THE CLEMENTE AND HERMINIA HINOJOSA SITE, 41 JW 8: A TOYAH HORIZON CAMPSITE IN SOUTHERN TEXAS

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FOREWORD

> Although archaeologists have all too often been inspired by idle curiosity or the desire to acquire objects for their own sake, it remains profoundly true that the only scientific purpose of digging things up is to assemble material from which to interpret the past.
>
> Grahame Clark
> **Archaeology and Society**, 1939

The results of an intensive field and laboratory research effort of site 41 JW 8, the Clemente and Herminia Hinojosa site, in Jim Wells County, southern Texas, are presented in this monograph. The investigations were based on a research design that has now provided new information on several facets of the extensive Late Prehistoric occupation at the site. Additionally, the researchers have been able to integrate these findings with materials of similar date from other sites in the region.

The present study builds on more than 15 years of research into the sites and materials of the Late Prehistoric era in south Texas. As late as the mid-1960s, little was known about the prehistory of the region, and the Late Prehistoric was known only from surface finds of diagnostic arrow point types (the occurrence of ceramics as part of Late Prehistoric material culture in southern Texas was not recognized until 1968). During the 1970s, substantial advances were made in our knowledge of the south Texas Late Prehistoric. Some links to the Late Prehistoric of central Texas could be noted, but with further study, the regional materials began to assume an identity of their own. Variations in Late Prehistoric cultural patterns could be documented from the Dimmit and Zavala Counties area (where sites were studied by T. C. Hill, Jr., and this writer) across south Texas to the coast.

A wealth of information on the Late Prehistoric came to light during archaeological research in the Choke Canyon Reservoir basin in the late 1970s and early 1980s. Reports published by Grant Hall, Lynn Highley, Ken Brown, and others, have given new dimensions to our developing concepts of the Late Prehistoric period. It was indeed fortunate that the research program at Choke Canyon was underway at the time the investigations at 41 JW 8 were carried out. This created an environment in which several archaeologists working on sites of a related time period could exchange information and ideas; as a result, interpretations of data derived from both projects have benefited.

Stephen Black's report on the research at 41 JW 8 constitutes a significant addition to, and synthesis of, our knowledge of the Late Prehistoric in the region. The materials found at the site have been described in detail, the studies by various consultant experts have been added, and a set of very useful, and in some cases, far-reaching interpretations have been offered. I believe that this volume will allow future researchers to develop and address a variety of interesting questions involving the Late Prehistoric period in southern Texas and in adjacent areas. Indeed, as with any good archaeological report, this study suggests more problems and questions than it resolves.

Thomas R. Hester, Principal Investigator

ABSTRACT

Site 41 JW 8 is a major prehistoric occupation site located along Chiltipin Creek in Jim Wells County, in southern Texas. Excavations at the site in 1981 evidenced a single component that can be linked with the Toyah horizon. Radiocarbon dating of three fire features, although not without problems, places the occupation to around A.D. 1350-1400. The excavation of 82 m^2 clustered in blocks produced an abundance of well-preserved data. Special studies of faunal and botanical remains and analyses of artifacts and cultural refuse distribution provide the basis for addressing various research problems. The site is shown to be a base camp where hunting and animal processing were major activities. Contrary to earlier interpretations, deer were more important than bison, although the remains of over forty other species suggest a diverse subsistence base. The site is thought to have been occupied while Chiltipin Creek was a spring-fed reliable water source surrounded by a mosaic of grassland, riparian, and thorny brush vegetation. A review of regional Late Prehistoric sites suggests that the site represents an occupational pattern--the Toyah horizon--that spread from central Texas in the 14th and 15th centuries during a period of increased rainfall.

KEYWORDS: South Texas, Toyah Horizon, Late Prehistoric, Radiocarbon Assays, Environmental Conditions, Bone Cluster Features, Rock/Charcoal Features, Macrobotanical Remains, Vertebrate Faunal Remains, Bison, Deer, Freshwater Bivalves, Soils Chemistry, Perdiz Arrow Points, Beveled Knives, End Scrapers, Bone Tempered Ceramics

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I. INTRODUCTION

The Clemente and Herminia Hinojosa site, 41 JW 8, is a prehistoric Indian campsite located on Chiltipin Creek in Jim Wells County about 40 miles west of Corpus Christi, Texas. This report presents the results of an archaeological project conducted at 41 JW 8 by members of the Center for Archaeological Research, The University of Texas at San Antonio (CAR-UTSA). The author served as project archaeologist and directed the field work and subsequent analysis. All of the illustrations in this report were done by the author, with the exception of the artifact photographs (J. Poindexter) and the SEM biosilica photographs (R. Robinson).

The site is named after the late Clemente and Herminia Hinojosa, former landowners of the property on which the site is located. The property is currently owned by Mrs. Eva Jimenez, daughter of Clemente and Herminia Hinojosa. Throughout the remainder of this report the site will be referred to in an abbreviated fashion as the Hinojosa site or simply as 41 JW 8.

PREVIOUS INVESTIGATIONS

The Hinojosa site was first recorded in 1974 during an archaeological survey of properties along the Chiltipin and San Fernando Creeks that were to be affected by flood control projects sponsored by the Soil Conservation Service (SCS; Hester and Bass 1974). The site was recommended for intensive site survey, including mapping, surface collection, and testing, in order to evaluate the site's potential eligibility for nomination to the National Register of Historic Places.

In 1975, members of the Center for Archaeological Research returned to 41 JW 8 for a week of intensive survey and testing (Hester 1977). The field work was directed by Feris A. Bass, Jr. The 1975 investigations consisted of surface collection, plane table mapping, and the excavation of a number of test units. Twelve 2-m^2 units were excavated to depths ranging between 15 and 110 cm below the surface. In addition, a vertical cut was made into the bluff edge adjacent to the site (Hester 1977). In most units cultural debris was concentrated in the upper 30 cm. In the "bone bed" area (Units K and L), a hearth feature and a concentrated deposit of bone continued to a depth of about 56 cm. Burned rock or caliche clusters were observed in several test units in the upper 30 cm. These were described as "disturbed." Two lower clusters were encountered, the one mentioned previously in Unit L and "a scatter" in Unit B at 75-95 cm.

Hester (1977:33-37) suggested the following preliminary interpretations concerning 41 JW 8: (1) it was a single component Late Prehistoric campsite dating to approximately A.D. 1300; (2) the site was seasonally occupied during the winter to early summer over a few years of at most a few decades; (3) the site was primarily a bison-hunting camp; and (4) the "bone bed" represented an erosional gully used as a refuse discard area and may, in addition, represent a bison processing locality.

The Hinojosa site was recognized during the 1975 project as an important and significant prehistoric archaeological site. Subsequently, the site was nominated to the National Register of Historic Places. Later in 1975, the Hinojosa site, 41 JW 8, was officially designated as an archaeological site on the National Register of Historic Places in recognition of the significance of the site. The 1977 report called attention to the fact that the site was located within the detention pool and on the edge of the 50-year sediment pool of the proposed floodwater structure on Chiltipin Creek (Floodwater Retarding Structure No. 5). Due to the potential for site damage during reservoir construction or through long-term inundation by floodwaters, additional archaeological work was recommended at the site.

1981 INVESTIGATIONS

In the spring of 1980, the National Park Service, Interagency Archeological Services-Denver, issued a Request For Proposals (RFP 530050) for further archaeological work at the Hinojosa site. The Center for Archaeological Research submitted a proposal dated July 21, 1980 (Hester, Eaton, and Black 1980). The proposal was accepted, and Contract No. C53007(80) was entered into by the CAR-UTSA and the National Park Service, Interagency Archeological Services-Denver. Dr. Thomas R. Hester served as principal investigator, and Jack D. Eaton served as co-principal investigator. The initial contract called for work to begin in the fall of 1980. Access problems caused the work to be postponed for a year.

The access problems stemmed from the change of ownership of the Hinojosa property. At the time of the 1975 testing at 41 JW 8 the ownership of the property was in transition following the death of Clemente Hinojosa. Subsequently, the property was divided between the Hinojosa heirs, and several of the parcels were sold. The CAR crew arrived in Alice (county seat, Jim Wells County) in November 1980 to begin work at the site. At that time the site was believed to lie on the property of Francis Ball. Mr. Ball had been contacted and had given his permission for the archaeological work. It was soon discovered that in fact the site was located on an adjacent property owned by Mrs. Eva Jimenez of Corpus Christi, daughter of Clemente and Herminia Hinojosa.

Efforts to obtain permission from Mrs. Jimenez were hampered by misunderstandings arising from the 1975 SCS project. In addition, a lively oral tradition concerning buried treasure on the property had been maintained by the Hinojosa family for many years. The family was unaware in 1980 of the scientific significance of the prehistoric deposits at 41 JW 8. Thus, the negotiations to obtain permission from Eva Jimenez took many months. A borderlands history professor, Dr. Gilbert Hinojosa (no relation), from UTSA served as mediator. Ultimately, Eva Jimenez agreed to allow the excavations subject to certain provisions. A family member was to keep watch on the work to insure that any valuables found would be properly reported. In addition, Mrs. Jimenez would retain ownership of any valuable materials recovered from the site. These and other provisions insuring that the work would be done promptly and that the excavation area would be backfilled were specified in a formal agreement signed on September 11, 1981.

Field work at the Hinojosa site began in early October 1981. The work continued through the middle of January 1982. The author served as field director and project archaeologist. A. Joachim McGraw served as assistant project archaeologist and was primarily responsible for the laboratory processing. Beverly Marshall Van Note served as laboratory assistant. The primary field crew consisted of Tom Miller, Cecil Peel, Mike Woerner, and Courtenay Jones. A total of approximately 2024 man hours was spent during the 1981 field investigations (including the two weeks in January 1982). Some 39 m^3 of soil were removed from 82 m^2 of excavation units during the 1981 season. The excavations centered on an irregularly shaped main excavation block referred to as the "Wagon Trail Area." Numerous cultural features and hundreds of artifacts were recovered from the site. Most of the project research goals were met or exceeded during the 1981 season, as will be discussed in the following sections of this report.

TO THE READER

A number of conventions are adhered to in this report. All site numbers are given in the trinomial system, wherein the first two digits refer to the state (Texas is 41), the second two characters refer to the county within the state (Jim Wells County is JW), and the final digits refer to the chronologic sequence of officially recorded archaeological sites on file at the Texas Archeological Research Laboratory at The University of Texas at Austin. In other words, 41 JW 8 is the eighth archaeological site officially recorded in Jim Wells County, Texas.

The metric system is used throughout this report for all measurements unless specifically noted otherwise. The following metric abbreviations are used: cm = centimeter, mm = millimeter, m = meter, km = kilometer, mg = milligram, g = gram, kg = kilogram, l = liter, ml = milliliter, cc = cubic centimeter, nm = nanometer, μm = micrometer.

A number of other abbreviations are used in the report. These include: UTSA = The University of Texas at San Antonio, CAR = Center for Archaeological Research, NPS, IAS-D = National Park Service, Interagency Archaeological Services-Denver, SCS = Soil Conservation Service, WTA = Wagon Trail Area, L. = level, Z. = zone, Col. = column, N = north coordinate, E = east coordinate, NPS = Noise Pit South, WFNP = Wheat Field Noise Pit.

II. RESEARCH DESIGN

The 1981 investigations at 41 JW 8 and the subsequent analysis were carried out according to research plans specified in the proposal (Hester, Eaton, and Black 1980). Those plans addressed both the RFP specifications and the research interests of the principal investigator and the project archaeologist. Field conditions made certain minor changes in the research plans necessary, as will be discussed. The overall research design will be discussed in four segments: major problems at 41 JW 8, research hypotheses, excavation strategy, and additional problems.

MAJOR PROBLEMS AT 41 JW 8

The proposal specified seven problem areas to be addressed by the investigations at 41 JW 8. These problem areas focused on questions raised by the 1975 testing and questions pertinent to regional problems.

1. Site Limits: The boundaries of the site needed further definition, especially the southern limits.

2. Site Depth: Were earlier components present below the extensive Late Prehistoric deposits?

3. Bone Bed: What did the "bone bed" actually represent in terms of Late Prehistoric activities at the site?

4. Seasonality: Was the site exclusively occupied during the winter and spring months?

5. Occupational Span and Frequency: Over what periods of time was the site occupied, how intensively, and at what intervals? How did these relate to the regional cultural-historical sequence? Did the rock clusters and bone bed, along with other aspects of intrasite variability, help solve this problem?

6. Faunal Exploitation: Did the faunal materials actually indicate a bison emphasis? Were the faunal remains of species expected in the immediate site vicinity? What kinds of exploitative patterns were represented?

7. Cultural Pattern: How did the Late Prehistoric component compare with the regionally defined cultural patterns for the period? What was the nature of the tool kit? What kind of functional or adaptive pattern is indicated (e.g., bison hunting[?]).

RESEARCH HYPOTHESES

In an effort to answer the previously stated questions concerning the Hinojosa site, four research hypotheses were formulated. Following each hypothesis is a list of expectations that were to be tested through the proposed field and laboratory methodology. These hypotheses were based on previous work at the site, previous work in the region, and the personal experience of the principal investigator and the author.

HYPOTHESIS #1: SITE FUNCTION

The majority of the cultural debris present at 41 JW 8 is related to the Late Prehistoric component. The Late Prehistoric component resulted from a pattern of repeated seasonal occupations emphasizing a specialized resource. Specifically, Late Prehistoric groups periodically visted 41 JW 8 during the winter-spring months while herd animals (bison, and to a lesser extent, antelope) were present in the general area. While men hunted herd animals around and away from the base camp, women and children stayed near the camp and hunted and gathered a variety of small animals and botanical resources which supplemented the less reliable herd animal resources.

Expectations:

1. Block excavations would reveal similar overlying features, including bison processing areas, refuse discard areas, cooking areas, and occupational floors (indicative of repeated occupations).

2. Meat weight analysis would show bison and, to a lesser extent, antelope were the most important food resources (bison emphasis).

3. Minimum individual analysis would illustrate a large number of smaller faunal species (supplemental resources).

4. Bison bone distributional studies would reveal processing patterns that served to maximize the resource (see Hypothesis #2).

5. Faunal analysis of species present and age groups present would indicate a winter-spring occupation (seasonality).

6. Continuation of select excavation units below the upper 50-60 cm containing exclusively Late Prehistoric material might evidence occasional earlier occupation. The earlier occupation if present would not follow the seasonal bison hunting pattern and would be of a much lesser extent.

7. Upon comparison of the Late Prehistoric cultural material to other Late Prehistoric sites in the region the closest similarities would be found to the north in sites within the proposed "bison corridor" (see Section XI). Sites south, east, and west of 41 JW 8 would evidence fewer similarities, although some contact with coastal groups was expected.

HYPOTHESIS #2: BISON-HUNTER'S CHIPPED STONE TOOL KIT

During the Late Prehistoric period, within the "bison corridor" in portions of south and central Texas, a specific bison hunting and processing technology existed utilizing a distinctive chipped stone tool kit. The chipped stone tool kit is the preserved portion of a total tool kit which would have included wood, leather, and other perishable components. The chipped stone tool kit consisted of **Perdiz** arrow points, small unifaces (end scrapers), and beveled bifaces (knives). **Perdiz** points functioned as hafted projectile points and were used to hunt and kill bison. The end scrapers were probably hafted and were used to deflesh bison hides. The beveled bifaces were knives that were probably hand-held and used to butcher bison (cutting hide, flesh, and sinew).

Expectations:

1. All three tools would be found in direct and indirect association with bison remains, although end scrapers might be found in clusters away from the main butchering localities (separate activity area).

2. All three tools have distinctive morphologies and would exhibit similarly distinctive wear and breakage patterns consistent with the hypothesized functions.

HYPOTHESIS #3: FUNCTION OF CLUSTER FEATURES

Burned rock or caliche cluster features have been accorded very little careful examination in most south Texas site excavations. The cluster features at 41 JW 8 represent several different functional activities, including cooking hearths, warmth hearths, and discard piles. These might have occurred as intact features buried fairly rapidly, or dispersed features exposed on the surface for a period of time, or purposefully scattered. Cooking and warmth hearths would have served as focal points for specific subgroups such as family activity areas.

Expectations:

1. Systematic field excavation methods, recording, and subsequent laboratory analysis of cluster features would reveal subtle and perhaps obvious differences related to function. The following types of clusters were expected to occur:

   a. Hearths would evidence direct burning (stained soil), charcoal and/or ash, and a high percentage of burned flakes inadvertently present around the hearth. Cooking hearths as opposed to warmth hearths would also evidence charred food resources such as seeds or bones and very high phosphate levels.

   b. Discard piles from hearths or possible stone boiling would evidence lack of direct burning, i.e., absence of charcoal, ash, and charred food remains; and low or average percentages of burned flakes. In addition, discard piles would tend to be more dispersed or scattered than hearths.

2. Analysis of artifact patterning around hearths would reveal functionally related clusters such as flintknapping or plant processing areas. Similar patterns would not occur around discard piles.

HYPOTHESIS #4: THE "BONE BED" ACTIVITY AREA

The "bone bed" area of 41 JW 8 functioned as an activity area where bison butchering and bone disposal occurred. Bison butchering or processing occurred on the edges or banks of a southwest to northeast trending erosional gully. The gully floor was used as a refuse discard dump for bison bone, other bone, and broken tools.

Expectations:

1. Careful exposure and recording of the "bone bed" would reveal in plan and profile an erosional gully.

2. The gully would contain refuse, as previously mentioned. Partially articulated bison bone segments might have been present.

3. Adjacent to the gully but at a slightly higher elevation (on the gully banks) the bone concentration would be noticeably less. Some discarded butchering tools might have been present. Some rock clusters might have occurred which served as warming fires rather than cooking fires (see Hypothesis #3).

EXCAVATION STRATEGY

In order to address the major site problems and most effectively test the hypotheses, the general approach to the excavation strategy was carefully considered. In general, the proposal called for the excavation of specific portions of the site, emphasizing careful and consistent excavation techniques, recording procedures, and collection of supplementary nonartifactual data. Rather than maximizing the amount of excavated area at the expense of adequate analysis, the proposal called for the excavation of only as large an area (and obtain as large a sample) as could be thoroughly analyzed.

The consideration of the specific excavation strategy to be employed at 41 JW 8 took into account two important RFP specifications. Section IV,B of the RFP stated that "If in the event that less than 100% of the available data from the site is to be recovered, the contractor must insure that the sample drawn is both adequate and representative." Given the monetary limits set forth in Section VIII,A of the RFP ($50,000), it was obvious that only a relatively small fraction of the site could be excavated. The site surface area had been estimated at 3000 m^2 (Hester 1977:6). The area of the site containing subsurface (buried) deposits was unknown but probably covered an area of less than 3000 m^2.

The questions of sample adequacy and representativeness are complex problems that have no fixed answers. A review of regional and North American approaches to sampling finds a great deal of controversy and a wide range of approaches. Most discussions of sampling are oriented toward surface surveys, although similar techniques can often be applied to excavation. One of the better discussions of sampling strategy is Mallouf's review of the literature in Mallouf, Baskin, and Killen (1977:89-93). The most important schools of thought can perhaps be divided into two groups: those who favor probability or statistical sampling (cf. Redman 1974; Mueller 1974) and those who favor judgement sampling (cf. Jelks 1975). The view taken here is that judicious, nonrandom, systematic procedures of exploration and observation are far more useful in solving archaeological problems than random sampling particularly with regard to the problems at 41 JW 8. This is especially apparent when one considers that purported random samples are not truly random, as Jelks (1975:6) points out. A true random sample can only be obtained if and only if the total sample (sample universe) is known. The only way that the sample universe of a buried site can be determined is by excavation of the entire sample. Otherwise, the random sample is only a sample of an arbitrary grid system, NOT the cultural deposits under consideration.

In south Texas, two principal excavation methods have been employed: <u>sondage</u> or test pit excavations, and block or horizontal excavations. The most often used technique is the sondage method which, while useful for preliminary testing, results in comparatively little information on spatial patterning. Block excavations, also referred to as open area or horizontal excavations (Hester, Heizer, and Graham 1975:76-78), have been increasingly used in south Texas and elsewhere. By excavating a block of contiguous excavation units, one is sometimes able to detect spatial relationships such as that existing between hearth features and related activity areas which are not apparent in small test units. An example of the usefulness of this technique is provided by 41 LK 67, a site excavated by the CAR-UTSA during the Nueces River Project (Brown et al. 1982). By opening up a large area, archaeologists were able to plot artifact patterning in relation to small rock clusters or hearths. Similar techniques have also been successfully employed at the Mariposa site (Montgomery 1978) in Zavala County, the Loma Sandia site in Live Oak County, and at several sites in Bexar County, such as the Panther Springs Creek site (Black and McGraw 1985).

The proposal called for the use of the block excavation technique (discussed previously) at 41 JW 8. The 1975 testing had revealed areas of the site with a high probability of intact cultural features. Opening a large excavation block in one or more of these areas would allow the exposure of several cultural features and related artifact patterning. The "bone bed" was one area of the site with proven research potential (see Hypothesis #4). An excavation block in this vicinity, containing a minimum of 16 contiguous square meter units, was proposed. In order to address the problem of site limits, especially in the southern periphery, additional testing in the form of shovel testing and 2-m^2 units was proposed. If another area containing significant deposits was revealed during the additional testing, a second block of at least 16 m^2 would be excavated. Flexibility of the exact excavation strategy was considered an absolute necessity. In order to emphasize the exposure and recording of cultural features, the features would have to be followed by opening more excavation units. It was recognized that at the Hinojosa site, like at most sites with limited prior testing, the exact configuration of the excavation areas should be determined as the excavations progressed.

Additional methodological aspects of the site research design are discussed in Section III.

ADDITIONAL PROBLEMS

Several problems were addressed during the analysis that were not considered in the research proposal. These represent research questions or hypotheses that were formulated as the analysis progressed. The two problems are listed here and are further discussed elsewhere in this report.

1. Lithic Sources: Where were the source areas for the lithics at the site? How far was the material transported? Was the material brought in as intact cobbles or flake blanks?

2. Fawcett's Neck Width Hypothesis: The author became aware of a reference to 41 JW 8 during the analysis phase of the project (Fawcett 1978). Fawcett has hypothesized that projectile point neck width measurements could be used to estimate the occupation date of single components in southern and central Texas. This hypothesis was initially tested using data derived from the 1975 testing at 41 JW 8 (Hester 1977). Does the 1981 projectile point data support Fawcett's hypothesis? Can the hypothesis be used to estimate the length of occupation for the Hinojosa site? Is the hypothesis useful for dating other sites in the region?

III. RESEARCH METHODS

A variety of field, laboratory, and analytical techniques were employed during the current research project. Descriptions of and references to many of the techniques can be found in standard archaeological texts, such as Hester, Heizer, and Graham (1975), Fladmark (1978), and Hole and Heizer (1973) to name but a few. In this section, the specific techniques used during the current project are discussed in enough detail to clearly describe how the data were obtained, processed, and analyzed. In some cases the research methods actually used during the project are contrasted with the planned methods outlined in the proposal. In these cases the reasons for deviation from the proposal are discussed.

FIELD METHODS

The research methods employed at 41 JW 8 during the 1981 season vary somewhat from the planned methods discussed in the proposal. Some changes resulted from the year delay in beginning the field season and the expenses involved in negotiating access. Other changes were caused by unexpected field conditions and problems in relocating the 1975 grid system, as will be discussed.

EXCAVATION CONTROLS

When field work began in early October 1981, the site had undergone a number of changes since the 1975 testing. As mentioned, the property had been divided into several smaller tracts, some of which were newly fenced. The fencing and new property lines led to several of the changes affecting the site. In 1975, an old road leading from the ruins of the Amargosa Stage Stop east of the site (Fig. 1) could still be driven. By 1981, the road was fenced off in several places, heavily overgrown, and washed out on the hillside east of the site. Heavy secondary growth had covered the road adjacent to the site and had extended some 3-5 m out from the fence line (shown parallel to the 1981 main baseline in Fig. 1) into the plowed field. Thus, one of the first tasks undertaken at the site was to clear the undergrowth.

The brush clearing was accomplished with machetes, a chain saw, and a heavy duty Green Machine® equipped with a brush blade. The Green Machine® proved to be a very effective tool for clearing most of the mesquite, whitebrush, huisache, briar, and other brush species. The old road (herein referred to somewhat euphemistically as the "wagon trail") was recleared along with the edge of the field and the fence corner area where the 1975 datum was located. In addition, several east-west transects were cleared between the field and the bluff edge.

After the site was recleared, a search was begun for the 1975 datums and excavation units. This was complicated by two factors: (1) the 1975 alidade map did not accurately tie-in the 1975 grid system with identifiable landmarks; and (2) the primary 1975 site datum was a wooden stake. As is apparent in Figure 1, the fence line running the length of the site has

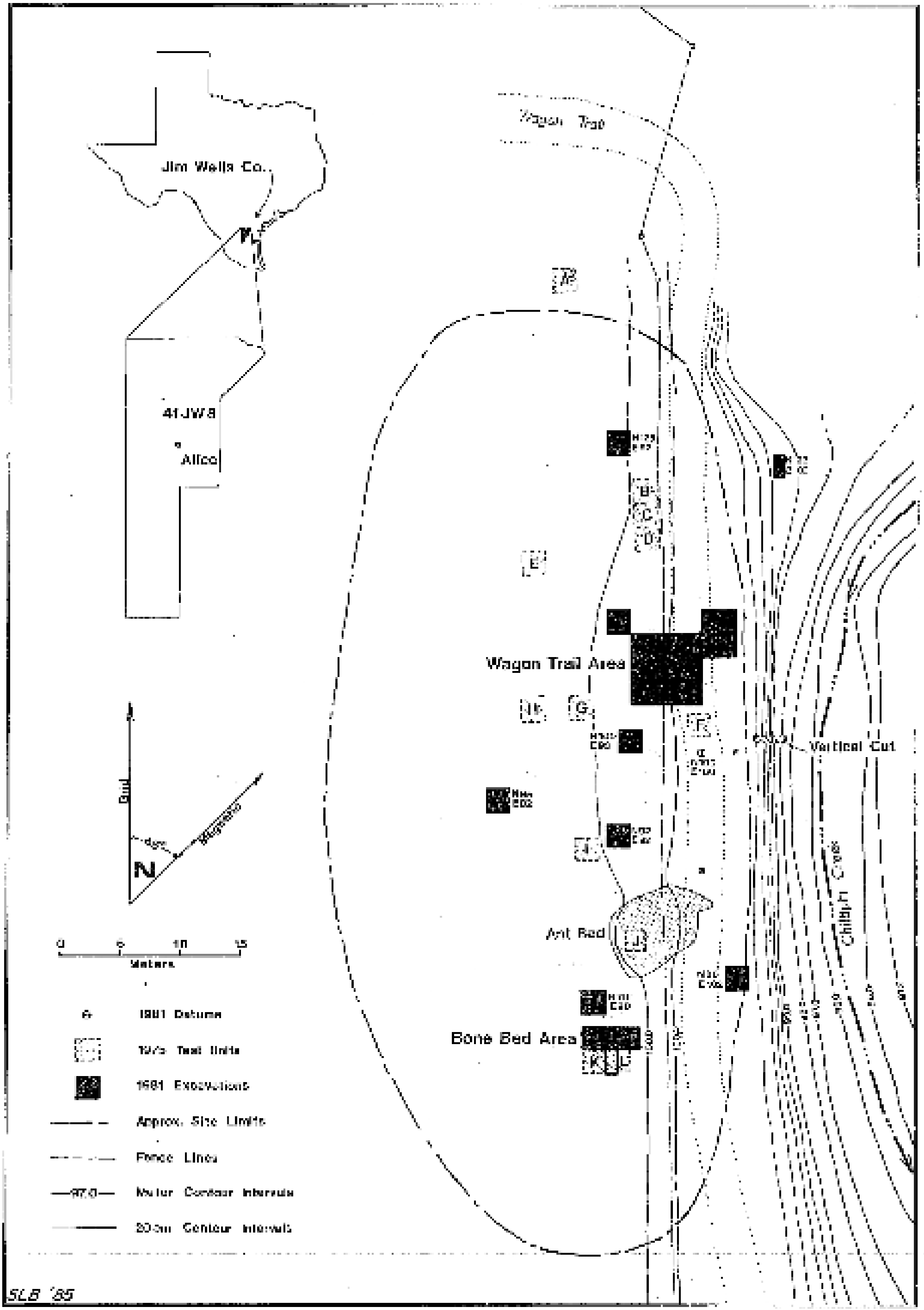

Figure 1. **Site Map of 41 JW 8.**

several angles and corners. Only one corner was shown on the 1975 field map, and it was not identified. All the 1975 grid stakes, including the datum, were wooden with the exception of one iron rebar driven into the northeast corner of Unit L. This iron rebar was not located until several months into the field season.

The 1981 field crew made measurements from various fence corners and used shovel scraping techniques in an unsuccessful attempt to relocate various 1975 grid points and excavation units. The 1975 excavation units had apparently been thoroughly backfilled as no trace could be found of any of the 12 units. Field plowing, brush regrowth, and erosion subsequent to 1975 effectively concealed the 1975 testing. Although several of the 1975 test units were ultimately relocated, we were forced to establish a new grid system in 1981. It was decided that the old roadbed offered a safer location for the 1981 datums since the road could no longer be traveled, and it was inside the fence lines and thus protected from agricultural disturbance.

The main horizontal datum (N100 E100) was established near the center of the wagon trail about 2.5 m east of the fence (fig. 1). The main datum consisted of a 20-inch long steel rebar (concrete reinforcing rod) one inch in diameter set into a bell-shaped concrete anchor inscribed with the site number and the grid coordinates. Backup datums were established at N110 E100, N100 E103, and N90 E100. The backup datums were also steel rebars set into concrete. A cross was filed into the top of each rebar to indicate the precise grid point. All grid stakes were set by using a transit and steel tapes.

The vertical datum was established by driving a 20d nail into an anaqua tree on the bluff edge. The elevation of the nail was arbitrarily designated as 100.00 m above datum. Prior to setting up the vertical datum, a number of excavation units were completed using line level measurements from a string tied at ground level in the southwest corner of each unit. The actual elevation of these grid stakes was later established using the transit. All elevations mentioned in the text refer to the vertical datum unless specified as below the surface.

The grid system was a metric grid with an arbitrary center point of N100 E100. Each excavation unit was given the coordinates of the southwest corner. Thus, any point within a given unit could be referenced by measuring the distance east and west of the southwest corner. For example, an artifact given the coordinates N104.35 E98.75 was found 35 cm north and 75 cm east of N104 E98, the reference corner of the excavation unit. The site grid system was established parallel to the wagon trail and to the fence line running the length of the site for ease of operation. Grid north was actually oriented some 45° west of magnetic north. Cardinal directions indicated in the text are based on grid north unless specified otherwise, such as "to the magnetic north."

EXCAVATION TECHNIQUES

The size of the excavation units at 41 JW 8 varied from 1 m^2 to 2 m^2. Most of the excavation focused on 2-m^2 recording units which were excavated in 1-m^2 quadrants or cells. Provenience was maintained in all excavations to the

1-m unit and 10-cm level. The purpose of the 2-m^2 recording units was to cut down on the amount of paper work involved. These 2-m^2 recording units were referenced by the grid coordinates of the southwest corner of the entire 2-m^2 unit followed by the quad designation. The quads were labeled SW, SE, NE, and NW in reference to their location with respect to the grid system and the 2-m^2 unit. This practice was conceived as a method to reduce errors introduced by keeping track of the specific grid coordinates of each quad. In retrospect, the quad designations probably introduced just as many errors (confusing NE with NW, for example) and created extra work in the laboratory converting the quad designations back to grid coordinates. Throughout this report all provenTences are given as grid coordinates of the southwest corner of a given unit. Unless followed by "(2 m)" all proveniences refer to the southwest corner of a 1-m^2 unit or to a specific location if centimeters are given.

The standard excavation unit-level was 10 cm in thickness and measured 1 m^2 (0.1 cubic meter of deposit). This was varied only in Level 1 of some units. For example, if a 2-m^2 recording unit was placed on an uneven surface, all quads were taken down to the same elevation in Level 1. Thus, if the surface varied from 99.89 in the northwest corner of the recording unit to 99.80 in the southwest corner, Level 1 ended at 99.70 in all quads. In some cases with artificially high humps such as along the fence line, in the plowed field (ridges and furrows), or near the 1975 units (old backfill piles) the raised portion was either shoveled off or included in Level 1.

All excavated soil was passed through 1/4-inch mesh hardware cloth. All artifactual material except as noted below was collected. The proposal called for the use of 1/8-inch mesh. Initial attempts to use 1/8-inch mesh proved extremely time consuming due to the heavy clay deposits in the grid eastern sections of the site (in the plowed field) and due to the exceptionally high frequencies of cultural materials in all excavation units within the main site area. Many excavation levels would have literally required hours to pick out the cultural material recovered on 1/8-inch mesh. The only practical alternative would have been water screening; however, we lacked a source of water. The subsequent loss of data by the use of 1/4-inch mesh was compensated by the collection of various soil and matrix samples as discussed later.

All bone, chert, burned rock, marine shell, prehistoric ceramics, ground stone, and historic refuse (metal, glass, etc.) retained on 1/4-inch mesh or recovered **in situ** were collected. All freshwater mussel umbos or intact valves were collected; unmodified fragments were not. Land snails presented a problem as they occurred in exceptionally large quantities in most areas of the site. No land snail fragments were collected. Whole identifiable land and water snails were collected only from designated "snail pits," with the exception of **Rabdotus** snails. **Rabdotus** snails are believed to be a primary food resource and were collected in all excavations.

The actual excavation technique varied according to location. The upper levels of most units were excavated using shovels. Sharpshooter shovels were often used as were flat shovels and cutoff round point shovels ("cutting shovels"). Each type of shovel had a specific use. Sharpshooter shovels were useful for maintaining a vertical face and removing a 10-cm-thick cut at a time. Square and cutting shovels were used to shovel scrape (schnitt) and to level off floors. In areas with intact features or undisturbed deposits (such as the main excavation block), all excavation was done with trowels or finer digging instruments, such as dental tools, bamboo splints, and brushes. In areas with unknown deposits, the first quad unit-level in a 2-m^2 unit was usually dug with a trowel. If the deposits appeared disturbed, the remaining quads at the same level were shovel dug. Thus, the disturbed deposits were quickly excavated, while the intact deposits were dug very slowly and carefully.

An effort was made in all trowel-dug excavations in areas with intact deposits to expose as much material as possible **in situ**. Exposed materials were pedestaled and left in place while the surrounding area around them was excavated. In cases of isolated materials not associated with a feature or living surface only the pedestaled items considered significant were mapped. For example, a **Perdiz** point would have been mapped in place while a single burned rock would not have been mapped. In the case of artifacts associated with a feature or living surface the crew attempted to leave as much as possible in place until it could be plotted in place. In practice one often had to make decisions as to what was left pedestaled and what was removed. In many areas the cultural materials were so numerous that plotting all the materials that could have been left in place was simply impossible. Emphasis on what to leave was always placed on clustered material, identifiable tools, identifiable bone, prehistoric sherds, and unusual artifacts. Small burned rocks, unmodified flakes and chips, and bone and snail fragments occurred in very high frequencies and were rarely pedestaled.

Particular emphasis was placed on faunal recovery. All identifiable bones (whole bones or bones with articular ends) were either pedestaled or collected as soon as they were observed. This was done to improve the recovery of identifiable bone. Because of this emphasis, many small bones were recovered that would have otherwise passed through 1/4-inch mesh or been crushed during the screening process. When concentrations of microfauna were observed in features or on living surfaces, a matrix sample was collected for flotation and fine screening in the laboratory.

Emphasis was also placed on charcoal recovery. Charcoal from undisturbed deposits was collected in aluminum foil pouches. Particular care was taken with concentrated charcoal deposits from cultural features. Feature charcoal was collected with clean forceps, with minimal handling. Additional charcoal was collected from the level excavations. In some areas of the site considerable quantities of scattered chunk charcoal was present. This scattered charcoal was collected by hand and placed in small aluminum pouches within the unit-level bags. The scattered charcoal was collected only for the purpose of wood species identification, hence we only attempted to collect a sample of the well-preserved charcoal chunks rather than the entire amount of pulverized charcoal present.

RECORDING TECHNIQUES

A variety of records were maintained during the 1981 season at 41 JW 8, for example, level notes, a field journal, survey notes, feature notes, plan and profile drawings, a site map, and sample inventories. These records provide a permanent chronicle of the excavations.

The level and feature notes were written in paragraph style on loose leaf paper and kept in a three-ring binder. This method of keeping field notes was used over preprinted forms for several reasons. Preprinted forms are most appropriate for use with inexperienced crews or on a site excavated over a long period of time to maintain consistency. In the 1981 season the crew was very experienced, the site deposits were comparatively uniform, and the field season was relatively short. Paragraph style notes can be written more quickly with an emphasis on what actually needs to be recorded. A similar approach was taken during Phase III of the Nueces River Project (Grant Hall, personal communication).

The daily field journal was kept primarily by the author. The journal recorded the daily events of the field season: crew members present, weather, visitors, excavation progress, field observations, changes in methodology, and problems encountered. The field journal was kept in the field notebook along with the survey notes and various other records. The survey notes largely consist of a daily record of the transit H.I. (height of instrument). The survey notes also discuss minor problems with using several different transits. For example, the transit used to set up the grid system was off slightly when used to turn 90°. Fortunately a better transit was used to set the back-up datums.

Record photography was done with 35 mm and 120 mm cameras. All photographs were recorded in the field notebook. Plan and profile drawings were done at several consistent scales on grid paper or film. Detailed drawings were made of the features. All materials recorded in situ were plotted on one of the plan maps. Plotted items from each unit-level were given a sequential item number. Each unit-level was numbered separately as the items were recorded and bagged. The plotted items were placed in small individual bags within the level bag. The provenience was maintained in the laboratory by adding a hyphenated number to the lot number.

Inventories were kept of features, soil samples, and charcoal samples (only those that could be potentially used for radiocarbon assay). The cultural features from the entire site were given a sequential number as they were formally designated a feature. Some clusters were not formally recorded as a feature in the field but were later given a feature number in the laboratory. The charcoal and soil sample inventories recorded the specific provenience details of each sample.

A plane table and alidade map of the site was made during the final weeks of the field season. Care was taken to avoid the mistakes made on the 1975 plane table map. The fence lines and corners were carefully shot in as were all excavation units and site datums. Topographic information was recorded for most of the site area. Some difficulty was encountered mapping the heavily vegetated steep bluff slope area. Figure 1 is based on the 1981 site plane table map (actually done in January 1982).

SOIL SAMPLING

The proposal called for the collection and subsequent analysis of soil samples for several purposes, including flotation, soils chemistry, phytolith analysis, and pollen analysis. Samples for these purposes were collected by several methods: feature matrix sampling, axial interval sampling, and column sampling. In addition to sampling the excavation areas, two off-site "noise pits" were excavated.

Matrix samples were taken from all formally recorded cultural features as well as from several areas that appeared to have high concentrations of microfauna or charred materials. All matrix samples were collected in heavy salt bags (triple layered with moisture seal). An effort was made to collect at least 20,000 cc of matrix for each sample so that a consistent-sized flotation sample could later be processed.

The axial interval sampling was an experimental approach to feature interpretation detailed in the proposal. As proposed, the axial interval sampling was conducted only in situations when intact features were encountered and recognized while most of the surrounding unit-levels were still intact. Axial interval sampling involved superimposing a grid oriented on cardinal directions over the approximate midpoint of the feature in question. Small (75 cc) samples were then taken at consistent intervals along the grid lines. The idealized sampling interval was 10 cm within a feature and 50 cm outside the feature. The length of the axial vectors varied depending on location and size of the excavation block. All axial interval samples were collected with sterilized phosphate-free equipment. Each sample was collected from a carefully cleaned surface and placed in a sterile phosphate-free glass vial. The sample removal equipment (a small, sharp trowel) and the glass vials were sterilized and cleaned with dilute hydrochloric acid (HCL) and distilled water.

Column samples were collected from a number of locations within the site. Two consistent volume sample (CVS) columns were collected in the main excavation block as the excavations progressed. Additional column samples were collected from the profiles of completed excavation units, including N80 E102 (2 m), N78 E90 (2 m), and N123 E106 (1 x 2 m) as well as the noise pits. Each column consisted of a series of samples taken from the least disturbed profile of a given excavation unit. These were collected after the profile had been divided into stratigraphic zones and illustrated. During sample collection, the wall sections were cut back with a sharp trowel to expose a fresh face. Samples were collected from the middle of each zone except in cases where the zone was extremely thick. Thick zones were divided into upper and lower sections. From each zone or half a zone, a matrix sample, phosphate sample, and a sediment sample (for grain-size analysis) were collected.

Two background noise pits were excavated well away from the site area. "Noise Pit South" (NPS) was a 1-m^2 unit excavated south of the site on the edge of the creek bluff at approximately grid point N17 E104. The only trace of prehistoric occupation recovered was a couple of small chert flakes. A second background pit, the "Wheat Field Noise Pit" (WFNP), was excavated east of the main site area in the middle of the plowed field at approximately grid point N89 E37. No trace of prehistoric occupation was recovered. Both noise pits were shovel excavated in 10-cm levels. Each unit was screened, and all bone, rock, and snails were collected. Column samples were collected from each pit profile upon completion of the excavation. The purpose of these off-site pits was to provide a control sample of screen recovery, microfauna, and botanical remains (flotation) as well as soils chemistry. Theoretically, the difference in recovered materials between the noise pits and the site excavations could be attributed to the prehistoric occupation.

CHRONOLOGICAL OUTLINE OF THE 1981-1982 SEASON

October 1981: In early October the final details of the land access negotiations were completed with Eva Jimenez. On October 12, the CAR crew arrived in Alice to begin work. During the first week the site was cleared, the 1975 excavations were searched for in vain, a new grid system was established, and the excavation of additional test units was begun. The test units (2 m^2) were partially in response to the proposal specifications and partially due to the failure to accurately relocate the 1975 work. A cold front moved through south Texas on October 22 dumping several inches of rain in the site area. Wet conditions did not allow a return to the site until October 28. By the end of the month, two 2-m units had been completed, and two others had been opened.

November 1981: Considerable progress was made during the month of November as ideal conditions prevailed (cool and dry). By November 13, eight test units had been completed (all 2-m units except one 1 x 2 m). With the exception of one unit, no intact features or living surfaces had been found. Most units evidenced disturbances caused by plowing, field leveling, and bioturbation. The approximate area of the "bone bed" appeared to be taken over by a very large leaf cutter ant bed complex.

An exceptional unit, N106 E98 (2 m), evidenced three discrete bone clusters (Features 2A, 2B, and 3). Based on these promising features, 2-m units were added on the grid north and south sides of the first unit. By the month's end a row of 1-m units had been added along the grid west side of the three 2-m units. The resulting 6- x 3-m unit was dubbed the "Wagon Trail Area" (WTA).

Dr. Hester was able to pinpoint the location of the 1975 "vertical cut" during a visit to the site on November 24. Using this as a reference point the crew was able to more precisely locate the "bone bed" area. This area still lay close to the large leaf cutter ant bed complex. On November 30, the crew began excavation of a 1- x 4-m trench (four 1-m units) designed to bisect Unit L from the 1975 testing.

December 1981: The excavations were concentrated in two areas in December, the "wagon trail" area and the "bone bed" area. The 1- x 4-m trench bisected Unit L from 1975 (iron stake found beneath the surface). Unfortunately, little or no evidence was found of the "bone bed," leading the crew to suspect that this feature was very localized and almost completely excavated in 1975. An isolated "living surface" (Feature 7) was recorded in this area. The crew attempted to expand the trench grid east and west, unfortunately large portions to the east were extensively disturbed by the leaf cutter ants. After removing Feature 7, finding no trace of the "bone bed," and encountering the ants, the decision was made to terminate excavations in the area.

The WTA 6- x 3-m block was expanded to the west to form a 6 m^2. The west half of this area was excavated in 1-m units to the level of Feature 6, a large hearth feature centered in Unit N106 E97. Feature 6 was a complicated "hearth" or cooking feature with an irregular rock cluster, an adjacent pit filled with charcoal and ash, several lobes of baked clay extending out from the pit, a snail cluster, and numerous artifacts and faunal materials all in tight association.

On December 16, three television crews from San Antonio and Corpus Christi, newspaper reporters from Alice and Corpus Christi, and News and Information representatives from UTSA visited the site. The media and field crew were cooperative; a number of largely factual news stories resulted, providing good publicity for the project and the various agencies involved.

A 2-m unit was begun adjacent to the grid northeast corner of the WTA in order to examine the immediate creek bank area. A two week break was taken at the end of December for the holidays.

<u>January 1982</u>: Field work was completed during the first two weeks of January. The crew worked long and hard under some extreme conditions (subfreezing with wind chill factors below 10°F) to complete the excavations. The northeast corner of the WTA was expanded to a 4- x 3-m area to expose two cultural features, a charcoal cluster (Feature 8) and a bone cluster (Feature 9). The 4- x 3-m area was completed on the last day of the field season.

Major activities during the final two weeks included plane table mapping, soil column collecting, noise pit excavation, profile illustration, and the installation of additional backup datums. Late in the afternoon on January 15, a backhoe was used to backfill the excavation units. Modern beverage containers and white caliche were used to mark the corners and edges of the excavation units in case archaeologists return to 41 JW 8.

LABORATORY AND ANALYTICAL METHODS

The data recovered from 41 JW 8 during the 1981-1982 project were processed at the archaeological laboratory of the CAR-UTSA. All materials were assigned a provenience or lot number, cleaned, and inventoried during the initial processing phase which ran concurrent with the field work. During the subsequent data analysis phase all materials were reexamined and placed in the final analytical categories used in this report. The CAR-UTSA will be the curator of all data collected from 41 JW 8.

INITIAL PROCESSING

Most of the initial laboratory processing took place as the field season progressed. Completed material bags were brought into the laboratory at the end of each week. Accompanying the bags was an inventory sheet with the provenience information and whether or not the provenience had been closed out (i.e., the unit-level was finished). The bags were crosschecked with the inventory and a lot number card index. Occasional inconsistencies such as coordinate errors or duplicate level numbers were rectified when the crew returned the following week.

Each separate provenience was assigned a sequential lot number, beginning with 56 (the first 55 numbers had been assigned in 1975). Duplicate index cards were filled out for each lot number (Appendix 2). One set of cards was organized by lot number, while the other was arranged by provenience (smallest north coordinate to largest, smallest east coordinate to largest). This card system has been used in several large projects at the CAR and was found to be an efficient way of keeping track of provenience data. The lot numbers were also placed on each field bag.

The field bags were then emptied, and most of the cultural material was washed. Several artifact types were not initially washed. For example, beveled knife fragments were not washed until they could be checked under magnification for organic residue (cf. Holloway and Shafer 1979). The faunal material included many small and fragile bones, hence the initial washing amounted to little more than rinsing.

Once cleaned the cultural materials from each unit-level bag were divided into major material categories and counted and/or weighed. In many past CAR projects, cultural materials were inventoried as they were cleaned and then reinventoried as they were analyzed. This was often due to lack of experience on the part of the initial processor and lack of agreement between the processor and the analyst concerning the desired analytical categories. This duplication of effort was largely avoided by using experienced personnel and using the 1975 materials to decide on many analytical categories prior to beginning the 1981 field season. Unmodified debitage, burned rock, snails, and historic materials were sorted and placed in final analytical categories as they were inventoried. These materials were placed in labeled plastic bags and stored for posterity (burned rock was counted, weighed, and discarded). Other artifact types such as bifaces, projectile points, and ceramics were divided into simple inventory categories (complete versus incomplete, rim sherd versus body sherd, etc.) and stored for further analysis.

All soil and charcoal samples were assigned a lot number and allowed to dry if damp. They were then inventoried and set aside for further processing. Faunal materials were weighed and set aside for final processing and identification. The initial processing system allowed the laboratory personnel to keep up with the field crew until the final part of the field season when large volumes of material were brought in every week.

DATA ANALYSIS

Upon completion of the field work and initial laboratory processing phases a data analysis phase was begun. This phase took several years to complete and resulted in this report. Special studies were conducted by consultants on the faunal data, botanical remains, radiocarbon assays, pollen, phytoliths, and mussel shells. The consultant reports are presented in Section VII. Additional analyses were done on various data categories by the author and are discussed in detail elsewhere in this report.

The data pertinent to the special studies done by the project consultants were delivered or mailed to the appropriate expert after complete inventory. In most cases only a sample of the available data could be analyzed by each consultant due to fiscal limitations.

LABORATORY RECORDS

All data recovered during the field season and amassed during the subsequent analysis are permanently curated at the CAR-UTSA laboratory. The materials, notes, and illustrations are filed in various locations in the laboratory. The following is a list of the types of records and data that were collected and a brief description of how they are maintained. All project records are available for examination by qualified researchers.

<u>Cultural Material</u>: All materials are stored in boxes according to the final analytical category as detailed in this report. Within each box the materials are stored either in plastic bags or other appropriate containers. The materials that were sorted into final analytical categories during the initial processing, such as unmodified debitage, are stored in lot bags by major category (i.e., all flakes and chips from a single lot are bagged together). All the materials that were further examined are stored within the final artifact grouping (i.e., by alphanumeric code) in appropriate containers. This allows researchers interested in a specific artifact type to quickly locate the materials of interest for comparative analysis.

<u>Lot Number Index</u>: The lot numbers are maintained on a card system as discussed earlier. These are kept in a cardboard index box.

<u>Inventory Sheets</u>: A separate inventory sheet was maintained for each provenience. Each sheet shows the initial processing material breakdown. These sheets were done in large format (18- x 24-inch gridded sheets). This size proved awkward. Regular 8-1/2 x 11-inch sheets (several if necessary) are recommended. These sheets are stored with the illustrations.

<u>Field Notes, Field Journal, Field Inventories, Level Notes, etc.</u>: The Field Notebook is maintained in a blue three-ring binder in the project files.

<u>Data Sheets</u>: The data sheets show the counts by provenience of the final analytical categories. These forms were filled out during the analysis and used to make distribution studies and to compile the final provenience data (Appendix 1).

Plotted Item Sheets: These forms were used to compile the provenience data and final analytical category for each artifact or item plotted in place.

Field Photographs: The field photographs, black and white prints, and color slides were carefully identified based on the field photograph logs.

Illustrations: All field plan maps, profile drawings, and plane table maps are stored in a map cabinet in the laboratory along with rough draft copies of the final illustrations. Final illustrations and the original of this manuscript are stored under lock and key in a separate location.

Project Files: All other notes, correspondence, and records of the 1981-1982 41 JW 8 project are stored in the CAR-UTSA laboratory.

IV. ENVIRONMENTAL SETTING

Today the Hinojosa site is located on the banks of a dry stream that holds water only after periods of heavy rainfall. About half the site and most of the uncultivated land in the area is overgrown by dense thorn brush. The other half of the site lies in a plowed field where wheat and other crops are planted semiannually. Looking at the area today, the factors that influenced the Indians to camp at the Hinojosa site are certainly not obvious. Six hundred years ago, the creek held water year round, and the site lay in a narrow wooded band surrounded by grass covered prairies interspersed with mottes of brush and prickly pear. To understand what the environmental setting was like at the time that 41 JW 8 was an Indian campsite one must consider a variety of modern, historic, and prehistoric environmental data.

CLIMATE*

Jim Wells County has a fairly mild climate characterized by hot summers and comparatively warm winters. The annual growing season usually lasts over 280 days (continuous days without freezing temperatures). Annual rainfall averages between 26 and 28 inches a year but varies widely on a year to year basis from the annual mean. Late spring (May) and early fall (September) are usually the wettest times of the year. March is the driest month of the year. The heaviest rainfall usually occurs in the early fall when tropical storms and hurricanes strike the Coastal Bend area. Humidity is fairly high most of the year due to the nearby coast (Alice lies about 45 miles due west of Corpus Christi Bay). The prevailing winds blow moist Gulf air in from the southeast.

A considerable amount of the annual precipitation is lost due to evaporation. Annual evaporation rates far exceed the annual precipitation. The average annual temperature is 72°F. During July and August the average temperature is 85°F, and the average daily high is over 96°F. The extremely hot conditions in July and August cause most of the soil moisture which is built up in the late spring to evaporate. Dry conditions are also common in the winter when northers bring frequent bursts of cool dry air down. These northers disrupt the normal prevailing wind pattern and push the moist Gulf air off the coast. The total rainfall from December through March averages less than five inches.

Two periodic climatic phenomena create serious problems in the Jim Wells County area: tropical storms and droughts. Tropical storms and hurricanes periodically strike the Coastal Bend area of Texas causing hundreds of thousands of dollars worth of damage to homes, crops, and urban areas. The Texas Coastal Bend area near Corpus Christi averages four years between occurrences of major tropical storms or hurricanes, five years between occurrences of hurricanes, and 16 years between occurrences of extreme

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*The information in this section was compiled from a variety of sources in addition to those cited. These include: Minzenmayer (1979); **The Texas Almanac** (1983-1984); the U.S. Weather Bureau, San Antonio; and maps from publications cited elsewhere.

hurricanes (Henry, Driscoll, and McCormack 1975). The damages are caused by high winds, associated tornados, and extremely heavy rainfall rates. Alice received over 13 inches of rain from a tropical storm on September 13, 1951. Because the topography in the area is relatively low and flat, large areas of the county are inundated for days following a severe storm. One of the most unpleasant lingering effects of a major storm in the coastal plain area is the presence of hordes of vicious mosquitos for weeks or months following major flooding.

Droughts also periodically create extreme conditions in Jim Wells County. Major droughts lasting over a year occur about once every 20 years. Shorter droughts lasting up to a year occur about once every 10 years. Periods of several months with little rain occur almost every year. Drought conditions are usually created when stable high pressure cells remain centered just off the coast southeast of Corpus Christi (Carr 1967). These high pressure cells may dominate the weather pattern for many months, effectively blocking all sources of moist air. The recent (1984) drought conditions in southern and central Texas exemplify this problem.

Jim Wells County lies within a climatically sensitive area that is currently classified as having a dry subhumid or a humid semiaric climate. This area borders large semiarid to arid regions to the west and large subhumid to humid regions to the east. Comparatively minor climatic shifts can and apparently have caused significant changes in south Texas climatic conditions. Gunn **et al.** (1982) have defined a south Texas climatic threshold that is linked to the average temperatures of the Northern Hemisphere. When the average annual temperature of the Northern Hemisphere exceeds 15-16°C, south Texas has a more arid climate. Conversely, when the average annual temperature is below the threshold, south Texas has a more humid climate. The south Texas climatic threshold model is based on a statistical analysis of various climatic factors, including global temperatures, atmospheric shielding, solar activity, and precipitation (Gunn **et al.** 1982). Projecting the climatic threshold across the estimated temperatures of the Holocene produces a series of dry and wet intervals.

The past climatic conditions in south Texas have not been studied enough to construct an accurate prehistoric climatic chronology. This is due to several factors, including a general lack of interest in the subject and very poor preservation. Paleoclimatic studies usually rely on the analysis of pollen, tree rings, fossil pack rat middens, and other environmental indicators. South Texas has notoriously poor preservation conditions due to alternating wet and dry conditions. Pollen analysis has been attempted with little success at a number of prehistoric sites (Hester 1977:28). One promising avenue for research has been suggested by Robinson's (1979, 1982) work with phytoliths. Unfortunately, Robinson has only published preliminary results to date, and these are not directly applicable to the 41 JW 8 site area. The preliminary results appear to document major shifts between cooler, more mesic periods and hotter, more xeric periods in the Holocene.

Holloway (1986) has recently reported the results of macrobotanical (charcoal) identification of samples collected at sites in the Choke Canyon Reservoir area dating back to 4000 B.C. Holloway summarized relevant macrobotanical, pollen, and faunal data and suggested that the region has had a relatively stable environment characterized by increasing aridity for 6000 years. He also criticized Gunn et al. (1982) and Robinson (1979, 1982) for relying on the identification of a definable Hypsithermal Interval in their climatic interpretations of south Texas. The Hypsithermal Interval is an inferred wetter/cooler interval around 4000-3000 B.C. that is linked to a glacial advance episode in the Northern Hemisphere. Holloway cites numerous studies that have failed to evidence this climatic interval in southern Texas and the surrounding region.

HYDROLOGY

In the current century the availability of reliable subsurface and surface water in south Texas has grown progressively worse. Large and small reservoirs provide adequate surface water supplies for localized areas during wet years but wells and springs continue to dry up. Most streams draining the eastern Reynosa Cuesta (Goliad Formation), including Chiltipin Creek, have not flowed regularly this century (Price and Gunter 1943:8). A number of lines of evidence suggests that at the time that the Hinojosa site was occupied, Chiltipin Creek was spring fed and held water year round.

A study of springs in Texas by Brune (1981) documents 10 now dry springs and seeps in Jim Wells County. Most of these were active reliable sources of water in the 19th century (Brune 1981:265-267). It is very interesting and informative to note the locations of many former small springs and seeps in the inland south Texas area that is today so dry. Of particular interest are the Amargosa Springs which are located very near the Hinojosa site. Brune gives the location of the Amargosa Springs as 16 km north-northwest of Alice near the junction of Chiltipin Creek and Amargosa Creek. This places the springs within a few hundred meters of 41 JW 8. In fact, Brune (1981:266) mentions a "way station for stagecoaches" near the springs. This is undoubtedly a reference to the Amargosa Stage Stop, the ruins of which lie some 200 m east of the Hinojosa site. Thus, 41 JW 8 is located at or just downstream from springs active less than a hundred years ago.

The water quality of the spring water that once kept Chiltipin Creek flowing may have left something to be desired. The name of the springs, Amargosa, is Spanish for "bitter." Brune (1982:265-266) notes that the springs flowing out of the Goliad and Lissie Formations, such as the Amargosa Springs, have very hard, alkaline, sometimes slightly saline, water. Thus, during dry periods in the prehistoric era, when the only water in Chiltipin Creek was provided by springs, the water may have tasted bad. After the mud settled out following heavy rains, Chiltipin Creek would have had much more drinkable water. In a land where surface water was hard to find, the taste of the water may not have been important.

Confirmation that the site was located near a spring-fed creek was provided by several of the project consultants. William Murray concluded that Chiltipin Creek had been a spring-fed creek at the time of the prehistoric occupation based on an examination of the freshwater mussel shells found in the site deposits (Section VII: Macrobotanical Analysis). Murray identified several clam specimens from the prehistoric occupation that evidenced seven to twelve years of growth and suggested that Chiltipin Creek "was a small (couple of meters wide) constantly running (possibly artesian source), shallow (1/2 meter deep) stream. The substrate bottom was probably mud or mud-sand base." Gentry Steele (Section VII: Vertebrate Faunal Remains) identified a number of water proximate faunal species from the site deposits, including aquatic birds, riparian mammals, soft shell turtles, and fish.

PHYSIOGRAPHY, GEOLOGY, AND SOILS

The Hinojosa site lies within a vast physiographic province known variously as the West Gulf Coastal Plain, the Rio Grande Plain, and the South Texas Gulf Coastal Plain (cf. Fenneman 1938; Bogush 1952; Carr 1967). This vast area of comparatively flat topography stretches from northeastern Mexico north to the Balcones Escarpment and east across Texas into adjacent Gulf coast states.

Site 41 JW 8 lies at an elevation of about 250 feet above mean sea level on the edge of a northeast-southwest trending Pliocene age geological formation, known as the Goliad Formation (Barnes 1975). The Goliad Formation, or the Reynosa Cuesta as it is termed in early publications (Price and Gunter 1943), can be characterized as a dissected rolling upland area with eroded ridges and valleys (Minzenmayer 1979). The Goliad Formation is made up of calcareous sands with some gravels and calcium carbonate concretions. This formation forms a 15- to 25-mile-wide band that provides minor topographic relief and has significant vegetational and soil associations that contrast with the Beaumont Formation to the southeast. The Beaumont Formation is a massive Pleistocene clay accumulation that forms the flat coastal prairie. The Hinojosa site occurs within a narrow band of the Lissie Formation sandwiched between the Beaumont Formation and the Goliad Formation. The Lissie Formation is a Pleistocene accumulation of sand, silt, and clay that forms a transition in soils and relief between the Goliad and Beaumont Formations. Thus to the north and west from the site, the topography is rolling and eroded, while to the south and east the topography becomes progressively flatter as one nears the coast.

The site lies on a raised area adjacent to Chiltipin Creek. From the perspective of the creek, the site lies atop a steep bluff. From the opposite perspective, the topography gradually slopes downhill from a sandy ridge some 1.4 km west of the creek to a low point approximately 200 m west of the site and then gradually rises adjacent to the creek. The slight rise adjacent to the creek appears to be a natural levee of Chiltipin Creek to which has been added cultural debris. No evidence was observed of layered sedimentary deposits or erosional facies, however, the fine sandy clay loam that dominates the site deposits would appear to be primarily alluvial rather than aeolian in origin. Some wind borne sediment has defintely been added to the site deposits. The best evidence of this was seen along the fence row (Wagon Trail Area) were vegetation has trapped fine aeolian sediments that are no doubt derived from erosion of the adjacent plowed fields.

The sandy loam soil on the topographic rise drains much better than the clayey soils in the eastern site area and in the field. The farmer who has leased the property for a number of years commented, "that corner [the site area] has always disked up real fine but the crops never do well there." He went on to attribute this phenomena to the fact that clayey soils hold moisture better and have more nutrients. The correlation between archaeological sites and poor crop growth has been noted in many areas of south Texas. Vela (1982) has suggested that stunted grain sorghum in site areas may be due to mineral deficiencies caused by concentrated land snails. The 41 JW 8 situation suggests that localized variation in soil characteristics may be the determining factor responsible for the difference in crop growth and that the snail concentrations are an unrelated coincidence.

Immediately adjacent to the main site area Chiltipin Creek is rather deeply entrenched; the west creek bank is a steep bluff some 4 m high. Upstream and downstream the bluff is noticeably less abrupt. The creek bed adjacent to the site is partially filled with recent clay loam sediments and heavily overgrown with grass and weeds. Every 50 or 75 m along the creek bed are small depressions some 5 to 10 m long that hold water for extended periods of time. The depression adjacent to the site is one of the larger depressions observed for several hundred meters in either direction. Under wetter conditions the modern creek has a series of shallow muddy pools of water. It appears likely that the Late Prehistoric creek would have been less clogged by sediments and vegetation and would have had somewhat larger and deeper pools.

A linear depression occurs in the plowed field some 250 to 300 m west of the site. This topographic feature appears to be a filled-in stream channel. The abandoned channel runs parallel to present-day Chiltipin Creek. Examination of topographic maps and aerial photographs reveals that the abandoned channel once joined present-day Chiltipin Creek at the modern junction of Amargosa Creek less than a kilometer upstream from the site. It is suggested that the abandoned channel is a relic channel of Chiltipin Creek. Dating the abandonment is difficult. It can be assumed that this event took place at least 500 years ago (prior to when the site was occupied). Given the fact that the abandoned channel is still quite distinct topographically, it is suggested that the change in stream channels took place within the past several thousand years.

Across Chiltipin Creek from the site are a series of low ridges with thin calcareous soils. The Amargosa Stage Stop lies on the slope of one such ridge. Erosional gullies on the slopes of these ridges reveal caliche and calcium carbonate concretions only a few inches below the surface. The soils associated with the ridges are not very fertile and do not support mid and tall native grasses. The ridges do provide an overlook of the lower lying areas west of the site.

Site 41 JW 8 lies within an area mapped by the Soil Conservation Service as having Opelika fine sandy loam, depressional soils (Minzenmayer 1979). As is usually the case, more variation was observed in the field than is recorded on the soils maps. Opelika fine sandy loam, depressional soils are characterized as deep calcareous loamy soils that form on nearly level upland areas. (The SCS refers to all of Jim Wells County as an "upland" area except for a narrow stretch of "bottomland" adjacent to the Nueces River.) Excavation profiles seem to fit the general description of Opelika soils except in the eastern edge of the site where a much darker clay loam was encountered.

In the main site area, adjacent to Chiltipin Creek, the soil is a gray brown fine sandy loam that becomes more compact and more calcareous with depth. Opelika soil is described as having an eight-inch-thick surface layer that is "friable, neutral, gray fine sandy loam" (Minzenmayer 1979:25). Between 8 and 22 inches, the soil is "firm, moderately alkaline, dark gray sandy clay loam." From 22 to 33 inches, the soil is "firm, moderately alkaline, gray sandy loam that has brownish mottles." A mottled white sandy clay loam occurs below 30 inches. The SCS descriptions of Opelika soil are similar to that observed at the site, although the lower zone in several excavation units appeared to be caliche rather than white clay.

The general soil map of Jim Wells County shows some interesting soil distributions with respect to 41 JW 8. The soil distributions mirror the differences observed in surface geology and topography. The site occurs within a one- to two-mile-wide band of deep loamy and clayey soils. Surrounding this band to the northeast, north, and northwest is a large area of shallower loamy soils that extends across northwestern Jim Wells County. Southeast of the site the band of deeper soil broadens to encompass most of the eastern section of the county. Minzenmayer (1979) notes that the deeper clayey soils provide excellent native range plants. These soils support the highest yields of native mid and tall grasses of any soil in the county. The implication is that 41 JW 8 lies at the head of an area which would have originally been a mid and tall grass prairie.

The detailed soils photomaps of Jim Wells County demonstrate another very interesting fact about the site location; the soils in the general site vicinity are significantly more diverse than comparable areas north and south as well as most of the rest of the county. This statement is based on a study of the photomap sheets showing the distribution of the 52 mapped phases of the 27 named soils series defined by the SCS in Jim Wells County (**ibid.**). The detailed soils distributions across the county are shown by 45 aerial photograph sheets. Each sheet covers an area of about 21 square miles. The Hinojosa site occurs on Sheet 16. Sheet 16 has a total of 35 out of the 52 mapped phases (67%), representing 22 out of the 27 named series (81%) for the entire county. Adjoining Sheet 16 to the west and following Chiltipin Creek upstream is Sheet 15. Sheet 15 has a total of 27 out of the 52 mapped phases (52%), representing 16 out of the 27 named series (59%). The photomap sheet adjoining Sheet 16 to the south along Chiltipin Creek is Sheet 20. Sheet 20 is almost as diverse as Sheet 16. Sheet 20 has 33 out of the 52 mapped phases (63%), representing 20 out of the 27 named series (74%). Farther downstream, soils diversity drops rapidly after Chiltipin Creek flows into San Fernando Creek north of Alice. Sheet 24 covers the eastern half of Alice and San Fernando Creek to the east. Sheet 24 has only 18 out of 52 (37%) of the mapped phases, representing only 11 out of 27 (41%) of the named series.

VEGETATION

South Texas lies within the Tamaulipan Biotic Province as defined by Dice (1943) and revised by Blair (1950). The Tamaulipan province is characterized as a thorny brush plain dominated by a relatively small number of species, including mesquite, **Acacia**, **Mimosa**, granjeno, **lignum vitae**, cenizo, whitebrush, prickly pear, and tasajillo (ibid.:103). Abundant evidence suggests that substantial changes have occurred in the vegetation patterns in south Texas during historic times (cf. Price and Gunter 1943; Bogush 1952; Inglis 1964; Weniger 1984). Today northern Jim Wells County is dominated by brush in uncleared and uncultivated areas. Evidence suggests that more of the area was covered with native grasses prior to the late 1800s.

In 1833, Benjamin Lundy crossed Jim Wells County from west to east just south of the site. He described the area as "delightful" and mentioned that the stream courses were wooded but that the uplands had "scarce a bush" (quoted in Inglis 1964:35). Lundy also pointed out that the country was "abounding in excellent grass." Other travelers such as Bonnell in 1840 and Michler in 1849 passed through sections of Jim Wells County and described prairie conditions with mesquite and oak concentrated near creeks and rivers (Inglis 1964:36). By 1885, the western area of Jim Wells County and adjacent Duval County were apparently covered in dense brush as indicated by Harvard's comments (ibid.). Harvard did note that eastern Jim Wells County was covered in a sparse scrubby chaparral that was absent in places "leaving the ground covered with thin sparse grass."

In examining the historic accounts of south Texas, the terms "prairie" and "grass prairie" are frequently used to describe much of the region particularly prior to the mid 1800s. This usually brings to mind a picture of an endless grassland. This picture may be misleading. Del Weniger (1984 and personal communication) has recently compiled hundreds of pre-1860 historic references to the landscape, water resources, vegetation, and fauna of Texas. Weniger emphasizes that the term "plain" refers to an endless level expanse of grass whereas "prairie" actually refers to a rolling topography covered with both grass and brush. Weniger argues that early travelers clearly indicate that the southern Texas prairie areas had dense stands of grass interspersed with mesquite, live oak, acacia, prickly pear, and other brush species. "Grass prairies" may have referred to areas of the prairie that had particularly dense stands of grass between the brush mottes. Early travelers often discussed vegetation from a practical perspective--from having had to cross through it. One can readily imagine that a reference to a prairie would emphasize the ease of passage after having to cross through or find a way around the extensive chaparral thickets bordering the major streams and rivers. Thus the terms "delightful" and "grass prairie" may have referred to areas of the praire that had ample grassy areas that allowed easy travel between the brush mottes.

In addition to the grass prairies, however, there are early historic accounts of unusually large concentrations of dense prickly pear (**Opuntia engelmannii**) west of the lower Nueces River in parts of Live Oak, Jim Wells, Duval, Nueces, and Kleberg Counties (Campbell and Campbell 1981:7). Campbell and Campbell (1981:14) make specific reference to a concentration of prickly pear located near 41 JW 8: "the greatest concentration of prickly pear plants nearest to the Mariames [group of Indians Cabeza de Vaca lived with] was in Duval and Jim Wells Counties, particularly between San Diego and Alice on the north and Falfurrias on the south." The Campbells' statement is based in part on data collected by Davenport and Wells (1918-1919) who interviewed long-time inhabitants of the area. The prickly pear fields were much reduced after the "great freeze of February 1899" (Davenport and Wells 1918-1919:209).

The nature and extent of the recent changes in the vegetation of south Texas are the subjects of considerable debate. Some have argued that thorny brush has "invaded" a pristine grassland aided by overgrazing, bovine digestive tract seed dispersal, and the cessation of natural range fires (cf. Bogusch 1952). Others seem to agree that the cited factors have caused a marked increase in density of thorny brush but contend that the brush was already present (cf. Inglis 1964). Del Weniger (1984) has recently created some controversy over his contention that dense stands of brush have long been present in the area. Weniger rejects the "natural" range fire argument by noting that of all the many pre-1860 range fires that he has found references to, none were attributed to natural causes. Weniger also attempts to demonstrate that range burning only became prevalent after the arrival of European settlers.

The role played by fire in maintaining grassland in southern Texas has long been discussed (Cook 1908; Johnson 1963). Weniger's contention that historic prairie fires were caused by man does not rule out the possibility that man has been setting prairie fires for many thousands of years (cf. Sauer 1950). Cabeza de Vaca noted that the Mariamo sometimes controlled the movement of deer by burning large areas of the open prairie, thus concentrating the deer in the smaller unburned areas (Campbell and Campbell 1981:17). The Campbells point out that the burning could have only been done during times when the grasses were dry and combustible (fall or winter?). Weniger does not cite the Cabeza de Vaca evidence due to controversy over the exact route of de Vaca's travels. In doing so, Weniger chooses to ignore the earliest and most detailed account of purposeful burning of the prairies by the aboriginal inhabitants of the region. This calls into question Weniger's contention that the Indians did not burn the prairies prior to being taught how to do it by the white settlers.

A recent review of the "historic role of fire on the Rio Grande Plains" by Charles Scifres (1980) emphasizes both the drastic nature of the recent change from grassland to brushland predominance in south Texas and the role fire and man have played in this change. Scifres argues that the ability to control fire is one of the principal reasons that prehistoric man adapted to grasslands and by extension to south Texas. Scifres believes that the historical vegetation changes can be attributed to the cessation of man-caused fires, elimination of the original grazing species (bison and pronghorn), and climatic change to an increasingly xeric climate. Scifres advocates the use of prescribed (controlled) burning to improve range pasture by increasing the grass and forage species.

The effect of fire in controlling south Texas brush has been studied by several groups of range management specialists (Box, Powell, and Drawe 1967; Scifres and Kelly 1979; White 1980). Experimental burnings at the Welder Wildlife Refuge have demonstrated that fire helps maintain grass density and diversity and reduces brush species density in the areas between brush mottes or thickets. The actual brush mottes themselves were little affected by fire as they lacked adequate fuel (dry biomass) to burn quickly. This suggests that prehistoric range fires could have helped maintain corridors and pockets of grass but would not have eliminated the larger brush mottes. In the era before extensive overgrazing by sheep and cattle the grasses were a much more dominant aspect of the vegetation as numerous travelers attest. Prehistoric fires would have had more fuel (dry biomass) during wet climatic intervals when grass stands reached maximum densities. Therefore, prehistoric fires, whether started by man or natural causes, may have been more effective in controlling brush spread than modern experiments in grazed areas suggest.

One factor which is not often emphasized in discussions of vegetation changes is the effect of short-term climatic cycles. An excellent example of how drastically the vegetation of a particular locality can change over a 20-year period is illustrated in Drawe, Chamrod, and Box (1978). The Welder Wildlife Refuge in Sinton County (about 80 km east of 41 JW 8) has been carefully monitored and studied since the mid-1950s. Drawe, Chamrod, and Box (1978) illustrate a series of photographs of one area of the refuge over a 22-year period. In 1956, just after the terrible drought of the early fifties, the area had a prickly pear and short grass vegetation community. The photograph (ibid.:frontispiece) shows a dense field of cactus with very sparse native short grasses. Later photographs, taken in 1965 and 1977 (Drawe, Chamrod, and Box 1978:Figs. 5 and 6), show the area changing to a mid grass and mesquite community. The 1977 photograph shows dense thick grasses, low mesquite, and almost no prickly pear. Drawe, Chamrod, and Box attribute the change primarily to increased moisture, although reduced grazing pressure was certainly a factor in the improved grass. Prickly pear is thought to have decreased because of disease and insect problems created by a decade of higher rainfall.

Jim Wells County is often included in the Coastal Bend region of Texas for purposes of vegetation and wildlife studies. Several studies sponsored by the Welder Wildlife Foundation in Sinton, Texas, provide detailed identification lists of native vegetation. Jones (1975) provides an identification key to roughly 1150 species and varieties of Coastal Bend flora exclusive of the grasses. Gould and Box (1965) provide very detailed identification of the grasses of the Coastal Bend. The study by Drawe, Chamrod, and Box (1978) discusses plant communities similar to those that might have been present in the Jim Wells County area prior to intensive grazing and agriculture.

SITE SETTING CIRCA A.D. 1350

To construct an environmental model at the time that the Hinojosa site was occupied, a number of lines of evidence were considered, and a number of assumptions were made. It is assumed that the local climatic conditions at that time (circa A.D. 1300-1400) were wetter than today. The average annual rainfall was probably similar to that of today; however, it is assumed that absence of clearing, plowing, overgrazing, and historic erosion would yield more effective rainfall. It is also assumed that the area had relatively uneroded soils that were generally deeper than today in the upland areas. Nonetheless, present-day soil trends are considered reliable indicators of trends present 600 years ago. In other words, it is assumed that thin soils today would have also been comparatively thin then. Chiltipin Creek would have been spring fed year round, although during dry periods the creek would have only held water in the deeper holes.

It is assumed that with increased effective moisture and without modern impact (overgrazing and cessation of the prairie fires) the general region would have had less brush and more grasses than today. The same species that are present today were undoubtedly present 600 years ago. Brush mottes contained the same thorny species that today are so widespread. It is assumed that periodic fires did occur, whether natural or man-made. The fires would have kept brush-free corridors open in most areas. It is assumed that the prickly pear fields noted the following century by Cabeza de Vaca were not as extensive during the occupation of the Hinojosa site. These assumptions are made based on the published evidence cited previously and on archaeological evidence that will be presented later in this report.

The environmental model is shown in Figure 2. The model recognizes four general vegetation patterns: mid to tall grass prairies, riparian woods, short grass and thorny brush uplands, and short to mid grass and scrub brush uplands. These general vegetation patterns reflect the major native plant communities that would have been present in the area. The complex array of soil type distributions noted around the site suggests that a number of smaller microenvironments with associated plant communities would have been present in addition to the major plant communities. The model presented here is a schematic interpretation that will be used in later sections of this report to discuss the environmental exploitation patterns evidenced by the archaeological data. It is recognized that any such model is a simplification of the complex array of plant communities that would have existed.

The model shows that the mid to tall grass prairie covered the areas that today have deep clayey and loamy soils. The mid to tall grass prairie would have extended south and east of the site area. Small mottes of mesquite, live oak, and prickly pear would have been interspersed throughout the prairie, particularly in depressional areas with increased soil moisture. The site lies on the edge of a linear band of riparian woods or galeria forest (Weniger 1984:36) paralleling Chiltipin Creek. This wooded area would have included mesquite, anaqua, elm, live oak, and hackberry trees, and a variety of vines and bushes. Larger trees would have been clustered around the shaded water holes along the creek. East of the site, the ridges with shallow soil would have been covered with short grasses, thorny brush, and plants suited for shallow calcareous soils such as ceniza. Short to mid grasses and taller thorny brush would have occupied the lower slopes of the ridges east of the site where soil depth increases. Prickly pear thickets (not shown in the model) would have occurred west and southwest of the site in the lower lying areas with deeper sandy soils between the upland ridges.

