south-central, west-central, and southeast portions of the state (Cheatum and Fullington 1971:10-11; Hubricht 1985:144). This snail is known from Coryell county and was identified in this analysis from 41CV111. Hubricht (1985:144) reported no records of *E. singleyana* from nearby Bell county. *E. singleyana* is spindle-shaped, and in life, ranges in color from amber, pale brown, to pinkish (Cheatum and Fullington 1971:10). Hubricht (1985:34) reported this snail can be found around rocks on stream bluffs.

Superfamily BULIMULACEA
Family BULIMULIDAE
Subfamily BULIMULINAE

Rabdotus mooreanus (Pfeiffer, 1868)
Prairie rabdotus

Material: 41BL148 (NISP=607; MNI=605); 41CV111 (NISP=990; MNI=803).

Remarks: *Rabdotus*, formerly placed in the genus *Bulimulus* (Allen and Cheatum 1961:299-301; Hubricht 1960, 1985:35-36; Pratt 1974) is commonly encountered in Texas archaeological sites. Hubricht (1985:35-36, 146) recognized three species of *Rabdotus* occurring within the borders of Texas. These include the South Texas tree snail (*R. alternatus*) (Neck 1987b:169), the prairie snail (*R. mooreanus*) (Neck 1987a:206), and *R. dealbatus*. The largest of these species, *R. alternatus*, is found primarily in south and west Texas. Both *R. mooreanus* and *R. dealbatus* occur in Bell and Coryell counties (Fullington and Pratt 1974:42-43; Hubricht 1985:146).

Fullington and Pratt (1974:18) discussed the problematic taxonomic status of *R. mooreanus* and *R. dealbatus*. The prairie snail (*R. mooreanus*) is more common in grassland and open woodland habitats, while *R. dealbatus* is more commonly associated with woodland areas (Fullington and Pratt 1974:18). Both species, however, may overlap in their ecological ranges and form hybrid populations (Fullington and Pratt 1974:18).

The shell of *R. mooreanus* is typically opaque white, while that of *R. dealbatus* is translucent with ragged brown axial bands (Fullington and Pratt 1974:16-18, 34). *R. mooreanus* is virtually restricted to areas with limestone substrates (Fullington and Pratt 1974:18). Hubricht (1985:35) noted that this semi-arboreal snail is usually found in open country on shrubs and grasses.

Rabdotus dealbatus dealbatus (Say, 1821)
Striped rabdotus

Material: 41BL148 (NISP=0; MNI=0); 41CV111 (NISP=32; MNI=27).

Remarks: Fullington and Pratt (1974:15-17, 34) reported three subspecies of *Rabdotus dealbatus* occurring in Texas, including *R. d. dealbatus*, *R. d. durangoanus*, and *R. d. ragsdalei*. Hubricht (1985:35-36) listed only *R. d. dealbatus* and *R. d. ragsdalei*, and did not discuss the status of *R. d. durangoanus*. Only *R. d. dealbatus* is known from Bell and Coryell counties (Fullington and Pratt 1974:42; Hubricht 1985:146). Morphological characteristics and the taxonomic status of *R. dealbatus* and *R. mooreanus* were discussed above. Fullington and Pratt (1985:16) reported that in Texas, *R. d. dealbatus* can be found in tall grass prairie and oak woodlands. Note: Turgeon et al. (1988:130) incorrectly refer to this species as the whitewashed rabdotus, the common name for *R. alternatus*.

Superfamily POLYGYRACEA
Family POLYGYRIDAE
Subfamily POLYGYRINAE

Polygyra texasiana (Moricand, 1833)
Texas liptooth

Material: 41BL148 (NISP=9; MNI=9); 41CV111 (NISP=1; MNI=1).

Remarks: The Texas liptooth (Turgeon 1988:139) can be found in both prairie or woodland habitats and is usually found under litter in low ground areas (Cheatum and Fullington 1971:12; Hubricht 1985:37).

Polygyra mooreana (W. G. Binney, 1857)
Grassland liptooth

Material: 41BL148 (NISP=183; MNI=169); 41CV111 (NISP=122; MNI=119).

Remarks: Commonly known as the grassland liptooth (Turgeon et al. 1988:139) this gastropod can be found in moist wooded areas under rocks, leaf litter, logs, and from river bluffs to hilltops (Cheatum and Fullington 1971:17; Hubricht 1985:39). This snail is most easily distinguished from *P. texasiana*, also from the area, by its slightly elevated spire. The spire of *P. texasiana* is depressed (Cheatum and Fullington 1971:10-13, 16). Note: Hubricht (1985:39) listed *P. mooreana* as named by W. G. Binney (1857), while Turgeon et al. (1988:139) listed the date as 1858.

Praticolella berlandieriana (Moricand, 1833)
Banded scrubsnail

Material: 41BL148 (NISP=3; MNI=3); 41CV111 (NISP=32; MNI=32).

Remarks: The banded scrubsnail (Turgeon et al. 1988:139) can be found in both open habitats and wooded areas near streams (Hubricht 1985:42). This low spired, depressed-globose polygyrid has an expanded aperture with a thickened inner lip. This snail averages 10-12.5 mm in diameter and is larger than *Polygyra mooreana*, though smaller than *Mesodon roemeri* (described below).

Mesodon roemeri (Pfeiffer, 1848)
Texas oval

Material: 41BL148 (NISP=3; MNI=3); 41CV111 (NISP=24; MNI=21).

Remarks: Hubricht (1985:44) reported that this snail can be found under leaf litter, rocks, and logs on wooded slopes near streams. It is more common in dense woodlands along water (Cheatum and Fullington 1971:31). Turgeon et al. (1988:138) commonly refer to *Mesodon roemeri* as the Texas oval. Distinguishing morphological characteristics of *M. roemeri* are provided by Cheatum and Fullington (1971:30-31, 57).

Class BIVALVIA
Order UNIONOIDA (Freshwater mussels)
Family UNIONIDAE
Genus Indeterminate

Material: 41BL148 (NISP=5; MNI=1); 41CV111 (NISP=11; MNI=7).

Remarks: These freshwater mussel fragments could not be identified to genus.

Amblema plicata plicata (Say, 1817)
Three-ridge

Material: 41BL148 (NISP=0; MNI=0); 41CV111 (NISP=1; MNI=1).

Remarks: This left umbo was recovered from Unit 5, Level 8 at 41CV111. Neck (1993:127-131) also identified this species from previous archaeological excavations at Fort Hood. Neck (1993:128) noted that all of the mussel species identified here from 41CV111 are native to the middle Brazos River drainage system, though no modern surveys in the area have been performed.

Quadrula cf. *Q. apiculata* (Say, 1829)
Southern mapleleaf

Material: 41BL148 (NISP=0; MNI=0); 41CV111 (NISP=1; MNI=1).

Remarks: This left umbo was recovered from Unit 2, Level 8 at 41CV111. Neck (1993:127-131) also identified this species from previous archaeological excavations at Fort Hood.

Tritogonia verrucosa (Rafinesque, 1820)
Pistolgrip

Material: 41BL148 (NISP=0; MNI=0); 41CV111 (NISP=1; MNI=1).

Remarks: This left umbo was recovered from Unit 6, Level 3 at 41CV111. Neck (1993:127-131) also identified this species from previous archaeological excavations at Fort Hood.

Phylum CHORDATA (Chordates)
Subphylum VERTEBRATA (Vertebrates)
Class Indeterminate

Material: 95 fragments from 41CV111.

Remarks: The sample consists of unidentified fragments of bone from throughout the site. Most of the material is probably of mammals, though fragmentation made positive identification to the level of class impossible. Eleven of the specimens are burned.

Small/Medium-sized Vertebrate
Class Indeterminate

Material: 3 fragments from 41CV111.

Remarks: These bones represent a small to medium-sized animal, but could not be identified to class. These three specimens are burned.

Class AVES (Birds)
Order Indeterminate

Medium-sized bird

Material: 1 left tarsometatarsus, distal end.

Remarks: This specimen from Unit 5, Level 3 at 41CV111 is bobwhite-sized, but could not be identified to order.

Order PASSERIFORMES
Family EMBERIZIDAE
Subfamily CARDINALINAE

Cardinalis cardinalis (Northern cardinal)

Material: 1 complete upper beak.

Remarks: This specimen was recovered from Unit 3, Level 1 at 41CV111. The specimen lacks weathering and appears to represent a recent intrusion into the site.

Class MAMMALIA (Mammals)
Order Indeterminate

Medium-sized mammal

Material: 1 lumbar vertebra.

Remarks: Recovered from Unit 4, Level 1 at 41CV111.

Medium/large mammal indeterminate

Material: 136 fragments from 41CV111.

Remarks: These specimens could not be identified to order. All were recovered from Units 5 and 6. Five of the specimens are burned.

Large mammal indeterminate

Material: 19 deer-sized fragments.

Remarks: These specimens could not be identified to order. All were recovered from Units 5 and 6. Five of the specimens are burned.

Order RODENTIA (Rodents)
Family SCIURIDAE (Squirrels)
Sciurus sp. (Tree squirrel)

Material: 1 left humerus, proximal end.

Remarks: The specimen is from Unit 3, Level 1 at 41CV111. This probably represents the fox squirrel (*Sciurus niger*), though the eastern gray squirrel (*S. carolinensis*) occurs today in adjacent McLennan county (Davis 1978:160). This bone is punctured, likely from a carnivore. It still contains a large amount of bone grease and is rootlet etched. It appears to be recent.

Order CARNIVORA
Family Indeterminate

Material: 1 metapodial, proximal portion of shaft.

Remarks: This specimen from Unit 5, Level 11 at 41CV111 could not be identified to family. The bone is burned.

Family CANIDAE (Canids)
Canis latrans (Coyote)

Material: 1 right tibia, distal end.

Remarks: Recovered from Unit 6, Level 7 at 41CV111. The small size of this specimen suggests it represents a sub-adult coyote (Distal breadth=17.6mm).

Family CERVIDAE (Deer and relatives)
cf. *Odocoileus* sp. (Deer)

Material: 1 enamel tooth fragment.

Remarks: Recovered from Unit 5, Level 4 at 41CV111.

Odocoileus sp. (Deer)

Material: 1 antler tip (Unit 5, Level 12); 2 permanent upper left PM3 or 4 tooth buds (Unit 5, Feature B, Level 4); 1 adult left upper molar (Unit 6, Level 7); 1 proximal phalange of paradigit (Unit 5, Level 12); 1 distal phalange of paradigit (Unit 5, Level 12); 1 middle phalange, proximal end (Unit 5, Level 12); 1 complete left astragalus (Backhoe dirt).

Remarks: All deer specimens were recovered from Units 5 and 6 at 41CV111. This is true of all of the larger vertebrate fauna from the site. The proximal paradigit from Unit 5, Level 12 is burned. The middle phalange from Unit 5, Level 12 is spirally fractured. Specimens were identified as deer based on Lawerence's (1951) criteria used in conjunction with comparative material. Morphological overlap between *Odocoileus virginianus* (white-tailed deer) and *Odocoileus hemionus* (mule deer) makes osteological differentiation between the two difficult. However, current range and habitat information indicates that the sample is probably representative of *Odocoileus virginianus* (Jones and Jones 1992:72). White-tailed deer are common in all vegetational zones in Texas, with bottomland hardwoods being the preferred habitat. Deer remains are common throughout archaeological sites in the region.

The maxillary tooth buds in the sample represent a sub-adult individual, while the remainder of the material appears to be adult. The material from Unit 5, Level 12 represents the lower part of at least one deer leg. All of the elements present here are considered low utility in terms of human consumption. Their taphonomic origin remains unclear.

Antilocapra americana/Odocoileus indeterminate (Pronghorn/deer)

Material: 1 left mandible, horizontal ramus fragment (Unit 5, Level 12); 1 right mandibular condyle (Unit 5, Level 12); 1 left humerus, distal shaft (Unit 5, Feature B, Level 6); 1 radial carpal fragment (Unit 6, Level 6); 1 metapodial, distal condyle (Unit 5, Level 12); 1 metatarsal shaft fragment (Unit 5, Level 12); 1 metatarsal shaft fragment (Unit 6, Level 6); 1 metatarsal shaft fragment (Unit 6, Level 7); 1 phalange, distal end (Unit 5, Level 12); 1 proximal phalange, distal end (Unit 5, Level 11).

Remarks: All were recovered from 41CV111 in Units 5 and 6. The metatarsal shaft fragment from Unit 5, Level 12 is burned. The proximal phalange from Unit 5, Level 11 is spirally fractured. These specimens were too undiagnostic, degraded, or comminuted for identification to genus, though they likely represent deer. With the exception of the metatarsal and metapodial elements, these generally represent low utility elements in terms of meat and bone grease yield.

LITHIC ARTIFACT ANALYSIS

41CV111

William A. Dickens

The excavation of 41CV111 recovered a total of 18,001 lithic artifacts. These artifacts include 30 projectile points, 35 bifaces, one core, one burin spall, two chopping tools, 44 edge modified tools, three hammerstones, two manos, and 17,883 pieces of debitage.

The analysis includes a brief discussion of the local raw material types and a technological classification and study of the material and procurement practices. The attributes of each tool were described on appropriate coding forms, one for projectile points, one for edge modified chipped stone, one for biface/non-projectile points, one for non-flaked stone, and one for debitage. Additionally, each tool was drawn to scale, noting any specific elements, such as edge angles, fractures, edge grinding, or area of retouch, that might be present. Measurements of each tool are provided in Appendix III. Tables of the debitage are provided in Appendix IV.

Raw Material

The geologic stratigraphy of Fort Hood is composed of a Cretaceous system known as the Fredericksburg group, Comanche series (Geno 1976:19). The Fredericksburg group is composed of several geologic formations: the Paluxy, Walnut, Comanche Peak, and the Edwards formations (Carlson et al. 1987:9). All these formations are rich in lithic resources,with the exception of the Paluxy Sand formation. The most important lithic procurement lies within the Edwards caprock (Skinner et al. 1984:6-30). A great diversity of cherts are available within this area. These cherts are characteristically found in vertically restrictive zones along and parallel to the bedding planes. Chert nodules range from flattened lenses to irregular masses that may approach three feet in length and over a foot in thickness (Pittmen 1959:127). Ledge cherts have also been found in the Belton Lake region that exceed 30cm in thickness (Banks 1990:61).

Cherts from within the Edwards formation on Fort Hood offer a wide diversity of both colors and textures. Colors range from whites, grays, greens, yellows, and browns to black and may combinations of any of these colors. Geno (1976:25) states that the gray colors are a result of weathering, the brown colors the result of included dolomite, and the black color derives from included organic matter. Additionally, these cherts may be solid to translucent, fine-grained to coarse and contain some pockets of coarse or fine-grained inclusions and\or fossiliforous materials.

In some areas, such as in the Henson Mountains region in north Fort Hood and in some of the streams, heavily waterworn deposits of gravels are present. These gravels have been often referred to as Uvalde gravel, but this terminology, applied to gravels found outside the region first described by Byrd (1971), has come under criticism since they are found on surfaces with unrelated geomorphological context (Dickens 1993a:131-132). The Fort Hood gravels, often referred to by local flintknappers as "Belton gravels," are a lag deposit of waterworn siliceous gravels anomalies to the geology of central and south Texas and unrelated to the present river channels and terrace deposits. The composition of Uvalde gravels as described by Byrd (1976:5) ranges from pebbles to boulders of chert, quartz, jasper, quartzite, limestone, and silicified wood. This description is very similar to the Fort Hood gravels and without knowing the exact geomorphic contexts of the Fort Hood surfaces, one could easily identify these gravels as Uvalde. However, it will require some additional study to work out the proper geomorphic placement of these gravels on Fort Hood.

There are some problems inherent in chert type identification which must be addressed. Not all of the chert recovered can be placed into exact type categories. There are color varieties present (12.8 percent) that cannot be recognized as coming from local sources. Also, there is the problem of color and texture ranges within individual chert types. Observations on some of the chert deposits and subsequent reduction experiments (Dickens 1993b) revealed that there is a wide range of colors and textures present within individual chert types. So much variation was present that it seemed, at first, that a large variety of types were represented. It was only after the reduction of several thousand examples of the various Fort Hood cherts and the manufacture of over 500 bifacially flaked tools (Dickens 1993b, 1993c, 1995; Dickens and Dockall 1993) that it became clear as to the range of variation present within a particular type. Eventually, seven types (Owl Creek Black, Fort Hood Gray, Gray-Brown-Green Mottled, Fort Hood Tan, Heiner Lake, Texas Novaculite, and Cowhouse White) were established. The support of these types was confirmed through an independent study conducted by Mariah Associates, Inc. in which an elemental analysis was undertaken on the seven chert types. The results indicated that each was an independent type (Charles Fredericks 1993: personal communication).

Chert Types

OWL CREEK BLACK

This form is deep black in color (2.5YR 2.5/0 - 7.5YR 3/0) and fine-grained in texture. White specks, hardened inclusions, and fossiliforous materials are occasionally present. This type does not lend itself well to heat alteration. Unless the temperature is increased in very small increments (15-25 degrees) it will consistently fracture at temperatures exceeding 400 degrees. However, no benefit was derived from the heating of this form. The main source of this form on Fort Hood, although not extensive, is in the vicinity of Owl Creek near the eastern boundary of the post. There are several sources of Owl Creek Black in regions adjacent to and north of Fort Hood (Dickens 1993c, 1995).

FORT HOOD GRAY

This chert is more or less uniform light to dark gray in color (2.5YR 4/0 -10YR 5/1 - 7.5YR 5/0) but may vary due to slight mottling of light and dark shades. Hardened inclusions and crystal pockets are often encountered. Within the upper drainage area of Owl Creek this type often occurs in the form of thick "amoeba-shaped" nodules, which come in a multitude of shapes and sizes. These nodules are often cylindrical or have small, hollow or crystal filled projections stemming from the main body in many directions. This type accepted heat alteration very well. Temperatures of 525-550 degrees F were required to thoroughly alter the chert, but color changes began to occur around 400 degrees F. Changes noted from heat alteration include a surface color change, increased gloss and fraturability of inclusions. Although this form is very flakable in its raw form, heating greatly increases the flaking ability over that of the raw form (Dickens 1995).

Deposits of this type vary. Some are found eroding from soft deposits under the crests of hills while others are found still embedded within the parent limestone. In the area of 41CV111 and 41CV148 Fort Hood Gray was observed eroding from the limestone of the ridge above the sites and occasionally from gravels present in Owl Creek. The chert eroding from the ridge is heavily cracked and occurred in small, blocky, chunks. Nodules from Owl Creek are usually larger and crack free.

GRAY/BROWN/GREEN MOTTLED

This is the most varied form encountered on Fort Hood. Its color ranges from gray-brown mottled, light brown to dark brown mottled, brown-green mottled, and light green to dark green mottled (2.5Y 5/2 - 2.5Y 6/2 - 2.5Y 7/2, 7.5YR 7/0 for background shades, and 5Y 6/2 - 10YR 5/3 for mottling and patches). This form occurs primarily as nodules, which can weigh up to 30 or 40 pounds. It occurs on hill slope deposits and within stream gravels. The interiors of nodules often become more grainy towards the center and may contain large hardened inclusions. This form takes heat alteration very well with few losses occurring during heating. Temperatures of 525-550 degrees F are required to thoroughly alter the chert's interior which becomes very glossy. The exterior color begins turning pinkish red (2.5YR 6/4) around 400 degrees F, culminating in a deep red color (2.5YR 6/3). The flaking quality is greatly improved, especially within the more grainy material from the interiors of large nodules and most inclusions.

FORT HOOD TAN

This type was previously listed as Fort Hood Yellow (Dickens 1993b, 1993c, Dickens and Dockall 1993) but was changed to Fort Hood Tan (Dickens 1995) as more extensive knowledge of its color range became known. The initial description of the type was based on a very bright yellow deposit occurring in the Henson Mountains (Dickens and Dockall 1993) and a small number of flakes from sites in Bull Branch (Dickens 1993b) and Spicewood Creeks (Dickens 1993c). A more thorough study revealed that the bright yellow forms were the extreme of the color range that incorporates only a minor percentage of abundance within the entire color range. For this reason a reappraisal of its name was considered, preferring one that represented more of the most generally encountered form, thus Fort Hood Tan (Dickens 1995).

Fort Hood Tan ranges from a solid light yellow to darker shades (2.5Y 7/4 - 10YR 5/3 - 10YR 7/2). It is most commonly found in nodular form or portions thereof (Dickens 1995). A large hilltop deposit and prehistoric quarry is found paralleling Preacher's Creek less than a kilometer northwest of 41CV111 and 41CV148. Examples of this type also occur within the Owl Creek gravels but appear little different (some stream examples are more rounded) from the terrace deposit.

Heat alteration results in a surface color change to a more pinkish-orange (5YR 7/6) than other Fort Hood forms, as well as increased glossing and flaking ability (Dickens 1995).

TEXAS NOVACULITE

This form is not a true novaculite, but a variety of chert. The name "Texas Novaculite" was coined by local flintknappers because, once heat altered, this chert looks and acts much like true Arkansas novaculite. It ranges from a white to light gray-brown in color (2.5Y 6/0, 10YR 6/1 - 10YR 6/2 - 10YR 7/2). It is most typically encountered in large, thick, egg-shaped nodules to smaller fragments thereof. A cross-section of one of these nodules reveals a dark brown ring several inches into the nodule with the interior becoming a lighter gray to off-white. It is a widespread type most commonly found eroding near terrace and ridge surfaces.

When heat altered, a very light pinkish color often occurs on the surface, but it never attains the deep reds seen in the grays GBG Mottled, and tans. In its raw state, this form is almost impossible to reduce, with flakes terminating in hinges and large stacks. Once heat altered, however, it becomes very glossy and extremely easy to flake: hence its similarity to Arkansas novaculite.

HEINER LAKE

This form has two varieties: Heiner Lake Tan and Heiner Lake Blue. The tan variety is a light gray to brown with light specks throughout (10YR 7/1 - 10YR 7/20). It occurs primarily as large tabular slabs, some approaching 20 pounds, and large "eggs" that may exceed several hundred pounds (Dickens 1993c, 1995). The blue variety was first described by the late J.B. Sollberger and most available deposits were essentially "cleaned" out by local flintknappers. However, additional examples of the blue variety were found eroding from a road bed west of Heiner Lake. Its color ranges from a dark gray to a dark blue-gray (7.5YR 3/0 - 7.5YR 2/0) interspersed with lighter bands. Of the samples observed, all were of tabular form found eroding from the parent limestone.

This form is greatly improved by heat alteration, being difficult to thin in its raw state. Heating at temperatures of 525 - 550 degrees F often failed to thoroughly alter the interiors. Increasing the "soaking" time (length of time left at the maximum temperature) or re-heating them corrected this problem.

COWHOUSE WHITE

This form has currently been located in only one deposit on the top of Union Hill on the north ridge of Cowhouse Creek, but there are indications that it may also occur in other areas. Its color is predominately a dirty white to white with occasional bands of light gray (5YR 4/1 - 5YR 8/2, 10YR7/1 for the banding, and 5YR 8/1 for the background color). Microscopically, there are numerous brownish "splotches" or specks throughout which no doubt contribute to the dirty appearance. It is fine to grainy in appearance and has a peculiar "ring' when flaked. It is found in tabular form to large flattened nodules, approaching a hundred pounds in weight. Many of these are cracked or broken as a result of frost and/or fire as evidenced by the dark staining on the surfaces of the weathering cracks/fractures. A large concentration of these now occur as a chert fence erected near the turn of the century.

Cowhouse White can be easily flaked in its raw state but becomes increasingly difficult as it becomes thinner. Thin flakes, however, will flake with some ease. The edges and platforms are easily crushed, however, suggesting that it has less tensile strength than the other local cherts. Heat alteration has little effect other than perhaps further weakening its tensile strength. Experiments in heat altering have reached 550 degrees F and it may take higher and/or more sustained high temperature soaking times before any changes in this form may occur.

Non-Chert Lithic Materials

LIMESTONE

Limestone is the primary constituent of the Paluxy, Comanche Peak, and Edwards formations that make up the stratigraphy of the post. These formations provide an abundance of material that was used as heavy duty tools such as hammerstones and in the manufacturing of ground stone tools such as manos and metates.

Tool Classification and Analysis

The analysis of the lithic materials is divided into three parts: 1) flaked tools, 2) ground stone tools, and 3) debitage. The flaked tool analysis includes an examination of bifacially flaked tools, unifacially flaked tools, and those expedient flake types that were modified through use. The debitage analysis centers on waste flakes that are a result of bifacial and unifacial tool manufacture and analysis.

Flaked Tools

Three groups of flaked tools are recognized, those bifacially flaked, those unifacially flaked, and those utilized without any specific intentional modification. The bifacial tools are categorized by projectile points, manufacturing stages of bifacial tools, cores, and those bifacial tools not classified as projectile points. Unifacial tools are recognized on the basis of the placement of edge modification. Those tools without specific modification were identified on the presence of use-related wear.