Thus, we see that 41 JW 8 was situated in an broad ecotone situation with a variety of habitats nearby. It should be emphasized that the boundaries between the posited habitats would not have been as sharp as shown in the model. Most topographic, soil, and moisture gradients are gradual rather than abrupt. One good reason for the variety of habitats that are postulated for the aboriginal site area is the soils diversity as noted earlier. Diverse soils support diverse flora which in turn support diverse fauna. The faunal assemblage recovered from the site supports the hypothesized broad

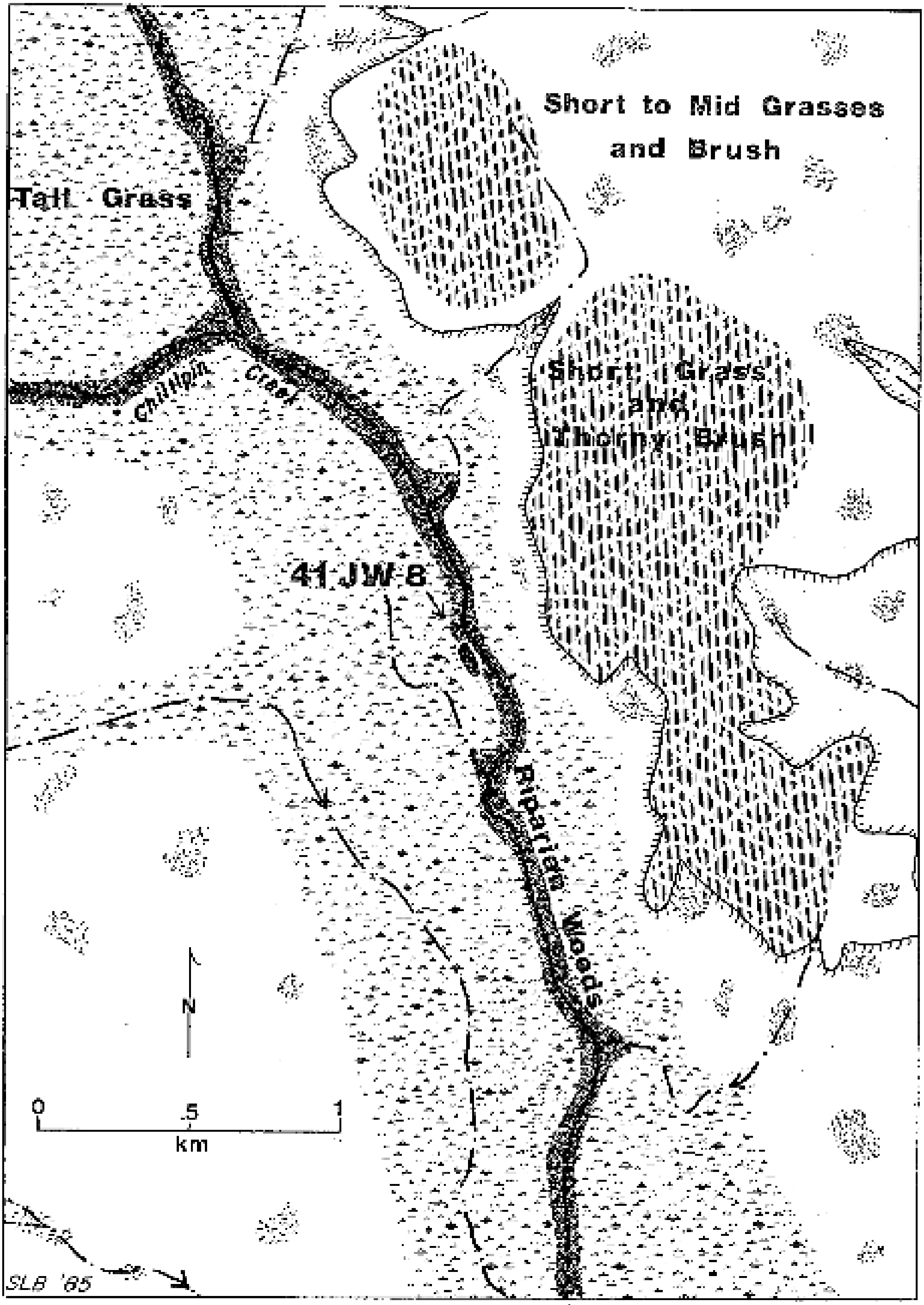

Figure 2. Environmental Model of Site Vicinity.

range of habitats rather well. Bison and antelope would be associated with the mid to tall grass prairies. The fish, mussels, soft-shelled turtles, and aquatic birds attest to the presence of a well-watered riparian zone. The javelina, **Rabdotus** land snails, and rats would have been associated with thorny brush and prickly pear thickets.

V. ARCHAEOLOGICAL AND ETHNOHISTORICAL BACKGROUND

The archaeological and ethnohistorical background of the southern Texas region and the Jim Wells County area is briefly summarized. The Late Prehistoric era is discussed in general terms in this section. Late Prehistoric cultural patterns and chronology are discussed in greater detail in Section XI. For additional prehistoric background and the history of archaeological research in the region the reader is referred to Mallouf, Baskin, and Killen (1977), Hester (1980a), and Hall, Black, and Graves (1982). Campbell and Campbell (1981) and Campbell (1983) summarize the ethnohistorical record for south Texas.

SOUTHERN TEXAS PREHISTORY

Intensive archaeological research has only taken place in southern Texas during the last decade (Hester 1980a; Hall, Black, and Graves 1982). Therefore, many problems in the regional prehistory have yet to be addressed. One of the greatest problems in understanding southern Texas prehistory is the lack of a tightly controlled chronology. Much of what is known about the chronologic development of southern Texas prehistory is based on comparisons with adjacent regions such as central Texas and the lower Pecos River area. The fact that even less is known about adjacent northeastern Mexico compounds the problem.

In broad terms, the prehistory of southern Texas and adjacent regions can be divided into three eras or general time spans: the Paleo-Indian, the Archaic, and the Late Prehistoric. Those three eras are seen by some as being developmental stages of a theoretical progression of culture toward civilization (cf. Willey and Phillips 1958; Prewitt 1981a). Herein, the three eras are seen as little more than gross divisions of cultural change through time. It can be argued that southern Texas has always offered a generally inhospitable environment for cultural development. Climatic and environmental conditions have provided challenges to cultural adaptation that have been successfully met by only a limited range of adaptive strategies. All known prehistoric cultures in southern Texas were hunting and gathering cultures that depended on the locally available natural resources for survival. Agricultural subsistence and sedentary life styles were nonexistent in southern Texas prehistory. Evidence for extra-regional trade and contact is rare for most areas of south Texas (Hall, Black, and Graves 1982:468-469).

The Paleo-Indian era in southern Texas, as well as in most areas of North America, has been traditionally viewed as a big game hunting adaptation to a late Pleistocene and early Holocene environment. The earliest human inhabitants of southern Texas are assumed to have been small groups of nomadic hunters who used spears tipped with fluted projectile points such as **Clovis** and **Folsom** to kill large Pleistocene animals like the mammoth and bison 10,000 to 12,000 years ago. Archaeologists are becoming increasingly aware that these early peoples also depended on a variety of resources in addition to extinct megafauna (Hester 1980a:28). Other resources notwithstanding, Early Paleo-Indian cultures remain best known for the distinctive remains of their hunting weapons. Surface finds of fluted projectile points are known from most areas of southern Texas especially in the interior. The late Pleistocene coastline is believed to have been much lower than the modern Gulf coastline due to the global lowering of the sea level (Hester 1980b). Evidence for Early Paleo-Indian adaptations to the late Pleistocene coastal environment may lie on the now inundated continental shelf (Coastal Environments, Inc. 1977).

Although many fluted projectile points have been collected in south Texas, only a few localities have been found that contain buried Early Paleo-Indian components. One such locality, the Buckner Ranch site, is located in Bee County some 50 miles northeast of 41 JW 8 (Sellards 1940). Hester (1980a: 142-146) interprets the Buckner Ranch site as an occupation site used by a succession of Paleo-Indian groups over a comparatively long time. The occurrence of lanceolate projectile points at Buckner Ranch along with stemmed dart points usually considered "Archaic" may be attributable to changing adaptive patterns during the later millennia of the Paleo-Indian era.

A series of unfluted lanceolate projectile points, including the **Plainview**, **Golondrina**, **Scottsbluff**, and **Angostura** types, are believed to represent successive Late Paleo-Indian occupations in south Texas (Hester 1980a). Adjacent regions once again provide the best excavated evidence of similar cultural adaptations. Sites like Baker Cave in southwest Texas (Word 1970; Hester 1983; Chadderdon 1983) document a shift to a more modern environment and toward small game hunting and plant gathering adaptations during the Late Paleo-Indian era. It is argued here that at least by 7000 B.C. human adaptation in southern Texas focused on a variety of plant and animal resources. Population increase during the later part of the Paleo-Indian era can be inferred from the much larger numbers of artifacts and sites in comparison with those attributable to Early Paleo-Indian occupation.

Hester (1980a:146) dates the end of the Paleo-Indian era to roughly 6000 B.C. and defines a transitional cultural period, the Pre-Archaic, between 6000 and 3500 B.C. in south Texas. This author has elsewhere argued that the term "Pre-Archaic" is no longer a useful cultural construct (Black 1980). If human adaptation in southern Texas already focused on a wide variety of resources by 7000 B.C. as is argued here, then an "Archaic" life style was obviously present during the so-called "Pre-Archaic." The term "Pre-Archaic" should be replaced by the more appropriate term, the "Early Archaic," as it has been redefined by Story (1980).

The Early Archaic era embraces roughly 3000 years of prehistory in south Texas, 6000 to 3000 B.C. The adaptive patterns evidenced across south Texas during this era are common to a large area of the Western Gulf Coastal Plain (Story 1980; McKinney 1981). Early Archaic sites in deep south Texas are poorly represented in comparison to Early Archaic sites along the Balcones Escarpment area that borders southern Texas on the north. This may reflect a very limited occupation in deep south Texas during this era or it may simply reflect the poor preservation of these sites and the relative dearth of archaeological research in the region. It has been suggested that drier, warmer climatic conditions occurred during the Early Archaic (Bryant and Shafer 1977). Higher rainfall and reliable springs along the Balcones

Escarpment may have made this area a much more favorable environment than inland south Texas.

Evidence of prehistoric occupation of south Texas during the succeeding millennia after 3000 B.C. is much more abundant. Excavations in the Choke Canyon Reservoir area have uncovered evidence of the Archaic era at dozens of sites. One of the problems of dealing with the Archaic cultures of south Texas is that they did not produce as many distinctive dart points in comparison with central Texas Archaic peoples. In south Texas, triangular and leaf-shaped bifaces are much more common than stemmed dart points. This is a problem because most of the Archaic chronologies in Texas and elsewhere rely on projectile points as chronological indicators. Various central Texas style Archaic dart points are often found in surface collections from south Texas. It has long been assumed that excavations would eventually document these artifacts in context and thus provide an equivalent south Texas Archaic chronology. This assumption has been called to question by recent investigations. The Choke Canyon excavations sampled buried Archaic components at many sites, yet stemmed projectile points were recovered in only very small numbers. Unifacial tools, simple bifaces, and distally beveled tools (gouges) were much more common. Grant Hall (personal communication) believes this reflects a much greater reliance on plant and small game resources in south Texas in comparison with an emphasis on deer and bison hunting in central Texas (Hall, Black, and Graves 1982; Hall, Hester, and Black 1986).

One unusual Archaic site in south Texas is the Loma Sandia site in Live Oak County (Hester 1980a). The 1977-1978 excavations at this cemetery site produced many Archaic burials believed to date to the later part of the Archaic era. The variety and quantity of the grave goods found with the Archaic burials may be linked to participation in a regional exchange system extending many hundreds of miles to the east (Hall 1983). Hall has suggested that cemeteries such as Loma Sandia may be located in areas with high concentrations of important natural resources such as pecans.

The later part of the Archaic era in south Texas, during the first millennium A.D., is recognized primarily by the widespread occurrence of small, expanding stem dart points such as the Ensor type. An overall reduction in size of projectile points also occurs in central Texas during the Late Archaic. Sometime around A.D. 1000 the Late Prehistoric era begins. Late Prehistoric cultures in south Texas are recognized by the presence of true arrow points and several distinct tool forms such as the small end scraper and the beveled knife. Bone-tempered ceramics occur over a wide area of south Texas by A.D. 1300. Accompanying these changes in artifacts are changes in adaptive strategies. Hall (in Hall, Black, and Graves 1982:471) sees a broader, more diversified hunting emphasis during the Late Prehistoric that often included large animals such as deer, bison, antelope, and possibly javelina. These changes in hunting emphasis may be partially attributable to the adoption of the bow and arrow and partially due to wetter conditions created by a significant climatic shift.

The Late Prehistoric era in south Texas is better known than preceding eras because of better site preservation and better site visibility. The chronology of the Late Prehistoric era in south Texas remains in question. In central Texas, the Late Prehistoric is divided into two phases, the Austin phase and the Toyah phase (Prewitt 1981a). The division between the early and late segments of the Late Prehistoric is not as clear in south Texas. Hester (1980a:158) has argued on the basis of excavated assemblages that in parts of south Texas the expanding stem arrow points (Austin phase) may have been used at the same time as the contracting stem arrow points (Toyah phase). The overlapping dates between some Late Prehistoric sites in the Choke Canyon area may support Hester's contention.

Several broad patterns of cultural adaptation have been defined for southern Texas. Hester (1976, 1981) sees a major division between coastal and inland adaptations which he terms the "maritime" and "savanna" traditions. The maritime and savanna traditions can be traced back several thousand years to at least the middle part of the Archaic. Ethnohistoric sources indicate that there were physical, linguistic, and cultural differences between coastal groups (whom Cabeza de Vaca termed the "canoe peoples") and inland groups. The maritime tradition involved full-time occupation along the bays and barrier islands of the middle and lower Texas coast. Subsistence was primarily based on fish, shellfish, and coastal fauna and flora. By contrast, the savanna tradition involved more diverse adaptations to a variety of localized inland resources.

The inland area of southern Texas had highly variable resource distribution. Areas with concentrated resources, termed "high resource density" areas, were surrounded by much larger "low resource density" areas (Hester 1981). High resource density areas often occur along perennial streams or rivers where concentrations of plants, animals, water, and lithic resources were found in close proximity. These "generalized resource areas" (Hall, Black, and Graves 1982:467) were repeatedly occupied through time, producing long linear archaeological sites paralleling the water courses. The distribution of water is one of the most important factors governing prehistoric settlement patterns in southern Texas. Virtually all of the perennial streams and rivers in south Texas evidence repeated occupation throughout prehistory. Smaller, more ephemeral streams and small springs were less heavily occupied. Sites along these less predictable water sources were probably occupied during periods of wetter climatic conditions. Upland areas located well away from reliable water sources evidence less intensive occupations that may be linked to the seasonal exploitation of certain plant resources (McGraw, Van Note, and Jones n.d.).

Hester (1981:123-125) suggests that along the coast and inland in high resource density areas the aboriginal groups may have developed well-defined, restrictive territories. These restrictive territories would have been the areas containing adequate resources year round. Hester believes that the large cemetery sites such as Loma Sandia in Live Oak County and the Late Prehistoric cemeteries along the coast reflect the existence of restricted territories. In contrast, most areas of south Texas did not have the high resource density necessary to sustain restricted territories. These areas would have been occupied by groups with much broader territories.

JIM WELLS COUNTY AND VICINITY

The present study is the only intensive archaeological project ever conducted in Jim Wells County. As of 1983, only 13 archaeological sites had been officially recorded in Jim Wells County. Sites 41 JW 1 and 41 JW 2 are located in the southern part of the county. Both sites are known only from surface collections of mostly Archaic materials. Sites 41 JW 3, 41 JW 4, and 41 JW 5 were recorded by L. W. Patterson along Lagarto Creek in the northern part of the county. All three sites have lithic materials that may be attributable to Archaic occupations. Of particular interest is 41 JW 3 which Patterson says is located on a rise that is one of the few lithic sources in the area.

Alvin C. Boldt, a former resident of Jim Wells County, recorded 41 JW 6, 41 JW 9, and 41 JW 12 east of Alice. A recent interview with Boldt revealed that 41 JW 6 and 41 JW 9 are actually two of a series of four to six small localities within an area about 700 m in diameter. Boldt collected a variety of Archaic and Late Prehistoric artifacts from these sites over a 15-year period. Some two and a half kilometers to the east Boldt made surface collections from four or five other localities along a low drainage. One of these localities was recorded as a separate site, 41 JW 12, based on Boldt's recollection that he had collected only Paleo-Indian and Archaic points from it. T. C. Kelly is currently studying the Paleo-Indian points from this site. All of Boldt's localities are small areas less than 100 m in diameter. Most are located on slightly raised topographic features adjacent to or overlooking small, unnamed drainages that flow into Agua Dulce Creek. Judging from Boldt's collection of burned rock, snail, and flake concentrations, most of the localities appear to be small occupation sites. The presence of chronologically sensitive materials dating to virtually the entire prehistoric sequence suggests the area was long a favored campsite. Boldt stated that prior to land modification in the 1930s the area had running creeks that held catfish and shallow rainy season lakes or swampy areas. Several of the localities are located adjacent to former lakes.

Gunnar Brune (1981:266) mentions that the Amargosa Springs near the Hinojosa site was visited by early man as evidenced by a **Clovis** point he says that Alvin Boldt collected near the springs. This statement is in error. Boldt actually found the **Clovis** point on an eroded ridge several miles northeast of the springs. The point was an isolated find (designated as 41 JW 13 due to the possible significance) that was not associated with any known or visible site. Chandler, Knolle, and Knolle (1983) discuss additional Paleo-Indian projectile points that were collected along Javelin Creek in northern Jim Wells and adjacent Nueces Counties.

The Hinojosa site and 41 JW 7 were initially recorded during a survey of SCS project localities in 1974 (Hester and Bass 1974). Site 41 JW 7 is located across Chiltipin Creek from the Hinojosa site near the Amargosa cemetery. The site is described as a light scatter of flakes, burned rock, and a few artifact fragments and is believed to represent a temporary campsite.

Jim Wells County remains archaeologically poorly known. Based on the few recorded sites and observations by local collectors, site density is comparatively low. Most site locations occur along the many small drainages in the county. One factor that may partially account for the relative low density of visible sites is the overall flat nature of much of the county. In contrast with areas to the west and north, Jim Wells County is less eroded and has deep soils. Older archaeological sites may be buried. On the other hand, cultivation and deep plowing have exposed many of the known sites, including 41 JW 8.

Warren (1984) recently surveyed a 100-acre-tract in Jim Wells County, seven miles south of 41 JW 8 along Resaca de Enmedio, a tributary of Chiltipin Creek. He did not locate any prehistoric sites despite backhoe trenching along the stream.

Adjacent to Jim Wells County are some of the best known and least known counties in south Texas in terms of archaeological resources. Duval, Brooks, and Kleberg Counties are very poorly known. Nueces and Live Oak Counties are comparatively well known whereas San Patricio County falls somewhere in between. C. K. Chandler (1982, 1983) has published several articles describing archaeological materials from San Patricio County.

Duval County archaeology has been recently summarized by McGraw, Van Note, and Jones (n.d.). They note relatively low site densities in upland areas and overall low densities of cultural materials in the southern part of Duval County.

In contrast, Nueces County has a much higher known site density, especially near the coast. Several hundred sites have been recorded in Nueces County, including inland campsites (Black 1978), cemetery sites along Oso Creek (Patterson and Ford 1974; Hester 1980a), sites on the barrier islands along the coast (Campbell 1964), and shell midden sites on the bay shores (Highley, Gerstle, and Hester 1977). The most recent summary of Nueces County archaeology can be found in Carlson, Steele, and Bruno (1982). Archaic and Late Prehistoric sites are well represented while Paleo-Indian sites are much less common. The Gulf coast and the bay systems offered a very different set of resources than was available inland.

The archaeological resources in the area south of Jim Wells County in Brooks County and in adjacent counties have been summarized in Mallouf, Baskin, and Killen (1977) and more recently in McGraw (1984). Much of this area occurs within the "sand plains" of southern Texas where surface water has long been all but nonexistent. Site densities appear to be low except near the few available water sources, such as the small aeolian depressions which hold water after periods of heavy rainfall.

The archaeological resources along the coast and margins of Baffin and Grullo Bays in Kleberg and Kenedy Counties are known from reports by Hester (1969, 1971). Recent work by Herman Smith (1982, 1983) may soon offer new insights into the prehistory of this area.

Live Oak and McMullen Counties are comparatively well known after years of work in the Choke Canyon Reservoir area. Twelve volumes in the Choke Canyon Series have been published by the CAR-UTSA to date. These include ethnohistoric work (Campbell and Campbell 1981), historical archaeology (Everett and Bandy 1981; Fox 1984, 1986), survey work (Thoms, Montgomery, and Portnoy

1981; Roemer 1981), survey and testing (Wood and Shafer 1981; Hall, Black, and Graves 1982; Hall, Hester, and Black 1986), and major site excavations (Brown et al. 1982; Scott and Fox 1982; Highley 1986). These reports document the best known archaeological area in southern Texas.

HISTORIC INDIANS OF SOUTHERN TEXAS

Historic contact in south Texas first occurred in the 1530s with the appearance of Cabeza de Vaca on the Texas coast (Campbell and Campbell 1981). In the following centuries the native inhabitants of south Texas were decimated by disease and displaced due to pressure from Spanish colonial occupations spreading from the south and groups of Apaches and Comanches moving in and raiding from the north. Within a few hundred years the native inhabitants of south Texas lost all ethnic identity. The small amount of ethnohistoric data known was collected by the Spanish. This information is spotty and motivated by an interest in converting the natives to Catholicism rather than recording native life styles (Campbell 1983).

The ethnohistoric sources suggest that south Texas was inhabited by hundreds of small bands who spoke many dialects of several language groups (Goddard 1979). An erroneous picture of linguistic and cultural homogeneity was fostered by use of the term "Coahuiltecan" to refer to virtually all the native groups of inland south Texas (cf. Ruecking 1955; Newcomb 1961). Campbell's work has called attention to this problem and has provided an accurate summary of the little that is known about the native inhabitants of south Texas and adjacent northeast Mexico.

The most accurate source of information on the aboriginal inhabitants of southern Texas comes from several documents written by survivors of the ill-fated Narvaez expedition to Florida in 1528. The most important and most famous of the survivors is Cabeza de Vaca, the treasurer of the expedition. Cabeza de Vaca's personal narrative and a similar narrative written by a historian, Oviedo y Valdes, based on a joint report of several of the survivors of the Narvaez expedition, provide perhaps the only accurate ethnographic data that is available for the inhabitants of southern Texas (Campbell and Campbell 1981).

It is very unfortunate that Cabeza de Vaca's account has been misinterpreted by many Texas historians. The key to understanding the account lies in accurately tracing Cabeza de Vaca's route across Texas. As Campbell and Campbell note, a careful study of the Narvaez expedition accounts reveals that Cabeza de Vaca traveled across southern Texas and crossed the Rio Grande in the vicinity of Falcon Lake. This interpretation is based on a well-reasoned study of the landmarks mentioned in the accounts as well as the Indian groups, direction of travel, and the repeated clearly stated goals of the survivors. A similar interpretation, published in the early 20th century (Davenport and Wells 1918-1919), has been virtually ignored by many historians as recent public school history textbooks attest (Campbell and Campbell 1981:65). The probable travel route of Cabeza de Vaca is shown by Campbell and Campbell (1981:Fig. 1) to cross Jim Wells County. The Campbells provide an excellent summary of the Indian groups mentioned by Cabeza de Vaca as well as by later accounts. The following pertinent details of the groups that ranged near Jim Wells County are extracted from Campbell and Campbell (1981).

Cabeza de Vaca spent several years among a group known as the Mariames (Campbell and Campbell 1981:13-22). The Mariames had a bilobate territory; most of the year they lived in the lower Guadalupe River valley. During the summer they traveled southwest along the coast and then moved inland to the northeastern edge of an extensive concentration of prickly pear. Campbell and Campbell (1981:14) place the Mariames' summer territory west of the Nueces River in parts of Jim Wells and Duval Counties. In 1533-1534 when Cabeza de Vaca was with the Mariames, their summer territory may well have included the 41 JW 8 area.

The Mariames relied on the vast fields of prickly pear for survival during the summer months. Apparently the superabundance of prickly pear fruits (tunas) provided a stable food source for several months. Periodic movement is indicated in order to find areas with ripe fruit. The fruits were usually eaten as they were found or after they were brought back to camp. In the late summer prior to the Mariames return to the lower Guadalupe River, the juice of the prickly pear fruit was extracted, and the tunas were split and dried in the sun so that they could be carried on their return to the winter territory. Land snails were noted in the Oviedo account as being an additional important food resource in the summer. The snails were searched for very carefully. Water was sometimes scarce in the summer territory of the Mariames as Cabeza de Vaca notes that tuna juice was squeezed into holes in the ground; the resulting sweet juice was consumed as a substitute for water.

Few other details of the Mariames summer subsistence pattern are directly stated in the accounts, however, a number of activities can be inferred from general statements and from suspicious missing comments. For example, it can be inferred that a wide variety of small animals were hunted, including snakes, rats, and fish. These animals were eaten as well as their bones which were saved and pulverized to be eaten later. Deer were hunted during the semiannual migration between the territories by chasing them into the bays and forcing them to swim until they became exhausted and drowned. Bison were mentioned as used by the Mariames for clothing and shields. No mention is made of bison hunting during Cabeza de Vaca's stay among the Mariames. This may be due to the occurrence of drought conditions as it can be inferred from several statements that the years 1533-1534 were unusually dry (**ibid.**:15).

The Mariames lived in small circular huts consisting of a four pole frame covered with mats. The mats were presumably made from some sort of woven plant fiber. The simple structures were transported every two to three days to a new encampment. Comparatively few items of material culture are discussed in detail. Bows and arrows were used. Some bows were obtained from the Avavares during the prickly pear season by trade. Small bison hide shields were used. Flint knifes, flint flakes, scrapers, digging sticks, and mortar and pestles are not directly mentioned but can be inferred (Campbell and Campbell 1981:18-19). Campbell and Campbell (1981:19) state that: "Pottery was evidently not made because it is said that prickly-pear juice was collected in holes in the ground for lack of suitable containers." Some type of woven or flexible basket was used to carry the dried prickly pear fruits. A small net is mentioned and described as being about five and a half feet in length and width. Cooking features used by the Mariames that might be preserved include open hearths and some type of pit oven.

The Avavares are another group described by Cabeza de Vaca that lived at least part of the year in the Jim Wells County area. Campbell and Campbell (1981:24-27) suggest that the Avavares may have ranged on both sides of the Nueces River in parts of Jim Wells, Duval, and San Patricio Counties. The seasonal movement of the Avavares is not clear. They are mentioned as collecting prickly pear in the summer and trading bows with the Mariames. They are also mentioned as remaining in the prickly pear area after the other groups had left. They apparently spent considerable effort (up to five days) searching for late ripening prickly pear. One passage describes the Avavares locating a stream valley with trees containing an edible pod after spending several days searching in vain for ripe tunas. Campbell and Campbell believe that these trees may have been the Texas ebony which has seed pods that hold edible seeds into the winter.

The Avavares hunted deer and used the deer skins to keep warm in the winter. The Avavares suffered greatly during the winter of 1534-1535 when the Spanish stayed with them for eight months. The Spanish noted that they mostly ate roots during the winter and suffered much more hunger than the Mariames. Cabeza de Vaca told of an interesting legend among the Avavares that involved a strange man known as Mala Cosa ("bad thing"). Mala Cosa was alleged to enter houses at night carrying a torch and a large flint knife. He would select a man and preform surgery on the man's abdomen and elbow. Other strange behavior is associated with this legendary character. Mala Cosa probably represents the trickster, an almost universal mythological figure among North American Indian groups (Radin 1956).

The Avavares had contact with a number of groups in the area, including the Mariames, the Fig People, the Cutalchuches, the Maliacones, and the Susolas. The Fig People were a coastal group that Campbell and Campbell place just south of Corpus Christi Bay. The Avavares apparently had friendly contact with the Fig People with whom they visited and traded. The Cutalchuches, the Maliacones, and the Susolas are mentioned as collecting tunas in the same area as the Avavares. Few details are available for these groups.

Campbell and Campbell also summarize ethnohistoric data for the 17th and 18th centuries for south Texas, but detailed information such as that just summarized is simply not available for these later periods. Cabeza de Vaca and his companions were the only Europeans to have actually lived among the aboriginal Indians of south Texas. Later accounts are almost all passing references made in connection with various duties of the Spanish colonialists. During the 18th and 19th centuries, the native groups were displaced by the Spanish from the south and the marauding Apache from the north. European diseases also played an important role in the destruction of native culture. Remnants of the native south Texas groups entered various Spanish missions in the area, including the missions at Guerrero, San Antonio de Bexar, and Goliad. It is obvious from the mission records that the groups were fragmented, displaced, and disoriented (Campbell 1979, 1983; Campbell and Campbell 1985).

By 1828, when Jean Louis Berlandier traveled through southern Texas, the only remaining Indian groups in the region were the Lipan Apaches, the Comanches, the Tonkawas, and a few surviving Karankawa along the coast. The Lipan Apache were forced into south Texas by the Comanches from the north. The Comanches actually only ventured into southern Texas to raid the Spanish and later Anglo settlements. The Tonkawa were a central Texas group that ranged into south Texas to hunt bison. By the 1870s, even these groups had been eliminated from south Texas. Today there are no known descendants of the aboriginal peoples who once lived in southern Texas.

ABORIGINAL SOUTH TEXAS

To generalize, the aboriginal cultural history of southern Texas can be viewed as a series of specialized hunting and gathering adaptations to a demanding environment. These specialized adaptations developed from a long culture history beginning at least 9000 years ago. Some of the groups present when the first Europeans chanced upon south Texas were probably direct descendants of the Paleo-Indian peoples who settled in the region. Outside influence through trade, migration, or the diffusion of ideas was probably minimal and restricted to similar peoples in adjacent regions. Northeast Mexico, the lower Pecos River area, and central Texas were the most important adjacent regions in terms of influence on and similarity to southern Texas groups. Population density probably remained low during all but the most favorable climatic conditions. Even during the most favorable climatic cycles the yearly climatic variations probably held the populations to relatively low densities. Most groups lived a nomadic life style governed by the seasonal availability of resources. Plant resources probably provided a much greater amount of the subsistence than did animals. Small animals, insects, snails, and snakes probably contributed more to the daily diet than did larger animals.

Social organization probably never involved much more than a band level society. The basic social group was probably the band (microband). The size of the microbands probably varied a great deal depending on subsistence patterns, climatic conditions, and territory size and location. Estimates of band sizes range from 30 (Hester and Hill 1975) to several hundred (Campbell 1983). Seasonal aggregation of related microbands into macrobands was governed by the availability of superabundant resources. The bands had territories centered on certain geographical features such as stream valleys or bay systems. Seasonal availability of favored resources often caused the bands to range over considerable distances and to develop oddly shaped territories such as the bilobate territory of the Mariamos (Campbell and Campbell 1981). Coastal groups remained on the coast year round and were well adapted to the marine environment. Inland groups had more varied adaptations dependent on climatic conditions, territory resources, and culture history.

Considerable interaction occurred between band groups. Related bands exchanged gifts, intermarried, shared territories, and camped together during certain seasons when superabundant resources were available. Most groups probably had patrilineal descent systems. Warfare was uncommon although certain groups were hostile to one another. Valuable or uncommon resources were often traded between groups. Flint, flint tools, marine shells, shell ornaments and tools, bows, asphaltum, and red ochre are items that were commonly traded. Coastal groups traded with inland groups from adjacent territories.

VI. ARTIFACT ANALYSIS

The artifactual materials recovered from the Hinojosa site were divided into the following material classes: lithics, prehistoric ceramics, baked clay, modified bone and shell, and historic materials. The provenience of these materials can be found by referring to Appendix 1. Additional nonartifactual materials such as mussel shells, faunal remains, and soil samples are discussed in Section VII.

LITHICS

Lithic materials make up the bulk of the cultural debris recovered from 41 JW 8. This is particularly significant when one considers the fact that very few lithic resources are locally available, hence most of the lithic materials at the Hinojosa site were brought in from many kilometers away. This section provides a discussion of the lithic materials and sources used by the people that camped at 41 JW 8 and a descriptive classification of the recovered lithic artifacts.

LITHIC MATERIALS AND SOURCES

The Hinojosa site is located within an area of very limited lithic resources. The only usable lithic materials available within a kilometer of 41 JW 8 are calcium carbonate concretions and caliche exposed in erosional gullies on the ridge east of Chiltipin Creek. Over 99.9% of the lithic artifacts (not including burned rock) recovered from 41 JW 8 are made of siliceous lithic materials transported to the site from sources at least 35 km distant. To the north, the nearest sources of siliceous materials occur some 50 to 60 km away, along the Nueces River. To the south and southeast, surface exposures of siliceous materials do not occur. The two closest sources of siliceous materials are the Nueces River some 35 km to the east-northeast and northwestern Duval County some 45-50 km to the northwest of the Hinojosa site.

The Nueces River valley provides the nearest source of siliceous lithic material to 41 JW 8. Chandler (1984) has recently documented the occurrence of at least two lithic source areas along the Nueces River below Lake Corpus Christi. These two source areas, "pebble beach" and the "Piedras Crossing," have deposits of chert, silicified wood, and agate cobbles and gravels along with larger pieces of sandstone. Based on a sample collected by Chandler (on file CAR-UTSA), most of the cobbles are oblong shaped and relatively small (less than 15 cm in length). Chert colors range from tan to gray to brown with darker colored thin cortex layers. Fine-grained, unflawed chert cobbles are less common than flawed, variable grain, poor quality chert cobbles. The silicified wood from these sources is very friable and poorly suited for chipped stone tools. Unusual materials such as quartzite and volcanic rocks may occur in small quantities. Most of the chert materials found at 41 JW 8 were probably derived from sources along the Nueces River.

Hilltop gravel exposures occur in northwestern Duval County northwest of Freer as well as other areas of south Texas farther to the west and north of Freer. The hilltop gravel exposures represent the remnants of gravel lag deposits left behind tens of thousands of years ago by long vanished rivers. Today these gravels often occur miles away from and many meters above any modern stream.

Present in these hilltop exposures are small well-rounded cobbles and pebbles of various lithic materials, including chert, silicified wood, chalcedony, and igneous rocks. Overall, the hilltop exposures offer a greater variety and higher quality of lithic materials than the Nueces River sources. Some overlap occurs. The Duval County cherts include the tan-gray-brown cherts typical of the Nueces River sources in addition to white chert and many exotic-colored cherts (red, yellow brown, and green). The fine-grained, glossy white chert seems to have been a favorite material based on surface collections in northwestern Duval County (41 DU 4, 41 DU 5, and 41 DU 6; notes on file CAR-UTSA) and in northeastern Duval County (McGraw, Van Note, and Jones n.d.). The silicified wood cobbles from Duval County tend to have more complete replacement by silica, hence they are less friable than the Nueces River samples collected by Chandler. The presence of white chert, exotic-colored chert, and igneous materials in low percentages at 41 JW 8 may suggest that the Duval County lithic sources were used less frequently than the Nueces River sources by the inhabitants of the Hinojosa site.

The following is a brief description of each distinctive lithic material found at 41 JW 8:

Chert: Also known as flint, chert is a cryptocrystalline siliceous material with conchodial fracturing properties that make it an ideal material for chipped stone tools. Most of the chert recovered from the Hinojosa site range from tan to gray to brown in color. The cortex layers are dark brown to almost black in color and tend to be thin and very hard. The curvature of the cortex on the flakes and cores from 41 JW 8 suggests that most chert cobbles were small in size. Artifacts and flakes of exotic-colored yellow brown chert were found in small numbers. Many flakes and most artifacts have glossy waxy surfaces and/or pink to purple tinges that indicate thermal alteration.

Thermal alteration, or heat treatment, is the purposeful improvement of siliceous lithic materials through gradual and prolonged application of indirect heat (Purdy and Brooks 1971). Prehistoric heat treatment of siliceous materials was a very widespread practice in North America (Hester and Collins 1974; Epstein 1979). Black and McGraw (1985) provide references to the large body of literature that has been devoted to heat treatment. In general, heat-treated chert can be recognized by one or more of the following properties: (1) a change in color to a darker and/or redder (or pink or purplish) color; (2) a change to a waxy or greasy texture; and (3) a change in appearance to a vitreous (glassy) luster of all flaked surfaces except the relic surfaces in existence prior to heat treatment (Hester and Collins 1974; Skelton and Meredith 1977). These changes were noted on many chert artifacts from 41 JW 8, particularly the Perdiz arrow points.

White Chert: As mentioned, white chert has been observed to be a favored material type in southeastern Duval County (McGraw, Van Note, and Jones n.d.). It should be noted that McGraw, Van Note, and Jones (n.d.) refer to this material as white chalcedony even though it is not translucent. This writer does not use the term "chalcedony" to refer to a totally opaque siliceous material.

White chert is comparatively rare at 41 JW 8 but it is an important lithic material for several of the bifacial tool types. The white chert recovered from 41 JW 8 is typically fine grain and glossy, with numerous tiny crystal-filled inclusions. The glossy appearance and sometimes greasy feel of many of the white chert artifacts may suggest heat treatment, although the raw material is glossier than most types of chert in south Texas.

<u>Silicified Wood</u>: Petrified or silicified wood is a lithic material formed by the replacement of wood by silica in such a way that the original form and cell structure are preserved. The Nueces River and Frio River valleys of south Texas are famous among rock collectors as source areas for silicified wood. A few chipped stone artifacts from 41 JW 8 are made from silicified wood.

<u>Quartzite</u>: Quartzite is a metamorphic rock that has a granular structure completely cemented by silica. Artifacts made from quartzite have a sparkley appearance due to the individual quartz grains visible within the matrix. The grain size and appearance of this material have given rise to the colloquial description "sugar quartzite" that is often applied to quartzite artifacts. In western south Texas, quartzite was frequently used for a specific lithic tool type, as defined by Hester, Gilbow, and Albee (1973), the **Clear Fork** tool. These authors suggested that quartzite was chosen over chert due to its hardness and durability. The source area for the small number of quartzite artifacts found at 41 JW 8 is not known.

<u>Chalcedony</u>: Chalcedony is a term used to describe a cryptocrystalline quartz that appears more translucent than ordinary chert. Chalcedony occurs in northwestern Duval County. A few artifacts and flakes made of chalcedony were recovered from 41 JW 8. Milky colored, semitranslucent chalcedony is known colloquially as "moonstone" by rock collectors (Black and McGraw 1985). Several flakes and bifacial fragments from 41 JW 8 are made from moonstone.

<u>Calcium Carbonates</u>: Calcium carbonate, $CaCO_3$ or calcite, is the rock-forming mineral that is the principal constituent of limestone and caliche. These rocks are the only naturally occurring lithic materials in northern Jim Wells County (except for pebble and sand-sized materials). Calcium carbonates were used for ground stone tools, abrading tools, and for hearth rocks at 41 JW 8. Erosional gullies on the ridges overlooking Chiltipin Creek east of the site provide exposures of calcium carbonate.

<u>Sandstone</u>: Sandstone is a sedimentary rock composed of cemented sand grains. Silica and calcium carbonate are common cementing agents. Surface exposures of sandstone occur along the Nueces River and in northwestern Duval County. Sandstone was the preferred material for ground stone tools at 41 JW 8 as well as many other southern Texas archaeological sites.

<u>Volcanic Materials</u>: Several hammerstone fragments and chipped stone tools from 41 JW 8 are made of purple or brown igneous (volcanic) material. The exact composition of these materials is unknown. The purple material has a finer matrix texture, smaller phenocrysts, and choncoidal fracturing. The

brown material has a coarser matrix texture with larger and more abundant phenocrysts and lacks chonchodial fracturing properties. The igneous materials from the Hinojosa site were probably derived from the northwestern Duval County source area.

LITHIC CLASSIFICATION SYSTEM

The lithic materials from 41 JW 8 are classified according to the morphological and technological attributes commonly used by archaeologists in the region. Most of the artifact classes and types have functional differences that are related to morphology and technology. In other words, most lithic artifacts were made a certain way in a certain shape to perform a specific task or range of tasks. Functional considerations for most of the finished artifact types are discussed in considerable detail based on microscopic wear pattern studies.

The classification of the 41 JW 8 lithics was simplified by the facts that only one cultural group is believed to be responsible for all the material and the range of artifact types is rather limited. This is in stark contrast to the situation often faced with multicomponent sites where the analyst must deal with lithics produced over thousands of years by many different groups (cf. Black and McGraw 1985).

The Hinojosa site lithic material can be divided into three major classes based on the degree and type of modification of the material. These classes are unmodified lithic material, chipped stone, and nonchipped modified stone. Each class can be divided into subclasses that can be divided into groups that can be divided into forms. The chipped stone class is much larger and more complex than any of the other classes. Table 1 shows the complete breakdown of the lithic classification system. Most artifact groups or forms were given alphanumeric artifact codes. The artifact codes are used where necessary throughout this report to simplify references to specific artifact types.

UNMODIFIED LITHIC MATERIAL

Pebbles, Rocks, and Gravels

Small quantities of rounded pebbles, gravels, flakes, and calcium carbonate rocks were found throughout the site deposits. The gravel-sized rocks (>64 mm) are almost all calcium carbonate concretions. These were most common in the lower excavation levels. The pebble-sized rocks (4-64 mm) are predominately stream worn (rounded to well-rounded) pieces of chert and other siliceous materials. These represent redeposited alluvial materials. Several unmodified calcium carbonate slabs 10-15 cm in diameter were recovered. These could represent incipient ground stone artifacts or, more likely, rocks brought to the site for use as hearth stones or anvils used to break open long bones. One slab was associated with Feature 3, a bone cluster.

TABLE 1. LITHIC CLASSIFICATION SYSTEM

Artifact	Artifact Code
UNMODIFIED LITHIC MATERIAL	
Pebbles, Rocks, and Gravels	
Asphaltum Pebble	
Burned Rock	BR
CHIPPED STONE	
Cores	C
Debitage	
Unmodified Debitage	
Flakes	
Primary	D1
Secondary	D2
Tertiary	D3
Chips	
Corticate	D4
Decorticate	D5
Chunks	D6
Modified Debitage	
Trimmed	MD1
Minutely Retouched and Utilized	MD2
Retouched Debitage with Concave Edge	MD3
Bifacial Artifacts	
Arrow Points	
Contracting Stem (Perdiz)	A1
Expanding Stem	A2
Triangular	A3
Fragments (unidentifiable)	A4
Finished Bifaces	
Beveled Knives	B1
Triangular	B2
Perforators	B3
Olmos Bifaces	B4
Fragmentary and Unfinished Bifaces	
Round Proximal	FB1
Miscellaneous Proximal Fragments	FB2
Miscellaneous Biface Fragments	FB3
Unifacial Artifacts	
End Scrapers	U1
Miscellaneous Scrapers	U2
NONCHIPPED MODIFIED STONE	
Ground Stone	MS1
Hammerstones	MS2
Abraders	MS3
Sandstone Pipe Bowl	MS4

A number of small flakes were recovered from the upper levels that have rounded edges and smoothed flake ridges. These seemingly appear to be stream-worn flakes. An alternative explanation that seems more likely in view of the ephemeral nature of Chiltipin Creek was suggested by Kenneth M. Brown. Brown (personal communication) has observed identically worn flakes eroding out of cow paddies (dung) in southern Texas. The flakes are apparently accidentally ingested by cattle while they are eating grasses growing on archaeological sites. The flakes become uniformly rounded and smoothed while passing through the bovine digestive system. The redeposited flakes become reincorporated into the site deposits as the cow dung breaks down. Tending to support this explanation are the facts that most of the worn flakes were recovered in the upper disturbed levels at 41 JW 8, and Clemente Hinojosa ran cattle on the property for many years.

__Asphaltum Pebble__

A small pebble-sized piece of asphaltum was found at 41 JW 8 (Lot 372). This piece is rounded and measures about 8 mm in length and weighs 0.2 g. The smooth, rounded exterior gives the pebble a natural weathered appearance identical to modern examples of asphaltum that are often found along the beaches of the Texas coast. Under 20-30X magnification, small subrounded to well-rounded quartz sand grains were observed embedded in microscopic folds in the asphaltum. It is suggested that this artifact represents beach asphaltum collected by or traded to the inhabitants of the Hinojosa site. Asphaltum decoration has been documented on several artifact classes present at the site, including pottery and the sandstone pipe. Asphaltum pieces have been recovered from several inland sites in south Texas, including two Late Archaic sites in the Choke Canyon Reservoir area, 41 MC 55 (Hall, Black, and Graves 1982) and 41 LK 201 (Highley 1986).

__Burned Rock__

Burned calcium carbonate rocks occurred in comparatively high frequencies in the site deposits. Most of the rocks are quite small in size (less than 5 cm in diameter). The larger burned rocks were usually associated with cluster features. It is suggested that most of the burned rocks are remnants of rocks used to line or outline hearth features. It is possible that some burned rocks represent discarded boiling stones, but the extremely fragile nature of most of the calcium carbonate material in the area casts doubt on this possibility.

CHIPPED STONE

__(C) Cores__ (N=35; Fig. 3)

A core is the portion of a chert cobble that remains after the removal of one or more flakes. In other words, cores are the by-product of flake production. Cores tend to be blocky in shape and lack the carefully shaped two-sided configuration of bifaces. Cores can be sorted into a number of categories based on attributes, such as the number of flake removals (scars), direction of flake removals, size, and types of flake platforms. The cores from 41 JW 8 are only sorted by size because very little variation or distinct patterning of other attributes was observed. The cores are sorted into size classes based on the minimum diameter: three cores are less than 2.5 cm in diameter, 29 are between 2.5 and 5 cm in diameter, and three cores are between 5 and 7.5 cm in diameter. Table 2 presents attribute data for each core.

The 35 cores recovered from 41 JW 8 could almost all be categorized as "exhausted cores." That is to say, almost all possibilities for useful flake removal have been exhausted. The Hinojosa site cores can be further characterized as generally small in size with multidirectional flake removals. Single facet and natural platform types are the most common, but multifaceted platforms are also present.

The collection of cores from 41 JW 8 can be characterized as a group of small exhausted cores that have had every useful flake removed from every possible platform and direction. The cores represent the maximum utilization of a scarce resource. Several of the hammerstones from 41 JW 8 are recycled exhausted cores. In contrast, sites in areas with plentiful chert, such as the sites in the Choke Canyon Reservoir area (Hall, Black, and Graves 1982), often have larger cores that were discarded long before they were exhausted. Five of the cores appear to be modified; one by hammerstone wear and four by trimming. These represent recycled artifacts.

Debitage

The definition of debitage is the fragments of chipped stone that are removed from larger pieces of chert such as cores or bifaces. Most of the debitage represent the waste products of chipped stone tool manufacture. Unmodified debitage pieces are the fragments of chert that lack definite evidence of modification. Modified debitage pieces are the fragments of chipped stone that have been further chipped or altered through use.

Unmodified Debitage

The unmodified debitage category includes all chipped stone debris that lacks evidence of modification (further chipping or use). This debris is sorted into the following: primary flakes, secondary flakes, tertiary flakes, corticate chips, decorticate chips, and chunks. The two considerations used to distinquish between the debitage groups are whether or not a piece of debitage has a platform (flake vs. chip) and how much cortex remains on the exterior (ventral) flake or chip surface. A flake is a purposefully removed piece of chipped stone that has a striking platform, a bulb of percussion, and dorsal (exterior) and ventral (interior) surfaces. A chip is a flake fragment that lacks a striking platform.

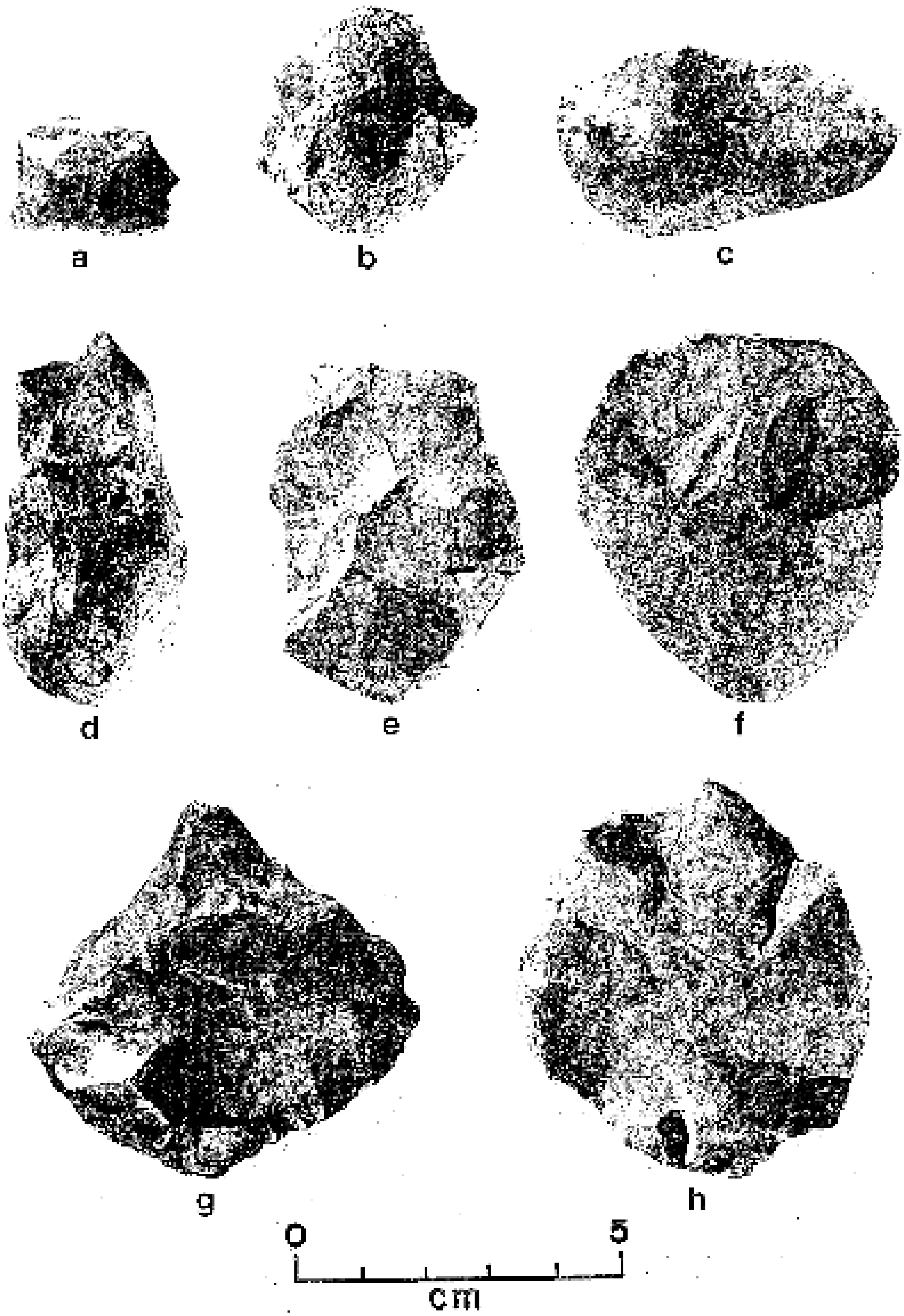

Figure 3. Cores (C). Lot numbers: a, 195; b, 285; c, 179; d, 189; e, 437; f, 342; g, 264; h, 344.

TABLE 2. CORE ATTRIBUTE DATA

Lot Number	Size Class	Cortex	Flake Removals	Removal Direction	Platform Types	Modification
56	2	1	2	3	2, 3	3
62	2	2	2	3	2	1
62	2	1	3	1	2, 1	1
62	2	1	3	3	2, 3	1
62	3	1	3	3	2	1
74	1	1	2	3	2	1
107	3	1	3	3	1, 2	1
110	2	2	3	2	2	2
124	2	1	3	3	1, 2, 3	1
131	2	1	3	3	1, 2	1
142	2	2	2	2	2, 3	1
173	2	1	3	3	2	1
179	2	1	3	2	2, 3	1
189	2	1	1	1	1	1
195	1	2	3	3	2, 3	1
240	2	1	2	3	1, 2	2
240	2	1	3	3	2, 3	1
264	2	1	3	3	1, 2	1
281-10	2	1	3	3	1, 2	2
284	2	1	2	3	1, 2	1
285	2	1	3	3	1, 2	1
312	2	1	2	3	1, 2	1
313	2	1	2	3	1, 2	1
320	2	1	3	3	2, 3	1
321	1	2	3	3	2, 3	1
325	2	2	3	3	2, 3	1
335	2	1	3	3	2	1
342	2	1	1	1	1	1
344	2	1	2	3	1, 2	1
344	3	1	3	3	1, 2	1
417	2	1	2	3	1, 2	1
437	2	1	3	3	2, 3	1
438	2	2	3	3	2, 3	1
518	2	1	2	3	2	2
519	2	1	2	3	2	1

<u>Size</u>
1 = <2.5 cm
2 = 2.5-5 cm
3 = 5-7.5 cm
4 = >7.5 cm

<u>Cortex</u>
1 = present
2 = absent

<u>Flake Removals</u>
1 = 1-2
2 = 3-5
3 = >5

<u>Removal Direction</u>
1 = single direction
2 = bidirectional
3 = multidirectional

<u>Platform Types</u>
1 = natural
2 = single facet
3 = multifacet

<u>Modification</u>
1 = none
2 = trimming
3 = hammerstone

(D1) Primary Flakes (N=103)

Primary flakes are the first flakes removed from a chert cobble. They have cortex (the weathered exterior surface of a cobble) entirely covering the ventral surface. Small patches of missing cortex from the ventral face were disregarded when it was obvious these patches were the result of platform shatter or postchipping damage.

(D2) Secondary Flakes (N=1564)

Secondary flakes have cortex only on a portion of the ventral surface or on the platform. As the name implies, secondary flakes are removed from chert cobbles after the primary flakes and usually before the tertiary flakes.

(D3) Tertiary Flakes (N=3585)

Tertiary or interior flakes do not have any cortex. Tertiary flakes are commonly smaller and much more numerous than primary or secondary flakes.

(D4) Corticate Chips (N=2319)

Corticate chips have some cortex on the ventral surface.

(D5) Decorticate Chips (N=4507)

Decorticate chips do not have any cortex.

(D6) Chunks (N=246)

Chunks are angular pieces of chipped stone that do not have a platform or well-defined ventral or dorsal surfaces. Chunks are often battered chert pieces that are no longer recognizable as chips or flakes. Chunks can also represent angular shatter fragments created when flawed chert is knapped.

Modified Debitage

The modified debitage category consists of flakes, chips, and chunks with edges that have been altered or modified after removal from the parent mass (core or biface). The regional literature contains a number of analytical or descriptive terms that have been applied to modified debitage, including trimmed flakes, retouched flakes, utilized flakes, and edge-damaged flakes. The view taken here is that it is difficult if not impossible to easily distinguish between flakes with minutely retouched edges, flakes with utilized edges (worn through use), and flakes with damaged edges. Detailed wear pattern studies would be necessary to begin to meaningfully differentiate between these categories of edge modification.

Flake edges are characteristically sharp, thin, and fragile. Many factors unrelated to prehistoric culture cause damage to flake edges, such as agricultural modification (clearing and plowing), cattle and horse tromp, trowel damage, screen damage, and bag damage. Recent edge modifications, such as that occurring during excavation, typically result in fresh looking broken edges. Obviously recent edge-damaged debitage was purposefully disregarded during the sorting process. Similarly, debitage with random nicks or irregular broken edges were not considered modified. Tiny chips with very small amounts of edge modification were also disregarded. The intent was to categorize as modified only those pieces of debitage that were prehistorically and purposefully modified.

The modified debitage pieces from 41 JW 8 are described in three groups. It should be noted that overlap occurs between the first group, trimmed debitage, and some of the minimally modified unifaces. It should also be noted that occasional trimmed flakes appear to have specialized morphological attributes, for example, a beaked projection. These are not assigned to a separate group due to the very small number of artifacts in question.

<u>(MD1) Trimmed Debitage</u> (N=51)

Trimmed debitage pieces, for the purpose of definition, are considered those flakes, chips, and chunks that have flaked edges with at least five **en echelon** (side by side) flake removals at least 2 mm in length. If flake removals cover most of both faces, then the artifact is considered a biface. If the flake removals are only on one face and form a regular edge that significantly alters the original shape of the flake, then the artifact is considered a uniface. This category commonly includes both incipient bifaces that were never completed and flakes with one or more regular edges that have been flaked to form a working tool edge. It is often difficult to distinguish between these two categories.

The MD2 category (minutely retouched and utilized debitage) is by far the most numerous type of trimmed debitage in the Hinojosa site lithic collection. All types of flakes and chips are purposefully trimmed. Trimmed chunks are uncommon. Larger flakes, particularly secondary flakes, tend to be carefully trimmed more often than smaller tertiary flakes and chips.

<u>(MD2) Minutely Retouched and Utilized Debitage</u> (N=776)

The MD2 category contains flakes, chips, and chunks with edges that have minute retouch, utilization, or edge damage for at least five continuous millimeters. In other words, pieces of debitage with irregular edge modification are not included. This group forms the most numerous tool category at 41 JW 8. MD2 specimens are believed to represent informal flake tools. These informal flake or debitage tools are simply pieces of debitage that were picked up from discarded waste and used with little or no special preparation. Typically, these tools may have been used to perform cutting, incising, scraping, and sawing functions for a limited time (single use episodes?) and then discarded. The specific function that a given tool was used for is difficult to determine even with microwear analysis, due to the very short-term nature of most of the hypothesized tool functions. A flake used for two minutes to sharpen a stick is not going to develop much wear.

All types and sizes of debitage occur in the MD2 category. Due to the ephemeral nature of the modification, many pieces of debitage classified as unmodified would probably be classified as minutely retouched and utilized if examined under magnification.

(MD3) Retouched Debitage with Concave Edge (N=43)

The MD3 category consists of modified debitage specimens that have a retouched concavity (semicircular notch) on at least one edge. Flakes or chips with irregular concavities or concavities formed by a single blow are not included in this group. Similar artifacts are usually referred to as "spoke shaves." It is often suggested that spoke shaves were used to smooth arrow shafts. The 41 JW 8 MD3 specimens are not uniform and vary considerably in the size and shape of the concave edge.

Bifacial Artifacts

Bifaces are two-sided pieces of chert that have been shaped by flaking on both faces. Most of the bifaces from 41 JW 8 are flake bifaces. That is to say, the bifaces were made from flake blanks rather than from an entire cobble (core biface). This is evidenced by the overall small size of most of the bifacial artifacts and the presence of flat flake plane remnants on many specimens. A few of the larger bifaces may be core bifaces.

The bifacial artifacts are divided into several functional and morphological groups. The smallest bifaces are arrow points. The distinctive size and shape of the arrow points from 41 JW 8 leave little doubt as to their functional identification. The larger complete bifaces and fragments of complete bifaces are described under the heading "Finished Bifaces." Four morphologically distinct groups of finished bifaces are defined. These four groups represent tool types that have been previously recognized in southern Texas. Functional differences are suggested for most groups based on morphology and microscopic examination although some functional overlap occurs.

The remaining bifacial artifacts are unfinished and fragmentary and do not fit into well-defined groups. These are divided into groups based on general morphological similarities. These bifacial artifacts were not microscopically examined.

Arrow Points

(A1) Contracting Stem (Perdiz) (N=99)

The A1 category consists of complete and identifiable fragments of small contracting stem arrow points (Figs. 4; 5,a-n). The blades are triangular with straight or rarely concave (recurved) or convex edges. The distal tips are usually very sharp when preserved. The blades have very distinct shoulders that usually form downturned prominent barbs. A few specimens have right angle or rounded shoulders. The stems usually contract gradually with a pointed or rounded base. Three specimens have atypical stems that slightly expand before contracting (Fig. 5,a-c). These may be similar to "bulbar stem" points (Corbin 1963, 1974). Some crude arrow points (Fig. 5,d-f) appear to have never been completed. These are classified as **Perdiz** points rather than as **Cliffton.** The occurrence of a small number of obviously unfinished arrow points along with a much larger number of finished arrow points makes it clear that the **Cliffton** type has little validity (see Highley, Graves, and Judson 1978; Black and McGraw 1985).

The **Perdiz** points from 41 JW 8 are typically made on heat-treated tertiary percussion flakes using pressure flaking. No evidence of blade technology was observed. Flake platform remnants occur on both the distal and proximal ends. Over 90% of the complete specimens exhibit glossy flake scars, a greasy feel, and/or the pink discoloration typical of heat-treated chert. Many specimens (Fig. 5,g-i) have large remnant flake planes on one or both blade faces that have been minimally modified. Virtually all of the stems have been completely flaked on both faces. Edge beveling was often used to shape the arrow points and to resharpen broken blades. Several examples (Fig. 5,f,m,n) have stubby, reworked blades.

Sixteen stem fragments are classified as **Perdiz** points based on a comparison with the larger number of complete or nearly complete specimens. These stems (Fig. 5,j-l) are carefully shaped and bifacially worked, leaving no doubt as to their identity. The identification of these same types of fragments as **Perdiz** may not be possible at sites where many other types of arrow point fragments are in the collection. At 41 JW 8, the **Perdiz** arrow points are the only artifact type that has a thin, narrow, bifacially shaped pointed segment. When only the lower pointed proximal tip of the stem remains, they are classified as A4 specimens (miscellaneous arrow point fragments) due to the possible confusion with distal fragments. Special studies were made of the stem width measurements and **Perdiz** arrow point breakage patterns (see Section VII: **Perdiz** Arrow Point Special Studies).

Perdiz Metric, Attribute, and Wear Pattern Data

A careful macroscopic and microscopic study was done of 34 of the most complete **Perdiz** points. Table 3 presents the results of this study. Each of the major attributes of the **Perdiz** points is discussed.

<u>Metric Data</u>: Each of the 34 points was measured and weighed. In cases where a small portion of the artifact is missing, the measurements reflect the estimated dimension based on the assumption that the missing section is similar to complete specimens (i.e., the artifact was assumed to be symmetrical). The weight is not added to because the missing sections are mostly very tiny barb or tip sections. The **Perdiz** points show considerable variation in size although the standard deviations were not calculated. Length ranges from 14 to 37 mm and averages 22.9 mm. Width ranges from 10 to 24 mm and averages 13.2 mm. Thickness is less variable (probably due to the

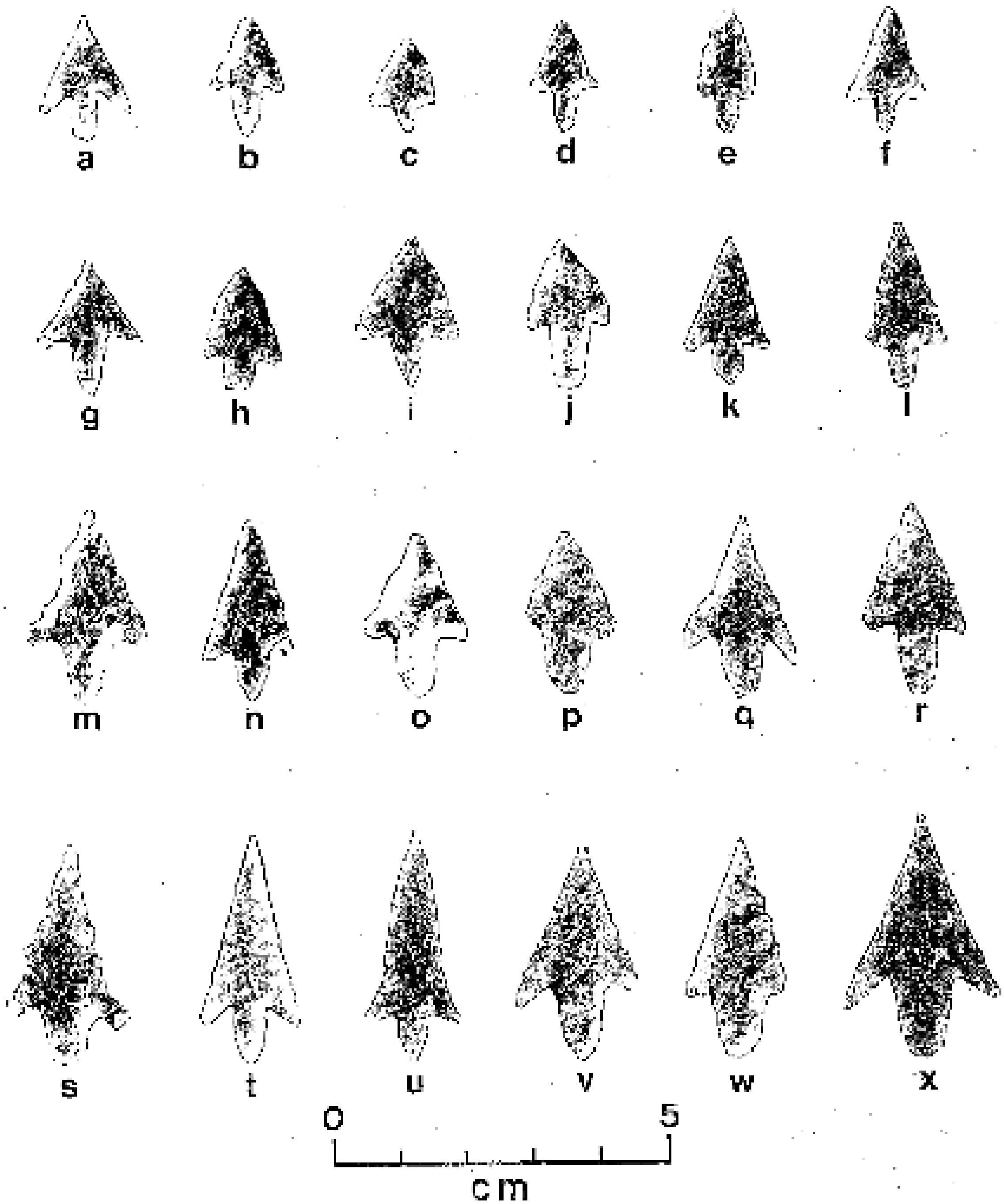

Figure 4. **Perdiz Arrow Points (A1).** Lot numbers: a, 316; b, 443; c, 312; d, 245; e, 327; f, 429; g, 443-1; h, 435; i, 437; j, 312; k, 429; l, 476; m, 157; n, 450; o, 456; p, 259; q, 445; r, 573; s, 107; t, 485-5; u, 110; v, 321; w, 294-5; x, 67.

fact that most were made on small, thin flakes), and ranges from 1.8 to 5.0 mm and averages 2.8 mm. Weight ranges from 0.3 to 1.5 g and averages 0.72 g. Stem width (measured at top of stem) ranges from 3.3 to 8.8 mm and averages 5.6 mm. Stem length ranges from 4.2 to 11.7 mm and averages 7.4 mm.

Chert Description: Most of the **Perdiz** points examined are made of fine grain, heat-treated chert. Tan, brown, and gray are the most numerous colors of chert, followed by pink, yellowish, and white. Over half of the specimens appear to be definitely heat treated (18), and eight others may be heat treated. Thus, the 34 specimens are for the most part made of good quality chert that was treated to improve the flaking quality. The illustrated specimens in Figure 4 show the fine workmanship of many of the 41 JW 8 **Perdiz** points.

Distal Morphology: Over half (18) of the complete specimens still have distal tips that are sharp to the touch. Six of the remaining specimens have noticeably dull tips, while the others have fractured or intermediate tip morphologies.

Blade Morphology: Six of the specimens have serrated edges. Most of these are only partially or slightly serrated. Thirteen have beveled blade edges. Edge beveling is a major blade flaking technique and is necessary due to the extreme thinness of many of the blade edges (i.e., the edges were too thin to biface). Edge beveling is commonly present on resharpened specimens. Based on obvious changes in edge angle, flaking technique, and blade shape, at least five of the specimens appear to have been resharpened.

Manufacture: Twenty-six specimens are completely bifacial. The remaining specimens have flake plane remnants on one (12) or both (7) sides. Platform remnants are present on the distal or proximal end of several specimens.

Microwear: The wear pattern study of the 34 **Perdiz** points involved a low power (10-40X) microscopic examination of all specimens followed by a high power (50-200X) microscopic look at four specimens with the heaviest wear. The major wear patterns observed are light to moderate blade edge and facial ridge rounding and polish, edge attrition, stem grinding, and stem edge and facial rounding and polish. In contrast to the end scrapers, the **Perdiz** points have neither heavy use wear nor consistent wear patterns. Instead, most **Perdiz** points appear to have comparatively little definite wear. The wear patterns that are present vary to some extent from specimen to specimen. Of the 34 specimens, seven have definite use wear, 11 have possible use wear, 12 are not worn, and four are indeterminate (plow damage prevented accurate use assessment).

One problem with **Perdiz** point microwear study is the difficulty encountered in distinguishing between edge attrition and abrasion due to use and edge damage caused by manufacture or resharpening. A number of specimens have edge-damaged blade edges that have crushing, rounding, and various types of microfractures that appear to this author to be the result of edge grinding, partial flaking, and edge resharpening rather than use wear.

The most consistent types of use wear on the **Perdiz** points are edge and ridge rounding and polish. On the blade edges, the rounding (abrasion) and polish

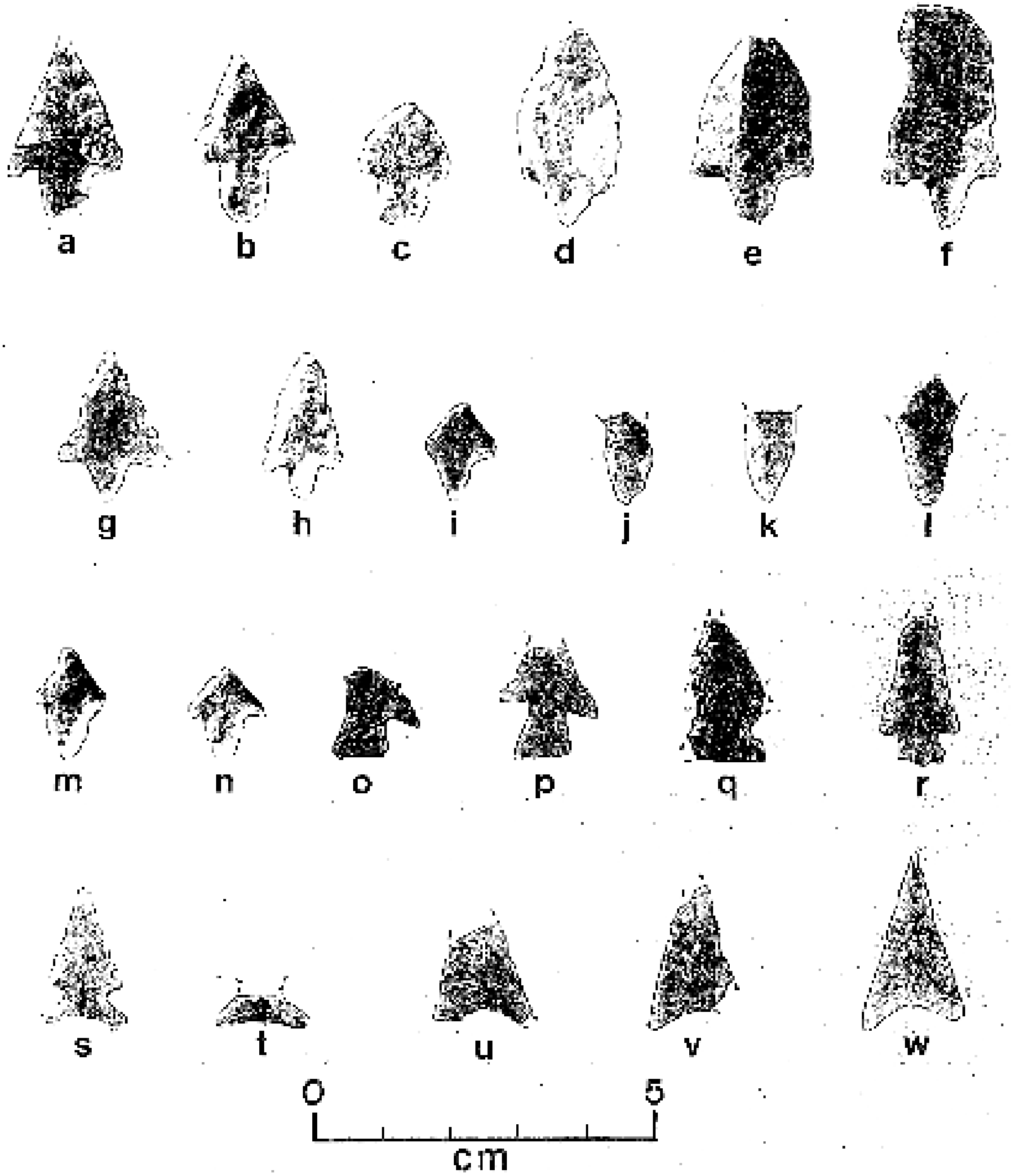

Figure 5. **Arrow Points.** a-n, Perdiz (A1); o-r, expanding stem with straight bases (A2:1); s,t, expanding stem with concave bases (A2:2); u-w, triangular (A3). Lot numbers: a, 523; b, 300; c, 443; d, 226; e, 379-1, f, 435; g, 236; h, 450; i, 383; j, 447; k, 157; l, 325; m, 366; n, 333; o, 519-2; p, 304-1; q, 107; r, 431; s, 366; t, 446; u, 328; v, 61; w, 478.

consistently occurs most heavily along the distal third of the blade. The edge rounding and polish are comparatively light and are confined to the immediate edge. Under high power magnification the polish appears to be only moderately reflective and covers an irregular surface (i.e., follows contours of irregularly rounded edge). No striations or built-up polish was observed. The edge rounding and polish are evenly present along the protruding sections of the blade and do not extend for any distance onto either edge aspect. Many of the specimens with edge rounding and polish also have light rounding and polish on the flake ridges on both faces. Once again, this was most noticeable on the distal third of most specimens. The facial ridge rounding and polish appear very similar to the edge wear and do not exhibit striations.

Edge attrition in the form of step fracturing, irregular nicking, and edge crushing was observed on many blade edges. Most specimens with these attributes are believed to be the result of resharpening and the accompanying edge grinding (platform preparation). However, on several specimens the edge attrition removed small areas of the rounded and polished edge and appear to be use damaged. These apparent use-damaged edges have bifacial edge damage (i.e., present on both aspects of the edge).

Wear was also observed on the stem edges and face. Many stem edges are heavily abraded by grinding but lack polish. A few specimens have light polish along the abraded stem edge. Ridge rounding and polish are noticed on the stem faces of some specimens. Most have only light to moderate rounding and polish, however, the polish seems to be more reflective than the polish observed on the blade. The most reflective polish was observed on the most prominent flake ridges near the central area of the upper portion of the stems. One specimen has noticeable polish that extends past the top of the stem (even with top of barb notches).

The interpretation of the **Perdiz** wear patterns is somewhat difficult in view of the absence of consistent wear patterns. Other researchers have had difficulty in evaluating arrow point wear as the "Stockton Point controversy" attests (Nance 1971; Hester and Heizer 1973; Sheets 1973). The lack of extensive or consistent wear may be a function of the tool type. Arrow points, used exclusively as arrow tips, would be expected to exhibit different types of wear depending on what was struck. Animal meat, hide, and bone are all likely to have been struck as are earth and wood (from misses or practice). In addition, the fact that **Perdiz** points are usually very thin and made of heat-treated material suggests that point breakage was very common. Given a comparatively short life span and the diversity of potential target materials, perhaps the inconsistent wear patterns and overall light use wear are to be expected.

The hafting modification (stems) and presence of stem grinding and occasional stem edge and facial polish strongly support the idea that **Perdiz** points were hafted. The most prevalent blade use wear patterns are edge and facial flake ridge rounding and polish. The light irregular nature of the polish is consistent with use produced by hide or meat (Keeley 1980). The presence of light polish on both the blade edges and face suggests penetration of soft material. The examined specimens from 41 JW 8 do not have any indications of scraper wear or heavy sawing or cutting wear. Thus, the hypothesis that

TABLE 3. PERDIZ (A1) ATTRIBUTE DATA

Lot Number	Provenience/ Level	Length	Width	Thickness	Weight	Stem Width	Stem Length	Heat Treatment	Macro Observations	Manufacturing	Missing Segments: Distal	Missing Segments: Part	Missing Segments: Two Barbs	Missing Segments: Stem
249-5	N107 E97 L.3	33	16	3.0	1.2	8.5	9.6	x	VST, BB	B		*		
523	N105 E94 L.2	28	18	3.5	1.2	8.3	6.5	x	ST, BB	B, FPR				x
137	Surface	33	18	4.2	1.5	7.0	7.2	?	ST, BB, SB	B, A		*		x
366	N79 E91 L.3	17	11	3.0	0.5	7.1	7.3	?	DT, BB, R	B, FPU				
316	N105 E95 L.1	19	13	1.8	0.4	3.5	7.2	x	VST	B, FP				
236	N92 E98 L.3	22	17	3.2	0.7	5.5	6.1	?	UF, BB	FPR	*			
67	N79 E90+E91 L.3	37	24	3.4	1.5	8.9	11.7	x	VST, BB	B, FPU				
321	N105 E95 L.1	32	20	3.4	1.2	7.0	11.3	?	DD, SB	B, FP	*	x		
333	N73 E92 L.2	14	12	2.4	0.3	6.2	7.0		DT, R	B, FP				
445	N110 E102 L.2	27	17	2.7	0.6	6.1	8.4		BB	FPR	*			
420	N109 E100 L.2	19	12	2.1	0.4	3.3	5.1	x	ST, BB	FP		x		
429	N108 E100 L.2	23	13	2.2	0.5	4.0	5.9		ST, SB	B	*			
435	N109 E101 L.2	19	12	2.2	0.5	5.0	4.8	?	ST, R	FP				*
437	N108 E102 L.1	23	15	2.5	0.7	6.1	7.9	x	R	B, FPB				
443	N110 E101 L.2	18	13	3.5	0.6	7.3	7.6		DT	B				
443	N110 E101 L.2	19	10	7.4	0.4	4.2	8.0	x	ST, BB	B, FP(?)				
304	N106 E95 L.2	23	14	4.9	1.3	6.1	7.5	x	ST	B				
523	N106 E94 L.2	29	16	3.5	1.2	6.1	10.7	?	ST	B, FP				
485-5	N109 E102 L.3	35	15	2.7	0.5	4.5	8.5	x	VST, DD, SB	B				
525-1	N110 E101 L.3	20	16	2.4	0.6	5.1	8.7	?	ST, BB	B, FP		*		
334	N73 E92 L.2	22	19	3.1	0.9	7.1	10.0	x	DT, R	B, FP(?)				*
456	N104 E94 L.5	25	16	5.0	1.5	6.0	9.2	x	DT	B, FP(?)				
456	N112 E102 L.2	27	14	3.0	0.7	4.9	8.0	x	ST, BB	B		x		
450	N111 E102 L.2	22	12	2.7	0.6	4.4	5.5		DT	FPR				
476	N108.5 E103 L.1	25	13	2.2	0.5	4.0	6.3	x	ST	B, FP				
312	N105 E95 L.1	23	12	2.7	0.7	6.1	9.6	x		B, FP	x			
312	N105 E95 L.1	14	10	1.9	0.3	3.5	4.2	x	ST	FP		*		
300	N109 E99 L.2	25	14	3.8	1.0	7.1	9.0	x	DD	B	x			
327	N100 E95 L.1	20	10	2.6	0.4	3.3	5.3		ST, BB	B, FP		x		
110	N125 E92 L.5	35	14	3.0	1.0	4.8	7.6	x	VST, SB	B				
74	N125 E92 L.1	26	13	2.8	0.9	6.0	8.0	?	BB, SB	FP	*	x	*	*
157	N92 E92 L.1	28	18	3.0	1.4	8.4	9.0			B, FP, PP				
245	N95 E83 L.2	17	10	2.2	0.4	3.5	6.7	x		FP		x		
239	N111 E92 L.2	25	14	3.3	1.0	7.5	8.2			B	*	x		

Notes: All metric data are expressed in millimeters; weight is expressed in grams.

Legend:

Heat Treatment: x = heat treated; ? = possibly heat treated

Macro Observations: VST = very sharp tip; ST = sharp tip; DT = dull tip; BB = blade beveling; SB = serrated blade; R = resharpened; UF = unfinished

Manufacturing: B = bifacially flaked blade; FP = flake plane remnant one face; FPB = flake plane both faces; A = asymmetrical; PP = proximal platform

Missing Segments: * = tiny segment missing; x = significant segment missing

Perdiz points were indeed arrow point tips used as projectiles to kill mammals (judging from the faunal analysis, predominately deer, antelope, and bison), remains highly viable. Thorough replicative studies would be needed in conjunction with wear pattern analyses to conclusively demonstrate the specific function of the **Perdiz** arrow point.

(A2) Expanding Stem Arrow Points

Six expanding stem arrow points were found at 41 JW 8. All six fall within the broad descriptions of either **Scallorn** or **Edwards** arrow points. These specimens are not classified under either formal type because of the following factors: (1) all six 41 JW 8 specimens are atypical of the formally defined types; (2) all six were found in association with **Perdiz** points; and (3) the occurrence of atypical expanding stem arrow points has been recognized at several sites with well-defined Toyah assemblages (see Section XI). The expanding stem arrow points are divided into two forms according to basal morphology.

(A2:1) Expanding Stem with Straight Base (N=4; Fig. 5,o-r)

All four arrow point fragments have expanding stems and generally straight bases. The shoulders are distinct and are right angled to slightly downturned. The stems appear angular with straight stem edges and a straight base. All four specimens fall within the broad descriptive range of **Scallorn** arrow points (Suhm and Jelks 1962:285); however, they do not appear typical of most **Scallorn** points from south Texas (see Hall, Black, and Graves 1982:295). The atypical attributes include the relative small size, the relative thinness, and the angularity of the stem. Similar specimens have been found with well-defined Toyah assemblages at the Rowe Valley site in Williamson County (Prewitt, personal communication) and at 41 LK 201 (Highley 1986). At the Wheatley site, Greer termed similar specimens **Scallorn** points and used the presence of "**Scallorn**" points to argue that the Toyah and Austin phases overlapped in central Texas (Greer 1976:108, Fig. 16,i,j).

All four specimens are incomplete. The specimen from Lot 304-1 (Fig. 5,p) is noticeably asymmetrical, thin, and angular. The length is estimated at roughly 23 mm; it is 15.0 mm in width, 2.1 mm in thickness, 5.4 mm in neck width, and 8.6 mm in stem width. The specimen from Lot 519-2 (Fig. 5,o) is somewhat similar although less complete due to thermal fracturing. Only the stem measurements can be given; it is 5.8 mm in neck width, 7.0 mm in stem length, and approximately 9 mm in basal width. This specimen has a prominent shoulder formed by a downturned barb, which is not typical of the **Scallorn** type. The specimen from Lot 107 (Fig. 5,q) has a central knot (hinge fractured thick area) on one face and is thermally fractured. It is 8.5 mm in neck width and 6.3 mm in stem length. The specimen from Lot 431 (Fig. 5,r) has a right-angled shoulder and an angular stem. The base is unusual in that it has two incipient basal notches. The length is incomplete but is estimated to have been about 30 mm. It is 11.7 mm in width, 5.2 mm in neck width, 5.2 mm in stem length, and 6.8 mm in basal width.

(A2:2) Expanding Stem with Concave Base (N=2; Fig. 5,s,t)

A complete arrow point and an arrow point fragment from 41 JW 8 have expanding stems and concave bases. The complete specimen has a short, triangular blade and a short, expanding stem. The shoulder is right angled. Side notches form a distinctive flaring base on both specimens. The bases are comparatively wide and markedly concave. Both specimens fit within the **Edwards** type as defined by Sollberger (1967, 1978) although they are atypically small and far south of their usual south-central Texas distribution. Sollberger notes that the **Edwards** type is the largest arrow point in south-central Texas.

The complete specimen (Fig. 5,s) is 20.5 mm in length, 11.2 mm in blade width, and 6.5 mm in thickness. The stem length is 4.9 mm, the neck width is 6.6 mm, the basal width is 12.7 mm, and the depth of the basal concavity is 1.4 mm. It weighs 0.6 g. The fragmentary specimen (Fig. 5,t) has an approximate neck width of 6.5 mm, a basal width of 14.0 mm, and a basal concavity depth of 1.0 mm.

(A3) Triangular Arrow Points (N=3; Fig. 5,u-w)

Three unstemmed triangular arrow points were found at 41 JW 8. All three have concave bases and straight to very slightly convex or concave blade edges. One specimen (Fig. 5,u) has a deep, V-shaped concavity and resembles the **McGloin** which is found in the Nueces Bay area (Hester 1980b:106). All of the specimens share most of the attributes of the **Starr** arrow point (Suhm and Jelks 1962:287) although they lack the distinctly concave blade edges that are usually typical of the type. These three triangular points are not assigned to a formal type due to their low frequency and somewhat atypical characteristics.

A complete specimen from Lot 478 (Fig. 5,w) is 25.1 mm in length, 15.2 mm in width, 2.9 mm in thickness, 3.2 mm in basal concavity, and weighs 0.8 g. The fragmentary specimen from Lot 81 (Fig. 5,v) has a shallow basal concavity of approximately 2.3 mm. The length is estimated at about 26 mm and the width at 15 mm. It is 2.1 mm thick. The specimen, which resembles the **McGloin** type (Lot 328), has an estimated length of about 26 mm and a width of about 16 mm. It has a basal concavity of over 5 mm and a thickness of 2.8 mm.

(A4) Unidentifiable Arrow Point Fragments (N=85)

The A4 specimens consist of distal, medial, and lateral arrow point fragments that could not be confidently placed in any of the other groups. The majority of the A4 specimens are distal fragments. Most if not all of these are **Perdiz** fragments that have snapped stems. No metric measurements of A4 specimens are provided. The A4 specimens were included in the special study of **Perdiz** arrow point breakage patterns (Section VII: Perdiz Arrow Point Special Studies).

Finished Bifaces

Four groups of morphologically distinct bifaces are described. These bifaces are considered finished "functional" tool forms or "formal" tool types. All four groups have been recognized, described, and defined by previous researchers in south Texas. The effort here is concentrated on B1, the beveled knife, because it is the most numerous finished biface type from the site (although technically most **Perdiz** arrow points are finished bifaces) and also because of specific research design problems. The other three types of finished bifaces are comparatively rare at 41 JW 8.

<u>(B1) Beveled Knives</u> (N=13; Fig. 6,a-g)

Within the beveled knives category are two complete bifaces and 11 fragments representing eight additional tools. Two fragments (distal and proximal) fit together to form a complete tool; two fragments (distal and medial) fit together to form most of a tool; and two fragments (distal and medial) are obviously sections of a single tool, although they do not fit together. The remainder of the group consists of a proximal, a medial, and three distal fragments.

The beveled knife is an interesting tool form that is temporally restricted to a very brief time period in southern Texas, probably for only a 300-year interval between A.D. 1300 and A.D. 1600. Where found in single component sites, they occur only with the Toyah phaselike assemblage of **Perdiz** arrow points, ceramics, end scrapers, and flake drills. The research proposal for the 41 JW 8 work called for a special study of the beveled knife. Ken Brown's (Brown **et al.** 1982:55-63) recent work on the collection of these tools from the Choke Canyon Reservoir area, provides an excellent discussion of this tool type.

Brown notes that considerable confusion occurs in the archaeological literature with regard to beveled knives. The most widespread Late Prehistoric beveled knife form is a four-sided, diamond-shaped biface that is alternately beveled on all four sides. The 4-beveled forms ("Plains" or "Harahey" bifaces) "appear during the Late Prehistoric in the southern Great Plains and elsewhere in Texas, occurring with low frequency but with widespread geographical distribution" (**ibid.**:55). Brown cites the presence of these artifacts in numerous defined late cultural manifestations and notes that most of the occurrences are found "in the southern Great Plains or the Blackland Prairies, with few occurrences on the Edwards Plateau . . ., the eastern woodlands, or the Gulf coastal plain" (Brown **et** al. 1982:55).

The beveled knife form that does occur on the Gulf coastal plain of southern Texas in the Choke Canyon Reservoir area and at 41 JW 8 is a predominately 2-beveled biface that "has a short, convex-edged, 'proximal' portion that is rarely beveled" (**ibid.**). Brown terms this form the "quadrilateral 2-beveled biface" and notes that while some sites in central and northeastern Texas have occurrences of both forms, the 2-beveled form is the only Late Prehistoric beveled knife that has been found in southern Texas.

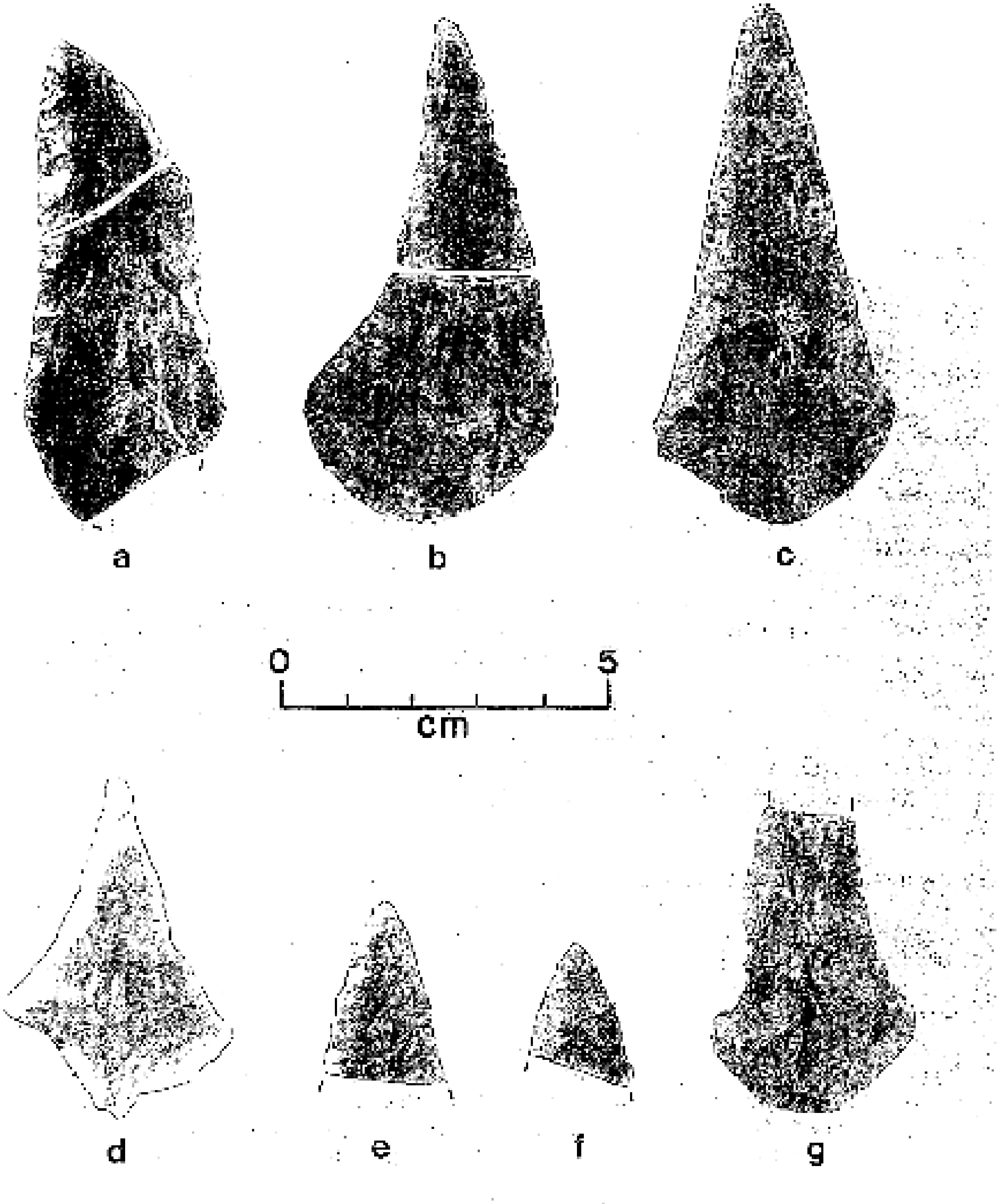

Figure 6. **Beveled Knives (B1).** Lot numbers: a, 433; b, 131 (proximal) and 321 (distal); c, 320; d, 56; e, 248; f, 519; g, 157.

The 2-beveled form apparently begins as a well-thinned, large, ovate biface that has a slight distal bevel. Brown was able to trace the use history of the 2-beveled form by studying the comparatively large sample of the tools from the various Choke Canyon area sites (see Brown et al. 1982:Fig. 22). One of the most important aspects of this artifact form is that "the characteristic shape is a result of repeated rejuvenation, not the manufacturing process" (Brown et al. 1982:56). Brown argues that the beveling probably served to increase the edge angle for the purpose of "heavy-duty cutting as well as minimizing width reduction due to resharpening" (ibid.).

Significant aspects drawn from Brown's study of the beveled knife form indicate a frequent pattern of transverse breakage; no clear-cut evidence for hafting; an absence of covaring metric attributes; and the possibility of functional differences between different sections of the tool edge, suggested by the fact that the distal sections often had steeper spine-plane angles than the lateral corner sections. Also, the average spine-plane angle (49-53°) for the Choke Canyon specimens accords with the "sawing" and "carving" functions found by a study of exceptionally well-preserved artifacts from Hogup Cave (Wylie 1975), and the many Choke Canyon specimens were all apparently made of local materials.

Brown discusses the wear patterns he observed on the 2-beveled bifaces at some length. Interestingly, he found that most of the Choke Canyon specimens showed "almost exactly the same kind of edge damage sustained by unifacial scraping tools" (Brown et al. 1982:59), i.e., en echelon step flaking on the beveled side of the edge. Furthermore, Brown observed asymmetrical edge polish and abrasion occurring on the beveled side of the edge rather than the flat ventral side. He notes that if accepted uncritically, this wear would be interpreted as typical unifacial scraper wear and notes the similarity of the profile of a 2-beveled biface edge to the uniface in cross section. Brown suggests that the location of the wear is a function of the edge morphology and discusses his experimental efforts to produce analogous wear using beveled edge tools on heavy-duty cutting and sawing of hard materials (seasoned wood and dry antler). He argues that a steep working edge will not produce typical bifacial edge damage even when used in such a manner.

Brown noted considerable edge and facial abrasion and polish on the Choke Canyon specimens that he interpreted as evidence of considerable penetration during use. He also noted a variety of other wear patterns on some specimens, such as edge nicking and bifacially distributed edge damage (edge breaks, edge crushing, and step fracturing). He concluded that the Choke Canyon specimens did not demonstrate a single pattern of edge wear and appeared to have served more than one function.

Brown's conclusions merit repeating here as they are in part supported by the Hinojosa site assemblage (ibid.:61):

> 1. Quadrilateral 2-beveled bifaces are a distinctive Late Prehistoric south Texas tool form, clearly of local manufacture but occurring in contexts similar to those yielding diamond-shaped 4-bevel knives elsewhere in Texas. Limited evidence from Choke Canyon suggests close association with bison remains.

2. Intuitive assessments of these tools as cutting implements seems to be substantiated by microwear observations. In at least some cases there is evidence of penetration and application to yielding substances. However, significant variability of wear is documented even in the small Choke Canyon collection.

3. Most specimens demonstrate extended curation and maintenance of the working edge, in some cases probably followed by recycling into perforating or scraping tools. <u>Patterned maintenance</u> of this tool form is responsible for its distinctive shape.

The beveled knives from the Hinojosa site fit the 2-beveled tool description with one exception, a specimen with three beveled edges but otherwise similar to the 2-beveled form in outline shape. The 41 JW 8 specimens were examined microscopically and are discussed individually.

The atypical specimen mentioned (Fig. 6,d) was found on the surface in the plowed field (Lot 56). This specimen is very short (53.5 mm) and has three beveled concave edges. It is 36.3 mm in width, has a maximum thickness of 7.12 mm, and weighs 10.4 g. The artifact is made of a white chert. Like most 2-beveled quadrilateral bifaces, the blade is left beveled. The atypical third bevel occurs on one basal edge. The other basal edge is incomplete (an angular fracture, possibly caused by plow damage, removed a small wedge-shaped section), but appears to have been slightly convex, and is not beveled. The extreme end of the distal tip has been removed by a impactlike fracture.

Orienting the artifact as shown in Figure 6,d, each of the beveled edges will be described. The right (forward) edge has a spine-plane angle of 65° near the lateral corner and 55° toward the tip. Evidence of wear mostly occurs near the tip and near the lateral corner. The distal 2 mm has heavy edge rounding (abrasion) over heavy step fracturing; proximal from this point, the edge rounding is light or not present. The proximal 12 mm (from lateral corner) has moderate to heavy rounding, especially near the lateral corner, with apparent polish on the bevel surface.

The left (forward) edge has wear similar to that found on the right edge. The left edge is noticeably steeper and has spine-plane angles of 89-90°. The tip and proximal sections of the edge show heavy rounding over step fractures with possible polish on the bevel surface.

The right (basal) edge is not beveled but is slightly steeper on the upper face. The edge is bifacially retouched and has moderate rounding that mainly occurs on the edge projections. The left (basal) edge is beveled but does not show edge rounding. It appears to have been freshly resharpened.

The Lot 56 specimen is clearly a worn out tool that has been repeatedly resharpened to such a degree as to have severely concave edges and is very short. The wear consists mainly of edge rounding and some polish on the beveled edges, mainly concentrated at the tip and at the lateral corners. The virtual absence of wear in the central section of both forward edges is probably the result of a resharpening episode just prior to discard. The basal beveling on one edge and use wear on the other basal edge are unusual.

It should be noted that the basal bevel is not located on the same face as the opposing distal edge as is typical of "Plains" 4-beveled knives. The use of all possible tool edges underscores the fact that this tool was virtually exhausted at the time of discard.

The other intact beveled knife (Lot 320; Fig. 6,c) is made of a mottled gray, coarse grain chert. This artifact was discarded while still complete and apparently serviceable, although a flake has been removed from the distal tip. It is 80.6 mm in length, 37.8 mm in width, 8.9 mm in thickness, and weighs 21.2 g. The spine-plane angles range from 65 to 82° on the left edge (as oriented in Fig. 6,c) and 50 to 79° on the right edge. The artifact may have been discarded due to the steepness of the edges.

The left edge of the Lot 320 specimen is partially plow damaged and has step fractures along both aspects of the edge which are only partially use related. The edge is moderately rounded and polished. The ventral face has hinge and step fractures which may be plow damaged. Some polish can be seen along the edge and on the flake ridges 4-5 mm from the edge on the ventral face. The bevel aspect of the edge definitely has step fractures overlain by rounding and polish. The polish extends on the highest flake ridges to the bevel ridge (point where bevel begins on dorsal face) along most of the edge.

The right edge has a similar wear pattern but the wear is more pronounced. The entire edge is well rounded and polished. It is significant to note that this edge, like virtually all of the worn beveled biface edges from 41 JW 8, is evenly rounded with respect to the edge aspects. While more abrasion and polish occurs on the bevel aspect than the ventral aspect, the edge itself is evenly worn, in contrast to the end scraper edges which are consistently rounded toward the dorsal aspect. The prominent flake ridges on both aspects are rounded and polished well away from the edge.

The proximal edges of this tool are ground but not polished. This may be a hafting modification. Another possible indication of haft wear is the flake ridge rounding and polish observed on both faces of the tool between the lateral corners.

A distal fragment (Lot 321; Fig. 6,b) and a proximal fragment (Lot 131; Fig. 6,b) fit together to form a complete tool. Figure 6,b shows the two fragments slightly apart (the distal section should be reversed for a fit) but illustrates the asymmetrical shape of the complete biface. The uniquely shaped artifact is made of a yellow tan chert that is mottled with darker inclusions. The proximal section was recovered from the plowed field at least 5 to 10 m away from where the distal section was recovered during excavation. The break is a transverse snap fracture that probably dates to the site occupation. Both fragments have plow marks on both faces. The distal section has badly battered edges that appear to be the result of plow damage.

The blade edges of the proximal section are rounded and polished. The distal blade edges have unbattered sections that show moderate edge rounding and polish. It appears likely that some of the edge damage on the distal blade edges is the result of an attempt to resharpen the tool. The proximal edges are unmodified except for a 11-mm section that is rounded and polished.

A distal fragment and a medial fragment were recovered from the same unit-level (Lot 433; Fig. 6,a) that fit together and form most of a beveled knife. This artifact is made of a fine grain, gray brown chert that contains large, coarse grain, gray inclusions. Pink discoloration and the glossy nature of the fine grain chert suggest heat treatment. The coarser areas of the artifact are thick knots where removal attempts have ended in hinge fractures. The length is estimated to have been about 82 mm. It is 31.3 mm in width and 10.5 mm in thickness.

Light to moderate edge rounding and polish are present along the blade edges and at the lateral corners. Any wear present on the tip has been removed by unifacial flaking which left a step-fractured edge. The most worn section of the tool is on the right (as orientec in Fig. 6,a) edge about 20 mm from the tip.

A proximal fragment (Fig. 6,g) from Lot 157 represents over half of a complete specimen. Plow marks are visible on both faces and may be the cause of two recent flake removals on the left edge. The specimen is made of fine grain, tan chert. The spine-plane angle of the blade edges is steep, ranging from 70 to 88°. This fragment has very heavy and consistent wear on all intact sections of both blade edges. This consists of extreme edge rounding and extensive polish along the edges and on flake ridges for a distance of 8-9 mm from the edge on both aspects. The most pronounced ridge wear occurs on the bevel aspect extending past the irregular ridge that parallels the blade edge where the bevel begins. The proximal edges are ground but not polished. Little ridge rounding or polish was observed on the proximal faces.

Two fragments, a distal (Lot 284) and a medial (Lot 285), were found about a meter apart and at about the same elevation. They are both made of a mottled gray chert that has an uneven texture, and they appear to be fragments of a single tool. Both fragments have moderate to heavy edge rounding and polish. The distal section also has considerable wear away from the edge on both faces. The medial section has moderate ridge rounding and polish on the bevel aspect and light wear on the ventral aspect.

One medial fragment (Lot 255) was recovered that has little or no visible wear. This fragment is made of a white chert and is thermally fractured. It is 10 mm thick.

Another medial fragment (Lot 320) is a small section from near the tip of a beveled knife. The edges have a series of step fractures along the bevel aspect which are partially smoothed over and polished by wear. Flake ridge rounding and polish are obvious along the beveled aspect. It is made of gray mottled chert and is 5.5 mm in thickness.

A distal fragment (Lot 248; Fig. 6,e), made of light gray, fine-grained chert, shows considerable wear. The tip is rounded and polished as are both edges. Both edges show evidence of an attempt to bifacially sharpen the edge, but still retain noticeable bevels.

The final specimen (Lot 519; Fig. 6,f) is a small tip fragment that shows light to moderate edge rounding and polish.

In summary, the 41 JW 8 beveled knives and fragments have a very consistent wear pattern. This consists of an evenly rounded and polished edge that is usually accompanied by worn flake ridges that extend 4-9 mm from the edge on both aspects. The polish is comparatively light (in comparison to added or "corn gloss" polish) and follows the microtopography of the rounded surface rather than forming facets. No definite striations were observed. The heaviest wear along the blade edge usually occurs at or near the tip and near the lateral corners. The heaviest wear on the edge aspects consistently occurs on the bevel aspect. Very little additional edge damage was observed on the blade edges. The proximal edges show more variation. Several specimens have similar wear along the proximal edges as that seen on the blade edges. Other specimens have ground proximal edges.

The 41 JW 8 beveled knives are similar in most respects to the Choke Canyon collection (Brown **et al.** 1982). The most important difference is that a more consistent pattern of wear was observed. The development of extensively rounded and polished edges and flake ridges on most of the specimens appears consistent with use on soft yielding material such as meat and hide.

The similarity between the wear noted on the beveled knives and that noted on the end scrapers at 41 JW 8 suggests that contact with similar material produced the wear. The difference in wear between the two tool types is in location and morphology. The end scrapers have distal edges that are rounded by wear toward the dorsal aspect. The beveled knives have evenly rounded edges. This difference is interpreted as the difference between longitudinal and transverse usage motions. The other major difference is that the beveled knives have rounded and polished flake ridges on both edge aspects that extend well beyond the edge, while the end scrapers have little wear on the ventral aspect, and the wear on the dorsal aspect only extends for a few millimeters. This difference reflects the amount of contact with the yielding material and the direction of use.

A strong case cannot be made for hafting. Certain beveled knives have ground proximal edges or proximal facial wear that could be interpreted as haft wear, but others do not. Some of the proximal wear could have resulted from the use of a protective leather pad bound or held around the proximal tool end to protect the hand and to provide a better grip.

<u>B2 Triangular Bifaces</u> (N=3; Fig. 7,a-c)

Three triangular bifaces were recovered from 41 JW 8; two specimens are complete, and one is missing the distal tip. All three are comparatively thick bifaces with narrow triangular outline shapes, straight bases, and slightly convex blade edges. The blade edges have been resharpened on two specimens.

Triangular bifaces are the most ubiquitous bifacial artifact form in south Texas. Archaic assemblages are often dominated by triangular forms. These are traditionally referred to as dart points despite a general lack of any functional evidence. The B2 specimens from 41 JW 8 are much thicker and heavier than the small, thin triangular arrow points, A3. A microscopic examination of the B2 specimens showed wear patterns consistent with a tool used in a cutting or penetrating motion on soft yielding material. This wear is similar to the wear found on the beveled knives, and it is suggested that both forms represent butchering tools.

The Lot 351 specimen (Fig. 7,b) is made of a very glossy white chert that has the tiny, crystal-filled inclusions that are typical of the material type. It is 38.9 mm in length, 18.5 mm in width, 6.7 mm in thickness, and weighs 4.3 g. The edges appear to have been resharpened shortly before discard; they are fairly sharp but do show light abrasion and polish. Some of the remnant flake ridges several millimeters away from the edge show moderate rounding and polish on both faces. The wear is consistent with a penetrating use on soft material, such as meat or hide, in the same manner as a projectile tip or a butchering knife.

The Lot 370 specimen (Fig. 7,a) is a fragmentary biface made of gray to yellow to pink quartzite with numerous voids. The coarse grain material is difficult to evaluate. All edges are abraded. No polish could be detected, however, the highly reflective quartz grains hampered observation. One blade edge is severely ground and also has a thick area adjacent to the edge. The grinding may have been connected with attempts to remove the thick flaw. The opposite edge is lightly rounded. This specimen may have never been completed. It is 24.4 mm in width and 7.9 mm in thickness.

The other B2 biface is a poorly thinned asymmetrical artifact (Lot 128; Fig. 7,c) made of tan chert. It is 44.0 mm in length, 20.7 mm in width, 8.8 mm in thickness, and weighs 6.3 g. Although numerous hinge fractures along the edges attest to futile attempts to further thin this artifact, it was definitely used. All edges have been rounded. The basal edge and the lower 10 mm of both blade edges are abraded but not polished. All of the remaining blade edges are polished. The distal tip is severely rounded and worn. Many small step fractures are present on both aspects along the bladed edges; all are rounded and polished to a distance of 4-5 mm from the edge. This artifact is very heavily worn. The wear is concentrated on the distal third of the tool but present along the entire edge. The basal and lower blade edge grinding and lack of polish suggest a haft. The blade edges are evenly worn (with respect to the aspects). This suggests a longitudinal action. The rounding and polish along the edge and on both aspects of the edge suggest use on a soft yielding material.

<u>(B3) Perforators</u> (N=4; Fig. 7,d,e)

Two proximal and two distal perforator fragments were found at 41 JW 8. The two proximal perforator fragments are from tools made on flakes; in other words they are flakes that have been marginally shaped rather than completely bifacially flaked. These two specimens have widely flaring bases that are irregularly shaped. All four perforator fragments have narrow, carefully shaped thick blade (bit) sections. Material types are brown chalcedony, white chert, tan chert, and gray chert. All except the chalcedony specimen appear to have been heat treated. Metric data are presented in Table 4.

Similar artifacts are found in many Late Prehistoric assemblages in southern Texas (Hester 1980a). Often these are described as "flake drills." The

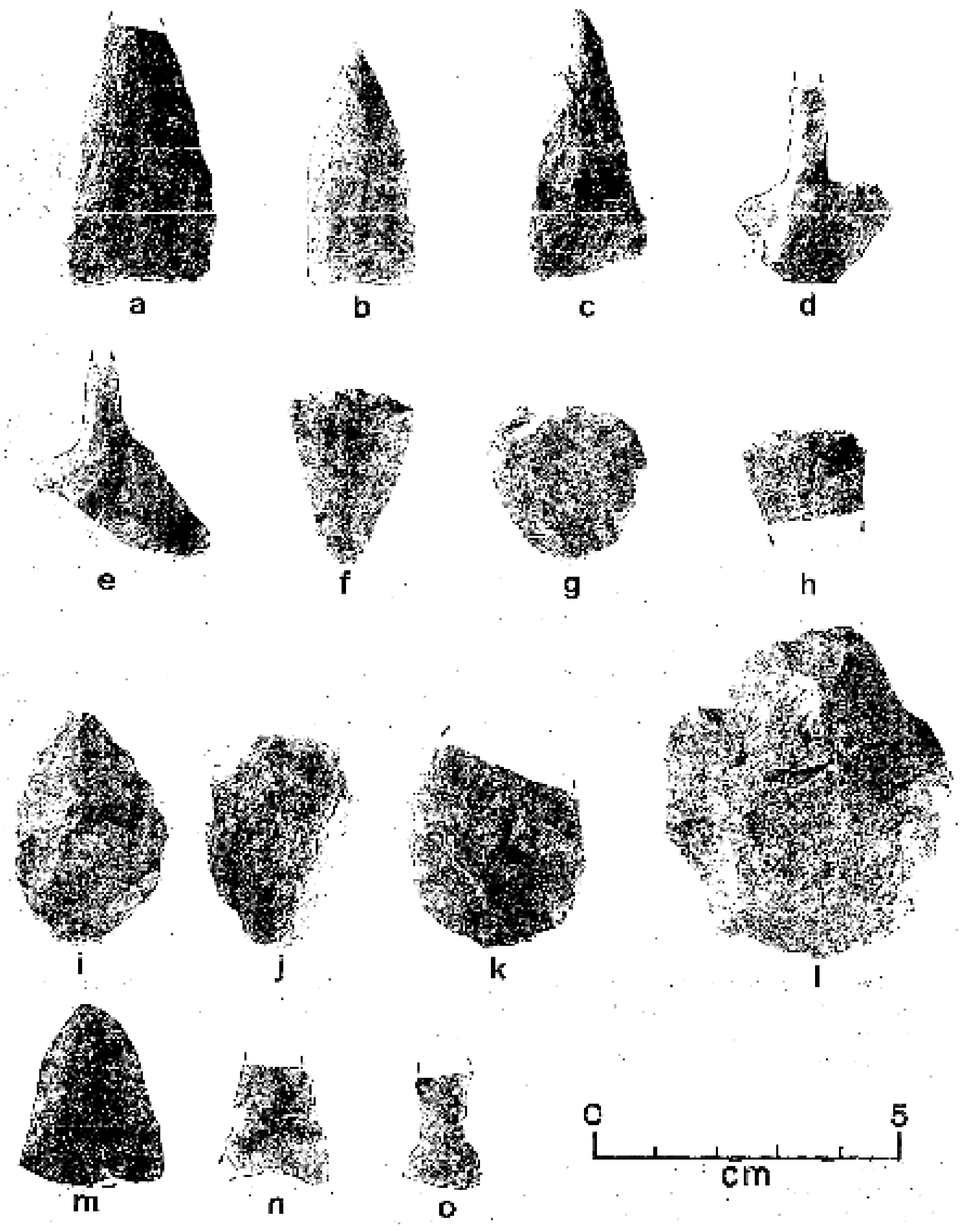

Figure 7. **Bifacial Tools.** a-c, triangular (B2); d,e, perforators (B3); f-h, **Olmos** biface (B4); i-l, round proximal (FB1); m-o, miscellaneous (FB2). Lot numbers: a, 370; b, 351; c, 128; d, 433; e, 131; f, 67; g, 369; h, 113; i, 421; j, 206; k, 261; l, 125; m, 345; n, 284; o, 289.

TABLE 4. PERFORATOR METRIC DATA

Lot Number	Blade Width	Blade Thickness	Base Width	Base Thickness
76	8.8	4.7	-	-
131	5.3	4.3	31.0	10.4
433	6.3	3.2	26.0	5.7
482	9.3	5.8	-	-

All measurements are expressed in millimeters.

term "perforator" is chosen here simply to indicate that the tool was used to make holes. The exact method used to make the holes could have been drilling, punching, or reaming. The functional difference can only be determined with extensive wear pattern and replicative studies.

A cursory microscopic examination of the B3 specimens revealed evidence of soft material wear (extensive edge rounding and polish) on one artifact (Lot 76) and harder, more resistant material wear (no polish, extensive edge crushing, and step fracturing) on two specimens (Lots 131 and 433). The remaining specimen (Lot 482) had mixed wear indications--edge rounding and polish near the tip and extensive edge damage farther away from the distal tip. Thus it would appear that the perforators from 41 JW 8 were used on several types of material.

<u>(B4) Olmos Bifaces</u> (N=3; Fig. 7,f-h)

Three Olmos bifaces were recovered from 41 JW 8; two specimens are complete, and one specimen is missing the proximal portion. These distinctive bifaces are subtriangular in outline and have a steeply beveled distal bit (the broad end). The bit when viewed on end is convex. The artifact resembles a miniature gouge. All three specimens are made of chert. Metric data are presented in Table 5.

Shafer and Hester (1971) recognized the Olmos biface as an unusually distinctive tool type with a limited spatial distribution. The distribution of Olmos bifaces occurs within "a narrow band 70 to 80 miles wide, extending across southern Texas from western Kleberg County to central Webb County," according to Shafer and Hester (ibid.:7). More recent work has shown that the distribution extends northeast to almost the Nueces River (Black 1978; Mokry, personal communication). The temporal placement of the Olmos biface is less certain due to the lack of excavated specimens. Shafer and Hester (1971) suggested a Late Archaic and Late Prehistoric placement. The 41 JW 8 specimens document the use of the tool during the Late Prehistoric. No other Olmos bifaces have been reported from Toyah-like assemblages.

TABLE 5. OLMOS BIFACE METRIC DATA

Lot Number	Length	Width	Thickness	Weight
67	28.6	21.0	7.3	4.1
113	-	21.4	8.7	-
369	26.8	27.9	6.7	5.6

All measurements are expressed in millimeters except weight which is in grams.

The precise function of the Olmos biface is unknown. Some sort of gouging or scraping function seems most likely in view of the morphology. The distribution of the tool type coincides with the northern prickly pear field ("land of the tunas") described by Cabeza de Vaca (Davenport and Wells 1918-1919; Campbell and Campbell 1981). This author was tempted to speculate that this unusual and obviously specialized tool form may have been used to process prickly pear (remove spines?). This suggestion is unlikely given the wear patterns (discussed later), the use spalls on the ventral surface, and the burinlike blows on the distal corners that Shafer and Hester believe are related to use wear. It is interesting to note the distributional coincidence of this specialized tool and one of the few documented ethnohistoric exploitation patterns for the area.

The three Olmos bifaces were examined microscopically. All three have extensive use wear.

The Lot 113 specimen (Fig. 7,h) is fragmentary; the proximal section has been removed by a transverse snap fracture. It is made of a coarse-grained grey chert. This artifact is very heavily worn. The wear is centered on and related to the bit. The central section of the bit edge is severely rounded and polished. The edge is rounded toward the ventral aspect. The well-developed polish extends across almost the entire ventral surface. The rounding and polish form a faceted surface adjacent to the edge that fades out toward the proximal end. This wear is not present on the sides of the ventral surface, only in the center. A series of small microfractures (feathered terminations) adjacent to the bit is present on the ventral aspect on both sides of the heavily worn central area. Striations are present on the polished facet that begin at the bit and run perpendicular to the edge. Under high magnification, 80X, the striations appear as rounded, shallow grooves. The dorsal aspect (the beveled face) is severely step and hinge fractured all along the bit edge. This appears to be from an earlier resharpening episode as the step and hinge edges are partially rounded and polished over. The polish occurs on the higher portions of the flake ridges and extends to the upper portion of the bevel. The side edges of the tool are not worn.

The Lot 67 artifact (Fig. 7,f) is made of a fine grain chert that is yellow tan in color. The bit edge is moderately rounded and polished. The ventral surface is covered by large shallow flake scars and shows no wear except for a narrow band of polish along the bit edge. The bevel surface has a number of hinge and step fractures along the bit that have well-worn and polished edges. The side edges of the tool are not worn except for some light rounding and polish along the proximal one-third. This may suggest haft wear or modification. Some of the prominent ridges on the ventral face at the proximal end are also rounded and lightly polished.

The Lot 369 specimen (Fig. 7,g) is made of gray, variable grain chert. The distal (bit) edge is very heavily worn except for a small area on one side that has a recent removal. The intact section of the distal edge is severely rounded and highly polished. The ventral surface is also heavily rounded and polished adjacent to the bit edge. This pattern is partially interrupted by several wide but short hinge fractures, most of which have been well-smoothed and polished by use. Striations were observed on the heavily polished area of the ventral face which run perpendicular to the bit edge. The bevel or dorsal aspect of the bit does not have hinge or step fractures and is much less worn than the edge or ventral aspect. Moderate ridge rounding and polish are present. The lateral edges of the tool are not worn except for along the proximal one-fourth of the tool. This section and the proximal edge are ground. Some edge rounding but little polish is present on the flake ridges on the faces of the proximal end of the tool.

In summary, the three **Olmos** bifaces from 41 JW 8 have consistent wear patterns that suggest extensive wear, hafting, use on a moderately hard material, and in a specific motion. The location of most of the wear adjacent to the bit edge and on the ventral aspect of the bit edge suggests that the tool was held dorsal side up and pushed (or pulled) bit forward with extensive contact along the ventral surface. The striations confirm the direction. The ventral aspect step fractures on two specimens suggest use on a resistant material but one in which extensive polish can develop. The polish present on two of the tools is much more reflective and extensive than that present on any other examined lithic tool. This wear appears to be consistent with a wood-working function, perhaps as a push-plane. Replicative experiments are needed to substantiate this interpretation.

Fragmentary and Unfinished Bifaces

Biface fragments and unfinished bifaces that cannot be placed in the above descriptive categories are divided into three morphological subgroups.

<u>(FB1) Round Proximal</u> (N=16; Fig. 7,i-l)

Eight complete and eight fragmentary bifaces have rounded proximal portions. These specimens are not uniform, varying widely in size, thickness, outline shape, and degree of finish. Most appear to be unfinished preforms that were discarded due to breakage or flaws, excessive thickness, and/or irregular shape. The smaller specimen (Fig. 7,i) probably represents a **Perdiz** preform. One specimen (Fig. 7,j) could be a preform for an **Olmos** biface. The larger specimen (Fig. 7,l) does not resemble any of the finished biface groups. Material types are all gray to brown chert except for one gray "sugar" quartzite specimen and one white chert specimen. In general, this group of artifacts represents manufacturing failures that could be expected given the relatively poor quality and small cobble size of the available lithic resources. No metric data are presented.

<u>(FB2) Miscellaneous Proximal Fragments</u> (N=6; Fig. 7,m-o)

Group FB2 contains six proximal biface fragments (Fig. 7,m-o) that have little in common with each other or the other biface groups. They appear to have been broken before completion. Material types are fine grain chert (2), coarse grain chert (1), white chert (2), and silicified wood (1). No metric data are provided.

<u>(FB3) Miscellaneous Biface Fragments</u> (N=154)

Group FB3 is a catch-all category, including distal, lateral, and medial biface fragments as well as many bifacial failure fragments. The term "bifacial failure fragments" is used to describe the flakes, chips, flake fragments, and chunks that evidence bifacial flaking but were obviously never portions of finished tools. Material types are fine grain chert (119), white chert (20), coarse grain chert (5), burned chert (3), quartzite (2), chalcedony (1), yellow jasper (1), and silicified wood (1).

<u>Unifacial Artifacts</u>

The unifacial tool category is comprised of flakes or flake fragments of siliceous stone that have been worked or trimmed on one face to form a purposeful shape. Almost all the 41 JW 8 specimens are trimmed on the dorsal face to form a semicircular tool edge. For a discussion and illustration of the morphological terminology used to describe unifacial tools see Black and McGraw (1985). The trimming is usually located on the distal end of the flake, hence the rubric term "end scraper." Traditionally, most unifacial stone tools are given the functional designation "scraper." These tools are characterized by comparatively steep edge angles, semicircular working edges, and comparatively little elaboration. Wear pattern studies have usually borne out the accuracy of the term "scraper" (Wilmsen 1970; Wylie 1975).

The Hinojosa site unifacial tool sample is remarkably uniform in morphology. Group U1 comprises over 95% of the unifacial tools. Group U2 contains a small percentage of atypical unifacial tools. It should be emphasized that the unifacial tools at 41 JW 8 are little more than trimmed flakes. Only the patterned trimming and shaping set them apart from the many MD1 specimens. Functionally, a great deal of overlap may exist between the unifacial tool and the modified debitage categories.

(U1) End Scrapers (N=64; Fig. 8,a-n)

Group U1 consists of complete and fragmentary unifacial tools that have a carefully trimmed semicircular distal end. The group could be divided into a number of subgroups depending on the criteria selected. For example, one could sort the group into flakes with intact platforms (26), flakes with trimmed platforms (4), and flake fragments which do not have platforms (34). Flake type could also be used as a sorting criteria: interior (14), secondary (12), corticate chip (9), and decorticate chip (29). Some variation in trimming location and extent occurs; hence one can distinguish between distal end trimming only (19), distal end and one side (6), distal end and two sides (15), and circumference trimmed (8).

These types of sorting criteria are considered to be functionally irrelevant by this researcher. It is suggested that all group U1 end scrapers were used in similar ways to perform similar functional tasks (probably animal hide scraping). Variations in flake type, trimming extent and location, and platform presence are believed to be fortuitous differences reflecting raw material availability, individual flake morphology, and knapping skill or style.

Small end scrapers have been described under a variety of terms, including: "thumbnail scrapers" (informal designation), "snub-nosed scrapers" (Jelks 1962), "small snub-nosed scrapers," "small turtle-back scrapers," and "trimmed flakes" (Hall, Black, and Graves 1982). Most of these terms are used to describe the appearance of these tools.

End Scraper Attribute Data, Metric Data, and Wear Patterns

Table 6 presents attribute data for all 64 U1 specimens and metric and microwear data for 30 complete specimens that were examined in greater detail. The 30 examined end scrapers have very consistent wear patterns that strongly confirm the accuracy of the functional term "end scraper."

The 30 end scrapers recovered from 41 JW 8 that have intact or trimmed flake platforms were carefully examined microscopically for wear patterns. The remaining 34 end scrapers do not have intact platforms, hence must be considered chips rather than flakes. Most of these are thought to have been flake tools that were broken during or subsequent to use or resharpening. Some no doubt originally began as chip tools (i.e., a flake fragment was used as a tool blank). Due to the difficulty of distinguishing between broken flake tools and chip tools and because the end scraper wear patterns are extremely consistent, the 34 end scrapers (or end scraper fragments) are not included in the wear study. A quick examination of several of these 34 excluded artifacts revealed identical wear patterns as those in the following discussion.

During the initial examination of the entire U1 sample, all 64 artifacts were examined for four attributes (material type, flake type, trimming location, and platform type). About a third of the way through this process, the author became aware that many of the end scrapers had readily observable edge rounding and polishing. The final two-thirds of the 64 end scrapers (41

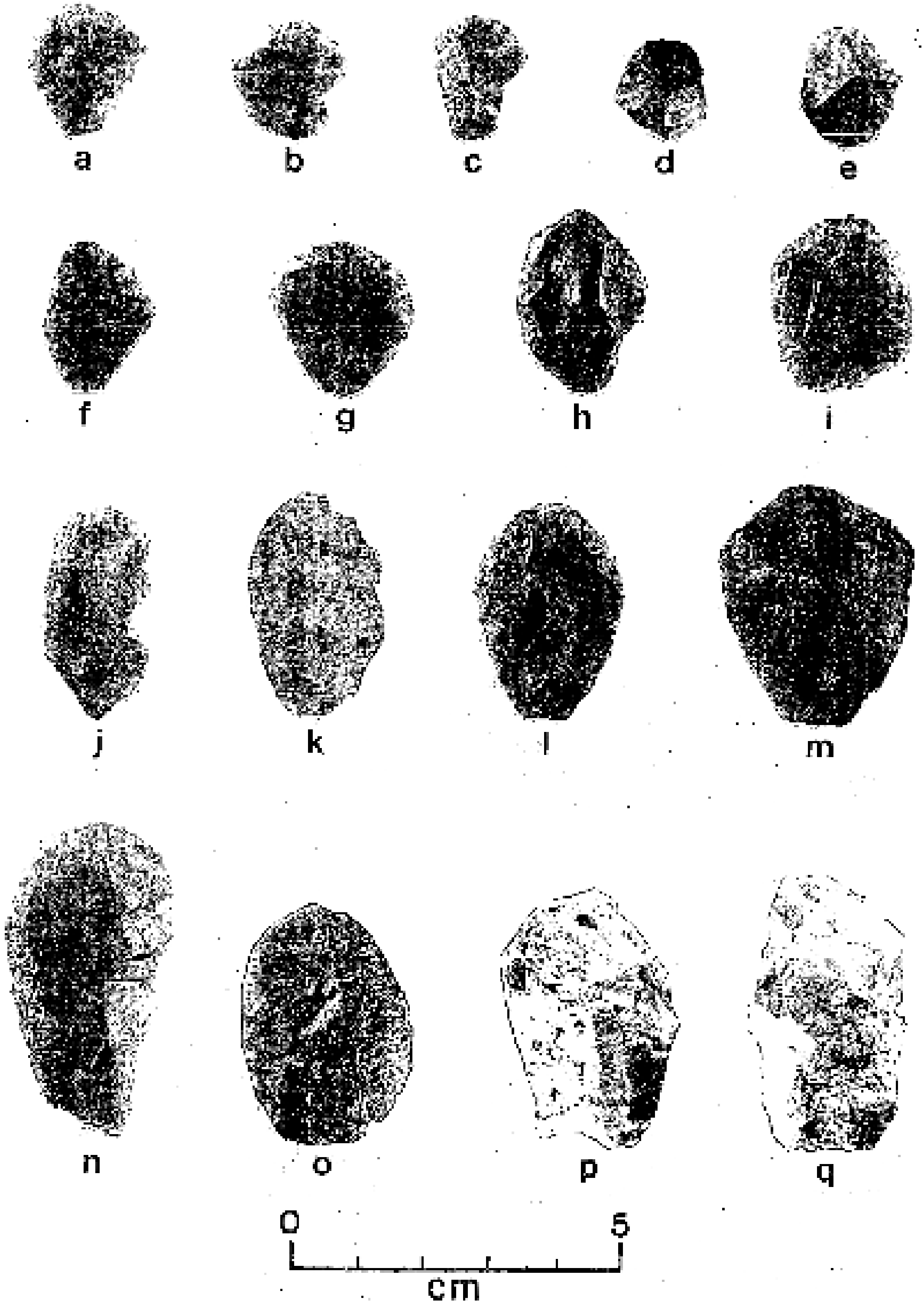

Figure 8. **Unifacial Tools.** a–n, end scrapers (U1); o–q, miscellancous scrapers (U2). Lot numbers: a, 338; b, 311; c, 752; d, 339; e, 341; f, 375; g, 316; h, 284; i, 111; j, 191; k, 523; l, 375; m, 275; n, 366-1; o, 159; p, 327; q, 472-15.

artifacts) were examined under good lighting by the unaided eye, and the presence or absence of obvious edge rounding and polish was noted. Obvious wear was observed on 23 of the 41 (56%).

The microscopic examination confirmed the macroscopic observations and revealed edge rounding and polish on all 30 complete artifacts, even those which did not appear to be worn in the first examination. The qualitative and quantitative extent of the edge rounding and polish varies from specimens that have only isolated traces of wear to artifacts which have completely rounded and polished working edges. This variation probably reflects the amount of use since the last edge rejuvenation rather than the total amount of use the artifact received. Evidence of edge rejuvenation was observed on 19 specimens (63%). Additional polish and rounding were observed on the flake ridges and protrusions on the ventral face adjacent to the edge on 18 specimens (60%). Use wear striations were observed on four of the specimens (13%). Different types of wear, edge spalling and bifacial edge damage, were observed on 11 specimens (37%). Each of these aspects of the observed wear is discussed in greater detail later.

All examined specimens have edge rounding and edge polish. Edge rounding and edge polish are easily observed under low magnification (10-30X) by holding the artifact with the edge angled toward the lense under high angle oblique lighting. In all but a few specimens the edge rounding and polish are concentrated on the semicircular end of the tool. Most specimens evidence this wear only over a 10 to 20 mm section of the end (equivalent to width of semicircular end or bit). A few tools with wider bits have correspondingly wider areas of polish (up to 35-40 mm). The rejuvenated specimens only have isolated remnants of edge rounding or polish or very light wear, depending on the thoroughness of the edge rejuvenation.

The edge rounding (abrasion) and polish are on the extreme edge of the ventral tool face and extend over a much wider area of the dorsal face. This clearly indicates the ventral face of the tool was in minimal contact with the worked material while the dorsal face was in much greater contact. The worn ends have well-rounded edges that are completely smoothed over and lightly polished. The tools with the heaviest wear have an edge that is about as round and smooth as the back of a stainless steel table knife blade (although obviously more irregular and not of the same shape). The polish is fairly bright and uniform but does not appear to be built-up like "hoe" polish or silica polish. The end scraper polish seems to result from the complete rounding and smoothing of the edge and appears identical in description to experimentally produced wet hide and meat polish (Keeley 1980:49-54). Protruding areas of the edge, such as flake ridges, are always the most heavily rounded and polished sections. Sections of the edge which have spine-plane angles approaching 90° are almost always more heavily worn than sections with spine-plane angles approaching 60°. The spine-plane angle, while not consistently measured, varies on most specimens, and ranges from about 60 to 100°. Most artifacts have spine-plane angles in the range of 70 to 90°. The steepest areas of the edges are invariably the end sections.

The ventral face of the artifacts (i.e., the flat side of the flake) has very little indication of wear except for the portion of the face immediately adjacent to the edge. Along sections of the edge, which are well rounded and polished (mostly along the bit), light polish can be observed on the ventral face along a narrow band that extends no more than 1 mm from the edge. Two artifacts have minute traces of a very reflective high polish. These areas are near the edge but do not appear connected with the edge polish or any other visible wear. It is suspected that the apparent high polish is actually the result of limited contact with a hard material. Given the minute amount and the lack of any regular pattern, these patches could be the result of impact with a piece of flint or even an excavation tool. The only other wear observed on the ventral face was the edge spalling or random nicking that will be discussed later. Thus, the ventral face of these tools seems to have little wear and must not have been in contact with the worked material except along the immediate tool edge.

In contrast, the dorsal face of the tools has much more extensive wear on most specimens. As mentioned, most edge rounding and polishing extend several millimeters onto the dorsal surface of the tool. It should be noted that while the ventral face is flat, the dorsal face is curved both by the original form of the flake and especially by the unifacial flaking along the dorsal face on the end (i.e., the end trimming that formed the tool edge). An additional aspect of the dorsal wear is the rounding and polishing of flake ridges and protrusions. This type of wear is more difficult to observe due to several factors. First, evidence of dorsal and edge wear is partially removed by edge rejuvenation on many specimens. Second, the ridge or protrusion wear is only present on heavily worn specimens. Finally, while the tool edge is easy to examine by rotating the artifact under the microscope along the edge, the ridge wear can only be observed by turning the artifact many different times in hopes of catching reflecting light just right. The easiest way to find dorsal flake ridge wear is to first locate the most heavily worn section of the edge and then check the adjacent flake ridges. Heavily worn sections of the edge are invariably accompanied by rounded and polished flake ridges or protruding areas of the dorsal surface.

Striations are on four of the most heavily worn specimens. The striations are only found on extremely worn sections of the tool which always occur near the center of the semicircular end. On all four examples, the striations are only on very steep sections of the edge and oriented perpendicular to the edge. The striations are less than a millimeter from the edge on the ventral face, continue over the edge, and onto the dorsal face up to 1.7 mm from the edge. On the very limited areas of the four artifacts that have striations, there seem to be a parallel series of closely spaced striations. The striations, when viewed under 30-160X, are seen as wide, shallow grooves with rounded and polished edges rather than sharp scratches.

The presence of well-worn edge remnants adjacent to unworn or lightly worn sections of the edge provides good evidence of edge rejuvenation. In addition, several specimens have very little indication of wear along what appears to be a freshly flaked edge. These are interpreted as rejuvenated tools that were never used again or were used for such a limited amount of time that no appreciable amount of wear was produced. Evidence of prior use is found in the form of tiny wear remnants on protruding ridges along the edge or on ridges that are still present on the dorsal surface. In other examples, edge rejuvenation is present along one continuous section of the

TABLE 5. END SCRAPER (U1) ATTRIBUTE DATA

Lot Number	Material Type	Flake Type	Trimming Location	Platform Type	Metric Attributes L	W	T	Wt	Microwear Attributes: Edge Rounding and Polishing	Ridge Rounding	Striations	Edge Rejuvenation	Edge Damaged Sides
55	1	1	3	1	23	19	5	2.2	x	x		x	
56	1	4	3	3									
56	2	4	3	3									
70	1	2	3	1	15	18	4	1.3	x	x			
70	1	4	2	3									
102	2	[illegible]	3	1	27	20	7	4.0	x	x		x	
108	1	4	2	3									
109	[illegible]	5	3	3									
111	1	4	4	2	28	25	7	5.7	x			x	
131	2	4	4	3									
131	3	[illegible]	4	1	28	21	5	4.1	x	x	x		
131	1	2	5	1	33	20	3	3.2	x	x		x	x
131	1	4	-	3									
155	1	1	[illegible]	1	29	17	2	1.5	x	x			
157	1	5	4	2	26	20	7	3.3	x			x	x
158	1	[illegible]	1	1	26	19	4	1.9	x	x		x	
187	1	5	1	3									
191	1	2	2	1	33	17	7	4.1	x			x	
194	1	2	3	1	36	25	7	6.9	x	x	x	x	
195	1	4	-	3									
214	1	4	-	3									
246	1	4	3	3									
252	1	2	1	1	20	15	3	1.1	x	x			x
258	1	4	3	3									
261	1	4	-	3									
264	1	5	1	3									
269	1	4	-	3									
274	1	5	-	3									
275	1	2	2	[illegible]	38	31	10	10.0	x	x			x
279	1	5	2	3									
281-1	1	4	4	2	30	28	6	3.3	x			x	x
283	2	2	1	1	24	16	8	3.2	x	x			
284	1	4	1	3									
311	1	4	4	2	19	19	4	1.5	x	x	x	x	x
314	1	5	3	3									
316	1	4	-	3									

TABLE 6. (continued)

Lot Number	Material Type	Flake Type	Trimming Location	Platform Type	Metric Attributes L	W	T	WT	Microwear Attributes: Edge Rounding and Polishing	Ridge Rounding	Striations	Edge Rejuvenation	Edge Damaged Sides
316	1	1	4	1	24	22	5	2.9	x	x	x		
318	1	4	[illegible]	3									
319	1	4	-	3									
320	[illegible]	4	1	3									
320	1	1	2	1	25	15	5	1.9	x			x	
323	1	4	-	3									
325	1	5		3									
327	1	2	2	1	45	25	9	9.1	x	x		x	x
330	1	4	1	3									
331	1	1	3	1	24	23	6	3.4	x	x		x	
336	1	4	-	3									
338	1	1	3	1	21	19	5	1.8	x			x	
339	1	2	1	1	16	15	7	1.4	x			x	
340	1	4	-	3									
341	1	2	1	1	19	17	[illegible]	1.2	x			x	
342	1	1	-	1	23	14	4	1.4	x	x			
343	1	4	3	3									
354-?	1	4	2	3									
363-1	1	2	1	1	48	25	8	10.5	x	x		x	x
374	1	1	3	1	23	18	3	1.2	x	x			x
375	1	1	1	1	34	24	7	6.3	x	x			
386	1	2	1	1	25	22	7	3.8	x	x			x
397	1	4	1	3									
420	1	5	1	3									
433	1	4	1	3									
433	1	4	1	3									
473	1	1	1	1	34	19	[illegible]	2.7	x			x	x
523-3	1	1	3	1	34	20	6	4.1	x			x	

Legend

Material Type: 1 = fine-grained chert; 2 = white chert; 3 = quartzite.

Flake Type: 1 = interior flake; 2 = secondary flake; 3 = primary flake; 4 = decorticate chip; 5 = corticate chip.

Trimming Location: 1 = end only; 2 = end and one side; 3 = end and two sides; 4 = circumference; 5 = side only.

Platform Type: 1 = intact platform; 2 = modified platform; 3 = platform missing (i.e., chip).

Metric Attributes: L = length; W = width; T = thickness (mm); WT = weight (g).

Microwear Attributes: x = present, see text for explanations.

edge until a heavily worn and severely rounded steep section of the edge is encountered. These heavily worn areas appear to have prevented the user from finishing the edge rejuvenation. One such specimen has ring cracks along the worn area, attesting to the force used in an unsuccessful attempt to remove the dull section of the tool. An additional fact which may evidence rejuvenation is that some of the end scrapers are noticeably smaller. These tend to be more completely trimmed and shaped than other specimens.

All of the wear patterns discussed are consistent with scraper wear. About a third of the examined tools also have indications of random nicking or spalling and bifacial edge damage. Although the random nicking is also present along the bit end of several specimens, it most often occurs along one or both sides away from the rounded and polished bit end. The random nicking or spalling was noticed on the ventral face; similar spalling is no doubt present on the dorsal face but is concealed by edge trimming. Bifacial edge damage occurs on several specimens along one side. The term "bifacial edge damage" is used to refer to a series of small step fractures that occur on both faces along one side of a tool that lacks edge trimming (i.e., has end trimming only or end and side trimming on opposite side). Both random nicking and bifacial edge damage probably reflect use of the side edge of the end scraper to perform some short-term cutting or sawing function. The absence of edge rounding and polish or more extensive edge damage along the tool side edges in question, argues that the wear is neither similar to the predominate end scraper usage nor the result of a repeated long-term function. In other words, the additional wear patterns must represent incidental use of the tool much like that represented by the modified debitage category MD2.

Several additional aspects of the end scraper wear pattern study deserve mention. Despite a careful search, no definite indication of hafting modification or haft wear was observed. If these end scrapers were hafted, one would seemingly expect to find either some type of haft modification such as notching or edge grinding, or evidence of haft polish on the flake ridges on the proximal section of the tool. The absence of these evidences may suggest that the end scrapers at the Hinojosa site were hand-held tools. This suggestion contradicts Hester's (1977:20) intuitive assertion that "given the small size of the specimens, they must have been hafted for use. . . ." It is also possible that the hafting method did not require hafting modification or result in distinctive wear. Wedel (1970) illustrates a variety of hafted scrapers from the Great Plains, including archaeological and ethnographic specimens. In particular, several specimens are shown which have small scrapers set in an antler handle with some type of mastic or resin.

The presence of striations on four heavily worn tools led the author to try and locate striations on the most heavily worn sections of other end scrapers. It was assumed that the striations were easy to overlook and might require higher magnification to observe. No additional definite striation patterns were found. Several explanations for the limited occurrence of striations are considered: (1) the striations may suggest that the four tools were used on a different material than the other 26 specimens; (2) striations only occur after extensive amounts of use; and (3) striations are present but not observed. While the first explanation cannot be ruled out, the other two explanations in combination seem most likely. Striations were only observed on the most heavily worn specimens on the most heavily worn sections of the tool where large, smooth, highly reflective areas were present. The striations were only clear under higher magnification (>30X) and by using low angle oblique lighting. Hence, it seems likely that less obvious striations were present but not observed due to the difficulty of coordinating low angle lighting on small, rounded areas under higher magnification. An added factor that hampered examination of the many small, polished projections is that many tools are made of highly reflective, fine grain chert, hence it is difficult to isolate the reflected polish.

In summary, the wear patterns on the 41 JW 8 end scrapers are highly patterned and consistent with the hypothesis that Late Prehistoric end scrapers were in fact used to process animal hides. These artifacts were often resharpened when the used worn edge no longer functioned efficiently. The presence of additional wear on about a third of these tools suggests that end scrapers were also used to perform spontaneous secondary functions. The absence of the nonscraper wear on the scraper-worn end may suggest that these secondary functions were contemporary with the primary function. The Hinojosa site end scrapers may have been employed as short-term flake knives when necessary by using the side of the tool.

(U2) Miscellaneous Scrapers (N=3; Fig. 8,o-q)

Three unifaces were recovered from 41 JW 8 which are not end scrapers. All three have unifacially worked edges along one lateral edge and lack the semicircular end trimming of group U1. These unifaces could be termed "side scrapers." Due to the small number of artifacts in this category, they are briefly described on an individual basis.

The unifacial artifact from Lot 159 (Fig. 8,o) is a secondary flake which has trimming on one side; the opposite side and distal end are covered by cortex. Other than the absence of end trimming, this specimen is similar to the U1 group in terms of size, morphology, and edge angle. No noticeable wear was observed microscopically. It is 37.6 mm in length, 26.5 mm in width, 8.0 mm in thickness, and weighs 7.7 g.

The uniface from Lot 327 (Fig. 8,p) is made on a thick tertiary flake of a poor quality, whitish chert that has numerous tiny voids partially filled by crystals. One side is crudely flaked (many hinge fractures) to form a very thick, convex working edge. Microscopic examination reveals that the artifact had been resharpened prior to discard. Small remnants of the previous edge show extreme rounding and edge polish. The polish is rather general rather than faceted and very high, and is confined to within 1.3 mm of the edge. A few apparent striations were observed on the ventral surface of the edge and perpendicular to the edge. The wear and futile attempt at edge rejuvenation are consistent with scraper wear. It is 41.8 mm in length, 26.1 mm in width, 15.3 mm in thickness, and weighs 15.8 g.

The unifacial artifact, found in Feature 9 (Lot 472-15; Fig. 8,q), is a thick decorticate chip that is yellow to white in color and has numerous bedding plane flaws. It is similar in size, shape, and appearance to the Lot 327 U2 specimen. The proximal section of the flake has been snapped off, however, the break occurs along a flawed area which may have taken place prior to the manufacture of the tool. One edge (distal edge of original flake) has a thick, convex bit that was formed by flaking and numerous hinge fractures. The edge is severely battered and has a few bifacial flake removals. Microscopic examination suggests that the artifact was discarded after a futile attempt at edge rejuvenation which apparently removed all traces of wear. It is 42.0 mm in width and 18.6 mm in thickness.

NONCHIPPED MODIFIED STONE

Stone artifacts modified by battering, grinding, or grooving were uncommon at 41 JW 8 in contrast to the many chipped stone implements. Most of the nonchipped modified stone artifacts are fragments of complete tools. The visible wear patterns and tool morphologies suggest that the following functional artifact types are present: hammerstones, grinding slabs, manos, abrading stones, and a pipe bowl. Sandstone, quartzite, chert, calcium carbonate, and volcanic rock types are all represented in the collection. Of these, calcium carbonate is the only material available in the site vicinity. The absence of complete nonchipped modified stone artifacts and the fact that most of the raw materials are nonlocal strongly suggest these were valued artifact types that were only discarded when nonfunctional. Complete examples of most of these artifact types are illustrated in Hester (1980a), Hall, Black, and Graves (1982), or Turner and Hester (1985).

All nonchipped modified stone artifacts are given a single artifact code (MS) due to the comparatively small number of these artifacts. For provenience of the specific types, a lot number list is provided in each artifact group description.

<u>(MS1) Ground Stone</u> (N=25)

The ground stone artifact category consists of all tool fragments with one or more artificially smoothed faces or facets. Most ground stone artifacts from 41 JW 8 are fragments of small, thin grinding slabs with flat or concave smoothed surfaces. Five specimens are fragments of rounded cobbles with convex, smoothed surfaces. These represent <u>manos</u> or hand-held milling stones used in conjunction with grinding slabs to pulverize organic materials, presumably plant remains. Two of the manos are made of quartzite and have some indications of battering along the tool edge; these may have also functioned as hammerstones. One atypical ground stone artifact (Lot 342) is a small, blunt-pointed calcium carbonate fragment, 1.4 cm in length, worn smooth, and slightly polished. Material types represented by the ground stone tools are sandstone (18), calcium carbonate (4), and quartzite (2). Slab fragment lot numbers are 62 (2), 63, 71, 131 (2), 134, 144, 147, 157, 186, 187, 226, 253, 301, 334, 340, 342, and 351. Mano fragment lot numbers are 56, 62, 70 (2), 513.

(MS2) Hammerstones (N=7; Fig. 9,a,b)

Seven hammerstones (two complete and five fragmentary) were recovered from 41 JW 8. A hammerstone is a rounded stone cobble used as a percussor to chip siliceous stone. Hammerstones typically exhibit battering wear on protruding edges or ends. One specimen (Fig. 9,a) made of silicified wood is an exhausted core that was recycled and used as a hammerstone. Material types are chert (1), silicified wood (1), volcanic rock (2), and quartzite (3). Lot numbers are 56 (2), 62, 66, 126, 131, and 522-1.

(MS3) Abraders (N=6)

Five fragmentary abrading stones were recovered from 41 JW 8. An abrading stone or an abrader is a stone cobble or slab that has one or more man-made grooves. The grooves typically appear V- or U-shaped in cross section and are 2-5 cm in length. The grooves are believed to be the result of biface edge abrading, the grinding or smoothing of the edge of a bifacial chipped stone tool. This is a basic step of flintknapping. The abraders may have also been used to shape bone or shell artifacts. All six specimens are made of a relatively hard calcium carbonate. Lot numbers are 56, 63(2), 104, 131, and 459-2.

(MS4) Sandstone Pipe Bowl (N=1; Fig. 9,c,c',d)

One usual artifact found at the Hinojosa site is a fragment of a decorated tubular pipe bowl. This artifact is made of buff-colored sandstone. The material has pebble-sized rock inclusions, occasional voids, and medium to coarse sand grains rather poorly cemented by calcium carbonate. The exterior and interior surfaces are ground smooth but remain uneven due to the poor quality of the material.

The interior surface is slightly smoother than the exterior. The interior of the bowl (Fig. 9,c) is constricted to a diameter of approximately 20 mm some 2 cm above the base. The interior diameter at the base is approximately 30 mm. The maximum interior diameter based on the preserved portion of the artifact is about 35 mm. The maximum exterior bowl diameter is approximately 58 mm. The pipe bowl walls range from 18 to 21 mm except at the base, where the walls taper to a rounded edge.

The exterior surface of the pipe bowl (Fig. 9,c') has been decorated with thick asphaltum designs and fugitive red film. Close examination reveals that the asphaltum was applied in a molten state, and that the fugitive red film (iron oxide paint) was added afterward to fill in the areas of the pipe without asphaltum. Based on the preserved portion of the pipe bowl, the decorative motif seems to be a geometric design (Fig. 9,d) consisting of four red ovals (fugitive red film) evenly spaced and outlined by wide black (asphaltum) dividers. Asphaltum and fugitive red film were also used to decorate ceramic vessels at 41 JW 8 and other Late Prehistoric sites in southern Texas.

METHODS

The analytical techniques chosen to examine the 41 JW 8 ceramics were largely based on the author's experience gained during his analysis of prehistoric ceramics on the Nueces River Project (Hall, Black, and Graves 1982; Hall, Hester, and Black 1986). The poor condition of most the Hinojosa site prehistoric ceramics and the extreme fragmentation of all vessels ruled out any hope of vessel reconstruction such as Highley's (1986) work with the 41 LK 201 collection. A preliminary examination of several dozen sherds revealed a high degree of homogeneity in the 41 JW 8 assemblage. Given the large sample size, high degree of homogeneity, and the poor condition of the majority of the collection, it was decided to concentrate on a detailed analysis of a select sample. One hundred of the better-preserved sherds were carefully examined microscopically.

The 100 sherd sample represents the larger and better-preserved sherds, rim sherds, decorated sherds, and other atypical specimens. Each lot bag was examined by the author for evidence of sherds with preserved surface finishes. Thus many smaller sherds not suffering from extreme weathering were also examined. Often a lot bag would contain two to five sherds from a single vessel (i.e., the sherds were identical in surface and paste characteristics). In these cases a maximum of two identical sherds was examined from a single lot. The 100 sherd sample was selected from 36 lot bags.

The select sample, while not statistically representative of the 41 JW 8 ceramic assemblage, does contain examples of virtually all variations observed within the total sample. Unusual sherds are overrepresented in the select sample. However, since decorative techniques only appear on a few of the sherds from a given vessel and some forms of decoration are extremely ephemeral, the percentage of decorated vessels estimated by the select sample ratios is probably too low. The sampling technique is felt to be adequate for the purposes of describing the ceramic assemblage and comparing it with regional ceramic assemblages.

ATTRIBUTE DEFINITIONS

For each sherd the following attributes were examined: exterior surface treatment, postfiring decoration, interior surface treatment, paste matrix, paste inclusions, sherd thickness, and vessel fragment. Due to the small size of even the larger fragments, vessel form can only be guessed at in most cases. Each attribute is defined and described next.

Exterior Surface Treatment

Exterior surface treatment describes the vessel surface treatment prior to firing. The Hinojosa site assemblage is characterized by extremely standardized exterior surface treatment. Virtually all sherds have well-smoothed exterior surfaces which have been floated to bring fine clay particles to the surface, thus concealing sand and bone particles and providing a surface which can be polished. Eight percent of the select sample lacks exterior burnishing (polishing). Thirty-three percent have highly burnished exterior surfaces, and 58% have lightly burnished exterior surfaces. One sherd does not have a preserved exterior surface. Highly burnished surfaces have a highly reflective, even surface, marred only by postdepositional scratching or weathering. Lightly burnished surfaces have low luster and/or uneven polishing. Unburnished surfaces have no visible surface luster. This attribute can usually be determined macroscopically. Postdepositional weathering undoubtedly effects the luster of the surface finish. Where possible, this factor was taken into consideration (i.e., if a sherd had a remnant of a highly polished surface surrounded by an eroded matte surface it was considered highly burnished).

Postfiring Decoration

Only two forms of decoration were observed, fugitive red filming and asphaltum painting. Twelve percent of the select sample have traces of asphaltum adhering to the exterior. Only one sherd has asphaltum connected with a broken edge (edge mending). The other 11 sherds have either asphaltum lines of various widths or merely traces of asphaltum in small areas. It appears the asphaltum was applied in molten form after the vessel was fired. Four sherds have fugitive red film on the exterior surface. One of those, a small rim sherd, also has fugitive red film on the rim and the interior surface. Fugitive red film is believed to be from mineral pigment such as earthy hematite (red ochre; Hall, Black, and Graves 1982). Fugitive red is always applied to burnished surfaces. The exact mechanism of application is unknown but it appears to be a postfiring decoration. Microscopic examination and chemical testing are often necessary to spot and confirm postfiring decorative techniques. The "Lewis Method" was used to positively identify asphaltum. This chemical test involves placing drops of two chemicals (isopentane and Toluene) on small amounts of scrapings of suspected asphaltum. Isopentane will not dissolve asphaltum while Toluene will (see Hall, Black, and Graves [1982:445] for a detailed explanation).

Interior Surface Treatment

Twenty-two of the sherds have burnished interiors, 31 have wet-brushed interiors, 32 have smoothed interiors, and 12 have uneven surfaces, two sherds do not have preserved interior surfaces, and the handle fragment has no interior surface. Wet-brushed surfaces exhibit a series of parallel ridges and furrows created by a brush (frayed stick?) while the clay was still wet (Hall, Black, and Graves 1982:444). The wet brushing serves to make the surface even, cover coil welds, and perhaps texture the surface.

Smoothed surfaces are those that lack brush marks and burnishing but have tactually smooth, even surfaces. These surfaces are probably created with a wet finger after the vessel has been formed. The final surface treatment type, uneven surfaces, describes essentially unfinished surfaces that lack smoothing, burnishing, or wet brushing. Coil lines, surface lumps, and finger indentations are commonly visible. As will be discussed, the interior surface treatment is often related to vessel form and function. Interior surface treatment can usually be determined macroscopically, however, microscopic examination with oblique lighting is often useful.

Paste Matrix

All ceramics are composed of various constituents, including clay, silt, and sand as well as intentionally added inclusions such as bone. The term "paste matrix" refers to the texture and grain size of the ceramic mixture excluding the intentionally added nonplastic inclusions. In other words, the paste matrix is used here to refer to the clay mixture derived from natural sources. Three types of paste matrices are defined: fine, silty pastes (24 sherds); coarse, silty pastes (32 sherds); and sandy pastes (44 sherds). The paste matrix must be evaluated by examining a fresh sherd break microscopically. The author used a variable-powered Olympus binocular microscope fitted with a micrometer in one eyepiece. The micrometer was calibrated for 30X. At 30X, fine silt particles (less than 0.0156 mm) are not visible while coarse silt particles (0.031-0.0625 mm) appear as distinguishable particles. Sand grains are easily visible at 30X.

Fine, silty pastes are very fine grained and are typically not very reflective. Coarse, silty pastes are relatively fine grained and usually reflective. Sandy pastes are usually very coarse grained and highly reflective. Silty pastes contain comparatively little sand by definition. Sandy pastes may have moderate to profuse sand quantities. Of course, sandy pastes also have silt and clay particles that appear as a finer grain matrix around and between the individual sand grains. Thus the term "paste matrix" is herein used to refer to the dominant paste constituent other than added temper. Sand is assumed to be an unintentional paste inclusion. The three paste matrix types are obviously derived from differing clay sources as will be discussed.

Paste Inclusions

Crushed bone was added to all but four of the select sample. The quantity of bone was estimated by examining the fresh break microscopically under 10-20X. The author developed considerable skill in estimating inclusion density during the Choke Canyon study (see Hall, Black, and Graves 1982:399; Hall, Hester, and Black 1986). Three quantity values were used: <u>profuse</u> (over 25% by volume), <u>moderate</u> (5-25%), and <u>sparse</u> (>5%). Profuse quantities of bone occurred in 16 sherds, moderate quantities in 53 sherds, and sparse quantities in the remaining 27 sherds that contained bone. The particle size of the crushed bone typically varied in each sherd from very fine (<.125 mm) to granular (>2 mm).