BIFACIALLY FLAKED TOOLS

DART POINTS (N = 30)

All statistics (length, width, etc.) for the projectile points are provided in Table III-1.

Bulverde (N=1)

This point type is characterized as having a triangular blade, strongly barbed shoulders, and a thin finely-chipped base that is wedge-shaped in cross-section. Its age has been established between 3000 BC - 2500 BC (Turner and Hester 1985:82-83). Prewitt (1981a:79) places the Bulverde point within the Marshall Ford Phase (Weir 1976) of his Central Texas chronology dating 2050 BC - 1450 BC.

Specimen 1 (157-1). This example was recovered from level 7 of Unit 1 (N501/E464). It is complete except for the tips of both shoulders which are missing and the lateral edges have been resharpened. It is made of Fort Hood Gray chert that has not been heat altered.

Castroville (N=1)

This point type has a large, triangular blade with very large barbs produced by basal notching, relatively straight edges, with a stem that is broad and usually expanding but often are parallel, and bases are straight to convex (Suhm, Krieger, and Jelks 1954:408-409). Turner and Hester (1985:86-88) place their age at 800 BC - 400 BC and Prewitt (1981a) describes it as a major component of the Uvalde Phase (300 BC - AD 200) of his Central Texas chronology.

Specimen 1 (275-8). This specimen recovered from Level 6 of Unit 6 (Trench 3) has suffered a lateral snap at approximate mid-section and has had extensive reworking along both lateral edges resulting in a Bell-like point appearance. The narrowed shape of the blade also suggests that the final use of this example may have been for some perforating function. It is made of Gray-Brown-Green Mottled chert that has not been heat altered.

Darl (N=1)

This point type is characterized by a long slender blade with straight to slightly convex edges, slight to no shoulders, commonly beveled lateral edges, straight to flaring stem edges sometimes ground smooth, and a concave to straight base (Suhm, Krieger, and Jelks 1954:414-415). Prewitt (1981b) divides Darl into Mohomet and Zephyr types based on the degree of blade beveling and stem grinding. Turner and Hester (1985:101) place its age in the Transitional Archaic at AD 200 and Prewitt (1981a:76 places the Mohomet variety in his Driftwood Phase (AD 550 -AD 700).

Specimen 1 (296-1). This specimen is complete was recovered from Level 5 of Unit 5 (Trench 2). It has alternately beveled stem and lateral edges and no smoothing on the stem, fitting Prewitt's (1981b) description of the Mohomet type. The point is patinated white, obscuring the type of chert it is made of and contains no observable evidence of heat alteration.

Ensor (N = 4)

The Ensor type is described as having a triangular blade with straight to slightly convex edges that are commonly finely serrated, shoulders that are slight to prominent, short bars, expanding stem often wider than the base with shallow notches, and straight to convex bases (Suhm, Kreiger, and Jelks 1954:422-423). Turner and Hester (1985:114) describe another variety having a shallow v-shaped basal notch called the Ensor-Frio. Prewitt (1981a:81-82) places the Ensor in the Twin Sisters Phase of the late Archaic period in his Central Texas chronology.

Specimen 1 (284-20). This specimen from Level 7 of Unit 6 (Trench 3) has been heavily damaged by fire resulting in pot-lidding and the fracture of its distal tip and one corner of the base. It is made of Fort Hood Gray chert.

Specimen 2 (310-1). This specimen from Level 10 of Unit 5 (Trench 2) is essentially complete, suffering only a relatively recent fracture to its distal tip. Both lateral edges have been heavily reworked producing concave shaped edges. It is made of Fort Hood Gray chert that has not been heat altered.

Specimen 3 (surface collection). This specimen was found on pothole backdirt and has had a bending fracture that removed the distal tip. One edge has had a slight resharpening modification. It is made of owl Creek Black that has not been heat altered.

Specimen 4 (Trench 3). This point has suffered severe impact damage which "peeled" a flake more than one-half the remaining length of one face. The lateral edges have been finely serrated. It is made of Owl Creek Black that has not been heat altered.

Fairland (N = 1)

These points have a triangular blade with convex, but occasionally straight edges, occasionally finely serrated, narrow shoulders, seldom barbed. The most distinctive part is the flaring base formed by shallow side notches and a deeply concave base which produces a very sharp basal corner (Suhm, Krieger, and Jelks 1954:424-425). Prewitt (1981a:81) places the Fairland as diagnostic within the Uvalde Phase (300 BC - AD 200) of his Central Texas chronology.

Specimen 1 (154-1). This specimen was recovered from Level 4, Subunit A of Unit 5 and is typical to the type. It is essentially complete but contains slight impact damage to its distal tip. Some minor edge resharpening (large serration-like flake scars) is confined to one lower lateral edge, otherwise no edge resharpening is present. It is made of Fort Hood Gray chert that has not been heat altered.

Lange (N = 8)

This point type is identified by a triangular blade with straight to convex edges, that are occasionally concave or recurved, prominent well barbed shoulders, expanding stem occasionally straight, and a straight to concave of convex basal edge (Suhm, Krieger, and Jelks 1954:436-437). Prewitt (1981a: 80-81) places the lange point within the San Marcos phase (650 BC - 300 BC) of his Central Texas chronology.

Specimen 1 (81-1). This specimen from Level 4 of Unit 3 has suffered both impact damage and pot-lidding from subjection to heat. The impact damage includes both lateral edges as well as the distal tip. It is made of Owl Creek Black that has not been heat altered.

Specimen 2 (113-1). This point recovered from Level 4 of Unit 4 has had both lateral edges reworked unifacially until little of the original shoulders remain. Some impact damage is present on the distal tip and the stem is thick (compared to the rest of the point) and contains several large step fractures. This and the reworking suggests that the point was originally much larger. It is made of Fort Hood Gray that has not been heat altered.

Specimen 3 (199-1). This example recovered from Level 2 of Unit 6 (Trench 3) is broken medially and is missing the distal half. It is made of Fort Hood Gray that has been heated, especially on the proximal end, after manufacture.

Specimen 4 (222-4). This example is from Level 3 of Unit 6 (Trench 3). It has suffered a bending/snap fracture removing its distal tip. It is a well made point with very controlled pressure flaking producing a parallel-like flake scar pattern. It is made of Fort Hood tan that has been heat alerted prior to manufacture.

Specimen 5 (246-1). This example was recovered from Level 5 of Unit 6 (Trench 3) and is represented only by the stem. It appears to have been subjected to several episodes of fracture evidenced by the differences in the surface patina on the fracture surfaces. It is made of Gray-Brown-Green Mottled chert that has not been heat altered.

Specimen 6 (246-6). This point was found in Level 5 of Unit 6 (trench 3) and has had a bending/snap fracture removing the distal end. Additional damage is noted on the proximal edge of the base which probably resulted from a combination of the haft and impact. It is made of Owl Creek Black chert that has not been heat altered.

Specimen 7 (275-7). This specimen recovered from Level 6 of Unit 6 (Trench 3) is essentially complete except for some minor impact damage to the distal tip. Some minor edge reworking is present on one lateral edge. It is made of Fort Hood gray chert that has not been heat altered.

Specimen 8 (299-7). This example was recovered from Level 10 of Unit 5. It has a bending/snap fracture removing the distal half of the point. The remaining half is slightly reddened and heavily pot-lidded from subjection to heat. It is made of Fort Hood chert.

Marshall (N = 1)

This point type has a blade that varies from triangular to broad oval with edge that are nearly straight to strongly convex. The shoulders are always strongly barbed with the larger barbs in line with the base. The stem is slightly expanding to parallel-sided and the base is straight, to concave or convex (Suhm, Kreiger, and Jelks 1954:444-445). Prewitt (1981a:80-81) places Marshall points within the San Marcos Phase (650 BC - 300 BC) of his Central Texas chronology. Turner and Hester (1985:149-150) place its occurrence earlier than Prewitt (1981a) at 1000 BC or slightly earlier.

Specimen 1 (202-1). This specimen recovered from Level 2 of Unit 6 (Trench 3)_and is represented only by the proximal corner containing most of the stem and one shoulder. It is made of Owl Creek Black chert that has not been heat altered.

Pedernales (N = 8)

This point type is highly varied. Typically it contains a triangular to leaf shaped blade, straight to convex edges, but occasionally convex, recurved, or narrowed to a thin needle-like tip. Shoulders vary from slight or weak, right angular, to various degrees of barbs which vary from large to small. The stem is the most characteristic portion of the point being rectangular to slightly contracting with a deep concave or U-shaped base (Suhm, Krieger, and Jelks 1954:468-471). Prewitt (1981a:80) places the Pedernales point within the Round Rock Phase of his Central Texas chronology with a date spread of 1450 BC - 650 BC while Turner and Hester (1985:171-173) provide earlier dates of 2000 BC.- 1200 BC.

Specimen 1 (51-2). This point was recovered from Level 4 of Unit 1 and has suffered impact damage removing the distal tip. Both lateral edges have had minor edge resharpening. It is made of Fort Hood gray that has not been heat altered.

Specimen 2 (68-5). This specimen found in Level 4 of Unit 3 has impact damage to the distal tip and haft damage to the stem. The impact to the tip removed the extreme distal tip and approximately one-half of the lateral edge. One corner of the stem is missing and is probably related to impact within the haft. It is made of Gray-Brown Green Mottled chert that has not been heat altered.

Specimen 3 (81-4). This example was recovered from Level 5 of Unit 3 and is complete. Only minor reworking is present on either lateral edge. It is made of Fort Hood Tan with some translucent portions, suggesting creek gravel as a possible parent source. No heat alteration is present.

Specimen 4 (114-1). This point was found in Level 4 of Unit 4 and has suffered severe impact damage resulting in a diagonal split across most of the remaining face of the point. One interesting feature of this point is the presence of stem smoothing which is not typical to the type. It is made of Texas Novaculite that has been pre-manufacture heat altered.

Specimen 5 (105-2). This specimen was recovered from Level 5 of Unit 1 and is complete. It has been post-manufacture heat altered turning the entire surface of the point a reddish color preventing exact identification of the chert type.

Specimen 6 (117-1). This specimen was found in Level 6 of Unit 2 and is essentially complete. Both lateral edges have been reworked distally, especially one edge which is reworked to a slight right angle from the normal edge. It is made of Fort Hood Tan chert that does not appear to have been heat altered.

Specimen 7 (240-1). This example was recovered from Level 10 of Unit 2 and is represented only by the base. The fracture is a "roll" type bending fracture. The material has been heated to a red color and the exact chert type cannot be determined.

Specimen 8 (surface collection). This specimen was found on the surface of a pot hole. It contains a bending/snap fracture of the distal tip and one shoulder resulting from impact. It is made of Fort Hood Tan chert that has not been heat altered.

Unknown Type (N = 4)

Projectile points in this category have been damaged, reworked, or purposefully manufactured into a form that cannot be placed into a known type.

Specimen 1 (86-1). This example recovered from Level 3 of Unit 1 is a large stemmed biface. It is crudely made with several large stacks on the dorsal surface. The distal tip is damaged from impact removing the distal quarter of the point. The stem is made at a 25 degree angle to the midline of the blade suggesting a possible use as a knife. It is made of Fort Hood Tan that has not been heat altered.

Specimen 2 (88-2). This specimen from Level 4 of Unit 4 is only a distal end fragment. It is heavily damaged by fire containing heavy pot lids. It is made of Fort Hood gray chert.

Specimen 3 (284-1). This example was recovered from Level 7 of Unit 6 (Trench 3) is the approximate distal half of a projectile point. Besides the missing proximal portion the distal tip has suffered impact damage. It is made of Owl Creek Black chert.

Specimen 4 (286-1). This example was recovered from Level 7 of Unit 6 (Trench 3). It has been extensively reworked resulting in a triangular shape. The distal end has been fractured from a non-impact cause and is made of Texas Novaculite that has been heat altered.

ARROW POINTS (N = 1)

Specimen 1 (8-1). This single example was recovered from Level 2 of Unit 2. It is the medial fragment of a heavily pot-lidded arrow point. The heat damage is too severe to determine the type of point or type of chert.

BIFACES (N =35)

This category includes the various reductive stages of bifacial tool manufacture. A biface is defined as a stone implement that has been flaked from opposing surfaces (Sanders 1990:19). During bifacial tool manufacture, the raw material is shaped into a desired form by passing through a series of reductive stages. These stages are assigned,in the simplest type sequence, as Biface I, II, and III. Not all reductive strategies follow this sequence, occasionally one or more stages can be skipped. If, for instance, a large macroflake was used as the beginning blank, initial thinning may be sufficient to bring the biface rapidly to a later stage, effectively eliminating a thicker middle stage.

Each specimen was examined for its stage of reduction, possible reason for abandonment, and possible use-wear. Additionally, material used and any heat alteration present was noted.

Biface I (N = 5)

This artifact class is a biface that has had only initial primary flaking and shaping. They were rough shaped by the hard hammer removal of large flakes as indicated by deep flake scars and, occasionally, high numbers of step fractures. In addition, some cortex is present on one or more of its surfaces. Secondary retouch is absent.

Five specimens were recovered. Table III-2 lists the statistics (provenance, length, width, etc.) for each specimen. Four are essentially complete (65-2, 297-1, 299-5, surface) and one is fragmented (299-6). Chert types include three of Fort Hood Gray (65-2, 297-1, 299-6), one Gray-Brown-Green Mottled (299-5), and one unknown (surface). Only one (65-2) of the Biface I's has been heat altered. This heating probably occurred after abandonment as there are some internal cracks present that caused initial flake removal to terminate or dive at or into these cracks. Unfortunately this specimen was found on the surface (probable pot hole backdirt) and no further site context can be determined. There is no apparent reason for the abandonment of the complete specimens.

Biface II (N = 13)

This category of biface has been altered from a rough shape to a thinner and more uniform one by hard hammer percussion as well as some soft hammer percussion, the latter increasing as the biface becomes thinner. In the hands of an expert, however, a hard hammer type percussor can be employed to nearly final completion, requiring only final edge shaping and notching with a pressure type tool. Flake scars are still large but the number of smaller ones increase, some cortex may remain, and secondary retouch is still lacking.

Thirteen examples were recovered. Table III-3 lists the statistics (Provenance, length, width, etc.) of each specimen. Three are essentially complete and ten are fractured. The complete specimens include Cat. No.'s 110-1, 222-1, and 279-1. The fractured specimens include four proximal (65-1, 132-1, 201-1, and 244-1), five distal (68-2, 201-2, 236-3, 295-1, 299-9), and one lateral (314-1) portions.

Chert types include four of Fort Hood Tan (201-2, 236-3, 295-1, 314-1), three of Owl Creek Black (222-1, 244-1, 299-9), and the remainder (six) are Gray-Brown-Green Mottled. One specimen (299-1) is pot lidded and crazed, and three (132-1, 236-3, 279-1) have a color change on both sides. The remaining specimens are not heat altered. Specimen 279-1 was heated only enough to turn portions of the edges red, fragmented specimen 236-3 was heated after fracture, specimen 299-1 is heavily pot-lidded after manufacture, and specimen 132-1 was heated prior to the last fracture. Specimen 132-1 is the only one that contains evidence of possible pre-manufacture heat alteration, however, the last flaking episode may have been preformed after the biface was broken.

There is no apparent reason for abandoning 279-1. It retains a series of long blade-like scars across one face, all originating from the same angle and some cortex remains on the proximal end producing a well formed Biface II preform. Specimen 222-1 contains several deep diving flake scars and is relatively small (64.8cm in length) compared to the other specimens and specimen 110-1 retains some severe stacks which were probable reasons for their abandonment.

Biface III (N = 17)

This biface type is the final reduction stage in preforming. It has been thinned and exhibits secondary modification, and a patterned edge straightening and shaping (usually oval or triangular shape). After this stage, the last step in bifacial manufacture (if desired) is minor thinning, shaping, and notching. It must be stressed that desired tools can be made at any time during the reductive process and that these descriptions are only for those culminating in a thin biface or projectile point.

The Biface III stage is a dangerous stage in biface reduction. The material has been so thinned that any miscalculation, such as excessive force or a misjudged blow, can easily result in a fracture. In arrow point manufacture, for instance, the simple pressure exerted on a thinned preform while holding it in the hand during pressure flaking may easily be sufficient for fracture.

Seventeen specimens were recovered. Table III-4 is a listing of the statistics (provenance, length, width, etc.) for each specimen. One is complete (281-1), seven are proximal (46-1, 194-3, 222-1, 275-1, 286-1, SRA-2, SRA-3), eight distal (176-1, 228-1, 246-1, 246-2, 246-3, 270-2, 320-1, SRA-4), and one lateral (299-4). Chert types include four owl Creek Black (222-1, 228-1, 246-1, 320-1), two Fort Hood Gray (194-3, SRA-4), four Gray-Brown-Green Mottled (270-2, 281-1, 286-1, 299-4), four Fort Hood Tan (176-1, 246-2, 246-3, SRA-4), one Texas Novaculite (46-1), and two that cannot be typed (275-1, SRA-3).

Five of the specimens contain some form of heat alteration. Specimen's 222-1 and 275-1 are pot-lidded and crazed indicating severe and uncontrolled heating. Specimen 270-2 was heated after abandonment as evidenced by the fracture surface being the same color as the rest of the piece. Specimen 299-4 is very glossy on all surfaces and appears to have been flaked after heat alteration. The same is true of specimen 194-3 which was flaked after heat alteration but internal cracking and crazing caused failure.

Knapping errors and material flaws are the primary reasons for failure of the Biface III's studied. There is no apparent reason for abandoning the complete specimen (201-1). This example is very well made with no observable flaws or errors.

CORE (N = 1)

Cores are the residual parent material left after usable flakes have been removed. Landmarks on cores include striking platforms and negative flake scars from individual flake removals (Barnett 1973:45; Sanders 1990:19).

Reductive experiments (Dickens 1993b, 1993c, 1995) have shown that the interiors of some of the chert nodules collected from various chert deposits on Fort Hood are tough, coarse grained, and hard to reduce. The outer portions are often fine-textured and flake more easily. Numerous cores have been collected in and around chert deposits and quarry areas (Dickens 1995; Dickens and Dockall 1993) that have had only the surface portions removed or "peeled." While a great number of these cores are small, many are large, especially in the Heiner Lake area and on Union Hill in the Cowhouse White deposit. These are the parent chert nodules from which many of the large macroflakes were obtained.

Only one core (279-1) was recovered from 41CV111. It was found In Level 3 of Unit 6 (Trench 3). It is not a large core, measuring 87.3mm x 75.9mm x 55.3mm and weighing 301.2gm. Only small flakes have been removed in a multi-directional manner. About one-half of the cortex still remains. The chert type is Fort Hood Tan that has not been heat altered.

BURIN SPALL (N = 1)

Burins are large flakes, or broken tools, from which a trihedral spall has been removed from one or more edges and originating from a flat horizontal surface. The spalls are discarded and the edge created by the removal of the spall on the flake is used in scraping or incising activities.

A single burin spall (236-4) was recovered from Level 4 of Unit 6 (Trench 3). Its dimensions are 38.4mm long, 5.5mm wide, and 6.8mm thick. There is no wear or use indicated on the specimen. It is made of an unidentified chert due to an overall red color resulting from subjection to heat.

CELT (N =1)

A single example (241-1) of a flaked celt or adze (Table III-5) was recovered from Level 7 of Unit 5 (Trench 2) is an elongated bifacially flaked tool with a steep bit (32 degrees). It is similar to the Dalton Adze but has no dulling or smoothing on the proximal or poll end (Turner and Hester 1985:252). Two notches have been formed near the proximal end that to facilitate hafting. This is supported by the presence of polish on some flake scar ridges on the surface of the proximal end. The bit end is crushed and step fractured, especially in the bit's center area, and there is some minor crushing and microflake spalling on the proximal end's edge. This damage is typical to chopping and adzing activities (Keeley 1980:38-40). It is made of Fort Hood Gray chert that has not been heat alerted.

CHOPPER (N =1)

A single specimen (222-3) of a chopping tool (Table III-5) was recovered from Level 3 of Unit 6 (Trench 3). It is fragmentary with only the working or bit edge remaining. The bit is beveled to 52 degrees and the edge is crushed with bifacial micro-flake scars and step fractures. There are also varying degrees of rounding present along the remaining portion of the edge. This is typical damage resulting from chopping activities on wood (Keeley 1980:38-40). It is made of Fort Hood Gray chert that has not been heat altered.

EDGE MODIFIED FLAKE TOOLS (N = 44)

This category of artifacts contains a number of tool types ranging from simple, expedient tools to more-modified and longer curated forms. A listing of the measurements are provided in Tables III-6 thru III-9. The expedient types are usually simple flakes that are utilized without any purposeful modifications and are discarded after the task is completed. These tools were used for a variety of tasks, such as cutting, sawing, planing, and scraping activities. Some activities, such as butchering large game, have a high attrition rate on stone tools. For such tasks, it is therefore more prudent to utilize an expedient tool which can easily be replaced, saving more formal tools for use in less destructive activities (Frison 1979:262-263). Evidence of use lies primarily in edge damage, which will result in a specific type of damage depending upon type of activity. This may include one or a combination of variables, such as striations, polish, and step-fracturing or the micro-scarring of one or more faces. Other variables which help to identify tool use are edge shape, tool thickness, and edge angle (Keeley 1980:17-61).

Purposeful edge modification, in the form of small pressure flakes or light percussion flaking, is often conducted to strengthen and/or resharpen an edge. Tools with this type of modification can also be expedient, although some may be retained for extended periods of use. A tool may also be used for several functions during its use-life, or it may serve several functions simultaneously (Frison 1979:263-264). Thus, a tool may be used for one function, and then for another. Passing from one function to another may require specific edge modifications which further alter the tool from its original form. This reworking often results in tools that exhibit evidence of use for the last modification, making it difficult to interpret initial use.

Two subcategories of edge-modified tools were established: (1) retouched-edge tools, or those that have been retouched with some soft percussion or light pressure flaking; and (2) expedient flake tools, or those with modifications resulting from use-related activities. Tables III-6 through III-7 lists the statistical data (provenance, length, width, etc.) for each specimen.

Retouched-Edge Tools (N = 9)

These tools exhibit a variety of wear. Five contain scraping wear (26-1, 47-2, 51-1, 77-4, 299-1), one cutting wear (148-1), two with cutting and scraping wear (22-2, 282-6), and one has a denticulated edge (314-2).

Those specimens with scraping wear (Table III-6) range in length from 38.1mm, 22.4mm in width, and 5.3mm in thickness. The largest specimen (77-4) is made from the greater portion of a cobble that has had one entire edge flaked to a 72 degree angle with the edge formed by that angle utilized. The size of the remaining specimens are made from thinner and smaller flakes, the thickest being 17mm. Two contain heat damage, 26-1 is pot-lidded and crazed, and 47-2 has turned red. materials include one of Fort Hood Gray (47-2), three of Gray-Brown-Green Mottled (51-1, 77-4, 299-1), and one undetermined chert (26-1).

The specimen with cutting use (Table III-7, 148-1) measures 82mm x 24mm x 13mm. It is made from a flake of Owl Creek Black chert by the crude percussion flaking of one edge. Both faces of the edge contain areas of micro-flake scarring and portions of the edge contain rounding.

The two specimens showing multiple use of cutting and scraping (Table III-8) are No.'s 22-2 and 282-6. They range in size from 56.6mm in length, 26.4mm in width, and 4.9mm in thickness. These are made on irregularly shaped flakes, both of Fort Hood Gray chert. The different utilized portions of edges alternate on each tool with no apparent pattern. There are small projections present on each tool and each is central to some modification. One is present on 22-2 and two are on 282-6. It is not the point formed by these projections that is utilized, but it is the concavities formed on either side of the projections that were used. Hard material, such as wood is the medium indicated by the edge damage present (Keeley 1980:35-36).

Specimen 314-2 is a medium sized flake (35mm x 25mm x 4mm) that has most of the existing edges modified into a series of large serrations forming a denticulated edge. The direction of use indicated by the edge with modification alternates on one edge. Good wear is indicated on all edges with moderate to heavy rounding and some polish in the concavities produced by the denticulation. It is made of non-heat treated Gray-Brown-Green chert.

Use-Modified Flake Tools (N = 35)

This tool category contains a wide variety of use-wear. Twenty-two contain scraping wear (Table III-6), four with cutting wear (Table III-7: 3-1, 202-2, 282-1,299-2), three with cutting and planing wear ((Table III-9: 202-4, 236-2, 275-4), and six with cutting and scraping wear (Table III-8: 45-1, 81-2, 91-3, 202-1, 272-2, 282-5). Those flakes containing scraping wear constitute the majority of examples (22) in this tool category. They are made on irregularly shaped flakes that range in size from 16.7mm in length, 9.7mm in width, and 2.2mm in thickness with most (19) under 10mm in thickness. Wear is indicated by the presence of micro-flake scarring, rounding and polish on the edge. Micro-flake scarring, for instance, should only be present on one face or that edge that had minute flakes driven away from the direction of use.