Sand grains were observed in all but five of the select sample sherds. As mentioned, sand is assumed to be an unintentional inclusion owing to the difficulty of distinguishing between naturally occurring sand present in the clay and intentionally added sand. Most of the sand grains were subangular to subrounded in morphological shape. Occasionally sherds were examined with predominately well-rounded or predominately angular sand grains. The author has previously argued that variation in sand grain morphology suggests differing clay sources (Hall, Black, and Graves 1982).

A few other paste inclusion types were observed, including hematite, quartzite fragments, resin bubbles, and untempered clay spheres. These are considered unintentional inclusions. Small particles of hematite were observed in only three sherds. Resin bubbles were observed in 11 sherds. Quartzite and untempered clay spheres were each observed in four sherds. In addition, two sherds had coarse to granular-sized white inclusions of unknown composition (caliche?). These incidental inclusions have been documented in south Texas ceramics and have been discussed in some detail by Hall, Black, and Graves (1982:442-443) and Hall, Hester, and Black (1986:381-382).

Sherd Thickness

The maximum thickness of each sherd was measured to the nearest millimeter using a pair of vernier calipers. The 99 rim and body sherds have an average thickness of 6.1 mm and range between 3 and 12 mm. The thickness of the sandy paste sherds (44) averages 6.7 mm while the silty paste sherds average 5.7 mm.

Vessel Fragment

The term "vessel fragment" refers to the section of the vessel from where a given fragment originated. The select sample consisted of seven rim sherds, one handle fragment, and 92 body sherds. Three of the body sherds appear to be fragments of pipe bowls. These sherds have small diameter curvatures, thick walls, and charred interior surfaces. Similar attributes were associated with pipe fragments recovered from Choke Canyon Reservoir (Hall, Black, and Graves 1982; Highley 1986).

Vessel Forms

Vessel form could not be determined for most of the ceramic fragments recovered from 41 JW 8 due to the extremely fragmented nature of the collection. The rim sherds, a few unusual sherds, and inferences from the surface treatment allow some speculation on vessel form. Bowl forms are suggested by certain rim sherds (Fig. 10,a-e), and by the fact that 22% of the select sample have burnished interior surfaces. A well-finished, polished interior surface suggests an open vessel form (bowl). Constricted neck vessels, such as ollas, are suggested by rim sherds (Fig. 10,f), a single handle fragment, and the fact that many sherds are noticeably finished more poorly on the interior. At Choke Canyon Reservoir, the olla forms had poorly finished interiors (Hall, Black, and Graves 1982). Certain rim forms (Fig. 10,g) appear to be from partially constricted neck forms such as jars. A final vessel form represented at 41 JW 8 is the pipe bowl.

Thus the ceramic assemblage from the Hinojosa site represents a very limited and simple range of functional vessel forms. Cooking, water storage, food storage, and smoking are functions of the inferred vessel forms. The figurine fragment discussed next is the only nonutilitarian ceramic form found at 41 JW 8.

CERAMIC FIGURINE FRAGMENT

One unusual ceramic object recovered from 41 JW 8 appears to be a fragment of a figurine (Fig. 10,h,h'). This artifact was not included in the select sample. The object is 3.7 x 1.65 x 1.45 cm and weighs 9 g. The cigar or thumb-shaped object is gray tan in color. The surface has been smoothed and very lightly polished. Design elements include tiny punctations, a shallow groove, and several wavey incised lines. Due to the unusual nature of the artifact, it was not broken to examine the paste. Based only on surface examination, the object appears to be made from a sandy paste with some bone temper. In other words, the object appears to be made from the same materials as many of the other ceramic fragments at the Hinojosa site. This may suggest that the figurine is a locally made artifact.

Ceramic figurine fragments are known from several sites in southern Texas and along the Texas Gulf coast (Chandler 1978). The specimen from 41 JW 8 most closely resembles a figurine found at a site in San Patricio County (Chandler 1978:344). The complete form and the function of these rare artifacts are not known. They may represent some type of effigy object or fetish.

CERAMIC SUMMARY AND DISCUSSION

The prehistoric ceramic materials from 41 JW 8 form a large collection of small fragments. The average weight per sherd of the ceramics recovered from the Wagon Trail Area is only 1.16 g. Many of the sherds are so badly weathered that surface treatment could not be determined. The collection is fairly homogeneous in most characteristics. Surface colors range from tan to gray to flesh. Fire clouds are common, especially on the exterior surfaces. Most exterior surfaces, unless clouded, are clearer and brighter in color (better oxidized) than the interior surfaces. Exterior surfaces are almost always smoothed, floated, and burnished. Interior surfaces are usually less well finished and often smoothed with an implement that left brush marks (a frayed stick?). Vessel forms are limited to simple, functional forms such as bowls, ollas, and jars except as noted. It is estimated that one-fifth to one-fourth of the vessels represented by the collection were decorated. Asphaltum lines are the dominant form of decoration although fugitive red filmed vessels are present. Much of the variation noted within the collection can be correlated with paste composition.

Several interesting differences are noted between the silty paste ceramics and the slightly less numerous sandy paste ceramics. Based on the select sample attributes, these differences include sherd thickness, surface finish, and surface color. The silty paste sherds average 1 mm less in thickness than the sandy paste sherds (5.7 vs. 6.7 mm). Silty paste sherds tend to be highly burnished more often than the sandy paste sherds. The surface color of the silty paste sherds tend to be flesh colored while the sandy paste sherds tend to be tan colored. It was also observed that the silty paste sherds are stronger than the friable sandy paste sherds. Silty paste sherds tend to have moderate to profuse quantities of bone while sandy paste sherds tend to have sparse to moderate bone quantities.

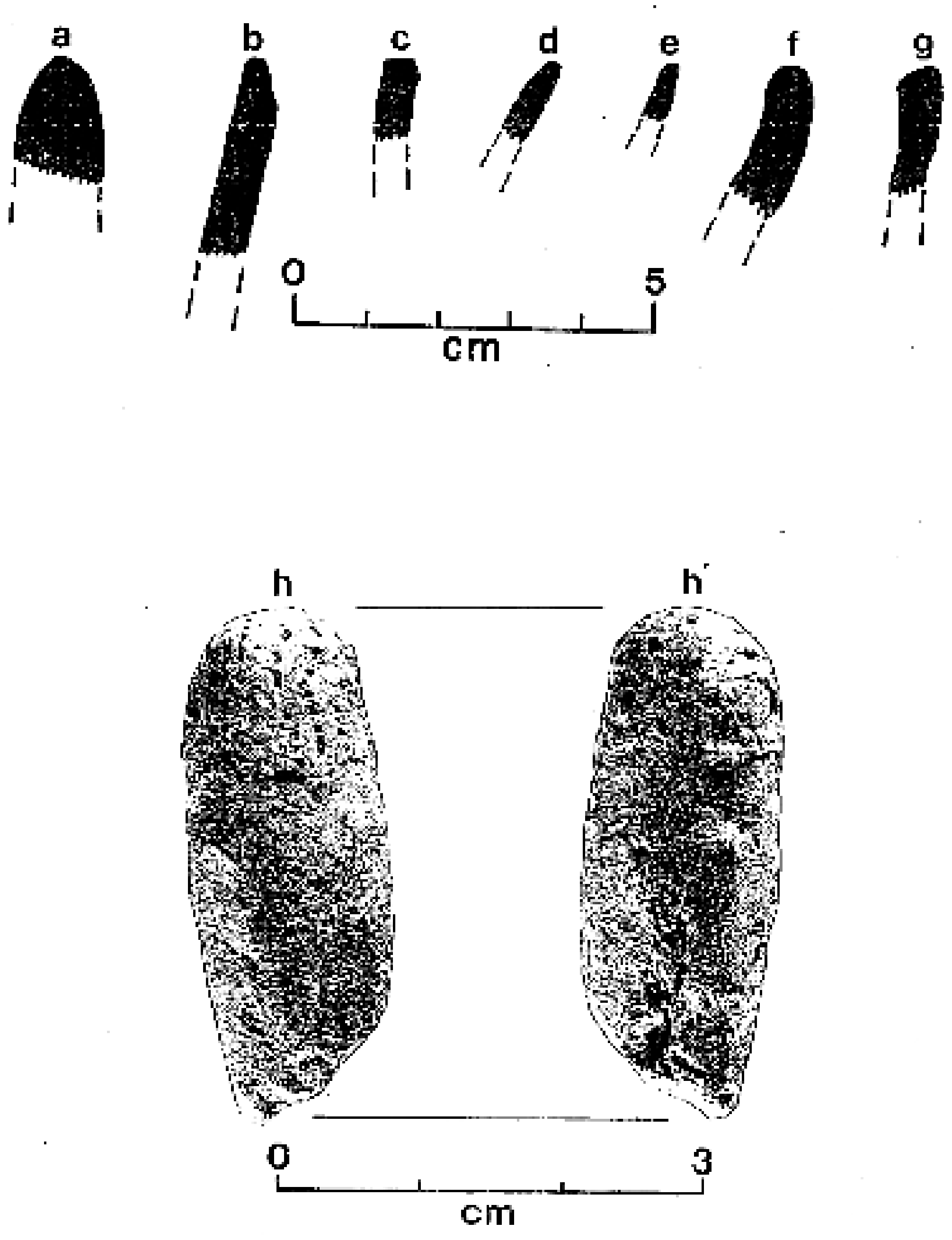

Figure 10. **Ceramic Artifacts.** a-g, rim sherd profiles (interior surfaces on the right); h,h', figurine fragment. Lot numbers: a, 459-1; b, 110; c, 448; d, 281; e, 441; f, 61; g, 384; h, 516.

The observed differences are interpreted as technological rather than cultural in nature. Silty pastes with bone temper allow the construction of stronger vessels with relatively thin walls. Silty paste vessel surfaces take a higher polish because the fine-grained paste compacts and covers inclusions better than the coarser grain sandy pastes. Sandy pastes need less bone temper, but must be thicker than silty paste vessels to make a durable vessel. Interestingly, asphaltum and fugitive red decoration occur in equal quantities on silty and sandy paste ceramics. It is suggested that the observed differences simply reflect the fact that prehistoric potters had to use slightly different techniques when using a sandy paste clay than they would have used with a silty paste clay. It is predicted that a study of reconstructed vessels from south Texas would reveal differences in vessel form that could be correlated with paste characteristics. Olla and jar forms are more likely to have been made from silty pastes with bone temper. Sandy pastes are probably better suited for bowl forms and possibly pipe bowls.

In the report on the 1975 field work at 41 JW 8, "one possible **Rockport** ware sherd" was noted (Hester 1977:26). The present analysis did not find any clear examples of **Rockport** ware. **Rockport** ware ceramics are typically thin, sandy paste sherds that are gray to tan in color and often have asphaltum decoration (Suhm and Jelks 1962; Campbell 1962). As mentioned, most of the sandy paste ceramics at 41 JW 8 are thicker than the silty paste sherds, and virtually all of the select sample have bone temper. **Rockport** ware ceramics are usually identified on the basis of surface characteristics such as color and asphaltum decoration and their general sandy paste. Careful studies of the pastes are few in number. Perhaps the most important is a paste study done by Story (1968) of the Ingleside Cove ceramics (**Rockport** ware). Story's careful microscopic examination revealed a great deal of paste variation. It is interesting to note that bone temper was present in a significantly large percentage of the sherds and that bone-tempered, sandy paste sherds constituted one of the most numerous paste groups at the site.

This author has noted the presence of bone tempering in a number of collections of sandy paste coastal pottery from the Freeport area (Black and Cox 1983) to the Corpus Christi area (Mokry and Black ms.). It is argued here that the sandy paste ceramics of the Coastal Bend region and the bone-tempered ceramics of inland south Texas commonly share attributes (sandy paste, bone temper, and asphaltum decoration) and are both basically functional pottery with limited variation in form (water jugs or ollas are the most common form in both areas). The most important difference is herein seen as the original clay source. The sandy clay of the coastal area is seen as a superior raw material that allowed the creation of thin-walled vessels. Sandy paste clay from inland sources is more likely to be an alluvial material that has coarser grain clay and larger sand size, hence could not be used to form thin-walled vessels. The finer grain inland clays, on the other hand, were used in conjunction with massive amounts of bone temper to create vessels as thin as the coastal wares.

The most important point of this discussion is that many of the differences between the coastal and inland ceramic traditions in southern Texas are seen as more a factor of raw material availability than cultural preference. The numerous shared attributes and the overall similarity in basic form and function suggest that the two traditions may share a common origin. There are significant differences, such as the form variation and the decorative motifs. Thus, the two traditions are distinct, however, they overlap in many attributes, as the Hinojosa sample attests.

BAKED CLAY LUMPS

Small, irregularly shaped lumps of baked clay were recovered in moderate quantities from 41 JW 8. These lumps range from tennis ball size to pea-sized with most lumps less than golf ball size. The baked clay lumps, while irregularly shaped, are generally rounded and oval to spherical. No evidence of purposeful shaping, smoothing, or manufacture was observed. Surface colors are tan to orange to yellow and usually obscured by thin, light gray, calcareous coatings. Fresh breaks reveal the same tan-orange-yellow-colored matrix in most lumps, although a few have darker, incompletely oxidized, gray cores. A number of the baked clay objects are broken and were examined microscopically. Virtually all have a very sandy clay matrix with occasional voids, pebbles, and root impressions. No trace was observed of bone, flakes, or snails.

Baked clay lumps (objects, balls, or nodules) are very common constituents in South Texas Gulf Coastal Plain site deposits. Various explanations have been advanced to explain these lumps as Black (1978) and more recently Smith (1982) have reviewed. Both authors agree with Corbin's (1963) explanation that most baked or burned clay objects result from building an open fire on a clay-rich soil surface. The heat of the fire "bakes" the underlying clay-rich soil, thus forming small hardened lumps. Smith (1982:36) concludes: "It now seems clear that many south Texas soils contain one or more chemical compounds that respond to the heat of a fire such that the matrix is bound up and hardened. . . ." It is suggested here that the "chemical compounds" are nothing more than the various clay minerals present in most soils within the South Texas Gulf Coastal Plain. One of the properties of clay is that when heated, the water within the clay is removed, leaving a hardened durable substance, ceramic material.

Several aspects of the baked clay lumps from 41 JW 8 remain puzzling. First, the baked clay lumps appear far sandier than the typical soil matrix at the site. Second, the absence of any flakes, bone, or snail shell fragments in any of the examined lumps is surprising in view of the frequency of these materials within the soils at the site. No explanation for these inconsistencies with the site soil matrix is immediately apparent.

MODIFIED BONE AND SHELL

Each of the bone and shell items, which have been modified by cutting, grinding, smoothing, and incising to form tools or ornaments, is discussed in the following few pages. The bone items are ulna tools, a bone needle, and bone beads. Both mussel shell and marine shell were modified.

Bone Needle

The bone needle (Lot 113; Fig. 11,e) is a small bone splinter which has been smoothed to form a slender, rounded object not unlike a toothpick. It is 3.3 cm in length (broken) and has a maximum diameter of 4 mm. The artifact is somewhat weathered but has highly polished traces in some areas. Many obvious scratch marks were observed perpendicular to the long axis of the needle. On close inspection, these proved to be rodent gnaw marks that occurred in paired clusters. It is suggested that this artifact was used on some type of relatively soft material (leather or plant fiber) in some type of sewing function. The remnants of the highly polished areas attest to repeated use. Similar tools have been found in southern, central, and southwestern Texas. The complete tool would have most likely had a rounded proximal end with a small hole drilled to thread the fiber or leather strand.

Bone Beads

Seven bird bone beads (Fig. 10,f-h) were found at 41 JW 8. All are made from a thin, hollow long bone shaft that appears to be a leg bone from a turkey-sized bird. All seven are similarly made and are of approximately the same diameter, 5-7 mm. They range in length from 7 mm to 20 mm (7, 10, 10, 12, 12, 12, and 20 mm). All appear to have been made by the groove and snap method. Four beads are only partially smoothed on the snapped edges, hence showing the construction technique. The remaining three have very well smoothed and polished ends. All the bone beads have polished areas ranging from lightly polished that may just be the result of handling to highly polished that appear to be purposeful.

All seven bone beads were found in the Wagon Trail Area and could represent a single broken bone bead necklace. Very similar bone beads were recovered in very large quantities from a burial found at the Arroyo de los Muertos site near Laredo (McGraw 1983). The burial, of a young woman and her infant, had hundreds of bone beads that were present as grave offerings. Most of these beads were arranged as necklaces and bracelets, although some loose beads were found away from the wrist and neck region of the burial suggesting that some beads were sewn on the clothes of the deceased. The Laredo burial is not well dated; however, it is thought to be Late Prehistoric in age. Bird bone beads have been found at many Late Prehistoric sites in southern Texas, such as several of the Zavala County sites (Hester and Hill 1975:14), 41 LK 201 (Highley 1986), and 41 MC 296 (Hall, Hester, and Black 1986:334).

MODIFIED SHELL

A small number of modified shell artifacts were found at the Hinojosa site. Seven fragments are freshwater mussel shell, and 15 marine shell fragments have been modified by cutting, grooving, and/or grinding. All appear to be fragments of shell tools, ornaments, or ornament manufacturing debris.

<u>Shaped Mussel Shell</u>

A number of mussel shell fragments that were recovered from the site appear to have been shaped by cutting and/or grinding. Many of these, upon close examination, appear to be fortuitously broken fragments that have a regular shape. Seven fragments have definite evidence of modification. Undoubtedly other shaped fragments were present but not identified. Five of the seven fragments have angular shapes that tend to be rectanguloid in outline. The other two fragments have oval outlines. With the exception of two irregular, angular fragments, these mussel shell pieces appear to represent shell ornament blanks that were never finished. The edges of most were formed by the use of a very sharp instrument (probably a flake) to cut the shell. Some of the edges appear to have been completely cut while others seem to be only partially cut and then snapped. Several of the fragments have smooth edges that appear to have been ground down. The absence of suspension holes and the unfinished look of these seven fragments suggest that they represent ornament blanks that were never completed.

The specimen from Lot 60 (Fig. 12,b) is a thick, oval fragment with smoothed edges. It is 21 x 24 mm.

The specimen from Lot 69 is a small, rectangular fragment with cut and smoothed edges. It is 13 x 14 mm.

The specimen from Lot 295 (Fig. 12,a) is a small, rectangular fragment that has been cut on three edges. It is 11 x 13 mm.

The two specimens from Lot 255 are small, irregular fragments with angular cut edges. They are 6 x 9 mm and 9 x 14 mm.

The specimen from Lot 280 is a square fragment with cut and ground edges. It is 7 x 9 mm.

The specimen from Lot 522-2 (Fig. 12,c) is a large, oval fragment with ground edges. This mussel shell may have been chipped. It measures 21 x 44 mm.

<u>Incised Mussel Shell</u>

Two mussel shell artifacts were found in association with Feature 7, the living surface documented in the southern portion of the site. One (Lot 354-2; Fig. 12,d) is a beautifully made pendant. The pendant is triangular and smoothed on all three edges with a biconically drilled suspension hole (3 mm in diameter). It is made from the edge section of a large, old mussel that must have been collected from a major river such as the Nueces River (Harold Murray, personal communication). It is 22 x 38.5 mm. On the interior face a geometric design is incised. The design consists of a double-incised line extending down from the edge of the suspension hole to the curving edge near the bottom. Two parallel-incised lines, spaced 7 mm apart, are perpendicular to the first line, extending from the double line to one edge of the artifact. Five smaller parallel-incised lines, spaced 1 to 2 mm apart, are between the larger parallel lines, dividing the space into six tiny panels. The entire design looks something like an upside down flagpole and flag.

Another incised fragment (Lot 343-4; Fig. 12,e) is made of thin mussel shell. Its outline shape is irregularly angular. The edges are cut, and it is 12 x 18 mm. A series of six parallel-incised lines, spaced 1.5 to 3 mm apart, covers the interior surface. One corner of the artifact is broken off along an incised line. The function of this artifact is not known.

Marine Shell

Nineteen marine shell fragments were recovered from 41 JW 8, including two fragments found in 1975 (Hester 1977:Fig. 7). Most of these fragments are either ornament or tool fragments or manufacturing debris. Table 8 lists the proveniences (lot numbers) and identification of each fragment. The identifications were made by Gentry Steele. Most fragments (such as Fig. 12,f,g) are small pieces which have chipped or irregularly broken edges and are thought to be debris resulting from the manufacture of shell ornaments or tools. These will not be described in detail. The specimens that are definitely tools or ornaments are described.

The specimen (Fig. 12,h) from Lot 51, recovered in 1975, is a fragment of a discoidal bead. Hester (1977) identified this as a conch fragment; Steele identified it as a Bivalvia fragment. The projected outline diameter is about 20 mm. The suspension hole is biconically drilled and is about 3.5 mm in diameter.

The specimen from Lot 55, also recovered in 1975 (Fig. 12,i), is a rectangular fragment of a ribbed marine shell. Hester (1977) identified it as a **Dinocardium** fragment; Steele identified it as a **Laevicardium** fragment. Several of the edges have cut marks but are otherwise rough.

One Lot 56 fragment (Fig. 12,k) is a piece of a large **Laevicardium** shell. Most of the edges are irregularly broken, however, one edge is heavily smoothed and rounded. This edge is the outer shell edge but appears to have been used for some sort of scraping function.

Another Lot 56 fragment (Fig. 12,l) is a conch (**Busycon**) body whorl section. The tip is rounded and smoothed. It is faceted and polished by use.

The specimen (Fig. 12,i) from Lot 131 is a hinge section of a **Callista** that has been smoothed and polished by use.

HISTORIC ARTIFACTS

A number of historic artifacts were recovered from the upper excavation levels at 41 JW 8. Most of these artifacts represent the 20th-century ranching and farming occupation of the area. A few historic items may date to the mid-19th-century. All historic artifacts recovered from the site clearly postdate the prehistoric occupation and are considered to be of very minor importance.

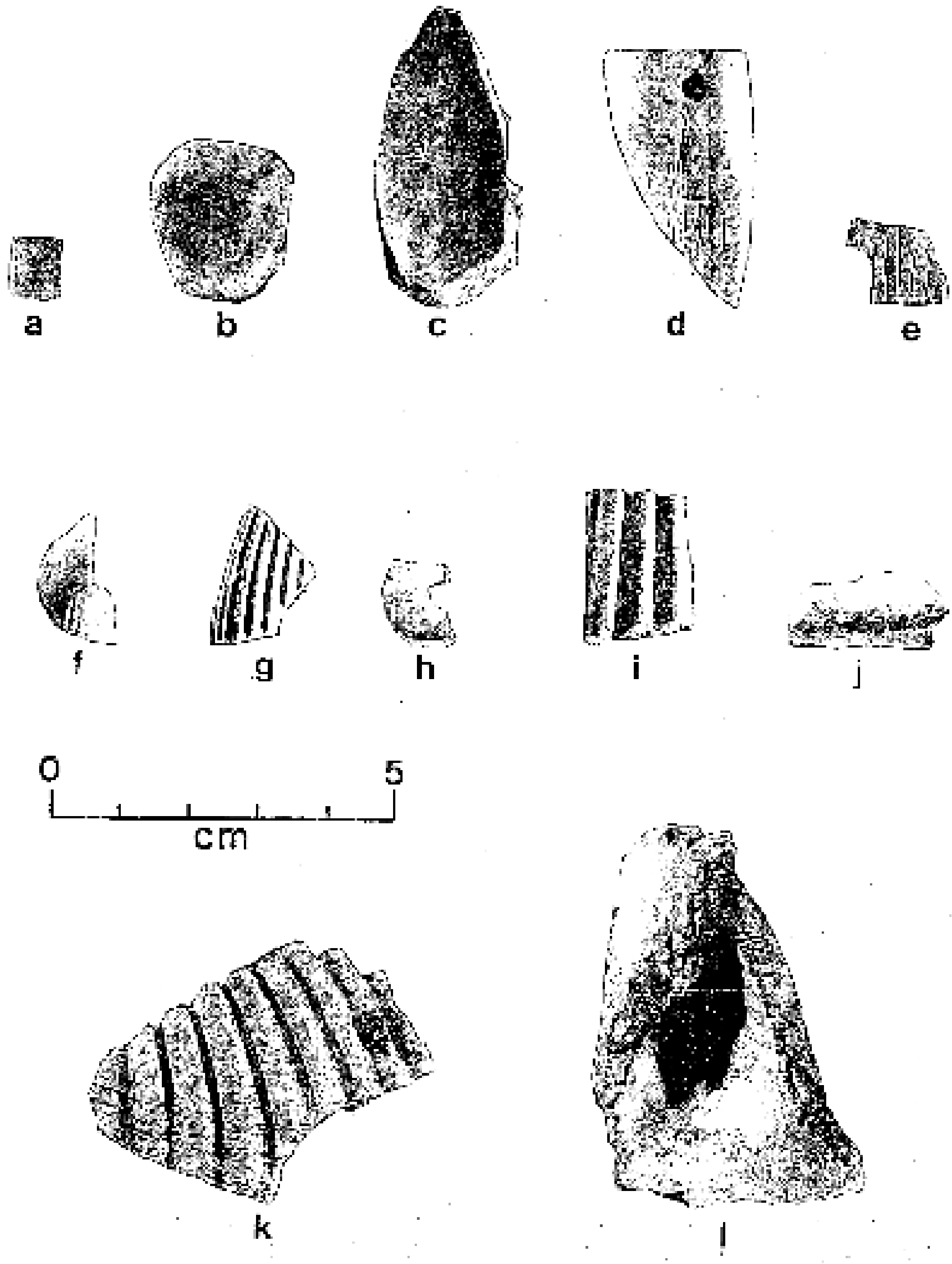

Figure 12. **Modified Shell Artifacts.** a-c, cut mussel shell; d, mussel shell pendant; e, incised mussel shell; f,g, marine shell fragments, h, marine shell bead; i-l, marine shell. Lot numbers: a, 295; b, 60; c, 522-2; d, 354-2; e, 343-4, f, 333; g, 56; h, 51; i, 55; j, 131; k, 56; l, 56.

TABLE 8. MARINE SHELL IDENTIFICATIONS

Lot Number	Taxon	Material Description
51 (1975)	Bivalvia	fragment, bead section
55 (1975)	**Laevicardium**	fragment with cut edge
56	**Laevicardium**	fragment with smoothed edge
56	**Busycon**	body whorl fragment, smoothed and polished
56	Bivalvia	fragment with cut edge
71	Bivalvia	2 fragments
61	**Callista**	2 hinge fragments
98	Bivalvia	fragment, weathered smooth edge
120	Bivalvia	fragment with cut edges
121	**Callista**	fragment with cut edge
131	Bivalvia	fragment with cut edges
131	**Callista**	hinge fragment, smoothed
176	Bivalvia	ribbed fragment
311	Bivalvia	fragment
333	Bivalvia	fragment
339	Bivalvia	fragment with cut edges
345	**Callista**	fragment with cut edge

Metal artifacts are the bulk of the historic materials. Twentieth-century metal items consist of plain wire fragments, barbed wire fragments, fence staples, wire nails, .22 caliber rimfire cartridge shells, sheet metal fragments, bottle caps, screws, an electric connector, and aluminum foil. The only metal item that may date to the 19th century is a hand-forged singletree center clip and hook. This device was commonly used in the 19th century to connect wagons to the horse's traces. It seems appropriate that this wagon part was recovered from the "Wagon Trail Area" (Lot 266).

A few 20th-century glass fragments were recovered. These consist of clear window pane fragments; clear and brown bottle fragments; and a small, white 4-hole button.

A bone button was also recovered. This artifact is 17 mm in diameter and is about 2 mm thick. The front face has a circular central recess 8 mm in diameter with five cylindrically drilled holes. Bone buttons in Texas generally predate the Civil War (Anne Fox, personal communication).

A small number of historic ceramics were also recovered from 41 JW 8. Four sherds of a crudely made stoneware were found. These range in thickness from 8 to 12 mm. The red exterior is poorly smoothed and partially covered with a light gray to black burnished slip. The core and interior surface are a uniform gray color. Based on the surface finish and curvature, these sherds probably represent fragments of a large water jug (Anne Fox, personal communication). Similar ceramics have been found in early historic contexts (mid

19th-century or earlier) in the Falcon Reservoir area (collection on file, CAR). Two small fragments of a lead-glazed earthenware were found. These represent Mexican-made ceramics dating to after 1850 (Anne Fox, personal communication). One small stoneware sherd with a burnished gray exterior was also recovered.

The singletree center clip and hook, bone button, and stoneware and earthenware ceramics probably represent a mid-19th-century occupation in the site area. These items can most likely be attributed to the initial construction of the nearby Amargosa Stage Stop which was built sometime prior to 1876.

VII. SPECIAL STUDIES

The analyses that were done of the 1981 materials are detailed in these special studies to provide critical data on many aspects of the prehistoric occupation such as subsistence, and information on the environmental conditions. A number of consultants studied aspects of the site for which they had particular expertise. Gentry Steele, a physical anthropologist and zooarchaeologist at Texas A&M University (TAMU), studied the faunal materials from the site. John Jones, a graduate student in paleobotany at TAMU, examined the charred botanical remains. Harold Murray, a malacologist at Trinity University, identified the freshwater mussel shells recovered from the site. Richard G. Holloway, a palynologist at TAMU, examined soil samples for pollen. Ralph Robinson, a graduate student in paleobotany at TAMU, studied phytoliths recovered from the site. The author interpreted the results of the radiocarbon assays done by several institutions. Additional studies were done by the author.

ANALYSIS OF VERTEBRATE FAUNAL REMAINS (D. Gentry Steele)

The faunal assemblage from the Hinojosa site (41 JW 8) represents a very significant south Texas vertebrate sample for several reasons. It is from a single component Late Prehistoric site occupied around 1250-1500 A.D., thus providing a faunal assemblage from a discrete period of time. The sample is one of the largest faunal assemblages examined from south Texas. Finally, the assemblage indicates that the bone is remarkably well preserved and in provenience so that there does not appear to have been a great amount of dispersal before deposition or dissolution of bone during the period of deposition.

SAMPLE

The site has been excavated twice. Faunal remains recovered during the first field season in 1975 were examined by Billy Davidson and reported by Hester (1977). The examined portion consisted of 7000 g of bone (number of bone fragments was not recorded). A sample of the faunal assemblage recovered during the second field season, 1981, was examined by the present author and consisted of 3041 identifiable fragments (the total weight of fragments was not recorded). The mean weight of a selected sample of bone fragments examined from the 1981 faunal assemblage was 0.15 g which is slightly smaller than the 0.37 g mean weight of bone fragments recovered from 41 LK 201, another south Texas site (Steele 1986). It should be noted that both of these means are based on material recovered from 1/4-inch screen and by hand picking of bones (see Steele and DeMarcay 1986 for significance of fine screening for faunal samples).

Subjectively, the bone assemblage from 41 JW 8 was composed predominately of highly comminuted bone, a significant portion of which was also burned. The great majority of breaks observed on the bone were spiral fractures which occurred while the bone was fresh and contained a high collagen content. Most of the few fractures which appeared to have occurred after the bone had dried and was friable, occurred quite recently as indicated by the lack of staining or patination of the fractured surfaces. A few of these fragments, however, evidenced fine line weather cracks which indicate that these bones at least had been exposed to dessication as well as freezing and thawing prior to burial. A microscopic examination of bone fragments indicated that they had been subjected to no appreciable chemical dissolution during their period of deposition. In these respects, the bone assemblage from 41 JW 8 compares favorably with the well-preserved bone assemblages from 41 LK 201 (Steele 1986), 41 MC 222 (Steele and Hunter 1986), and 41 MC 296 (Steele and Hunter 1986).

The following analysis is based upon an examination of all modified bone (Table 7); all bone from identified features (Table 10); all bone plotted on site maps (Table 11); and all bone from Units N104 E94, N104 E95, E104 E96, N105 E94, N105 E95, N105 E96, N108 E94, K108 E95, N109 E94, and E109 E95 (Table 12). The bone from these samples were recovered by hand sorting during the process of excavation and from sieving all matrix through 1/4-inch screens. Additional two-liter samples from each feature were screened through a U.S.A. standard testing sieve no. 35 with an opening size of 500 micrometers. Potentially identifiable bone (teeth, complete bones, and fragments with articular ends) were picked from this sample (see Section VII: Water Separation). These materials were added to the analysis.

DIETARY PATTERNS

Various reports based upon analyses of faunal remains recovered from south Texas sites have emphasized the diversity of the faunal assemblages (Hester and Hill 1975; Hester **et al.** 1975; Hester 1975, 1977; Steele and Mokry 1985; Steele 1986; Steele and Hunter 1986), and the assemblage from 41 JW 8 corroborates these previous assessments. Davidson identified 30 taxa recovered during the 1975 field season, and the remains of 33 taxa recovered during the 1982 field season (Table 9). The combined sample consists of 45 identified taxa containing at least 31 genera.

Upon more careful examination, the sample contains the remains of fishes, birds, amphibians, reptiles, and mammals. Of these classes, mammals are by far the most commonly represented. Part of the reason for the greater representation of the mammals is that the bones of the other classes are smaller and more fragile, therefore more subject to destruction and loss. Even when this bias against the recovery of the smaller vertebrates is taken into account the mammals still represent by far the largest number of species identified, and the class whose skeletal elements are most commonly recovered. This preponderance of mammalian remains in south Texas sites has been noted previously (Steele 1986; Steele and Hunter 1986), and it probably reflects the fact that mammals are the most consistently available and easily harvestable vertebrates in the region. It is also apparent that when the amount of meat contributed by each class of vertebrates is considered, the mammals again are the most important. This is simply because most species of mammals are considerably larger than other vertebrates.

Upon closer examination of the mammals (see Table 9), 19 taxa were recovered, including opossums, artiodactyls, lagomorphs, carnivores, insectivores, and rodents. Of these, the remains of artiodactyls and lagomorphs are most

TABLE 9. SYSTEMATIC LIST OF THE IDENTIFIED VERTEBRATE REMAINS RECOVERED FROM 41 JW 8 DURING THE 1975 AND 1981/1982 FIELD SEASONS

Vertebrate Remains*	Field Season 1975	Field Season 1981/1982
Phylum Chordata		
Subphylum Vertebrata		
Class indeterminate (vertebrates)		x
Class Osteichthyes		
Order indeterminate (fishes)	x	x
Order Cypriniformes		
Family Ictaluridae		
Genus indeterminate (catfishes)	x	x
Order Perciformes		
Family Sciaenidae		
Genus **Aplodinotus**		
A. grunniens (freshwater drum)		x
Class Aves		
Order indeterminate (birds)	x	x
Order Anseriformes		
Family Anatidae		
Genus indeterminate (ducks, geese, and swans)		x
Order Galliformes		
Family Meleagridae		
Genus **Meleagris**		
M. gallopavo (wild turkey)	x	x
Order Falconiformes		
Family indeterminate (birds of prey)	x	x
Order Ciconiiformes		
Family Ardeidae		
Genus indeterminate (herons)	x	
Order Strigiformes		
Family Cuculidae		
Genus **Geococcyx**		
G. californianus (greater roadrunner)	x	
Class Amphibia		
Order Anura		
Family Ranidae		
Genus **Rana**		
Species indeterminate (frogs)	x	

TABLE 9. (continued)

Class Reptilia		
Order Squamata		
Suborder Serpentes		
Family indeterminate (snakes)		x
Family Colubridae		
Genus **Coluber**		
Species indeterminate (racer)	x	
Genus **Elaphe**		
Species indeterminate (rat snakes)	x	
Genus **Natrix**		
Species indeterminate (water snakes)	x	
Family Crotalidae		
Genus indeterminate (rattlesnakes)		x
Genus **Crotalus**		
Species indeterminate (rattlesnakes)	x	
Order Testudines		
Family indeterminate (turtles)	x	x
Family Emydidae		
Genus **Terrapene**		
cf. **T. ornata** (western box turtle)	x	x
Genus **Chrysemys**		
Species indeterminate (water turtle)		x
Genus **Pseudemys**		
Species indeterminate (sliders)	x	
Family Testudinidae		
Genus **Gopherus**		
cf. **G. berlandieri** (Texas tortoise)		x
Class Mammalia		
Order indeterminate (mammals)		x
Order Marsupialia		
Family Didelphidae		
Genus **Didelphis**		
D. virginiana (Virginia opossum)	x	x
Order Artiodactyla		
Family indeterminate (artiodactyls)	x	x
Family Bovidae		
Genus **Bison**		
B. bison (bison)	x	x
Family Antilocapridae		
Genus **Antilocapra**		
A. americana (pronghorn)	x	x
Family Cervidae		
Genus **Odocoileus**		
O. virginianus (white-tailed deer)	x	x
Family Tayassuidae		
Genus **Dicotyles**		
D. tajacu (collared peccary)		x

TABLE 9. (continued)

Order Carnivora		
Family Canidae		
Genus **Canis**		
Species indeterminate (dogs, wolves, coyotes)		x
C. latrans (coyotes)	x	x
C. lupus (wolves)	x	
Family Mustelidae		
Genus **Mephitis**		
Species indeterminate (striped skunk)	x	
Family Procyonidae		
Genus **Procyon**		
P. lotor (raccoon)	x	
Order Insectivora		
Family Soricidae		
Genus **Cryptotis**		
C. parva (least shrew)		x
Family Talpidae		
Genus **Scalopus**		
S. aquaticus (eastern mole)		x
Order Lagomorpha		
Family Leporidae		
Genus **Lepus**		
cf. **L. californicus** (black-tailed jackrabbit)	x	x
Genus **Sylvilagus**		
cf. **S. auduboni**i (desert cottontail rabbit)	x	x
Order Rodentia		
Family Cricetidae		
Genus indeterminate (rats, mice, and voles)		x
Genus **Neotoma**		
cf. **N. micropus** (Mexican wood rat)	x	x
Genus **Sigmodon**		
S. hispidus (hispid cotton rat)	x	x
Genus **Microtus**		
cf. **M. pinetorum** (pine vole)		x
Genus **Ondatra**		
O. zibethicus (muskrat)		x
Family Geomyidae		
Genus **Geomys**		
Species indeterminate (pocket gopher)	x	x
Family Sciuridae		
Genus **Spermophilus**		
Species indeterminate (ground squirrels)	x	

*The vernacular name is listed in parentheses beside the identified taxon.

TABLE 10. TABULATION OF FEATURE BONES

Feature Number	Lot Number Item Number	Taxon	Material	Comments
F.2A	156-1	**Odocoileus**	ulna fragments	
	156-2	Mammalia	23 fragments	many exhibit spiral fractures
	156-3	Aves	long bone fragments	
	156-4	Testudines	scapula fragment	
	182-1,2,3	**Bison**	3 humerus segments	based on size, two individuals are represented
	182-4	**Bison**	carpal	
F.2B	165-1	Mammalia	19 fragments	
	183-1	**Bison**	left femur segment	spiral fractures present
F.3*	184-1	**Meleagris**	left femur	
	184-2	**Odocoileus**	phalange	
	184-3	**Neotoma**	left ulna, right mandible	
	184-4	**Odocoileus**	left tibia segment	
	184-5,6,10,11,12	**Gopherus**	5 carapace and plastron fragments	
	184-5	**Lepus**	left femur	spiral fracture
	184-5,6,8,10,12	Mammalia	5 fragments	some exhibit spiral fractures
	184-7	**Odocoileus**	right mandible	
	184-8	Aves	femur fragment	small bird
	184-9	**Bison**	right humerus segment	
	184-12	**Scalopus**	humerus, 2 vertebrae, 2 phalanges, occipital	possibly represents an intrusive individual
F.5	304-1	**Canis**	right and left upper molars	
	304-2	**Sylvilagus**	left zygomatica	
	304-3	Mammalia	fragment	
	304-4	Osteichthyes	vertebra	small species

TABLE 10. (continued)

Feature Number	Lot Number Item Number	Taxon	Material	Comments
F.6§	397-11,16	Mammalia	3 fragments	butcher marks and spiral fractures
	397-13	**Microtus**	right mandible	
	397-14	**Terrapene**	plastron fragment	
	397-15	**Odocoileus**	2 vertebrae	subadult
	397-17	**Odocoileus**	left ulna	subadult
	unplotted	**Gopherus**	plastron fragment	
F.7††	353-1	**Odocoileus**	phalange	
	353-4	Ansariformes	left humerus	goose or swan sized shaft removed by cutting
	353-6	**Sylvilagus**	left maxilla	cf. **S. auduboni**
	353-7	**Odocoileus**	metapodial epiphysis	subadult
	354-1,7	Mammalia	4 fragments	all spirally fractured with butcher marks
	354-5	**Lepus**	left scapula	
	354-6	**Odocoileus**	right talus	weathered
	354-7	Ictaluridae	vertebra	
	354-7	Serpentes	vertebra	
	454-1	**Bison**	left tibia segment	
	454-2,4,5	Mammalia	11 fragments	some bison sized
	454-3	**Antilocapra**	lumbar vertebra	adult
F.8†	442-1	Mammalia	vertebrae fragments	adult
	442-2	**Odocoileus**	phalange	adult
	442-3	**Odocoileus**	metapodial	probably
	442-4	**Odocoileus**	phalange	all one
	442-5	**Odocoileus**	vertebra	individual
	463-3	**Odocoileus**	caudal vertebra	adult

TABLE 10. (continued)

Feature Number	Lot Number Item Number	Taxon	Material	Comments
F.8[+]	483-1	**Odocoileus**	calcaneus	
	485-1,3,4	Odocoileus	3 metapodials	adult, 1 is spiral fractured
	485-2	Mammalia	2 vertebrae fragments	
	525-1,21	Mammalia	26 fragments	large mammal
	525-2	Mammalia	rib fragments	large mammal
	525-3	**Terrapene**	femur, carapace	cf. T. **ornata** fragments
	525-4	**Odocoileus**	calcaneus fragment	
	525-5	**Odocoileus**	radius fragment	
	525-6	**Odocoileus**	maxilla fragment	
	525-7	**Odocoileus**	molar fragment	
	525-8	Mammalia	fragment	large mammal
	525-9	**Terrapene**	radius, humerus	cf. T. ornata
	525-10	**Odocoileus**	radius fragment	
	525-11	**Odocoileus**	radius fragment	
	525-12	**Odocoileus**	metacarpal	
	525-13	**Odocoileus**	rib fragment	
	525-14	**Odocoileus**	scapula fragment	
	525-15	**Odocoileus**	rib fragment	
	525-17	**Lepus**	2 vertebrae	
	525-18	**Odocoileus**	mandible fragment	
	525-19	**Odocoileus**	phalange	
	525-20	**Terrapene**	2 carapace scutes	cf. **T. ornata**
	525-22	Odocoileus	radius fragments	
	526-1	Mammalia	8 fragments	large mammal
	526-2	**Odocoileus**	metacarpal	
	526-3,4	**Odocoileus**	2 lumbar vertebrae	very large individual
F.9[*]	472-2,4,6	Mammalia	90 fragments	variety of species represented
	472-10,14	Mammalia	fragments	variety of species represented
	472-16,17,20	Mammalia	fragments	variety of species represented

TABLE 10. (continued)

Feature Number	Lot Number Item Number	Taxon	Material	Comments
F.9π	472-3,9,11	**Gopherus**	15 carapace and plastron fragments	
	472-5	**Dicotyles**	mandibular fragment	
	472-8	**Neotoma**	left humerus	cf. **N. micropus**
	472-12	**Bison**	left ulna fragment	spirally fractured
	472-13	**Bison**	radius fragment	with butcher marks
	472-18	**Testudines**	carapace fragment	
	unplotted	**Sigmodon**	right innominate	
F.10	265-1,3,6	Mammalia	24 fragments	bison-sized mammal bones spirally fractured
	265-2	**Bison**	left femur segment	subadult
	265-4	**Bison**	metapodial segment	subadult
	265-5	**Didelphis**	left innominate	
	292 unplotted			
		Bison	tibia fragment, right humerus fragment, and 17 other fragments	subadult some spiral fractures
		Odocoileus	left humerus, vertebra, 2 phalanges	spiral fractures

Note: Many of the Lot 525 deer bones had spiral fractures and butcher marks.

* Plotted items for F.3 are shown in Figure 18.
π Plotted items for F.9 are shown in Figure 19.
§ Plotted items for F.6 are shown in Figure 21.
\+ Plotted items for F.8 are shown in Figure 22.
++Plotted items for F.7 are shown in Figure 23.

TABLE 11. TABULATION OF THE NONFEATURE PLOTTED BONES, WTA UNITS

Unit	Lot Number Plot Number	Taxon	Material	Comments
N105 E96	377-1	**Odocoileus**	left radius	adult
N105 E96	515-1	cf. **Odocoileus**	phalange	
N105 E97	293-1,2	**Odocoflous**	2 lumbar vertebrae	adult
N105 E97	293-3,4	**Bison**	2 long bone fragments	burned and weathered
N105 E97	293-5	**Moleagris**	tibia segment	spirally fractured
N105 E97	293-6	**Canis**	left tibia	as large as **C. latrans**
N105 E97	293-7,8	**Odocoileus**	vertebrae	
N105 E97	315-1	**Didelphis**	left mandible	old adult
N105 E97	315-1,3,4	**Odocoileus**	3 vertebrae	
N105 E97	315-2,5	**Bison**	2 femur segments	subadult
N106 E94	379-3	**Lepus**	right femur	adult
N106 E94	379-4,5	Tastudines	2 carapace scutes	
N106 E94	379-8	**Odocoileus**	petrosal	adult
N106 E96	523-1	**Odocoileus**	phalange	
N106 E94	523-2	**Bison**	long bone fragment	spirally fractured
N106 E95	384-1	**Odocoileus**	right upper premolar	old adult
N106 E95	384-2,3	**Lepus**	left maxilla fragments	
N106 E95	384-4	Artiodactyla	proximal and distal phalanges	adult
N106 E95	384-6	**Odocoileus**	right mandible segment	old adult
N106 E95	384-7	Canidae	upper canine	
N106 E95	385-1	**Odocoileus**	left calcaneus	adult, weathered
N107 E94	380-1	**Odocoileus**	phalange	adult
N107 E94	380-1	**Sylvilagus**	left mandible	cf. **S. auduboni**
N107 E95	382-1	**Odocoileus**	ulna	adult
N107 E95	382-2		upper premolar	
N107 E95	382-3	**Sylvilagus**	right mandible	cf. **S. auduboni**
N107 E95	382-4	**Canis**	right mandible	old adult

TABLE 11. (continued)

Unit	Lot Number Plot Number	Taxon	Material	Comments
N107 E95	383-1	**Odocoileus**	atlas	adult
N107 E96	516-5	**Bison**	radius segment	subadult
N107 E97	281-4	**Gopherus**	carapace scute	
N107 E97	281-5	**Odocoileus**	upper premolar	old adult
N107 E97	281-6	**Odocoileus**	molar	old adult
N107 E97	281-9,11	Artiodactyla	2 phalanges	
N107 E97	294-1	**Odocoileus**	humerus	adult
N107 E97	294-2		tibia segment	adult, spirally fractured
N107 E97	294-3	**Bison**	vertebra	adult
N107 E97	323-1	**Bison**	vertebrae, 5 fragments	some spirally fractured
N107 E97	323-2	Testudines	carapace scute	
N107 E98	185-1	**Bison**	talus	adult
N108 E96	393-1	cf. Chrysemys	plastron scute	
N108 E96	393-2	**Canis**	right maxilla	old adult
N108 E96	521-1	**Odocoileus**	left talus	weathered
N108 E96	521-2	Sciuridae	right femur segment	adult
N108 E96	521-2	Mammalia	metatarsal	
N108 E97	295-1	**Lepus**	right innominate adult	
N108 E97	295-2	Mammalia	tarsal element	
N108 E97	295-3	**Odocoileus**	right ulna	adult
N108 E97	329-1	Mammalia	fragment	burned
N108 E97	329-2	Testudines	plastron scute	
N108 E97	329-3	**Geomys**	left femur	
N108 E97	329-3,4	**Gopherus**	plastron and	
N108 E97	329-7,8		carapace scutes	

TABLE 11. (continued)

Unit	Lot Number Plot Number	Taxon	Material	Comments
N108 E98	303-1	**Antilocapra**	lower molar	adult
N108 E98	303-2	Mammalia	28 fragments	
N108 E100	429-1	**Odocoileus**	ulna	adult
N108 E101	434-1	**Antilocapra**	right mandible	old adult
N108 E101	435-1	Artiodactyla	vertebra	adult
N108.5 E103	477-1	**Chrysemys**	innominate	large specimen
N108.5 E103	477-2	**Odocoileus**	petrosal	
N109 E96	396-1	Canidae	left radius	adult
N109 E96	396-2	**Lepus**	left mandible	
N109 E97	302-1	**Antilocapra**	right humerus	adult, spirally fractured
N109 E102	478-1	**Cryptotis**	left mandible	
N109 E102	478-2	**Sylvilagus**	left talus	cf. *S. audubonii*
N109 E102	478-3,4	Mammalia	20 fragments	small and medium-sized animals
N111 E100	463-1	**Odocoileus**	ulna	adult
N111 E100	463-2		radius	adult
N111 E101	483-1	**Odocoileus**	right calcaneus	weathered

TABLE 12. TABULATION OF THE VERTEBRATE REMAINS RECOVERED FROM SELECTED WTA UNITS

Provenience	Lot Number	Taxon	Material	Comments
N104 E94 L.1	310	Mammalia	49 fragments	16 burned
		Serpentes	vertebra	
N104 E94 L.2	369	**Odocoileus**	three tooth fragments, talus fragment	subadult
		Lepus	left ulna, cranial fragments	
		Sylvilagus	right mandible, calcaneus	cf. S. **audubonii**
		Neotoma	right humerus	cf. N. **micropus**
		Serpentes	vertebra	
		Testudines	3 carapace fragments	
		Terrapene	right humerus, scutes, innominate	
N104 E94 L.3	370	Vertebrata	8 fragments	
		Osteichthyes	vertebra	
		Serpentes	9 vertebrae	
		Terrapene	7 carapace and plastron fragments	
		Mammalia	194 fragments	
		Odocoileus	5 teeth, metapodials, phalanges, vertebrae fragments	some spiral fractures
		Canis	left femur	cf. C. **familiaris** based on size
		Sylvilagus	molar, vertebra	
		Neotoma	right humerus	
N104 E94 L.5	456	**Antilocapra**	left innominate	spiral fractures
N104 E95 L.1	313	Vertebrata	112 fragments	36 burned
		Testudines	plastron fragment	
		Odocoileus	molar fragment	
N104 E95 L.2	368	Crotalidae	2 vertebrae	
		Terrapene	6 carapace, plastron scutes	cf. T. ornata
		Odocoileus	molar fragment	
		Lepus	axis vertebra	
		Sylvilagus	left calcaneus, humerus	cf. S. **audubonii**
		Sigmodon	right mandible	
		Scalopus	right humerus	
N104 E95 L.3	375	Odocoileus	phalange	
N104 E96 L.1	314	Vertebrata	165 fragments	55 burned and many spirally fractured
		Ictaluridae	vertebra	
		Terrapene	carapace scute	
		Sylvilagus	right femur	

TABLE 12. (continued)

Provenience	Lot Number	Taxon	Material	Comments
N104 E96 L.2	514	**Chrysemys**	vertebra	
		Mammalia	2 fragments	
		Odocoileus	metacarpal	spirally fractured
N104 E96 L.3	376	**Bison**	left femur	burned
		Odocoileus	left femur, vertebra	very large specimen
		Canis	lumbar vertebra	
		Didelphis	sacrum, vertebra	
N104 E96 L.4	413	Mammalia	2 fragments	bison size, spirally fractured, weathered
		Didelphis	vertebra	
N105 E94 L.1	311	Mammalia	66 fragments	22 burned
N105 E94 L.2	371	**Terrapene**	carapace fragment	
		Mammalia	2 fragments	
		Odocoileus	phalanges	
N105 E94 L.3	372	**Chrysemys**	carapace scute	
		Mammalia	fragment	spiral fracture
N105 E95 L.1	312	Testudines	3 carapace fragments	
		Vertebrata	196 fragments	51 burned
N105 E95 L.2	373	**Terrapene**	carapace scute	
		Gopherus	plastron scute	
		Odocoileus	right mandible	old adult
		Lepus	left mandible	
N105 E96 L.1	316	Vertebrata	211 fragments	many spirally fractured
		Testudines	humerus	
		Terrapene	3 carapace scutes	
		Odocoileus	3 fragments including petrosal, premolar, phalange	
N105 E98 L.3	352	Mammalia	fragment	bison size, spiral fracture
		Bison	vertebrae fragments	
		Odocoileus	left innominate	
		Canidae	vertebra	
N108 E94 L.1	324	Vertebrata	170 fragments	60 burned
		Neotoma	right femur	
N108 E94 L.2	517	**Aplodinotus**	vertebra	
		Serpentes	3 vertebrae	
		Testudines	3 plastron fragments	
		Terrapene	2 carapace scutes	

TABLE 12. (continued)

Provenience	Lot Number	Taxon	Material	Comments
N108 E94 L.2	517	Odocoileus	upper and lower molars	
		Lepus	right talus, left tibia, right radius	
		Sylvilagus	right calcaneus, left ulna, vertebra	
N108 E94 L.3	389	Vertebrata	82 fragments	31 burned, many spirally fractured
		Serpentes	4 vertebrae	
		Testudines	right femur	
		Aves	metatarsal	
		Canis	upper third molar	
		Sylvilagus	right humerus, femur segment	femur from subadult
		Sigmodon	right innominate	
		Cricetidae	right femur	cf. Microtinae
N108 E94 L.4	424	Vertebrata	4 fragments	
		Serpentes	vertebra	
		Testudines	1 carapace scute	
		Sylvilagus	right maxilla	cf. C. auduboni**i**
N108 E95 L.1	327	Vertebrata	300 fragments	110 burned, many spirally fractured
		Scalopus	right humerus	
N108 E95 L.2	520	Vertebrata	111 fragments	18 burned, many spirally fractured
		Osteichthyes	cranial fragment	
		Serpentes	3 vertebrae	
		Testudines	4 carapace scutes	
		Gopherus	femur	
		Bison	right lower molar	
		Odocoileus	phalange	
		Canis	upper canine	
		Lepus	left maxilla	
		Sylvilagus	right innominate	
N108 E95 L.3	392	Vertebrata	56 fragments	19 burned, some spirally fractured
		Terrapene	3 carapace fragments	
		Sylvilagus	metatarsal	
		Sigmodon	right mandible	
N108 E95 L.4	427	Vertebrata	5 fragments	
		Testudines	femur	
		Sylvilagus	premaxilla	
N109 E94 L.1	325	Vertebrata	98 fragments	40 burned, many spirally fractured
		Sylvilagus	right humerus	

TABLE 12. (continued)

Provenience	Lot Number	Taxon	Material	Comments
N109 E94 L.2	518	Vertebrata	215 fragments	67 burned, many spirally fractured
		Serpentes	4 vertebrae	
		Testudines	humerus	
		Terrapene	carapace fragment	
		Gopherus	carapace and plastron scutes	
		Odocoileus	molar	
		Lepus	left calcaneus, right humerus	
		Sylvilagus	left scapula, right humerus, left innominate	
N109 E94 L.3	390	Vertebrata	78 fragments	11 burned
		Testudines	humerus	
		Terrapene	13 carapace and plastron scutes	
		Mammalia	3 fragments	
		Odocoileus	phalange	
		Lepus	left ulna	
		Sylvilagus	right humerus	
		Cricetidae	right femur	cf. Microtinae
N109 E94 L.4	425	Vertebrata	10 fragments	7 burned
N109 E95 L.1	326	**Terrapene**	carapace scute	
		Sylvilagus	right maxilla	
N109 E95 L.2	519	Vertebrata	185 fragments	68 burned, many spirally fractured
		Osteichthyes	cranial fragment	
		Serpentes	3 vertebrae	
		Terrapene	6 carapace and plastron scutes	
		Falconiformes	phalange	
		Mammalia	2 fragments	
		Odocoileus	6 molar fragments	
		Lepus	left maxilla, calcaneus	
		Sylvilagus	right humerus, right radius, left femur, left mandible	
N109 E95 L.3	391	**Odocoileus**	tibia segment, phalange	tibia from subadult
N109 E95 L.4	426	Vertebrata	10 fragments	6 burned
		Ondatra	right femur	

While this may explain the greater faunal diversity during the Pleistocene, it may not explain the greater diversity observed at 41 JW 8, and the sites occupied within the Choke Canyon basin during the Holocene. The widely accepted model for climatic changes during the Holocene suggests that the epoch has been characterized by increasing seasonality and increasing dessication. If this model is correct, the greater diversity seen within the last few thousand years may reflect the presence of a greater abundance of wetlands, and poorly drained grasslands. These habitats could have occurred in the region if more water was available, even though the seasonality and ambient temperatures remained as they are today. The presence of the extant western and Mexican derived fauna in prehistoric sites tends to support this view.

DESCRIPTION OF TAXA

Presented is the description of the taxa recovered from 41 JW 8 during the 1981 field season. Information presented for each taxon includes the provenience of the material and what was recovered. Notes about the taxa which are pertinent to their classification, interpreting human behavior from the remains, or information pertinent to environmental reconstruction are also presented. Classification of the fishes follows Blair et al. (1968). Classification of the amphibians and reptiles follows Conant (1975). Classification of the birds follows Robbins, Brunn, and Zim (1966). Classification of the mammals follows Davis (1974), Hall (1981), Schmidly (1977, 1983), and Steele (1986). Where these authors differ this report follows Steele's assessment.*

PHYLUM CHORDATA

SUBPHYLUM VERTEBRATA

CLASS indeterminate (vertebrates)

Referred Material: Material consists of fragments of unidentified bone.

Remarks: Material assigned to this taxon consists predominately of undiagnostic slivers of bone. While most of this material is probably from mammals, the assignment to that class was not unequivocal. Much of the material exhibited spiral fractures, suggesting that the bone was broken while fresh, and much of the material was burned or scarred by carnivores and rodents.

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*Editor's Note: Because of the nature of this section, the headings will be presented in a different format than the rest of the report.

CLASS OSTEICHTHYES

ORDER indeterminate (fishes)

Referred Material: Material is one cranial fragment and one vertebra.

Remarks: These fragments represent two different specimens judging from the size of the remains, and quite possibly two different species.

ORDER CYPRINIFORMES

FAMILY ICTALURIDAE

GENUS indeterminate (catfishes)

Referred Material: The material is one vertebra.

Remarks: Specimen appears to have been from a small fish.

ORDER PERCIFORMES

FAMILY SCIAENIDAE

Aplodinotus grunniens (freshwater crum)

Referred Material: The material is one vertebra.

Remarks: Specimen appears to have been from a moderate-sized fish.

CLASS AVES

ORDER indeterminate (birds)

Referred Material: The specimen is one metatarsal.

Remarks: The specimen is from a bird the approximate size of a chicken.

ORDER ANSERIFORMES

FAMILY ANATIDAE

GENUS indeterminate (ducks, geese, and swans)

Referred Material: The specimen is a left humerus.

Remarks: The specimen was the size of a goose or swan. The shaft had been cut from the proximal end which was recovered.

ORDER GALLIFORMES

FAMILY MELEAGRIDAE

Meleagris gallopavo (wild turkey)

Referred Material: Material consists of one complete left femur and one proximal tibia segment.

Remarks: Positive identification was possible because of the completeness of the specimen. The tibia segment was spirally fractured.

ORDER FALCONIFORMES

FAMILY indeterminate (birds of prey)

Referred Material: The specimen is one complete distal phalange.

Remarks: The specimen was from an adult bird.

CLASS REPTILIA

ORDER SQUAMATA

SUBORDER SERPENTES

FAMILY indeterminate (snakes)

Referred Material: The material consists of isolated vertebrae from several localities within the site.

Remarks: Although specific taxa could not be identified from the vertebra, it appeared that several different specimens were represented, and possibly more than one taxon.

FAMILY CROTALIDAE

GENUS indeterminate (rattlesnakes)

Referred Material: The specimen is one vertebra.

Remarks: The vertebra appears to have been from a moderate-sized rattlesnake.

ORDER TESTUDINES

FAMILY indeterminate (turtles)

Referred Material: The material consists of carapace and plastron fragments.

Remarks: Most of the material probably represents the taxa identified below. There were, however, some fragments which could not be assigned to the following taxa.

FAMILY EMYDIDAE

Terrapene cf. **T. ornata** (western box turtle)

Referred Material: The material consists of carapace and plastron fragments from several localities within the site.

Remarks: Although not all material assignable to the genus could be assigned to the species **T. ornata**, all material which could be classified at the species level was **T. ornata**. **Terrapene ornata** is the species inhabiting the region today.

Chrysemys

SPECIES indeterminate (water turtle)

Referred Material: The specimen is one plastron scute.

Remarks: This is the only specimen representative of a water dwelling turtle recovered from the site.

FAMILY TESTUDINIDAE

Gopherus cf. **G. berlandieri** (Texas tortoise)

Referred Material: The material consists of carapace and plastron fragments.

Remarks: This taxon was the second most commonly recovered turtle from the site. Because of the incomplete and fragmentary nature of the material it could be positively assigned only to the level of genus. The material does, however, compare favorably with **G. berlandieri**, the species which inhabits the region today.

CLASS MAMMALIA

ORDER indeterminate (mammals)

Referred Material: The material is predominately postcranial fragments scattered throughout the site.

Remarks: Most of this material, judging from the size and thickness of the bone fragments, represents comminuted artiodactyl remains; however, because of the comminuted nature of the material no positive identification could be made. It should also be noted that a great proportion of this material was spirally fractured and burned. A smaller proportion of the material also evidenced gnawing scars from rodents and carnivores, and weathering of the cortical surface.

ORDER MARSUPIALIA

FAMILY DIDELPHIDAE

Didelphis virginiana (Virginia opossum)

Referred Material: The material consists of a left mandible, one sacrum, and one vertebra.

Remarks: Although opossums are relatively easy to capture as they forage at night, remains of the species occur relatively infrequently in faunal assemblages in south Texas (see Steele 1986; Steele and Hunter 1986). This low density in the assemblages may indicate a low incidence of nocturnal hunting by the humans or a lower density of the opossums than exists today.

ORDER ARTIODACTYLA

FAMILY indeterminate (artiodactyls)

Referred Material: The material consists of postcranial fragments recovered from areas throughout the site.

Remarks: Most of the material was either deer or pronghorn, but could not be positively identified as one or the other. The other remains of artiodactyls recovered from the site, bison and peccary, could usually be assigned to species.

FAMILY BOVIDAE

Bison bison (bison)

Referred Material: The material consists of dental and postcranial fragments recovered throughout the site.

Remarks: Bison remains have been found in other Late Prehistoric south Texas sites so their occurrence here is not unexpected (Hester and Hill 1972, 1975; Hester 1975; Hester et al. 1975; Steele and Mokry 1985; Steele 1986; Steele and Hunter 1986). All of the bison remains show spiral fracturing and some show charring. It is also apparent from an examination of the remains that more than one adult is represented in the faunal assemblage, at least one subadult and at least two adults. From one feature (2A) three humerus segments were found, and based upon the size differences of the fragments two individuals were represented.

FAMILY ANTILOCAPRIDAE

Antilocapra americana (pronghorn)

Referred Material: The material consists of postcranial and cranial remains from several areas within the site.

Remarks: Pronghorn remains have been reported previously from this site (Hester 1977) and from other sites in the region (Hester and Hill 1972, 1975; Hester 1975; Hester **et al.** 1975; Steele and Mokry 1985; Steele 1986; Steele and Hunter 1986). In addition to the material positively identified as pronghorn there is also the possibility that additional material identified as artiodactyl also represents this species. The remains, however, do not appear to be as plentiful as those of deer.

FAMILY CERVIDAE

Odocoileus virginianus (white-tailed deer)

Referred Material: The material consists of cranial and postcranial remains recovered from all areas of the site.

Remarks: White-tailed deer remains were the most commonly identified elements found at 41 JW 8, and on this basis it is reasonable to infer that the species was a major dietary element for the inhabitants. Although there was a wide age range represented in the assemblage, subadult to old adult, there were no remains of foetal deer or deer less than six months old. Since no cranial elements from the frontal region were found it could not be determined if any of the specimens were taken while they were in antler either. Therefore, the deer sample cannot substantiate a spring or fall occupation of the site. One additional comment about the species should be made. Deer from south Texas are recognized as some of the largest extant white-tailed deer, and some of the specimens recovered indicated that exceptionally large deer were in the region during Late Prehistoric times as well.

FAMILY TAYASSUIDAE

Dicotyles tajacu (collared peccary)

Referred Material: The material is a mandibular fragment from Feature 9.

Remarks: Previously the collared peccary and the armadillo have been considered historically recent intruders into south Texas (Hester 1977, 1980a). Recently, however, with larger faunal assemblages undergoing scrutiny, remains of the collared peccary have been recovered **in situ** from Late Prehistoric components at this site and 41 LK 201 (Steele 1986); and from surface collections at Late Prehistoric sites in Nueces County (Steele and Mokry 1985), Kleberg County (Smith 1984a), and McMullen County (Steele and Hunter 1986). The possible presence of peccary from Late Archaic levels has also been reported by Steele (1986) from 41 LK 201.

Of the four artiodactyls represented in the faunal assemblage at 41 JW 8, the collared peccary is represented by the fewest remains. Since relatively few peccary remains have been recovered at other sites, their presence raises a series of questions. Are the identifications positive? If they are positive, could they represent intrusive elements? Or, does the low incidence of peccary remains reflect their minimal utilization or availability. The material reported from Nueces County, Live Oak County, McMullen County, and this site were all examined by the author, and the material compared favorably with positively identified peccary remains housed in the comparative faunal collections at Texas A&M University. Since positive identification of at least some of the material seems assured, that raises the question of the association of the peccary remains with Late Prehistoric materials at 41 JW 8 and the other sites. Since no other evidence of mixing is indicated in Feature 9 from this site, the association at 41 JW 8 seems valid. The material recovered from the Late Prehistoric levels at 41 LK 201 consisted of a left upper first incisor, a humerus fragment, and a left calcaneus, and all were recovered from three different locations within the site. Again, since no inordinate amount of mixing of remains was reported at this site, these associations also seem valid. The surface finds from Nueces, McMullen, and Kleberg Counties could conceivably have been mixed with later material, but Steele and Mokry (1985) report no historical material from 41 NU 102 and 41 NU 103, the two sites from which the peccary material was recovered. It appears then that at least some of these peccary remains, if not all of them, are validly associated with the Late Prehistoric (and possibly the Late Archaic as well). Why the hunters and gatherers were harvesting so few peccary is more difficult to assess. At the present time there appears to be no way to determine whether peccary remains are scarce because they were scarce in the area, or whether they were not favored as game by the human inhabitants. Considering the catholic diet of the inhabitants one would predict that the former reason is the more probable one.

ORDER CARNIVORA

FAMILY CANIDAE

Canis

SPECIES indeterminate (dogs, wolves, and coyotes)

Referred Material: The material consists of cranial and postcranial remains from various areas within the site.

Remarks: Previous faunal analysis of the site identified both coyote and the gray wolf within the bone assemblage. The material recovered during the second period of excavation, and reported here, was too incomplete to attain positive species identification. On the basis of the size range of the material, however, it appears that both the coyote and the domesticated dog are represented in the assemblage. Based upon dental remains, adult and old adult specimens were represented in the assemblage. None of the canid material showed evidence of spiral fractures, charring, or gnawing damage.

The material suggestive of dog is smaller than coyote skeletal material, but significantly larger than the gray or red fox skeletal material. The problem one encounters in making positive identification of domestic dog remains is that few, if any, discrete traits are distinctive of the domestic dog, and its size overlaps the foxes and the coyotes. Given these problems, positive identification requires a well-preserved skeleton or some cultural associations that suggest the remains are those of a dog. Remains of dog have also been reported from 41 NU 11 (Hester 1975), and Steele (1986) reported a tibia of a canid which was smaller than a coyote. He noted, however, that the evidence was too tenuous to warrant allocating the remains positively to that species.

ORDER INSECTIVORA

FAMILY SORICIDAE

Cryptotis parva (least shrew)

Referred Material: The specimen is a left mandible from N108 E94, Lot 389.

Remarks: This is the first fossil record for this species within south Texas and possibly the state. Schmidly (1983:40) states that a critical component of its habitat is the presence of dense herbaceous ground cover, especially grasses.

FAMILY TALPIDAE

Scalopus aquaticus (eastern mole)

Referred Material: The material consists of a humerus, two vertebrae, two phalanges, and the occipital bone.

Remarks: Most of the remains of this species were found within Feature 3, and could therefore represent the remains of a single individual. Since moles are burrowing mammals which inhabit the region today, it is possible that these remains represent an intrusive specimen into the archaeological assemblage. On the other hand, its association in Feature 3 makes it possible for that one specimen to be a part of the archaeological assemblage.

ORDER LAGOMORPHA

FAMILY LEPORIDAE

Lepus californicus (black-tailed jackrabbit)

Referred Material: The material consists of cranial and post-cranial remains scattered throughout the site.

Remarks: Hulbert (1979) has noted the difficulty in distinguishing **Lepus californicus** from **Sylvilagus aquaticus**, the largest cottontail rabbit. In spite of his reservations, the present author has identified this material as black-tailed jackrabbit. This assessment is based upon the author's observations that while **S. aquaticus** is as large as the black-tailed jackrabbit, the bones are more gracile. This is particularly noticeable in the mandible. Hulbert (1979) lists mean mandibular length for **L. californicus** as 17.9 ± 0.9 and mean mandibular depth at the fourth premolar as 13.2 ± 1.0 mm. The same measurements listed for **S. aquaticus** are 17.7 ± 0.7 and 11.8 ± 0.7 mm, respectively. Two mandibular fragments recovered from 41 JW 8 were complete enough to measure mandibular depth at the fourth premolar. One specimen (N106 E94, Lot 384) had a mandibular depth of 13.7 mm, and the second specimen (N109 E96, Lot 396), 14.4 mm. Both of these specimens fall near or greater than the mean for mandibular depth for **L. californicus**, and outside of the range of one standard deviation for **S. aquaticus**.

For the small mammals, both the black-tailed jackrabbit and the desert cottontail rabbit were the most frequently represented species within the bone assemblage.

Sylvilagus cf. **S. auduboni** (desert cottontail rabbit)

Referred Material: The material consists of cranial and postcranial remains scattered throughout the site.

Remarks: Steele (1986) reviewed the taxonomy of the cottontail rabbits, and this report follows his assessment. Most of the material recovered from 41 JW 8 could only be assigned to the genus since the material was so comminuted. However, the consistently very small size of the remains warranted the tentative assignment of the material to **S. auduboni**, the smallest of the Texas cottontail rabbits.

ORDER RODENTIA

FAMILY CRICETIDAE

GENUS indeterminate (rats, mice, and voles)

Referred Material: The material consists of long bones recovered from scattered localities within the site.

Remarks: Material referred to this taxon represents the long bones of indigenous mice which could not be assigned to genus on the basis of the material recovered.

Neotoma cf. **N. micropus** (Mexican wood rat)

Referred Material: The material consists of cranial and postcranial remains recovered from various localities within the site.

Remarks: The pack rat which is found within the area today is **N. micropus**, the largest species of pack rat. The material recovered from 41 JW 8 falls within the size range of this species, and on this basis has been tentatively assigned to that species.

Ondatra zibethicus (muskrat)

Referred Material: The specimen is a right femur recovered from N108 E94, Lot 426.

Remarks: The muskrat today is restricted to the upper reaches of the Rio Grande, the Pecos River, and the northern and eastern edges of the state. This represents the second subfossil record for the species in the southwestern part of the state, the species has also been reported from Live Oak County (Steele 1986). Since the species prefers marshy areas, or along creeks, it strongly indicates that nearby Chiltipin Creek, or some other resource, contained a year-round supply of ponded or slow running water.

Sigmodon hispidus (hispid cotton rat)

Referred Material: Material consists of cranial and post-cranial fragments at various localities within the site.

Remarks: This species is ubiquitous throughout the state today, and a common inhabitant of grassland communities.

Microtus cf. **M. pinetorum** (pine vole)

Referred Material: The specimen is a right mandible from Feature 6, Lot 397.

Remarks: There are extant records for two species of voles occurring in Texas, **M. ocrogaster** in far east Texas and **M. pinetorum** in northeast and central Texas (Schmidly 1983). In subfossil samples, **M. ocrogaster** has been identified from deposits in San Patricio County (Raun and Laughlin 1972), and **M. pinetorum** in Goliad County (Flynn 1983), Kerr County (Roth 1972), Hill County (Jelks 1962), Montague County (Dalquest 1965), Travis County (Lundelius 1974), and Live Oak County (Steele 1986). While these two species are quite similar in morphology and size, **M. pinetorum** tends to be slightly smaller. The specimen recovered from 41 JW 8 compared more favorably with **M. pinetorum** than **M. ocrogaster**. This specimen represents the southernmost record for the species. Schmidly (1983:205) states that the species preferred habitat is poorly drained, wet grasslands.

FAMILY GEOMYIDAE

Geomys

SPECIES indeterminate (pocket gopher)

Referred Material: The specimen is one femur from N108 E97, Lot 329.

Remarks: While the femur could be identified to genus, specific identification was not possible. The genus is represented in the faunal community of the region today.

ANALYSIS OF MACROBOTANICAL MATERIALS (John G. Jones)

INTRODUCTION

The paleoenvironmental conditions in south Texas are not well known. This is due in part to the generally poor preservation of both pollen and plant macrofossil evidence. Though recently there have been a number of important paleoenvironmental studies conducted in this area (Bryant and Riskind 1977; Dering 1982; Holloway 1986), and a summary review of the region (Bryant and Holloway 1985), much is still unknown and is in need of additional study. Hopefully, the results presented in this report may be of value to the further understanding of the paleoenvironment of the region.

Charcoal and plant remains were recovered from the Hinojosa site (41 JW 8) during excavations in 1981 and 1982. This site is located north of Alice, Texas, in Jim Wells County, in the Tamaulipan Biotic Province (Blair 1950). This province is characterized as a thorny, brush plain dominated today by **Prosopis** (mesquite), **Acacia** (acacia), **Mimosa** (mimosa), **Celtis** (hackberry), **Leucophyllum** (cenizo), **Aloysia** (whitebrush), and **Opuntia** spp. (cacti).

METHODOLOGY

All samples recovered were generally small and fragmentary. Seed specimens large enough to have identifiable morphological features and charcoal samples large enough to possess a series of growth rings, which are needed for making identifications, were analyzed. Identifications were made at the lowest possible taxonomic classification level (i.e., family, genus, or species). Identifications were based on morphological comparisons with reference specimens maintained in the macrobotanical collections at Texas A&M University. For charcoal specimens, which comprised the majority of the samples, clear transverse surfaces were examined utilizing the snap method (Lenney and Casteel 1975). Because of the generally small size of the specimens, longitudinal and tangential sections could not be made, thus all charcoal identifications were based on transverse section identifications.

All seed identifications were based on the Texas A&M University comparative seed collections. Dr. Hugh D. Wilson, of the Texas A&M University Biology Department provided more specific identifications of seeds in the Chenopodiaceae and Phytollacaceae families.