One specimen (68-3) is made on a blade-like flake and the others are all made on irregular or broken flakes. Materials include six of Fort Hood Tan chert (22-3, 22-5, 68-1, 68-3, 282-43, 19-1), one of Owl Creek Black (222-3), one of Fort Hood gray (22-4), one unknown chert type (43-2), and the remaining specimens (13) are of Gray-brown-Green chert. Two are pot-lidded and heat crazed (1-1, 22-5) and nine have been reddened on both sides (22-3, 43-1, 43-2, 47-1, 68-3, 194-1, 194-2, 202-5, 282-4). Although heated flakes could easily been selected for use, only one specimen (202-5) contains evidence of use after heat alteration. This is substantiated by use-related flake damage removing the heat colored surface revealing very glossy flake scars.

Those flakes with cutting wear are made on one blade (202-2), one irregular flake (3-1), and two macro-flakes (282-1, 299-2). They range in size from 22.7mm in length, 12.5mm in width, and 4.2mm in thickness. Wear is indicated by micro-flake scarring on both edge faces, rounding of the edge, and diagonal striations. Materials include one of Fort Hood Tan (202-2), one of gray-Brown-Green Mottled (299-2), one Texas Novaculite (282-1), and one unknown (3-1). Heat alteration is present on three specimens (3-1, 202-2, 282-1), but only one (202-2) was used after heat alteration had occurred.

NON-FLAKED LITHIC TOOLS (N = 5)

Hammerstones (N = 3)

This artifact type is a round, oval, or cylindrical tool that is used in the hard hammer manufacturing stage of lithic reduction. Hammerstones can be made of various materials, including limestone, chert, quartzite, quartz, hematite, and silicified wood. In the Fort Hood region, gravel deposits contain an abundance of naturally shaped cobbles suitable for use as hammerstones. Wear on hammerstones is evidenced by battering present on one or more ends or edges. However, various degrees of scratching and battering (ring cracks) may be present on the dorsal or ventral surfaces, as well (Dickens 1994:140-142). Some specimens may exhibit extensive, especially in areas where source material is scarce, while other hammerstones show only minor wear. In addition, hammerstone may be made from recycling other discarded tools such as manos, choppers, and other large or thick tools.

Three hammerstones (Table III-10) were recovered from 41CV111. One (246-1) is made of Gray-Brown-Green Mottled chert and the other two (275-5, 241-1) are made of poor grade hematite. Specimen (275-5) is blockish in shape with severe damage to both ends causing several large flakes to become detached. The remaining two specimens are rounded and containing typical battering and crushing wear on their edges.

Manos (N = 3)

These tools are most often made of limestone that have been pecked or ground into a suitable shape. The raw material selected for use is most often a conveniently shaped stone that subsequently becomes ground from use rather than an extensive modification from an odd shaped stone.

Three manos (253-1, 314-3, 314-4) were recovered from 41CV111 (Table III-11). All are fragmentary and both contain typical mano wear with numerous scratches and small pitting to their dorsal and ventral surfaces. Specimen 253-1 is the most complete with two wear facets and moderate battering on both ends from use as a hammerstone.

Debitage (N = 17881)

This artifact class includes those flakes that result from flaked tool reduction and other activities of stone tool modification. Flaked tool manufacture is a reductive process that begins with an unmodified piece of material that is shaped into a desired form to be used for a specific function (Callahan 1979; Collins 1975). The initial stage begins with the acquisition, through quarrying or trade, of the raw material. The stone is then shaped through a series of distinctive reductive stages accomplished through a structured strategy: the knapper must adjust for changing width/thickness relationships and edge angles if the finished product is to have the proper features and attributes (Callahan 1979:37).

Each stage or technique produces a distinctive assemblage that reflects the material being worked and the particular reduction technique. Thus, the debitage can provide evidence for production technology through the qualification of certain attributes (Morrow 1984:20). Four methods of analysis were employed for this study. These were size grade, presence and amount of cortex, material type, and heat alteration.

Ahler (1975) describes size grading within an assemblage as a reflection of the reduction stage. The size of waste flakes produced in the various stages will decrease systematically from the initial stage to the final stage (Behm 1983:11-14; Newcomer 1971:88-90; Stahle and Dunn 1982:85-94). Since no resulting by-product can be larger than the maximum size of its parent, the larger sizes of debitage represent earlier stages of manufacture and the decreasing debitage sizes represent later and final stages. However, it must be understood that the above assumption is based on complete flakes and that flakes tend to break randomly in all stages of reduction. Therefore, including all flakes and flake fragments in each size grade is less time consuming than pre-sorting complete flakes and any bias will be evenly distributed (Stahle and Dunn 1982:86).

Size grading was accomplished by passing the debitage through a series of nested screens. At times it was necessary to manipulate some flakes gently through the screen if they become lodged.

The presence and amount of cortical material was another consideration studied in conjunction with size grading. This is based on the assumption that the raw material initially collected is covered with cortex and, as reduction proceeds, the amount of cortex will be reduced. More cortex should be present on flakes produced initially than flakes produced from later reduction stages. This is important to consider when evaluating where the material originally came from and whether the initial reduction stages were conducted on the site or somewhere else.

The chert types were studied to evaluate resource exploitation. Fort Hood and the surrounding region contain a great variety of chert: many types are distinctive with individual physical properties that could affect their selection for use. The natures of the different cherts can also influence tool manufacture and use. Also, by defining chert types and by locating sources, it is possible to ascertain the range of territory covered by indigenous groups inhabiting a specific site.

The presence of heat alteration is an important consideration when evaluating manufacturing processes. Published literature on the heat alteration of flaked stone tools is increasing. It has been established that heat altering siliceous stone as a preparation for flaking was a widespread practice (Crabtree and Butler 1964; Purdy and Brooks 1971). It has been an element of various lithic technologies of North America from Paleoindian times into the Historic period (Hester and Collins 1974:219). Several prehistoric assemblages of thermally altered debitage and finished tools have been described (Hester 1972:63-65; Hester and Collins 1974:219-224; Hester and Sollberger 1973:181-185).

The evidence of thermal alteration on cherts from Fort Hood is easily identified. Experiments involving heat-altered preforms and flakes (Dickens 1995) have shown that most cherts from this region undergo both a surface color change and an interior texture change. The change in color is due to the presence of ferric impurities (Collins and Fenwick 1974:135; Patterson 1984:168, 171; Schindler et al. 1984:175) and is limited to the outer surface of the chert. Additionally, it has ben found that this change may occur at temperatures lower than those required for altering chipping qualities (Collins and Fenwick 1974:135) and requires the investigator to be familiar with the materials being analyzed.

Macroscopically, interior changes include an increase in "gloss" or luster and a smoothing of the texture. Electron microscopy studies by Nelson (1968) of raw and annealed flint revealed that flint heated at 250 degrees C did not differ much from raw flint, except that when fractured, the surfaces appeared to be more transgranular with better-defined spherical voids about 0.1 micron in diameter. However, flint annealed to 400 degrees C displayed a fracture surface that was totally transgranular. This results in fracture surfaces that are very smooth (Nelson 1968). Therefore, like color change, interior changes sufficient for improved chipping quality will not occur unless proper temperature and heat "soaking" (period that flint is left to heat at maximum temperature) time conditions are met.

There are several important changes that occur within chert after heat alteration. The first is that heating vastly improves the chert's chipping quality by altering the material from one that is tough and resists flake removal to one that has reductive qualities similar to glass. Second, the flakes removed after heat treating are often larger and less likely to hinge or step fracture (Collins and Fenwick 1974:138; Mandeville and Flenniken 1974:147). However, experimentation has shown that prolonged heating impairs the tensile strength of the material. In other words, after the longer the period of exposure to heat, the more fragile the material becomes.

The debitage analyzed for heat alteration was divided into six categories: no heat treatment present, undetermined, color change on one side and gloss on the other or high gloss on both sides; presence of pot-lids, color change on both sides, partial surface or edge only colored. The only category that represents the use of material annealed prior to reduction is the category containing a color change on one side, lustrous on the other or color change on both sides. Those categories containing pot lids or a color change on both sides represent flakes that have been heated subsequent to flake removal. In these cases, the evidence for heating prior to flake removal would be altered and be undetectable.

DEBITAGE ANALYSIS

Debitage flakes recovered totaled 17881. The raw counts of the debitage are provided in Table IV-1. The table is broken down into totals and percentages within the variables of units, levels, grades, material, cortex, and burning. Debitage tables are located in Appendix IV.

It is evident from Table IV-1 that as flake size decreases, the number of flakes increases. This indicates that all stages of bifacial reduction are represented, which agrees with Behm's (1983:4) observations on the character of lithic deposits. The decrease in the number of flakes in Grade 7 is a reflection of 1/4 inch (7mm) screening bias, wherein flakes less than 1/4 inch in size fell through the screen and were not recovered.

Table IV-8 lists the cortex by grade. It can be determined from this table that the amount of cortex decreases as the size of the flakes decrease. This agrees with the assumption that as reduction proceeds, the amount of cortex decreases as flake size decreases, providing further support that different stages of biface reduction are present.

The presence of tertiary flakes (Cortex 3) in Grade one is an indication of the use of large chert cobbles. There is an increase of primary and secondary flakes in Grades 4 (26mm) through 6 (13mm). This higher percentage of cortex in the smaller grades may be a reflection of a specific material selection or reduction strategy. The reduction of small, relatively thin cobbles (such as can be found in Owl Creek) could retain small amounts of cortex until later stages of reduction. The eventual removal of these flakes would produce flakes in smaller sizes. Large flakes (macroflakes) were often spalled from large cobbles (Dickens and Dockall 1993). This technique was commonly preformed on large cobbles where good quality chipping chert occurs only on the outer portions of the cobble (Dickens 1995). Such spalls would contain varying degrees of cortex on the dorsal surface. The reduction of these macroflakes can produce both primary and secondary flakes in very small sizes (Dickens 1995; Dickens and Dockall 1993).

Table IV-10 is a comparison of material type by cortex. The higher percentages of secondary flakes for Owl Creek Black (Type 1), Fort Hood Gray (Type 2), Gray-Brown-Green Mottled (Type 3), and Fort Hood Tan (Type 4) over Texas Novaculite (Type 5) and Heiner Lake (Type 12) indicates chert type availability and preference. The distance to the known Heiner Lake chert deposit is almost 15 kilometers away. Any transport of this material may have been limited to late stage or finished bifaces, thus reducing the number of possible primary and secondary flakes. The very low total (overall of Texas Novaculite chert is an obvious reflection of preference, since this type is found both in Owl Creek and on the top of the ridge directly behind the site.

Table IV-9 is a listing of burning by grade and Table IV-11 is a listing of burning by material. The presence of purposeful heat alteration (Burn 1) is low, averaging 7.7 percent. The highest percentage of purposeful heating is seen in Gray-Brown-Green Mottled chert. This type can be chipped easily in its raw state but it often contains a number of inclusions and a "blending" of poor chipping material throughout. These problems can be lessened with heat altering (Dickens 1995).

It is interesting to note the relatively high percentage (1.8 percent) of Owl Creek Black chert. This form does not require heat alteration to improve flakability. Heating experiments conducted on it resulted in little to no improvement in chipping quality. So why the high number of heated flakes? The better grades of this form in their natural state are often very glossy. The only explanation is a probable error in the identification of these glossy flakes as being heat altered. The lack of purposeful heating in Texas Novaculite (0.1 percent) is likewise interesting. This form requires heat altering to be chippable at all. This toughness, however, makes it very suitable for heavy duty type tools such as choppers and adzes that do not require heat altering. The low number of heated Texas Novaculite flakes (12) from 41CV111 may reflect its restriction to this type of usage.

Table IV-7 is a comparison of material by grade. The primary deduction from this comparison is one that supports the primary acquisition of some chert types i.e., Fort Hood Gray, Gray-Brown-Green Mottled, Fort Hood Tan, and Owl Creek Black, as coming from more local sources as opposed to sources from more distant regions. Material acquired locally would not require extensive reduction before transport to the home base and flakes produced from these would be larger and may contain cortex. The typical strategy of acquiring material from more distant locations i.e., Heiner Lake, would involve reducing the material to thinner bifaces prior to transport. Any subsequent reduction or modification of these bifaces would produce predominately smaller and non-corticated flakes.

41BL148

John E. Dockall

Test excavations at 41BL148 yielded a total of 1645 lithic artifacts. These artifacts include 4 complete or fragmentary projectile points, 19 bifaces or biface fragments, four cores, four edge-modified implements, two hammerstones, and 1612 pieces of debitage.

The analysis of material from 41BL148 followed the same theoretical and methodological framework as that described earlier for 41CV111. The criteria for identifying various raw material types was also employed and the same varieties were recorded. Measurements of each tool are provided in Appendix V. Tables of the debitage are provided in Appendix VI.

Tools

Flaked Tools

The material correlates of the biface technology at 41BL148 include complete and fragmentary dart points, reworked dart points, and fragmentary and complete bifaces that were broken or aborted in various stages of manufacture. This evidence documents one of the important technologically oriented activities at 41BL148; the manufacture and maintenance of hunting/subsistence oriented personal gear. Other lithic implements included edge modified flake tools produced by hard hammer percussion of flake cores.

BIFACIALLY FLAKED TOOLS

DART POINTS (N=4)

Table V-1 provides numerical data on the dimensions of projectile points from 41BL148. Where similar point styles have been identified at 41CV111 the description for those styles is not repeated below.

Ensor (n=2)

Specimen 1 (Surface Find). This specimen was recovered as a general surface find at 41BL148. The point is complete but has been reworked distally by bifacial pressure flaking that maintained the symmetry of the blade and tip. The barbs and shoulders are also intact. The raw material is Owl Creek Black chert that was not heat altered. There is some slight white patination on both surfaces.

Specimen 2 (Cat No. 49-1). The specimen was recovered from the profile of Unit 1 at an elevation of 104.25. The point is complete except for a small portion of the tip which is missing due to a bending fracture. The cause of the bending fracture is not known but does not seem to be the result of projectile impact because the barbs and shoulders are also intact. There is some evidence of reworking along both lateral edges of the blade; the right lateral edge of each surface exhibits additional pressure flaking and step fractures that give the blade an alteranately bevelled appearance. Reworking is not as pronounced as in Specimen 1 and the blade is in proportion to the base. The raw material is heat-altered Texas Novaculite.

Lange (n=1)

Specimen 1 (35-2). This dart point was recovered from Unit 1, Level 6 (104.2-104.10) and exhibits a bending fracture distally that removed about one-third of the blade and both barbs are also incomplete due to snap or bending fractures. These fractures may be the result of projectile impact. The raw material is Gray-Brown-Green Mottled chert that has not been heat-altered.

Unidentified Fragments (n=1; 19-7). This single specimen is a probable stem portion of a finished projectile point that was manufactured from Owl Creek Black chert. This proximal fragment has a bi-convex cross-section and pressure flaking on both surfaces. Lateral edges are regular but there is some potlidding evident. The provenience is Unit 3, Level 3.

BIFACES (N=19)

As with 41CV111, this general category includes both complete and fragmentary specimens from various stages of manufacture. The same general theoretical concepts of biface technology were applied during the analysis of material from 41BL148.

Biface I (n=12)

It is interesting that more Stage I bifaces were recovered at 41BL148 than at 41CV111 despite the fact that more testing occurred at 41CV111. A partial explanation is that a number of stage I bifaces were recovered as surface finds adjacent to a large pothole and probably represent the culled discards of looting. Surface indications of looting at 41BL148 were quite noticeable and had impacted a fair portion of the site. Table V-2 provides data on the dimensions and provenience of each specimen. Raw material variability closely follows that at 41CV111 in the types that are represented. There are four of Owl Creek Black (5-7, 5-8, 10-3, and 30-1), three of Fort Hood Gray (5-14, 35-1, and 10-2 overshot flake), four of Fort Hood Tan (19-3, 5-10, 5-12, and 10-1), and one indeterminate chert type (99-1). Only three specimens were considered to be complete (5-14, 10-3, and 19-3). Biface 5-14 was abandoned during manufacture due to internal fractures and failure in thinning (platform loss) while 19-3 could be considered as either an abandoned flake core or early stage biface. Biface 10-3, also of Owl Creek Black chert, is a percussion flake with lateral edge retouch and proximal dorsal thinning to remove the striking platform. Specimen 30-1 of Owl Creek Black chert represents a basal thinning failure that resulted in end-shock at the medial portion of the biface. Another biface fragment (also Owl Creek Black chert) exhibits a combination of failure causes, overshot and bending fracture (Specimen 5-8). Biface 10-2, of Fort Hood Gray chert, represents an overshot or outrepasse flake. All remaining biface fragments exhibit simple transverse or bending fractures (end shock) failure types typical of biface breakage during manufacture. Only three (5-7, 10-1, and 99-1) exhibit evidence of heat alteration in the form of color or luster changes. Only one specimen represents the deliberate heat treatment of raw material prior to manufacture (10-1). All specimens were examined for use-wear and none was observed.

Biface II (n=3)

Only one specimen is complete (5-9), the other two being fragmentary (5-3 and 5-11). Both fragmentary specimens were manufactured of Fort Hood Gray chert and the complete biface was manufactured from Owl Creek Black chert. The reason for abandonment of the whole biface included both edge/platform collapse and insufficient width maintained in thinning. Specimen 5-3 is a medio-lateral fragment that exhibits both and oblique or perverse fracture and a transverse fracture while 5-11 has both an internal flaw and a transverse break. Only specimen 5-3 show any indication of post-breakage heat alteration in the form of total surface color change.

Biface III (n=4)

All specimens in this category are incomplete. Table V-4 provides provenience and dimensional data on stage III bifaces. There are two distal fragments (5-2 and 5-4), one medial fragment (10-1) and one basal fragment (general surface find at 41BL148). There are two of Fort Hood Gray chert (surface find and 5-2), one of Gray-Brown-Green Mottled chert (10-1), and one of an unidentified good quality off-white chert (5-4) that has been deliberately heat treated prior to manufacture. Perverse fractures are present on two specimens (5-4 and surface find) and two (4-2 and 10-1)) have transverse/snap fractures. The lateral blade edges of both distal fragments are alternately bevelled suggesting that they may have been resharpened prior to implement breakage. This further suggests that they may have been completed tools. The general surface find has a slightly concave base, a convex lateral edge, and rounded basal corners similar to *Kinney* points. Specimen 5-2 exhibits hard hammer percussion flaking over both faces and the remaining specimens exhibit soft hammer percussion. All were broken during manufacture or resharpening.

CORES (N=4)

All complete cores exhibit hard hammer percussion as the method of flake removal. Flake removal was not systematic in that a preferred platform was not consistently utilized for flake production. Rather, flakes were removed from suitable platforms that were the negative flake scars of previous flake removals.

Three are partial cobble/pebble cores (11-1, 30-1, and 5-1) and one is a decorticated core (5-13). All cores have multidirectional flake removal patterns. Raw materials represented include three of Fort Hood Gray chert (11-1, 30-2, and 5-13) and one of Owl Creek Black chert (5-1). Core 5-13 has been thermally altered (color change) after discard while core 5-1 exhibits stream-rolled/weathered cortex and has only been partially reduced. The cortex of 30-2 indicates that it is a weathered nodule and has not been stream-rolled. All cores of Fort Hood Gray chert are larger and may also be considered as incompletely reduced. Table V-5 provides provenience and dimensional data on all cores.

CORE FRAGMENTS (N=2)

Core fragments are identified by the presence of features common to cores but are considered as incomplete and fragmentary. Both specimens (19-4 and 19-5) are of Fort Hood Gray chert and retain cortex and evidence of having been removed from irregularly or amorphously shaped nodules. These fragments were also recovered from Level 3 of Unit 3. See Table V-5 for core fragment measurements.

EDGE-MODIFIED FLAKE TOOLS (N=4)

The reader is referred to this same section pertaining to 41CV111 for a detailed discussion of methods of tool identification and edge modified tool variability. All specimens from 41BL148 can be considered as retouched-edge (19-8) or utilized-edge tools (3-1, 37-1, and 12-1). Specimen 19-8 is a small flake fragment of Owl Creek Black chert with a heavily modified distal tip. Rounding is moderate with some crushing and step fracturing. The extreme end of the tip is also slightly rounded but there is no bifacial or alternating edge damage. The probable function of this tool was as a perforator. Specimen (12-1) is a core trimming flake of Fort Hood Gray chert with one utilized edge. The utilized edge has one segment with numerous bifacial microflake scars, slight rounding and polish. The lower portion of the same edge has largely unifacial but heavily crushed wear traces. The probable uses of this tool include both cutting and scraping. Neither specimen exhibits any type of heat alteration. Both specimens 3-1 and 37-1 are cortical percussion flakes that have been utilized as expedient cutting implements. Implement 3-1 is of Texas Novaculite and exhibits a small amount of bifacial retouch distally to create a point. Proximally, on the left lateral edge (dorsal aspect) is also an area of percussion retouch creating a concave edge. Implement 37-1 is a large flake of Gray-Brown-Green Mottled chert. Table V-6 provides both provenience and dimensional data on edge-modified tools from 41BL148.

NON-FLAKED LITHIC TOOLS (N=2)

Hammerstones (n=2)

Only two hammerstones (5-5, 5-6), both of unmodified quartzite cobbles, were recovered from 41BL148. Wear on both hammerstones is considered minimal to light and consists of light battering and crushing along the edges of the cobbles. Both specimens were recovered as surface finds adjacent to a looter's pit near unit N499/E434.5. Each cobble is roughly circular in shape and fist-sized in dimensions. Table V-7 provides dimensional data for each hammerstone.

Debitage Analysis

The debitage sample from 41BL148 is considerably much smaller than that retrieved from 41CV111. Therefore, statements regarding the significance of patterning described for 41BL148 are, in the main, general and considered qualitative. Tests of significance were not performed but the patterns that are described are found to be broadly similar to previous debitage studies from Fort Hood (Dickens 1993a, 1993b; Dockall 1994). Debitage tables are located in Appendix VI.

Sample Composition

The debitage sample from 41BL148 was recovered from Units 1 and 3. A total of 1612 pieces of debitage were recovered from both units and the fill from each unit was screened through 1/4" mesh. During the technological analysis, the debitage was identified to specific raw material types using criteria established by previous research at Fort Hood (Dickens 1993a, 1993b; Dickens and Dockall 1993). The various raw material types have been described in an earlier portion of this report.

Data from Table VI-1 indicates that Fort Hood Gray and Fort Hood Tan cherts are most abundant at 41BL148. Both of these chert types are located in the immediate vicinity of the site: Fort Hood Gray in in the bluffs and drainages originating from the bluffs behind the site and Fort Hood Tan within the alluvial gravels of Owl Creek below the site. Both types of raw material primarily occur as cobbles or nodules. Owl Creek Black and Gray/Brown/Green chert types are secondary but still significant resources utilized at 41BL148. These raw materials also occur primarily as occasional cobbles within the gravels of Owl Creek. Currently, the known outcrop of Owl Creek Black is at some distance from either 41CV111 or 41BL148. Debitage analysis indicates that the majority of Owl Creek Black was being brought to 41BL148 and 41CV111 in a partially finished state (see below). Texas "Novaculite," Heiner Lake chert, and quartzite were only modestly represented at either 41BL148 or 41CV111. The only hammerstones recovered from 4BL148 were also quartzite which may indicate that the quartzite in the debitage may represent debris from damaged hammerstones. The proportion of quartzite in the gravels of Owl Creek is currently unknown.

There was a significant difference in the abundance of debitage recovered from units 1 and 3 at 41BL148. Unit 1 only produced 207 pieces of debitage or only 12.8% of all debitage. The major proportion of debitage (1405 pieces) was recovered from unit 3 and represents 87.2% of the entire sample. The actual significance of these abundance differences is not known but may reflect post-occupation disturbance, unit location, or possible prehistoric activity differences in the area surrounding the location of excavated units. Table VI-4 provides data regarding the proportion of different raw material types recovered from each excavation unit. There are only modest differences between the excavation units. Slightly more Fort Hood Gray and Fort Hood Tan cherts in unit 1 could influence the interpretation of more early stage reduction occurring at this unit and more later stage reduction at unit 3. Differences reflected between quartzite and unknown chert types is reflective of the disparity between sample sizes between each unit. Owl Creek Black and Gray/Brown/Green chert types are quite comparable across units. The behavioral significance of this patterning is not known.

Cortex

The abundance of dorsal cortex on debitage is generally interpreted as an indication of the stage of reduction that a piece of debitage represents. The general assumption is that the more dorsal cortex a piece has, the earlier in the reduction sequence that it was removed. The total sample of debitage at 41BL148 is taken as evidence of the interpretation that little initial reduction of raw material was occurring, even given the abundance of locally available raw materials adjacent to the site. This has potentially significant behavioral implications that may indicate that raw material availability was not as significant regarding site location as other resources. Also, raw material procurement may not have been a primary activity at this site. Certainly, the number of recovered bifaces and biface fragments suggests that middle to late stage finishing and possibly projectile point retooling/rehafting were a potentially significant aspect of technologically oriented site behavior.

The overall character of cortex abundance at 41BL148 (Table VI-1) can be interpreted to mean that there was little initial or primary reduction of cores or flake blanks at the site. This may indicate that local material abundance was not a crucial factor in site location selection. The abundance of tertiary debitage (indicative of later stages of reduction or tool manufacture) can be interpreted as evidence that the majority of raw material at 41BL148 was arriving in some degree of advanced reduction either as preshaped flake cores or middle to late stage bifaces. The majority of primary and secondary debitage at 41BL148 was recovered from unit 1, even though this unit produced the smallest proportion of debitage. If we can assume that these trends are reflective of some degree of real trends then units 1 and 3 reflect slightly different knapping reportoires. Unfortunately, there is no real indication of the time depth represented in each of these units and to treat them as time equivalent assemblages is not warranted in this study. Certainly, however, the debitage cortex profile for unit 3 is indicative of more later stage core reduction or biface manufacture. To further suggest that this may represent the location of different activity areas is premature at this time.

An examination of major raw material types at 41BL148 reveals some interesting trends regarding the differential treatment of these raw materials. This differential treatment largely involves the application of different reduction strategies to each raw material type (Table VI-10). Owl Creek Black and Fort Hood Tan cherts reflect less total cortical debitage than either Fort Hood Gray or Gray/Brown/Green chert types. Total cortical debitage for Owl Creek and Fort Hood Tan is 14.7% and 20.8%, respectively. Fort Hood Gray and GBG chert total cortical debitage values are both 25.7%. It is tantalizing evidence that the majority of cores and core fragments are of Fort Hood Gray chert which is in line with the preliminary cortex data here that suggests that this material type was subject to more initial core reduction than other identified chert types. Also, although all major materials are represented among the biface/projectile point artifact types, the majority were identified as Owl Creek Black chert. This also correlates with the cortical data for Owl Creek Black chert suggesting that this raw material was used primarily for the manufacture or late stage finishing of bifacial artifacts. The relatively low proportion of cortex debitage among all major raw material types may be taken as preliminary evidence for the transport of cores and bifaces to 41BL148 in a somewhat advanced stage of reduction or manufacture.

Size Grade

Supporting data for the above preliminary interpretations can also be found in the size grade values for 41BL148. If the debitage assemblage is taken as a whole unit of analysis, then the dominance of small flake sizes (between grades 5, 6, and 7) is readily apparent. A significant proportion of debitage (88.4%) occurs within these size grades, which are usually associated with late stages of biface manufacture or tool maintenance and resharpening. When the same debitage assemblage is broken down into respective excavation units (Table VI-3) the trend is equally as apparent. Unit 1 has 81.7% of all debitage is grades 5-7 while unit 3 has 89.4%. The only real difference between these units is to be found in size grade 7 in which unit 1 has only 3.4% as compared to unit 3 with 29.5%. Again, this seems to follow the general interpretation of the debitage in unit 3 more reflective of later stage implement manufacture or flake blank production. An examination of major raw material types according to size grade also reveals some interesting slight differences in the treatment of materials during the knapping process at 41BL148 (see Table VI-7). The Owl Creek Black chert is devoid of any large (grades 1 and 2) debitage and very little of the median size debitage (grades 3 and 4). Again, this is support for the general interpretation that this material was brought to the site in an advanced stage of manufacture or reduction. Although other materials also follow this same general trend, there is a slightly greater proportion of large and median size grades represented among them. When examining the smallest size grades (grades 6 and 7) the trend is more apparent. Owl Creek Black chert has a full 85.7% of all debitage within these grades. Fort Hood Gray, Gray/Brown/Green, and Fort Hood Tan cherts represent 73%, 67.2%, and 67% of all debitage in grades 6 and 7. Owl Creek Black cherts are also coming from the greatest distance from 41BL148, are less abundant in the gravels of Owl Creek, and were possibly more specifically utilized for the manufacture of bifacial artifacts than other raw material types. Also, the above described differences in the abundance of various raw material types in each excavation unit may also have contributed to this patterning.

Heat Alteration and Burning

The proportion of different degrees or types of burning can be indicative of post-depositional impact upon a site or the deliberate pre-manufacture alteration of raw material to make it suitable for knapping. Dickens (1993a:80-82, 1993b:102, 105) has described the influence of heat upon each raw material type as well as the influence of heat upon the knappability of each Fort Hood rock type.

The proportion of each burning type for the site as a whole (Table VI--1) indicates that deliberate heat treatment of raw material (as indicated by heat type 1--luster change) was not occurring in the immediate environs of units 1 and 3 and that raw material that had been heat-treated elsewhere and brought to the site was also not abundant. Severely burned debitage (heat type 2) also represents only 13.8% of all debitage. The proportion of raw materials in each excavation unit representative of each heat type follows the same general pattern for the site as a whole (Table VI-6). One difference is that only 6.3% of all debris from unit 1 was burned on both sides but this is felt not to be significant.

When individual raw material types are examined for variation in burning (Table VI-11) some interesting patterning begins to emerge that reflect Dickens' (1993a, 1993b) initial assessments of the influence of deliberate heat alteration of these cherts prior to knapping. Here, only heat types 1 and 2 are actually relavant. Owl Creek Black was not subjected to deliberate heat treatment due to its excellent fracture properties. This raw material also does not accept heat well (Dickens 1993a:80). Dickens (1993a:81-82) noted that the knapping quality of both Gray/Brown/Green and Texas "Novaculite" cherts is vastly improved with heat alteration. Significantly, this is reflected in the debitage of 41BL148 in which GBG and Texas "Novaculite" reflect deliberate heat alteration values of 11.3% and 10.5%, respectively.

RECOMMENDATIONS AND CONCLUSIONS

David L. Carlson

ANALYSIS AND REVIEW

Despite the limited extent of the excavations at 41CV111 and 41BL148 some interesting patterns did emerge. One was the relatively low ratios of tools given the amount of debitage at the site. Table 10 summarizes the ratios of bifaces, cores, unifaces, and points per thousand flakes (kflks).

Table 10. Tool Ratios (Tools/kflks) for Various Fort Hood Sites.

Site	Bifaces	Cores	Unifaces	Points
41BL670	12.5	0.0	16.3	10.0
41BL671	4.2	0.6	4.6	4.6
41CV495	8.2	1.4	11.7	8.2
41CV496	10.6	6.0	19.6	3.0
41CV497	7.4	2.1	21.0	10.5
41CV207 (Surface collections)	11.3	48.0	0.0	0.0
41CV207 (STPs)	5.0	0.0	0.0	1.7
41CV869 (STPs)	2.9	2.3	8.2	0.6
41CV876 (STPs)	8.0	0.0	4.0	0.0
41CV971 (STPs)	9.7	4.8	7.2	0.0
41CV111 (Units 1-4)	2.7	0.0	3.3	1.9
41CV111(Unit 5)	2.6	0.0	3.7	1.1
41CV111(Unit 6)	2.1	0.3	1.5	1.8
41BL148	5.0	1.2	2.5	1.2

Sites 41BL670, 41BL671, 41BCV495, 41CV496, and 41CV497 are all rockshelters that were excavated during previous field schools (Carlson 1993a; Carlson 1993b). Site 41CV207 is a large surface lithic quarry locality along Henson Creek and 41CV869, 41CV876, and 41CV971 are sites located in close proximity to the lithic quarry area (Carlson 1993c). Of particular interest is that ratios of major tool categories are significantly larger at rockshelters than at open sites. This suggests that tools in the rockshelters are being brought to the site, not made there. Some may be cached for future use (it is easier to find a cache in a rockshelter than in an open site covered by trees). Cores are not common except on quarry sites. This suggests that most cores are tested cobbles rather than formal cores which are shaped and carryed to habitation sites for future reduction or removal of expedient flakes. Apparently most expedient flakes are selected from among the larger flakes produced by biface reduction. Finally, the low tool category ratios suggest that there is a net loss of tools from 41CV111. Tools are produced here, but are broken and discarded elsewhere. This pattern is a very strong one, spanning the Middle Archaic through Transitional Archaic periods if our assignment of the test units is correct.

The other interesting pattern involved a difference in raw material selection for biface (non projectile point) versus unifacial (mostly utilized flake) tools. Since sample sizes of bifaces and unifaces were small, we had to include material from all test units. The proportion of raw material types for bifaces is shown in Table 11.

Table 11. Observed and Expected Distribution of Raw Material Types.

	Owl Creek	FH Gray	GBG	FH Tan	Other
Bifaces	9	13	10	9	6
Expected Bifaces	6.6	8.5	10.4	15.4	8.2
Unifaces	2	10	21	9	6
Expected Unifaces	6.4	8.4	10.2	15.1	8.0
Expected Unifaces (Large Flakes)	4.1	8.8	13.4	15.9	5.7

A Chi-square test on the expected vs. observed raw material distribution for bifaces is 6.5204 (df=4, $p < .1635$) which is not statistically significant. The same test on unifaces is 17.7293 (df=4 $p < .0014$) which is highly signficant. If we assume that only larger flakes (sizes 1 and 2) will be chosen for unifacial tools, the chi-square value is 8.560 (df=4, $p < .07$) which is also no longer significant. This suggests that expedient tools were chosen from readily available large flakes. It is also interesting that unifaces are predominately made from Gray/Brown/Green which is available on the site and immediately up the colluvial slope.

RECOMMENDATIONS

Although heavily disturbed by pothunting, both 41CV111 and 41BL148 have intact cultural deposits and should be considered eligible for the National Register of Historic Places. Site 41CV111 provides an opportunity to separate at least Middle Archaic and Transitional Archaic period occupations. The alluvial fan here has aggraded laterally so that deposits farther from the talus fan that borders the southern side of the site are younger in age. Clear evidence of a Transitional Archaic occupation is found in Test Unit 5 where a midden/burned rock feature was partially exposed and excavated. Dates on the bottom and top of that midden provide adjusted age estimates of 1020±90 B.P. and 1520±80 B.P. respectively. The midden contains abundant charcoal for dating and holds great potential for flotation analysis for carbonized plant remains. It also contains preserved faunal materials. This component lies below the depth that most of the pothunting reached and seems to have been ignored in favor of the "richer" Middle Archaic "*Pedernales*" deposit. The Middle Archaic deposit is badly disturbed and we did not find evidence of intact features, charcoal, or faunal material. However, numerous *Pedernales* points and *Lange* points from these units provide an opportunity for typological comparison of point types from a single locality. Unit 6 may contain an intact Late Archaic/Transitional Archaic deposit which is distinct from that found in Unit 5.

Site 41BL148 received far less attention. Two test pits in the site confirmed the existence of undisturbed deposits, but did not allow us to evaluate the relative ages of the east and west sides of the site.

The existence of cultural material around the burned rock midden deposits that have been the focus of intense pothunting may provide an opportunity to examine prehistoric activity areas located around burned rock features. For that reason we suggest that the site is also eligible.

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APPENDIX I

SOIL-STRATIGRAPHIC DESCRIPTIONS

SITE 41CV111

BHT-1; T0, 3.5 m above modern channel.

A/C 0-21 cm; (FA); dark brown (10YR 3/3) clay loam; moderate medium subangular blocky; firm; many roots; common carbonate sand grains; common biocasts; faintly laminated; clear smooth.

Ab 21-48 cm; (UWRA-Tanktrail paleosol); very dark grayish brown (10YR 3/2) clay loam; firm; few 2 to 4 mm coarse fragments; few snails; clear smooth.

Bw1b 48-72 cm; (UWRA-Tanktrail paleosol); dark brown (10YR 3/3) loam; common very dark grayish brown (10YR 3/2) biocasts; weak coarse subangular blocky; friable; common carbonate sand grains; few pebble stringers (2 to 10 mm diameter) dipping towards modern channel; abrupt smooth.

Bw2b 72-87 cm; (UWRA-Tanktrail paleosol); dark brown (10YR 3/3) sandy clay loam; weak coarse subangular blocky; friable; 1% carbonate mycelia; 3 to 5 % coarse fragments 2 to 4 mm, horizon dipping to modern channel; abrupt smooth; hearth charcoal age of 810±70 yr B.P.

Cb 87-223 cm; (UWRA); alternating beds (10 to 20 cm thick) of gravel-rich (0.2-2 cm diameter) and gravel-poor zones; brown (10YR 4/3) to pale brown (10YR 6/3) sandy clay loam matrix. Gravels become matrix-supported and moderately well sorted and coarsen downward.

BHT-2; T0, 3.5 m above modern channel.

A/C 0-22 cm; (FA); very dark grayish brown (10YR 3/2) clay loam; 10 to 20 % brown (10YR 5/3) biocasts; moderate medium subangular blocky; firm; faintly laminated; 2 to 3 % carbonate fragments 3 to 5 mm; clear wavy.

A1b1 22-42 cm; (UWRA-Tanktrail paleosol); very dark brown (10YR 2/2) silty clay loam; moderate medium subangular blocky; firm; few snails; clear wavy (*Fairland* point at 30 to 40 cm in EU 5).

A2b1 42-61 cm; (UWRA-Tanktrail paleosol); very dark grayish brown (10YR 3/2) clay loam; common brown (10YR 5/3) biocasts; moderate coarse subangular blocky; firm; few fine carbonate coarse fragments; few snails; clear wavy.

A3b1 61-105 cm; (UWRA-Tanktrail paleosol); very dark grayish brown (10YR 3/2) silty clay loam; weak coarse prismatic to angular blocky; firm; dispersed charcoal, bone and burned limestone and chert; gradual wavy; (hearth charcoal age of 1020±90 yr B.P. and *Ensor* point at 90 to 100 cm in EU5).

A4b1 105-148 cm; (UWRA-Tanktrail paleosol); very dark grayish brown (10YR 3/2) silty clay loam; weak coarse prismatic to angular blocky; firm; 1 % carbonate mycelia; dispersed charcoal, large burned limestone cobbles and chert concentrated in horizontal zones; clear smooth; (hearth charcoal age of 1520±80 yr B.P.).

Ab2 148-174 cm; (LWRA); dark brown (10YR 2.5/2) clay loam; moderate medium prismatic to angular blocky; very firm; 1 % carbonate mycelia; few limestone fragments, dispersed charcoal and snails in upper part.

Bw1b2 174-222 cm; (LWRA); brown (10YR 4/3) clay loam; common biocasts; weak coarse prismatic; very firm; few limestone fragments, carbonate mycelia and snails.

Bw2b2 222-262 cm; (LWRA); brown (10YR 5/3) loam; few loamy pockets and carbonate mycelia; gradual (hand auger).

Bw3b2 262-292 cm; (LWRA); brown (10YR 5/3) loam; common medium faint yellowish brown (10YR 5/6) mottles; loamy pockets; dense gravel bed in lower 12 cm, waterworn and angular, 0.2 to 2 cm (auger).

BHT-3; T1b; 4.0 m above the modern channel; LWRA throughout.

A1 0-23 cm; black (10YR 2/1) clay loam; moderate medium subangular blocky; firm; gradual smooth; (Marcos and Lange points at 10-20 cm in EU6).

A2 23-58 cm; black (10YR 2/1) clay loam; moderate medium subangular blocky; firm; burned limestone, chert, and bone with many snail fragments; gradual smooth (Lange points at 20-30 cm, 40-50 cm, and 50-60 cm).

Bw1 58-84 cm; brown (10YR 4/3) clay loam; weak coarse prismatic to angular blocky; firm; few snails; gradual smooth; (hearth with no charcoal, Castroville point at 60-70 cm in EU6).

Bw2 84-128 cm; brown (10YR 5/3) loam; weak coarse prismatic; firm; few snails; gradual smooth.

Bk1 128-164 cm; yellowish brown (10YR 5/4) loam; weak coarse prismatic to angular blocky; firm; 4 to 5 % carbonate filaments and threads; few snails; gradual smooth.

Bk2 164-209 cm; yellowish brown (10YR 5/4) sandy clay loam; weak coarse prismatic to angular blocky; firm; 4 to 5 % carbonate filaments and threads; few snails.

BHT-4; T1b; 4.5 m above the modern channel.

A 0-30 cm; (FC); black (10YR 2.5/1) loam; moderate fine and medium subangular blocky; friable; few angular pebbles; clear smooth; (hearth charcoal age of 130±90 from 10 to 20 cm and 450±60 yr B.P. at 20-30 cm in EU1 and extrapolated to BHT-4; Perdiz point extrapolated from EU2 to BHT-4).

A1b1 30-52 cm; (LWRA); black (10YR 2/1) clay loam; moderate fine and medium subangular blocky; friable; 1 to 2 % carbonate mycelia; few to common angular pebbles; clear wavy; (Pedernales points extrapolated from EU1, EU2, and EU3).

A2b1 52-104 cm; (LWRA); very dark brown (10YR 2/2) clay loam; weak coarse subangular bocky; firm; common burned limestone and chert; many snails; clear wavy; (Pedernales points extrapolated from EU1, EU2, and EU3).

Bk1b2 104-166 cm; (FHA); yellowish brown (10YR 5/4) silty clay loam; weak coarse prismatic; firm; 5 to 8 % angular pebbles 2 to 10 mm; 1 to 2 % carbonate mycelia; few burned chert and limestone fragments; clear wavy; (flakes, biface, mussel shell; Bulverde point extrapolated from EU1)

Bk2b2 166-194 cm; (FHA); yellowish brown (10YR 5/4) silty clay loam; weak coarse prismatic; firm; 4 to 5 % carbonate mycelia; 10 to 15 % angular pebbles 2 to 10 mm; gradual smooth.

Bk3b2 194-248 cm; (FHA); yellowish brown (10YR 5/4) silty clay loam; weak coarse prismatic; firm; 4 to 5 % carbonate filaments and threads; 5 to 10 % angular pebbles 2 to 10 mm; charcoal age of 4990±70 yr B.P. at 206 cm).

BCb2 248-288 cm; (FHA); yellowish brown (10YR 5/4) loam; 1 % carbonate mycelia; 5 % angular pebbles (hand auger).

41BL148

BHT-5; T1a; 5.0 above modern channel.

A 0-23 cm; (WRFA); very dark grayish brown (10YR 2.5/2) clay loam; moderate medium subangular blocky; hard; 5 % fine angular carbonate pebbles; abrupt wavy.

AB 23-51 cm; (WRFA); very dark grayish brown (10YR 3/2) loam; 15 to 20 % carbonate and chert pebbles 0.2 to 1 cm diameter and moderately well sorted and subrounded (concentrated in upper part); clear wavy.

Bk1b 51-99 cm; (FHA); dark yellowish brown (10YR 4/5) clay loam; moderate coarse prismatic to angular blocky; friable; 2 to 3 % carbonate mycelia; 5 to 8 % pebbles like in AB horizon.

Bk2b 99-188 cm; (FHA); strong brown (7.5YR 4/6) loam; moderate coarse prismatic to angular blocky; friable; 5 % carbonate filaments; 7 to 10 % poorly sorted and angular to subrounded pebbles and cobbles 0.2 to 3 cm diameter; clear wavy.

BK3b 188-262 cm; (FHA); strong brown (7.5YR 4/6 and 7.5YR 5/6) clay loam; 3 to 4 % carbonate filaments; weak coarse prismatic; firm; 5 to 8 % pebbles and cobbles 0.2 to 3 cm diameter; clear wavy; dispersed charcoal carbon-14 age of 6910±70 at 208 cm.

BCb 262-287 cm; (FHA); strong brown (7.5YR 4/6) clay loam; 10 % pockets of very pale brown (10YR 7/3); weak coarse prismatic; firm; 1 % carbonate filaments; 5 % very fine pebbles.

BHT-6; alluvial fan; 8.0 m above modern channel.

A1 0-17 cm; (WRFA); very dark grayish brown (10YR 3/2) loam; moderate medium subangular blocky; firm; 5 % very fine pebbles; abrupt wavy.

A2 17-34 cm; (WRFA); very dark grayish brown (10YR 3/2.5) loam; moderate medium subangular blocky; firm; 15 to 20 % angular and poorly sorted pebbles 0.5 to 3 cm diameter; abrupt wavy.

BAb1 34-64 cm; (Undifferentiated fan alluvium); brown (10YR 4/3.5) clay loam; moderate coarse subangular blocky; firm; 10 % very fine and well sorted pebbles; gradual wavy.

Bwb1 64-105 cm; (Undifferentiated fan alluvium); strong brown (7.5YR 4/6) loam; weak coarse prismatic; firm; 5 to 8 % poorly sorted and angular pebbles 0.2 to 1 cm diameter; abrupt irregular.

Bk1b1 105-142 cm; (Undifferentiated fan alluvium); strong brown (7.5YR 5/6) loam; weak coarse prismatic; very hard; 1 to 2 % carbonate mycelia; 15 to 20 % poorly sorted angular pebbles 0.2 to 1 cm diameter; gravel pockets grade to loamy sediments downslope in trench; abrupt irregular.

Bkmb2 142 to 196 cm; (FHFA); reddish yellow (7.5YR 6/6) loam; weak coarse prismatic in pockets; very firm; 10 to 15 % poorly sorted angular pebbles 0.2 to 1 cm diameter; discontinuous carbonate laminar cap 0.3 to 0.5 cm thick; 10 % carbonate filaments and 2 % carbonate nodules 0.4 to 1 cm diameter below the Bkm; clear wavy.

C1b2 196-268 cm (FHFA); alternating horizontal beds of reddish yellow (7.5YR 6/6) and strong brown (7.5YR 5/6) loam, 10 to 15 cm thick each; moderately well sorted and angular cobbles 0.5 to 4 cm diameter; few fine shale fragments.

C2b2 268-318 cm; (FHFA) (hand auger); strong brown (7.5YR 5/6) loam; 10 % angular pebbles up to 0.8 cm diameter; few fine shale fragments; concentrated pebble zone or limestone at bottom.

BHT-7; alluvial fan; 9.0 m above modern channel.

A 0-24 cm; (WRFA); black (10YR 2/1) loam; moderate fine and medium subangular blocky; friable; few pebbles; abrupt smooth.

AB 24-51 cm; (WRFA); very dark grayish brown (10YR 3/2) loam; moderate medium subangular blocky; friable; 15 to 20 % poorly sorted and angular pebbles and cobbles 0.5 to 3 cm diameter; abrupt smooth.

Bwb1 51-68 cm; (undifferentiated fan alluvium); dark brown (10YR 3/3) loam; moderate medium subangular blocky; friable; 5 to 10 % moderately well sorted angular pebbles 0.2 to 0.4 cm diameter; gradual smooth.

Bk1b1 68-98 cm; (undifferentiated fan alluvium); brown (10YR 4/3) loam; weak coarse prismatic; firm; 1 % carbonate mycelia; 12 to 15 % diffuse and moderately well sorted angular pebbles 0.3 to 0.8 cm diameter; gradual smooth.

Bk2b1 98-142 cm; (undifferentiated fan alluvium); brown (10YR 4/3) loam; weak coarse prismatic; firm; 2 to 3 % carbonate mycelia; 5 to 8 % diffuse and moderately well sorted angular pebbles 0.3 to 0.8 cm diameter; gradual smooth.

Bk1b2 142-178 cm; (GTFA-Royalty paleosol); dark brown (10YR 3/3) clay loam; weak coarse prismatic; firm; 4 to 5 % carbonate filaments; 5 to 8 % diffuse and angular pebbles 0.3 to 0.8 cm diameter; clear smooth.

Bk2b2 178-215 cm; (GTFA-Royalty paleosol); dark brown (10YR 3.5/3) and 40 % yellowish brown (10YR 5/4) clay loam; weak coarse prismatic; firm; 5 to 8 % carbonate filaments; 5 to 10 % diffuse and angular pebbles 0.3 to 0.8 cm diameter; clear smooth.

Bk3b2 215-225 cm; (GTFA-Royalty paleosol); light yellowish brown (10YR 6/4) loam and 25 % yellowish brown (10YR 5/4); weak coarse prismatic; firm; 3 to 5 % carbonate filaments; 30 to 40 % diffuse and angular pebbles and cobbles 0.5 to 3 cm diameter; gradual smooth.

BCb2 225-325 cm; (GTFA-Royalty paleosol) (hand auger); yellowish brown (10YR 4/4) loam; 10 to 20 % angular pebbles with few 3 cm diameter cobbles.

Cb2 325-380 cm; (GTFA) (hand auger); dense, angular pebbles and cobbles.