RESULTS AND DISCUSSION

The results of this study are presented in Table 13. Data have been arranged by feature number, horizontal and vertical provenience, and lot number. The majority of the charcoal specimens recovered from the site were identified as either **Prosopis** (mesquite) or **Acacia**. Both genera, generally tend to be found in the same types of ecological habitats, and are members of the family Fabaceae. The lack of adequate comparative materials exhibiting the total range of taxonomic variation, and the high degree of morphological similarity in the woods of these species prevented positive identification beyond the general level of **Prosopis/Acacia**. In some cases, however, when a specific

TABLE 13. RESULTS OF MACROBOTANICAL ANALYSIS

Provenience	Lot Number	Feature	Level	Material	Identification	Comments
N125 E92	132	1	4	nut	indeterminant	very fragmentary
	133	1	4	fruit	***Chenopodium** cf. **berlandieri***	
				seed	indeterminant	
N107 E98	181	2	2	seed	**Malvaceae**	
				seed coat	indeterminant	possibly modern
N109 E98	298	5	2	wood	cf. **Celtis**	
	307	5	2	wood	hardwood	very fragmentary
	308	5	2	seed coat	indeterminant	
				wood	cf. **Celtis**	
				wood	hardwood	very fragmentary
N106 E97	290	6	2	fruit	***Chenopodium** cf. **berlandieri***	
				seed	**Oxalis**	possibly modern
				achene	cf. **Helianthus**	
	399	6	2	wood	hardwood	
				achene	Asteraceae	
				fruit	***Chenopodium** cf. **berlandieri***	
				other	tooth	rodent incisor
				other	insect larval case	
	400	6	2	wood	**Prosopis/Acacia**	
				wood	hardwood	
	401	6	2	wood	**Prosopis/Acacia**	
	404	6	2	wood	cf. **Celtis**	
				wood	**Prosopis/Acacia**	
				wood	hardwood	
	405	6	2	wood	**Diospyros**	
	406	6	2	wood	cf. **Acacia**	
	407	6	2	wood	**Prosopis/Acacia**	
N76 E92	354	7	2	wood	cf. **Celtis**	
				wood	**Prosopis/Acacia**	
				wood	hardwood	
	356	7	2	seed	indeterminant	poor preservation
N110 E102	481	8	3	wood	cf. **Celtis**	
				wood	cf. **Prosopis**	
				wood	**Prosopis/Acacia**	
	496	8	5	wood	**Prosopis/Acacia**	
				other	bone	small fragment

TABLE 13. (continued)

Provenience	Lot Number	Feature	Level	Material	Identification	Comments
N109 E102	485	8	3	wood	cf. **Celtis**	
				wood	cf. **Prosopis**	
				wood	**Prosopis/Acacia**	
N110 E101	494	8	3	wood	hardwood	small fragments
				caryopsis	**Setaria**	
	525	8	3	wood	cf. **Celtis**	
				wood	cf. **Acacia**	
				wood	cf. **Prosopis**	
				wood	**Prosopis/Acacia**	
				wood	hardwood	fragmentary
				bark	hardwood	
N108 E102	472	9	3,4	wood	**Prosopis/Acacia**	
				wood	hardwood	
				bark	hardwood	
N108 E96	363	**WTA Col.2	1	achene	Asteraceae	
				seed	**Oxalis**	possibly modern
				seed	Malvaceae	
				seed	**Solanum rostratum**	possibly modern
				fruit	*__Chenopodium__	
				seed	Phytolaccaceae	
				wood	hardwood	small fragments
	378	WTA Col.2	2	seed	Malvaceae	
				caryopsis	Gramineae	
				fruit	*__Chenopodium__	
				seed	*Phytolaccaceae	
N108 E96	402	WTA Col.2	3	fruit	*__Chenopodium__ cf. **berlandieri**	
				seed	indeterminant	fragmentary
	452	WTA Col.2	4	seed coat	indeterminant	
N74 E91	337		3	wood	**Prosopis/Acacia**	
N75 E91	345		2	wood	cf. Celtis	
				wood	**Prosopis/Acacia**	
				wood	hardwood	
				other	bone	small fragment
N76 E91	343		2	other	snail shell	
				wood	cf. **Prosopis**	
				wood	**Prosopis/Acacia**	

TABLE 13. (continued)

Provenience	Lot Number	Feature	Level	Material	Identification	Comments
				wood	cf. Celtis	
				wood	hardwood	
				other	snail shell fragments	
N76 E91	366		3	wood	cf. Prosopis	
				wood	Prosopis/Acacia	
				wood	hardwood	
N75 E91	509		4	wood	Prosopis/Acacia	
N96 E83	245		2	wood	Prosopis/Acacia	
N96 E82	246		2	wood	cf. Celtis	
				wood	Prosopis/Acacia	
N95 E82	239		3	wood	cf. Celtis	
				wood	Prosopis/Acacia	
N96 E82	247		3	wood	cf. Prosopis	
				wood	cf. Prosopis/Acacia	
				wood	hardwood	poor preservation
N105 E94	371		2	wood	Prosopis/Acacia	
				wood	hardwood	
N104 E94	370		3	wood	cf. Celtis	
				wood	Prosopis/Acacia	
				wood	hardwood	
N105 E95	374		3	wood	Prosopis/Acacia	
				wood	hardwood	
N105 E94	411		4	wood	Prosopis/Acacia	
				wood	hardwood	
N104 E95	412		4	wood	Prosopis/Acacia	
				wood	hardwood	
N104 E94	456		5	wood	Prosopis/Acacia	
				wood	hardwood	
N104 E97	265		2	wood	Prosopis/Acacia	
				wood	hardwood	
	291		3	wood	Prosopis/Acacia	
	292		4	wood	Prosopis/Acacia	
				wood	hardwood	
N106 E94	379		3	wood	Prosopis/Acacia	
				wood	hardwood	
				other	snail shell fragment	

TABLE 13. (continued)

Provenience	Lot Number	Feature	Level	Material	Identification	Comments
N107 E94	380		2	wood	cf. **Celtis**	
				wood	**Prosopis/Acacia**	
				wood	hardwood	
N107 E95	382		2	wood	**Prosopis/Acacia**	
				wood	hardwood	
				other	snail shell fragment	
N106 E95	384		2	wood	cf. **Celtis**	
				wood	**Prosopis/Acacia**	
				wood	hardwood	
N107 E95	383		3	wood	**Prosopis/Acacia**	
				wood	hardwood	
				fruit	indeterminant	
N106 E95	385		3	wood	**Prosopis/Acacia**	
				wood	hardwood	
N106 E96	359		2	wood	indeterminant	too small to identify
				seed	indeterminant	poor preservation
N106 E97	420		2	seed	**Diospyros texana**	
N107 E98	126		2	wood	**Prosopis/Acacia**	
N106 E99	126		2	wood	**Prosopis/Acacia**	
N107 E98	158		3	wood	**Prosopis/Acacia**	
N106 E98	166		3	wood	**Prosopis/Acacia**	
N107 E98	159		4	wood	hardwood	small fragment
N106 E98	167		4	wood	hardwood	small fragments
N107 E96	388		3	wood	**Prosopis/Acacia**	
				wood	hardwood	
	423		4	wood	cf. **Prosopis**	
N109 E94	516		2	wood	cf. **Celtis**	
				wood	**Prosopis/Acacia**	
				wood	hardwood	
				other	bone	small fragments
N108 E95	520		2	seed	**Diospyros texana**	
				seed	cf. **Celtis**	fragmentary
N108 E94	389		3	wood	cf. **Prosopis**	2 large fragments
				wood	**Prosopis/Acacia**	
				wood	hardwood	
				other	snail shell	

TABLE 13. (continued)

Provenience	Lot Number	Feature	Level	Material	Identification	Comments
				other	bone	1 large fragment
N109 E95	426		4	wood	**Prosopis/Acacia**	
N108 E97	329		4	wood	**Prosopis/Acacia**	
N108 E100	430		3	wood	**Prosopis/Acacia**	
N109 E101	473		2	wood	**Prosopis/Acacia**	
				wood	hardwood	
				other	bone	
N108 E101	434		1	wood	**Prosopis/Acacia**	
N109 E96	522		2	wood	**Prosopis/Acacia**	
N111 E93	262		2	wood	**Prosopis/Acacia**	
N110 E92	254		3	wood	**Prosopis/Acacia**	
				wood	hardwood	
E111 E101	448		2	wood	**Prosopis/Acacia**	
				wood	hardwood	
	464		3	wood	**Prosopis/Acacia**	
				wood	hardwood	
	483		4	wood	**Prosopis/Acacia**	
N123 E106	508	Matrix Z.1		wood	hardwood	small fragments
				nut	indeterminant	small fragments
				seed	indeterminant	
N125 E92	109		4	wood	cf. **Celtis**	
				wood	cf. **Prosopis**	
				wood	**Prosopis/Acacia**	
				wood	hardwood	very fragmentary
Off Site	500	***NPS Z.1		seed	Malvaceae	
				seed	*Phytolaccaceae	
				achene	Asteraceae	possibly modern
				seed coat	indeterminant	possibly modern
	502	***NPS Z.3		seed	indeterminant	fragmentary
				seed	indeterminant	fragmentary

* Identified by Dr. Hugh D. Wilson, Texas A&M University, Biology Department
** Column 2 controlled volume sample
*** Background Noise Pit South, Zone 1, Zone 3

charcoal specimen was more than several centimeters long and exhibited sufficient numbers of diagnostic characteristics, then the specimen was noted as comparing favorably (cf.) to a specific genus.

Several specimens of charcoal, belonging to the Ulmaceae family, were recovered and probably are of the genus **Celtis** (hackberry). Because of the presence of this plant, specifically **Celtis pallida**, in the area today as well as the presence of charred **Celtis** seeds recovered archaeologically, it seems likely that this charcoal is from **Celtis** plants. **Diospyros** (persimmon) wood was also recovered, though this appears to be of minor importance as a fuel resource.

Several charred seeds were identified, and like the charcoal specimens, represent species that are found in the area today. Items recovered that may represent prehistoric diet are **Diospyros texana**, **Chenopodium** cf. **berlandieri**, and a possible example of **Helianthus**. Seeds, in general, seemed to have suffered more than the woods in terms of preservation. This is reflected by the larger number of indeterminate seeds noted in Table 13. Some noncharred seeds were recovered that may be of a modern intrusive origin, such as **Solanum rostratum** (buffalobur) and **Oxalis** (wood sorrel). These were, in all cases, recovered from either Level 1 or 2, or from the background noise pit. These are identified and noted under comments in Table 13. In some cases, snail shells and bone fragments, both charred and noncharred, were recovered. These were present in the soil and ash matrix which was often included in the field charcoal samples. For purposes of future analysis, they were separated, and their presence was noted in Table 13.

As Bryant and Holloway (1985) have noted for south Texas, there appears to have been a mosaic paleovegetation in that region consisting of areas of uplands dominated by grasses and semiarid shrubby vegetation and a complementary more mesic vegetation along protected lower areas and drainages where moisture was more abundant. Since **Prosopis** and **Acacia** are currently found in both xeric upland and mesic riparian habitats, it is difficult to determine the precise sources of these specimens recovered in the archaeological deposits of this site. What I suspect is that these plants were exploited in both types of south Texas habitats.

Archaeological materials recovered were in all cases, species found in the area today, suggesting no major environmental changes during at least the past 600 years. Instead, as Bryant and Holloway (1985) have proposed, the region of south Texas has probably undergone continuous localized changes in microenvironments which may have shifted from xeric to more mesic or from mesic to more xeric depending upon the local availability of moisture. Similar conclusions also are noted in a number of other studies conducted in the same general area of south Texas and northeastern Mexico. These include Dering (1982), Holloway (1986), and the study of the pollen record from the Chihuahuan desert by Bryant and Riskind (1978).

CONCLUSION

Analysis of the macrobotanical materials from site 41 JW 8 suggests that the vegetational setting 600 years ago contained the same elements as we see in the region today. Then, as now, the vegetational composition most probably consisted of a mosaic of xeric and mesic plants which expanded or contracted their ranges depending upon the availability of moisture. In south Texas, **Prosopis/Acacia** wood was the major wood component recovered, however, **Celtis** and, to a lesser extent, **Diospyros** were also present. These materials suggest the exploitation of both xeric and mesic plant habitats. Plant materials in prehistoric times were probably not transported great distances, and the archaeological evidence suggests that the Hinojosa site was a single component campsite. Thus, ecological trends or reconstructions cannot safely be made based only on one small area over a short period of time. It is hoped that future macrobotanical and pollen analyses will be conducted for this region of Texas and that those results will further expand our current knowledge of the present paleoenvironmental reconstructions.

FRESHWATER BIVALVES (Harold D. Murray)

Freshwater bivalves (mussel shells) were recovered in relatively small numbers from 41 JW 8. Only intact bivalve shells or bivalve umbos were collected. All of these were examined and identified when possible by comparison with the author's bivalve collection at Trinity University, San Antonio, Texas. Based on this examination, the following bivalve families and species are represented:

Sphaeriidae
- **Sphaerium** sp.

Unionidae
- **Anodonta imbecillis**
- **Cyrtonaias tampicoensis**
- **Lampsilis teres**
- **Lampsilis** sp.
- **Toxolasma parva**

It should be noted that **Toxolasma** is the same as **Carunculina**. **Carunculina** is an older, invalid genus name that is common in the literature.

AGE OF THE SPECIMENS

Accurate aging of the specimens is difficult because the annual growth lines may be false as the result of environmental factors. Normally the growth cessation lines or rings (grooves or indentations on the outer surface of the bivalve) are caused by the annual cessation of growth during the winter. Aging of the specimens is ideally accomplished by counting the number of annual rings. However, the annual rings can be easily confused with growth cessation lines caused by environmental stress. For example, a drought could result in a cessation of growth and form a ring very similar to annual growth rings. Thus, the aging of the specimens must be approached conservatively. The following are the approximate ages of the identified species:

A. imbecillis, from juvenile (less than a year) to 7 years.
C. tampicoensis, 10-12 years old.
L. teres, 8 years old.
T. parva, 7 years old.

Because mussels cannot survive extended dry periods and because at least one species, **C tampicoensis**, is about 12 years old, it is suggested that the nearest stream (the most likely collection source, Chiltipin Creek) had a permanent source of water which lasted 12 or more years during the occupational period of the site. It is assumed that specimens were not transported from a source of water some distance away. Since these species require a fish host for the parasitic, glochidal stage one must assume a permanent body of water greatly exceeding 12 years in order to have it populated by the correct species of host fish. This does not necessarily imply that Chiltipin Creek itself was a permanent body of water for such a long period as the host fish could have moved upstream from a permanent body of water (San Fernando Creek?).

THE COLLECTION

Over 95% of the identified bivalves at 41 JW 8 is **Toxolasma parva**, the smallest unionid species which rarely exceeds 4 cm. Most of the **T. parva** were less than 25 mm. The preferred habitat of **T. parva** is shallow (50-200 cm), quiet water in soft mud. One specimen of **Sphaerium** was present and lives in the same habitat. Several specimens of **Anodonta imbecillis** were identified (discussed later), and it also lives in the same habitat. The larger **Cyrtonais tampicoensis** and **Lampsilis teres**, which were found in small numbers, are more often found in deeper water (greater than 200 cm) in a variety of habitats (i.e., mud, mud-sand, mud-cobble, or cobble-sand). The distribution of the species suggests that most of the collections were made along the shore in shallow water.

<u>Significance of **Anodonta imbecillis**</u>: The presence of several specimens of **A. imbecillis** is important. Examinations of much larger samples (18,000± valves) from the Choke Canyon Reservoir area (Murray 1982) and a study of mussels from 41 GD 21 on Coleto Creek near Victoria (Fox 1979:57-61) revealed no representatives of the genus **Anodonta**. It was interpreted that **Anodonta** was introduced to the area by European settlers. The specimens from the Hinojosa site cast doubt on that opinion; however, the site is a comparatively young site (ca. 600 years old). Possibly the genus appeared in this area at about this time or slightly earlier.

<u>Significance of **Cyrtonaisis tampicoensis**</u>: All previous studies of bivalves from prehistoric sites in southern Texas (cited previously) have shown the predominant species collected to be **Cyrtonaisis tampicoensis**. Furthermore, all the streams, rivers, and lakes which have been studied in the south Texas area currently have **C. tampicoensis** as the most common species in terms of numbers of individuals. The Hinojosa site only has a couple of individuals of this species. This difference is unexplained; however, several questions can be posed:

1. Was the habitat inadequate (i.e., was the stream too small for the species)? The species grows quite large and may reach 100 mm or more in length.

2. Were they present but not collected?

3. Were they collected but transported elsewhere to be used as tools or ornaments?

None of the three possibilities can be ruled out; however, the first seems most likely. It does not seem likely that a larger species used at many other sites in southern Texas would have been ignored in favor of a small species (**T. parva**). It also seems improbable that tool or ornament usage would have not been evidenced at 41 JW 8 in view of the worked mussel and marine shells that were recovered. It may be significant that both of the previous studies were done in areas with much larger streams or rivers.

<u>**Lampsilis sp**</u>: Several small fragments were clearly **Lampsilis**; however, because there is a second species of **Lampsilis** possible in the area, no positive species identification could be made.

SUMMARY

Based on the recovered bivalves, the impression of the nearby stream (Chiltipin Creek) during the active period of site occupation is that it was a small (couple of meters wide), constantly running (possibly artesian source), shallow (a half of a meter deep) stream. The substrate bottom was probably mud or mud-sand base.

<u>RADIOCARBON ASSAYS</u>

Large samples of well-preserved wood charcoal were recovered from three horizontally and vertically discrete cultural features during the 1981-1982 season at 41 JW 8. Samples from each feature were submitted for radiocarbon assay. The resulting dates were expected to confirm the previous assays recovered from the site as well as the relative dating provided by stratigraphy and associated artifacts. The dates were expected to fall between A.D. 1200 and 1500 and average between A.D. 1300 and 1400. Unfortunately, the radiocarbon assays received range between A.D. 660 and 1570 (uncorrected midpoints) and are furthermore inconsistent within individual features. Thus, the radiocarbon assays present serious problems in interpretation as will be discussed.

Initially, four charcoal samples were submitted for assay; two samples (Features 6 and 8) were sent to the Center for Applied Isotope Research at the University of Georgia, and two (Features 5 and 6) were sent to the Radiocarbon Laboratory at The University of Texas at Austin. Two radiocarbon laboratories were used to provide crosschecks on the dating. The first dates were received from the Georgia laboratory. The sample from Feature 6 was assayed at 525 ± 65 B.P. (UGa-4541), which was in line with expectations. The sample from Feature 8 was assayed at 1290 ± 65 B.P. (UGa-4540), which is more than twice as old as expected. In order to check this date a second charcoal sample from Feature 8 was submitted to the Austin laboratory.

The three assays received from the Austin laboratory only added to the problem. Feature 5 was assayed at 520 ± 90 B.P. (TX-4652), which is within the expected range. Feature 6 was assayed at 970 ± 60 B.P. (TX-4653), which is over 400 years older than the assay from the Georgia laboratory. Feature 8 was assayed at 500 ± 60 B.P., which is in line with our expectations but some 790 years younger than the comparable Georgia laboratory assay. Thus, on the two features dated by both laboratories the resulting assays differed by hundreds of years. Moreover, the differences were not consistent between laboratories; on Feature 6 the Georgia laboratory's date was much younger than the Austin laboratory's, while on Feature 8, the Austin laboratory's date was much younger than the Georgia laboratory's.

In order to resolve the problems Salvatore Valastro of The University of Texas at Austin and John Noakes of the University of Georgia agreed to obtain assays on additional samples from the two features in question at no additional cost. Valastro pointed out to the author that although the samples were from discrete features, therefore archaeologically identical, the charcoal sent to each laboratory cannot be considered scientifically identical unless a large sample from each feature is pulverized and split exactly. Valastro agreed to chemically pretreat and split samples from the two features in question and send half of each sample to the Georgia laboratory for additional assays.

The resulting assays only partially improved the situation: Feature 6 was assayed at 1090 ± 110 B.P. by the Austin laboratory (TX-4886) and 655 ± 70 B.P. by the Georgia laboratory (UGa-5289), while Feature 8 was assayed at 700 ± 80 B.P. by the Austin laboratory (TX-4887) and 380 ± 185 B.P. by the Georgia laboratory (UGa-5290). While the split assays from Feature 8 overlapped within the two-sigma level, the split assays from Feature 6 did not. John Noakes agreed to run one final assay on Feature 6 charcoal to attempt to resolve the problem. The resulting assay fell in line with the two Austin laboratory assays from Feature 6: 930 ± 70 B.P. (UGa-5280).

At the present time, then, 12 radiocarbon assays have been determined from charcoal samples collected from 41 JW 8. Table 14 summarizes all of the radiocarbon assays from 41 JW 8. These assays, with the exception of TX-2206, which has an extremely large error range, have been corrected by the calibration based on the consensus data of the 1979 radiocarbon workshop (Klein et al. 1982) and plotted in Figure 13. Table 14 and Figure 13 show the ambiguity of the assays and illustrate the problem of how to interpret these dates. Given the facts that the recovered charcoal samples were very well preserved, were from seemingly ideal contexts, and that two of the features have four or five radiocarbon assays each, the inconsistent results are particularly distressing. The following discussion will review some of the factors involved in the radiocarbon assay process in an attempt to explain why the resulting assays did not meet our expectations.

The field notes, plan maps, and photographs were carefully reexamined several times after the anomalous dates were received. As discussed elsewhere in this report, the stratigraphy and artifact associations strongly suggest that

TABLE 14. RADIOCARBON ASSAYS

Sample Number	Radiocarbon years B.P.	Years B.P. 5730 1/2-life	Provenience
Tx-2206	650 ± 1230	669 ± 1220	1975 "bone bed"
Tx-2207	580 ± 50	596 ± 50	1975 Unit H, Level 1
Tx-4652	520 ± 90	535 ± 90	Feature 5
UGa-4541	525 ± 65	540 ± 65	Feature 6
Tx-4653	970 ± 60	998 ± 60	Feature 6
Tx-4886	1090 ± 110	1122 ± 110	Feature 6
UGa-5289	655 ± 70	674 ± 70	Feature 6
UGa-5280	930 ± 70	930 ± 70	Feature 6
UGa-4540	1290 ± 65	1327 ± 65	Feature 8
Tx-4654	500 ± 60	515 ± 60	Feature 8
Tx-4887	700 ± 80	720 ± 80	Feature 8
UGa-5290	380 ± 185	391 ± 185	Feature 8

all of the cultural deposits in the Wagon Trail Area of the site represent an occupation closely related to the Toyah phase of central Texas (Jelks 1962; Prewitt 1982; Prewitt 1985) and thus can be expected to date to no earlier than A.D. 1300 in southern Texas. All three features were relatively undisturbed. Their proximity to the current ground surface and the degree of bioturbation noted at the site might explain minor contamination with more modern carbon-bearing materials but not with earlier materials. Deeper stratigraphic testing below the Toyah horizon occupation produced very little evidence of earlier occupations and little or no organic material. The only possible earlier evidence consisted of flakes and one comparatively deeply buried rock cluster (Feature 1) that had no charcoal whatsoever. Thus, a review of the field data suggests that the features in question should date to after A.D. 1300. Similar Late Prehistoric components at two sites in the Choke Canyon Reservoir area of south Texas, 41 MC 296 and 41 LK 201, have been radiocarbon dated well after A.D. 1300 (Hall, Black, and Graves 1982; Hall, personal communication).

The radiocarbon assays from 41 JW 8 were all run on chunk wood charcoal samples that are well suited for analysis. Chunk wood charcoal is subject to contamination in a limited number of ways. Fine rootlets may be present in the charcoal, however, most of these were removed prior to sending the samples to the radiocarbon laboratories, and the laboratories were advised of this possibility. Standard sample preparation procedures should have removed the remaining rootlets. In addition, rootlet contamination would yield later dates rather than earlier dates. A possible factor that could cause the dates to come out too old has been called "post-sample-growth error" (Ralph

Radiocarbon Assays - 41JW8

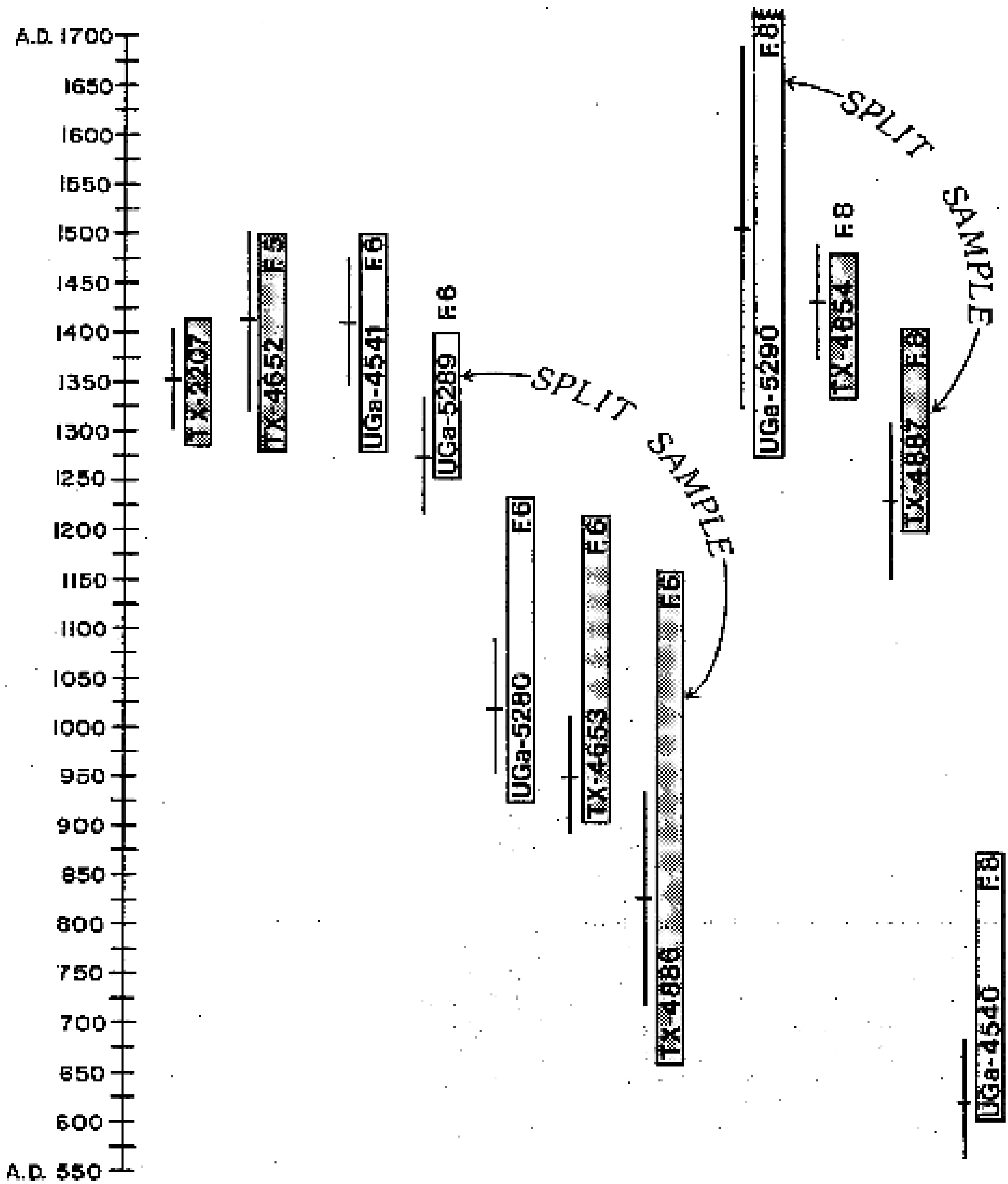

Figure 13. Radiocarbon Assays from 41 JW 8.

1971:4). This error occurs in cases where the dated wood is significantly older than the event being dated. This could occur if the heart wood from old trees had been burned in the fires that resulted in Features 6 and 8. In this part of south Texas, there are very few trees that live more than 100-200 years, hence this factor cannot likely explain why some of the dates are 400 to 800 years older than the associated artifacts.

Most of the other sources of radiocarbon assay error concern the mechanics of how the samples were processed in the radiocarbon laboratory. Erroneous dates can result from a number of stages in the processing, including sample pretreatment, equipment calibration, and sample counting time (Ralph 1971; Fleming 1977; Browman 1981). Several studies comparing dates run by different laboratories on replicative samples from well-dated contexts have shown significant variation between laboratories. Browman (1981:254) states that the major reason for discrepancies between samples less than 2000 years old is an error in the calibration of the reference standard. Clark (1975:252-253) analyzed 192 independent replicative observations by various laboratories on tree ring samples. He concluded: "There can be no doubt that on the average the variability between replicate observations is far in excess of the variability expected in view of the quoted standard errors" (**ibid.**:252). Recent comparisons of tree ring dates during calibration studies have shown systematic but comparatively small differences between comparatively small groups of cooperating laboratories (Klein **et al.** 1982; Stuiver 1982).

Within the last two decades, it has been demonstrated that the amount of carbon-14 present in the atmosphere has systematically varied over at least the past 7000 years (Browman 1981). Since the validity of radiocarbon dating has been based on the assumption that the amount of atmospheric carbon-14 is a constant, the systematic deviations have to be taken into account. A number of calibration curves and charts have been published, including Ralph, Michael, and Han (1973), Damon **et al.** (1974), Clark (1975), Klein **et al.** (1982), and Stuiver (1982). Each is based on a comparison between dendrochronogically dated tree ring samples and careful radiocarbon assays of those samples. All of the cited calibrations agree on most of the major deviations; they disagree to some extent on the minor deviations or "wiggles" present in some calibrations and the mathematical techniques used to "smooth" the curves (Browman 1981:256-257).

The calibration published by Klein **et al.** (1982) represents the most widespread effort to date to compile tree ring dates. As mentioned, this calibration is the result of a major workshop held in Tucson, Arizona, in 1979 (Michael and Klein 1979). This calibration should gain rapid acceptance over the next few years. Until now the archaeologist had to choose between several calibrations which varied significantly for certain date ranges. One very positive aspect of the new calibration is the ease with which a non-specialist can calibrate a date. Several of the available calibrations lack the clear cut tables and user instructions that accompany the Klein **et al.** (1982) calibration.

It is very important to note that a radiocarbon date is not a fixed absolute date but rather a statistical estimate of the absolute date range within which the actual or "true" date, a sample ceases to accumulate radioactive carbon, occurs. Most authorities on the subject of radiocarbon dating stress the fact that radiocarbon assays are usually expressed with an error factor (plus or minus) of one standard deviation (one sigma). This means that the actual date has two in three (68%) statistical chances of falling within the error range given in the assay. This also means that the "true" date of one out of three radiocarbon assays will not fall within the one-sigma range. The use of a two-sigma error range will increase the statistical chance to 95%. The calibrated date ranges shown in Figure 13 reflect the 95% confidence level range.

Radiocarbon assays are normally reported using the Libby carbon-14 half-life of 5568 (by standard agreement). Conversion to the more accurate carbon-14 half-life of 5730 is accomplished by multiplying the reported radiocarbon date (years B.P. from the 1950 radiocarbon standard) by 1.029. For example, TX-4652 (520 ± 90) is converted to 535 ± 90 (520 x 1.029 = 535). The one-sigma range is then determined by adding and subtracting the one-sigma error. This is shown in Figure 13 by the horizontal bar (5730 half-life date midpoint) and the vertical line (standard one-sigma error range). Using the preceding example, the one-sigma range is 625 to 445 B.P. or A.D. 1325 to 1505. The B.P. date is converted to the Christian calendar by subtracting the B.P. date from 1950 (positive numbers are A.D. dates, and negative numbers are B.C. dates).

The Klein **et al.** (1982) calibration is calculated simply by looking up the standard assay (Libby half-life date B.P) in the calibration tables (dates in 10-year intervals) and reading the calibrated date range given for the closest sigma error (provided for 20, 50, 100, 150, 200, and 300 year errors). Although some rounding off is necessary, the table has been constructed to yield 95% confidence interval date ranges. The general effect of the calibration upon the 41 JW 8 assays (vertical bars in Fig. 13) is that the older dates are shifted somewhat later while the younger dates are shifted slightly earlier. These corrections do not negate the fact that something is drastically wrong with the suite of radiocarbon assays from 41 JW 8.

If one were to assume that all the dates are basically correct, then one would have to conclude that two discrete features (6 and 8) both had a mixture of charcoal dating to between A.D. 1300 and 1400 and some 300 to 700 years earlier. This seems highly unlikely, and it is therefore assumed that some of the dates are incorrect. The problem then becomes to try and decide which dates are incorrect.

If one assumes that all of the charcoal from the site was deposited during a single occupation, then this occupation can be dated by finding the time interval with the greatest number of overlapping dates. Seven of the eleven calibrated dates have error ranges that overlap between A.D. 1350 and 1400. This overlap falls within the expected range based on artifact association and stratigraphy. This possibility is considered most likely by the author. If true, this means that two dates were determined by each laboratory that were 300 to 700 years too old. In other words, the sample processing techniques at both laboratories were apparently inconsistent.

If, on the other hand, one assumes that the charcoal dated from the site was deposited over a longer time span or during several occupations, then each feature should be examined separately. The fact remains that the majority of the assays fit within the expected date range; hence at least one occupation dates to between A.D. 1350 to 1400. Feature 5, with only a single assay, appears to date to this occupation. Feature 8 has three out of four assays that fall within this same occupation. The fourth assay (UGa-4540) is clearly wrong. Feature 6 has two date clusters. The first two dates determined by the Georgia laboratory fit within the A.D. 1350 to 1400 occupation. The third, the Georgia laboratory assay, and both the Austin laboratory assays, overlap between A.D. 925 and 1150. By virtue of numerical superiority, one must assume that the earlier date range is applicable to Feature 6. However, there is no physical evidence that Feature 6 is any earlier than the other two features. In fact, Feature 6 is slightly higher in elevation (and closer to the surface) than either of the other two features and has some Toyah phase artifacts (pottery sherds, a small end scraper, and an arrow point fragment) that are clearly in direct association. In other words, the possibility that Feature 6 actually dates to between A.D. 945 and 1010 is considered very unlikely.

The conclusion about the radiocarbon assays from 41 JW 8 is that the radiocarbon laboratories did not use consistent, reproducible procedures. This conclusion is strengthened by an examination of the two pairs of samples that were sent to the Austin laboratory for pretreatment and splitting. In June of 1983, following the discovery of the initial inconsistencies, the author removed a large charcoal sample from the charcoal sample bags from both features in question (Features 6 and 8). These were properly packaged and sent to the Austin laboratory for pretreatment and splitting. Valastro processed and split the samples and sent one-half of each sample to the Georgia laboratory. Given the serious nature of the inconsistencies (both laboratories agreed to run additional samples without charge), one assumes that the samples were treated with more than normal caution to insure that comparable results were obtained. Therefore, both pairs of dates should have been close together. This was not the case. On Feature 8, the Austin laboratory dated the sample at 700 ± 80 while the Georgia laboratory dated the sample at 380 ± 185. This pair does overlap within the calibrated two-sigma range, however, this is only due to the very large error factor of the Georgia laboratory date. On Feature 6, the Austin laboratory dated the sample at 1090 ± 110 while the Georgia laboratory dated the sample at 655 ± 70. This pair does not even overlap at the two-sigma range (calibrated or uncalibrated).

An earlier draft of this section of the report was sent to both laboratories along with a request for additional information on how each sample was processed and for any suggestions for possible sources of error. The resulting responses may partially explain the discrepancies. The assays produced by each laboratory are examined below.

Four of the six valid assays from the Austin laboratory (TX-2206 not considered due to large error factor) overlap between A.D. 1350 and 1400 when calibrated. The remaining two dates, both from Feature 6, overlap between about A.D. 900 and 1150. It is significant to note that the assays determined by the Austin laboratory for each of the problematic features, 6 and 8, are internally consistent. That is to say, both assays for each feature are statistically consistent (they overlap).

By contrast, the five assays from the Georgia laboratory are noticeably inconsistent. Of the three assays from Feature 6, two overlap between A.D. 1300 and 1400 (calibrated) while the third agrees with the older assays determined by the Austin laboratory. The two Georgia laboratory assays from Feature 8 are 350 years apart from overlapping. Thus, the Georgia laboratory assays are not internally consistent.

Both laboratories use the benzene method for sample preparation and a liquid scintillation counter for counting the radiocarbon. Both laboratories use the new NBS (National Bureau of Standards) oxalic acid RM 49 standard that is referenced to the old NBS standard. In addition, the Austin laboratory also periodically uses 12,000-year-old tree and modern tree (1840) samples from Arizona as reference crosschecks. Both laboratories report assays based on the Libby half-life (5568) and tied to the standard 1950 reference point. Thus, the two laboratories use similar basic processing techniques that should yield similar results.

The difference between the laboratories involves the sample preparation techniques that were used on the 41 JW 8 samples. The Austin laboratory used the same pretreatment procedure for each sample. First, the sample is examined, and obvious contaminants are removed (dirt, roots, etc.). Next, it is boiled in a 2% (0.2N) HCl solution for 30 minutes to one hour to remove calcareous material such as limestone. Next, the sample is rinsed and then boiled with a 2% (0.2N) sodium hydroxide solution to remove any humic acids which might be present. Then, the HCl boil is repeated, and the sample is rinsed a final time with distilled water. After thorough drying, the charcoal is picked piece by piece for the final sample. This procedure was used for all the assays sent to the Austin laboratory and also for the split samples assayed by the Georgia laboratory (UGa-5289 and UGa-5290). The length of counting time varies at the Austin laboratory from a minimum of 24 hours to 48 hours depending on the quality and age of the sample (i.e., an ample sample of a relatively young date is not counted as long as a small sample of an older date).

The Georgia laboratory used similar procedures for the 41 JW 8 sample with one seemingly significant exception--the alkali (sodium hydroxide) boil. Samples UGa-4540 and UGa-4541 were not boiled in an alkali bath "due to the well preserved nature of the charcoal" (Noakes 1984). Noakes went on to say: "This, I admit, may have been an error but repeated distilled water rinsing indicated that the samples were of a very clean condition." He also suggested that based on his past experience "the [41 JW 8] problem lies in the chemical preparation." The letter from John Noakes also revealed the reason for the large error factor for UGa-5290; a vacuum line ruptured during the chemical synthesis, and much of the sample was lost.

Valastro and Noakes both reported that they had checked their laboratory records and had double-checked their counting equipment and found no irregularities or indications of malfunctioning equipment. Therefore, we should expect consistent results for the samples which were pretreated with the full acid and alkali baths and in which no loss of sample occurred. The split Feature 6 sample assays (TX-4886 and UGa-5289) meet this requirement as well as two of the other Feature 6 assays (TX-4653 and UGa-5280). As Figure 13 shows, while three of these assays are consistent and overlap when calibrated between A.D. 925 and 1150, the fourth assay (UGa-5289) agrees with the A.D. 1300 to 1400 expected range.

In the final analysis, the problem of inconsistent radiocarbon assays from 41 JW 8 cannot be solved based on the current data. Three out of four of the valid dates for Feature 6 are 150 to 375 years older than expected. Given recent confirmation of the fact that Toyah phase related materials in southern Texas date after A.D. 1300 (Prewitt 1985; Hall, Hester, and Black 1986), the Feature 6 dates are anomalous. One possible explanation for the anomalous dates is that they fall within or near one of the "flat" regions in the calibrated curves (Klein **et al.** 1982:114). The "flat" regions of the curve are "periods when the C-14 in the atmosphere has decreased at a rate greater than the 1.2 mil per 10 years" (**ibid.**). Based on the published data, the errors resulting from the "flat" region would not account for the magnitude of the Feature 6 anomaly.

FINAL CAVEATS

A recent in depth discussion of radiocarbon techniques concluded that: "Radiocarbon dating now has the potentiality of far surpassing even the most optimistic plaudits it received a quarter of a century ago" (Browman 1981:287). This author cannot agree. Numerous colleages have cited other examples of serious discrepancies between and within radiocarbon laboratories (including other laboratories not mentioned here) on comparable samples.

This problem has serious consequences for the archaeologist. It appears necessary to have a large number of assays for each occupational component or feature at a given site to be able to distinguish between good dates and erroneous dates and to get an accurate idea of the dating range. This effectively means that site components or features with only a limited number of charcoal samples cannot be confidently radiocarbon dated. The archaeological literature is repleat with examples of components, features, and even sites which are discussed as being firmly dated on the basis of a single radiocarbon assay. The use of single dates in such a confident manner is simply irresponsible.

Another common misuse of radiocarbon assays involves the quoted or calibrated assay midpoint. The midpoints of radiocarbon assays are frequently cited and discussed as if the midpoint is an accurate estimate of the actual date. In fact, the assay midpoint is only the central point in a much larger two-sigma range in which the true date can be expected to occur 95% of the time. Thus, radiocarbon assays should always be discussed as ranges or very clearly stated as rough approximations. The use of numerous overlapping assays is necessary to accurately define the date ranges of site components. An excellent example of this approach is provided by the George C. Davis site radiocarbon dating (Story and Valastro 1977).

The implication for archaeologists of the aforementioned problems is clear: **many (perhaps most) features, components, and sites cannot be accurately** dated by radiocarbon dating alone. This is because of the nature of radiocarbon dating as a statistical approach and the lack of adequate samples of datable carbon from many (if not most) features, components, and sites.

Finally, this author would like to make some recommendations to archaeologists who rely on radiocarbon assays. One suspects that like the author, prior to the Hinojosa site experience, most archaeologists have never taken the time to understand how radiocarbon dating really works. Previously, this author used radiocarbon dates rather carelessly; if a date "looked right," it was used uncritically, if not it was ignored or explained away. In order for radiocarbon dating to live up to the "optimistic plaudits" mentioned, the tool of radiocarbon dating must be used for what it is rather than for what we archaeologists would like it to be. Toward this end the following suggestions are offered:

(1) Archaeologists should take time to carefully investigate the radiocarbon laboratories to which he or she sends samples. The pretreatment methods, equipment calibration standards, and counting times used by a given laboratory can seriously effect how the date will come out. If samples are to be split and sent to two laboratories, it behooves the archaeologist to make sure that both laboratories use essentially identical methods, or else the results are liable to be inconsistent.

(2) Archaeologists should work more closely with radiocarbon scientists at all stages of the process, from the field circumstances to the final interpretations. Each feature, component, or site is unique and should be treated as such.

(3) Radiocarbon laboratories should provide as standard information the processing details for each sample. Some laboratories make a standard practice of this; many others do not. Most information could be summarized in three to five pages. The pretreatment variation, the sample count times, and any problems in processing for each sample should be reported to the archaeologist.

(4) It is very obvious that a detailed comparative study needs to be made of the radiocarbon laboratories that provide data to archaeologists. This study would reveal which procedures are and are not producing reliable results and would provide a means to evaluate and compare data received from various radiocarbon laboratories.

PERDIZ ARROW POINT SPECIAL STUDIES

A comparatively large sample of Perdiz arrow points (100) and fragments of other arrow points (64; most of which are probably Perdiz fragments) was recovered from 41 JW 8. These were found in virtually all excavation units in most excavation levels except for the lowest nonproductive levels. The large arrow point sample was used for three special studies in addition to the wear pattern examination discussed in Section VI. These studies are an evaluation of a projectile point neck width dating formula hypothesis, a look at plow-damaged arrow point distribution, and a study of arrow point breakage patterns.

NECK WIDTH HYPOTHESIS

Bill Fawcett (1978) has suggested that a mathematical relationship exists between the neck width of central and southern Texas Late Archaic and Late Prehistoric projectile points and time. Simply stated, Fawcett contends that projectile point neck width gradually decreased through time. Furthermore, he argues that the average neck width for a group of projectile points from a single component can be used to derive an estimate of the occupation date. Fawcett derived a "mean neck-width formula" from measurements of projectile points from south, central, and coastal Texas sites that had discrete occupation levels dated by radiocarbon assays. Fawcett (1978:137) then used the **Perdiz** point data from 41 JW 8 presented in Hester (1977) as a test of his mathematical model. Based on his measurement from photographs of 27 **Perdiz** points from the 1975 testing and surface collection, Fawcett determined the mean neck width of the 27 illustrated points was 7.5 mm and estimated that the Hinojosa site dated to A.D. 1327. This date is very close to the mean date of the two radiocarbon assays from 1975 (although one of the dates had a plus or minus of 1230!). Fawcett (1978:137) concluded that "a single application of the formula demonstrates the accuracy of this formula dating methodology."

A number of weaknesses in Fawcett's methodology are readily apparent. First, he makes the unstated assumption that south, central, and coastal Texas prehistories were so similar that projectile point size (or at least projectile point neck width) was uniform at any point in time and changed diachronically at a uniform rate. Second, his data was mostly derived from measurements of photographs of select projectile points; hence he assumes that the photographed points were representative of the entire sample from a given occupation level and that measurements from photographic representations are accurate. Fawcett also assumes each radiocarbon assay is accurate, although he uses various linear regression correction factors to adjust shell and snail assays. Finally, while Fawcett cites the site references, radiocarbon assays, and mean neck widths, no data is provided on sample size or even the type of projectile point being measured.

The validity of all of Fawcett's assumptions can be seriously challenged. The absence of the sample size and type data makes it impossible to evaluate the formula. These problems aside, the idea presented by Fawcett is an interesting one. If an accurate neck-width formula could be constructed then many site components could be dated that lack carbon preservation. In an effort to provide better neck-width data and to test Fawcett's basic premise, the **Perdiz** points from the 1981 season were accurately measured. All measurements were made of the actual specimens using calipers.

The sample of **Perdiz** points from the 1981 season at 41 JW 8 was much larger and better controlled than the 1975 sample. A total of 77 **Perdiz** points with measurable stem (neck) widths was recovered. The mean stem width of this total was 58.7 mm. The neck-width formula devised by Fawcett is:

$$Y = .832\ (X) - .0099,$$

where X is the neck width in millimeters, and Y is the estimated age in hundreds of years B.P. (before the radiocarbon present, A.D. 1950). Using this formula, an estimated age of 487 B.P. (A.D. 1463) is derived by plugging in the site mean (.832 x 5.87 - .0099 = 4.87 x 100 = 487; 1950 - 487 = 1463). This date is within the range of the radiocarbon assays but is about 100 years later than the A.D. 1350-1400 period in which this author believes the site was occupied.

The neck-width model was further tested by looking at the distribution of neck widths within the excavated sample from 41 JW 8. The following assumptions were made: (1) it was assumed that the site deposits result from repeat visits to the site by related groups over several generations, and (2) it was assumed that the **Perdiz** points in the lower excavation levels were deposited before those in the upper levels. Given these assumptions and Fawcett's hypothesis one would expect that the **Perdiz** points from the lower levels would have a larger mean neck width than those from the upper levels.

The sample of **Perdiz** points from the Wagon Trail Area was used to evaluate the neck-width hypothesis because this area was felt to be less disturbed than most other excavation areas and had associated radiocarbon assays. The WTA **Perdiz** points were divided into two groups. Those from Levels 1 and 2 were placed in the upper group while those from Levels 3 and 4 were placed in the lower group. Unfortunately, **Perdiz** points were more numerous in the upper levels. Nonetheless, the resulting means tentatively appear to support Fawcett's hypothesis. The lower group had a mean neck width of 6.51 mm (N=9) while the upper group had a mean neck width of 5.48 mm (N=22). Plugging these means into the neck-width formula one arrives at estimated dates of A.D. 1409 for the lower group and A.D. 1495 for the upper group.

It is interesting that the 41 JW 8 **Perdiz** point neck-width dates appear to be within the range of most of the radiocarbon assays. The 85-year spread between the lower sample and the upper sample does not seem to be an unreasonable estimate of the length of the prehistoric occupation. However, certain caveats seem to be warranted. First, the neck-width means were based on comparatively small sample sizes; the addition or subtraction of one or two unusually large or small neck widths would significantly alter the mean. Second, and perhaps most important, Fawcett's neck-width formula was not derived from a large well-controlled sample.

It is suggested that in spite of the many weaknesses in Fawcett's neck-width hypothesis, the basic premise may have merit. Projectile points do generally decrease in size through time during the Late Archaic and Late Prehistoric periods in central and southern Texas. However, it remains to be demonstrated whether the decrease in projectile point size can be mathematically linked to neck width through time. This author does not believe that the original formula was accurately constructed. A more reliable formula could be constructed by the accurate measurement (beyond the photographic measurement of complete illustrated specimens) of projectile points from a series of comparatively well-dated single component sites such as 41 JW 8 or from isolated components. Crucial to the accuracy of the formula is the sample size of each projectile point type and the accuracy of the radiocarbon dating of the components represented by the projectile point types.

PLOW DAMAGE STUDY

The Hinojosa site is located on the edge of an agricultural field that has been plowed for many years. Many of the artifacts recovered from the site bear scars, breaks, and iron deposits (plow damage visible on the artifacts in Fig. 6) that attest to frequent plowing. During the artifact analysis, it became apparent that a majority of the lithic artifacts from the surface and first level had been struck at least once with the plow. It was also observed that the artifacts from the lower levels had not been disturbed by plowing. In an effort to document the extent of the plow zone a study was made of 157 Perdiz arrow points (A1) and arrow point fragments (A4).

Arrow points were chosen for the study because of the large number of specimens and their relatively wide vertical and horizontal distribution. It was observed that iron deposits left by plowing are most commonly found on the ridge scars of bifacial artifacts. Hence, the more numerous lithic items such as flakes might not show damage as often as bifacially chipped artifacts. The arrow points are the most numerous bifacial artifact group at 41 JW 8. The 157 specimens represent all the A1 and A4 artifacts that were placed in bags with full provenience information. Other A1 and A4 specimens were only labeled by lot number and were not included simply to save the author the time from having to look up the provenience. The 157 specimens are considered an adequate sample.

Each arrow point or fragment was examined under 10X-20X magnification for the presence of iron deposits (plow marks). As mentioned, plow damage is evidenced by breaking, scarring, and iron deposits. Virtually all lithic artifacts that appear plow damaged have surface traces of iron. These plow marks appear as isolated dark surface deposits or a linear series of deposits that usually occur on flake ridge tops or near the artifact edge. Under magnification, the edges of the plow marks appear maroon to red to orange in color. Some care had to be exercised as a small percentage of the examined artifacts had iron inclusions within the chert and red-stained areas that could be confused with plow marks. Somewhat more common were silver to gray metal traces. These represent contact with the galvanized 1/4-inch screen hardware cloth during the excavation recovery process.

About 35% of the 157 specimens have noticeable plow marks. Assuming that the sample is representative of all the artifacts, over one-third of all the artifacts recovered from the site have been displaced by plowing. On a vertical basis the 157 specimens have a highly significant distribution. Of the four arrow points recovered from the surface, three had plow marks. Although this is a small sample of surface material, almost every surface-collected artifact of any type examined by the author had obvious plow marks. Level 1 specimens have plow marks on 38 out of 74 (51%). Level 2 specimens have plow marks on 14 out of 45 (31%). None of the 22 specimens from Level 3 or the 12 specimens from Levels 4-6 have plow marks. This correlates very well with the profile illustrations and observations that the plow zone was approximately 20 cm thick.

Discussions with relatives of the landowner and with the tenant farmer revealed that the site was never deep plowed to their knowledge. The Hinojosa family told the author that the family had acquired the property in the early 1900s by hiring workers from Mexico to hand grub several hundred acres in the site vicinity. The Hinojosa property was deeded to the family in exchange for the land clearing. Thus, the site was spared the severely destructive deep root plowing often used in more recent times to clear land in southern Texas (Dusek 1982). In fact, the plow marks observed on the 41 JW 8 specimens could be more accurately called "disk" marks as most probably represent the shallow disking that precedes planting. A disk plow has several closely spaced rows of metal (iron) disks that literally cut up compacted soil and agricultural waste and allow the soil to absorb more moisture. Each row of disks turns in the opposite direction of the adjacent row. Thus, an artifact would probably be displaced only a few centimeters by disking.

ARROW POINT BREAKAGE PATTERNS

A breakage study was made of all specimens identified as **Perdiz** points (A1, N=100) and all unidentifiable arrow point fragments (A4, N=87). As mentioned, the majority of the A4 fragments are thought to be broken **Perdiz** points. This statement is supported by the fact that **Perdiz** points account for about 92% of the identifiable arrow points.

The purpose of the study was to look at how **Perdiz** points had been broken and to attempt to correlate the breakage patterns with functional interpretations. The study was prompted by recent observations on a small sample of **Perdiz** points recovered at 41 LK 67 (Brown **et al.** 1982:42-43). Brown noticed that most of the **Perdiz** points found at 41 LK 67 had transverse snaps of the proximal section (stem) and/or the distal tip. He suggested that arrow points striking a hard substance (stone, wood, or bone) would tend to shatter, while an arrow point striking a soft substance such as animal tissue or soil would break once embedded due to stress caused by the weight of the shaft. Brown argued that an arrow point embedded in soft material would be susceptible to transverse snapping of the blade and the stem.

As Brown notes, the two extant examples of hafted **Perdiz** points found in dry central Texas caves, were both snapped at the top of the foreshaft. The remaining stem fragments measured 7 and 10 mm long. The missing stem sections of the 41 LK 67 **Perdiz** points appear to have been less than 7 mm, leading Brown to suggest that "a somewhat different breakage pattern must be implied, probably involving breakage of the stems inside the haft due to lateral stress on impact" (**ibid.**:43). Brown unsuccessfully attempted to look for similar breakage patterns in the archaeological literature and noted the problem of bias against illustrating broken specimens.

All of the A1 and A4 specimens from 41 JW 8 were divided into categories based on the location and angle of the breaks. Most of the breaks were transverse snap breaks. The original categories were based on schematic drawings of **Perdiz** points showing the various break locations. Some categories with minimal numbers were combined with closely related break categories. Figure 14 shows examples of most of the common break categories recognized at 41 JW 8. Tables 15 and 16 show a breakdown of the examined specimens. The tables are organized by the location(s) of the missing

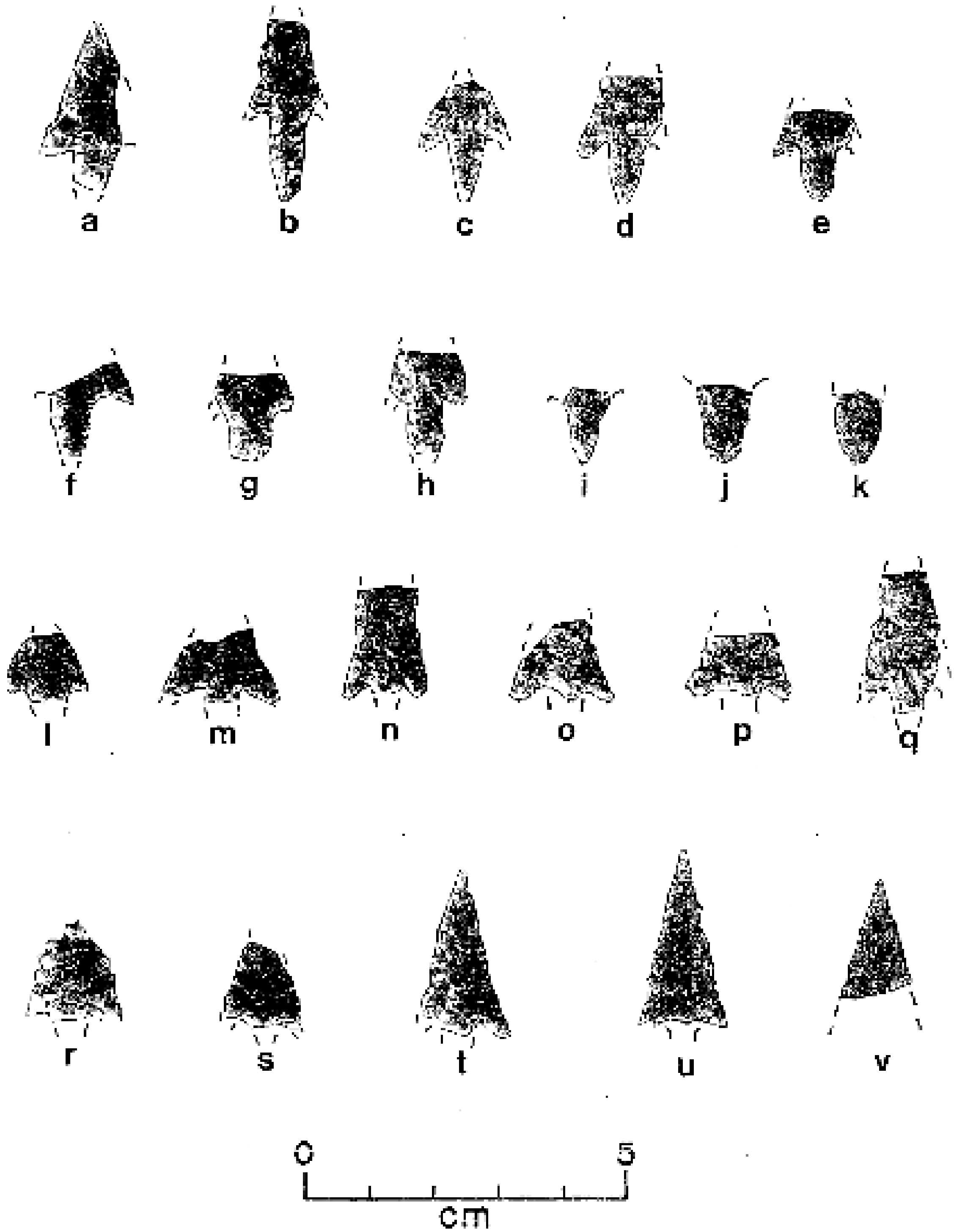

Figure 34. **Arrow Point Fragments.** a-h, **Perdiz** (A1); i-v, miscellaneous (A4). Lot numbers: a, 440; b, 254; c, 514; d, 434; e, 328; f, 57; g, 126; h, 191; i, 179; j, 259; k, 487; l, 437; m, 384; n, 513; o, 523; p, 342; q, 342; r, 328; s, 321; t, 313; u, 433; v, 433.

TABLE 15. (A1) ARROW POINT BREAKAGE

Missing:	DT	1B	2B	LS	US	EB	Count
	X						7
	X	X					17
	X		X				3
	X				X		2
	X	X		X			2
	X			X			2
	X		X	X			2
		X					12
			X				3
						X	18
				X			3
		X		X			1
			X	X			1
Total	35	32	9	11	2	18	73

TABLE 16. (A4) ARROW POINT BREAKAGE

Missing:	DT	1B	2B	LS	US	EB	LH	LT	Count
	X				X				6
	X	X			X				16
	X		X		X				4
	X						X		10
							medial subtotal:		36
								X	16
							X		8
					X				5
		X			X				3
			X		X				3
							distal subtotal:		35
						X			7
				X		X			3
							proximal subtotal:		10
Total	36	19	7	3	37	10	28	15	81

Note: DT= distal tip (less than one-third blade)
1B= one barb
2B= two barbs
LS= lower stem (less than one-third stem)
US= upper stem (more than one-half stem)
EB= entire blade (above stem)
LH= lower half (lower blade section and stem)
LT= lower two-thirds (all but distal tip)

portions of each fragment. The breakage categories and patterns for each group (A1 and A4) are discussed next.

Table 15 contains data on only 73 of the 100 A1 specimens. This total includes neither the 24 specimens that are completely intact (four of which were never finished) nor the three thermally fractured specimens. Of the 73 broken specimens, 35 (48%) are missing the distal tip. All but four of these 35 have transverse snap fractures. The four atypical specimens have acutely angled snap fractures. Of the 73 broken specimens, 41 (56%) are missing one or both barbs. Most of the barb fractures are snap fractures. Of the 73 broken specimens, 13 have stem fractures. Of these, 11 (15% of broken A1 specimens) are missing only the lower few millimeters. Of the 73 fragmented A1 specimens, 18 (25%) are complete stem fragments. Two of these have triangular or wedge-shaped remnants of the blade. The remaining 16 have transverse snap fractures at the top of the stem.

Table 16 contains data on 81 of the 87 A4 specimens. This total does not include three definitely unfinished fragments, two thermally fractured fragments, or one indeterminate fragment. Of the 81 fragments, 35 can be classified as distal sections, 36 as medial sections, and 10 as proximal fragments. Of the 81, 36 (44%) are missing the distal tip, 37 (46%) are missing most of the stem, and 26 (32%) are missing one or both barbs. It should be noted that 7 of the 10 proximal fragments are narrow pointed fragments that this author feels are more likely to be stem sections than distal tips. Conversely, the 16 distal fragments that are missing the lower two-thirds are pointed and appear most likely to be distal sections rather than stem fragments. As with the A1 specimens, except for a small number of acute snap fractures, all specimens have transverse snap fractures.

The fact that almost all of the A1 and A4 fragments have transverse snap fractures is interesting. Two technological factors, thinness and heat treatment, may contribute to the breakage pattern. The complete A1 specimens averaged less than 3 mm in thickness. This author has found thin flakes to be much more susceptible to snap fracture than thicker flakes or other thick artifacts. The heat treatment noted on many **Perdiz** points also increases the brittleness of chert. Given that the **Perdiz** arrow point is an extremely fragile projectile tip, breakage can be expected to have resulted from almost any stress. The susceptibility to breakage may have been compensated by the fact that **Perdiz** points are simply made from relatively small flakes and are thus cheap and easy to manufacture (in terms of raw material and effort).

A study of combined breakage data (Tables 15 and 16) reveals that many of the smaller arrow point fragments were not recovered. For example, 71 fragments were missing the distal tip, yet only 16 (23 counting the pointed "proximal" fragments) tips were recovered. At least 83 barb fragments are missing; none were recovered. The absence of these tiny fragments is no doubt due to the use of 1/4-inch mesh screening. The stem fragments are better represented; 39 fragments are missing most or all of the stem, and 28 stems were recovered.

More of the stem fragments consisted of the entire stem rather than only the lower section of the stem which suggests that the 41 JW 8 specimens were hafted similarly as the known examples (Jelks 1962; Olds 1965). Some fragments are missing only the lower portion of the stem (14 specimens). These are comparable to the 41 LK 67 specimens and may as Brown suggests be due to lateral stress on impact.

If Brown is correct, the transverse snap fractures noted on a large majority of the 41 JW 8 arrow point fragments are largely related to impact stress. The recovery of numerous distal and medial sections at the site suggests that the projectile impact either occurred at the site or that the target animals were brought back to the camp. The latter is evidenced by the relatively large quantity of medium to large mammal bones recovered from the site.

SOILS CHEMISTRY

Soils chemistry is a nonartifactual form of analysis which can provide important supplementary data for the interpretation of an archaeological locality. While some initial attempts have been made to analyze chemical aspects of archaeological site sediments in southern and south-central Texas (Black and McGraw 1985), very little comparative data is currently available for the region. Black and McGraw (1985) discuss this problem and make some comparisons between the soils chemistry results from the Panther Springs Creek site (41 BX 228) and the few other south-central Texas sites for which there is data. Over most of south Texas almost no previous studies have been done.

The soils chemistry work reported herein is thus somewhat of a pioneering study in the region. A major purpose of this study is simply to demonstrate that soils chemistry is effected by the hunters and gatherers who occupied 41 JW 8 and many other similar localities in southern Texas. If the changes in soil chemistry can be linked to cultural occupations and features, then this type of analysis has a definite potential application in future research in the region.

At 41 JW 8 we are dealing with a known prehistoric locality and recognizable cultural features. The soils chemistry samples were collected from known rather than unknown contexts, thus the excavations guided the soils chemistry testing. If it can be demonstrated that the prehistoric occupations are marked by changes in soil chemistry and that particular features are associated with soil chemistry anomalies within the occupation zone, we can suggest that future studies attempt to use soils chemistry testing to guide excavations.

SOILS CHEMISTRY BACKGROUND

Shackley (1975) has discussed the application of soils chemistry to archaeological problems at some length. Among the possible changes in soils chemistry due to human occupation are changes in soil ph, organic matter content, and phosphate content to name but a few. Of these, phosphate distribution has proven to be the most effective indication of human activity and was chosen as the major soils chemistry method used in this study.

It has long been known that the distribution of phosphate is influenced and often concentrated by man's activities. Animal and plant tissue, teeth, bones, and excrement all contain phosphorus in the form of orthophosphate (Lewis 1978). In calcareous soil conditions, such as those present at 41 JW 8, calcium phosphate compounds are formed when orthophosphates are added to the soil. These compounds are insoluble and tie down the phosphate and prevent lateral or vertical migration under most conditions. Thus, an area where man has deposited organic materials and wastes can be expected to have more phosphate than an unoccupied area. This fact has been used for many years to help determine the nature of man's land use in many different parts of the world. Black and McGraw (1985) summarize and provide references for the use of phosphate analysis to document man's activities.

METHODS

With the exception of the soils chemistry results obtained during the pollen pretesting, all of the soils chemistry analysis was conducted by the author. The methods that are briefly outlined are obtained from Dr. Donald R. Lewis in a two-part archaeometry course (ANT 6973) offered at the graduate level by the UTSA Anthropology Department. Dr. Lewis supervised the author's work and provided invaluable advice. Most of the details of the methods outlined are derived from detailed papers prepared by Dr. Lewis. The work was conducted in the Archaeometry Laboratory at the UTSA.

Phosphate Spot Testing

Phosphate spot testing is a relatively quick, inexpensive method of determining if phosphate is present and if so, in what relative quantity. The method has been widely used in archaeological applications and is discussed in detail by various authors (Woods 1975; Eidt 1977, 1984; Lewis 1978).

In brief, spot testing involves the placement of a small quantity of soil (100-200 mg) on a circular paper filter, adding drops of two chemical solutions at carefully measured time intervals and watching the resulting reaction. Samples without phosphate will not stain the filter, while samples with large quantities of phosphate will turn the central portion of the filter very dark blue. Two minutes after the last solution is added, the final evaluation of the spot test ranking is made. All of the 41 JW 8 samples were stabilized at the two minute mark by dipping the stained filter into a solution of sodium citrate. The stabilized filters retained the approximate color intensity at the time of stabilization for several months. Two years later, the colors are faded, however, the filters can still be compared for relative values.

The spot test ranking is based on four parameters: the length of time before blue appears, the approximate closure of the blue ring around the sample, the length of the color rays extending out from the sample, and the intensity of the color (Woods 1975). The author attempted to use this rating system, but found that all of the samples collected within the occupation area at 41 JW 8 had considerable quantities of phosphate, turned blue instantaneously, and had complete ring closures. The length of the color rays were discovered to be partially a function of the quantity of soil used. Thus, the intensity of the color was the only factor that could be used to distinguish most of the samples. It was found that the stabilization allowed the visual comparison of all the samples. The spot test ranking given, as follows, was based on a side-by-side visual comparison. A ranking of one indicates very little phosphate whereas a six indicates a very high quantity of phosphate.

During the spot testing it was observed that the quantity of soil had some effect on the size of the area of the filter that was covered by blue. A simple experiment was conducted using four soil samples (from the same provenience) that varied between 10 and 40 mg. Each sample was processed and the resulting filters compared. While all four had equally intense coloration, the size of the resulting stain increased with quantity. This experiment suggests that while 10-20 mg of soil is an adequate sample, size consistency is important for accurate comparisons.

Total Phosphate Determination

A more accurate determination of the quantity of phosphate present in soil can be made using more sophisticated chemical procedures. As noted by Lewis (1978), phosphate can be divided into three fractions or types, labile, bound, and mineral. The process of fractionation yields the total phosphate determination and the percentage of each constituent fraction. This method is time consuming, and it requires considerable equipment. However, the percentage of the phosphate fractions allows a more thorough understanding of the nature of the activities which resulted in the phosphate distribution.

Alternatively, the total phosphate can be determined by using spectrophotometric techniques. Basically this involves extracting phosphate from a soil sample, adding a colormetric reagent to form a blue color, and measuring the intensity of the blue color using a spectrophotometer. The quantity of phosphate is determined by comparing the spectrophotometer readings of the soil samples with the readings obtained on a series of samples of known phosphate content. The basic method was developed to determine the phosphate content of natural water (Murphy and Riley 1962). This method has been modified by Lewis to fit the nature of the samples (soil instead of water) and adapted for the equipment available at the CAR Archaeometry Laboratory. A detailed outline of the method is on file at the CAR.

Results

Table 17 provides the phosphate data for all of the processed samples. Phosphate spot tests were conducted on 42 samples. The total phosphate amounts were determined for 22 of the 42 spot tested samples. The data show a great deal of consistency as well as patterning that can tentatively be linked to the prehistoric occupation.

It is significant that the highest spot test rankings and total phosphate quantities occur within the most intensive occupation zone, the WTA, as defined by excavation and from the cultural features. The two off-site columns, the Noise Pit South (NPS) and the Wheat Field Noise Pit (WFNP), had

TABLE 17. PHOSPHATE TESTING RESULTS

Lot Number	Provenience	Spot Test Ranking	Total Phosphate ppm
	F.5 A.I. (0,0)	6	2342/2392
	F.5 A.I. (0,-10)	6	
	F.5 A.I. (0,-20)	4	
	F.5 A.I. (0,-50)	5	
	F.5 A.I. (0,10)	6	1144
	F.5 A.I. (0,150)	4	499
	F.5 A.I. (0,200)	4	573
	F.5 A.I. (-10,0)	6	
	F.5 A.I. (-50,0)	4	
	F.5 A.I. (-100,0)	4	798
	F.5 A.I. (-150,0)	3	
	F.5 A.I. (10,0)	6	
	F.5 A.I. (20,0)	6	
361	WTA Col. 1, L.1	5	893
362	WTA Col. 1, L.2	5	895
403	WTA Col. 1, L.3	4	717
451	WTA Col. 1, L.4	3	298
363	WTA Col. 2, L.1	5	1348
378	WTA Col. 2, L.2	5	764
402	WTA Col. 2, L.3	4	
452	WTA Col. 2, L.4	2	179
489	WFNP Z.1	1	
491	WFNP Z.2	1	20
493	WFNP Z.3	1	
500	NPS Z.1	1	
490	NPS Z.2	1	55
502	NPS Z.3U	1	
507	NPS Z.3L	1	
501	N80 E102 Z.1	3	
498	N80 E102 Z.2U	3	
504	N80 E102 Z.2L	2	
508	N123 E105 Z.1	5	
495	N123 E105 Z.2	3	282
505	N123 E105 Z.3	2	
405	F.6A	5	1397
406	F.6B	4	868
400	F.6C	6	1493
401	F.6D	4	796/808
404	F.6E	6/6	1529/1597
407	F.6F	5	649
496	F.8	5	762
242	N96 E82 L.2 rock cluster	3	

Note: ppm = parts per million; A.I. = Axial Interval; WTA = Wagon Trail Area; WFNP = Wheat Field Noise Pit; NPS = Noise Pit South; U = Upper; L = Lower; L. = Level the lowest phosphate quantities. In fact, the samples from these areas had almost no phosphate. It is particularly interesting to note that the samples from the middle of a fertilized wheat field registered the lowest total phosphate determination of the 22 samples.

Within the samples collected from the occupation area, several patterns are apparent. The four columns (WTA Columns 1 and 2, N80 E102, and N123 E106) all show a decrease in phosphate with depth. This is consistent with the fact that the prehistoric occupation was concentrated within the upper three levels (equivalent to Zones 1 and 2). The WTA columns indicate higher phosphate quantities than the other two columns. This is consistent with the fact that much greater quantities of cultural material were recovered in the WTA. Within the WTA, the highest phosphate quantities are associated with Features 5 and 6, the two definite cooking features (hearths).

A comparison of the phosphate spot tests ranks with the total phosphate determinations (Table 18) shows that while the average of each rank is progressively higher in total phosphate the ranges of the upper three categories partially overlap. This suggests that spot test differences of only one rank cannot be considered significant unless backed by total phosphate determinations. The fact that the rank averages are consistent suggests that spot testing is a valid method of determining overall relative quantities.

Two different total phosphate determinations were made on three samples as shown in Table 17. In each case the two determinations are in close agreement. However, it should be noted that the paired determinations were made from different concentrations of the same soil extract. Thus, no attempt was made to take subsamples of a soil sample and run a complete extraction and determination of each. In all likelihood, given the variation in phosphate content of the samples from different areas within Feature 6, subsampling would result in greater variation.

AXIAL INTERVAL SAMPLING

Axial interval sampling, as outlined in Section III, was an experimental method of obtaining soil samples for phosphate testing in and around key features. Feature 5, a cluster of burned rock and charcoal (see Section VIII) was selected as a trial case for axial interval sampling. In brief, this involved superimposing a two-dimensional grid centered over Feature 5 and colleting small soil samples (75 cc) at intervals within and around the feature. The grid was oriented on cardinal directions. The samples were identified by cartesian coordinates that reflect the distance in centimeters from the midpoint (0,0). The north-south grid line was designated the X-axis and the east-west grid line the Y-axis. The first coordinate was a positive number north of the midpoint, and the second coordinate was a positive number east of the midpoint. Thus, sample (0,200) was collected 2 m due east of the midpoint, while sample (-150,0) was collected a meter and a half due south of the feature midpoint.

Figure 15 illustrates the axial interval sampling conducted at Feature 5. Phosphate spot tests were done on all of the axial interval samples. Figure 15 shows that the quantity of phosphate is much higher within and immediately

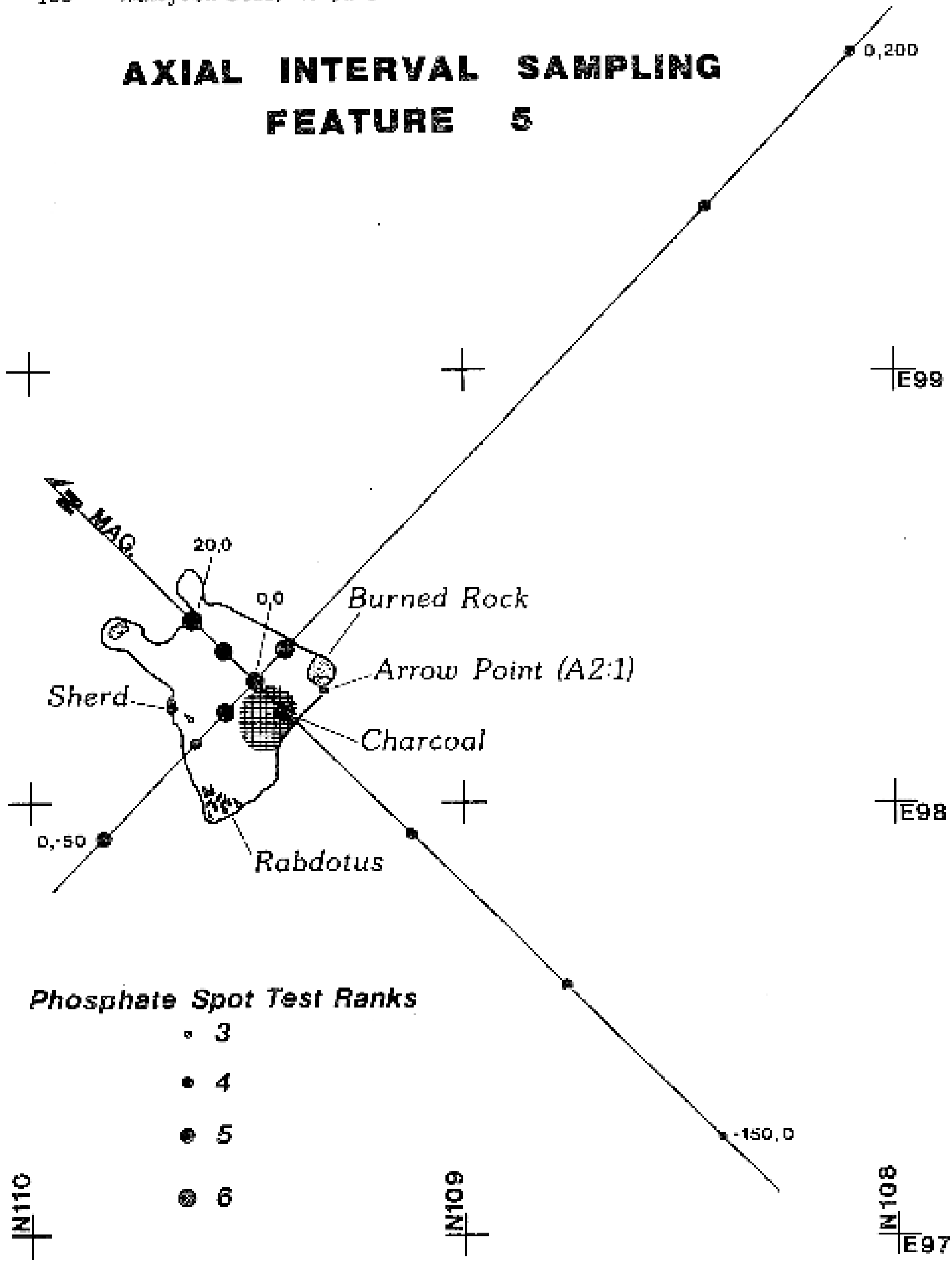

Figure 15. Axial Interval Sampling, Feature 5.

TABLE 18. A COMPARISON OF SPOT TEST RANKS TO TOTAL PHOSPHATE

Spot Test Rank	Total Phosphate High	Low	Average	Sample Count
6	2392	1144	1750	6
5	1397	649	958	7
4	868	499	722	7
3	298	282	290	2
2	179	179	179	1
1	55	20	38	2

adjacent to the central feature area than in the surrounding area. The highest total phosphate reading from the site was from a sample collected in the center of Feature 5.

ADDITIONAL SOILS CHEMISTRY

Fourteen soil samples were submitted to the Soil Testing Laboratory at Texas A&M University by Richard Holloway, the project pollen analyst. The purpose of this test was to determine the likelihood of pollen preservation as discussed in Section VII (Pollen Analysis). A secondary benefit is that the tests provide additional soils chemistry data from 41 JW 8. Table 19 presents the results of these tests. The Soil Testing Laboratory provides a standardized report that rates the amount of key chemical constituents based on agricultural usages. Most of the results are reported in parts per million (ppm). Each test category is briefly discussed next.

The soil pH of the 14 samples ranged from 7.7 to 8.1, a fairly consistent range of mildly alkaline readings. The soil phosphorus readings were of limited value because the maximum detection level was 150 ppm, and most of the samples measured over this. As expected, the samples from the Noise Pit South averaged significantly lower in phosphorus than the samples from the site area. One unusual anomaly was reported. The WTA Col. 1, L.2 sample (Lot 362) was found to have only 11 ppm of phosphorus. This figure does not agree with the other samples from the WTA and with the total phosphate determinations made by the author. It is assumed that the Soil Testing Laboratory result is in error.

Nitrogen levels ranged from 3 to 18 ppm and showed no particular patterning. Potassium levels ranged from 372 to 560 ppm. Magnesium levels ranged from 305 to 756 ppm. Both potassium and magnesium had higher average amounts from the WTA samples as opposed to the Noise Pit South. The calcium readings were all over the maximum detection level, 4000 ppm, indicating very calcareous soils. The percentage of organic matter ranged from 1.00% to 6.40%. The WTA samples had a higher average organic matter content than the Noise Pit South

TABLE 19. SOILS TESTING LABORATORY RESULTS

					ppm			
Lot Number	Provenience	pH	Phos-phorus	Nitro-gen	Potas-sium	Magne-sium	Cal-cium	Organic Matter
361	WTA Col.1 L.1	7.8	>150	3	560	395	>4000	1.86%
362	WTA Col.1 L.2	7.9	11	3	532	405	>4000	1.93%
403	WTA Col.1 L.3	7.9	>150	16	468	440	>4000	1.65%
451	WTA Col.1 L.4	7.9	133	11	408	455	>4000	1.72%
500	NPS Z.1	7.8	48	3	428	360	>4000	2.32%
490	NPS Z.2	7.8	36	3	380	305	>4000	1.00%
502	NPS Z.3U	7.7	35	3	372	365	>4000	1.37%
405	F.6 (A)	7.8	>150	3	512	420	>4000	2.48%
404	F.6 (E)	7.9	>150	16	756	500	>4000	6.40%
407	F.6 (F)	8.1	>150	3	492	440	>4000	2.16%
307	F.5 (S. 1/2 U)	7.8	>150	5	468	435	>4000	3.28%
309	F.5 (S. 1/2 L)	7.9	>150	18	508	480	>4000	3.28%
497	F.8 upper	8.0	>150	3	396	410	>4000	1.44%
488	F.8 lower	8.0	>150	3	460	475	>4000	3.64%

samples. Within the WTA, the feature samples had noticeably higher organic matter readings than the nonfeature samples. It should be noted that the organic matter readings reflect only the available carbon, hence, most of the additional carbon provided by charred botanical materials was not measured (R. Holloway, personal communication).