BHT-8; alluvial fan; 10.0 m above modern channel.

A1 0-21 cm; (WRFA); black (10YR 2/1) loam; moderate fine and medium subangular blocky; hard; few fine pebbles; clear smooth.

A2 21-45 cm; (WRFA); black (10YR 2/1.5) loam; moderate medium subangular blocky; hard; 5 % angular pebbles 0.2 to 1 cm diameter; gradual smooth.

ABk 45-70 cm; (WRFA);very dark grayish brown (10YR 3/2.5) clay loam; moderate coarse subangular blocky; hard; 1 % carbonate mycelia; 5 % angular pebbles 0.2 to 1 cm diameter; abrupt smooth.

Bk1 70-84 cm; (WRFA); brown (10YR 4/3) loam; moderate medium subangular blocky; hard; 2 to 3 % carbonate mycelia; 20 % diffuse and angular pebbles 0.5 to 4 cm diameter; gradual smooth.

Bk2b1 84-145 cm; (undifferentiated fan alluvium); yellowish brown (10YR 4/4) loam; moderate medium angular blocky; hard; 8 to 10 % carbonate filaments; 5 to 8 % angular and diffuse pebbles 0.2 to 0.8 cm diameter; clear smooth.

Bk1b2 145-205 cm; (GTFA and Royalty paleosol); dark brown (10YR 3/3) clay loam; moderate coarse prismatic; firm; 10 to 12 % carbonate filaments; 5 % angular and diffuse pebbles 0.2 to 0.8 cm diameter; gradual smooth.

Bk2b2 205-335 cm; (GTFA and Royalty paleosol); brown (10YR 4/3) clay loam; weak coarse prismatic; firm; 5 % carbonate filaments; 10 % diffuse and angular pebbles; gradational with an increase in pebbles with depth. A bulk humate carbon-14 age of 10,540$\pm$90 from 215 to 225 cm.

Cb2 335-395 cm; (GTFA) (hand auger); strong brown (7.5YR 5/4) loam; 25 to 30 % angular and diffuse pebbles up to 1 cm diameter.

BHT-9; alluvial fan; 11 m above modern channel.

A1 0-31 cm; (WRFA); black (10YR 2/1.5) loam; moderate fine and medium subangular blocky; slightly hard; 8 to 10 % diffuse and angular pebbles and cobbles 0.5 to 4 cm diameter; gradual smooth.

A2 31-65 cm; (WRFA); very dark brown (10YR 2.5/2) loam; moderate fine and medium subangular blocky; slightly hard; 20 % diffuse and angular pebbles and cobbles 0.5 to 5 cm diameter; gradual smooth.

AB 65-97 cm; (WRFA); very dark grayish brown (10YR 3/2) loam; weak coarse subangular blocky; slightly hard; 35 % diffuse and angular pebbles and cobbles 0.3 to 4 cm diameter; clear smooth.

Bk1b1 97-152 cm; (Undifferentiated fan alluvium); brown (10YR 4.5/3) loam; weak coarse prismatic; hard; 5 to 8 % carbonate mycelia; 20 % diffuse and angular pebbles and cobbles 0.5 to 5 cm diameter; abrupt smooth.

Bk2b1 152-222 cm; (undifferentiated fan alluvium); yellowish brown (10YR 4/4) clay loam; weak coarse prismatic; firm; 3 to 5 % carbonate filaments; 10 to 15 % diffuse and angular pebbles and cobbles 0.3 to 8 cm diameter.

Bkb2 222-299 cm; (GTFA-Royalty paleosol) (hand auger); dark brown (10YR 3/3) loam; 10 % angular pebbles 0.2 to 1 cm diameter in lower 10 cm.

APPENDIX II

PROVENIENCE OF FAUNAL REMAINS

Barry W. Baker

LIST OF TABLES

Table II-1. Gastropods and Mussel Shell from 41BL148 by Excavation Unit and Level (No Vertebrate Fauna Recovered).

Unt	Lvl	Taxon	Element	Portion of Element	Total
1	1	*Anguispira strongylodes*	Shell	Complete or nearly complete	26
1	1	*Anguispira strongylodes*	Shell	Apex	1
1	1	*Anguispira strongylodes*	Shell	Whorl fragment	3
1	1	*Oligyra orbiculata*	Shell	Complete or nearly complete	33
1	1	*Polygyra morreana*	Shell	Complete or nearly complete	6
1	2	*Anguispira strongylodes*	Shell	Complete or nearly complete	205
1	2	*Anguispira strongylodes*	Shell	Apex	6
1	2	*Anguispira strongylodes*	Shell	Whorl fragment	27
1	2	*Mesodon roemeri*	Shell	Complete or nearly complete	2
1	2	*Oligyra orbiculata*	Shell	Complete or nearly complete	286
1	2	*Polygyra morreana*	Shell	Complete or nearly complete	54
1	2	*Polygyra morreana*	Shell	Lip (peristome)	1
1	2	*Rabdotus morreanus*	Shell	Complete or nearly complete	12
1	2	*Rabdotus morreanus*	Shell	Apex	1
1	2	*Rabdotus morreanus*	Shell	Whorl fragment	1
1	3	*Anguispira strongylodes*	Shell	Complete or nearly complete	55
1	3	*Anguispira strongylodes*	Shell	Whorl fragment	15
1	3	*Oligyra orbiculata*	Shell	Complete or nearly complete	220
1	3	*Oligyra orbiculata*	Shell	Lip (peristome)	5
1	3	*Polygyra morreana*	Shell	Complete or nearly complete	42
1	3	*Practicolella berlanderiana*	Shell	Complete or nearly complete	1
1	3	*Practicolella berlanderiana*	Shell	Lip (peristome)	1
1	3	*Rabdotus morreanus*	Shell	Complete or nearly complete	2
1	3	*Rabdotus morreanus*	Shell	Lip (peristome)	1
1	3	*Rabdotus morreanus*	Shell	Apex	12
1	3	Unionidae	Shell	Fragment	5

1	4	*Anguispira strongylodes*	Shell	Complete or nearly complete	2
1	4	*Oligyra orbiculata*	Shell	Complete or nearly complete	3
1	4	*Polygyra morreana*	Shell	Complete or nearly complete	9
1	4	*Rabdotus morreanus*	Shell	Complete or nearly complete	1
1	5	*Anguispira strongylodes*	Shell	Complete or nearly complete	4
1	5	*Oligyra orbiculata*	Shell	Complete or nearly complete	34
1	5	*Polygyra morreana*	Shell	Complete or nearly complete	1
1	5	*Polygyra texasiana*	Shell	Complete or nearly complete	2
1	5	*Rabdotus morreanus*	Shell	Complete or nearly complete	3
1	6	*Anguispira strongylodes*	Shell	Complete or nearly complete	2
1	6	*Mesodon roemeri*	Shell	Complete or nearly complete	1
1	6	*Oligyra orbiculata*	Shell	Complete or nearly complete	46
1	6	*Polygyra texasiana*	Shell	Complete or nearly complete	6
1	6	*Practicolella berlanderiana*	Shell	Complete or nearly complete	1
1	6	*Rabdotus morreanus*	Shell	Complete or nearly complete	9
3	3	*Anguispira strongylodes*	Shell	Complete or nearly complete	8
3	3	*Anguispira strongylodes*	Shell	Whorl fragment	1
3	3	*Oligyra orbiculata*	Shell	Complete or nearly complete	30
3	3	*Polygyra morreana*	Shell	Complete or nearly complete	7
3	3	*Rabdotus morreanus*	Shell	Complete or nearly complete	229
3	3	*Rabdotus morreanus*	Shell	Lip (peristome)	77
3	3	*Rabdotus morreanus*	Shell	Apex	70
3	3	*Rabdotus morreanus*	Shell	Whorl fragment	41
3	4	*Anguispira strongylodes*	Shell	Complete or nearly complete	2
3	4	*Oligyra orbiculata*	Shell	Complete or nearly complete	5
3	4	*Polygyra morreana*	Shell	Complete or nearly complete	32
3	4	*Polygyra morreana*	Shell	Lip (peristome)	17
3	4	*Polygyra morreana*	Shell	Apex	14
3	4	*Rabdotus morreanus*	Shell	Complete or nearly complete	41

3	5	*Oligyra orbiculata*	Shell	Complete or nearly complete	4
3	5	*Polygyra texasiana*	Shell	Complete or nearly complete	1
3	5	*Rabdotus morreanus*	Shell	Complete or nearly complete	65
3	6	*Anguispira strongylodes*	Shell	Complete or nearly complete	3
3	6	*Oligyra orbiculata*	Shell	Complete or nearly complete	4
3	6	*Rabdotus morreanus*	Shell	Complete or nearly complete	42
				Total =	1,840

Table II-2. Gastropods, Mussel Shell and Vertebrate Fauna from 41CV111 by Excavation Unit and Level.

Unt	Lvl	Taxon	Element	Portion of Element	Side	Total
0	0	*Odocoileus* sp.	Astragalus	Complete or nearly complete	Left	1
1	1	*Anguispira strongylodes*	Shell	Complete or nearly complete		47
1	1	*Anguispira strongylodes*	Shell	Whorl fragment		11
1	1	*Oligyra orbiculata*	Shell	Complete or nearly complete		158
1	1	*Oligyra orbiculata*	Shell	Lip (peristome)		1
1	1	*Polygyra morreana*	Shell	Complete or nearly complete		10
1	1	*Practicolella berlanderiana*	Shell	Complete or nearly complete		1
1	1	*Rabdotus morreanus*	Shell	Complete or nearly complete		2
1	1	*Rabdotus morreanus*	Shell	Whorl fragment		9
1	2	*Anguispira strongylodes*	Shell	Complete or nearly complete		4
1	2	*Mesodon roemeri*	Shell	Complete or nearly complete		1
1	2	*Oligyra orbiculata*	Shell	Complete or nearly complete		29
1	2	*Polygyra morreana*	Shell	Complete or nearly complete		4
1	3	*Anguispira strongylodes*	Shell	Complete or nearly complete		17
1	3	*Mesodon roemeri*	Shell	Complete or nearly complete		1
1	3	*Oligyra orbiculata*	Shell	Complete or nearly complete		40
1	3	*Polygyra morreana*	Shell	Complete or nearly complete		4
1	3	*Rabdotus morreanus*	Shell	Complete or nearly complete		7
1	4	*Anguispira strongylodes*	Shell	Complete or nearly complete		10
1	4	*Oligyra orbiculata*	Shell	Complete or nearly complete		18
1	4	*Oligyra orbiculata*	Shell	Lip (peristome)		1
1	4	*Polygyra morreana*	Shell	Complete or nearly complete		3
1	4	*Practicolella berlanderiana*	Shell	Complete or nearly complete		2
1	4	*Rabdotus morreanus*	Shell	Complete or nearly complete		43
1	4	*Rabdotus morreanus*	Shell	Lip (peristome)		13

1	4	*Rabdotus morreanus*	Shell	Apex		3
1	4	*Rabdotus morreanus*	Shell	Whorl fragment		2
1	5	*Anguispira strongylodes*	Shell	Complete or nearly complete		5
1	5	*Oligyra orbiculata*	Shell	Complete or nearly complete		7
1	5	*Polygyra morreana*	Shell	Lip (peristome)		1
1	5	*Practicolella berlanderiana*	Shell	Complete or nearly complete		1
1	5	*Rabdotus dealbatus*	Shell	Complete or nearly complete		2
1	5	*Rabdotus morreanus*	Shell	Complete or nearly complete		54
1	5	*Rabdotus morreanus*	Shell	Lip (peristome)		11
1	5	*Rabdotus morreanus*	Shell	Apex		11
1	5	*Rabdotus morreanus*	Shell	Whorl fragment		9
1	5	Unionidae	Shell	Umbo (hinge)	Left	1
1	6	*Anguispira strongylodes*	Shell	Complete or nearly complete		1
1	6	*Oligyra orbiculata*	Shell	Complete or nearly complete		8
1	6	*Polygyra morreana*	Shell	Complete or nearly complete		2
1	6	*Rabdotus morreanus*	Shell	Complete or nearly complete		63
1	6	*Rabdotus morreanus*	Shell	Lip (peristome)		14
1	6	*Rabdotus morreanus*	Shell	Apex		5
1	6	*Rabdotus morreanus*	Shell	Whorl fragment		10
1	7	*Mesodon roemeri*	Shell	Complete or nearly complete		1
1	7	*Oligyra orbiculata*	Shell	Complete or nearly complete		7
1	7	*Polygyra morreana*	Shell	Complete or nearly complete		4
1	7	*Practicolella berlanderiana*	Shell	Complete or nearly complete		4
1	7	*Rabdotus morreanus*	Shell	Complete or nearly complete		33
1	7	*Rabdotus morreanus*	Shell	Lip (peristome)		6
1	7	*Rabdotus morreanus*	Shell	Apex		15
1	7	*Rabdotus morreanus*	Shell	Whorl fragment		5
2	0	*Polygyra morreana*	Shell	Complete or nearly complete		1

2	0	*Rabdotus morreanus*	Shell	Complete or nearly complete		2
2	1	*Anguispira strongylodes*	Shell	Complete or nearly complete		13
2	1	*Anguispira strongylodes*	Shell	Whorl fragment		1
2	1	*Oligyra orbiculata*	Shell	Complete or nearly complete		16
2	2	*Anguispira strongylodes*	Shell	Complete or nearly complete		19
2	2	*Anguispira strongylodes*	Shell	Whorl fragment		11
2	2	*Oligyra orbiculata*	Shell	Complete or nearly complete		60
2	2	*Polygyra morreana*	Shell	Complete or nearly complete		11
2	2	*Practicolella berlanderiana*	Shell	Complete or nearly complete		1
2	2	*Rabdotus morreanus*	Shell	Whorl fragment		2
2	6	*Rabdotus morreanus*	Shell	Complete or nearly complete		1
2	6	*Rabdotus morreanus*	Shell	Lip (peristome)		1
2	6	*Rabdotus morreanus*	Shell	Whorl fragment		1
2	7	*Anguispira strongylodes*	Shell	Complete or nearly complete		1
2	7	*Mesodon roemeri*	Shell	Complete or nearly complete		2
2	7	*Oligyra orbiculata*	Shell	Complete or nearly complete		1
2	7	*Rabdotus morreanus*	Shell	Complete or nearly complete		6
2	7	*Rabdotus morreanus*	Shell	Whorl fragment		1
2	8	*Rabdotus morreanus*	Shell	Complete or nearly complete		1
2	8	*Rabdotus morreanus*	Shell	Whorl fragment		2
2	8	*Quadrula* cf. *Q. apiculata*	Shell	Umbo (hinge)	Left	1
2	8	Unionidae	Shell	Fragment		1
3	1	*Anguispira strongylodes*	Shell	Complete or nearly complete		281
3	1	*Anguispira strongylodes*	Shell	Whorl fragment		13
3	1	*Euglandina singleyana*	Shell	Complete or nearly complete		1
3	1	*Euglandina singleyana*	Shell	Apex		1
3	1	*Mesodon roemeri*	Shell	Complete or nearly complete		5

3	1	*Oligyra orbiculata*	Shell	Complete or nearly complete		308
3	1	*Polygyra morreana*	Shell	Complete or nearly complete		9
3	1	*Practicolella berlanderiana*	Shell	Complete or nearly complete		4
3	1	*Practicolella berlanderiana*	Shell	Lip (peristome)		1
3	1	*Rabdotus dealbatus*	Shell	Complete or nearly complete		4
3	1	*Rabdotus dealbatus*	Shell	Apex		3
3	1	*Rabdotus morreanus*	Shell	Complete or nearly complete		7
3	1	*Cardinalis cardinalis*	Beak, upper mandible	Complete or nearly complete	Axial	1
3	1	*Sciurus* sp.	Humerus	Proximal end	Left	1
3	2	*Anguispira strongylodes*	Shell	Complete or nearly complete		46
3	2	*Anguispira strongylodes*	Shell	Whorl fragment		12
3	2	*Mesodon roemeri*	Shell	Complete or nearly complete		4
3	2	*Mesodon roemeri*	Shell	Whorl fragment		3
3	2	*Oligyra orbiculata*	Shell	Complete or nearly complete		481
3	2	*Polygyra morreana*	Shell	Complete or nearly complete		26
3	2	*Practicolella berlanderiana*	Shell	Complete or nearly complete		1
3	2	*Rabdotus dealbatus*	Shell	Complete or nearly complete		1
3	2	*Rabdotus dealbatus*	Shell	Lip (peristome)		2
3	2	*Rabdotus dealbatus*	Shell	Apex		5
3	2	*Rabdotus morreanus*	Shell	Complete or nearly complete		3
3	3	*Anguispira strongylodes*	Shell	Complete or nearly complete		12
3	3	*Oligyra orbiculata*	Shell	Complete or nearly complete		8
3	4	*Anguispira strongylodes*	Shell	Complete or nearly complete		2
3	4	*Anguispira strongylodes*	Shell	Whorl fragment		1
3	4	*Oligyra orbiculata*	Shell	Complete or nearly complete		11
3	4	*Polygyra morreana*	Shell	Complete or nearly complete		1
3	4	*Rabdotus morreanus*	Shell	Complete or nearly complete		45
3	4	*Rabdotus morreanus*	Shell	Lip (peristome)		25
3	4	*Rabdotus morreanus*	Shell	Apex		16
3	4	*Rabdotus morreanus*	Shell	Whorl fragment		32

3	5	*Anguispira strongylodes*	Shell	Complete or nearly complete	1
3	5	*Polygyra morreana*	Shell	Complete or nearly complete	13
3	5	*Polygyra morreana*	Shell	Lip (peristome)	3
3	5	*Polygyra morreana*	Shell	Apex	3
3	6	*Anguispira strongylodes*	Shell	Complete or nearly complete	1
3	6	*Oligyra orbiculata*	Shell	Complete or nearly complete	5
3	6	*Polygyra morreana*	Shell	Complete or nearly complete	1
3	6	*Practicolella berlanderiana*	Shell	Complete or nearly complete	4
3	6	*Rabdotus morreanus*	Shell	Complete or nearly complete	29
3	6	*Rabdotus morreanus*	Shell	Lip (peristome)	15
3	6	*Rabdotus morreanus*	Shell	Apex	14
3	6	*Rabdotus morreanus*	Shell	Whorl fragment	19
3	7	*Oligyra orbiculata*	Shell	Complete or nearly complete	1
3	7	*Practicolella berlanderiana*	Shell	Complete or nearly complete	2
3	7	*Rabdotus morreanus*	Shell	Complete or nearly complete	61
3	7	*Rabdotus morreanus*	Shell	Lip (peristome)	15
3	7	*Rabdotus morreanus*	Shell	Apex	10
3	7	*Rabdotus morreanus*	Shell	Whorl fragment	8
4	1	*Anguispira strongylodes*	Shell	Complete or nearly complete	215
4	1	*Anguispira strongylodes*	Shell	Whorl fragment	18
4	1	*Mesodon roemeri*	Shell	Complete or nearly complete	1
4	1	*Mesodon roemeri*	Shell	Lip (peristome)	1
4	1	*Oligyra orbiculata*	Shell	Complete or nearly complete	319
4	1	*Oligyra orbiculata*	Shell	Multispiral operculum	5
4	1	*Polygyra morreana*	Shell	Complete or nearly complete	26
4	1	*Polygyra texasiana*	Shell	Complete or nearly complete	1
4	1	*Practicolella berlanderiana*	Shell	Complete or nearly complete	10
4	1	*Rabdotus dealbatus*	Shell	Complete or nearly complete	7
4	1	*Rabdotus dealbatus*	Shell	Lip (peristome)	3
4	1	*Rabdotus dealbatus*	Shell	Apex	4

4	1	*Rabdotus morreanus*	Shell	Complete or nearly complete		2
4	1	Mammalia (Medium)	Lumbar vertebra	Complete or nearly complete	Axial	1
5	3	Aves (Medium)	Tarsometatarsus	Distal end	Left	1
5	4	*Anguispira strongylodes*	Shell	Complete or nearly complete		1
5	4	*Anguispira strongylodes*	Shell	Whorl fragment		3
5	4	*Mesodon roemeri*	Shell	Complete or nearly complete		1
5	4	*Mesodon roemeri*	Shell	Whorl fragment		2
5	4	*Oligyra orbiculata*	Shell	Complete or nearly complete		4
5	4	*Rabdotus morreanus*	Shell	Complete or nearly complete		1
5	4	Vertebrata	Indeterminate	Fragment		6
5	4	Mammalia (Medium/large)	Indeterminate	Fragment		8
5	4	Mammalia (Medium/large)	Long bone	Diaphyseal fragment		3
5	4	Mammalia (Large)	Long bone	Diaphyseal fragment		3
5	4	*Odocoileus* sp.	Permanent tooth	Upper PM3 or 4	Left	2
5	4	cf. *Odocoileus* sp.	Tooth, perm/decid ind	Enamel fragment		1
5	5	*Anguispira strongylodes*	Shell	Complete or nearly complete		1
5	5	*Oligyra orbiculata*	Shell	Complete or nearly complete		6
5	5	*Rabdotus morreanus*	Shell	Complete or nearly complete		2
5	5	*Rabdotus morreanus*	Shell	Lip (peristome)		1
5	5	Vertebrata	Indeterminate	Fragment		3
5	5	Mammalia (Medium/large)	Indeterminate	Fragment		1
5	5	Mammalia (Medium/large)	Long bone	Diaphyseal fragment		1
5	5	Mammalia (Large)	Long bone	Diaphyseal fragment		3
5	6	Unionidae	Shell	Fragment		2
5	6	Mammalia (Medium/large)	Indeterminate	Fragment		2
5	6	Mammalia (Medium/large)	Long bone	Diaphyseal fragment		4
5	6	*Antilocapra/Odocoileus*	Humerus	Distal posterior part of shaft	Left	1

5	7	*Anguispira strongylodes*	Shell	Complete or nearly complete		1
5	7	Unionidae	Shell	Fragment		2
5	7	Mammalia (Medium/large)	Indeterminate	Fragment		6
5	7	Mammalia (Medium/large)	Long bone	Diaphyseal fragment		1
5	8	*Amblema plicata*	Shell	Umbo (hinge)	Left	1
5	8	*Rabdotus morreanus*	Shell	Complete or nearly complete		12
5	8	*Rabdotus morreanus*	Shell	Apex		2
5	8	Mammalia (Medium/large)	Indeterminate	Fragment		1
5	8	Mammalia (Medium/large)	Long bone	Diaphyseal fragment		1
5	9	Mammalia (Medium/large)	Indeterminate	Fragment		1
5	10	Mammalia (Medium/large)	Long bone	Diaphyseal fragment		1
5	11	Unionidae	Shell	Fragment		1
5	11	Vertebrata	Indeterminate	Fragment		1
5	11	Mammalia (Medium/large)	Indeterminate	Fragment		3
5	11	Mammalia (Large)	Pelvis	Ilium fragment	Right	1
5	11	Mammalia (Large)	Long bone	Diaphyseal fragment		1
5	11	Carnivora	Metapodial	Proximal portion of shaft		1
5	11	*Antilocapra*/*Odocoileus*	Proximal phalange	Distal anterior end		1
5	12	Unionidae	Shell	Fragment		3
5	12	Vertebrata	Indeterminate	Fragment		62
5	12	Small/Medium Vertebrata	Long bone	Diaphyseal fragment		3
5	12	Mammalia (Medium/large)	Indeterminate	Fragment		28
5	12	Mammalia (Medium/large)	Rib	Shaft fragment		1
5	12	Mammalia (Medium/large)	Long bone	Diaphyseal fragment		3
5	12	Mammalia (Large)	Indeterminate	Fragment		5
5	12	Mammalia (Large)	Long bone	Diaphyseal fragment		2
5	12	*Odocoileus* sp.	Prox. phalange of paradigit	Complete or nearly complete		1

5	12	*Odocoileus* sp.	Middle phalange	Proximal end		1
5	12	*Odocoileus* sp.	Dist. phalange of paradigit	Complete or nearly complete		1
5	12	*Odocoileus* sp.	Antler	Tip of tine		1
5	12	*Antilocapra/Odocoileus*	Mandible	Mandibular condyle	Right	1
5	12	*Antilocapra/Odocoileus*	Mandible	Horizontal ramus fragment	Left	1
5	12	*Antilocapra/Odocoileus*	Metapodial	Distal articular condyle		1
5	12	*Antilocapra/Odocoileus*	Metatarsal	Anterior portion of shaft		1
5	12	*Antilocapra/Odocoileus*	Phalange	Distal posterior end		1
6	1	*Anguispira strongylodes*	Shell	Complete or nearly complete		3
6	1	*Oligyra orbiculata*	Shell	Complete or nearly complete		7
6	2	*Anguispira strongylodes*	Shell	Complete or nearly complete		5
6	2	*Oligyra orbiculata*	Shell	Complete or nearly complete		1
6	2	*Rabdotus dealbatus*	Shell	Complete or nearly complete		1
6	2	*Rabdotus morreanus*	Shell	Complete or nearly complete		5
6	3	*Anguispira strongylodes*	Shell	Complete or nearly complete		1
6	3	*Oligyra orbiculata*	Shell	Complete or nearly complete		7
6	3	*Rabdotus morreanus*	Shell	Complete or nearly complete		14
6	3	*Rabdotus morreanus*	Shell	Lip (peristome)		7
6	3	*Rabdotus morreanus*	Shell	Apex		5
6	3	*Rabdotus morreanus*	Shell	Whorl fragment		13
6	3	*Tritogonia verrucosa*	Shell	Umbo (hinge)	Left	1
6	3	Vertebrata	Indeterminate	Fragment		1
6	3	Mammalia (Medium/large)	Indeterminate	Fragment		8
6	3	Mammalia (Large)	Scapula	Neck	Left	1
6	4	*Anguispira strongylodes*	Shell	Complete or nearly complete		4
6	4	*Anguispira strongylodes*	Shell	Whorl fragment		1
6	4	*Rabdotus morreanus*	Shell	Complete or nearly complete		23
6	4	*Rabdotus morreanus*	Shell	Lip (peristome)		4

6	4	*Rabdotus morreanus*	Shell	Apex	2
6	4	*Rabdotus morreanus*	Shell	Whorl fragment	6
6	4	Unionidae	Shell	Fragment	1
6	4	Vertebrata	Indeterminate	Fragment	7
6	4	Mammalia (Medium/large)	Indeterminate	Fragment	11
6	5	*Anguispira strongylodes*	Shell	Complete or nearly complete	1
6	5	*Anguispira strongylodes*	Shell	Whorl fragment	1
6	5	*Oligyra orbiculata*	Shell	Complete or nearly complete	2
6	5	*Practicolella berlanderiana*	Shell	Complete or nearly complete	1
6	5	*Rabdotus morreanus*	Shell	Complete or nearly complete	23
6	5	*Rabdotus morreanus*	Shell	Lip (peristome)	5
6	5	*Rabdotus morreanus*	Shell	Apex	5
6	5	*Rabdotus morreanus*	Shell	Whorl fragment	3
6	5	Mammalia (Medium/large)	Indeterminate	Fragment	9
6	5	Mammalia (Medium/large)	Long bone	Diaphyseal fragment	2
6	5	Mammalia (Large)	Long bone	Diaphyseal fragment	2
6	6	*Rabdotus morreanus*	Shell	Complete or nearly complete	75
6	6	*Rabdotus morreanus*	Shell	Lip (peristome)	4
6	6	*Rabdotus morreanus*	Shell	Apex	2
6	6	Vertebrata	Indeterminate	Fragment	8
6	6	Mammalia (Medium/large)	Indeterminate	Fragment	6
6	6	*Antilocapra/Odocoileus*	Fused 3rd & 4th metatarsal	Diaphyseal fragment	1
6	6	*Antilocapra/Odocoileus*	Radial carpal bone	Fragment	1
6	7	*Mesodon roemeri*	Shell	Complete or nearly complete	2
6	7	*Oligyra orbiculata*	Shell	Complete or nearly complete	1
6	7	*Rabdotus morreanus*	Shell	Complete or nearly complete	113
6	7	*Rabdotus morreanus*	Shell	Apex	17
6	7	*Rabdotus morreanus*	Shell	Whorl fragment	4
6	7	Mammalia (Medium/large)	Indeterminate	Fragment	20

6	7	Mammalia (Medium/large)	Long bone	Diaphyseal fragment		10
6	7	Mammalia (Large)	Indeterminate	Fragment		1
6	7	*Canis latrans*	Tibia	Distal end	Right	1
6	7	*Odocoileus* sp.	Permanent tooth	Upper M	Left	1
6	7	*Antilocapra/Odocoileus*	Fused 3rd & 4th metacarpal	Diaphyseal fragment		1
6	8	Vertebrata	Indeterminate	Fragment		7
6	8	Mammalia (Medium/large)	Indeterminate	Fragment		5
6	10	*Rabdotus morreanus*	Shell	Complete or nearly complete		9
					Total = 3,771	

APPENDIX III

LITHIC TOOL MEASUREMENTS - 41CV111

Willam A. Dickens

LIST OF TABLES

Table III-1. Projectile point measurements from 41CV111.

PROJECTILE POINTS					
Point Type	Cat No.	Length (mm)	Width (mm)	Thickness (mm)	Juncture Width (mm)
Bulverde	157-1	42.7	21.6	5.4	14.0
Castroville	275-8	*42.5	43.5	8.5	20.5
Darl	296-1	40.6	18.8	5.3	16.6
Ensor	284-2	24.0	17.6	5.0	11.1
Ensor	310-1	43.4	21.5	5.9	14.4
Ensor	Surface	*43.3	29.5	7.6	14.5
Ensor	Trench 3	*39.9	25.7	6.2	14.7
Fairland	154-1	61.3	26.1	6.6	17.2
Lange	81-1	46.4	22.9	8.6	17.4
Lange	199-1	*47.4	31.6	7.2	16.8
Lange	222-4	*41.1	29.1	5.8	16.3
Lange	246-1	*15.3	*26.9	7.0	20.5
Lange	246-6	*38.1	26.8	6.3	16.4
Lange	275-7	44.0	24.8	7.1	15.0
Lange	299-7	32.2	30.6	5.7	18.4
Lange	113-1	39.9	21.0	7.9	18.4
Marshall	202-1	27.3	26.4	8.6	N.A.
Pedernales	51-2	*46.4	24.7	8.5	14.0
Pedernales	68-5	*59.9	26.2	8.3	18.3
Pedernales	81-4	54.7	21.2	7.5	13.7
Pedernales	114-1	*43.4	28.0	10.0	16.9
Pedernales	105-2	59.6	23.0	9.6	15.7
Pedernales	117-1	54.6	26.0	7.6	18.3
Pedernales	240-1	*14.5	*19.2	*7.8	N.A.
Pedernales	Surf.	*42.0	*31.5	8.4	19.9
Undeter.	86-1	63.0	37.8	10.0	23.8

Undeter.	88-2	*30.0	*19.2	7.8	N.A.
Undeter.	284-1	*40.0	*29.8	6.0	N.A.
Undeter.	286-1	41.5	29.3	7.1	N.A.
Undeter. Arrowpoint	8-1	*14.4	*14.3	2.9	N.A.

* = Incomplete specimen

Table III-2. Biface I measurements from 41CV111.

BIFACE I				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
65-2	58.5	55.3	19.3	54.7
297-1	84.2	56.1	22.7	106.5
299-5	106-1	61.7	39.0	260.9
299-6	*67.9	*57.5	23.9	91.2
Surface	64.8	62.1	35.5	130.5

* = Incomplete specimen

Table III-3. Biface II measurements from 41CV111.

BIFACE II				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
65-1	*84-9	58.5	22.2	*126.3
68-2	*59-9	*41.8	*10.2	*22.5
110-1	80.1	46.3	21.9	63.4
132-1	*47.7	*40.8	18.6	*22.6
201-1	*59.2	48.8	16.1	45.3
201-2	*59.5	46.9	14.4	34.7
222-1	64.8	33.2	14.9	31.9
236-3	*36.3	*45.6	11.5	15.8
244-1	*28.6	*41.5	10.5	14.5

279-1	90.5	69.8	26.0	153.7
295-1	*47.5	*46.3	13.1	29.7
299-9	*37.0	*41.4	9.7	15.5
314-1	*56.6	*14.3	*8.4	*6.4

* = Incomplete specimen

Table III-4. Biface III measurements from 41CV111.

BIFACE III				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
46-1	72.5	50.7	13.1	60.7
176-1	*22.3	*26.4	5.3	2.5
194-3	*26.2	32.3	6.1	*5.1
222-1	*51.6	31.5	6.4	*12.1
228-1	*25.4	*28.1	6.5	*3.9
246-1	*58.1	38.5	7.1	*21.1
246-2	*47.9	38.4	7.2	*13.6
246-3	*54.6	27.5	7.1	*10.4
270-2	*30.0	*19.5	6.8	*3.1
275-1	*49.3	*29.9	8.3	*9.6
281-1	69.1	38.8	13.5	32.8
286-1	*58.3	45.1	8.3	*24.1
299-4	*55.2	*23.4	*9.1	*12.2
320-1	*33.2	*47.8	7.2	*10.7
SRA#1	68.2	60.6	10.5	45.3
SRA#2	*40.1	26.3	9.0	*11.0
SRA#3	*37.1	25.6	15.6	*11.3
SRA#4	*43.4	48.1	8.1	*15.4

* = Incomplete specimen

Table III-5. Copper and Celt measurements from 41CV111.

CHOPPER/CELT					
Type	Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
Chopper	241-1	81.0	35.9	14.8	43.5
Celt	222-3	40.7	61.0	28.5	55.3

Table III-6. Measurements for edge modified flakes containing scraping wear from 41CV111.

EDGE MODIFIED: SCRAPING WEAR				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
1-1	29.4	21.7	4.0	3.1
1-2	55.0	44.5	9.4	24.3
22-1	17.8	19.4	4.9	2.1
22-3	25.4	23.4	5.5	2.5
22-4	31-5	32.1	8.3	9.0
22-5	30.1	18.8	7.5	3.7
26-1	37.9	21.8	8.4	5.6
43-1	32.9	33.3	4.6	7.0
43-2	46.5	20.3	8.5	5.5
47-1	35.8	42.3	10.3	11.6
47-2	42.2	38.2	17.6	27.5
51-1	40.0	31.4	6.1	8.2
68-1	38.1	23.5	3.9	4.2
68-4	16.4	16.3	2.9	.9
77-4	110.1	42.3	32.4	173.7
81-3	45.7	26.9	7.4	8.5
88-1	74.1	66.5	19.5	90.0
91-1	56.3	32.5	5.7	8.7
194-1	50.0	29.8	4.2	4.5
194-2	50.4	34.9	6.5	7.7

202-5	26.6	9.0	2.4	1.0
222-2	30.4	30.5	8.5	7.0
236-1	52.3	45.3	8.3	18.0
282-4	38.2	34.6	7.7	10.4
299-3	39.9	40.3	5.5	8.9
299-8	55.4	34.9	10.2	24.4
314-2	34.7	24.8	3.8	3.1
319-1	44.3	45.0	12.2	20.3

Table III-7. Measurements for edge modified flakes containing cutting wear from 41CV111.

EDGE MODIFIED: CUTTING WEAR				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
3-1	21.7	27.4	4.4	2.3
148-1	82.0	23.5	12.9	24.9
202-2	32.1	12.0	3.4	1.4
282-1	80.0	39.9	15.9	47.9
299-2	71.8	55.5	16.0	59.0

Table III-8. Measurements for edge modified flakes containing both cutting and scraping wear from 41CV111.

EDGE MODIFIED: CUTTING AND SCRAPING WEAR				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
22-2	56.0	41.6	8.7	N.A.
45-1	29.0	24.7	5.7	4.1
81-2	38.1	25.4	6.7	6.0
91-3	19.6	24.6	4.2	2.5
202-1	18.7	22.4	4.1	1.9
275-2	87.2	47.3	13.5	30.3
282-5	60.4	33.7	6.7	10.2
282-6	60.7	25.6	3.7	5.6

Table III-9. Measurements for edge modified flakes containing scraping and cutting wear from 41CV111.

EDGE MODIFIED: SCRAPING AND PLANING WEAR				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
202-4	37.4	29.8	8.0	7.4
236-2	66.9	60.6	13.9	46.6
275-4	38.0	31.8	28.7	57.5

Table III-10. Measurements for hammerstones from 41CV111.

HAMMERSTONES				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
246-1	89.2	65.2	40.4	271.1
275-5	81.4	47.6	34.5	214.1
241-1	63.8	45.1	22.8	90.0

Table III-11. Measurements for Manos from 41CV111.

MANOS				
Catalog No.	Length (mm)	Width (mm)	Thickness (mm)	Weight (gm)
253-1	102.28	84.91	N.A.	44.0
314-3	46.6	45.5	16.5	39.1
314-4	45.0	44.8	17.3	39.0

APPENDIX IV

DEBITAGE TABULATIONS - 41CV111

David L. Carlson

LIST OF TABLES

Table IV-1. Summary Tabulations of Debitage by Unit, Level, Size, Material, Cortex, and Burning

Unit	Count	Percent
1	1857	10.4
2	1190	6.7
3	1295	7.2
4	2598	14.5
5	3794	21.2
6	7147	40.0
Total	17881	

Level	Count	Percent
1	632	3.5
2	675	3.8
3	2043	11.4
4	4439	24.8
5	2503	14.0
6	1508	8.4
7	2047	11.4
8	703	3.9
9	585	3.3
10	902	5.0
11	587	3.3
12	1257	7.0
Total	17881	

Grade		Count	Percent
1	74 mm	3	0.0
2	54 mm	147	0.8
3	37 mm	733	4.1
4	26 mm	2547	14.2
5	17 mm	4103	22.9
6	13 mm	8975	50.2
7	7 mm	1373	7.7
Total		17881	

Material		Count	Percent
1	Owl Creek Black	2392	13.4
2	Fort Hood Gray	3120	17.4
3	Gray/Brown/Green	3794	21.2
4	Fort Hood Tan	5642	31.6
5	Texas "Novaculite"	456	2.6
12	Heiner Lake	154	0.9
13	Unknown	2286	12.8
99	Quartzite	37	0.2
Total		17881	

Cortex		Count	Percent
1	Primary	652	3.6
2	Secondary	2209	12.4
3	Tertiary	15020	84.0
Total		17881	

Burning		Count	Percent
0	Absent	11155	62.4
1	One side	1373	7.7
2	Potlids	1607	9.0
3	Two sides	3746	20.9
Total		17881	

Table IV-2. Debitage by Level and Unit.

SOURCE: Level Unit	1	2	3	4	5	6	Totals
1	119	1	31	13	0	468	632
row %	18.8	0.2	4.9	2.1	0.0	74.1	3.5
col %	6.4	0.1	2.4	0.5	0.0	6.5	
% tot	0.7	0.0	0.2	0.1	0.0	2.6	
2	81	10	215	47	2	320	675
row %	12.0	1.5	31.9	7.0	0.3	47.4	3.8
col %	4.4	0.8	16.6	1.8	0.1	4.5	
% tot	0.5	0.1	1.2	0.3	0.0	1.8	
3	327	8	177	454	1	1076	2043
row %	16.0	0.4	8.7	22.2	0.0	52.7	11.4
col %	17.6	0.7	13.7	17.5	0.0	15.1	
% tot	1.8	0.0	1	2.5	0.0	6.0	
4	842	3	815	1795	88	896	4439
row %	19.0	0.1	18.4	40.4	2.0	20.2	24.8
col %	45.3	0.3	62.9	69.1	2.3	12.5	
% tot	4.7	0.0	4.6	10.0	0.5	5.0	
5	356	66	44	144	183	1710	2503
row %	14.2	2.6	1.8	5.8	7.3	68.3	14.0
col %	19.2	5.5	3.4	5.5	4.8	23.9	
% tot	2.0	0.4	0.2	0.8	1.0	9.6	
6	61	107	0	78	112	1150	1508
row %	4.0	7.1	0.0	5.2	7.4	76.3	8.4
col %	3.3	9.0	0.0	3.0	3.0	16.1	
% tot	0.3	0.6	0.0	0.4	0.6	6.4	
7	71	157	13	67	249	1490	2047
row %	3.5	7.7	0.6	3.3	12.2	72.8	11.4
col %	3.8	13.2	1.0	2.6	6.6	20.8	
% tot	0.4	0.9	0.1	0.4	1.4	8.3	
8	0	336	0	0	363	4	703
row %	0.0	47.8	0.0	0.0	51.6	0.6	3.9
col %	0.0	28.2	0.0	0.0	9.6	0.1	
% tot	0.0	1.9	0.0	0.0	2.0	0.0	

9	0	115	0	0	444	26	585
row %	0.0	19.7	0.0	0.0	75.9	4.4	3.3
col %	0.0	9.7	0.0	0.0	11.7	0.4	
% tot	0.0	0.6	0.0	0.0	2.5	0.1	
10	0	387	0	0	508	7	902
row %	0.0	42.9	0.0	0.0	56.3	0.8	5.0
col %	0.0	32.5	0.0	0.0	13.4	0.1	
% tot	0.0	2.2	0.0	0.0	2.8	0.0	
11	0	0	0	0	587	0	587
row %	0.0	0.0	0.0	0.0	100.0	0.0	3.3
col %	0.0	0.0	0.0	0.0	15.5	0.0	
% tot	0.0	0.0	0.0	0.0	3.3	0.0	
12	0	0	0	0	1257	0	1257
row %	0.0	0.0	0.0	0.0	100.0	0.0	7.0
col %	0.0	0.0	0.0	0.0	33.1	0.0	
% tot	0.0	0.0	0.0	0.0	7.0	0.0	
Totals	1857	1190	1295	2598	3794	7147	17881
col %	10.4	6.7	7.2	14.5	21.2	40.0	100.0

Table IV-3. Debitage by Size Grade and Unit.

SOURCE: Grade Unit	1	2	3	4	5	6	Totals
1	0	0	1	0	0	2	3
row %	0.0	0.0	33.3	0.0	0.0	66.7	0.0
col %	0.0	0.0	0.1	0.0	0.0	0.0	
% tot	0.0	0.0	0.0	0.0	0.0	0.0	
2	7	26	10	15	38	51	147
row %	4.8	17.7	6.8	10.2	25.9	34.7	0.8
col %	0.4	2.2	0.8	0.6	1.0	0.7	
% tot	0.0	0.1	0.1	0.1	0.2	0.3	
3	74	55	123	74	150	257	733
row %	10.1	7.5	16.8	10.1	20.5	35.1	4.1
col %	4.0	4.6	9.5	2.8	4.0	3.6	
% tot	0.4	0.3	0.7	0.4	0.8	1.4	
4	288	184	276	203	535	1061	2547
row %	11.3	7.2	10.8	8.0	21.0	41.7	14.2
col %	15.5	15.5	21.3	7.8	14.1	14.8	
% tot	1.6	1.0	1.5	1.1	3.0	5.9	
5	440	306	323	440	843	1751	4103
row %	10.7	7.5	7.9	10.7	20.5	42.7	22.9
col %	23.7	25.7	24.9	16.9	22.2	24.5	
% tot	2.5	1.7	1.8	2.5	4.7	9.8	
6	954	586	452	1442	1903	3638	8975
row %	10.6	6.5	5.0	16.1	21.2	40.5	50.2
col %	51.4	49.2	34.9	55.5	50.2	50.9	
% tot	5.3	3.3	2.5	8.1	10.6	20.3	
7	94	33	110	424	325	387	1373
row %	6.8	2.4	8.0	30.9	23.7	28.2	7.7
col %	5.1	2.8	8.5	16.3	8.6	5.4	
% tot	0.5	0.2	0.6	2.4	1.8	2.2	
Totals	1857	1190	1295	2598	3794	7147	17881
col %	10.4	6.7	7.2	14.5	21.2	40.0	100.0

Table IV-4. Debitage by Raw Material and Unit.

SOURCE: Material Unit

	1	2	3	4	5	6	Totals
1	119	117	154	121	649	1232	2392
row %	5.0	4.9	6.4	5.1	27.1	51.5	13.4
col %	6.4	9.8	11.9	4.7	17.1	17.2	
% tot	0.7	0.7	0.9	0.7	3.6	6.9	
2	318	210	216	391	764	1221	3120
row %	10.2	6.7	6.9	12.5	24.5	39.1	17.4
col %	17.1	17.6	16.7	15.1	20.1	17.1	
% tot	1.8	1.2	1.2	2.2	4.3	6.8	
3	334	150	259	607	1195	1249	3794
row %	8.8	4.0	6.8	16.0	31.5	32.9	21.2
col %	18.0	12.6	20.0	23.4	31.5	17.5	
% tot	1.9	0.8	1.4	3.4	6.7	7.0	
4	830	580	488	756	646	2342	5642
row %	14.7	10.3	8.6	13.4	11.4	41.5	31.6
col %	44.7	48.7	37.7	29.1	17.0	32.8	
% tot	4.6	3.2	2.7	4.2	3.6	13.1	
5	21	23	45	116	102	149	456
row %	4.6	5.0	9.9	25.4	22.4	32.7	2.6
col %	1.1	1.9	3.5	4.5	2.7	2.1	
% tot	0.1	0.1	0.3	0.6	0.6	0.8	
12	17	3	6	16	49	63	154
row %	11.0	1.9	3.9	10.4	31.8	40.9	0.9
col %	0.9	0.3	0.5	0.6	1.3	0.9	
% tot	0.1	0.0	0.0	0.1	0.3	0.4	
13	212	101	126	584	389	874	2286
row %	9.3	4.4	5.5	25.5	17.0	38.2	12.8
col %	11.4	8.5	9.7	22.5	10.3	12.2	
% tot	1.2	0.6	0.7	3.3	2.2	4.9	
99	6	6	1	7	0	17	37
row %	16.2	16.2	2.7	18.9	0.0	45.9	0.2
col %	0.3	0.5	0.1	0.3	0.0	0.2	
% tot	0.0	0.0	0.0	0.0	0.0	0.1	
Totals	1857	1190	1295	2598	3794	7147	17881
col %	10.4	6.7	7.2	14.5	21.2	40.0	100.0

Table IV-5. Debitage by Cortex and Unit

SOURCE: Cortex	Unit 1	2	3	4	5	6	Totals
1	59	65	42	97	160	229	652
row %	9.0	10	6.4	14.9	24.5	35.1	3.6
col %	3.2	5.5	3.2	3.7	4.2	3.2	
% tot	0.3	0.4	0.2	0.5	0.9	1.3	
2	227	153	212	335	411	871	2209
row %	10.3	6.9	9.6	15.2	18.6	39.4	12.4
col %	12.2	12.9	16.4	12.9	10.8	12.2	
% tot	1.3	0.9	1.2	1.9	2.3	4.9	
3	1571	972	1041	2166	3223	6047	15020
row %	10.5	6.5	6.9	14.4	21.5	40.3	84.0
col %	84.6	81.7	80.4	83.4	84.9	84.6	
% tot	8.8	5.4	5.8	12.1	18.0	33.8	
Totals	1857	1190	1295	2598	3794	7147	17881
col %	10.4	6.7	7.2	14.5	21.2	40.0	100.0

Table IV-6. Debitage by Burning and Unit.

SOURCE: Burning Unit

	1	2	3	4	5	6	Totals
0	1111	871	809	1784	2085	4495	11155
row %	10	7.8	7.3	16.0	18.7	40.3	62.4
col %	59.8	73.2	62.5	68.7	55.0	62.9	
% tot	6.2	4.9	4.5	10	11.7	25.1	
1	80	63	38	79	590	523	1373
row %	5.8	4.6	2.8	5.8	43.0	38.1	7.7
col %	4.3	5.3	2.9	3.0	15.6	7.3	
% tot	0.4	0.4	0.2	0.4	3.3	2.9	
2	112	86	53	151	277	928	1607
row %	7.0	5.4	3.3	9.4	17.2	57.7	9.0
col %	6.0	7.2	4.1	5.8	7.3	13.0	
% tot	0.6	0.5	0.3	0.8	1.5	5.2	
3	554	170	395	584	842	1201	3746
row %	14.8	4.5	10.5	15.6	22.5	32.1	20.9
col %	29.8	14.3	30.5	22.5	22.2	16.8	
% tot	3.1	1	2.2	3.3	4.7	6.7	
Totals	1857	1190	1295	2598	3794	7147	17881
col %	10.4	6.7	7.2	14.5	21.2	40.0	100.0

Table IV-7. Debitage by Raw Material and Grade.