In summary, the soil testing results from Texas A&M confirm trends noted in the phosphate testing conducted by the author. The fact that phosphorus, potassium, magnesium, and organic matter readings all average higher from the intensively occupied site area (the WTA) than the off-site area (the NPS) suggests that the prehistoric occupation at the Hinojosa site significantly altered the overall soil chemistry.

CONCLUSIONS

The phosphate testing of soil samples from 41 JW 8, although limited in scope, provides a basis and some supporting data for the hypotheses which follow. The hypotheses are the tentative conclusions or interpretations of the 41 JW 8 data.

1. Intensively occupied Late Prehistoric hunter and gatherer sites in southern Texas have much higher phosphate concentration than adjacent nonsite areas.

2. Certain types of cultural features such as cooking hearths result in very localized phosphate anomolies (extremely high concentrations).

3. Spot tests are adequate for defining occupation zones but must be combined with total phosphate determinations to accurately define anomolies within intensively occupied site areas.

4. Intensive prehistoric occupation areas may also show increased quantities of other aspects of soils chemistry such as magnesium, potassium, and organic matter.

Future researchers in the region will have the opportunity to test the above hypotheses and to expand the application of phosphate testing in southern Texas. One potential approach would be the use of spot tests on soil samples collected from shovel tests. The use of a systematic method of shovel test location, such as transect or grid sampling, should allow accurate determination of the intensively occupied site areas.

The total phosphate determination methoc could be used within an intensively occupied zone to define anomalies caused by cultural features. Phosphate tests from samples associated with other types of cultural features (in addition to hearths) may also demonstrate anomalies. A fractionation study of various cultural features might provide more specific functional evidence.

It should be noted that the Hinojosa site is comparatively recent in contrast to many sites in southern Texas. It remains to be seen whether the high phosphate readings found in intensive occupation zones and some cultural features at the Late Prehistoric site of 41 JW 8 are also found at Archaic sites in the region.

WATER SEPARATION

Fifty-eight soil samples were collected at the Hinojosa site for the purpose of recovering cultural materials missed by the use of 1/4-inch mesh screening. These soil samples consist of feature matrix samples, on-site control column samples, and off-site control column samples. The samples ranged in volume from two liters to more than six liters. A two-liter sample from 29 of the soil samples was processed using water separation techniques. The major goal of the water separation program was to recover microfauna and charred botanical remains.

The experience gained in previous attempts at flotation (Black and McGraw 1985) guided the 41 JW 8 water separation program. McGraw constructed a flotation device at the CAR laboratory nicknamed the "Izum of Texas." This device is a modified version of the Davis and Wesolowsky (1975) original Macedonian "Izum" with certain improvements suggested by the Bodner and Rowlett (1980) flotation system. Detailed plans of the device are on file at the CAR.

The water separation device is built around two 55-gallon drums positioned such that the first drum is higher than the second. The first barrel has a metal rebar rack about 10 inches below the top on which a wooden sluice box is placed. The sluice box has a stainless steel fine mesh screen bottom and six-inch wooden sides. One end of the box is only four inches high and has a metal lip that extends outward for several inches. One side of the first barrel has a wide notch cut six inches deep into the top edge of the barrel to which has been soldered a sheet metal spillway. The sluice box is placed in the first barrel so that the metal lip extends out over the metal spillway. The second barrel is placed under the metal spillway to catch water overflowing the first barrel. The second barrel has a metal rebar rack a few inches below the top on which is placed a shallow tray with a stainless steel fine mesh screen bottom. Water enters the system through a relatively low pressure hose attached to a squared-off S-shaped plastic pipe device that is lowered into the first barrel. The pipe device forces the water stream upward and allows directional control of the water stream. An assortment of small drainage hoses are connected to both barrels at various depths to control the water level and to allow drainage.

The system works most effectively when both barrels are full of water and the water intake matches the outtake. One person can manage the system, although two people make it much easier. The water separation procedure is begun by slowly adding a measured amount of soil (two liters) into the sluice box while a gentle stream of water is directed with the pipe device through the bottom of the box. Most of the soil quickly washes through the fine screen and sinks to the bottom of the barrel. The material with a specific gravity less than that of water, the light fraction, floats to the top, while the heavy fraction stays in the bottom of the sluice box. The light fraction materials follow the water flow over the metal lip of the box, across the spillway, and into the shallow tray in the second barrel. After all of the soil has been removed from the sluice box and all of the floating materials have washed into the second barrel, the sluice box and shallow tray are emptied into other shallow trays with fine mesh screen bottoms. A fine stream of water is useful in washing all of the materials out of the collecting box and tray and into the drying trays.

The resulting light and heavy fractions are allowed to dry for several hours and then placed in separate containers (bags, jars, or vials). The light fraction usually consists of roots, small snail shells, charcoal, charred seeds, and occasionally pieces of bone. The heavy fraction usually consists of rock fragments, flint flakes, larger snail shells and fragments, pottery shords, water-logged charcoal, bones, and baked clay lump fragments. Feature matrix samples usually had large quantities of both fractions while the off-site samples rarely had anything other than a few roots and snails.

Using two people, it took 6 to 12 minutes per two-liter sample from the beginning to the drying rack, once the system was working properly. The samples with higher clay content were noticeably more time consuming than sandy loam samples. When the set up and clean up time is added in, the actual time spent per sample is between 15 and 20 minutes. A full-time water separation program with an adequate number of drying screens could achieve much more efficent processing times.

One of the most important factors in evaluating a water separation system is the flotation recovery rate (Wagner 1982). Wagner developed a simple and inexpensive method of testing flotation rates using charred poppy seeds.

This method involves the addition of a known quantity of charred poppy seeds into a measured soil sample prior to processing. During the sorting process, the poppy seeds are counted and compared to the initial count. The resultant ratio can be used to compare the recovery efficiency of various systems. All the processed samples had either 25 or 50 poppy seeds added. Virtually all of the recovered seeds were found in the light fraction as would be expected. The recovery rate was calculated for 10 of the samples and ranged from a low of 36 out of 50 to a high of 25 out of 25 and averaged 81%. The actual recovery is probably somewhat higher, but some samples had tremendous quantities of charcoal which hindered the search.

A total of 23 of the processed samples was sorted several months after processing. Time was not available to completely sort out all of the various constituent materials, hence only the microfauna and charred seeds were extracted. Even so, the sorting process is extremely time consuming. A sample from the occupation area required one to three hours to sort depending on the nature of the sample. Of the faunal materials, only identifiable bone was pulled (i.e., complete bones, teeth, or bones with articular ends). Many samples had literally thousands of tiny bone fragments.

Table 20 provides data on various aspects of the water separation samples, including provenience, sample size, poppy seed recovery, and cultural material recovery. The relative amounts of some cultural materials are given to indicate the nature of the sample.

The 41 JW 8 water separation efforts were very limited in scope. The potential value of the approach is demonstrated by the resulting botanical data alone (Section VII: Analysis of Macrobotanical Materials). Steele (Section VII: Analysis of Vertebrate Faunal Remains) made some use of the microfauna recovered from the water separation at 41 JW 8 and has elsewhere emphasized the importance of fine screen samples for faunal interpretations (DeMarcay and Steele 1986). However, it should be emphasized that to make the most effective use of water separation at a southern Texas archaeological site we are going to have to devote a great deal more time and energy to this type of analysis. Larger samples from more widespread contexts will be necessary as well as complete processing, sorting, and analysis. These efforts will be expensive and very time consuming. The potential benefits are more complete subsistence and environmental data.

It has been argued (Section IV and Hall, Black, and Graves 1982) that most of the prehistoric inhabitants of inland south Texas relied more on plant resources than animals for basic subsistence. This is a difficult assertion to prove, largely because we have so little solid information on the plant remains in southern Texas sites. Limited water separation analysis at 41 BX 228 (Black and McGraw 1985) and 41 JW 8 have demonstrated that charred botanical remains are indeed present in at least some Archaic and Late Prehistoric contexts in the region.

Similarly, it has been argued that climatic changes in southern Texas are at least partially responsible for some of the cultural changes that have been observed (Gunn **et al.** 1982, and this report). One of the more effective ways of examining climatic or environmental change or stability is through examining the floral and faunal changes through time. This report

TABLE 20. WATER SEPARATION DATA

Lot Number	Provenience	PS	HB	MF	CS	FF	CH	SN
		Items of Recovery						
363	WTA Col. 2 L.1			X	X	X	X	X
378	WTA Col. 2 L.2		X	X	X	X	X	X
402	WTA Col. 2 L.3	22/25		X	X	X	X	X
452	WTA Col. 2 L.4	22/25		X	X		F	X
500	NPS Z.1				?			X
490	NPS Z.2U				?			X
502	NPS Z.3U						F	X
507	NPS Z.3L							X
508	N123 E106 Z.1			XX	X	X	X	X
495	N123 E106 Z.2			X			F	X
505	N123 E106 Z.3	25/25		X			F	X
132	F.1		X	X	?	X	X	X
133	near F.1	21/25	X	X	X		X	X
181	F.2	39/50		X	X	XX	X	X
243	F.4	40/50					F	X
307	F.5		X	XX		X	XX	X
308	F.5		X	XX	X	X	X	X
290	F.6	36/50	X	XX	XX	X	X	X
399	F.6			XX	X	XX	XX	X
359	near F.6	23/25		X	X	XX	X	X
356	F.7	38/50		X		XX	X	X
494	F.8	38/50	X	X	X	X	XX	X
496	F.8		X	XX		XX	XX	X

Note: PS = poppy seed, HB = burned hackberry seeds, MF = microfauna, CS = charred seeds, FF = flint flakes, CH = charcoal, sn = land snails, X = present, XX = numerous, F = flecks, ? = uncertain.

demonstrates that faunal materials, in particular the smaller fauna that is best recovered through fine screening, can provide environmental data.

POLLEN ANALYSIS (Richard G. Holloway)

INTRODUCTION

Fourteen soil samples from 41 JW 8 were sent for analysis to the Palynology laboratory at Texas A&M University. These samples were obtained from a column in the main excavation area, three features in the main area, and a column from an off-site area for testing.

METHODS AND MATERIALS

Prior to chemical extraction of the pollen, the samples were sent to the soil testing laboratory at the Texas Agricultural Experiment Station located on the campus of Texas A&M University. The results of this analysis are presented in Table 19. On the basis of the soil test results, it was decided to analyze four of these samples. The four chosen for further analysis were: (1) Lot 362, WTA Col. 1, L.2; (2) Lot 404, F.6E; (3) Lot 309, F.5, lower south one-half; and (4) Lot 488, F.8, charcoal cluster.

Thirty (30) mls of soil was initially treated with 10% HCl to remove carbonates. The residue was screened through 150 mm mesh screen and treated with 70% HF overnight to remove the silicates. Remaining inorganic particles were removed by heavy density separation using $ZnCl_2$ (S.G. 1.99-2.00). A second treatment of $ZnCl_2$ was used to attempt to reduce the large organic fraction. The residue was acetylated (Erdtman 1960) to remove extraneous organic particles, dehydrated using an ethanol series, and transferred to 1000 cs silicon oil with butanol. The pollen residue was examined under the microscope using 400X magnification.

RESULTS AND DISCUSSION

After screening two slides, only a few isolated pollen grains were encountered. These represented low spine composites and a few oak grains. These grains are extremely resistant and, thus, would have been expected. A large number of fungal spores and additional plant debris were encountered. These 14 samples all had extremely low percentages of organic matter (Table 19) in addition to having a high pH. These two characteristics made the recovery of pollen problematic, at best.

Some pollen was present in the sample but because of the heavy concentration of other plant materials, the pollen could not be concentrated in the residue. Any attempt at oxidation of the plant debris would have likewise oxidized the pollen grains. Additional attempts at heavy density separation would likely have proved futile as the plant materials and pollen have essentially the same specific gravity. Additionally, pollen might have been trapped and held within the solution by the larger plant particles.

This problem of little pollen recovery coupled with excessive organic material is quite common throughout central and south Texas. Pollen samples were examined from a number of archaeological sites thoughout this area (Bryant and Holloway 1985) with the same results. Additionally, high pH values associated with these soils would have served to severely reduce the probability of pollen recovery (Holloway 1981).

It is indeed unfortunate that a better understanding of the paleoenvironmental conditions of this site were not possible. The high pH values, extremely low quantity of organic material, and the inability to sufficiently concentrate the pollen residues, all preclude the analysis of the fossil pollen from this sample.

BIOSILICA ANALYSIS (Ralph L. Robinson)

Poor preservation of organic microfossil and macrofossil evidence of prehistoric vegetation has hampered efforts to reconstruct paleoenvironments in many areas of Texas, including the geographical area in which the study area is located. The Hinojosa site, 41 JW 8, is in an ecotone between the western margin of the Western Gulf Coastal Plain and the eastern margin of the Rio Grande Plain. Gould (1969) placed Jim Wells County in two vegetational regions, with a small portion of the eastern edge of the county in the Gulf Prairies and Marshes Region and the greatest part of the county in the South Texas Plains Region. Ecotones are ideal research areas because of the dynamic equilibrium of biotic communities.

Macrofossil evidence of silica accumulator biota--biosilica, or phytoliths as they are commonly known,--was found to be well preserved and abundant in the sediments of the Hinojosa site. Scanning Electron Microscopy (SEM) and Light Microscopy were used to analyze the biosilica assemblage extracted from four sediment samples. The biosilica assemblage was deposited by: the Poaceae (Grass Family); three grass subfamilies, the Panicoideae (tall grasses), the Pooideae (humid and/or cool environment grasses), and the Chloridoideae (short grasses); the cf. Cyperaceae (Sedge Family); at least three species within the Ulmaceae (Elm Family), **Ulmus crassifolia** Nutt. (Cedar Elm), **Celtis pallida** Torr. (Grajeno), and **Celtis** cf. **laevigata** Willd. (Texas Sugarberry); the Boraginaceae (Borage Family), **Ehretia** anacua (Teran and Berl.) I.M. Johnst. (Anacua); and the Spongillideae (Freshwater Sponge Family). Based upon the environmental requirements of the biota which produced this biosilica assemblage, it is suggested that the environment of the Hinojosa site at A.D. 1350-1400 was similar to that of today but with more available moisture. It is also suggested that the January mean minimum temperature was probably not below 36 to 40°F.

BIOSILICA ANALYSIS: MATERIALS AND METHODS

The materials and methods used in this analysis are discussed in five divisions: Processing of Sediment Samples, Processing of Flora and Fauna, Mounting of Samples for Light Microscopy, Mounting of Samples and Operating Procedures for Scanning Electron Microscopy, and Analysis Methodology.

Processing of Sediment Samples

Step 1. Sample Selection. Four sediment samples from the Hinojosa site were selected for processing. Samples 1, 2, and 3 were from Col. 1, and Sample 7

Note: Robinson did not complete the final stage of his analysis: the quantification of the biosilica assemblage from each sample. Thus, the interpretations in this section are based on relative impressions rather than statistically valid counting procedures. The sample provenience of the illustrated specimens (Figs. 16 and 17) has not been identified.

was from F.6. Table 21 summarizes Step 1 of the processing method and describes the samples. Before volume and weight measurements were taken, all roots and macrofossils except very small charcoal and snail shell fragments were removed and described.

Step 2. Removal of water soluble organic and inorganic compounds. Each sample was dispersed with a solution of 5.56 g of sodium hexametaphosphate per liter of distilled water and decanted after 1.5 to 3.75 hours of sedimentation. This step was repeated three times. Standard Sedimentation Tables were used in all stages of processing, including rinses.

Step 3. Removal of carbonates and the less than 5 µm fractions. Carbonates were removed in two stages: (a) 3% hydrochloric acid at room temperature for 2.5 hours; (b) concentrated hydrochloric acid was then added and heated at 100°C for 1.5 hours. Samples were stirred every 15 minutes during this step. The samples were then rinsed and decanted after sedimentation to remove the less than 5 µm fraction.

Step 4. Removal of organic compounds. A 3:1 mixture of concentrated nitric acid/saturated solution of sodium chlorate in water, heated at 100°C for 6.5 hours was used to remove organic compounds. Each sample was then rinsed five times with sedimentation time allowed to retain the greater than 5 µm size fractions.

Step 5. Exotic known. One **Lycopodium** spore tablet containing 12,500 ± 250 spores was added to each sample, dissolved with 10% hydrochloric acid, and rinsed to remove chlorides.

Step 6. Sedimentation. The *Step 2* dispersant solution was used to isolate and remove the 5 µm to less than 10 µm size fraction. Standard Sedimentation Tables were used. Dispersal and sedimentation were repeated 10 times, and the remaining fraction (10 µm and larger) was rinsed twice. The 5 µm to less than 10 µm fraction was then microscopically examined for biosilica.

Step 7. Heavy density separation. A 2.3 specific gravity solution of zinc bromide, distilled water, and hydrochloric acid was used for the heavy density separation of biosilica from the heavier quartz and other minerals. The 10 µm and greater fraction was placed in bent, U-shaped sections of 3/8-inch (inside diameter) Nalgene clear plastic tubing. The amount of water present in each sample was calculated, and the necessary amount of 2.5 specific gravity solution was added to each sample and vortexed to bring the specific gravity to 2.3. The heavy liquid with a specific gravity of 2.3 was added, vortexed, and the tubing placed in a 50-ml centrifuge tube containing water. The samples were then centrifuged at 1500 gravities for 10 minutes. After centrifuging, the plastic tubing was removed from the centrifuge tube and clamped between the lower, heavy fraction and the upper, lighter fraction. This step was repeated three times. The light fraction of the samples, which contains the biosilica, and the exotic known was then placed in 250-ml centrifuge containers, diluted with water and hydrochloric acid to a specific gravity of less than 1.5, and decanted after centrifuging. After repeated rinses to remove the bromide and hydrochloric acid, the light fraction was transferred to three-dram glass vials. For a more detailed description of biosilica processing techniques, refer to Robinson (1982).

TABLE 21. SUMMARY OF STEP 1 OF BIOSILICA PROCESSING

Sample Number	Provenience	Lot Number	Biosilica Processing Number	Volume Processed	Weight of Sample (g)	Description
1	NTA Col. 1 L.1	361	192	10 cc	12.70	light gray, sandy loam; Celtis spp. seed, roots, and charcoal
2	NTA Col. 1, L.2	352	193	10 cc	12.70	light grey, sandy loam; snail shell fragments (Rabdotus spp.), worm casts and roots
3	NTA Col. 1, L.3	403	194	10 cc	13.90	light gray, sandy loam; snail shell fragments (Rabdotus spp.), complete snail shell, discoidal, whorls on same plane; rodent bone and roots
7	F.6 (matrix area B)	406	165	10 cc	13.80	light gray, sandy loam; snail shell fragments (Rabdotus spp.), mammal bone fragment, roots and charcoal

<u>Processing of Flora and Fauna</u>

During the past seven years an extensive comparative collection of biosilica has been prepared using the following methods:

A. Processing of Flora

<u>Step 1</u>. Plants are collected, identified, and pressed. A detailed record is kept in a permanent record log of exact location, collection date, soil type, and associated plants. Several plants of the same species are collected so that an example of the plant remains are on permanent file. Selected plant parts are removed, washed, dried at 100°C, and weighed.

<u>Step 2</u>. Phytoliths are separated from the plant tissues by oxidation using the same solution used in Step 4 of the sediment processing procedure, centrifuged to retain all size fractions, and rinsed.

<u>Step 3</u>. Phytoliths are stored in three-dram glass vials.

B. Processing of Fauna

<u>Step 1</u>. Sponges are collected, washed, and dried as detailed above. A record is kept in a permanent record log of collection date, location, and environmental conditions. Accurate identification can only be made after processing and microscopic analysis of spicules.

<u>Step 2</u>. Nitric acid is used to destroy the tissues, leaving only the diagnostic spicules and a few adhering diatoms and phytoliths. Samples are rinsed and centrifuged until all traces of acid are removed.

<u>Step 3</u>. The spicules are transferred to three-dram glass vials for storage.

<u>Mounting of Samples for Light Microscopy</u>

Two types of slides were prepared for light microscopy: (1) liquid, and (2) solid mounting media. (1) Several drops of the sample, biosilica in distilled water, were pipetted on a cleaned microscope slide, covered with a cleaned coverslip, and sealed with fingernail polish. (2) Several drops of the sample were pipetted on a cleaned coverslip and allowed to dry for several hours. Four drops of Permount were placed on a cleaned microscope slide and allowed to dry for several minutes to allow excess toluene to evaporate. The microscope slide was then inverted and placed on the coverslip, and allowed to dry. This method of mounting insures that the biosilica will be on one plane, on or near the coverslip, and therefore will require minimum racking of the microscope during transects. Liquid mounting media (1) was used for 41 JW 8 biosilica samples and comparative biosilica samples; solid mounting media (2) was used only for comparative biosilica samples. A Nikon Optiphot Microscope with Hoffman Modulation Contrast was used for all light microscopy.

Mounting of Samples and Operating Procedures for Scanning Electron Microscopy (SEM)

A cleaned glass coverslip was attached to a cleaned, polished SEM stub with double stick tape. Four drops of the sample were pipetted on the coverslip and allowed to dry for 12 hours at 90°C. This is an effective method of attachment as biosilica adheres to the glass coverslip as desiccation occurs. Carbon paint was applied to the upper edge of the SEM stub and the underneath side of the attached coverslip to enhance electrical conduction. This prevents the buildup of electrons and the resulting charging of samples. The samples were sputter coated with 20 nm of gold-palladium, using a Technics, Inc., Hummer. All photomicrographs were made on a Jeol-25S II Scanning Electron Microscope using Kodak Tri-X Pan film. The operating conditions of the SEM which remained constant are as follows: working distance of 10 mm, 190 m objective aperture, and zero degrees of tilt. Variable operating conditions such as keV of accelerating voltage, condenser setting, and magnification are listed in the captions of Figures 16 and 17.

Analysis Methodology

The analysis was conducted in five steps: 1. Light Microscopy Analysis, 2. SEM Analysis, 3. Classification, 4. Calculation of Biosilica Sum, and 5. Analysis of Spectra and Diagrams.

Step 1. Light microscopy analysis. Light microscopy of the 41 JW 8 biosilica and **Lycopodium** spores mounted in water was the first step of microscopic analysis. All samples were scanned in transects at 100X, 200X, and 400X. 1000X was used to examine individual, small phytoliths from grasses. As biosilica was observed, a probe was pressed against the coverslip, rotating the specimen so the morphology of all surfaces could be seen. Unusual types were drawn. Biosilica and **Lycopodium** spores were counted.

Step 2. SEM analysis. One 41 JW 8 sample (Sample 3) was selected for SEM analysis as light microscopy had revealed that a wide variety of diagnostic phytolith types were present. A four-drop sample of Sample 3 was scanned with the SEM, and 27 photomicrographs were taken of selected types of the hundreds of phytoliths examined. Biosilica counts were not made during SEM scans because: (1) the expense of SEM analysis; (2) many types of biosilica are difficult to identify without the observation of three-dimensional morphological characteristics which can be seen in a liquid mounting medium; and (3) SEM reveals only the external morphology of biosilica which is transparent in transmitted light, and internal morphology is valuable taxonomically. The wide range of magnification and the depth of field of SEM photomicrographs does make them extremely valuable for taxonomic analysis when used in combination with light microscopy.

Step 3. Classification. The types of biosilica observed during light microscopy and SEM were compared to comparative samples (II). Light microscopy was used to examine comparative samples in liquid and solid mounting media. Drawings made using light microscopy were utilized (Robinson 1982). Several hundred SEM photomicrographs were also utilized. Four of these photomicrographs are shown in Figures 16,a,c,d and 17,g. The types of biosilica observed were classified according to (1) three-dimensional morphology; (2) the tissues in which they were deposited **in vitro**; and (3) the taxa of organisms which produced the tissues (Table 22). The resolution of the taxonomic level of identification (family to species of organism) is dependent upon taphonomic variables and the diagnostic value of a type or suite of types (assemblages) which could be identified with certainty.

<u>Step 4</u>. The counts made during light microscopy are used to calculate a valid biosilica sum of the biosilica assemblage. The biosilica sum is converted into three types of spectra and diagrams: (a) relative frequency; (b) concentration or actual frequency; and (c) influx.

(a) Relative frequency is simply a percentage frequency of types of biosilica or the number of individual members of one type of biosilica divided by the number of individual members of all types of biosilica considered.

(b) The concentration of biosilica per cubic centimeter of matrix is calculated using the formula shown:

$$\text{Actual biosilica frequency/Biosilica concentration per cubic centimeter of sediment} = \frac{\text{\# of exotic added X biosilica counted}}{\text{\# of exotic added X volume of sediment}}$$

(c) The biosilica influx is the actual frequency of biosilica concentration deposited per square centimeter per year. Influx is calculated as follows:

$$\text{Biosilica influx per square centimeter per year} = \frac{\text{Actual biosilica frequency}}{\text{rate of sediment deposition (years/cm)*}}$$

*Biosilica influx calculations are limited by the assumption that depositional rates within a stratigraphic unit are uniform. High resolution stratigraphic analysis is necessary for high resolution biosilica influx values.

<u>Step 5</u>. Analysis of spectra and diagrams. The three types of spectra and diagrams are then analyzed to determine the type of community of silica-accumulating biota which produced the biosilica assemblage and therefore the local paleoenvironment or paleomicroenvironment. Relative vegetational biomass or change in vegetational biomass through time can be discerned with spectra and diagrams from reliably dated columns from stratified sediments. The carrying capacity of the environment can then be inferred from the relative biomass.

Figure 16. SEM Photomicrographs of Phytoliths from 41 JW 8 and Comparative Collection Plants.

a, comparative collection: **Tripsacum dactyloides** (L.) L., (Eastern Gammagrass), Poaceae, Panicoideae, Andropogoneae; bilobate panicoid short cell phytolith, ventral orientation length: 25 μm; 12.5 keV accelerating voltage, condenser setting 12;

b, Poaceae, Panicoideae; bilobate panicoid short cell phytolith, dorsal or ventral orientation, length: 17 μm; 15 keV accelerating voltage, condenser setting 12;

c, comparative collection: **Phalaris caroliniana** Walt., (Carolina Canarygrass), Poaceae, Pooideae (Festucoideae), Aveneae; elongate festucoid short cell phytolith, dorsal/lateral orientation, length: 27 μm; 12.5 keV accelerating voltage, condenser setting 12;

d, comparative collection: **Hordeum pusillum** Nutt., (Little Barley), Poaceae, Pooideae (Festucoideae), Triticeae; elongate festucoid short cell phytolith, dorsal/lateral orientation, length: 34 μm; 12.5 keV accelerating voltage, condenser setting 1;

e, Poaceae, Pooideae (Festucoideae); elongate festucoid short cell phytolith, dorsal/lateral orientation, length: 24 μm; 12.5 keV accelerating voltage, condenser setting;

f, Poaceae, Pooideae (Festucoideae); elongate festucoid short cell phytolith, ventral/lateral orientation, length: 83 μm; 12.5 keV accelerating voltage, condenser setting 1.

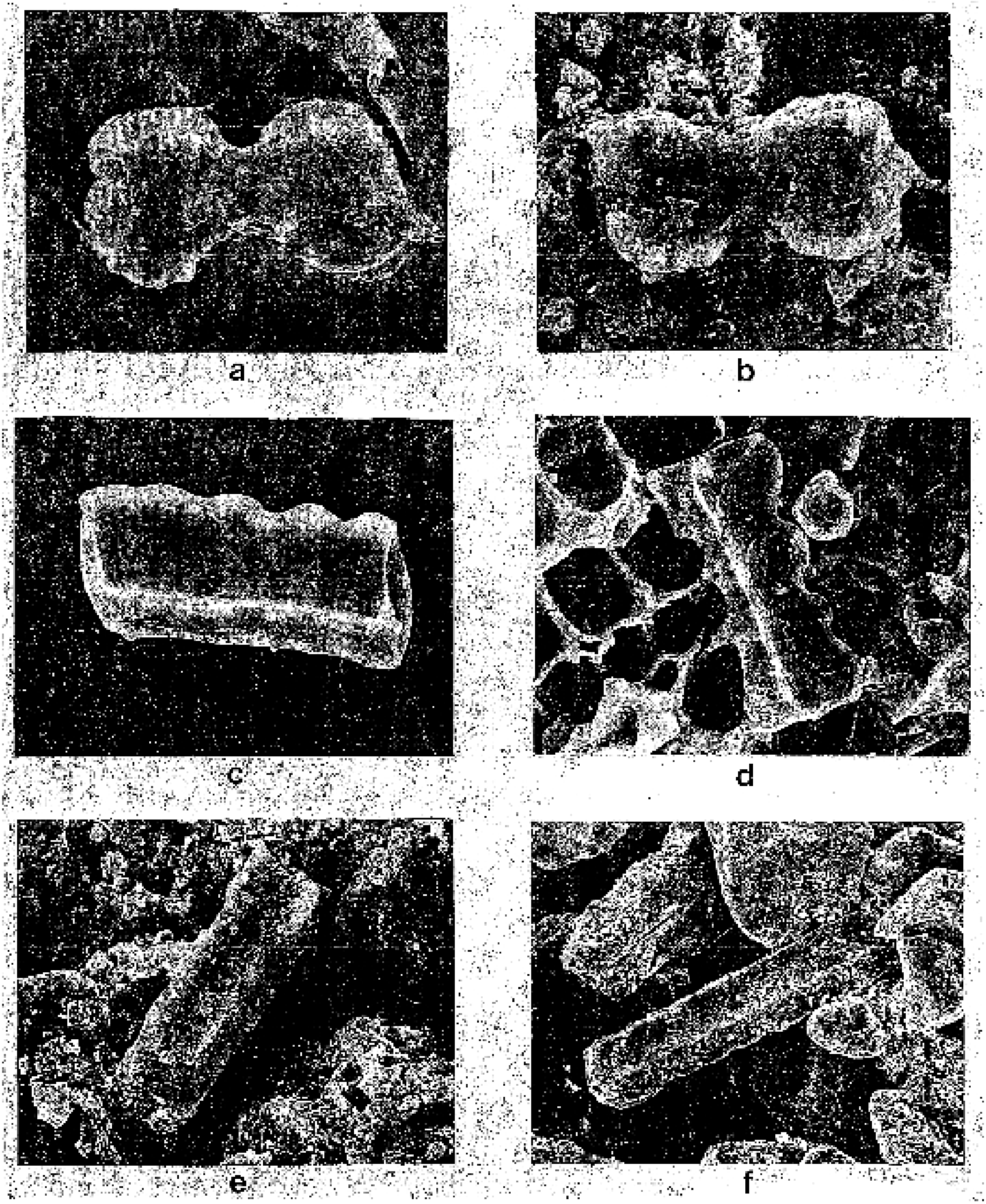
a
b
c
d
e
f

Figure 17. **SEM Photomicrographs of Phytoliths from 41 JW 8 and Comparative Collection Plants.**

a. comparative collection: **Phalaris caroliniana** Walt., (Carolina Canarygrass), Poaceae, Pooideae (Festucoideae), Aveneae; trichome, lateral orientation, length: 52 µm; 12.5 keV accelerating voltage, condenser setting 12;

b. Poaceae; panicoid or chloridoid bulliform cell phytolith, dorsal or ventral orientation, width: 47 µm; 12.5 keV accelerating voltage, condenser setting 1;

c. center: Ulmaceae, **Celtis** spp.; trichome base, dorsal or ventral orientation, width: 40 µm; t: Poaceae, Pooideae (Festucoideae); festucoid trichome, lateral orientation, length of base: 35 µm; 12.5 keV accelerating voltage, condenser setting 1;

d. center: Ulmaceae, **Celtis** cf. **laevigata** Willd., (Texas Sugarberry); trichome base with surrounding epidermal cells (tissue fragment), dorsal orientation, width: 31 µm; 12.5 keV accelerating voltage, condenser setting 1;

e. cf. Ulmaceae, **Celtis** spp.; trichome, dorsal orientation, width: 53 µm; 15 keV accelerating voltage, condenser setting 12;

f. Ulmaceae; trichome, dorsal orientation, width of base: 33 µm; 12.5 keV accelerating voltage, condenser setting 1.

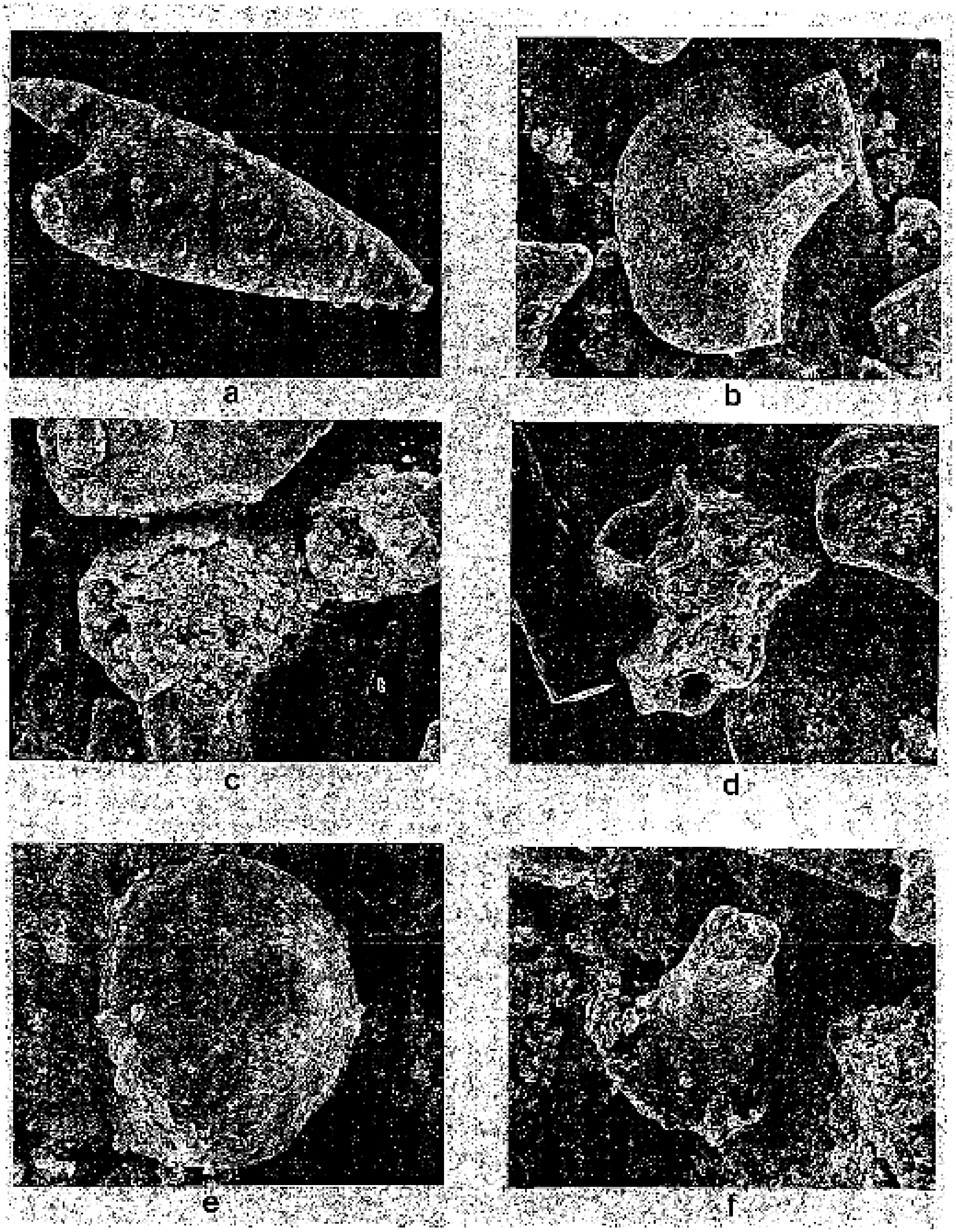
a
b
c
d
e
f

TABLE 22. TYPES OF BIOSILICA IN 41 JW 8 SEDIMENT

- Phytosilica
  - Vascular Plants—Phytoliths
    - Monocotyledoneae
      - Poaceae (Gramineae), Grass Family
        - Panicoideae, Subfamily of Tall Grasses, (C-4) 4-carbon photosynthetic pathway
          - Epidermal tissue
            - Panicoid short cells
              - Bilobates (Fig. 16,b)
              - Crosses
            - Tissue fragments
        - Chloridoideae, Subfamily of Short Grasses, (C-4) 4-carbon photosynthetic pathway
          - Epidermal tissue
            - Chloridoid short cells
            - Chloridoid bulliform cells
            - Tissue fragments
        - Pooideae (Festucoideae), Subfamily of humid and/or cool season grasses, (C-3) 3-carbon photosynthetic pathway
          - Epidermal tissue
            - Festucoid short cells
              - Conical
              - Elongate (Fig. 16,e,f)
              - Oblong
            - Trichomes (Fig. 17,c[t])
            - Tissue fragments
        - Poaceae, identified to taxonomic level of Grass Family
          - Epidermal tissue
            - Bulliform cells
            - Trichomes
            - Long cells
            - Tissue fragments
          - Mesophyll
        - cf. Cyperaceae (Sedge Family)
          - Epidermal tissue
            - Short cells
    - Dicotyledoneae
      - Ulmaceae (Elm Family)
        - Epidermis of Leaves
          - **Ulmus crassifolia** Nutt. (Cedar Elm)
            - Tissue fragments: trichome, trichome base with surrounding epidermal cells
            - Trichome
            - Trichome base
          - **Celtis pallida** Torr. (Granjeno)
            - Tissue fragments: trichome, trichome base with surrounding epidermal cells
          - **Celtis cf. laevigata** Willd. (Texas Sugarberry)
            - Tissue fragment: trichome base with surrounding epidermal cells
          - **Celtis spp.** (Hackberry)
            - Trichome (Fig. 17,e)
            - Trichome base (Fig. 17,e)
            - Tissue fragments (Fig. 17,d)
      - Ulmaceae, identified to taxonomic level of Elm Family
        - Trichomes (Fig. 17,f)
        - Trichome bases
        - Epidermal cells
        - Tissue fragments
      - Boraginaceae (Borage Family)
        - Epidermis of Leaves
          - **Ehretia anacua** (Teran & Berl.) I. M. Johnst. (Anacua)
            - Trichomes
            - Trichome bases
            - Epidermal cells
            - Tissue fragments
- Zoosilica
  - Spongillidae (Freshwater Sponge Family)
    - Megascleres (body spicules)

BIOSILICA ANALYSIS: RESULTS AND CONCLUSIONS

The results of this analysis are summarized in Table 22 and illustrated in Figure 16,b,e,f and Figure 17,h,i,j,k, and l. At this time, Step V of the analysis has not been completed; the results are a description of the assemblage of biosilica extracted from the 41 JW 8 sediments and the paleoecological implications.

As shown in Table 22, the Poaceae (Grass Family) is represented by phytoliths of several genera of the Panicoideae (tall grasses), several genera of the Pooideae (humic and/or cool environment grasses), and the Chloridoideae (short grasses). There is probably at least one genera of the Cyperaceae (Sedge Family) present. Phytoliths of two families of trees were identified, the Ulmaceae (Elm Family) and the Boraginaceae (Borage Family). The Ulmaceae are represented by **Ulmus crassifolia** (Cedar Elm), **Celtis pallida** (Granjeno), and **Celtis cf.** laevigata (Texas Sugarberry). One member of the Boraginaceae was present, **Ehretia anacua** (Anacua).

Spicules of the Spongillideae (Freshwater Sponge Family) were also observed. These aquatic animals were probably from Chiltipin Creek. As freshwater sponges attach themselves to available substrate, the spicules may have been introduced into the site sediment by local inhabitants in the act of bivalve mollusk procurement. I have found several freshwater sponges attached to the shells of living freshwater bivalves. The possibility also exists that the sponge spicules are present because of alluvial or aeolian deposition.

The biosilica assemblage from the Hinojosa site suggests an environment similar to that of today but with more available moisture. Most of the taxa identified are present in the South Texas Plains Region and/or the Gulf Coastal Plain Region in the modern environment. When individual taxa within the assemblage are considered, the presence of **Ehretia anacua** (Anacua) and the grasses in the subfamily Pooideae (Festucoideae) are especially important as environmental indicators. Anacua and the Pooideae grasses are extant in the modern environment.

Ehretia anacua (Anacua) is an indicator of paleotemperature, with a natural geographical range of: north to Hays and Travis Counties; east to Harris County; west into the South Texas Plains Region and the Mexican states of Nuevo Leon and part of Coahuila; and southward into the Mexican states of Tamaulipas, Guanajuato, and Veracruz (Correll and Johnston 1970; Vines 1977). A drought-resistant species, Anacua's main limiting environmental factor is temperature. At the northern boundary of its natural range, the Anacua is represented by a few, possibly relect, populations which are seasonally partially deciduous. The January mean minimum temperatures (JMMT) for Hays and Travis Counties are 40°F and 41°F, respectively. Planted as ornaments as far north as Dallas County with a JMMT of 36°F, the Anacua die in excessively cold winters (Correll and Johnston 1970). In the area of the Western Gulf Coastal Plain Region (Victoria County and part of Goliad County), where Anacua is most abundant (in Texas), the JMMT is 46°F. It is therefore suggested that the JMMT during the occupation of the Hinojosa site at A.D. 1350-1400 was probably not less than 36 to 40°F, or within 7 to 11°F of the present JMMT of 47°F for Jim Wells County. The possibility exists that winter temperatures went well below the projected means and that the population of Anacua was reestablished by surviving relect populations and/or that reestablishment took place because of the food procurement activities of man, as the drupes of Anacua are sweet and edible.

The grasses within the subfamily Pooideae (Festucoideae) are important indicators of mesic, cool season, or cool humid environments. Of the 523 species of grasses in the extant flora of Texas, only 86 native species and varieties are of the subfamily Pooideae. Of these 86 taxa, only nine have been found in the South Texas Plains Region, and 17 in the southwestern part of the Gulf Prairies and Marshes Region (Gould 1969). Phytoliths from those grasses are usually uncommon in modern soil samples from most regions of Texas. When found in samples of sediments from archaeological sites, they are usually part of the biosilica assemblages from mesic environmental conditions (Robinson 1982).

The biosilica assemblage from 41 JW 8 is very similar to assemblages from mesic periods at 41 GD 21, Coleto Creek, Goliad County, Texas (Robinson 1979); and 41 LK 31/32 and 41 LK 201, Choke Canyon, Live Oak County, Texas (Robinson 1982). Both of these areas of study are also on the western margin of the Western Gulf Coastal Plain in south Texas.

Additional interdisciplinary research in this area of Texas will prove or disprove the proposed mesic interval of approximately A.D. 1350-1400. The investigation of carbon isotope ratios of bone collagens of **Bison bison** from archaeological sites could provide an independent test. An increase of the Pooideae (C3) grasses in the diet of **Bison bison** should be detectable in the $^{13}C/^{12}C$ ratios of their bone collagens.

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Last, I would like to thank Suzanne G. Tool, College Station, Texas, for manuscript editing and typing.

VIII. CULTURAL FEATURE ANALYSIS

Three types of cultural features were recognized at the Hinojosa site: bone clusters, rock/charcoal clusters, and living surfaces. All three feature types are interpreted as occupational features. Most of the features were recovered from the main excavation block (Wagon Trail Area). Feature exposure and analysis were emphasized in the research design and during the project. Discrete cultural features, such as the features from 41 JW 8, are thought to represent activity loci during discrete occupational episodes. Thus, the careful exposure and analysis of these features can provide behavioral inferences concerning the activities resulting in the cultural features.

Nine features were formally recorded and assigned feature numbers in the field. Two additional features were designated as formal features and assigned feature numbers during the analysis. All features were carefully exposed, mapped, and photographed in the field. Matrix samples, axial interval samples, and charcoal samples were collected from some features as noted. All radiocarbon assays from the 1981 season were determined from feature charcoal. Each feature is described in detail. A summary of the interpretations and special studies is provided with each feature description. Further details are discussed in appropriate sections of this report.

BONE CLUSTERS

Five discrete bone clusters (recorded as four features) were recorded during the 1981 season. A bone cluster is simply a distinct concentration of bone. The bone clusters at 41 JW 8 were very well-preserved concentrations, tightly clustered, and with little or no evidence of surface exposure. All of the bone clusters are interpreted as discard piles of bone refuse disposed of after processing and/or meat consumption. The "bone bed" uncovered at 41 JW 8 in 1975 (Hester 1977) appears to have been a large bone cluster.

This author strongly believes that the bone clusters at 41 JW 8 are the result of efficient butchering and processing techniques used by the former inhabitants of the site. The faunal consultant (Steele) has cautioned the author that the subject of bone modification has recently received considerable attention (Binford 1981). The fact that the bones are severely fragmented does not necessarily mean that the animals were butchered and that the bones were efficiently processed by the inhabitants. Other agents, such as animal scavengers, rodents, natural weathering, and ungulate traffic can also be responsible for faunal fragmentation. Thus the mechanisms of breakage cannot be determined without careful taphonomic analysis that is beyond the scope of this project. Nonetheless, the discrete nature of the faunal clusters, the extreme fragmentation of almost all bones containing marrow, the cut marks noted on some bones, the occurrence of diverse species within discrete deposits, and the heavy burning of some bone are interpreted by this author as being the product of an efficient system of animal butchering, bone processing, and bone disposal.

It should also be noted that the well-preserved nature of the bone found within the bone clusters does not necessarily demonstrate rapid burial. Steele (personal communication) pointed out that bone experts will not make such an evaluation based on bone condition without an analysis of the depositional environment of the fauna. This author has observed weathered bone in southern Texas on many different occasions. Based on these observations, the bones surviving on the surface for a period of several months to several years are almost always severely sun bleached, cracked, and/or animal gnawed. Modern discrete bone clusters (dead animals) are usually disarticulated and scattered within a few weeks. The 41 JW 8 bone clusters showed little or no evidence of such exposure and scattering. Hence, it is hypothesized that the Hinojosa site bone clusters are well preserved in part due to being rapidly buried. This hypothesis awaits confirmation by a regional taphonomic study.

FEATURE 2

Provenience: N106 E98 and N107 E98, Level 2, 10 to 24 cm below the surface (99.87-99.73). Lot numbers: 155, 165, 181, 182, and 183.

Dimensions: Irregular, Feature 2A measured approximately 40 cm (N-S) x 23 cm (E-W); Feature 2B measured roughly 18 cm in diameter.

Associations: Charcoal flecks, three modified flakes (MD2), a core, a small oval biface (FB1), an end scraper (U1), and a flat unmodified limestone slab.

Radiocarbon Assays: None, inadequate charcoal sample.

Special Sampling: A matrix sample was taken from Feature 2A (Lot 181). A two-liter sample was water separated (see Section VII: Water Separation).

Description: Feature 2 consisted of two clusters of fragmented animal bone and associated artifactual material. No difference was observed between the feature matrix and the surrounding soil. Each cluster is described below.

Feature 2A consisted of fragmented deer, turtle, bird, and bison bone as well as the flat rock, the oval biface, and the end scraper already mentioned. Three bison humerus fragments from Feature 2A appear to represent at least two individuals. A large amount of splintered long bone fragments was recovered from the cluster along with numerous **Rabdotus** land snails and a few charcoal flecks. The identifiable bone fragments were not oriented in a consistent direction. All materials were very tightly clustered except for an unidentifiable large mammal bone fragment located some 50 cm west of the main cluster.

Feature 2B consisted of a bison femur fragment with postmortem crushing and spiral fractures and 19 unidentifiable fragments of a medium to large mammal (deer or bison). One of the fragments was burned. Several flakes, including a secondary flake and two modified flakes (MD2), and a small core were recovered from Feature 2B. Small charcoal flecks were noted against some of the bone fragments; however, no other evidence of direct burning was noted (i.e., the feature area did not appear to have been the scene of a fire).

Interpretation: Both clusters appear to represent two separate although associated features. These clusters were the first two of five bone clusters found at the site. They were recorded as a single feature due to their close physical proximity. In retrospect, they probably should have been given separate feature designations.

Both clusters appear to be discarded refuse dumps. The tight nature of the clusters (bones stacked one against the other) and the relatively good condition of the bone (unweathered although adversely affected by the moist soil conditions at the time of exposure) may suggest that these materials were deposited in small, shallow holes (pits?) and covered with soil. The two clusters represent separate events, although these events were probably close together in time. Some of the fragmentation of the bone may well have been caused by traffic on the "wagon trail," the area in which the feature was located.

FEATURE 3

Provenience: N106 E98, Level 3, 99.71-99.66.

Dimensions: 36 cm (E-W) x 16 cm (N-S).

Associations: No cultural materials other than bone (Table 23) were found in direct association with Feature 3. Feature 3 occurred between the two clusters of Feature 2 on a horizontal basis but slightly lower in elevation.

Radiocarbon Assays: None.

Special Sampling: A matrix sample was taken from the central area of the feature. This sample has not been analyzed.

Description: Feature 3 consisted of a small, compact cluster of animal bone; most were fragmented. The feature was in the form of a tightly clustered arc or crescent as shown in Figure 18. No difference was observed between the feature matrix and the surrounding soil. An interesting aspect of the feature is the diversity of species identified from the bone assemblage. At least seven different animals contributed to the assemblage, including bison, deer, jackrabbit, turtle, turkey, wood rat, and mole. The bones are unburned and in comparatively excellent condition. All of the larger elements collected, such as a bison humerus, a deer tibia, a deer mandible, and unidentified bone from large mammals and some of the smaller animal bone, are fractured.

Interpretation: Feature 3 like all of the bone clusters recorded at 41 JW 8 appears to be a discard pile of butchered and processed animal bone. The tight stacking of the bone in a small cluster suggests intentional placement. The absence of any evidence of scattering or weathering may suggest that the bone was not exposed on the surface for any length of time.

TABLE 23. PLOTTED ITEMS ASSOCIATED WITH FEATURE 3

Lot Number	Item Number	Elevation	Identification
184	1	99.67	turkey left femur
184	2	99.66	deer phalange
184	3	---	wood rat right mandible and left ulna fragment
184	4	99.69	deer left tibia fragment
184	5	99.70	jackrabbit femur fragment, tortoise plastron (scute), and medium to large mammal skull fragment
184	6	99.69	tortoise plastron (scute) and large mammal long bone fragment
184	7	99.71	deer right mandible fragment
184	8	99.67	small bird femur and a large mammal rib fragment
184	9	99.67	bison right humerus fragment
184	10	99.66	tortoise plastron (scutes) and large mammal long bone fragments
184	11	99.68	tortoise plastron (scutes)
184	12	---	unplotted items from lower section of feature: tortoise plastron and carapace scutes, large mammal long bone fragment, and eastern mole phalanges (2), vertebrae (2), humerus and occipital

Note: The faunal elements (except item 12) are plotted by item number on a map of the feature in Figure 18.

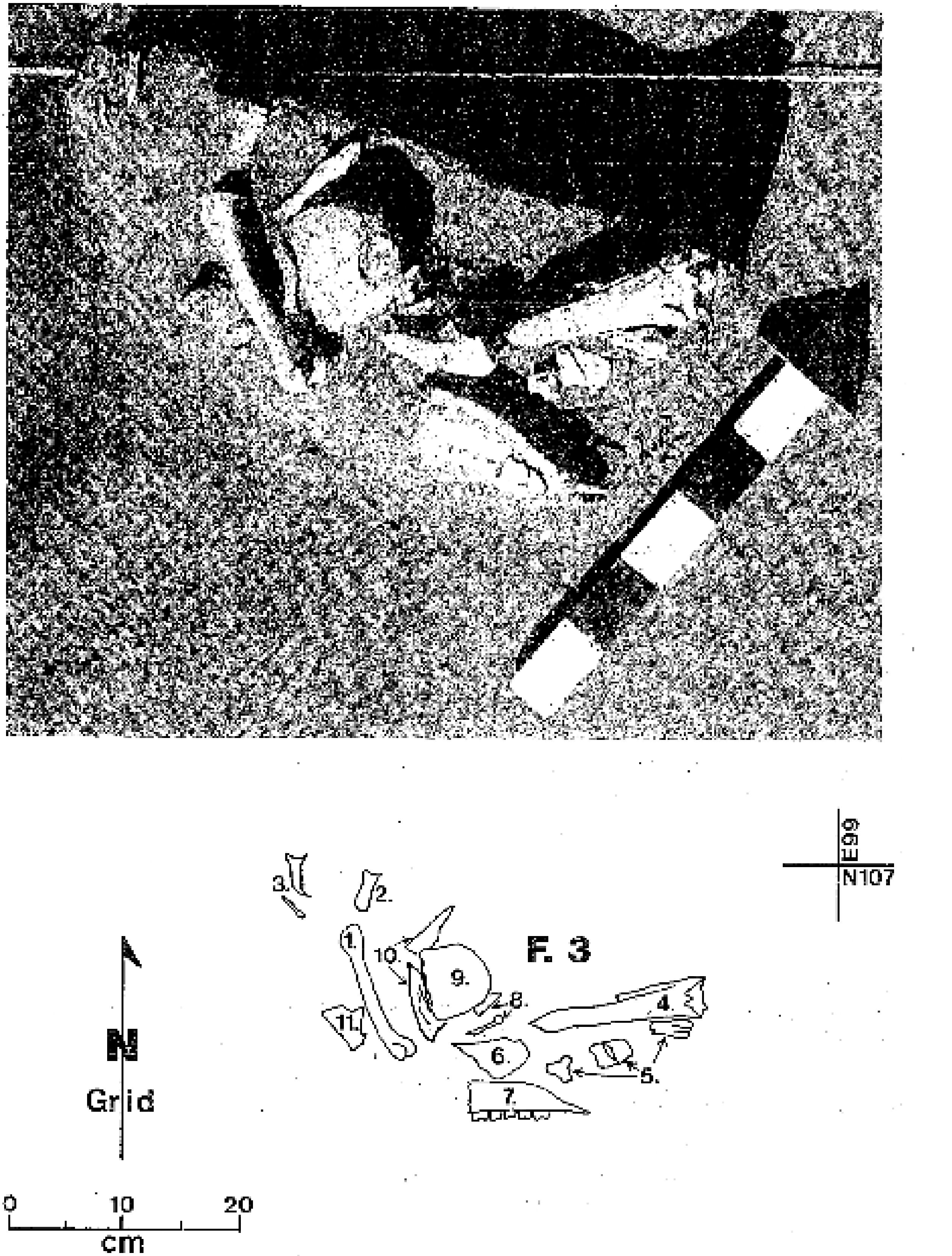


Figure 18. **View of Feature 3 and Plan Map.** North arrow in photograph points to magnetic north. Refer to Table 23 for the identification of the numbered items in plan map.

FEATURE 9

Provenience: N108 E102, Levels 3 and 4 and N108.5 E103, Level 2, 99.82-99.71.

Dimensions: Approximately 73 cm (N-S) x 10-13 cm (E-W).

Associations: Two lithic artifacts were found within Feature 9, a modified tertiary flake (MD2) and a thick unifacial tool (U2). Other items found in direct association were a thermally fractured chert spall, several chunks of charcoal, several very small mussel valves, and a number of land snails. The plotted items recovered from Feature 9 are shown in Figure 19 and listed in Table 24. Feature 8 was located some 1.5 to 2 m to the west of Feature 9 at a slightly higher elevation.

Radiocarbon Assays: None; the amount of charcoal recovered was inadequate for an assay.

Special Sampling: None.

Description: The feature consisted of a tight cluster of fragmented animal bone arranged in a narrow, elongated area. Some of the bone were stacked three elements deep. At least six species are identifiable from the faunal assemblage: bison, three types of rodents, javelina, and turtle. In addition, several rib fragments of a deer-sized mammal were recovered. With the exception of the rat bones, all elements are fragmented. Most of the bison elements and bison-sized fragments are burned, spiral fractured, or have cut marks.

The spatial arrangement of the feature suggests that the contents were placed in a long, narrow depression and were not simply piled on a surface. Unfortunately, the feature matrix was no different from the surrounding soil and, thus, a pit or depression outline could not be detected. Turtle plastron, fire discolored and broken into two large sections, formed the upper layer. Several comparatively large chunks of charcoal were recovered in the upper portion of the feature. No evidence of direct burning (of the feature area) was detected.

This feature was very carefully excavated by Kenneth M. Brown who noted the orientation and direction of dipping for most of the linear bone fragments. Most elements were oriented more or less parallel to the long axis of the feature and predominately dipped to the north. The bone elements were obviously tightly packed and placed one atop the other. Several of the larger bison elements were the deepest elements in the feature.

Interpretation: Feature 9 appears to be a purposeful bone disposal pile. The location of the feature near the edge of the bluff and the spatial arrangement of the contents suggest that the discarded bone was placed in a narrow erosional gulley. The absence of any evidence of sedimentation or weathering suggests that the feature was quickly covered soon after deposition. The nature of the bone (fragmented, butchered, and burned) suggests the interment probably followed processing and/or consumption which included removal of all meat and marrow processing.

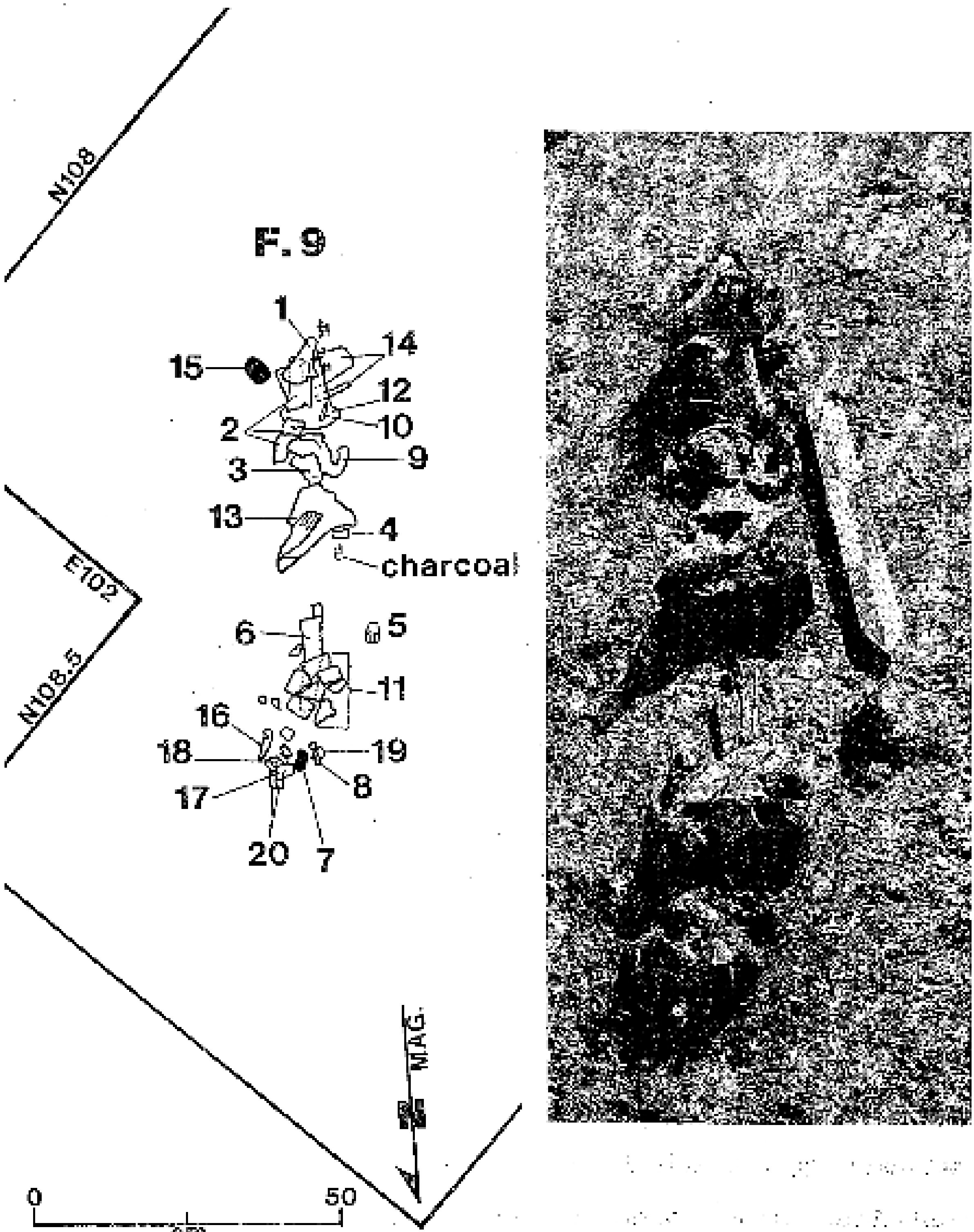


Figure 19. **Plan Map and View of Feature 9.** The photograph is an oblique view taken from the magnetic north end of the feature looking south. Refer to Table 24 for the identification of the numbered items in the plan map.

TABLE 24. PLOTTED ITEMS FROM FEATURE 9

Lot Number	Item Number	Elevation	Identification
472	1	99.82	deer ulna tool
472	2	99.77	bison size long bone fragments
472	3	99.79	tortoise plastron fragments
472	4	99.80	large mammal fragment
472	5	99.78	javelina mandibular fragment
472	6	99.78	large mammal fragments
472	7	99.80	modified tertiary flake (MD2)
472	8	99.79	wood rat humerus
472	9	99.76	tortoise plastron fragments
472	10	---	small mammal fragment
472	11	99.80	tortoise plastron fragment
472	12	99.73	bison ulna fragment
472	13	99.73	bison radius fragment
472	14	99.71	bison size marrow fragments
472	15	99.74	unifacial tool (U2)
472	16	99.77	large mammal long bone fragment
472	17	99.78	large mammal long bone fragment
472	18	99.80	tortoise scute fragment
472	19	99.80	burned corticate chip
472	20	99.76	deer size rib fragments

Note: The faunal elements are plotted by item number on a map of the feature in Figure 19.

FEATURE 10

Provenience: N104 E97, Levels 2-4, 99.94-99.68.

Dimensions: Approximately 60 cm (grid N-S) x 50 cm (grid E-W).

Associations: Several burned calcareous concretions were found within the cluster along with several flakes and a mussel shell. Feature 6 was located some 1.5 m to the grid north. The faunal elements recovered from Feature 10 are listed in Table 10.

Radiocarbon Assays: None.

Special Sampling: None.

Description: Feature 10 was a loosely clustered bone concentration. The feature was not originally designated as such in the field due to the somewhat scattered nature of the bone. As the excavations progressed, the elements were plotted **in situ** and were eventually recognized as aspects of a cultural feature. Contributing to the difficulty of feature recognition were several disturbances and the fact that the feature extended through portions of three separate levels. A rodent run and several large mesquite roots intruded into the feature and caused displacement of the bone. Other than the rodent run fill, no difference was noted between the matrix around the faunal elements and the adjacent soil.

Nine faunal elements are identified from Feature 10: four deer bones, four bison bones, and an opossum bone. Most of the bison elements are from a subadult. The homogeneous nature of the elements (size, species, and condition) helps to confirm the validity of the belated feature designation. Most of the bone are fragmented, including a number of bison and deer size fragments that could not be identified. Much of the bison bone and some of the deer bone are spiral fractured and/or burned.

Interpretation: Feature 10, like the other bone cluster features, is interpreted as a refuse dump of processed animal bone. The vertical extent of the feature (over 25 cm from the uppermost element to the lowest) suggests that the discarded bone was placed in a hole. The pit outline was not detected. The homogeneous nature of much of the bone suggests that the feature represents a single event. Feature 10 was probably more tightly clustered prior to the penetration of several very large mesquite tree roots which caused considerable displacement.

ROCK/CHARCOAL FEATURES

Five discrete rock/charcoal features were recorded during the 1981 season. A rock/charcoal feature is a distinct concentration of burned rock (calcium carbonate concretions) and/or charcoal. These features obviously represent fire-related activities such as cooking hearths, warmth hearths, or hearth discard piles. Often associated with those features are faunal and artifactual materials. Charcoal from three of these features provided ample material for the radiocarbon assays.

FEATURE 1

Provenience: N125 E92, Level 4, 30-38 cm below the surface.

Dimensions: Approximately 20 cm (N-S) x 30 cm (E-W).

Associations: There was very little in direct association with Feature 1 except a few unburned and burned unidentifiable bone fragments and several small burned rocks. A pottery sherd and an end scraper (U1) were recovered from the level containing the feature.

Radiocarbon Assays: None; insufficient charcoal.

Special Sampling: Matrix samples were taken within the feature and 75 cm grid north of the feature. Both samples had low to moderate quantities of burned hackberry seeds, microfauna, charred seeds, snails, and a few small charcoal chunks.

Description: Feature 1 consisted of a small, irregularly shaped charcoal stain (not illustrated). Small amounts of bone and burned rock occurred within the feature but not in a significantly greater density than the surrounding excavation levels. The matrix of the feature appeared dark gray brown in comparison to the surrounding soil. Filled-in rodent runs and burrows surrounded much of the feature. These disturbances had noticeably looser soil texture.

Interpretation: The feature occurred on a ground surface that sloped to the grid north. Several poorly defined rock clusters were observed in lower levels (9 and 11). The overall deep nature of the cultural deposits in the excavation unit and the noticeable slope of the sedimentation suggest that the area was filled in by slope wash from the higher ground to the grid west. Feature 1 is thought to represent either hearth residue washed into an erosional feature (small depression) or possibly an animal burrow that filled in with burned cultural material. It should be noted that the wall of the excavation unit revealed a greater amount of disturbance than any other unit. The end scraper from Level 4 has plow marks and is the most deeply buried artifact from the site that is known to have been plow damaged. Little cultural significance is attached to the feature.

FEATURE 4

Provenience: N100 E93 and N100 E94, Level 6, 48-58 cm below the surface.

Dimensions: The main cluster measured 46 cm (grid N-S) x 49 cm (grid E-W); a few small rocks were scattered outside the main concentration.

Associations: None.

Radiocarbon Assays: None.

Special Sampling: A matrix sample was collected from between the rocks and the rock pedestals (created during feature exposure). It is interesting to note that of all the feature matrix samples or on-site column samples that were water separated, the sample from Feature 4 had the least amount of cultural material.

Description: Feature 4 consisted of a small cluster of burned rock with a few scattered rocks occurring at the same elevation up to 1.2 m away from the main cluster (not illustrated). Little or no difference was noted in the appearance of the feature matrix in comparison to the surrounding soil. No associated cultural material (artifacts, faunal material, charcoal) was present. The feature was more or less circular but was not tightly clustered or formal in appearance.

Interpretation: The feature is interpreted as some sort of fire-related cultural feature remnant, such as a weathered hearth or a stone boiling dump. Due to the absence of cultural associations, little significance is attached to Feature 4. It is possible that Feature 4 is the result of an earlier occupation at the site.

FEATURE 5

Provenience: N109 E98 and N109 E97, Levels 2 and 3, 99.87-99.75.

Dimensions: Approximately 40 cm (N-S) x 50 cm (E-W).

Associations: An expanding stem arrow point (A2:I) and a body sherd were found in direct association with the feature along with several unburned bone and mussel shell fragments, 10 **Rabdotus** snails, 3 **Helicina** snails, and a tertiary flake.

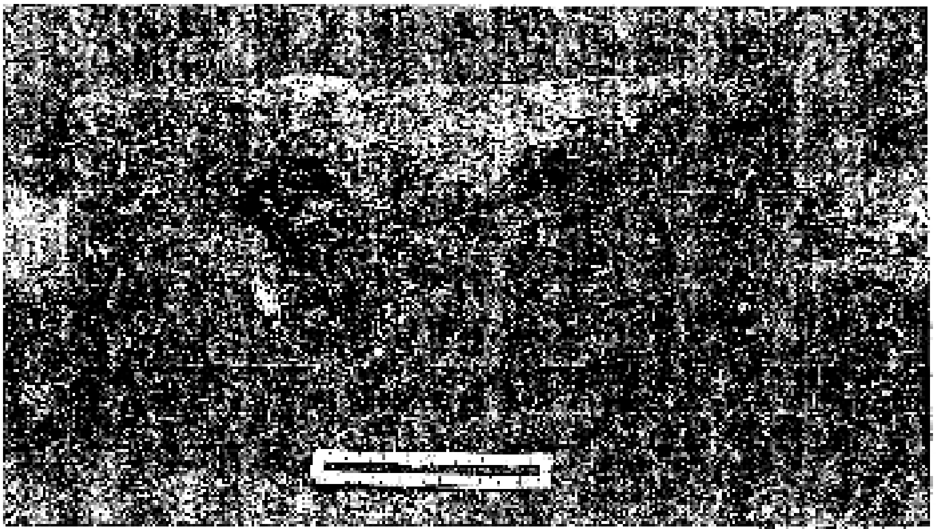
Radiocarbon Assays: TX-4652, 520 ± 90 (see Section VII: Radiocarbon Assays).

Special Sampling: Four matrix samples were collected from various areas of the feature. Considerable quantities of cultural materials were recovered from the two samples which were water separated. Feature 5 was one of the trial cases for the axial interval sampling as described in Section VII (Soils Chemistry). High quantities of phosphate were found within and immediately adjacent to Feature 5 as is shown in Figure 15.

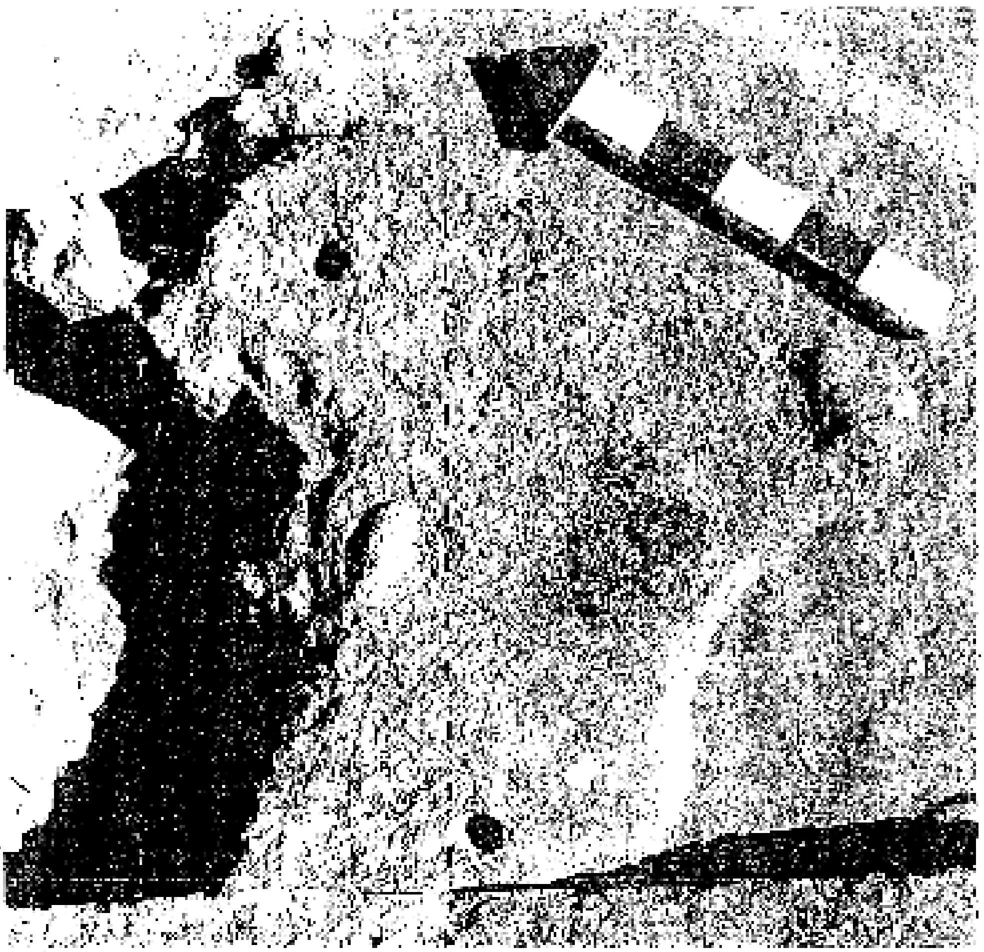
Description: Feature 5 (Fig. 20,b) was a small, tight cluster of charcoal-stained soil, ash, charcoal, and associated cultural material. In plan the feature was irregularly circular; the feature profile revealed a 12-cm-deep pit in which the cultural materials were located (Fig. 20,a). The upper portion (detection surface) of Feature 5 had an outer ring of charcoal-stained soil, and in the center was a very loose ash lens. The pit sloped from grid east to form a slightly undercut outline which reached a maximum depth on the grid west side of the feature. In addition to the charcoal-stained soil and ash lens, concentrations of intense charcoal staining, baked clay (not shown in profile), and large intact chunks of wood charcoal were in the pit fill. The feature matrix was further distinguished by mottling (snail, burned rock, and bone fragments).

Four faunal species contributed elements to Feature 5: coyote, cottontail rabbit, a small unidentified fish, and an unidentified large mammal (probably deer or bison). In addition, a number of unburned whole and fragmented **Rabdotus** land snails were recovered. The charred wood from the feature could only be identified as some type of hardwood. A charred seed coat was recovered during flotation of the lower feature fill, however, it could not be identified.

Interpretation: Feature 5 is believed to be the remains of a small fire hearth. The hearth appears to have been contained within a small pit. The presence of several pockets of bone and baked clay adjacent to but not within



a



b

Figure 20. **Views of Feature 5.** a, view to the northwest of the cross section of feature along dashed line shown in *b*; b, overhead view of pedestaled feature.

the pit suggests reuse of the feature at least once. The fact that the pit fill appears layered and undisturbed suggests that it was not cleaned out after the final use. The absence of intense soil discoloration around the pit edges and the small size of the feature suggest comparatively little repeated use in contrast to Feature 6.

FEATURE 6

Provenience: N106 E97 and N106 E96, Levels 2 and 3, 99.96 (detection surface) to 99.88 (bottom of lowest plotted artifact); small pit below main feature extends to a depth of 99.81.

Dimensions: Approximately 80 cm (N-S) x 130 cm (E-W).

Associations: Numerous artifacts were directly associated with Feature 6: an arrow point fragment, two body sherds, an end scraper, two biface fragments, one trimmed tertiary flake, two modified secondary flakes, a modified decorticate chip, and various faunal elements. The 17 items that were piece plotted in Feature 6 are listed in Table 25 and shown in Figure 21. Additional flakes, sherds, and arrow points were recovered at the same elevation range in close association with the feature. Feature 6 was located on the east edge of Feature 11, the apparent living surface that was exposed in the western half of the Wagon Trail excavation area. Features 2A, 2B, and 3 were located just east of Feature 6 at lower depths. Feature 10 was located just south of Feature 6 and was first detected at about the same elevation.

Radiocarbon Assays: UGa-4541 (525 ± 65), TX-4653 (970 ± 60), TX-4886 (1090 ± 110), UGa-5289 (655 ± 70), and UGa-5280 (930 ± 70); all are uncorrected assays. See Section VII (Radiocarbon Assays) for a detailed discussion of these widely varying assays.

Special Sampling: Eleven matrix samples and seven charcoal samples were collected from various portions of the feature. In lieu of an axial interval sampling (due to the fact that much of the surrounding excavation area was already excavated below the feature level), a series of samples was collected along a grid north-south transect (grid line E97). Phosphate testing of the various matrix areas of Feature 6 showed comparatively high readings, ranging from 649 to 1597 ppm.

Description: A complicated fire feature, Feature 6 was composed of overlapping charcoal, **Rabdotus** snail shells, ash, baked clay, and charcoal-stained soil concentrations within and around a roughly circular cluster of burned rocks (Fig. 21). In addition, a small pit extended below the main feature level on the northeast edge of the feature.

Feature 6 was exposed, excavated, and removed during a one-month period (November 18-December 18). This rather lengthy excavation period was due to the following: (1) the feature was extended into two units and four levels; (2) we wanted to expose the entire western half of the Wagon Trail Area to the same level (thus we were able to confidently tie in Feature 6 with Feature 11); (3) we wanted to leave the feature exposed for the principal investigator, NPS, IAS-D and SCS representatives, and the news media to see;

TABLE 25. PLOTTED ITEMS ASSOCIATED WITH FEATURE 6

Lot Number	Item Number	Elevation	Identification
397	1	99.91	modified secondary flake (MD2)
397	2	99.94	end scraper (U1)
397	3	99.94	trimmed tertiary flake (MD1)
397	4	99.94	body sherd
397	5	99.94	modified decorticate chip (MD2)
397	6	99.91	biface fragment (FB3)
397	7	99.92	modified secondary flake (MD2)
397	8	99.94	biface proximal fragment (FB1)
397	9	99.88	body sherd
397	10	99.90	arrow point distal fragment (A4)
397	11	99.93	bison-sized long bone fragment
397	12	99.90	mammal caudal vertebra
397	13	99.88	vole right mandible
397	14	99.90	turtle plastron fragment
397	15	99.91	deer thoracic vertebrae (2)
397	16	99.93	mammal vertebral fragment
397	17	99.91	deer ulna

Note: See Figure 21 for horizontal location of cultural materials plotted by item number.

and (4) the careful exposure and recording of this complicated feature was very time consuming. During most of the month only the upper surface of the feature was exposed, and this was covered by plastic except when work on the feature was actively taking place. The plastic kept the moisture content of the feature relatively constant.