SOURCE: Material	Grade 1	2	3	4	5	6	7	Totals
1	0	5	60	276	596	1251	204	2392
row %	0.0	0.2	2.5	11.5	24.9	52.3	8.5	13.4
col %	0.0	3.4	8.2	10.8	14.5	13.9	14.9	
% tot	0.0	0.0	0.3	1.5	3.3	7.0	1.1	
2	0	33	96	415	687	1661	228	3120
row %	0.0	1.1	3.1	13.3	22.0	53.2	7.3	17.4
col %	0.0	22.4	13.1	16.3	16.7	18.5	16.6	
% tot	0.0	0.2	0.5	2.3	3.8	9.3	1.3	
3	0	25	166	535	846	1908	314	3794
row %	0.0	0.7	4.4	14.1	22.3	50.3	8.3	21.2
col %	0.0	17.0	22.6	21.0	20.6	21.3	22.9	
% tot	0.0	0.1	0.9	3.0	4.7	10.7	1.8	
4	3	70	320	960	1339	2662	288	5642
row %	0.1	1.2	5.7	17.0	23.7	47.2	5.1	31.6
col %	100.0	47.6	43.7	37.7	32.6	29.7	21.0	
% tot	0.0	0.4	1.8	5.4	7.5	14.9	1.6	
5	0	4	22	81	102	208	39	456
row %	0.0	0.9	4.8	17.8	22.4	45.6	8.6	2.6
col %	0.0	2.7	3.0	3.2	2.5	2.3	2.8	
% tot	0.0	0.0	0.1	0.5	0.6	1.2	0.2	
12	0	2	9	21	37	80	5	154
row %	0.0	1.3	5.8	13.6	24.0	51.9	3.2	0.9
col %	0.0	1.4	1.2	0.8	0.9	0.9	0.4	
% tot	0.0	0.0	0.1	0.1	0.2	0.4	0.0	
13	0	8	58	249	488	1188	295	2286
row %	0.0	0.3	2.5	10.9	21.3	52.0	12.9	12.8
col %	0.0	5.4	7.9	9.8	11.9	13.2	21.5	
% tot	0.0	0.0	0.3	1.4	2.7	6.6	1.6	
99	0	0	2	10	8	17	0	37
row %	0.0	0.0	5.4	27.0	21.6	45.9	0.0	0.2
col %	0.0	0.0	0.3	0.4	0.2	0.2	0.0	
% tot	0.0	0.0	0.0	0.1	0.0	0.1	0.0	
Totals	3	147	733	2547	4103	8975	1373	17881
col %	0.0	0.8	4.1	14.2	22.9	50.2	7.7	100.0

Table IV-8. Debitage by Cortex and Grade.

SOURCE: Cortex Grade	1	2	3	4	5	6	7	Totals
1	2	22	55	132	186	238	17	652
row %	0.3	3.4	8.4	20.2	28.5	36.5	2.6	3.6
col %	66.7	15.0	7.5	5.2	4.5	2.7	1.2	
% tot	0.0	0.1	0.3	0.7	1.0	1.3	0.1	
2	1	63	240	548	604	689	64	2209
row %	0.0	2.9	10.9	24.8	27.3	31.2	2.9	12.4
col %	33.3	42.9	32.7	21.5	14.7	7.7	4.7	
% tot	0.0	0.4	1.3	3.1	3.4	3.9	0.4	
3	0	62	438	1867	3313	8048	1292	15020
row %	0.0	0.4	2.9	12.4	22.1	53.6	8.6	84.0
col %	0.0	42.2	59.8	73.3	80.7	89.7	94.1	
% tot	0.0	0.3	2.4	10.4	18.5	45.0	7.2	
Totals	3	147	733	2547	4103	8975	1373	17881
col %	0.0	0.8	4.1	14.2	22.9	50.2	7.7	100.0

Table IV-9. Debitage by Burning and Grade

SOURCE: Burning	Grade 1	2	3	4	5	6	7	Totals
0	2	105	469	1556	2480	5640	903	11155
row %	0.0	0.9	4.2	13.9	22.2	50.6	8.1	62.4
col %	66.7	71.4	64.0	61.1	60.4	62.8	65.8	
% tot	0.0	0.6	2.6	8.7	13.9	31.5	5.1	
1	1	8	59	220	325	676	84	1373
row %	0.1	0.6	4.3	16.0	23.7	49.2	6.1	7.7
col %	33.3	5.4	8.0	8.6	7.9	7.5	6.1	
% tot	0.0	0.0	0.3	1.2	1.8	3.8	0.5	
2	0	3	41	189	390	863	121	1607
row %	0.0	0.2	2.6	11.8	24.3	53.7	7.5	9.0
col %	0.0	2.0	5.6	7.4	9.5	9.6	8.8	
% tot	0.0	0.0	0.2	1.1	2.2	4.8	0.7	
3	0	31	164	582	908	1796	265	3746
row %	0.0	0.8	4.4	15.5	24.2	47.9	7.1	20.9
col %	0.0	21.1	22.4	22.9	22.1	20.0	19.3	
% tot	0.0	0.2	0.9	3.3	5.1	10.0	1.5	
Totals	3	147	733	2547	4103	8975	1373	17881
col %	0.0	0.8	4.1	14.2	22.9	50.2	7.7	100.0

Table IV-10. Debitage by Raw Material and Cortex.

SOURCE: Material Cortex

	1	2	3	Totals
1	69	336	1987	2392
row %	2.9	14.0	83.1	13.4
col %	10.6	15.2	13.2	
% tot	0.4	1.9	11.1	
2	113	363	2644	3120
row %	3.6	11.6	84.7	17.4
col %	17.3	16.4	17.6	
% tot	0.6	2.0	14.8	
3	135	480	3179	3794
row %	3.6	12.7	83.8	21.2
col %	20.7	21.7	21.2	
% tot	0.8	2.7	17.8	
4	112	669	4861	5642
row %	2.0	11.9	86.2	31.6
col %	17.2	30.3	32.4	
% tot	0.6	3.7	27.2	
5	12	46	398	456
row %	2.6	10.1	87.3	2.6
col %	1.8	2.1	2.6	
% tot	0.1	0.3	2.2	
12	28	32	94	154
row %	18.2	20.8	61.0	0.9
col %	4.3	1.4	0.6	
% tot	0.2	0.2	0.5	
13	179	278	1829	2286
row %	7.8	12.2	80.0	12.8
col %	27.5	12.6	12.2	
% tot	1.0	1.6	10.2	
99	4	5	28	37
row %	10.8	13.5	75.7	0.2
col %	0.6	0.2	0.2	
% tot	0.0	0.0	0.2	
Totals	652	2209	15020	17881
col %	3.6	12.4	84.0	100.0

Table IV-11. Debitage by Raw Material and Burning.

SOURCE: Material	Burning 0	1	2	3	Totals
1	1563	324	429	76	2392
row %	65.3	13.5	17.9	3.2	13.4
col %	14.0	23.6	26.7	2.0	
% tot	8.7	1.8	2.4	0.4	
2	2128	263	404	325	3120
row %	68.2	8.4	12.9	10.4	17.4
col %	19.1	19.2	25.1	8.7	
% tot	11.9	1.5	2.3	1.8	
3	2147	407	159	1081	3794
row %	56.6	10.7	4.2	28.5	21.2
col %	19.2	29.6	9.9	28.9	
% tot	12.0	2.3	0.9	6.0	
4	3928	251	348	1115	5642
row %	69.6	4.4	6.2	19.8	31.6
col %	35.2	18.3	21.7	29.8	
% tot	22.0	1.4	1.9	6.2	
5	369	12	20	55	456
row %	80.9	2.6	4.4	12.1	2.6
col %	3.3	0.9	1.2	1.5	
% tot	2.1	0.1	0.1	0.3	
12	103	9	2	40	154
row %	66.9	5.8	1.3	26.0	0.9
col %	0.9	0.7	0.1	1.1	
% tot	0.6	0.1	0.0	0.2	
13	889	106	243	1048	2286
row %	38.9	4.6	10.6	45.8	12.8
col %	8.0	7.7	15.1	28.0	
% tot	5.0	0.6	1.4	5.9	
99	28	1	2	6	37
row %	75.7	2.7	5.4	16.2	0.2
col %	0.3	0.1	0.1	0.2	
% tot	0.2	0.0	0.0	0.0	
Totals	11155	1373	1607	3746	17881
col %	62.4	7.7	9.0	20.9	100.0

Table IV-12. Debitage by Cortex and Burning.

SOURCE: Cortex Burning	0	1	2	3	Totals
1	382	70	33	167	652
row %	58.6	10.7	5.1	25.6	3.6
col %	3.4	5.1	2.1	4.5	
% tot	2.1	0.4	0.2	0.9	
2	1296	231	155	527	2209
row %	58.7	10.5	7.0	23.9	12.4
col %	11.6	16.8	9.6	14.1	
% tot	7.2	1.3	0.9	2.9	
3	9477	1072	1419	3052	15020
row %	63.1	7.1	9.4	20.3	84.0
col %	85.0	78.1	88.3	81.5	
% tot	53.0	6.0	7.9	17.1	
Totals	11155	1373	1607	3746	17881
col %	62.4	7.7	9.0	20.9	100.0

APPENDIX V

LITHIC TOOL MEASUREMENTS - 41BL148

John E. Dockall

LIST OF TABLES

* = Incomplete measurement

Table V-1. Dimensions of projectile points from 41BL148.

Point Type	Cat. No.	Length	Width	Thickness	Juncture Width
Ensor	49-1	40.9	22.3	5.5	12.7
Ensor	62-30-1	32.8	22.4	5.1	14.7
Lange	35-2	48.8	34.7	7.9	23.8
Fragment	19-7	12.6*	15.8*	5.3*	---

Table V-2. Biface I measurements from 41BL148.

Catalog No.	Length	Width	Thickness	Weight
10-1	32.4	34.3	5.8	7.5
10-2	71.4	35.3	16.4	29.8
10-3	39.9	29.8	10.3	11.2
35-1	77.3	43.3	20.2	76.9
5-10*	62.2	---	73.9	71.2
5-12*	52.2	68.5	25.5	77.3
19-3*	95.2	62.0	33.9	163.3
5-8*	56.6	65.6	15.9	57.0
30-1*	56.9	43.8	11.4	37.0
5-14	100.2	67.7	30.8	163.2
5-7*	28.1	51.2	18.3	27.6
99-1*	27.2	40.6	15.1	---

Table V-3. Biface II measurements from 41BL148.

Catalog No.	Length	Width	Thickness	Weight
5-11*	66.5	43.9	12.3	---
5-3*	55.9	32.7	10.5	17.4
5-9	103.6	45.0	20.6	85.2

Table V-4. Biface III measurements from 41BL148.

Catalog No.	Length	Width	Thickness	Weight
10-4*	22.7	20.9	4.1	1.3
62-30-2*	49.0	34.8	5.5	7.6
5-4*	60.7	38.8	9.3	18.2
5-2*	50.6	27.2	11.3	17.3

Table V-5. Measurements of cores from 41BL148.

Catalog No.	Length	Width	Thickness	Weight
11-1	81.1	64.3	44.8	227.3
5-13	78.1	61.9	37.2	145.1
5-1	69.0	56.8	25.7	97.5
30-1	91.3	55.4	28.3	133.7
19-4	90.4	25.3	N.A.	133.3
19-4	75.9	25.8	N.A.	53.0

Table V-6. Measurements of edge-modified implements from 41BL148.

Catalog No.	Length	Width	Thickness	Weight
3-1	60.4	47.5	14.4	31.3
37-1	96.6	56.4	16.8	52.3
12-1	59.1	17.8	18.4	15.2
19-8	17.9	18.2	4.0	1.1

Table V-7. Measurements of quartzite hammrstones from 41BL148.

Catalog No.	Length	Width	Thickness	Weight
62-5-6	116.3	95.5	67.9	1043
62-5-5	88.8	87.3	47.6	572

APPENDIX VI

DEBITAGE TABULATIONS - 41BL148

David L. Carlson

LIST OF TABLES

Table VI-1. Summary Tabulations of Debitage by Unit, Level, Size, Raw Material, Cortex, and Burning

Unit	Count	Percent
1	207	12.8
3	1405	87.2
Total	1612	

Level	Count	Percent
0	10	0.6
1	127	7.9
2	300	18.6
3	522	32.4
4	136	8.4
5	327	20.3
6	190	11.8
Total	1612	

Grade		Count	Percent
1	74 mm	3	0.2
2	54 mm	18	1.1
3	37 mm	44	2.7
4	26 mm	122	7.6
5	17 mm	283	17.6
6	13 mm	721	44.7
7	7 mm	421	26.1
Total		1612	

Material		Count	Percent
1	Owl Creek Black	272	16.9
2	Fort Hood Gray	416	25.8
3	Gray/Brown/Green	256	15.9
4	Fort Hood Tan	418	25.9
5	Texas "Novaculite"	57	3.5
12	Heiner Lake	11	0.7
13	Unknown	179	11.1
20	Quartzite	3	0.2
Total		1612	

Cortex		Count	Percent
1	Primary	133	8.3
2	Secondary	236	14.6
3	Tertiary	1243	77.1
Total		1612	

Burning		Count	Percent
0	Absent	1066	66.1
1	One side	91	5.6
2	Potlids	223	13.8
3	Two sides	232	14.4
Total		1612	

Table VI-2. Debitage by Level and Unit.

SOURCE: Level Unit

	1	3	Totals
0	0	10	10
row %	0.0	100.0	0.6
col %	0.0	0.7	
% tot	0.0	0.6	
1	10	117	127
row %	7.9	92.1	7.9
col %	4.8	8.3	
% tot	0.6	7.3	
2	13	287	300
row %	4.3	95.7	18.6
col %	6.3	20.4	
% tot	0.8	17.8	
3	43	479	522
row %	8.2	91.8	32.4
col %	20.8	34.1	
% tot	2.7	29.7	
4	19	117	136
row %	14.0	86.0	8.4
col %	9.2	8.3	
% tot	1.2	7.3	
5	48	279	327
row %	14.7	85.3	20.3
col %	23.2	19.9	
% tot	3.0	17.3	
6	74	116	190
row %	38.9	61.1	11.8
col %	35.7	8.3	
% tot	4.6	7.2	
Totals	207	1405	1612
col %	12.8	87.2	100.0

Table VI-3. Debitage by Size Grade and Unit.

SOURCE: Grade Unit

	1	3	Totals
1	0	3	3
row %	0.0	100.0	0.2
col %	0.0	0.2	
% tot	0.0	0.2	
2	7	11	18
row %	38.9	61.1	1.1
col %	3.4	0.8	
% tot	0.4	0.7	
3	13	31	44
row %	29.5	70.5	2.7
col %	6.3	2.2	
% tot	0.8	1.9	
4	18	104	122
row %	14.8	85.2	7.6
col %	8.7	7.4	
% tot	1.1	6.5	
5	50	233	283
row %	17.7	82.3	17.6
col %	24.2	16.6	
% tot	3.1	14.5	
6	112	609	721
row %	15.5	84.5	44.7
col %	54.1	43.3	
% tot	6.9	37.8	
7	7	414	421
row %	1.7	98.3	26.1
col %	3.4	29.5	
% tot	0.4	25.7	
Totals	207	1405	1612
col %	12.8	87.2	100.0

Table VI-4. Debitage by Raw Material and Unit.

SOURCE: Material Unit

	1	3	Totals
1	32	240	272
row %	11.8	88.2	16.9
col %	15.5	17.1	
% tot	2.0	14.9	
2	63	353	416
row %	15.1	84.9	25.8
col %	30.4	25.1	
% tot	3.9	21.9	
3	28	228	256
row %	10.9	89.1	15.9
col %	13.5	16.2	
% tot	1.7	14.1	
4	64	354	418
row %	15.3	84.7	25.9
col %	30.9	25.2	
% tot	4.0	22.0	
5	5	52	57
row %	8.8	91.2	3.5
col %	2.4	3.7	
% tot	0.3	3.2	
12	1	10	11
row %	9.1	90.9	0.7
col %	0.5	0.7	
% tot	0.1	0.6	
13	14	165	179
row %	7.8	92.2	11.1
col %	6.8	11.7	
% tot	0.9	10.2	
20	0	3	3
row %	0.0	100.0	0.2
col %	0.0	0.2	
% tot	0.0	0.2	
Totals	207	1405	1612
col %	12.8	87.2	100.0

Table VI-5. Debitage by Cortex and Unit.

SOURCE: Cortex Unit

	1	3	Totals
1	14	119	133
row %	10.5	89.5	8.3
col %	6.8	8.5	
% tot	0.9	7.4	
2	72	164	236
row %	30.5	69.5	14.6
col %	34.8	11.7	
% tot	4.5	10.2	
3	121	1122	1243
row %	9.7	90.3	77.1
col %	58.5	79.9	
% tot	7.5	69.6	
Totals	207	1405	1612
col %	12.8	87.2	100.0

Table VI-6. Debitage by Burning and Unit.

SOURCE: Burning Unit

	1	3	Totals
0	150	916	1066
row %	14.1	85.9	66.1
col %	72.5	65.2	
% tot	9.3	56.8	
1	5	86	91
row %	5.5	94.5	5.6
col %	2.4	6.1	
% tot	0.3	5.3	
2	39	184	223
row %	17.5	82.5	13.8
col %	18.8	13.1	
% tot	2.4	11.4	
3	13	219	232
row %	5.6	94.4	14.4
col %	6.3	15.6	
% tot	0.8	13.6	
Totals	207	1405	1612
col %	12.8	87.2	100.0

Table VI-7. Debitage by Raw Material and Grade.

SOURCE: Material	Grade 1	2	3	4	5	6	7	Totals
1	0	0	3	7	29	139	94	272
row %	0.0	0.0	1.1	2.6	10.7	51.1	34.6	16.9
col %	0.0	0.0	6.8	5.7	10.2	19.3	22.3	
% tot	0.0	0.0	0.2	0.4	1.8	8.6	5.8	
2	0	5	14	30	63	152	152	416
row %	0.0	1.2	3.4	7.2	15.1	36.5	36.5	25.8
col %	0.0	27.8	31.8	24.6	22.3	21.1	36.1	
% tot	0.0	0.3	0.9	1.9	3.9	9.4	9.4	
3	0	1	6	25	52	115	57	256
row %	0.0	0.4	2.3	9.8	20.3	44.9	22.3	15.9
col %	0.0	5.6	13.6	20.5	18.4	16.0	13.5	
% tot	0.0	0.1	0.4	1.6	3.2	7.1	3.5	
4	2	9	16	38	73	230	50	418
row %	0.5	2.2	3.8	9.1	17.5	55.0	12.0	25.9
col %	66.7	50.0	36.4	31.1	25.8	31.9	11.9	
% tot	0.1	0.6	1	2.4	4.5	14.3	3.1	
5	0	1	1	2	10	19	24	57
row %	0.0	1.8	1.8	3.5	17.5	33.3	42.1	3.5
col %	0.0	5.6	2.3	1.6	3.5	2.6	5.7	
% tot	0.0	0.1	0.1	0.1	0.6	1.2	1.5	
12	0	0	0	3	3	5	0	11
row %	0.0	0.0	0.0	27.3	27.3	45.5	0.0	0.7
col %	0.0	0.0	0.0	2.5	1.1	0.7	0.0	
% tot	0.0	0.0	0.0	0.2	0.2	0.3	0.0	
13	1	2	4	15	52	61	44	179
row %	0.6	1.1	2.2	8.4	29.1	34.1	24.6	11.1
col %	33.3	11.1	9.1	12.3	18.4	8.5	10.5	
% tot	0.1	0.1	0.2	0.9	3.2	3.8	2.7	
20	0	0	0	2	1	0	0	3
row %	0.0	0.0	0.0	66.7	33.3	0.0	0.0	0.2
col %	0.0	0.0	0.0	1.6	0.4	0.0	0.0	
% tot	0.0	0.0	0.0	0.1	0.1	0.0	0.0	
Totals	3	18	44	122	283	721	421	1612
col %	0.2	1.1	2.7	7.6	17.6	44.7	26.1	100.0

Table VI-8. Debitage by Cortex and Size Grade.

SOURCE: Cortex Grade	1	2	3	4	5	6	7	Totals
1	1	5	7	13	36	41	30	133
row %	0.8	3.8	5.3	9.8	27.1	30.8	22.6	8.3
col %	33.3	27.8	15.9	10.7	12.7	5.7	7.1	
% tot	0.1	0.3	0.4	0.8	2.2	2.5	1.9	
2	2	9	18	32	56	94	25	236
row %	0.8	3.8	7.6	13.6	23.7	39.8	10.6	14.6
col %	66.7	50.0	40.9	26.2	19.8	13.0	5.9	
% tot	0.1	0.6	1.1	2.0	3.5	5.8	1.6	
3	0	4	19	77	191	586	366	1243
row %	0.0	0.3	1.5	6.2	15.4	47.1	29.4	77.1
col %	0.0	22.2	43.2	63.1	67.5	81.3	86.9	
% tot	0.0	0.2	1.2	4.8	11.8	36.4	22.7	
Totals	3	18	44	122	283	721	421	1612
col %	0.2	1.1	2.7	7.6	17.6	44.7	26.1	100.0

Table VI-9. Debitage by Burning and Size Grade.

SOURCE: Burning Grade

	1	2	3	4	5	6	7	Totals
0	2	17	29	78	178	477	285	1066
row %	0.2	1.6	2.7	7.3	16.7	44.7	26.7	66.1
col %	66.7	94.4	65.9	63.9	62.9	66.2	67.7	
% tot	0.1	1.1	1.8	4.8	11.0	29.6	17.7	
1	0	0	4	10	22	46	9	91
row %	0.0	0.0	4.4	11.0	24.2	50.5	9.9	5.6
col %	0.0	0.0	9.1	8.2	7.8	6.4	2.1	
% tot	0.0	0.0	0.2	0.6	1.4	2.9	0.6	
2	1	0	2	11	32	103	74	223
row %	0.4	0.0	0.9	4.9	14.3	46.2	33.2	13.8
col %	33.3	0.0	4.5	9.0	11.3	14.3	17.6	
% tot	0.1	0.0	0.1	0.7	2.0	6.4	4.6	
3	0	1	9	23	51	95	53	232
row %	0.0	0.4	3.9	9.9	22.0	40.9	22.8	14.4
col %	0.0	5.6	20.5	18.9	18.0	13.2	12.6	
% tot	0.0	0.1	0.6	1.4	3.2	5.9	3.3	
Totals	3	18	44	122	283	721	421	1612
col %	0.2	1.1	2.7	7.6	17.6	44.7	26.1	100.0

Table VI-10. Debitage by Raw Material and Cortex.

SOURCE: Material Cortex

	1	2	3	Totals
1	8	32	232	272
row %	2.9	11.8	85.3	16.9
col %	6.0	13.6	18.7	
% tot	0.5	2.0	14.4	
2	30	77	309	416
row %	7.2	18.5	74.3	25.8
col %	22.6	32.6	24.9	
% tot	1.9	4.8	19.2	
3	39	27	190	256
row %	15.2	10.5	74.2	15.9
col %	29.3	11.4	15.3	
% tot	2.4	1.7	11.8	
4	16	71	331	418
row %	3.8	17.0	79.2	25.9
col %	12.0	30.1	26.6	
% tot	1	4.4	20.5	
5	19	8	30	57
row %	33.3	14.0	52.6	3.5
col %	14.3	3.4	2.4	
% tot	1.2	0.5	1.9	
12	1	6	4	11
row %	9.1	54.5	36.4	0.7
col %	0.8	2.5	0.3	
% tot	0.1	0.4	0.2	
13	19	15	145	179
row %	10.6	8.4	81.0	11.1
col %	14.3	6.4	11.7	
% tot	1.2	0.9	9.0	
20	1	0	2	3
row %	33.3	0.0	66.7	0.2
col %	0.8	0.0	0.2	
% tot	0.1	0.0	0.1	
Totals	133	236	1243	1612
col %	8.3	14.6	77.1	100.0

Table VI-11. Debitage by Raw Material and Burning.