As the feature was exposed and excavated, a number of more-or-less discrete concentrations were discerned. These were excavated, collected, and sampled separately as matrix areas A-F. Materials from mixed uncertain contexts were bagged separately. Most of the six matrix areas appeared to be separate depositions, although some were arbitrarily divided to look for differences in matrix composition across the feature. Each matrix area is described next.

Matrix area A was a lobe (irregular mass protruding out from the larger matrix area C/E on the grid east side of the rock cluster) located on the grid southeastern portion of the feature. This area consisted of charcoal-stained soil mixed with ash, baked clay fragments, and large chunks of charcoal. Several of the charcoal chunks were incompletely oxidized, suggesting that the fire was extinguished rather than allowed to burn down to

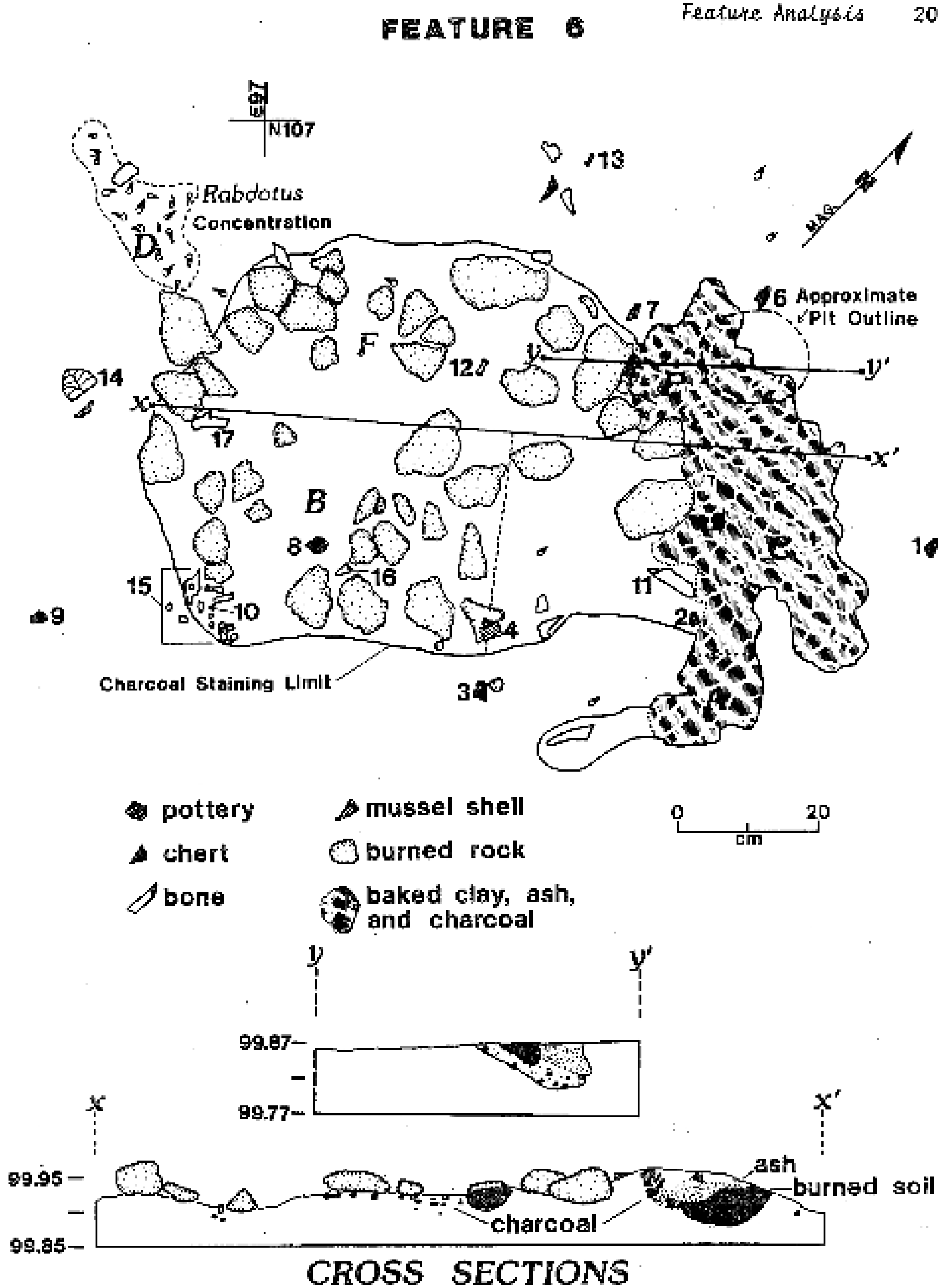


Figure 21. Plan Map and Profile of Feature 6. Numbered items are listed in Table 25.

a bed of ashes. The fact that area A extended out from the central feature area suggests that it represents a feature clean-out episode.

Matrix area B consisted of fill in the southern half of the feature directly under and between the rock cluster. The area B matrix contained considerable quantities of charcoal, most located in a thin layer directly beneath the rocks. Plotted items 4, 8, 10, and 15-17 were located in area B. Matrix areas B and F were arbitrarily divided at the first cross section line (x-x'; Fig. 21).

Matrix area C was located in the southern half of the large feature fill lobe, east of the rock cluster. The first cross section line divides areas C and E arbitrarily. Areas C and E are distinguished from the other matrix areas, both by location and a difference in fill characteristics. The fill of the C/E area had a much greater ash and baked clay content than any other area of Feature 6. Numerous chunks of charcoal were also recovered. Plotted item 5 was found within area C.

Matrix area D was the lobe of concentrated **Rabdotus** snails that extended to the grid northwest from the rock cluster. Very little charcoal or ash was recovered from this lobe.

Matrix area E was located in the northern half of the feature area, east of the rock cluster (see the area C discussion). The pit feature, discussed later, originated within or was covered by area E. Area E had particularly noticeable concentrations of ash and crumbly yellow clay on the northern edge of the area.

The final matrix area, F, was the northern counterpart to area B. Area F contained particularly large quantities of charcoal and very dark charcoal-stained soil but very little baked clay and no visible ash. It is significant to note that many of the charcoal fragments in area F appeared to be from finger-sized sticks. These fragments were concentrated directly beneath the rocks--as if the rocks were placed atop a small stick fire and not disturbed after the final usage.

The pit feature was filled with ash and charcoal and measured approximately 12 cm (N-S) x 16 cm (E-W). The pit was not recognized until the feature was partially excavated and cross sectioned, and the upper materials had been removed. The first cross section (Fig. 20, x-x') was grid south of the pit and did not intersect the pit. The pit was discovered during the final removal of the level containing the lower portion of the grid northern feature area (see Fig. 20,y-y' for a view of the second cross section showing the pit). For this reason the elevation of the original surface of the pit is not known, although it clearly occurred within the main feature level (approximately 99.96-99.88). The bottom of the pit was at 99.81, and the pit was at least 7 cm in depth. In profile the Feature 6 pit is very similar to the Feature 5 pit. Both have asymmetrical cross sections appearing undercut on one side and gradually sloping on the other.

The rock cluster around which the other aspects of the feature were arranged contained about 20-30 burned rock fragments at least 5 cm in maximum diameter. All of the rock appeared to be either weathered, low grade (soft) limestone nodules or calcium carbonate concretions weathered prior to use. This description is typical of the eroding, calcareous material found on the slope of the ridge across the creek. The rock was heavily burned, and some were fragmented in **situ** (presumably due to thermal shock). The rocks were arranged in an irregular circular pattern with more in the outer ring than the central area of the cluster. All rocks appeared to lie on the same surface, at about 99.93-99.90.

Charred botanical remains were identified from two general matrix samples collected from the feature (mixed matrix areas). Charred **Chenopodium** fruits and **Asteraceae** achenes (an achene is a small, dry, hard fruit) were identified from both samples. One sample also had an **Oxalis** fruit which may be modern. These plant remains are all edible fruits, although they could have been introduced as accidently charred material.

Interpretation: Feature 6 is a very interesting example of a hearth feature evidencing several reuse episodes. The recovered faunal and botanical materials associated with the various feature matrix areas clearly indicate that Feature 6 was a cooking hearth. We can infer that bison, deer, turtle, **Rabdotus** land snails, and several plant fruits were consumed in the vicinity of and possibly cooked in Feature 6.

The two pottery fragments recovered from in and around the feature are some of the largest and best-preserved sherds recovered from the site. Both show carbonization on the exterior surface. This can be interpreted as resulting from the breakage of a cooking vessel in the feature vicinity. Two lines of evidence support this possibility. First, the presence of uncharred bone and snails on top of and adjacent to the feature suggests that some food items were not directly roasted in the fire. The proposed mechanism for cooking food without direct roasting is by boiling within the ceramic vessel represented by the sherds. The second supporting observation is the placement of rocks in a small cluster with a small central rock-free opening. It will be recalled that the rocks were placed directly on top of the charcoal and that some of the charcoal under the rocks was incompletely carbonized, as if the rocks partially extinguished the charcoal directly underneath. Therefore, the rock cluster may have functioned as a cooking stand.

Another interesting aspect of Feature 6 is the lobes of charred soil, ash, baked clay, and charcoal that extended to the east of the rock cluster. These appear disturbed in contrast to the layered appearance of the matrix and rocks within the rock cluster. These lobes (matrix areas A, C, and E) are interpretated as hearth clean-out deposits representing earlier episodes of feature use. As many as three clean-out episodes may be evidenced by the extent of the lobes and by the difference in composition (especially between areas A and C/E). The burned rocks are both thoroughly burned and fragmented which may result from the reuse of the same rocks through several use episodes. If the rocks were used only for the episode represented by the rock cluster then the bottoms of the rocks should have been more heavily burned than the tops, which they were not.

It is interesting to note that the phosphate readings from the matrix areas (arbitrarily divided) are similar and also different from the other areas. The phosphate sample from matrix area B (868 ppm) is comparable to that from area F (649 ppm) and very different from the matrix area C (1493 ppm) and E (1529 and 1597 ppm) readings. These differences lend support to the separation of the major lobes.

The small pit beneath fill lobe E provides possible evidence of an additional use episode. During one of the feature use episodes, perhaps a secondary fire was built within the pit and produced the fill lobe which covered the pit.

The **Rabdotus** concentration (area D) on the northwest side of the rock cluster is interpreted as a refuse dump--perhaps the remains of a pot of land snail soup.

In summary, Feature 6 is interpreted as an extraordinarily well-preserved cooking feature that evidences repeated reuse of the same hearth. It is argued that meat, snails, and fruits from several species were cooked and consumed in and around the hearth. The large amount of charcoal, ash, baked clay, charcoal-stained soil, and fire-reddened soil in and around the feature attests to the intensity of use in this area. The fill lobes and the pit evidence several use episodes of the feature. The presence of lithic tools, particularly the modified and trimmed flakes and the end scraper, may suggest that faunal processing took place around the feature. However, the fact that most of these lithic tools were found on top of the fill may argue that they were discarded after the final use of the hearth. It is suggested that Feature 6 may be functionally associated with one or several of the nearby bone clusters, Features 2A, 2B, 3, and 10. The various aspects of Feature 6, combined with the functional association of one or more of the bone clusters, form an almost complete sequence of prehistoric behavior.

FEATURE 8

Provenience: Feature 8 was centered in N110 E101 and extended slightly west into N110 E100, south into N108 E100, southeast into N109 E102, and east into N110 E102. The feature was exposed in Levels 2 and 3 of these site units between an elevation of 99.87 and 99.76.

Dimensions: The charcoal occurred within an irregular oval area measuring roughly 1.45 m (N-S) x 1.2 m (E-W). The bone covered a larger area, 2.3 m (E-W) x 1.5 m (N-S). The rock clusters measured roughly 65 cm (E-W) x 55 cm (N-S) (grid northeast cluster) and 70 cm (NE-SW) x 35 cm (NW-SE).

Associations: Thirty-six items of cultural material in association with Feature 8 were piece plotted. These items include a Perdiz arrow point and many faunal elements (see Table 26 and Figure 22). In addition to the plotted items, a number of other lithic, ceramic, and faunal materials were recovered from within and adjacent to the feature.

Radiocarbon Assays: UGa-4540 (1290 ± 65), UGa-5290 (380 ± 185), Tx-4654 (500 ± 60), Tx-4887 (700 ± 80); all are uncorrected and uncalibrated assays. See Section VII (Radiocarbon Assays) for a detailed discussion of the varying results of these radiocarbon assays.

Special Sampling: Four matrix samples and a number of bags of charcoal were collected. The recovery of cultural materials, in particular charcoal, flakes, and microfauna was very good from the two water-separated matrix samples. In fact the Lot 496 matrix sample had so much charcoal it was very difficult to sort. The phosphate level was also tested from the Lot 496 sample. The reading of 762 ppm, while relatively high, is noticeably lower than the high readings from the central sections of Features 5 and 6. This difference may well be an artifact of the limited phosphate sampling of Feature 8.

Description: Feature 8 was a loosely clustered concentration that consisted of a thin layer of charcoal, two irregular rock clusters, and a large amount of animal bone, most disarticulated, fragmented, and butchered deer bone. Definite evidence of postdepositional disturbance was noted in the form of large plant roots and several rodent runs. Even so, the feature appears to be the result of several overlapping activity episodes.

The charcoal layer was encountered near the surface of detection of the feature (approximately 99.89). The layer was thin (5 cm or less) and was composed of a very large number of chunk wood charcoal fragments. Figure 22 shows the approximate extent of the charcoal layer. The layer was very discrete and seems to have been deposited on a surface which slopes very gently from the grid east (toward creek) to the grid west. The charcoal layer occurred within a lightly mottled gray brown fine sandy clay loam that follows the same slope. The underlying matrix was an homogeneous gray brown fine sandy clay loam, slightly coarser (less clay) and browner. A fire-damaged **Perdiz** point (plotted item 33) was found within the upper portion of the charcoal layer.

The rock cluster on the grid south and east side of the feature occurred within the charcoal layer. While most of the rocks were found within the charcoal layer, a few rocks on the far grid east side of the feature were directly above the charcoal. Some of the rocks appeared to have been fractured **in situ**. The bottom elevations of the rocks in this cluster ranged from 99.86 to 99.77, although most were 99.80 or higher.

The second rock cluster was located on the grid northwest side of Feature 8, below to slightly within and on the edge of the charcoal cluster. The rock bottom elevations ranged from 99.84 to 99.77; most were 99.80 or lower. No charcoal was found beneath any of the rocks in this cluster.

The numerous animal bone fragments associated with Feature 8 occurred over a wider area than either the burned rock or the charcoal layer. Most of the bone fragments were found around the edges of the rock and charcoal concentration, although some elements were found within. The bones were scattered, except for several small clusters (plotted items 9, turtle bone cluster; 25, cluster of large mammal bones; 23 and 24, two deer vertebrae which may have been articulated; and 28, several mammal vertebrae that were poorly preserved). None of the bones are burned. Most bones are fragmented. Spiral fractures and butcher marks (cuts) are present on several deer bones. As mentioned, the majority of the bones are identified as deer bones. The plotted bones ranged in bottom elevation from 99.87 to 99.76, with most occurring above 99.80.

TABLE 26. PLOTTED ITEMS ASSOCIATED WITH FEATURE 8

Lot Number	Item Number	Elevation	Identification
525	1	99.84	large mammal rib fragments
525	2	99.82	large mammal rib fragments
525	3	99.82	turtle carapace scute, femur
525	4	99.80	deer calcaneus
525	5	99.78	deer radius fragment
525	6	99.83	deer maxilla fragment
525	7	99.82	deer molar
525	8	99.76	large mammal fragment
525	9	99.83	turtle radius and humerus
525	10	99.85	deer radius fragment
525	11	99.79	deer radius fragment
525	12	99.80	deer metacarpal fragment
525	13	99.82	deer rib fragment
525	14	99.85	deer scapula fragments
525	15	99.78	deer rib fragment
525	16	99.83	arrow point distal fragment (A4)
525	17	99.79	jackrabbit vertebrae (2)
525	18	99.87	deer mandible fragment
525	19	99.80	deer phalange
525	20	99.82	turtle carapace scutes (2)
525	21	99.81	deer size fragments
525	22	99.80	deer radius fragments
526-3	23	99.76	deer lumbar vertebra
526-4	24	99.76	deer lumbar vertebra
526-1	25	99.76	large mammal fragments (8), deer metacarpal
483-1	26	99.74	deer calcaneus
463-3	27	99.79	deer caudal vertebra
442-1	28	99.82	mammal vertebrae fragments
442-2	29	99.83	deer phalange
442-3	30	99.84	deer metapodial
442-4	31	99.83	deer phalange
442-5	32	99.84	deer vertebra
443-1	33	99.90	**Perdiz** point (A1)
485-1	34	99.81	deer metapodial fragment
485-2	35	99.82	mammal vertebrae fragments
485-3	36	99.80	deer metapodial fragment
485-4	37	99.81	deer metapodial fragment

Note: The faunal elements are plotted by item number in Figure 22. The lot numbers are used in the faunal section (VII) of this report, which provides a detailed description of all the feature bone (also see Table 10).

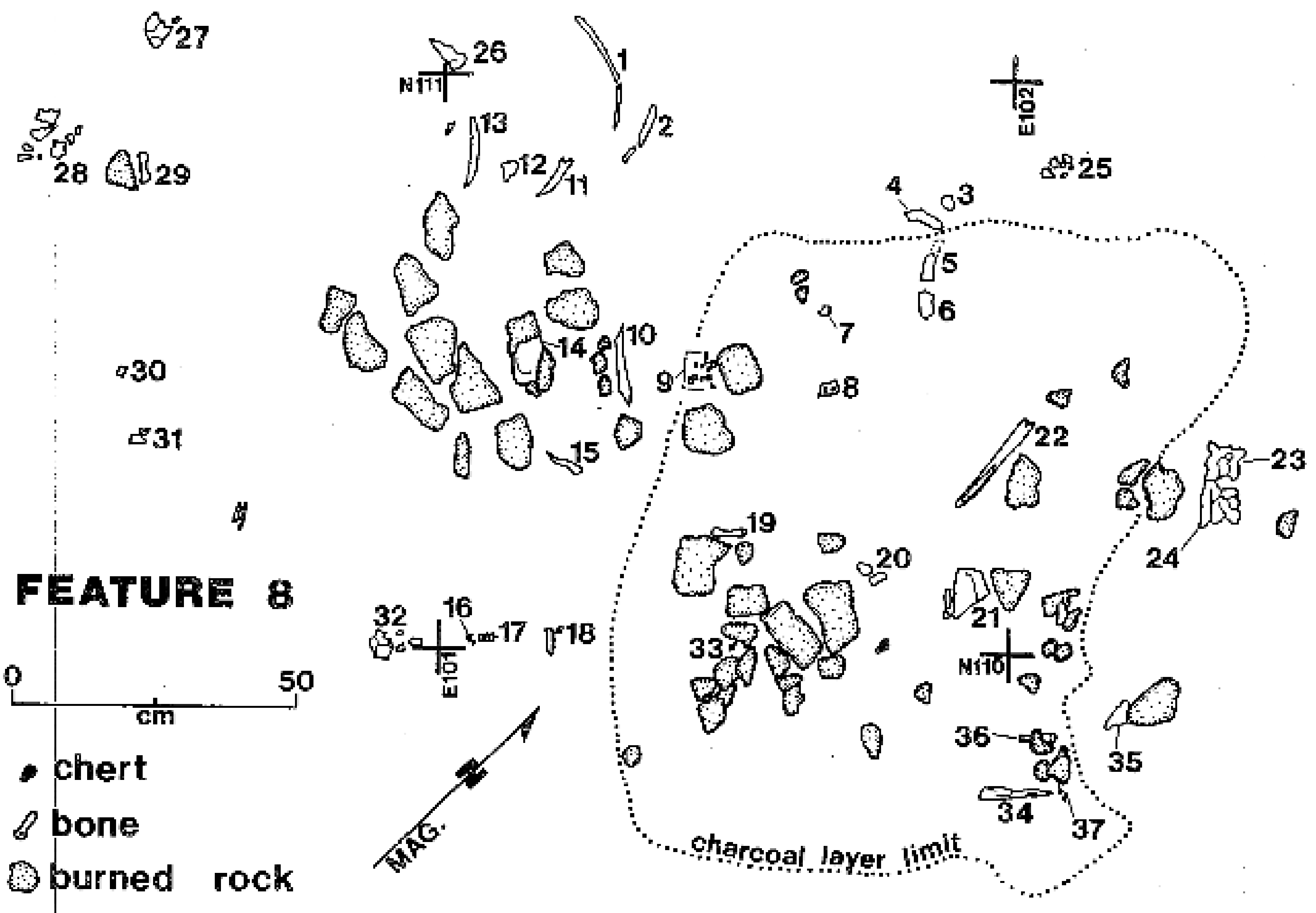


Figure 22. Plan Map of Feature 8. Numbered items are listed in Table 26.

<u>Interpretation</u>: Feature 8 is somewhat difficult to interpret. The lack of any evidence of fired soil, ash, or baked clay suggests that the charcoal layer is not a primary deposit. The irregular rock clusters do not seem to form definite hearths such as the ring of rocks in Feature 6. On the other hand, some of the rocks are fragmented in place (in other words, two fragments found side by side fit together). Perhaps the rocks split after deposition due to root penetration along thermal stress fractures.

The faunal materials may suggest a discrete activity--the butchering of a large deer. A large quantity of deer bones was recovered from Feature 8 representing several parts of the body of an adult deer. The bone is fragmented and spiral fractured with butcher marks; all support the feature interpretation. However, while most of the deer bones are of an adult, it cannot be stated that they were of the same animal. Nor can we rule out the possibility that the faunal materials are the result of more than one disposal episode. The lower surface of almost all the bones was below the bottom of the charcoal layer, hence we can infer that the bone was deposited prior to the charcoal.

A plausible explanation for Feature 8 is that it represents a deer butchering episode (or the resulting disposal thereof), subsequently covered by a deposit of stained soil, rock, and charcoal. In the absence of any evidence of natural deposition, it is argued that the faunal remains were intentionally covered. The lowest fill deposit is represented by the northwestern rock cluster. From evidence on the opposite side of the feature, a profile suggests that a layer of mottled sandy clay loam was placed over a stable surface (which apparently the bones lay jumbled on). Within this soil layer were the charcoal layer and the southeastern rock cluster. It is suggested that the faunal remains were covered with a series of smaller deposits (basket loads?) removed from a fire hearth. The rock clusters, the mottled soil, and charcoal layers all seem to be different deposits (loads?). Features 5 or 6 could have been the source of this fill.

LIVING SURFACES

A living surface is a discrete surface with an accumulation of occupational debris. The surface may be recognized stratigraphically as a physical interface or by the exposure of associated artifactual material lying on a common surface. At the Hinojosa site, the living surfaces were recognized by large accumulations of artifactual material vertically clustered on more or less level surfaces. The actual surfaces were not stratigraphically distinct except for the increased cultural material.

Two living surfaces were recognized. Both were only partially exposed as it was observed that material continued into the excavation unit walls. The presence of small intact clusters of cultural material and well-preserved fragile artifacts, such as bone tools and shell ornaments, suggests that the living surfaces were buried fairly rapidly. Both living surfaces were exposed below the plow zone. The presence of large quantities of highly fragmented cultural material in the upper levels in several areas of the site suggests that later living surfaces have been disturbed.

The living surfaces were recognized at 41 JW 8 when concentrated cultural materials were exposed in situ in several excavation units at approximately the same elevation. An effort was made to record as much of the material in place as possible. Often, however, the concentrations were so dense that isolated bone fragments, snails, flakes, and burned rock were removed in order to allow exposure of clustered materials, identifiable bone, and diagnostic artifacts. Thus, the living surface illustrations and inventories are biased toward these materials. This bias can be partially overcome by looking at the cultural material frequencies for the unit-levels containing the living surfaces. It should be noted that without in situ exposure, living surfaces would show up as horizons (horizontal concentrations) in cultural material distributions.

The excavation of large contiguous blocks is necessary to recognize and expose living surfaces. The excavation areas at 41 JW 8 were large enough to detect two living surfaces; however, much larger excavations would be necessary to fully expose these "macro" features. Recent excavations at the Rowe Valley site in Williamson County by the Texas Archeological Society have demonstrated the value of exposing very large site areas (Prewitt 1982, 1983, 1984). Thus, it must be recognized that the interpretation of a living surface is limited by the lack of knowledge of the actual size of the feature and the surrounding and related "macro" and "micro" features.

FEATURE 7

Provenience: N75 E91 and E92, N76 E91 and E92, 99.68 to 99.62. The feature continued into the grid north, west, and south walls.

Dimensions: The dimensions were impossible to define due to limited excavation and problems with leaf cutter ants. The exposed area measured about 2 x 2.4 m.

Associations: Numerous artifacts and bones were found on the surface. These are shown in Figure 23, and the plotted items are identified in Table 27. The "bone bed" feature, uncovered in 1975, was located immediately grid south of the section of Feature 7 exposed in 1981.

Radiocarbon Assays: None.

Special Sampling: Two matrix samples were collected.

Description: Feature 7 (Figs. 23 and 24), a concentration of cultural material, was partially sampled in 1981 and possibly in 1975. The 1975 testing of the "bone bed" and associated materials was not recorded as precisely as the 1981 excavations, but the 1981 feature description is incomplete due to problems with a leaf cutter ant bed. Therefore, the following discussion is based only on a partial sample of the feature and limited information extracted from the 1975 field notes.

It is apparent that Units N75 E92 and N76 E92 were centered on an extremely dense concentration of cultural material found primarily within a 6-cm-thick layer. Within this concentration were a large number of bone fragments;

TABLE 27. PLOTTED ITEMS ASSOCIATED WITH FEATURE 7

Lot Number	Item Number*	Elevation	Identification
353-1	1	99.65	deer phalange
353-2	2	99.66	ceramic body sherd
353-3	3	99.64	ceramic body sherd
353-4	4	99.64	Anseriformes, left humerus shaft removed by cutting
353-6	5	99.66	cottontail rabbit left maxilla
353-7	6	99.61	deer metapodial epiphysis
354-1	7	99.66	mammal bone fragment
354-2	8	99.67	mussel shell pendant
354-3	9	99.68	ceramic body sherds (5)
354-4	10	99.67	irregular biface (FB1)
354-5	11	99.65	jackrabbit left scapula
354-6	12	99.64	deer right talus
354-7	13	99.63-99.67	end scraper (U1), modified secondary flake (MD3), a snake vertebra, a fish vertebra, and three mammal bone fragments
343-1	14	99.68	tooth fragment**
343-2	15	99.64	bone fragment**
343-3	16	99.64	bone fragment**
343-4	17	99.66	bone fragment**, biface fragment (FB3), and an incised mussel shell fragment
343-5	18	99.63	bone fragment** and body sherd
343-6	19	99.64	bone fragments**
***	20	99.70	end scraper (U1)
***	21	99.67	core
454-1	22	99.60	bison left tibia fragment
454-2	23	99.54	bison-sized fragments
454-3	24	99.57	antelope lumbar vertebra
454-4	25	99.55	bison-sized fragments
454-5	26	-----	bison-sized fragments

*Items 1-21 are plotted in Figure 23. The lot numbers are used elsewhere in this report to provenience these artifacts.

**Faunal materials from Lot 343 were not analyzed.

***Items 20 and 21 were recovered from N76 E93, a unit which was not completed due to ant problems and is not otherwise analyzed. These items are not mentioned or inventoried elsewhere in this report.

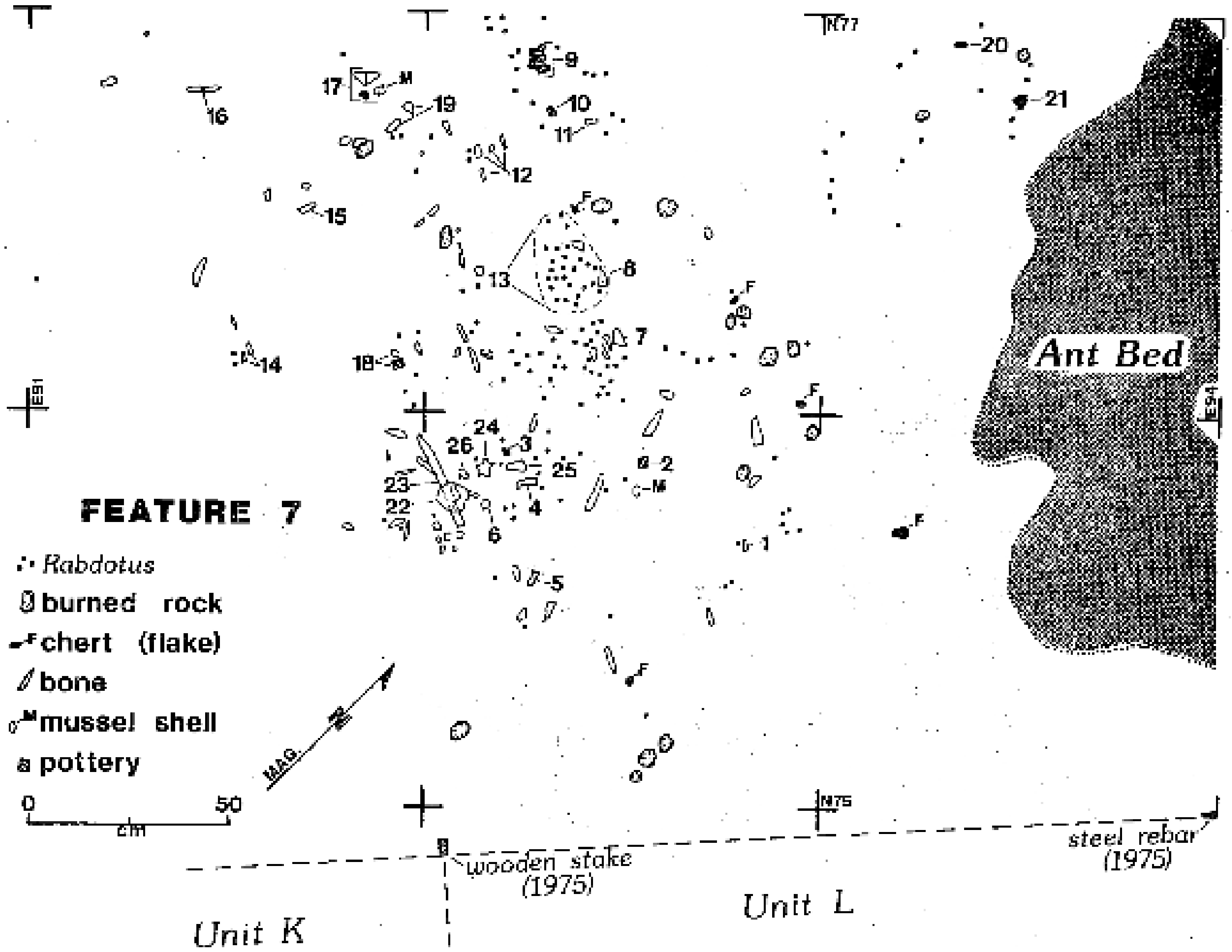


Figure 23. **Plan Map of Feature 7.** Numbered items are listed in Table 27.

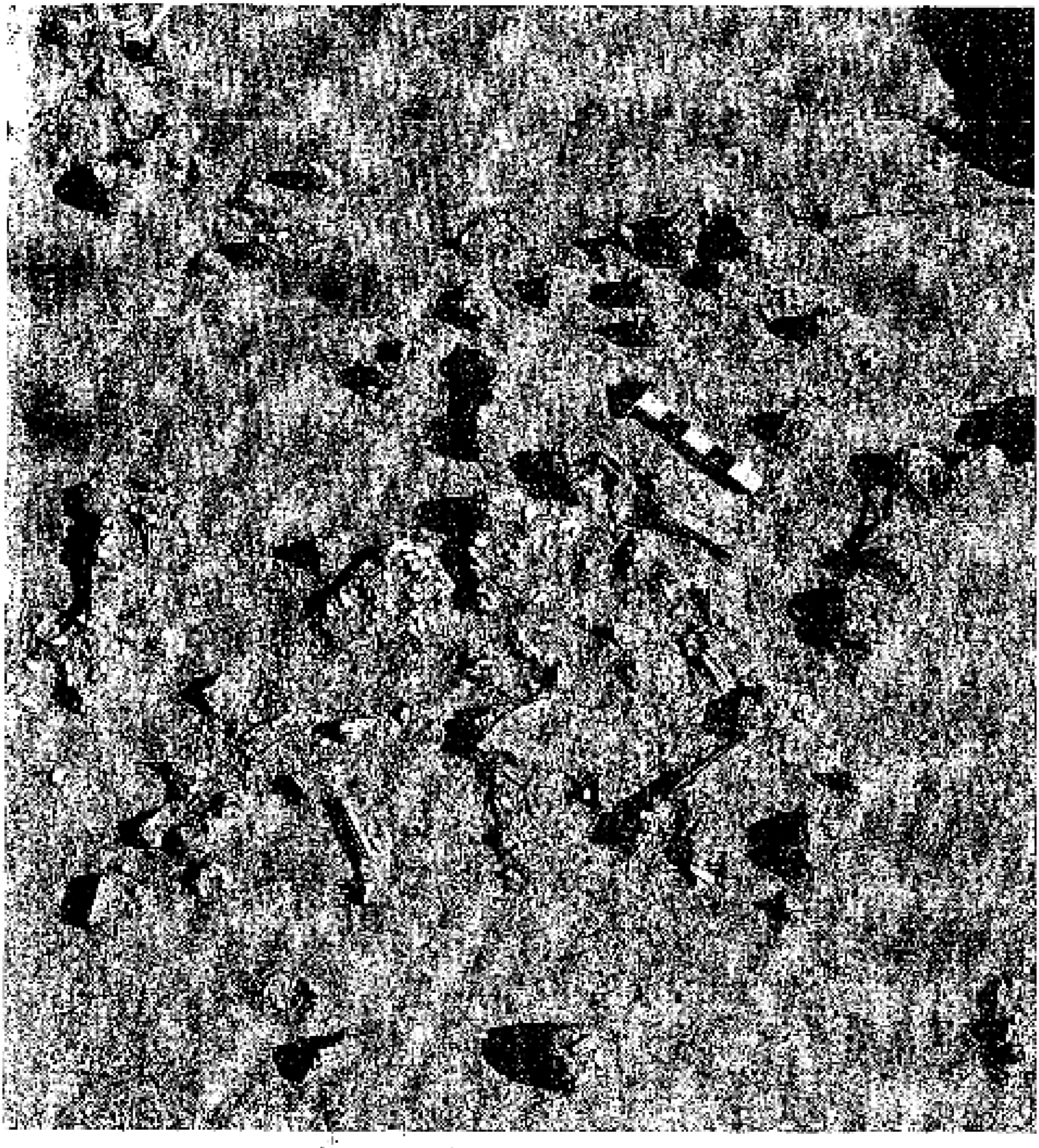


Figure 24. View of Feature 7. Note concentrated Rabdotus and fragmented bone.

very large amounts of **Rabdotus** snails, including three clusters; a mussel shell pendant, a piece of incised mussel shell; pottery sherds; biface fragments; and many modified and unmodified flakes. In addition, a small cluster of bone elements was uncovered within and below the concentrated layer.

The small bone cluster was not given a separate feature designation, however, it was similar to the formally recorded cluster features. The bones represent a bison-sized large mammal and are badly fragmented. One bison bone and a pronghorn bone were identified with this fragmented cluster. The upper portions of several of the bone fragments were first detected at the same level as Feature 7.

Four of the mammal fragments found in Feature 7 (items 7 and 13) are spirally fractured and have butcher marks. This suggests that the area may have been used for butchering animals.

Several hundred **Rabdotus** land snails were recovered in association with Feature 7. Three clusters were apparent. The central cluster (Fig. 23, item 13) had 36 large snails, several artifacts, and bones. The **Rabdotus** clusters are comparable to those found within Feature 11.

Two incised mussel shell artifacts and a goose or duck humerus with a cut and snap brake, indicating the shaft was purposefully removed, were recovered from Feature 7. One of the mussel shell artifacts is a complete pendant (Fig. 12,d). The other is a fragment that may represent manufacturing debris. It is possible that the Feature 7 area was a mussel and bone working area.

<u>Interpretation</u>: Feature 7 is thought to represent a living surface or activity area deposited in a single occupational episode. This living surface is associated with the small cluster of bison bone found within and below the feature and possibly with the "bone bed" found in 1975. The "bone bed" was located about 1.5 to 2 m to the east of the central area of Feature 7 (as exposed). It is suggested that the "bone bed" was a large bone disposal feature (cluster), i.e., a small erosional gully filled with butchered bone (mostly bison) and covered. Feature 7 may be the center of the butchering activity area from which the "bone bed" materials were derived. Due to the aforementioned problems, this interpretation must be considered tentative.

FEATURE 11

<u>Provenience</u>: Across most of the western two-thirds of the main Wagon Trail Area excavation block between approximately 99.95 and 99.85 m in elevation.

<u>Dimensions</u>: The defined portion of Feature 11 covers an area measuring 6 x 5 m (NW-SE x SW-NE). The living surface obviously continues to the south and west. Most of the plotted items were found between 99.92 and 99.88 on a more or less level surface.

<u>Associations</u>: Features 6 and 10 occurred within Feature 11 and are considered to be contemporaneous. Numerous artifacts were recovered from

Feature 11. It is not possible to enumerate all of the associated materials as many items were found on the screen or were otherwise not plotted in place. Figure 25 shows the approximate extent of Feature 11 and the distribution of the major plotted items. These consist of some 50 plotted bone elements, three ulna tools, three **Rabdotus** clusters (not including the cluster on the edge of Feature 6), three end scrapers, six modified flakes, seven ceramic sherds, a Perdiz arrow point, and four miscellaneous lithic tool fragments.

Radiocarbon Assays: See Feature 6.

Special Sampling: None.

Description: Feature 11 was a concentration of cultural materials all on the same surface level. The surface was defined by the artifact elevations and was not otherwise physically discrete. The concentration occurred at the bottom of the plow zone. It is likely that other materials related to the feature have been displaced by plowing. The absence of materials east of the E98 grid line may be an artifact of the "wagon trail" or road on the inside of the fence.

One interesting aspect of Feature 11 was the occurrence of several small **Rabdotus** clusters. Four of these are shown in Figure 25 and are visible in the foreground of Figure 26. Each small cluster of large **Rabdotus** land snails contained 20 to 40 snails and was vertically and horizontally discrete. Numerous scattered **Rabdotus** snails were found in Feature 11. The clusters may represent small piles of snail shells that were discarded after the snails had been consumed (or removed for consumption). Several other slightly less discrete clusters were noted during the excavations within Feature 11 as well as other proveniences within the site.

Interpretation: Feature 11 is interpreted as a concentration of cultural material left on a common surface after a single occupational episode. This is evidenced by the large number of items found vertically clustered at roughly 99.90, some 20 to 30 cm below the surface. The interpretation that the materials were deposited during a single occupational episode is based on the presence of intact artifact clusters (**Rabdotus**, bone fragments, and Features 6 and 10) and the presence of a number of fragile items that are well preserved. It is argued that if the surface had not been covered fairly rapidly by sediments and decomposed organic matter (leaves and such) the clusters would not have survived intact, and the fragile items would have been poorly preserved.

A number of activites obviously contributed debris to the Feature 11 surface. Feature 6, as has been discussed, is believed to be a cooking hearth used for several cooking episodes. Feature 10 is interpreted as a faunal disposal pit dug from the Feature 11 surface or possibly higher. The three ulna tools (one pointed awl and two blunt-tip flakers) attest to flintknapping and sewing/weaving activities. The end scrapers and modified flakes suggest hide working and other activities. The overall impression of the feature is of a discard area for the refuse of many activities. Feature 11 is obviously a part of a much larger distributional pattern that cannot be accurately defined without the excavation of a much larger surrounding area.

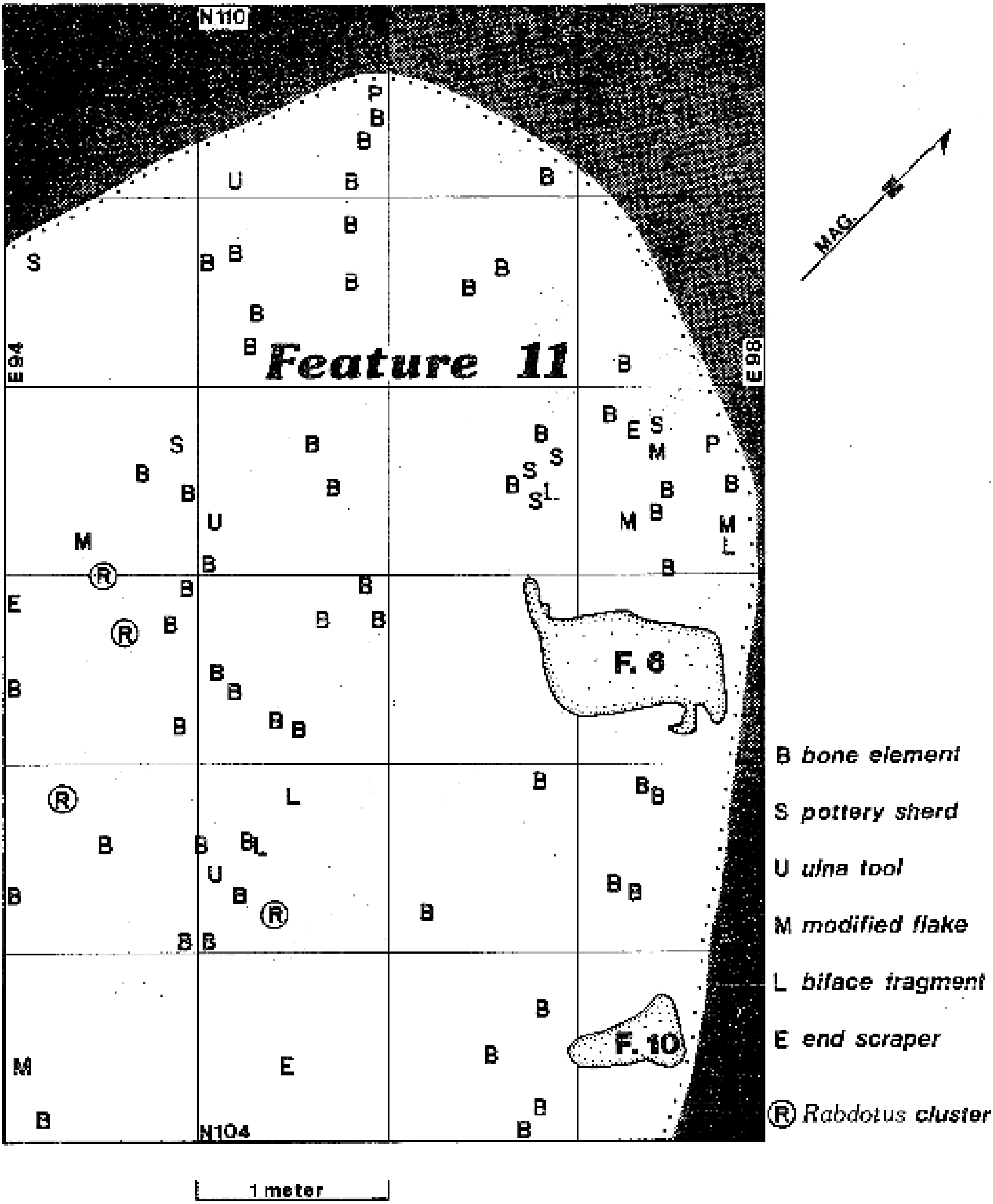


Figure 25. Plan Map of Feature 11.

Figure 26. **View of Feature 11.** Courtenay Jones is plotting Feature 11 items. Feature 6 is visible on extreme right side.

IX. ARTIFACT AND FEATURE DISTRIBUTIONS

The distributions of the artifacts and features found at 41 JW 8 during the 1981 season are discussed both for the overall site and for each excavation area. The emphasis here is placed on the discussion of the artifacts and features found in the major excavation block, the Wagon Trail Area. The raw data on the artifact distributions are presented in Appendix I.

OVERALL DISTRIBUTIONS

On a site-wide basis, the cultural materials are strongly concentrated in the upper 30 cm. A few excavation areas exhibit deeper distributions; however, very little evidence was found of earlier occupations or more than one horizon. Unfortunately, the bulk of the cultural materials was recovered from Levels 1 and 2 in all areas of the site. Levels 1 and 2 occur wholly and partially, respectively, within the plow zone at the site. This is documented by the study of plow-damaged arrow points (Section VII: Perdiz Arrow Point Special Studies), the absence of intact features in Level 1 and Level 2 (except in the WTA), and the excavation wall profiles (Fig. 27).

The virtual absence of any physical evidence of an earlier occupation or deeper horizons and the lack of earlier chronological indicators suggest that the cultural materials can be attributed to a single component. There is some evidence in the Wagon Trail Area that the Late Prehistoric component represents several repeat visits to the site by the same group or closely related groups. Even so, all of the primary occupation materials are restricted to a single horizon in any one excavation unit. In other words, there are no examples of significant cultural material concentrations in nonadjacent levels within any excavation unit. In all cases where cultural materials were found below Level 3, the quantities of almost all materials tapered dramatically. It is also significant that the excavation units with the deeper distributions of cultural materials were also the units with the most evidence of postdepositional disturbance.

HORIZONTAL ARTIFACT DISTRIBUTIONS

Based on the preceding reasoning, it can be assumed that materials found in any excavation level are attributable to the Late Prehistoric component. Thus the horizontal distributional patterns are used for a comparison of the various excavation areas. Table 28 shows the horizontal distribution of various artifact categories by excavation area. Each excavation area is physically separated from the other areas as shown in Figure 1. Due to the variation in excavation area size from a 1- x 2-m area (N123 E106) to an irregular area with 48 contiguous 1-m^2 (WTA), the excavation areas are compared on the basis of the unit cell averages (density).

A unit cell at 41 JW 8 is the smallest provenience unit, the 1-m^2. The unit cell averages are calculated by totaling all the cultural material counts or weights of a given category for every level within an excavation area and dividing the resulting total by the number of unit cells in the area. For example, 63 Perdiz points were found in the 48 unit cells of the WTA. The

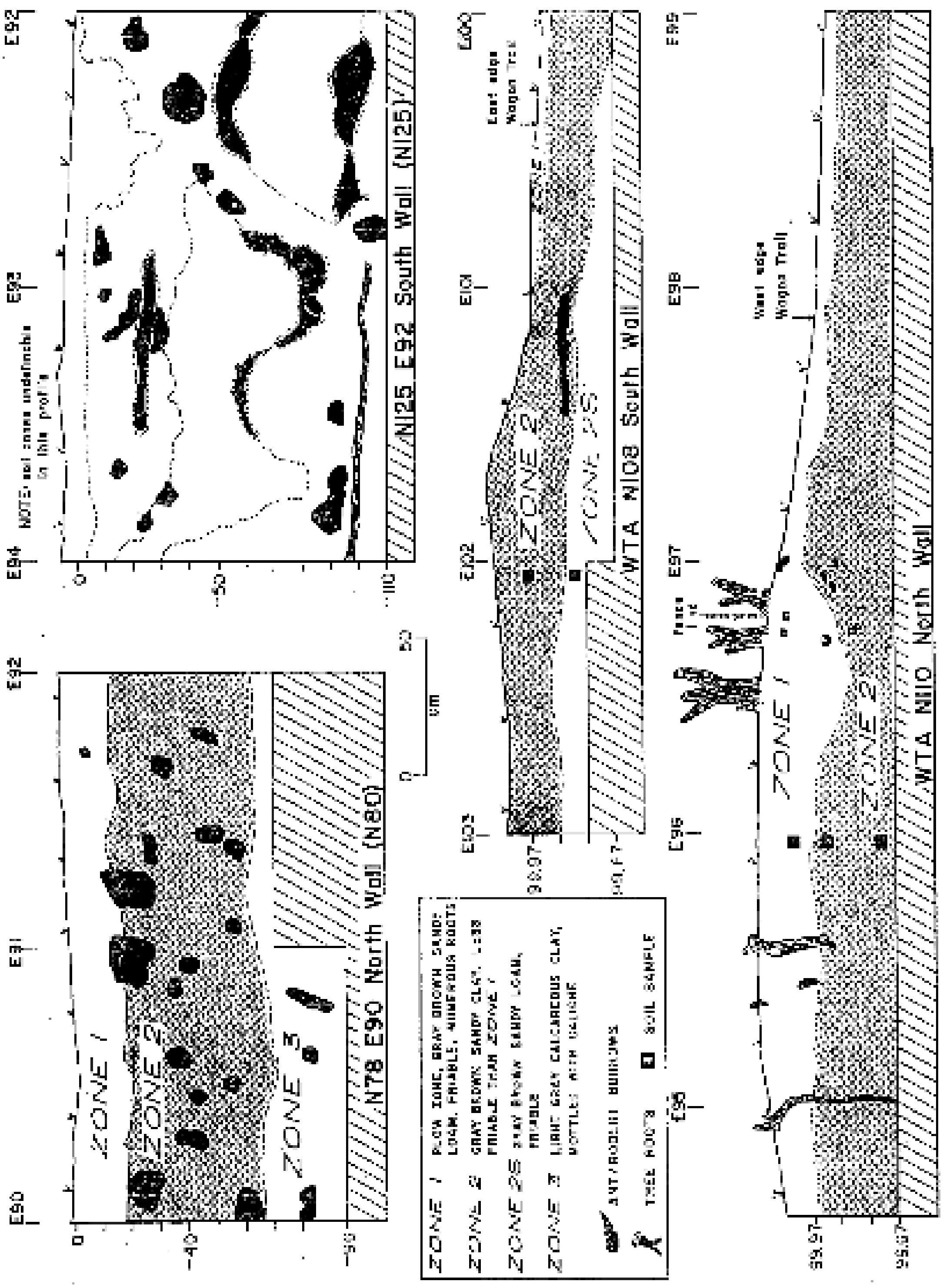


Figure 27. Excavation Unit Profiles.

TABLE 28. HORIZONTAL ARTIFACT DENSITIES BY EXCAVATION AREA

Excavation Area	Number of Cells	Arrow Points A1	Arrow Points A4	Bifaces	U-1	Sherds	XD	D	Cores	Rabdotus	Mussel	BRW*
"Bone Bed"	8	0.88	1.00	2.00	1.00	11.88	11.00	204.75	0.50	104.12	0.75	1.05
N78 E90	4	1.00	0.75	4.00	0.25	16.50	9.00	175.75	0.00	266.00	1.75	1.63
N80 E102	4	0.75	0.00	0.50	0.25	2.25	5.50	33.25	0.00	48.50	0.50	0.25
N92 E92	4	1.50	0.75	2.50	0.75	13.75	15.00	132.00	0.25	73.75	0.75	0.98
N95 E82	4	1.50	0.00	1.00	0.75	4.25	12.25	125.25	0.75	155.50	0.50	2.31
N100 E93	4	0.50	1.00	3.25	0.00	8.00	12.75	113.75	0.50	130.75	1.00	2.37
WTA	48	1.31	1.33	2.27	0.75	7.60	10.48	162.77	0.31	244.14	1.79	0.75
N123 E106	2	0.50	0.00	0.00	0.00	0.50	1.00	12.00	0.00	158.50	1.50	0.40
N125 E92	4	1.00	0.50	3.25	1.50	8.75	15.00	133.75	0.75	724.00	39.00	6.40
Artifact Totals	82	96	84	183	50	675	883	12,330	28	19,103	269	100.97
Average Densities		1.17	1.06	2.23	0.71	8.23	10.77	150.36	0.34	232.96	3.28	1.23

*Burned Rock Weight (BRW) in kilograms. All other items are counts.

cell average is 1.31 (63 divided by 48). Note that it does not matter how many excavation levels were dug in a given unit cell because this is a cell average rather than a level average.

The artifact categories not shown in Table 28 are represented by so few specimens that a horizontal distribution has little relevance. In some cases several artifact categories are combined. All the complete and fragmentary bifaces (B and FB) are combined except for the arrow points. All the modified debitage categories (MD) and all the debitage categories (D) are combined.

Table 28 shows that most artifact categories are not evenly distributed among the excavation units, an unsurprising observation. Two of the areas, N80 E102 and N123 E106 have very low concentrations of all materials and are considered to be out of the major occupation zone. It is significant that those two areas are the easternmost excavations on the very edge of the bluff top overlooking the creek.

All of the remaining areas with moderate to high artifact distributions are considered part of the main occupation area. It is thus apparent that the western, northern, and southern limits of the site were not reached by the excavations. It should be noted that Table 28 is organized so that the southernmost area is at the top, and the northernmost area is at the bottom. Thus, one can see at a glance some north-south trends in the artifact distributions. For example, the Perdiz points occur in the greatest density in the central areas of the site (as tested) while the pottery sherd density is greater in the southern areas.

It is interesting that the southernmost areas (the "bone bed" area and N78 E90) and the northernmost unit (N125 E92) have most of the highest artifact densities at the site. Other trends are apparent; however, it is difficult to place much emphasis on the significance of these trends as they are based on comparatively little testing. The reader is reminded that the 1981 investigations were not oriented toward sampling the entire site but rather locating a well-preserved area and focusing on a block excavation.

Each excavation area will be summarized in terms of the significant artifact distributions and features. Postdepositional disturbances that could have effected the distributions are also discussed as well as vertical distributions. Some inferences as to activity areas are drawn.

"BONE BED" AREA

Our attempts to open a major excavation block in the "bone bed" area of the site were seriously hampered by a huge leaf cutter ant nest (Figs. 1 and 23). This was unfortunate because the artifact densities were comparatively high in this area. The highest cell density rate for debitage at the site was recorded for this area. Above average densities of end scrapers, sherds, modified debitage, and cores were also recovered in this area. The other artifact categories have moderate densities in the "bone bed" area that are slightly below the site average for most categories.

The eight cells in the "bone bed" area were excavated to a depth of 30 or 40 cm below the surface (Level 3 or 4). As is the case over most of the site, the artifact quantities were lower in Levels 3 and 4 than Levels 1 and 2. Feature 7 was recorded in this excavation area in the lower portion of Level 2. Just south of the 1981 excavations in this area, the "bone bed" was uncovered in 1975 (Hester 1977). In all likelihood, extensive excavations in this vicinity would produce additional intact features. This area is considered to be within the intensive occupation zone at the Hinojosa site.

N78 E90

Unit N78 E90 is just north of the "bone bed" area and has comparable artifact densities. The highest densities of bifaces and pottery sherds at the site were recovered from N78 E90. Above average debitage, **Rabdotus**, and burned rock densities were also recorded. The four cells were excavated through Level 5 (two cells), Level 7, and Level 8. The highest recovery of most artifact categories occurred in Level 2 or 3. All artifact categories except **Rabdotus** tapered off in the lower levels. The **Rabdotus** recovery actually increased somewhat in Level 7. No explanation is readily apparent as this increase is not correlated with increases in other categories. No cultural features were recorded. Moderate ant and rodent disturbances were noted in this area (Fig. 27) and may have contributed to the presence of small numbers of artifacts in the lower levels.

N80 E102

Unit N80 E102 is located on the bluff edge and appears to have been on the margin of the occupation area. The excavations were conducted through Level 3 (two cells), Level 4, and Level 5. All categories of artifacts occurred in low to very low densities. Ant, rodent, and root disturbances were noted.

N92 E92

Unit N92 E92 had high densities of **Perdiz** points, bifaces, end scrapers, sherds, and modified debitage. The excavations were continued through Level 3 (two cells) and Level 5 (two cells). The upper two levels has very high densities, Levels 3 and 4 had very little cultural material, and Level 5 was sterile. Other than the plow zone, no disturbances were noted. No features were exposed.

N95 E82

Unit N95 E82 was the westernmost excavation at the site and was placed within the wheat field that was planted during the 1981 field season. The clay content of the soil in this area was higher than other tested areas of the site. Higher than average densities of **Perdiz** points, modified debitage, end scrapers, cores, and burned rock were recovered. The excavations continued to Level 3 (two cells), Level 4, and Level 5. Once again, high artifact densities were evidenced in the upper two levels, low densities in Level 3, and almost nothing in the lowest two levels.

One small rock cluster was exposed in Level 2. This cluster did not have a noticeable concentration of charcoal or a well-defined shape, therefore it was not formally recorded as a cultural feature. The cluster was found in the lower portion of the plow zone and was probably partially displaced. A phosphate spot test of the cluster matrix indicated only a moderate level of phosphate.

The artifact recovery and the rock cluster suggest that the N95 E82 area was within the main occupation zone.

N100 E93

Unit N100 E93, a four-cell area, was located just south of the WTA. All cells were excavated through Level 6. As with most areas, high densities of cultural materials were recovered from the upper two levels. The biface, modified debitage, core, and burned rock densities were higher than the site average. Interestingly, a minor increase in cultural material occurred in Level 6 where a small cluster of burned rock (Feature 4) was recorded. The rock cluster was associated with a slight increase in debitage and little else. The absence of charcoal or artifacts, which could have provided chronological information, limits the interpretation of this feature. As it is the deepest feature found at the site, it could date to an earlier brief occupation.

N123 E106

Unit N123 E106 was a two-cell excavation area placed on the very edge of the bluff toward the northern end of the site. Both cells were excavated through Level 8. Low to very low densities of cultural material were recovered from all levels. Minor changes in density were observed on a vertical basis as materials were recovered in all levels. The wall profile revealed that the deposits sloped markedly from west to east (toward the creek). The cultural materials in the unit are thought to be derived from slope wash deposits of materials originally deposited up the slope (to the west). Several large rodent runs were observed. This area is interpreted as being down slope from the occupation zone and out of the main site area.

N125 E92

Unit N125 E92 was a four-cell area and the deepest excavation at the site. All cells were excavated through Level 11. Once again very high densities of cultural material were recovered from the upper two levels, while low densities were recovered from the lower levels. Minor increases in debitage and burned rock were recorded for several of the cells in Levels 7 through 9. A small rock cluster (Feature 1) was recorded in Level 4. Rock scatters were recorded in Levels 3 and 9. These burned rock accumulations are not regarded as particularly significant due to the extreme disturbance noted in the area. During the excavation, many areas with noticeably unconsolidated (loose) soil were noted and attributed to rodent activity. When the excavation wall was profiled (Fig. 27), the extent of the disturbance was so great that any apparent cultural feature was suspect. It is hypothesized that the severely disturbed area is the result of field leveling activites. The high densities of certain artifacts indicate the area was within the main occupation zone.

The N125 E92 area contained the highest densities of unifaces, cores, **Rabdotus**, mussel umbo, and burned rock of any area at the site. The **Rabdotus**, mussel umbo, and burned rock densities are in particular, far and above any densities in evidence in the other portions of the site. This may be partially explained by the severe disturbance in the area. Perhaps field leveling resulted in the area being filled by adjacent surface materials. On the other hand, these densities could indicate a major activity area, where mussels and snails were cooked or discarded.

WAGON TRAIL AREA

The WTA excavations were the main focus of the 1981 field season. The excavations began with two separate four-cell units that were eventually connected as the area was expanded to 48 cells and a small 0.5- x 1-m unit (added to expose Feature 9). In comparison to the other excavation areas, the WTA had the highest density of arrow point fragments (A1) and above average densities of **Perdiz** arrow points, bifaces, and scrapers, debitage, and **Rabdotus** snails. The densities of all other categories were slightly below the site average except for burned rock which was noticeably scarce. Three to six levels were excavated in each cell, with most excavated through Level 4. The greatest densities were recovered from the upper two levels; however, moderate quantities were also recovered from Levels 3 and 4.

As has been mentioned, the WTA was less disturbed than any other tested area of the site. The plow zone affected the upper level and a half on the field side of the fence. The large mesquite trees along the fence caused some disturbance by their roots. Just inside the fence on the creek side, the soil was compacted by traffic along the "wagon trail" or field road. Other disturbances were caused by rodent and insect burrowing. The presence of seven well-preserved features attests to the relatively minor degree of postdepositional disturbance in the area.

The comparatively large excavation area warrants a closer look at the artifact and feature distributions in the WTA. Figures 28 through 33 are distributional maps of various artifact categories and features in the WTA. The artifact density maps were prepared by extracting the raw data from the provenience charts in Appendix 1 and plotting the numbers on plan maps of the area. Various combinations of levels were used depending on the artifact category. For example, most all the sherds were found in Levels 1 and 2, hence these levels were combined for the density map. Burned rock occurred in all levels, hence maps were constructed for Levels 1 and 2 and Levels 3 and 4. The density intervals were chosen by listing all the cell totals for any given category (for example, the Level 1 and 2 totals of sherds) and looking for breaks in the distributions. In this way the highest densities

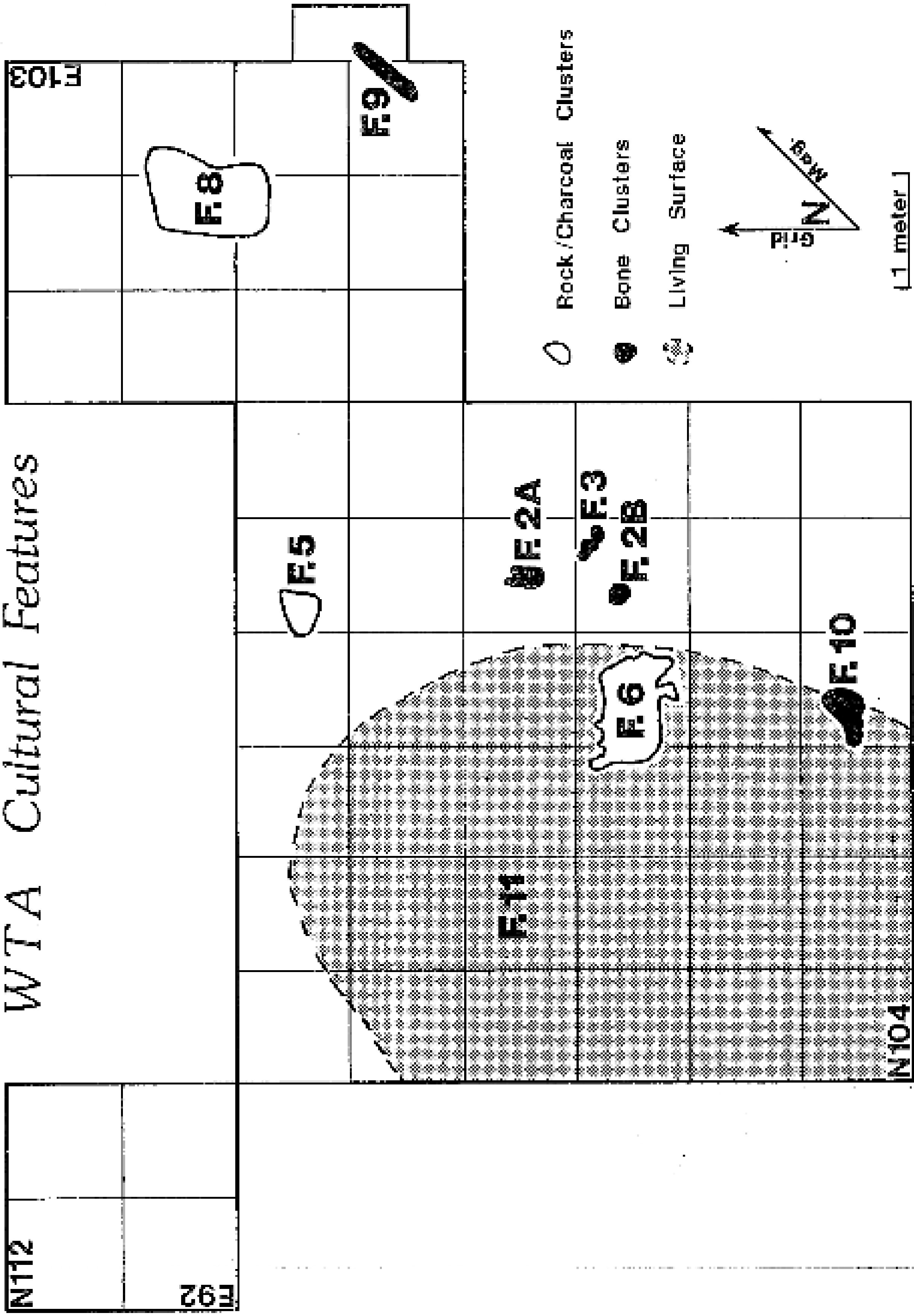


Figure 26. WTA Cultural Feature Distribution.

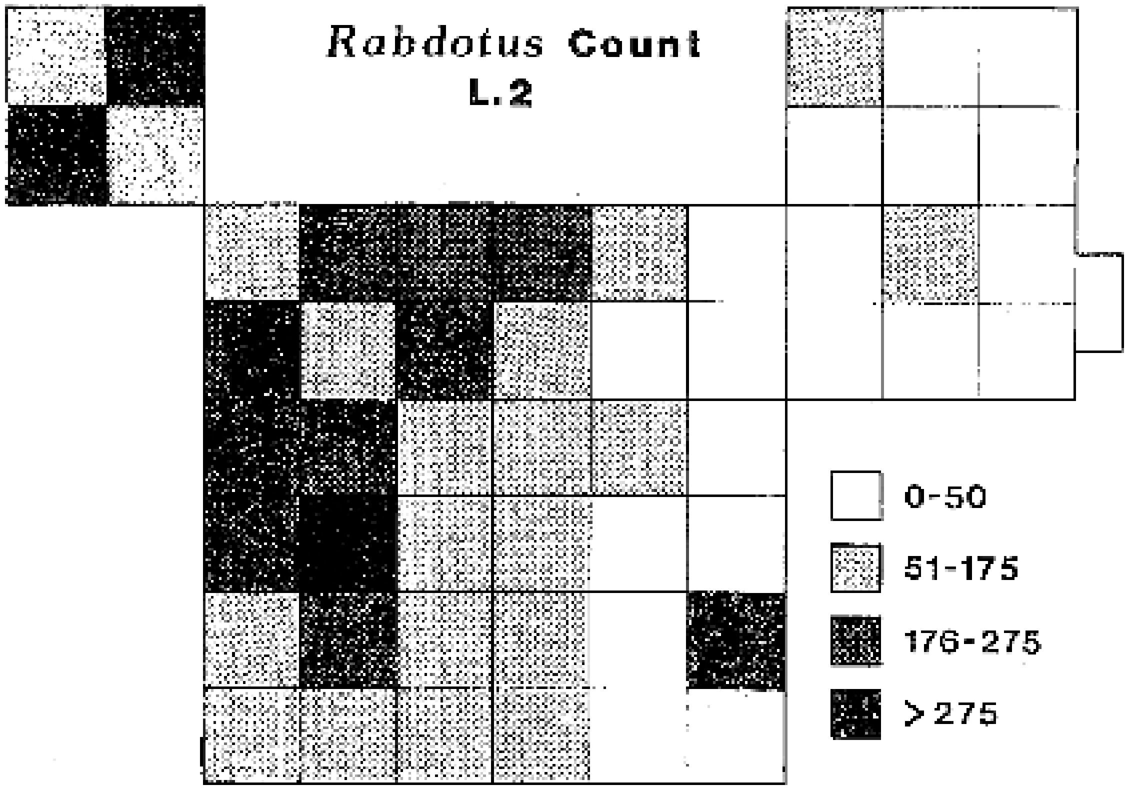
for any given category are highlighted. The resulting maps allow us to compare the distributions of various artifact categories across the WTA.

Overall, most artifact categories have higher densities in the western half of the WTA than the eastern half. In particular the northeast cell block (WTANE) has comparatively low densities of many artifact categories. In fact if this block were removed from the WTA cell averages, the WTA would have noticeably higher densities of most artifact categories. It is significant that the WTANE is on the edge of the creek bluff. All of the excavations near the bluff edge revealed comparatively low artifact densities. This suggests that most of the site occupation occurred away from the edge of the bluff.

The distribution of the cultural features in the WTA somewhat contradicts the previous statement as two of the features (Features 8 and 9) were found near the bluff edge. As Figure 28 shows, all of the features in the WTA were found in the eastern half of the area except Feature 11, the living surface. It is difficult to determine if the WTA features are contemporaneous or represent activites from several reoccupations. The rock/charcoal cluster features (5, 6, and 8) have overlapping radiocarbon assays, however, the majority of the Feature 6 assays are earlier than the assays from Features 5 and 8. The bone cluster features (2A, 2B, 3, 9, and 10) are generally lower in elevation than the rock/charcoal features; however, since they are interpreted as bone disposal features that were placed in small pits or erosional features it is likely that some or all are contemporaneous with the other features. It may be significant that none of the rock/charcoal or bone clusters overlap horizontally. If one were found directly or partially above another, then multiple occupations could be inferred. Thus, the possibility that all the features are contemporaneous cannot be ruled out.

The mapped artifact distributions show a number of reasonably distinct concentrations that suggest specific activity areas. It should be noted that the 1-m cell may not provide enough resolution to accurately define activity areas. Based on the block excavations at a number of sites in the Choke Canyon Reservoir area, Hall (personal communication) believes that 50-cm provenience cells are needed. Hall argues that the 1-m cell masks the distribution of small activity areas. Nonetheless, the distribution maps of the WTA do reveal artifact clustering at the 1-m cell resolution that suggests behavioral patterning. The distributional patterns of each plotted artifact category are discussed next.

The WTA distribution of **Rabdotus** land snails is plotted for Level 2 in Figure 29 (upper). Level 2 was chosen because the **Rabdotus** quantities were higher in most units in Level 2, and they were associated with Feature 11 which had several plotted clusters of snails. The single cell recovery rates in Level 2 ranged from a low of seven in N109 E102 to a high of 378 in N106 E95. Most of the higher densities of **Rabdotus** snails were found in the western half of the WTA. Two definite anomolies are present, the N106 E95 concentration and a concentration of 253 found in N105 E99. Both of these squares have much higher quantities of **Rabdotus** than the surrounding squares. These are interpreted as disposal piles of snails. Four small clusters were defined within Feature 11. These four clusters occur a meter to a meter and a half away from the center of N106 E95 and almost ring the cell. It may be



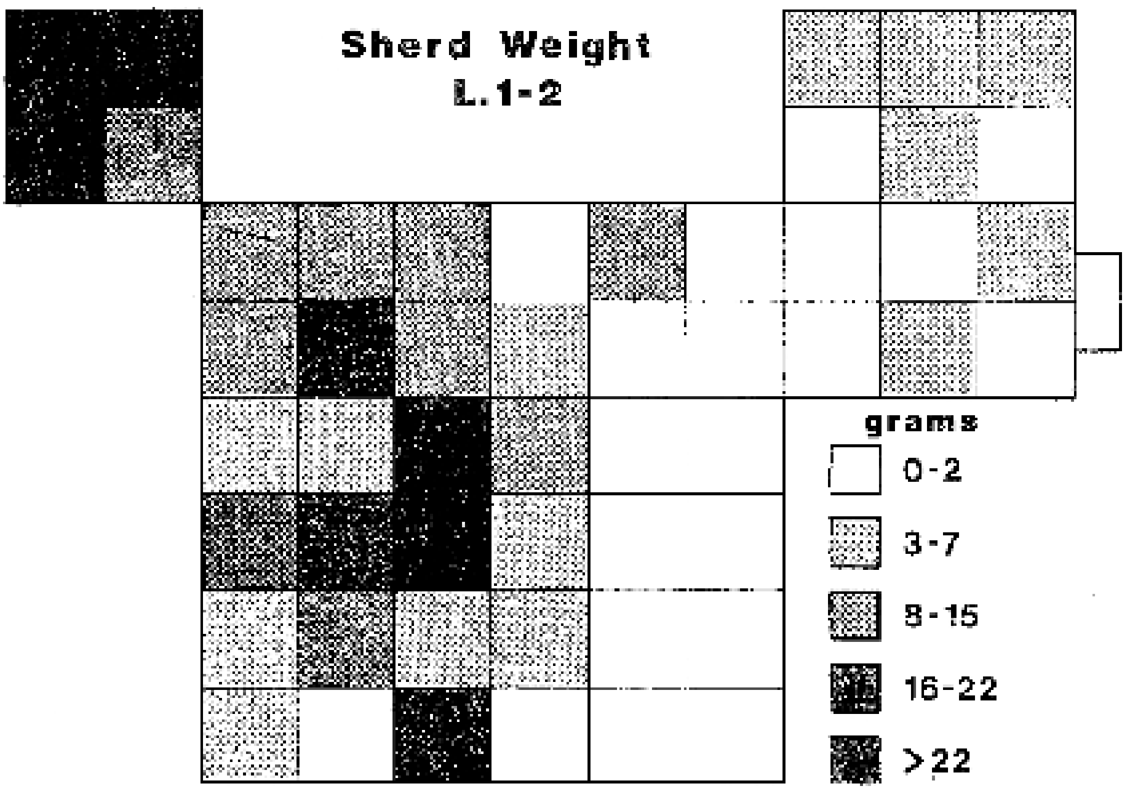


Figure 29. WTA Rabdotus Distribution, Level 2 and WTA Sherd Weight, Levels 1 and 2.

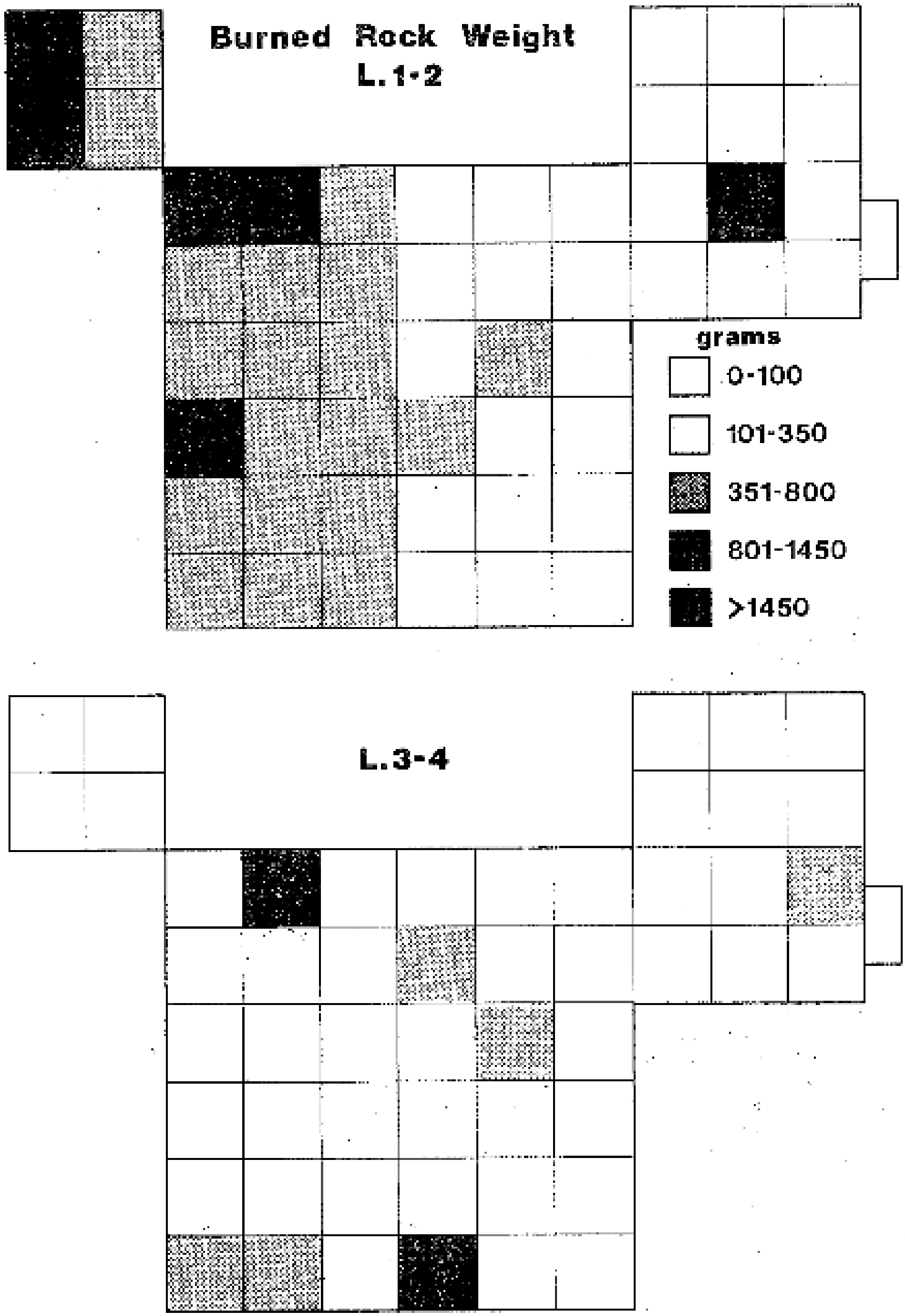


Figure 30. **WTA Burned Rock Distribution, Levels 1, 2, 3, and 4.**

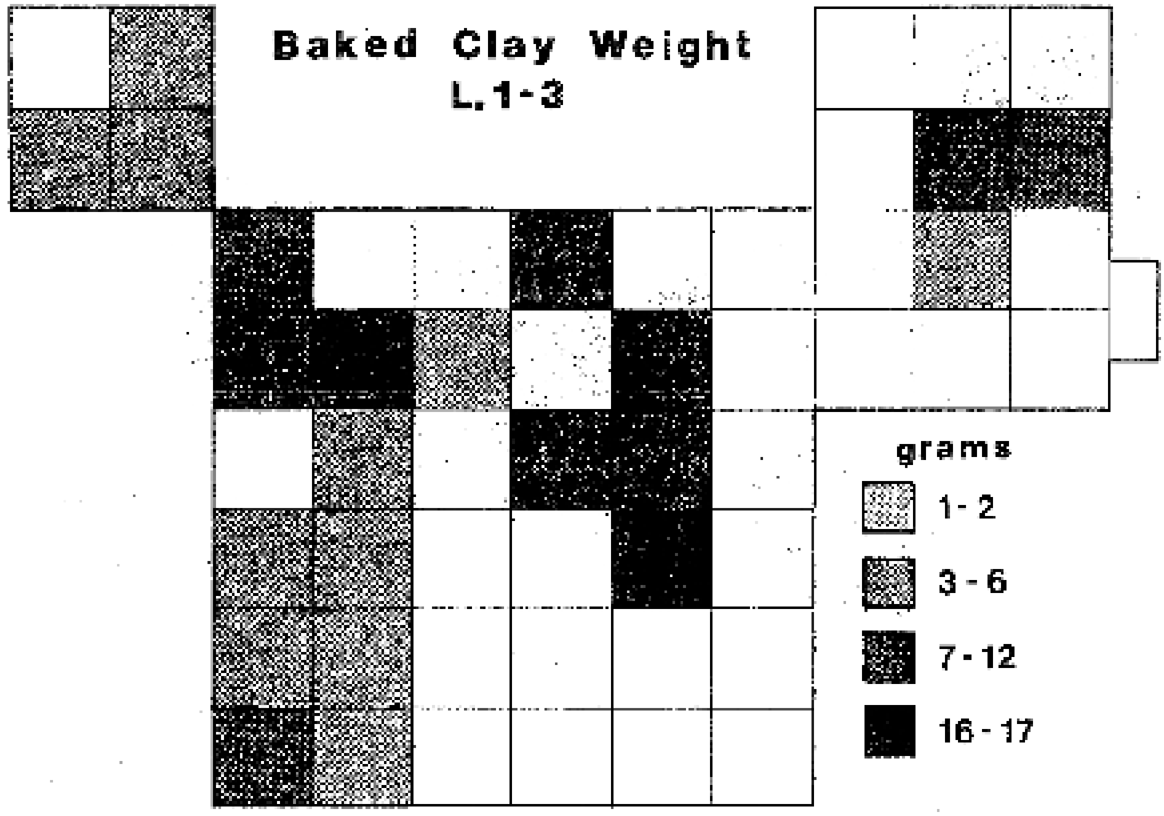
significant that the two anomalies occur east and west of the two features interpreted as primary hearths or cooking features (5 and 6). If these distributions are assumed to be contemporary, then one could suggest that the snails were being discarded away from the most likely cooking locations.