SOURCE: Material Burning

	0	1	2	3	Totals
1	168	7	78	19	272
row %	61.8	2.6	28.7	7.0	16.9
col %	15.8	7.7	35.0	8.2	
% tot	10.4	0.4	4.8	1.2	
2	310	10	75	21	416
row %	74.5	2.4	18.0	5.0	25.8
col %	29.1	11.0	33.6	9.1	
% tot	19.2	0.6	4.7	1.3	
3	162	29	14	51	256
row %	63.3	11.3	5.5	19.9	15.9
col %	15.2	31.9	6.3	22.0	
% tot	10.0	1.8	0.9	3.2	
4	290	22	20	86	418
row %	69.4	5.3	4.8	20.6	25.9
col %	27.2	24.2	9.0	37.1	
% tot	18.0	1.4	1.2	5.3	
5	45	6	2	4	57
row %	78.9	10.5	3.5	7.0	3.5
col %	4.2	6.6	0.9	1.7	
% tot	2.8	0.4	0.1	0.2	
12	8	0	0	3	11
row %	72.7	0.0	0.0	27.3	0.7
col %	0.8	0.0	0.0	1.3	
% tot	0.5	0.0	0.0	0.2	
13	83	17	34	45	179
row %	46.4	9.5	19.0	25.1	11.1
col %	7.8	18.7	15.2	19.4	
% tot	5.1	1.1	2.1	2.8	
20	0	0	0	3	3
row %	0.0	0.0	0.0	100.0	0.2
col %	0.0	0.0	0.0	1.3	
% tot	0.0	0.0	0.0	0.2	
Totals	1066	91	223	232	1612
col %	66.1	5.6	13.8	14.4	100.0

Table VI-12. Debitage by Cortex and Burning

SOURCE: Cortex Burning	0	1	2	3	Totals
1	94	18	7	14	133
row %	70.7	13.5	5.3	10.5	8.3
col %	8.8	19.8	3.1	6.0	
% tot	5.8	1.1	0.4	0.9	
2	161	21	16	38	236
row %	68.2	8.9	6.8	16.1	14.6
col %	15.1	23.1	7.2	16.4	
% tot	10	1.3	1	2.4	
3	811	52	200	180	1243
row %	65.2	4.2	16.1	14.5	77.1
col %	76.1	57.1	89.7	77.6	
% tot	50.3	3.2	12.4	11.2	
Totals	1066	91	223	232	1612
col %	66.1	5.6	13.8	14.4	100.0

APPENDIX VII

Field Sack Tables for 41CV111

David L. Carlson

Field Sack (FS) Numbers for 41CV111

FS	UNIT	LEVEL	FEATURE	REMARKS
1	1	1		Lithics
2	1	1		Fauna
3	3	1		Lithics
4	3	1		Fauna
5	2	1		Soil Sample
6	2	1		Lithics
7	2	1		Fauna
8	2	2		Lithics
9	2	2		Fauna
10	1	1		Soil Sample
11	1	1		Flotation Sample
12	2	2		Soil Sample
13	2	0		Lithics - Surface
14	2	2		Flotation Sample
15	4	1		Fauna
16	4	1		Lithics
17	1	2		Fauna
18	1	2		Lithics
19	3	1		Soil Sample
20	3	1		Flotation Sample
21	3	2		Fauna
22	3	2		Lithics
23	1	2		Flotation Sample
24	1	2		Soil Sample
25	4	1		Lithics
26	4	1		Fauna
27	4	1		Soil Sample
28	4	1		Flotation Sample
29	1	3		Lithics
30	1	3		Fauna
31	1	3	1	Flotation Sample
32	1	3	1	Soil Sample
33	2	3		Fauna - Botanical
34	2	3		Soil Sample
35	2	3		Flotation Sample
36	1	3	1	Soil Sample
37	1	3	1	Pollen Sample
38	1	3	1	Flotation Sample
39	1	3	1	Charcoal - C14
40	3	2		Flotation Sample
41	3	2		Soil Sample
42	2	4		Lithics
43	3	3		Lithics
44	3	3		Fauna
45	3	2		Lithics
46	1	3		Lithics - Biface
47	1	3	1	Lithics
48	1	3	1	Fauna
49	1	3		Soil Sample
50	1	3		Flotation Sample
51	1	4		Lithics
52	1	4		Fauna
53	2	4		Flotation Sample
54	2	4		Soil Sample
55	2	4		Lithics
56	3	3		Soil Sample
57	3	3		Flotation Sample
58	4	2		Lithics
59	4	2		Fauna
60	4	2		Soil Sample
61	4	2		Flotation Sample
62	3	3		Lithics
63	3	3		Lithics
64	2	0		Lithics
65	0	0		Lithics

FS	UNIT	LEVEL	FEATURE	REMARKS
66	0	0		Lithics
67	1	3		Charcoal - Scattered
68	3	4		Lithics
69	3	4		Fauna
70	3	4		Soil Sample
71	3	4		Flotation Sample
72	2	5		Flotation Sample
73	2	5		Soil Sample
74	2	5		Lithics
75	2	5		Fauna
76	4	3		Lithics
77	3	4		Lithics
78	1	4		Lithics
79	1	4		Fauna
80	3	4		Fauna
81	3	4		Lithic
82	3	4		Fauna
83	4	3		Soil Sample
84	4	3		Flotation Sample
85	4	3		Lithics
86	1	3		Lithics - Pedernales
87	1	3		Fauna
88	4	4		Lithics
89	1	4		Flotation Sample
90	1	4		Soil Sample
91	1	5		Lithics
92	1	5		Fauna
93	2	6		Lithics
94	2	6		Fauna
95	2	6		Charcoal
96	2	3		Lithics
97	3	5		Lithics
98	3	5		Fauna
99	1	5		Lithics
100	1	5		Fauna
101	3	5		Soil Sample
102	3	5		Flotation Sample
103	1	5		Flotation Sample
104	1	5		Soil Sample
105	1	5		Lithics - Pedestal
106	1	6		Lithics
107	1	6		Fauna
108	2	6		Soil Sample
109	2	6		Flotation Sample
110	2	6		Lithics
111	2	6		Charcoal
112	4	4		Lithics
113	4	4		Lithics - Tool
114	4	4		Lithics - Tool
115	3	6		Lithics
116	3	6		Fauna
117	2	6		Lithics
118	3	6		Soil Sample
119	3	6		Flotation Sample
120	4	4		Lithics
121	4	4		Soil Sample
122	4	4		Flotation Sample
123	4	4		Lithics
124	3	7		Lithics
125	3	7		Fauna
126	2	7		Fauna
127	2	7		Lithics
128	3	7		Lithics
129	3	7		Fauna
130	1	6		Flotation Sample
131	1	6		Soil Sample
132	1	6		Lithics - Biface
133	1	6		Lithics - Chert Nod

FS	UNIT	LEVEL	FEATURE	REMARKS
134	1	7		Lithics
135	1	7		Fauna
136	3	7		Flotation Sample
137	3	7		Soil Sample
138	2	7		Soil Sample
139	2	7		Flotation Sample
140	2	7		Charcoal
141	4	5		Lithics
142	4	5		Flotation Sample
143	4	5		Soil Sample
144	2	0		Lithics - Profile
145	2	0		Fauna - Profile
146	2	7		Lithics
147	5	2		Lithics
148	5	3		Lithics
149	1	7		Flotation Sample
150	1	7		Soil Sample
151	4	6		Soil Sample
152	4	6		Flotation Sample
153	5	3		Fauna
154	5	4	A	Lithics
155	5	4	A	Fauna
156	4	6		Fauna
157	1	7		Lithics - Point
158	2	7	2	Lithics - Brnd LS
159	2	8		Lithics
160	2	8		Fauna
161	2	8		Charcoal - Screen
162	4	6		Lithics
163	5	4	B	Lithics
164	5	4	B	Fauna
165	5	4	B	Charcoal
166	2	7	2	Soil Sample
167	5	4	B	Lithics
168	5	4	B	Fauna
169	5	4	B	Soil Sample
170	5	4	B	Flotation Sample
171	4	7		Lithics
172	4	7		Fauna
173	4	7		Soil Sample
174	4	7		Flotation Sample
175	5	5	B	Fauna
176	5	5	B	Lithics
177	5	5	A	Soil Sample
178	5	5	B	Lithics
179	5	5	B	Fauna
180	6	1		Lithics
181	6	1		Fauna
182	2	0	2	Lithics
183	2	0	2	Fauna
184	2	8		Fauna
185	2	8		Charcoal
186	2	0	2	Lithics - Brnd Rock
187	2	0	2	Soil Sample
188	2	8		Soil Sample
189	2	0	2	Charcoal
190	2	8		Flotation Sample
191	2	8		Charcoal
192	5	5	A	Charcoal
193	5	5	B	Charcoal
194	5	5	B	Lithics
195	5	5	B	Fauna
196	5	5	B	Charcoal
197	2	0	2	Lithics
198	6	1		Fauna
199	6	1		Lithics
200	2	8		Charcoal
201	2	8		Lithics

FS	UNIT	LEVEL	FEATURE	REMARKS
202	6	2		Lithics
203	6	2		Fauna
204	5	5	B	Soil Sample
205	5	5	B	Flotation Sample
206	2	9		Lithics
207	5	5	B	Fauna - Bone
208	5	5	B	Fauna - Bone
209	5	5	B	Fauna - Bone
210	5	5	B	Fauna - Bone
211	2	9		Lithics
212	2	9		Charcoal
213	5	5	B	Lithics
214	5	6	A	Lithics
215	5	6	A	Fauna
216	5	6	A	Charcoal
217	5	6	A	Flotation Sample
218	5	6	A	Soil Sample
219	5	6	B	Lithics
220	5	6	B	Fauna
221	5	6	B	Charcoal
222	6	3		Lithics
223	6	3		Fauna
224	2	9		Charcoal
225	2	9		Soil Sample
226	2	9		Flotation Sample
227	6	3		Lithics
228	5	6	B	Lithics
229	5	6	B	Charcoal
230	5	6	B	Soil Sample
231	5	6	B	Flotation Sample
232	6	3		Soil Sample
233	5	7	4	Lithics - Rocks
234	5	7		Lithics
235	5	7		Fauna
236	6	4		Lithics
237	6	4		Fauna
238	5	7		Charcoal
239	5	7	4	Charcoal
240	2	10		Lithics
241	5	7		Lithics
242	5	7		Fauna
243	6	4		Fauna
244	6	4		Lithics
245	6	3		Lithics
246	6	5		Lithics
247	6	5		Fauna
248	5	7		Soil Sample
249	5	7		Flotation Sample
250	2	10		Flotation Sample
251	2	10		Soil Sample
252	2	10		Charcoal
253	2	0		Lithics - Surface
254	5	8		Charcoal
255	5	8		Lithics
270	5	8		Lithics
271	5	8		Fauna
272	5	8		Charcoal
273	5	8		Soil Sample
274	5	8		Flotation Sample
275	6	6		Lithics
276	6	6		Fauna
277	6	6		Soil Sample
278	6	6		Flotation Sample
279	6	5		Lithics
280	6	5		Fauna
281	5	8		Lithics - Biface
282	5	9		Lithics
283	5	9		Fauna

FS	UNIT	LEVEL	FEATURE	REMARKS
284	6	7		Lithics
285	6	7		Fauna
286	6	7		Lithics
287	6	7		Fauna
288	6	7		Flotation Sample
289	6	7		Soil Sample
290	6	8		Fauna
291	6	8		Lithics
292	5	9		Charcoal
293	5	9		Flotation Sample
294	5	9		Soil Sample
295	6	8		Lithics
296	5	9		Lithics - Point
297	5	9		Lithics - Bif & Tool
298	5	9		Lithics
299	5	10		Lithics
300	5	10		Fauna
301	6	8		Soil Sample
302	6	8		Flotation Sample
303	6	9		Lithics
304	6	9		Fauna
305	6	9		Flotation-Hearth
306	6	9		Flotation Sample
307	6	9		Soil Sample
308	6	10		Lithics
309	6	10		Fauna
310	5	10		Lithics - Point
311	5	10		Soil Sample
312	5	10		Flotatation Sample
313	5	10		Charcoal
314	5	11		Lithics
315	5	11		Fauna
316	5	11		Charcoal
317	6	10		Soil Sample
318	6	10		Flotation
319	5	11	4	Rock Hearth
320	5	12		Lithics
321	5	12		Fauna
322	5	12		Charcoal
323	5	12		Burned Rock
324	5	12		Soil Sample
325	5	12		Flotation

APPENDIX VIII

Field Sack Tables for 41BL148

David L. Carlson

Field Sack (FS) Numbers for 41BL148

FS	UNIT	LEVEL	FEATURE	REMARKS
1	1	1		Lithics
2	1	1		Fauna
3	1	2		Lithics
4	1	2		Fauna
5	3	0		Lithics - Surface
6	1	2		Lithics
7	1	2		Fauna
8	1	3		Lithics
9	1	3		Fauna
10	3	1		Lithics
11	3	1		Lithics
12	3	2		Lithics
13	3	0		Lithics - Surface Co
14	1	3		Soil Sample
15	1	3		Lithics
16	1	3		Flotation Sample
17	1	4		Lithics
18	1	4		Fauna
19	3	3		Lithics
20	3	3		Fauna
21	3	3		Soil Sample
22	3	3		Flotation Sample
23	1	4		Soil Sample
24	1	4		Flotation Sample
25	1	5		Lithics
26	1	5		Fauna
27	1	4		Lithics Cores & BR
28	3	4		Soil Sample
29	3	4		Flotation Sample
30	3	4		Lithics
31	3	3		Lithics
32	3	4		Fauna
33	1	5		Soil Sample
34	1	5		Flotation Sample
35	1	6		Lithics
36	1	6		Fauna
37	1	6		Soil Sample
38	1	6		Flotation Sample
41	3	5		Soil Sample
42	3	5		Flotation Sample
43	3	5		Lithics
44	3	5		Fauna
45	3	6		Soil Sample
46	3	6		Flotation Sample
47	3	6		Lithics
48	3	6		Fauna
49	1	0		Lithics - Point
50				Lithics - General surface

APPENDIX IX

Blood Residue Analyses

Archaeological Investigations Northwest, Inc.

BLOOD RESIDUE ANALYSIS RESULTS

Texas A & M University, sites 41CV111 and 411BL148
AINW project #93/158

Site No.	Lot No.	AINW RAL #	TYPE OF ANTI-SERUM: bovine	chicken	deer	human	rabbit	NIS	NIS v. TWEEN
41CV111	05-2	1	*+	*+	-	-	*+	+	+
"	286-1	2	*+	*+	*+	*+	*+	+	+
"	275-8	3	*+	*+	*v+	*+	*v+	+	++
"	310-1	4	-	-	*v+	-	-	v+	+
"	117-1	5	*+	*+	*v+	*+	*+	+	++
"	296-1	6	-	*v+	*v+	-	-	v+	+
41BL148	35-1	7	*v+	*+	*+	*+	*+	+	++
GEL NO.			843	842	842	843	841	841	845
GEL NO.			**844	**844	**844	**845	**845		**859

TECHNICIANS:
Shirley Barr Williams, Barbara K. Gustafson

KEY: - = negative reaction; + = positive reaction: f+ = faint positive reaction: v+ = very faint positive reaction: ++ = strong positive reaction; ** = repeats; * = reaction was positive; however, positive reaction to NIS indicates that this result is spurious.

(RAL 2:93-158AM)121393sbw

Archaeological Investigations Northwest, Inc.

1034 S.E. 122nd Ave. • Portland, Oregon 97233
FAX (503) 252-5405
Phone (503) 252-5140

December 13, 1993

Alston V. Thoms, Ph.D.
Associate Laboratory Head
Archaeological Research Laboratory
Texas A & M University
College of Liberal Arts
College Station, Texas 77843-4352

Re: Blood residue analysis of six artifacts from site 41CV111 and one artifact from site 41BL148, for the Fort Hood '92 Field School.
AINW-RAL Letter Report #93/158

Dear Dr. Thoms,

Archaeological Investigations Northwest Inc. (AINW) conducted blood residue analysis for you on six artifacts from site 41CV111, and one artifact from site 41BL148 for the Fort Hood '92 Field School. All seven artifacts are large dart points, and all seven artifacts were made from cryptocrystalline silicates (CCS). At your request we used bovine, chicken (to represent avian), deer, human, and rabbit antisera for the blood residue analysis. I conducted the cross-over electrophoresis tests during the last two weeks of November, 1993. Enclosed you will find a chart showing the results of our analysis and a brief report on our laboratory procedures.

All five antisera used are Organon Teknika/Cappel forensic antisera. None of the antisera react outside of the family of animals represented, but do react well within those families. For example, the deer antiserum reacts with white-tail deer, mule deer, elk, and moose, but does not react with other artiodactyl groups.

Standard procedures for our analysis include first testing the specimens (residues in solution extracted from the artifacts) against a non-immune serum (NIS), in this case a solution prepared from goat serum and 5% ammonia solution, to determine if there are any contaminants or extraneous proteins which might give false positive results. The NIS is not an antiserum and the specimens should not react to it. If positives are detected with this procedure, the specimens then have an equal volume of a 1% solution of a non-ionic detergent (TWEEN 80, Sigma Chemical Corp.) added to them to increase specificity and break the non-specific bonds, and are run again. If the specimens still react to the NIS after the addition of the non-ionic detergent, any reactions of those specimens to the antisera must then be discounted.

In the initial NIS and antiserum run all seven specimens had positive reactions for the NIS and several of the antisera. The NIS was repeated with TWEEN 80 added to the specimens, and all of the specimens still reacted to the

NIS, indicating that the positive reactions to the antisera on those specimens were spurious (See items marked with an asterisk on the enclosed chart.).

Similar results to those observed on these artifacts were obtained by AINW on recently made and used experimental artifacts. Those that tested positive to NIS after the addition of the non-ionic detergent had been hafted using a mixture of pitch and charcoal. The liquid specimens extracted from those particular experimental artifacts appeared black or dark brown in solution. The solutions from most of your specimens which tested positive for the NIS were also very dark in color; in fact, they were visually almost identical to the solutions of the experimental artifacts which reacted similarly. Although blood residues were not identifiable on these artifacts, the similarity in color of the liquid specimens to those of the experimentally produced artifacts, together with the strong positive reaction to the NIS, suggest that the artifacts may have been hafted with similar mastic (i.e., charcoal and pitch). We have seen similar reactions with other archaeological artifacts before, but usually on smaller and relatively late period arrow points. This is the first time we have seen this kind of reaction to such an extent on large dart points.

The liquid specimens obtained from these artifacts have been frozen for storage, and will be retained for one year should you wish any additional tests. If you have any questions about the analysis or the enclosed report, please call me or Dr. John Fagan.

Sincerely,

Shirley Barr Williams
Senior Blood Residue Technician

Enclosures

(RAL 2:RAL93158)121393sbw

ARCHAEOLOGICAL INVESTIGATIONS NORTHWEST
RESIDUE ANALYSIS LABORATORY

Laboratory Methods and Procedures

Blood residue analysis performed at Archaeological Investigations Northwest's (AINW) Residue Analysis Laboratory uses the technique of cross-over electrophoresis, a form of immunoelectrophoresis to analyze surface residues extracted from stone artifacts and other objects. Cross-over electrophoresis uses an agarose gel base with known antisera as reactants to identify the types of animals that left protein residues on the surface of tested artifacts.

Antisera are used as reactants in determining the identity of proteins extracted from artifacts, and are obtained from certified laboratories. An antiserum is made by injecting a laboratory animal, most commonly a goat or rabbit, with a protein from some other animal. The injected animal's immune system reacts with the foreign substance to produce a new substance, an antibody, that will react with the originally introduced antigen (protein). All vertebrates produce antibodies (immunoglobulins) as part of their immune systems. In solution these antibodies recognize specific foreign proteins (antigens), bind with them, and then precipitate out of solution. This antigen-antibody reaction and subsequent precipitation is a well known and useful property in medical and forensic research (Gaensslen 1983), and is the basis of cross-over electrophoresis.

Antigen-antibody reactions can be highly specific, although proteins from closely related species share enough of the same binding sites on the immunoglobulin molecule to react in similar ways. (Immunoglobulins are large Y-shaped proteins with binding sites located on the V portion of the Y.) Quantification of this type of reaction with sophisticated tests such as radioimmunoassay have been used to determine taxonomic relationships between living and extinct animals (for example, see Lowenstein [1980, 1985]), although that is outside the scope of cross-over electrophoresis.

In the AINW Residue Analysis Laboratory, residues to be tested are extracted from the surface of artifacts placed in a pre-washed tray. The extraction solution used is a 5% ammonia solution. This type of solution has been used for similar testing in forensic medicine (Kind and Cleevely 1969; Dorrill and Whitehead 1979), and generally shows better lifting power for proteins than either distilled water or saline solution, which can also be used. The extraction solution is pipetted underneath the artifact and the tray is floated in an ultrasonic cleaner for five minutes. The artifact and extraction solution are then placed on a rotator for five minutes. The extracted solution is then drawn off and stored in an airtight microcentrifuge tube. It is refrigerated if testing is to be done within a week, or frozen if testing is to be done a week or more later. Cross-over electrophoresis uses approximately five microliters (one-millionth of a liter) of the extracted surface residues per test, which is a great advantage in archaeological work where there is usually only a small amount of residual protein available for testing. Details of the extraction process, such as amount of solution used, extraction time, side tested, and type of solution used, are recorded for each artifact, along with data from the microscopic analysis if that step is performed.

To perform the electrophoresis, an agarose gel on gel bond (from Sigma Chemical Company and FMC Corporation, respectively) is prepared, which is a thin, flat sheet. Pairs of wells, or depressions, are punched out of the gel. Several liquid specimens extracted from the surface of the artifacts, plus positive and negative controls, are placed in the wells on each gel. Each pair of wells is a test for one artifact against one antiserum: one known antiserum is placed in a well opposite a well containing the solution extracted from the surface of the artifact. The paired specimens are situated on the gel bond in such a way that when placed in the electrophoresis, the extracted solutions to be tested are in wells oriented near the cathode and the antisera are in the wells near the anode. The agarose must have a high electroendosmosis rating.

Each gel is numbered and the specific antiserum and the extracted solution from each specific artifact are recorded on a laboratory form (Cross-over Electrophoresis Record) for each electrophoresis run. The results of each run, including the non-immune serum (NIS) and controls for each antiserum used, are also recorded on the laboratory record form for each group of artifacts analyzed. The Comparative Results form lists the artifact number, our assigned specimen number (if different than the submitted artifact number), our tracking number for the prepared gel, and the antisera used for the test. This form shows both the results of the analysis (negative and positive reactions) for the solutions extracted from the surfaces of the artifacts and the results of the non-immune serum tests.

Electrophoresis is done by placing the prepared gel between two troughs containing barbital buffer (obtained from Sigma Chemical Company). Cotton flannel wicks are placed in the liquid buffer and contact is made with each end of the sheet-like gel to form a complete circuit. Electrodes in each trough are connected to a power source for the electrophoresis operation. An electric current is applied across the gel (130 volts) for 40 minutes, and the high endosmosis of the agarose allows serum gamma globulins (IgG) in the antiserum (in the anodal well) to move towards the cathode while other proteins (albumin, and alpha and beta globulins) in the extracted solution (in the cathodal well) move towards the anode. When a positive reaction occurs, a protein precipitate forms between the two wells and may be visible as a white line or arc (Culliford 1971). This indicates a match between a known antiserum and unknown residue specimen, and occurs when the antigen in the specimen and antibodies in the antiserum bind and precipitate out of solution. Although this precipitate shows up as a white line between the two reactants, it may not be visible until stained with dye. After blotting and an overnight saline bath, the gel is dried and stained with Coomassie blue (a standard protein stain) to facilitate the viewing of positive reactions and as a permanent record of the cross-over electrophoresis results. The gel is archived at the AINW Laboratory.

A cross reaction (not to be confused with the cross-over electrophoresis reaction), or anomalous positive, sometimes occurs when an antibody recognizes the shape, rather than the chemical composition, of an antigen and partially reacts to it. Non-specific reactions to other proteins present in the extracted solution may occur as well. Therefore, in order to rule out false positives, extracted solutions from artifacts are run against a non-immune serum (derived from dried blood and not an antiserum) as part of a protocol to eliminate any cross reactions. If this step results in all negative reactions, then the extracted solution from the surface of the artifact is assumed to provide valid results during the cross-over procedures with antisera. However, if a positive reaction to the non-immune serum occurs, then a second step is needed to confirm or negate the cross reaction. In this second step, a 1% solution of a non-ionic detergent (Tween 80, obtained from Sigma Chemical Corporation) is added to each extracted solution; the addition of the detergent solution leads to a stronger binding of antigen by breaking weak, non-specific bonds (for example, see Newman 1990). The extracted solutions from the artifacts' surface are then rerun against the non-immune serum and if all negative results are obtained, then the positive results of the following cross-over reactions with antisera can be accepted (Newman and Julig 1988). If, however, the reactions to the 'cleaned' non-immune serum are positive, then the positive reactions of any subsequent cross-over electrophoresis with antisera reactants are not accepted.

The electrophoresis unit of the Residue Analysis Laboratory at AINW uses a Heathkit regulated H.V. power supply (model #EIA-416, 120/240 VAC, 50-60 Hz, 150 watts) which supplies the constant 130 volts needed for the electrophoresis. An acrylic chamber for the electrophoresis has removable troughs for holding the buffer, and the electrodes built into the troughs are made of platinum wire to prevent electrons from the metal from entering the solution. The Residue Analysis Laboratory uses an electronic scale that meets specifications of 0.01 gram accuracy. Other equipment includes an Olympus binocular microscope (240X maximum magnification), an ultrasonic cleaner, and a rotomix rotator.

Forensic antisera are obtained from Organon Teknika Corporation, Sigma Chemical Company, and Nordic Immunological Laboratories. The type of antisera used has been solid phase absorbed to prevent cross reactions. As noted above, this type of antiserum will react not only with similar proteins from the target animal, but with proteins from closely related species as well. The forensic antisera used with this type of electrophoresis will give positive reactions at approximately the family level. For example, deer antiserum should react with blood proteins from other cervids such as moose or elk, but not with bovine proteins.

Although not performed for this particular analysis, artifacts may be examined under a binocular microscope to identify the location of residues. Although microscopic examination is not always desired or necessary, in many cases tissues, hair, and other residues may be identified through microscopic examination. In some cases, residues which were not visible under the microscope may be identified using cross-over electrophoresis. Nevertheless, microscopic examination can be used as a means of screening a collection to identify those artifacts with visible residues.

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