It is interesting to note that **Rabdotus** snails appear to be negatively correlated with the bone clusters. Very few **Rabdotus** shells were found in association with any of the bone clusters. This suggests that snail processing/disposal was a separate activity from bone processing/disposal. This could be attributed to several different reasons: (1) snail gathering was not done when animal meat was available; (2) snail and meat processing/disposal activities were conducted by separate members of the group; or (3) the two activities were conducted at different times of the year (during different occupations).

Figure 30 shows the distribution of burned rock in Levels 1 and 2 and Levels 3 and 4. The Level 1-2 map shows consistently higher rock densities in the western half of the WTA. This map also shows at least five anomalies with noticeably higher quantities of burned rock. It is interesting that the rock/charcoal cluster features are only partially correlated with the high density cells. The Level 3-4 map shows consistently less rock than the upper map, but also shows five higher density anomalies. These lower anomalies are not correlated with any of the rock/charcoal cluster features. Two of the concentrations on the lower map are correlated with upper map anomalies, therefore probably reflect single disposal events. The fact that overall, the cells with high burned rock density are not directly associated with fire features suggests that these distributions may be linked to disposal patterns. The presence of three anomalies on each map that do not overlap with lower or higher anomalies may suggest temporal differences in occupation. The lowest anomalies presumably represent earlier disposal events than the overlying upper anomalies. This supports the idea that the site deposits represent several repeat occupations.

Figure 29 (lower) shows the WTA distribution of ceramics in Levels 1 and 2. Once again, the highest densities occur in the western half of the WTA, and several higher density clusters or anomalies can be defined. The higher densities of pottery sherds show wider distributions than the snail or rock concentrations. The central higher density cluster occurs immediately west of Feature 6. It will be recalled that Feature 6 is interpreted as possibly having been used to cook (boil?) snails in a ceramic vessel. In fact the ceramic and **Rabdotus** anomalies west of Feature 6 do overlap. The other major ceramic concentration occurs in the four-cell-block on the northwest corner of the WTA. Both ceramic anomalies may represent the main sherd distribution of broken vessels. This possibility is difficult to evaluate in view of the extremely fragmented nature of the ceramic sample.

Figure 31 (upper) shows the WTA distribution of baked clay in Levels 1-3. Comparatively small quantities of baked clay were recovered. Baked clay was typically recovered as small lumps and is interpreted as resulting from building fires within or on top of clay-rich soil. Although baked clay was found in association with both Feature 5 and Feature 6, the higher density cells surround these features. This may partially be a result of the removal of considerable quantities of baked clay in the matrix samples collected from



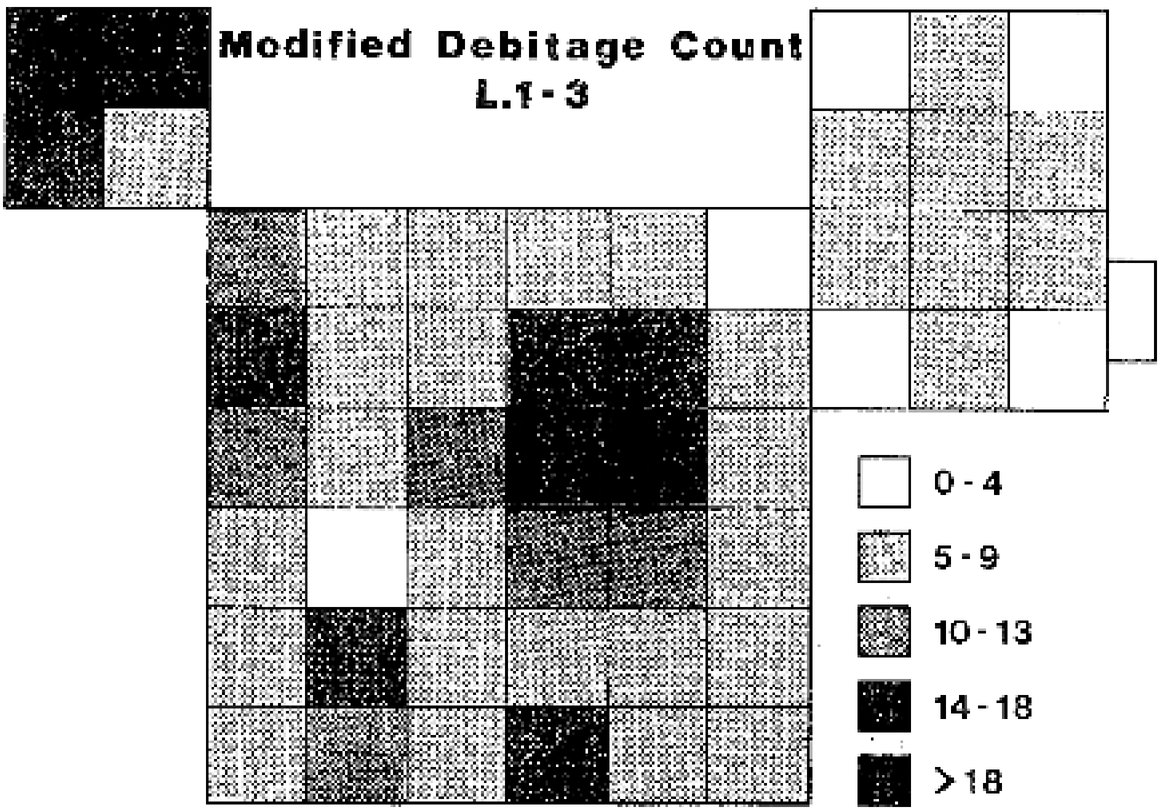


Figure 31. WTA Baked Clay Distribution, Levels 1-3 and Modified Debitage Distribution, Levels 1-3.

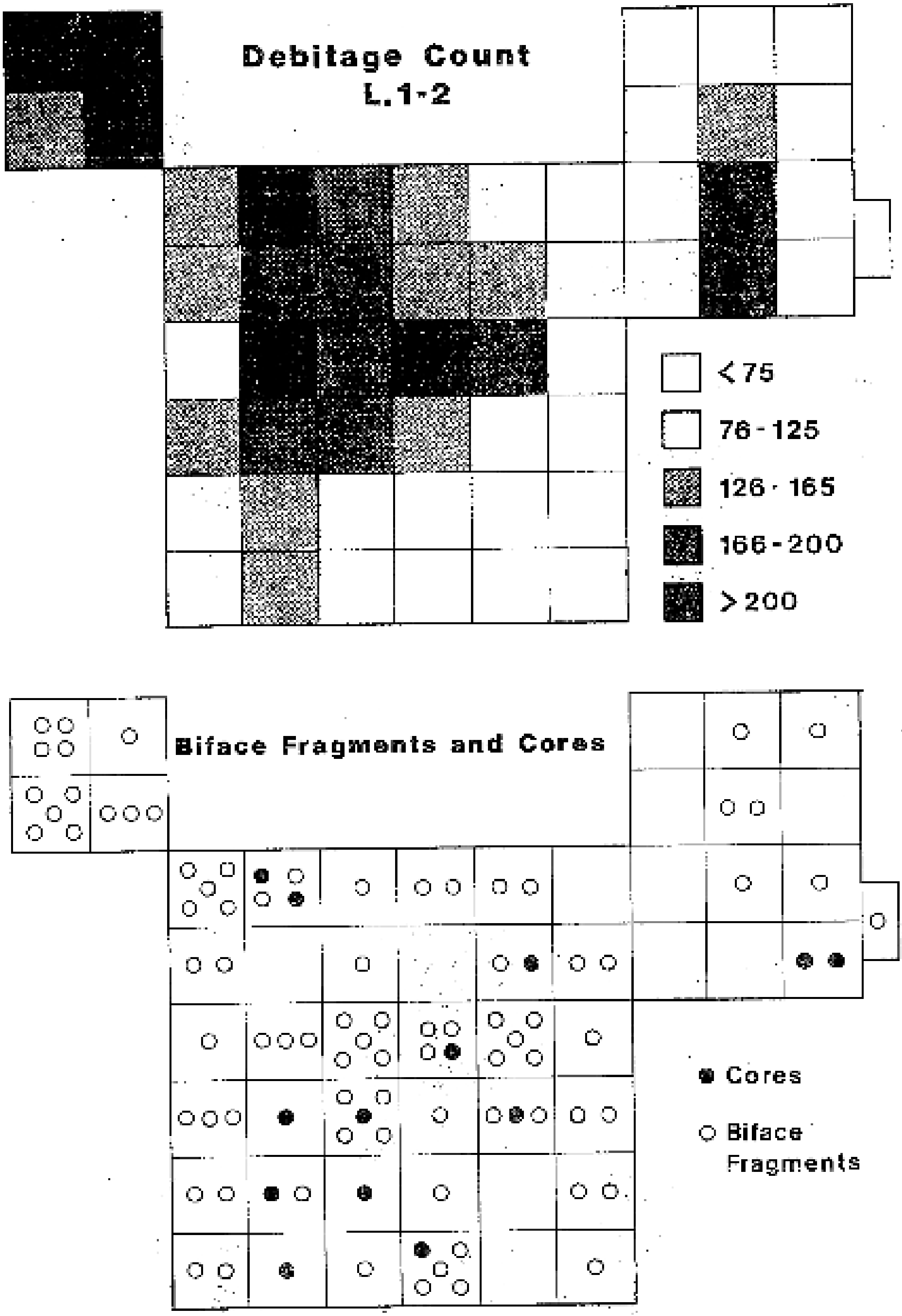


Figure 32. WTA Cores, Biface Fragments, and Debitage Distributions.

these features. The matrix baked clay has not been quantified. Feature 8 is directly associated with a baked clay anomalie. Several of the burned rock and baked clay concentrations coincide or overlap. Both are obviously related to fire activities.

Figure 32 shows the Level 1-2 distributions of debitage, bifacial fragments, and cores in the WTA. Table 29 shows the cell densities of biface fragments and cores by the plotted frequency ranges. The biface frequency is highly correlated with debitage frequency; progressively more bifaces were found in the cells with progressively higher debitage quantities. With one exception, the density of the cores is also positively correlated with increased debitage. These correlations and the map distributions provide good evidence for a major flintknapping activity area located in the northwest quadrant of the main WTA excavation block.

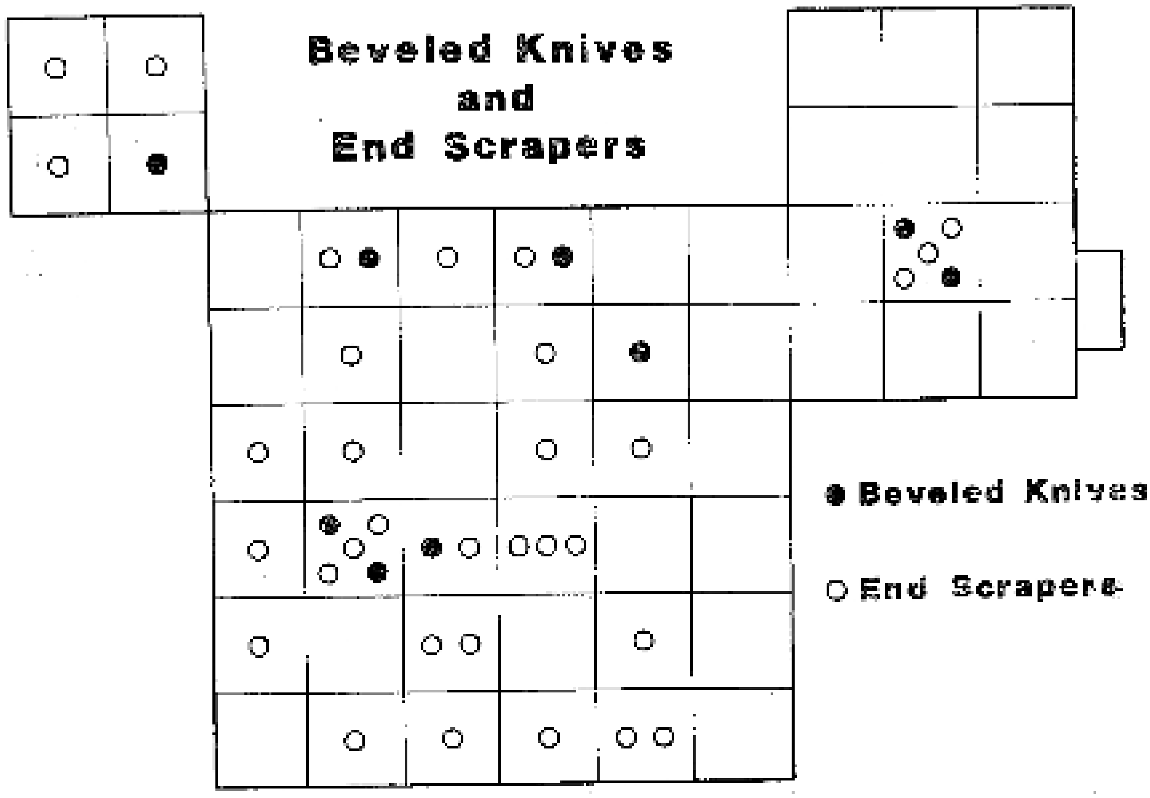
Figure 31 (lower) shows the WTA distribution of modified debitage in Levels 1-3. Several high density concentrations are apparent. The largest concentration is centered in the area between Features 5 and 6. This concentration partially overlaps the debitage, biface, and core concentration, but appears to represent a separate activity area. The density of modified debitage was compared to the density of debitage by looking at the distribution of cell density rankings. In general, the higher densities of debitage are associated with higher densities of modified debitage. However, the cells with only a moderate density of debitage (126-165) have the highest average modified debitage densities. This may indicate that while modified debitage pieces (informal flake tools) are more likely to be found in areas with higher debitage quantities they have a separate distribution, thus may represent separate activities.

Figure 33 (upper) shows the distribution of end scrapers (U1) and beveled knives (B1) in the WTA (all levels). Interestingly, the illustration clearly shows that while end scrapers have a much wider distribution, the beveled

TABLE 29. WTA DEBITAGE RECOVERY COMPARED WITH BIFACE FRAGMENT AND CORE FREQUENCIES

Debitage Density	Number of Cells	Biface Frequency	Core Frequency
<75	7	0.86	0.00
76-125	19	1.05	0.21
126-165	11	1.91	0.36
166-200	12	2.08	0.17
>200	3	2.67	1.00

Note: This table was constructed on the basis of the data derived from Appendix 1 and shown in Figure 32.



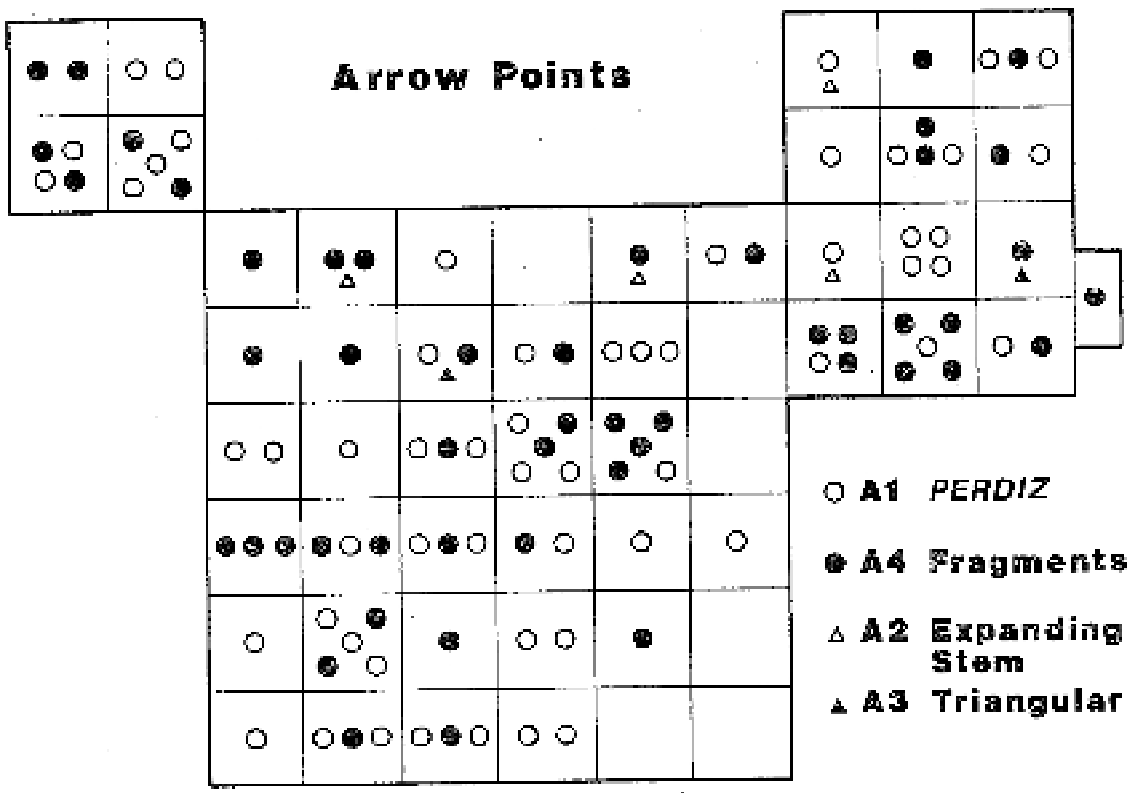


Figure 33. WTA End Scrapers, Beveled Knives, and Arrow Points Distributions.

It is argued elsewhere in this report that the peoples who occupied the Hinojosa site had a technological inventory specifically adapted to the exploitation of large mammals. Perdiz arrow points killed the animals, beveled knives were used to butcher the animals, and end scrapers were used to process the hides. The fact that virtually every deer, bison, and pronghorn bone (except phalanges and teeth) is broken suggests intensive processing. Also many of these fragmented bones are spiral fractured, burned, or have cut marks which supports this interpretation. The bone clusters themselves suggest that the larger mammals (as well as smaller animals) were efficiently processed and then carefully disposed of. Thus, we appear to be dealing with a group of people who were actively seeking and fully exploiting the large mammal resources available in the area.

All of the bones identified at the site are from animals that probably could be found in the immediate site vicinity. The environmental setting model (Fig. 2) suggests that diverse habitats were available very near the site. Under favorable environmental conditions (adequate moisture), such as posited for the site occupational period, the local vicinity could be characterized as a "high resource density" area (Hester 1981:122). The wide variety of animals identified at the site also suggests that all of the available animal habitats were exploited. The larger mammals were probably hunted by the adult males, and the women and children hunted and snared smaller animals and gathered a variety of supplementary resources. The males probably had to go some distance from the site to find the larger mammals at times. This may be documented by the general scarcity of deer, bison, and pronghorn cranial materials, as presumably the entire carcasses would not have been brought to camp for distant kills. On the other hand, virtually the entire deer skeleton is represented in the collection; hence at least some deer were killed close enough to camp to bring back the complete carcass. Thus, we can infer that several exploitive patterns are represented.

<u>Cultural Pattern</u>: The cultural pattern represented by the Late Prehistoric occupation at the Hinojosa site is clearly related to the Toyah phase of central Texas (Jelks 1962; Prewitt 1982, 1985). This is further discussed in the following two sections of this report.

RESEARCH HYPOTHESES

<u>Hypothesis #1, Site Function</u>: That the site represented a Late Prehistoric pattern of repeated seasonal occupation (winter to spring) emphasizing a specialized resource (bison and pronghorn).

As has been discussed, the evidence suggests occupation during all or most of the warm months rather that the cooler months. This does not rule out the possibility of winter occupation. The specialized resource was deer as the major species followed by bison and pronghorn. Repeated occupation is definitely evidenced. The expectations are evaluated individually (refer to Section II for a complete listing of each expectation).

1. The block excavations did evidence most of the predicted features, including refuse discard areas (the bone cluster features), cooking areas (Features 5 and 6), and occupational features (Features 7 and 11). These

features were not overlying each other, and they do not occur at a single elevation or surface. No area was identified as a "bison processing area"; however, the clusters of end scrapers and beveled knives in the WTA, as well as the presence of bison bones in most of the bone cluster features, are evidence of bison processing.

2. No meat weight analysis was done; the relative importance of meat in the diet was based on the rough proportion of bone recovered from the site (see Section VII: Analysis of Vertebrate Faunal Remains). The most numerous bones collected were deer rather than bison. Bison and pronghorn were secondary to deer in importance at 41 JW 8.

3. Minimum individual analysis was not done; based on the relative numbers of elements, a large number of smaller faunal species were indeed harvested as supplementary resources.

4. No specific study was done of the bison bone distribution because all of the bone was not studied. The fact that all of the bison bone recovered is fragmented and that many fragments have spiral fractures or cut marks, argues that the resource was maximized.

5. No winter occupation was evidenced. A warm month, spring to fall occupation was evidenced.

6. The excavations revealed minimum evidence of an earlier occupation. If any earlier occupation is actually present, it is very different and of very little extent.

7. The closest similarities to 41 JW 8 in terms of the Late Prehistoric material culture are found at other sites in southern Texas, including 41 LK 201 (Highley 1986), 41 MC 296 (Hall, Hester, and Black 1986), and the Berclair site (Hester and Parker 1970). All of these sites are closely related to the Toyah phase of central Texas and are considered as Toyah **horizon** sites by this author. This concept will be discussed in the following sections.

Hypothesis #2, Bison-Hunter's Chipped Stone Tool Kit: That **Perdiz** arrow points, end scrapers, and beveled knives make up the chipped stone tool kit used during the Late Prehistoric in south and central Texas for hunting and processing bison.

The artifacts collected at the Hinojosa site suggest that this specialized tool kit was present, and the tools were used as hypothesized. However, it is now recognized that deer were more important than bison and also that antelope were important. Thus, the tool kit could be better termed the "artiodactyl-hunters chipped stone tool kit." Bison bones have been given a prominent place in the analyses of collections from similar sites, hence the common inference that bison hunting was the most important subsistence activity. It is predicted that faunal studies at similar Toyah horizon sites will also show that deer is the dominant artiodactyl. Bison as the largest animal was no doubt highly prized and sought after, however, deer were more common. The same tool kit was no doubt used for both.

The two expectations were more or less borne out by the excavations with some modifications.

1. All three of the tools (A1, U1, and B1) were found in indirect association with the artiodactyl remains.

2. The wear and breakage patterns of the three tools are consistent with the hypothesized functions as discussed in Sections VI and VII (Perdiz Arrow Point Studies). Perdiz points have light wear patterns that intuitively resemble what would be expected from a projectile tip used to hunt large mammals. The end scrapers have very patterned wear that is very consistent with hide scraping. The beveled knives also show patterned wear that is consistent with use as a meat or hide cutting tool. Extensive replicative studies would be required to confirm these functions and to rule out other similar functions, nonetheless, on an intuitive assessment, the tools have the hypothesized wear patterns.

<u>Hypothesis #3, Function of Cluster Features</u>: That burned rock clusters at 41 JW 8 represented different functions such as cooking hearths, warmth hearths, or discard piles.

Some differences were observed in rock cluster features at the Hinojosa site. Cooking hearths were definitely present. Warmth hearths may or may not have been present. The concept of the "warmth hearth" is hard to demonstrate. While fires may have been built just to keep warm, this will be very difficult to ever prove. Discard piles were probably present. Feature 8 consisted of two rock clusters that lacked a regular shape and direct evidence of burning. These are suggested to have been discard piles. This is a difficult assertion to prove due to the possibility that the clusters could be cooking hearths that were exposed on the surface long enough for all the charcoal, ash, and baked clay to have been destroyed by weathering. Thus, the expectations can only be partially evaluated.

1,a. Cooking hearths were identified. Feature 5, which had little burned rock, and Feature 6, which had a distinct ring of burned rock, are both cooking hearths. Evidence of this is direct burning (stained soil), ash, charcoal, baked clay, charred plant remains (seeds and fruits), charred and uncharred bone, and very high phosphate levels.

1,b. Features 8, 1, 4 (the rock clusters), and several rock clusters not formally recorded could be interpreted as discard piles. They generally lacked the evidence of direct burning, charcoal, ash, and charred food remains. They also had lower phosphate readings than the definite cooking hearths. They could also be weathered cooking hearths.

2. Functionally related artifact clusters were found in apparent association with the two cooking hearth features. Feature 6 was found on one edge of the living surface, Feature 11. Within Feature 11, artifact clusters suggest a number of activities such as flintknapping and hide scraping. In addition, many of the bone clusters (Features 2A, 2B, 3, and 10) may be associated with the cooking hearths. It can be stated, contrary to be my original expectation, that similar activities were

evidenced around the possible discard piles. In fact, Feature 8 is associated with bone clusters and several artifact concentrations.

<u>Hypothesis #4, The "Bone Bed" Activity Area</u>: That the bone bed area functioned as a bison butchering/processing and bone disposal area.

This hypothesis cannot be evaluated due to the fact that we were not able to open an excavation block around the "bone bed" because of the problems with leaf cutter ants as discussed in Section III. However, the recognition of six other features with clustered bone at the site suggests that the "bone bed" was simply a larger example of the same type of feature, a bone disposal area. The expectations are not reviewed.

ADDITIONAL PROBLEMS

<u>Lithic Sources</u>: As discussed in Section VI, two areas are thought to have been the sources for most of the siliceous stone used at 41 JW 8. The most important source was probably along the Nueces River some 35 km east of the site. The secondary source was the hilltop gravel lag deposits in northwest Duval County and vicinity, a minimum of 45 km from 41 JW 8.

<u>Projectile Point Neck Width Hypothesis</u>: As discussed in Section VII (Perdiz Arrow Point Special Studies), the Hinojosa site Perdiz points were used to evaluate the hypothesis advanced by Fawcett (1978). While the 41 JW 8 data seem to support the hypothesis, shortcomings in the construction of the original formula limit the application of this dating technique. The idea remains viable and could be better evaluated if more single component samples were measured.

XI. THE LATE PREHISTORIC IN SOUTHERN TEXAS

The term "Late Prehistoric" is used herein and in most archaeological references in southern Texas to refer to the prehistoric cultural era immediately preceding the onset of historic contact. This period begins around A.D. 1000 in southern Texas and continues until historic contact in the 16th and 17th centuries. The Late Prehistoric era is marked by the introduction of the bow and arrow and pottery over most of southern and central Texas. Other terms such as "Neo-american" (Suhm, Krieger, and Jelks 1954) and "Neoarchaic" (Prewitt 1981a) refer to this same era.

In comparison with earlier cultural periods such as the Archaic era, the Late Prehistoric is better understood. This is because many Late Prehistoric sites are better preserved than older sites (less time to deteriorate), and they are more visible (closer to the surface), hence more likely to have been found, recorded, and tested. The ethnographic record, although very incomplete, provides some historic documentation of the Late Prehistoric groups and cultural patterns as they rapidly changed after historic contact. Thus, the Late Prehistoric era is the best known prehistoric cultural period in southern Texas prehistory.

PREVIOUSLY DEFINED CULTURAL PATTERNS

A number of Late Prehistoric cultural patterns (variously termed complexes, aspects, foci, or phases) have been defined or hypothesized for south Texas and adjacent regions. Although the southern Texas Late Prehistoric cultural patterns share some similarities with southwest and southeast Texas as well as northeastern Mexico, central Texas provides the most similar and significant comparative data. Hence, the following discussion will review only the cultural patterns relevant to south and central Texas. These are the Central Texas Aspect (Austin and Toyah phases), the Brownsville complex, the Rockport complex, the Turtle Creek phase, and the unnamed Dimmit/Zavala pattern. These Late Prehistoric patterns are based on varying degrees of archaeological study, and some may very well prove to be invalid cultural constructs. A summary of each pattern follows.

CENTRAL TEXAS ASPECT

Major References: Suhm, Krieger, and Jelks (1954); Jelks (1962); and Prewitt (1981a).

Geographical Distribution: Large area of central and south-central Texas, perhaps extending into south Texas.

Material Culture:

Austin phase: Scallorn arrow points, small dart points, Friday knives.

Toyah phase: Perdiz arrow points, beveled knives, flake drills, end scrapers, bone tools, Leon Plain pottery.

<u>Temporal Placement</u>: The Austin phase has been dated to between A.D. 700 and 1300 and the Toyah phase to between A.D. 1300 and 1750 (Prewitt 1981a). Prewitt (1985) has recently suggested that both phases began earliest in northern central Texas and progressively later as one moves south.

<u>Discussion</u>: The Central Texas Aspect has been validated by a large number of excavations. It has been suggested that the Toyah phase can be linked to the historic Jumano (Kelley 1947) or the Tonkawa (Suhm 1959). Jelks (1962:99) suggested that the Toyah phase ended before historic contact.

The Toyah phase has long been recognized as an abrupt change in adaptation. Shafer (1971) and Greer (1976) have suggested that the Austin phase represents the original inhabitants of central Texas while the Toyah phase represents new peoples. The Toyah assemblage has been interpreted as a Plains-like adaptation emphasizing bison hunting (Hester and Parker 1970; Shafer 1971; Prewitt 1981a). Shafer (1971) has suggested that horticulture was introduced into northern central Texas during the Toyah phase and that semipermanent villages may have been established. Ceramic tradewares in the northern and eastern sections of central Texas suggest considerable interaction with eastern and northeastern horticultural groups (Greer 1976).

Recent excavations at the Rowe Valley site (41 WM 437) by the Texas Archeological Society field school have uncovered the largest area yet exposed of a Toyah phase site (Prewitt 1982, 1983, 1984). Field school director Elton R. Prewitt believes that the upper component at the site represents a late Toyah phase occupation (ca. A.D. 1700) by a Wichita speaking Tonkawa group. A circular campsite arrangement is typical of Plains groups. Flintknapping activity areas have been exposed as well as butchering and bone disposal areas. Ceramics recovered at the site indicate trade with protohistoric Caddoan groups. No historic materials have been recovered.

BROWNSVILLE COMPLEX

<u>Major References</u>: MacNeish (1958); Prewitt (1974); Hester and Ruecking (1969); and Mallouf, Baskin, and Killen (1977) contains an excellent summary.

<u>Geographical Distribution</u>: Rio Grande delta of extreme southern Texas (Hidalgo, Willacy, and Cameron Counties).

<u>Material Culture</u>: Sophisticated shell working technology (tools and ornaments), cemetery sites, triangular arrow points, trade contacts with Huastecan and northern Mexico desert areas.

<u>Temporal Placement</u>: The date is unknown but is presumably A.D. 1200-1600.

<u>Discussion</u>: Much of the Brownsville complex is known only from surface collections, principally those collected by A. E. Anderson in the 1930s. Recent researchers have pointed out the need for "considerable refinement" in this cultural construct (Mallouf and Zavaleta 1979:28).

ROCKPORT COMPLEX

Major References: Suhm, Krieger, and Jelks (1954); Campbell (1958); and Corbin (1974).

Geographical Distribution: Confined to a narrow band 20-25 miles wide along the central Gulf coast of Texas from approximately Baffin Bay to the Colorado River.

Material Culture: **Perdiz**, **Fresno**, **Scallorn**, **Starr**, **Padre**, and bulbar stemmed arrow points, and **Rockport** ware ceramics (sandy paste with asphaltum decoration).

Temporal Placement: Approximately A.D. 1000 to the 19th century.

Discussion: Campbell (1958:168) believes that the Rockport focus (complex) can be partially linked to the historic Karankawa groups. In a recent paper certain to be controversial, Herman Smith (1984b) argues that the Karankawa, who he links with the Rockport complex, were recent immigrants (after A.D. 1200) from the Carribean. This argument is based largely on a single linguistic study (Landar 1968) that links a very limited Karankawa vocabulary to the Carib language group. Newcomb (1983:362) has discredited this link in an excellent summary of the Karankawa. Smith fails to provide a single comparison of Karankawa material culture or subsistence to that of the Carib Indian groups. Smith also fails to recognize that **Rockport** ware ceramics share similarities with upper Texas coast and inland south Texas ceramics (form, bone-tempering, and asphaltum decoration). Excavations at many sites along the coast (Corbin 1974) have shown considerable continuity between the Archaic Aransas focus and the Late Prehistoric Rockport complex. This author would argue that the Karankawa represent native groups whose ancestors can be traced to the Archaic cultures in the area. Further refinement of the Rockport complex is obviously needed.

TURTLE CREEK PHASE

Major Reference: Mitchell (1978).

Geographical Distribution: South-central Texas along the Balcones Escarpment on the southeastern edge of the Edwards Plateau.

Material Culture: **Edwards** arrow points and Pueblo III trade pottery(?).

Temporal Placement: Poorly established but presumably early in the Late Prehistoric.

Discussion: The Turtle Creek phase as defined apparently reflects the major distribution of the **Edwards** point. Mitchell believes that it is the initial phase of the Late Prehistoric and predates **Scallorn** and **Perdiz** points. This phase has yet to be substantiated by excavation (Black and McGraw 1985).

It does appear likely that the **Edwards** point is an early arrow point in the area. Recent excavations at the Rainey site, a well-stratified sink hole site in Bandera County, suggest that **Edwards** points predate **Scallorn** points (Henderson n.d.). However, it should be noted that an untyped crude expanding stem arrow point found at the Rainey site may predate the **Edwards** point.

The main problem with the Turtle Creek phase is that it remains poorly defined. A cultural phase cannot be defined on the basis of a single artifact type. The **Edwards** point and crude expanding stem arrow points clearly represent the initial Late Prehistoric phase in south-central Texas. The definition and understanding of this phase will require further work.

DIMMIT-ZAVALA PATTERN

Major References: Hester and Hill (1975); Montgomery (1978); and Hester (1978).

Geographical Distribution: Dimmit and Zavala Counties on the tributaries of the Nueces River.

Material Culture: **Perdiz, Scallorn, Zavala,** and possibly triangular arrow points, end scrapers, blades, manos, beveled knives, and bone-tempered pottery.

Temporal Placement: The radiocarbon dates generally are late (i.e., A.D. 1450 to 1750), although the Late Prehistoric probably begins in the area somewhat earlier.

Discussion: The Dimmit-Zavala pattern is the result of an intensive study of the area; hence the geographical pattern is actually the boundaries of the study area. This area has two distinctive patterns, one along Tortugas Creek and the parallel Nueces River drainage and the other near the Chaparrosa Creek and the Turtle Creek confluence. One important aspect of the Dimmit-Zavala pattern is the apparent lack of temporal separation between the smaller Late Archaic dart points and the expanding and contracting stem arrow points. It has been suggested that several projectile point forms were in use at the same time (Hester 1975:114).

The preceding references provide data on settlement patterns, subsistence remains, intrasite patterning, and dating. This study area is one of the best known Late Prehistoric occupation areas in the region. Subsistence appears to have been based on plant resources and small mammals, rodents, and reptiles; bison were infrequently killed (probably due to scarcity in the area). Deer and pronghorn were the major large animals.

LATE PREHISTORIC CHRONOLOGY IN SOUTH TEXAS

It has long been recognized that the Late Prehistoric era in central Texas begins with the expanding stem arrow point (**Scallorn**) during the Austin phase. The Toyah phase follows and is marked by the widespread adoption of the contracting stem arrow point (**Perdiz**). In south-central Texas, the Austin phase appears to be predated by occupations characterized by **Edwards** arrow points and as yet undefined crude expanding stem points (Henderson n.d.). In southern Texas the chronology has been less clear; at many sites, expanding and contracting stem points seem to occur together, leading Hester and Hill (1975:18) to suggest that they were contemporaneous. Recent work in the Choke Canyon Reservoir area (Hall, Black, and Graves 1982; Hall, Hester, and Black 1986) has documented the earlier occurrence of expanding stem arrow point assemblages and the comparatively late occurrence of components with assemblages similar to the Toyah phase materials.

The two best examples of the earlier Late Prehistoric occupation in the Choke Canyon area are two sites in McMullen County, 41 MC 222 and 41 MC 296. At the Skillet Mountain site, 41 MC 222, **Scallorn** and **Edwards** arrow points were found with bone-tempered sandy paste ceramics and a large collection of faunal remains, including bison. The radiocarbon dates from 41 MC 222 have a considerable range, however, they best overlap between A.D. 1300-1350. The most important aspect of this is the association of pottery, bison, and expanding stem arrow points at around A.D. 1300. Site 41 MC 296 is important because it has stratified deposits that include an earlier Late Prehistoric component with expanding stem arrow points and a later component with contracting stem arrow points. The radiocarbon dates from the early Late Prehistoric component at 41 MC 296 range from A.D. 800 to 1325 and cluster best between A.D. 1225-1300. The later component clusters nicely between A.D. 1425-1500.

Another Choke Canyon site, 41 LK 201, has a very good late component of the Late Prehistoric with two consistent radiocarbon dates that range between A.D. 1425-1650. This site shares many similarities with 41 JW 8 as well as a number of other sites in southern and central Texas. These similarities are **Perdiz** points, bone-tempered pottery, small end scrapers, flake drills, beveled knives, and extensive faunal remains, including deer and bison.

The strong similarities between the Choke Canyon and the central Texas Late Prehistoric sequence are very significant. Hall believes that these similarities suggest that central Texas peoples were moving into southern Texas and bringing their distinctive assemblages with them. Prewitt has recently compiled radiocarbon data which supports this interpretation. Prewitt (1985) argues that the Austin and Toyah phases were both introduced to central and southern Texas from the southern Plains (through north Texas) in successive waves. He supports this contention by radiocarbon assays that he believes show the Austin phase beginning in north-central Texas about A.D. 600, in central Texas by A.D. 700, and in south-central Texas by A.D. 850. Similarly, the Toyah phase was first introduced in north-central Texas around A.D. 1250, in central Texas at A.D. 1350, and south Texas by A.D. 1450. Such an explanation would solve the problem of why Late Prehistoric dates in southern Texas have always seemed to fall later than comparable components in central Texas (Hester 1975).

In order to evaluate the relationship between southern and central Texas a brief comparative study was made of selected south and central Texas Late Prehistoric sites. The emphasis was placed on sites in southern Texas that have either a Toyah horizon assemblage or have been radiocarbon dated to after A.D. 1200. Figure 34 shows the location of the sites for which data were compiled. Table 31 provides comparative attribute data for each site.

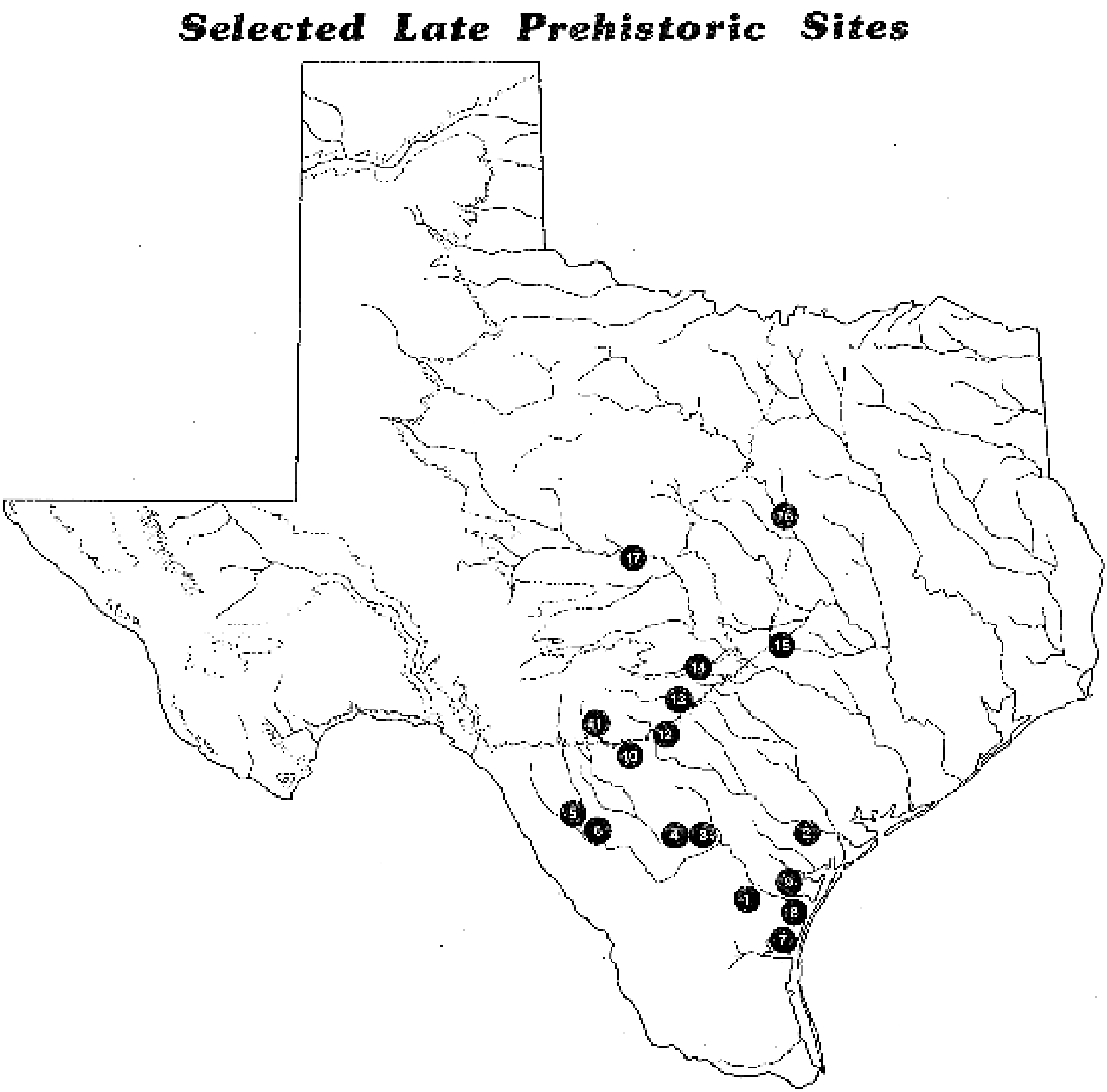


Figure 34. **Location of Select Late Prehistoric Sites.** Refer to Table 31 for identification of each site represented by the numbers on this map.

TABLE 31. COMPARATIVE DATA ON SELECT LATE PREHISTORIC SITES

Map Number	Site	Reference	Archaeological Work	Topographic Location	Components	Lithics	Ceramics	Worked Bone	Faunal	Miscellaneous
1	[illegible] Site (41 [illegible])	[illegible] 1977	S, T, E	[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible] Site (41 [illegible])	Hester and [illegible] 1970	S	[illegible]	S	[illegible]	[illegible]		[illegible]	
3	41 [illegible]	[illegible] 1986	S, T, E	[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	41 [illegible]	[illegible] et al. 1982	S, T, E	[illegible]	M	[illegible]	[illegible]		[illegible]	[illegible]
4	41 MC 55	Hall, Black, and Graves 1982	S, T, E	[illegible]	M	[illegible]	[illegible]		[illegible]	[illegible]
	41 MC 222	Hall, Hester, and Black 1986	[illegible]	[illegible]	S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	41 MC 296	Hall, Hester, and Black 1986	S, T, E	[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible] Site (41 [illegible])	[illegible] 1978	S, T, E	[illegible]	M	[illegible]			[illegible]	[illegible]
6	[illegible] (41 [illegible])	[illegible] and Hester 1975	S, T, E	[illegible]	M	[illegible]			[illegible]	[illegible]
	[illegible] Site (41 [illegible])	Hester and Hill 1975	S	[illegible]	S	[illegible]				
7	[illegible]	[illegible] 1979	S	[illegible]	M	[illegible]	[illegible]		[illegible]	[illegible]
8	[illegible] Sites [illegible], including 41 [illegible] and 41 [illegible]	[illegible], personal communication; [illegible] and [illegible] 1986	S, T	[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	41 [illegible]	[illegible], personal communication	S	[illegible]	S	[illegible]	[illegible]		[illegible]	
10	41 [illegible]	[illegible] and [illegible] 1982	S, T	[illegible]	M	[illegible]			[illegible]	
11	[illegible] Site (41 [illegible])	[illegible] n.d.	S, T, E	[illegible]	M	[illegible]		[illegible]	[illegible]	[illegible]
12	[illegible] Springs [illegible] Site (41 [illegible])	Black and McGraw 1985	S, T, E	[illegible]	M	[illegible]		[illegible]	[illegible]	[illegible]
13	[illegible] Rockshelter (41 [illegible])	Johnson, Suhm, and Tunnell 1962	S, T, E	[illegible]	M	[illegible]		[illegible]	[illegible]	[illegible]
14	[illegible] Site (41 [illegible])	[illegible] 1986	S, T, E	[illegible]	M	[illegible]	[illegible]			[illegible]
15	[illegible] (41 [illegible])	[illegible], personal communication 1982, 1985, 1986	S, T, E	[illegible]	M	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible] Site (41 HI 1)	Jelks 1962	S, T, E	[illegible]	M	[illegible]		[illegible]	[illegible]	[illegible]
17	[illegible] Site (41 [illegible])	[illegible] 1959	S	[illegible]	S	[illegible]			[illegible]	

NOTE: The map numbers for each site (or group of related sites) are shown in Figure 34.

KEY: Archaeological Work: S=surface, T=testing, E=excavation
Topographic Location: R=river, C=creek/stream, O=oxbow slough, CD-B=clay dune/bay shore, U=upland (or high terrace), RS=rockshelter, SH=sink hole, -1=0 to 100 meters, -2=100 to 200 meters
Components: S=single component, M=multicomponent
Other Arrow Points: a=atypical expanding stem, b=Edwards, c=Zavala, d=straight stem, e=Sabinal, f=a and d, g=a, b, and e
Other Ceramics: a=pipe bowls, b=figurines, c=a and b, d=brushed, incised and/or punctated
Marine Shell: x=present, function unknown, a=ornaments, b=tools, c=a and b

Table 32 provides a list of Late Prehistoric radiocarbon assays from south Texas. Figure 35 plots all 33 of the calibrated dates from Table 32. Figure 36 shows the dates which can be linked to the expanding stem arrow point (Austin horizon) and those which can be linked to the contracting stem arrow point (Toyah horizon). The use of the term "horizon" will be explained later.

In general, the attributes of Late Prehistoric Toyah phase sites in central Texas are found at many sites in south Texas. Major differences, other than sampling problems, are few. South Texas sites almost always have the 2-beveled knife rather than the Plains 4-beveled knife (Brown **et al.** 1982). South Texas sites also have more marine shell artifacts and pottery with asphaltum and/or fugitive red decoration. Central Texas Toyah sites often have traces of trade ware from eastern Texas (particularly late Caddoan wares). In addition, domesticated corn has been found at a few central Texas sites (Jelks 1962; Shafer 1971; Harris 1985) suggesting that some horticulture may have been practiced. Other differences are minimal. Sites from both regions have a wide variety of animal species in faunal assemblages. The most important food species is invariably either deer or bison. It is difficult to compare the Late Prehistoric sites from south and central Texas without concluding that the two regions are closely linked.

If the southern Texas Late Prehistoric is indeed strongly linked with central Texas peoples, then the cultural constructs of the region need to be reassessed. Archaeologists working in south Texas have avoided using the central Texas phase designations for many years, even though the Late Prehistoric materials they found were often very similar to those found in central Texas. This reluctance stemmed from differences in radiocarbon dates and associated materials as well as settlement patterns. Another problem in linking the two areas is precisely because the two areas are considered separate cultural regions.

Figure 35 shows 33 calibrated radiocarbon dates from Late Prehistoric sites in southern Texas. These form a very even distribution when arranged by the earliest end member of each date range. Although a few dates range before A.D. 1000, the majority range after A.D. 1050. Similarly, although a few dates range after A.D. 1600, most are before A.D. 1525. Figure 36 shows the 30 dates which can be assigned to either the Austin horizon or the Toyah horizon. Although considerable overlap occurs, the majority of the Austin horizon dates clearly cluster earlier than the majority of the Toyah horizon dates. The dashed horizontal lines show the approximate main cluster range for each horizon. Most of the Austin horizon dates fall between A.D. 1075 and 1375. The majority of the Toyah horizon dates fall between A.D. 1300 and A.D. 1600. Thus, the dichotomy between expanding stem and contracting stem arrow point assemblages long defined in central Texas is also evidenced in southern Texas.

It should be pointed out that the radiocarbon dates used to illustrate the Austin/Toyah dichotomy in south Texas are all from 41 JW 8 or the Choke Canyon sites. The dates from mixed assemblages in western south Texas (assay numbers 31-33 in Table 32) are very late. It is likely that the Austin and Toyah horizons may not have spread intact into many areas of south Texas. We do not have radiocarbon data from much of southern Texas; thus, the

TABLE 32. LATE PREHISTORIC RADIOCARBON ASSAYS FROM SOUTH TEXAS

Assay Number	Site	Association	Sample Number	Assay	Calibrated Range
1	41 JW 8	Toyah	TX-2207	580 ± 50	1285-1415
2	41 JW 8	Toyah	TX-4652	520 ± 90	1280-1500
3	41 JW 8	Toyah	UGa-4511	525 ± 65	1330-1430
4	41 JW 8	Toyah	TX-4653	970 ± 60	905-1215
5	41 JW 8	Toyah	TX-4886	1090 ± 110	660-1160
6	41 JW 8	Toyah	UGa-5289	655 ± 70	1255-1400
7	41 JW 8	Toyah	UGa-5280	930 ± 70	925-1235
8	41 JW 8	Toyah	TX-4654	500 ± 60	1335-1480
9	41 JW 8	Toyah	TX-4887	700 ± 80	1200-1405
		assays 1-9 presented in this report			
10	41 MC 222	Austin	TX-2875	700 ± 150	1050-1420
11	41 MC 222	Austin	TX-2876	710 ± 50	1230-1340
		assays 10-11 from Hall, Black, and Graves (1982)			
12	41 MC 222	Austin	TX-4666	360 ± 60	1415-1645
13	41 MC 222	Austin	TX-4694	540 ± 60	1325-1425
14	41 LK 201	Toyah	TX-4667	360 ± 50	1415-1645
15	41 LK 201	Toyah	TX-4668	320 ± 60	1425-1655
16	41 MC 296	Toyah	TX-4677	430 ± 80	1340-1645
17	41 MC 296	Toyah	TX-4678	330 ± 60	1420-1655
18	41 MC 296	Toyah	TX-4682	450 ± 60	1390-1505
19	41 MC 296	Toyah	TX-4683	290 ± 50	1435-1665
20	41 MC 296	Toyah	TX-4684	320 ± 60	1425-1655
21	41 MC 296	Austin	TX-4685	780 ± 60	1190-1315
22	41 MC 296	Austin	TX-4686	750 ± 70	1210-1330
23	41 MC 296	Austin	TX-4687	1110 ± 60	785-1035
24	41 LK 128	Austin?	TX-4674	1030 ± 70	885-1155
25	41 LK 128	Austin	TX-4671	830 ± 50	1055-1270
26	41 LK 128	Austin	TX-4670	660 ± 50	1250-1395
27	41 LK 128	Austin	TX-4665	830 ± 60	1055-1270
28	41 LK 128	Austin	TX-4676	670 ± 60	1245-1395
29	41 MC 55	Toyah	TX-4692	460 ± 60	1385-1500
30	41 MC 55	Toyah	TX-4693	760 ± 80	1055-1360
		assays 12-30 from Hall, Hester, and Black (1986)			
31	41 ZV 83	?	TX-1526	430 ± 60	1400-1515
		assay 31 from Montgomery (1978)			
32	41 ZV 155	?	TX-1514	170 ± 60	1640-1950
33	41 ZV 155	?	TX-1515	410 ± 40	1405-1605
		assays 32-33 from Hill and Hester (1973)			

Note: The assay number is the number used in Figures 35 and 36. The Association is based on the central Texas Late Prehistoric phases (Jelks 1962; Prewitt 1981a). The assays are given in years B.P. (1950). The Klein calibration range is the two-sigma range given in years A.D. (Klein et al. 1982).

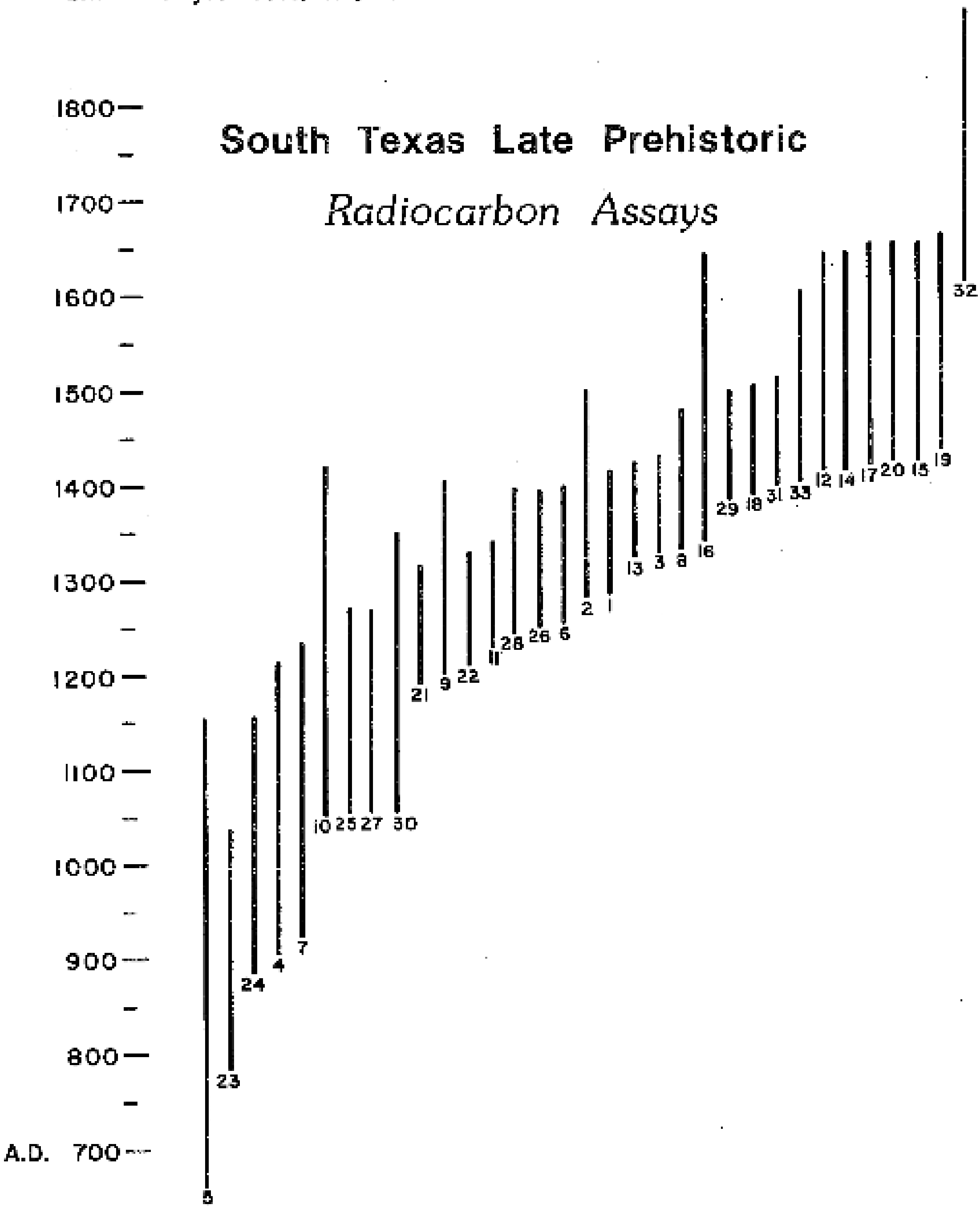


Figure 35. South Texas Late Prehistoric Radiocarbon Assays.

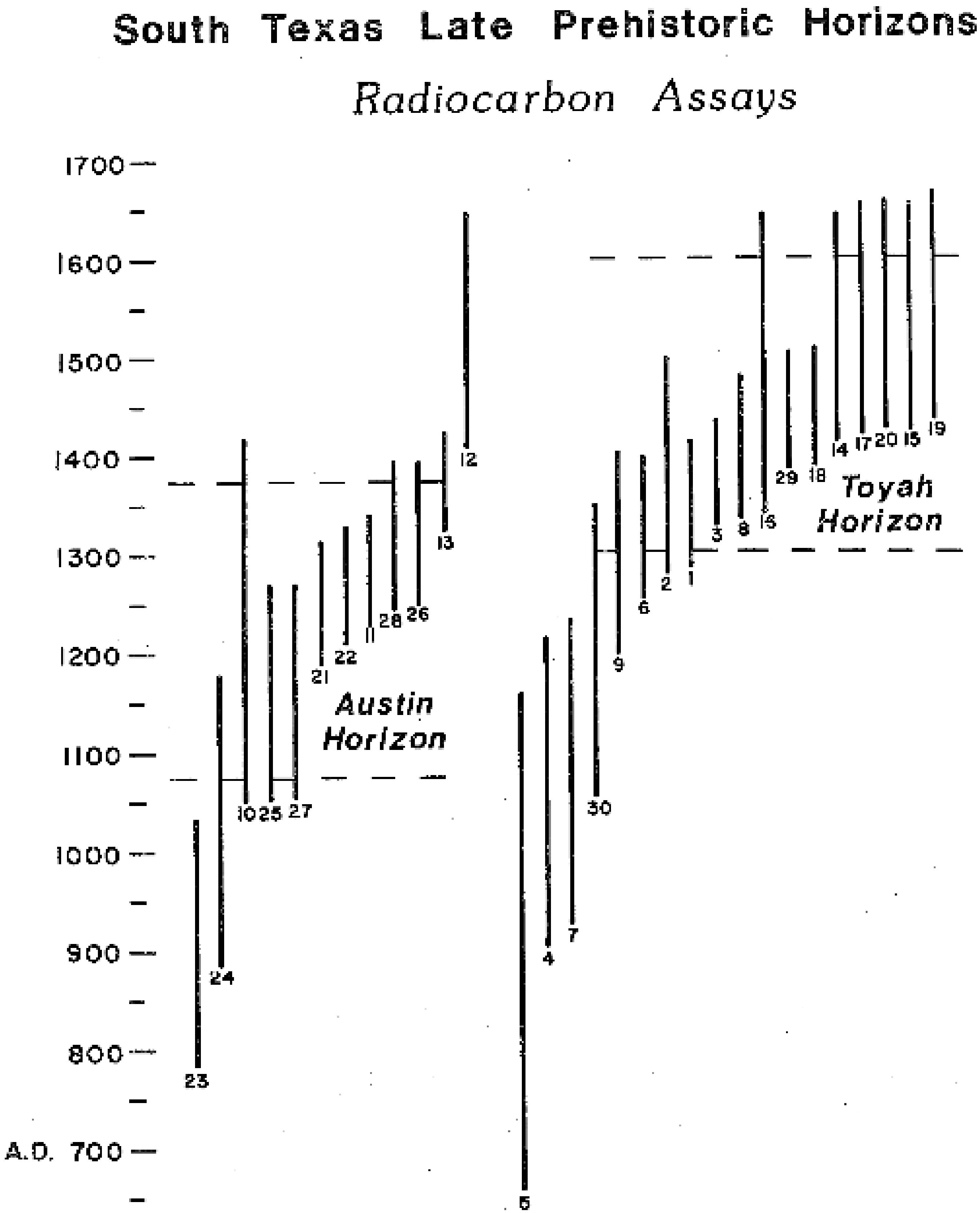


Figure 36. Radiocarbon Assays of Late Prehistoric Horizons in South Texas.

chronology of the southern Texas Late Prehistoric needs considerable refinement. This refinement can only come from a much larger sample of radiocarbon assays from isolated components.

The Late Prehistoric radiocarbon data from south Texas suggests that Prewitt's estimates of when the central Texas phases (horizons) spread south may need to be modified. For example, Prewitt's (1985) estimate of the beginning of the Austin phase in his south cluster (which includes south-central Texas) is A.D. 850. The Austin horizon does not appear to be present in the Choke Canyon area until after A.D. 1000. The Toyah horizon, on the other hand may be present in south Texas 150 years earlier than Prewitt's estimate of A.D. 1450. These differences may reflect the lack of an adequate sample of radiocarbon assays. Prewitt's contention that Late Prehistoric dates generally begin later in south Texas does seem to be borne out by the south Texas data.

The following section will focus on the later part of the Late Prehistoric era in southern Texas and the cultural assemblage that has been defined as the Toyah focus (Jelks 1962) or phase (Prewitt 1982, 1985) of central Texas. It will be argued that this same assemblage is present in many areas of south Texas and represents a movement of central Texas cultural patterns and/or peoples into southern Texas after A.D. 1350. The southern Texas sites with the Toyah-like assemblages are examples of a very broad cultural pattern that stretched over a several hundred year period, from far north-central Texas to far west-central Texas to deep southern Texas. It will be argued that this cultural pattern is perhaps best described as a **horizon** rather than a phase in recognition of the widespread nature of the pattern.

THE TOYAH HORIZON

A number of sites in southern Texas have been found which have Late Prehistoric components that can be closely linked to the Toyah phase of central Texas. The Hinojosa site, for example, has an artifact assemblage that save for a few minor differences could have been recovered from a central Texas Toyah rockshelter. The sites with Toyah-like components are the Kyle rockshelter in Hill County (north-central Texas), the Finis Frost site in San Saba County (west-central Texas), the Rowe Valley site in Williamson County (central Texas), the Berclair site in Goliad County (eastern south Texas), and the Hinojosa site in Jim Wells County (deep south Texas). The artifacts common to these and other sites are **Perdiz** arrow points, bone-tempered pottery, beveled knives, small end scrapers, and flake drills. All of these sites also appear to have bison bone.

These similarities have been pointed out elsewhere (Hester and Parker 1970) and have long been recognized. In the 41 JW 8 proposal (Hester, Eaton, and Black 1980) we used the concept of the "bison-corridor" to suggest that the Toyah-like sites in southern Texas were the campsites of groups who followed the bison herds from central Texas. It was noted that these sites do not occur in the western part of south Texas toward the Rio Grande, in the lower Rio Grande Valley, or south of Jim Wells and Nueces Counties. We noted that the widespread occurrence of bison after A.D. 1300 fits Dillehay's (1974) model of periodic movement of bison out of the central and upper southern Plains and into the lower southern Plains.

The close similarity of many sites across a very large geographical area has created a problem with the constructs used to encompass these culturally related sites. Why not call all of these sites by a single term given the widespread similarity? The most obvious choice is the Toyah phase. However, this phase was originally defined and has remained defined for central Texas only. Thus, archaeologists working in the region have used the more general term "Late Prehistoric" to avoid using a more specific term that had not been defined for south Texas. The time has come to recognize that we are definitely dealing with a single cultural tradition marked by innovative technological changes that were adopted over a very wide area within a few hundred years.

Prewitt (personal communication) believes that the phase concept should be expanded to allow for a cultural phenomena that is found over several cultural regions. Thus, he would term southern Texas sites like 41 JW 8 "Toyah phase" sites. This author has previously argued (Black and McGraw 1982, 1985) that the phase concept as applied to central Texas by Weir (1976) and Prewitt (1981a) far exceeds the original intention of the concept. Willey and Phillips (1958) suggested that phases be applied to cultural regions which they believed should be restricted to relatively homogeneous geographical regions. Central Texas and south Texas are composed of a number of major geographical areas such as the Edwards Plateau, the Balcones Escarpment, the Gulf Coastal Plain, and the Blackland Prairie. If the application of the phase concept to central Texas is questionable, the extension to cover much of southern Texas is clearly stretching the phase concept far beyond its definition.

Perhaps, as Prewitt suggests, the time has come to redefine the phase concept to allow for just such a large geographical area. This author believes this is unnecessary; a concept already exists that can be applied to the problem, the "horizon."

The term "horizon" and its temporal counterpart, the "tradition," were thought by Willey and Phillips (1958:30) to be "the most practical means for effecting cultural-historical integration on a geographical scale larger than that of the region." They define "horizon" as "a primarily spatial continuity represented by cultural traits and assemblages whose nature and mode of occurrence permit the assumption of a broad and rapid spread" (ibid.:33). They go on to note that while the site components (or other archaeological units) linked by a horizon are assumed to be contemporaneous, the temporal relationship may in fact be expected to be "sloped" rather than "horizontal." This provision recognizes that it takes some time for a cultural pattern to spread.

It is suggested that sites with artifact assemblages very similar to the central Texas Toyah phase materials in southern Texas, represent the spread of a cultural "horizon." It is interesting to note that most of the Toyah horizon sites in southern Texas occur 100-200 years after the Toyah phase begins in northern central Texas. This is an excellent example of the "sloped" temporal relationship during the spread of a horizon. It is also significant to note that certain changes in the assemblage do occur as the Toyah horizon spreads into south Texas. For example, the beveled knife form found in central Texas is the bipointed, diamond-shaped "Plains Knife" or "Harahey" biface, while the beveled knife form in southern Texas is the "2-beveled quadrilateral biface" (Brown **et al.** 1982). Another example is the use of asphaltum and hematite for pottery decoration in southern Texas. These forms of decoration are generally absent from central Texas.

Although the concern here is with the Toyah horizon in southern Texas, similar assemblages also occur west and east of central Texas. The widest distribution is that of the **Perdiz** arrow point. Prewitt (1981, 1985) uses the **Perdiz** point as a "key index marker" of the Toyah phase. The **Perdiz** point can similarly be used as a "horizon marker" (Willey and Phillips 1958) to define the maximum spread of the horizon. In the case of the Toyah horizon, the **Perdiz** point had a wider distribution than most other elements of the assemblage. A distribution map of **Perdiz** points (Prewitt ms.) indicates a range across most of Texas from the northeast corner, to the southeast corner, to 41 JW 8 and farther south, and to the Big Bend area in west Texas.

Obviously, one cannot use the **Perdiz** point distribution alone to define the spread of the Toyah horizon. There are indications that most of the elements of the Toyah horizon also spread far west and southwest from central Texas. As one moves farther away from the apparent initial Toyah area, north-central Texas (Prewitt 1985), the assemblage becomes progressively more modified, no doubt indicating influences from other cultures. At the Finis Frost site in San Saba County (Green and Hester 1973), the Toyah assemblage is complete. Farther west in the Big Bend region, **Perdiz** points, end scrapers, and beveled knives occur but bone-tempered pottery and flake drills apparently do not (Kelley, Campbell, and Lehmer 1940). Lehmer (1960:125-126) includes these materials in the Livermore focus which he suggests originated in the south-western Plains. He notes how this complex sharply contrasts with others in the area and speculates that this "appears to represent a group of late plains hunters who were driven to take refuge in the mountain country by severe drought" (**ibid.**:126). South of the Big Bend region across the Rio Grande in Coahuila, Mexico, the **Perdiz** point and small end scrapers are found within the Jora complex (Taylor 1966).

It is suggested that the appearance of the expanding stem arrow points across much of southern Texas after A.D. 1000 can also be interpreted as the spread of the "Austin horizon." However, unlike the Toyah horizon, the expanding stem arrow point assemblages do not appear to have a well-defined tool kit that is unique to the related sites. It is interesting to note that ceramics in south Texas appear to have been initially introduced into the area along with expanding stem arrow points. This can be seen at several sites in the Choke Canyon area, including 41 MC 222, 41 MC 296, and possibly 41 LK 128 (Hall, Black, and Graves 1982; Hall, Hester, and Black 1986). Greer (1976:149-152) has suggested that ceramics may have first appeared in central Texas during the Austin phase. Ceramics have recently been found in apparent association with **Scallorn** and **Edwards** arrow points in south-central Texas at 41 BX 228 (Black and McGraw 1985).

It should be mentioned that expanding stem arrow points have been recently recognized as a minor component of Toyah horizon assemblages. The expanding stem arrow points found in isolated Toyah components are atypical of the well-defined expanding stem types, the **Scallorn** and the **Edwards** arrow points. The atypical expanding stem points are typically smaller and thinner than most **Scallorn** and **Edwards** arrow points and often have very angular stems. These have been documented at 41 JW 8, at Rowe Valley (Prewitt ms. and personal communication), and at 41 LK 201 (Highley 1986). At many sites, atypical expanding stem arrow points have been classified as **Scallorn** points. For example, atypical expanding stem arrow points were found at the Wheatley site, 41 BC 114 (Greer 1976). Greer (1976:108) notes that the sample of 13 "**Scallorn**" points at the Wheatley site "is a heterogeneous grouping of points generally comparable to Scallorn forms." The illustrations in the Greer (1976) report show a very diverse group of points, few of which are typical of the defined type (Suhm and Jelks 1962:285-286). Greer (1976:141-147) uses the cooccurrence of the expanding stem arrow points and typical Toyah assemblage materials (**Perdiz** points, end scrapers, beveled knives, and pottery) to argue that **Perdiz** and **Scallorn** points, and by extension, the Toyah and Austin phases, were contemporaneous. Greer points out that virtually any expanding stem arrow point in Texas is usually called a "**Scallorn**" (except for **Edwards** points, of which he makes no mention). The recognition of atypical expanding stem points in definitely late contexts calls for the reexamination of expanding stem arrow point typology.

Further comments on the Toyah horizon in southern Texas are made in the following section of this report.

XII. A TOYAH CAMPSITE IN SOUTHERN TEXAS

The Clemente and Herminia Hinojosa site, 41 JW 8, is seen, as a result of this research, as a major campsite of Late Prehistoric, Toyah horizon peoples who repeatedly revisted the location during the 14th century A.D. Some of the major interpretations derived from the analyses are summarized. These interpretations are organized by topics the author believes to be the most important in understanding the site.

OCCUPATION PERIOD OF THE SITE

The question of when the site was occupied is a bothorsome one. The radiocarbon assays can be interpreted in several ways as discussed in Section VII (Radiocarbon Assays). It is clear that most of the assays indicate a occupation during the 14th century A.D. The calibrated dates overlap best between A.D. 1350 and 1400. This time interval is assumed to be the major period of occupation at the site, although we have little means of determining over what length of time the site was revisted. A comparison with the dates from other Toyah horizon sites in southern Texas (Section XI) shows that 41 JW 8 is the earliest Toyah horizon site yet documented in the region. Site 41 MC 55, from Choke Canyon, may also have a contemporaneous occupation as one assay (Assay 30 in Table 32) appears early. Sites 41 MC 296 and 41 LK 201 clearly date later than 41 JW 8. As has been noted, the probability of a 14th-century Toyah horizon occupation in deep south Texas is somewhat early according to Prewitt's estimation of the spread of the Toyah.

The dating of Feature 6 definitely represents a problem in interpretation. Three consistently early assays from this feature suggest a date before A.D. 1150, perhaps as early as A.D. 950. There is no physical evidence to link these older dates with pre-Toyah horizon cultural materials. These assays are clearly too early for the Toyah horizon. All of the Toyah assays for central Texas cited by Prewitt (1985) are after A.D. 1200. Based on our current knowledge, it seems unlikely that the early dates actually indicate a very early Toyah horizon occupation at the Hinojosa site. In lieu of a readily acceptable explanation, the early dates from Feature 6 will remain enigmatic.

SUBSISTENCE AT 41 JW 8

Prior to the faunal study of the 1981 season materials, the Hinojosa site, like many Toyah horizon sites, was thought to be a bison hunters' camp (Hester 1977; Hester, Eaton, and Black 1980). Deer are now known to have been the most numerous species killed by the site occupants. Bison and pronghorn were the next most important species followed by small mammals such as rodents and rabbits. One of the remarkable aspects of subsistence at 41 JW 8 is the diversity of the faunal assemblage; 44 faunal taxa representing over 31 genera were recovered (Section VII: Analysis of Vertebrate Faunal Remains). Large and small mammals, rodents, turtles, snakes, birds, and fish were all identified. Studies of other Toyah horizon sites such as 41 LK 201 (Steele 1986) and 41 MC 296 (Steele and Hunter 1986) have shown similarly diverse faunal assemblages. This is also true of several of the non-Toyah Late Prehistoric sites in Zavala County (Hester and Hill 1975).

The importance of hunting and animal processing at the Hinojosa site is documented by the large amount of animal bone, the numerous projectile points and end scrapers, and the bone cluster features. The Wagon Trail Area, in particular, suggests a repeated pattern of bone processing and disposal. Most of the major lithic tools, **Perdiz** points, end scrapers, and beveled knives have wear patterns that are consistent with meat and hide processing. Taken together and contrasted with the scarce evidence for plant processing, it is obvious that the inhabitants of 41 JW 8 were, first and foremost, hunters.

There is some significant evidence of other subsistence activities. **Rabdotus** snail collecting seems to have been a very important activity at 41 JW 8. In fact, **Rabdotus** snail shells were the most numerous item recovered from the site. Based on the densities of **Rabdotus** recovered from the site, it can be estimated that somewhere between a quarter and a third of a million of these land snails were collected during the occupations at the site. The WTA distributional studies showed considerable clustering of the **Rabdotus** snails, with the largest concentrations associated with the living surface, Feature 11. Freshwater mussels played a decidedly smaller subsistence role. Low densities of mussel shells were recovered in all areas of the site except one. The strong concentration of mussel shells in Unit N125 E92 probably suggests an activity area. The relative scarcity and the extremely small size of most of the mussel shells from the site suggest they were not a major item in the diet.

Evidence of plant collecting and processing was also present at the Hinojosa site. Charred hackberry seeds were recovered from many contexts at the site, and probably represent a food resource. Uncharred hackberry seeds were very numerous; however, these may be of recent origin, perhaps introduced into the deposits via rodent burrowing. Charred **Chenopodium** fruits were recovered from several contexts, including several feature matrices. **Chenopodium** and other charred plant seeds, persimmon and **Helianthus**, probably represent food items. Grinding stones were recovered in very low numbers from the site. Most grinding stones from the site are represented by small sandstone fragments recovered from the surface of the plowed field. Several factors may cause the importance of plant collecting to be underestimated. First, plant remains are notoriously poorly preserved in southern Texas, unlike animal bone. Second, ground stone tools represent more invested labor and may have been more difficult to replace than chipped stone tools; hence more likely to have been removed from the site. Wooden mortars may also have been used at the site, similar to specimens found in northeastern Mexico and southwestern Texas (cf. Prewitt 1981b). Thus, while plant gathering seems to have been less important than hunting at 41 JW 8, it was no doubt a significant subsistence activity.

ENVIRONMENTAL CONDITIONS DURING THE SITE OCCUPATION

The author believes that the spread of the Toyah horizon into south Texas and specifically to 41 JW 8 occurred during a period of increased rainfall in the region. This interpretation is not shared by some and can neither be convincingly substantiated nor refuted given our present knowledge. The arguments for and against this interpretation will be briefly reviewed. It is hoped that such a discussion will encourage others to conduct the careful studies necessary to confirm or deny this interpretation.

Climatic studies of the region have not yet achieved the resolution needed to understand the environmental conditions for the period. For example, Bryant and Shafer (1977) present a model of gradual dessication over the last 7000 years. Story (1980) suggests a steplike model with a general drying trend punctuated by several drought periods and intervals of increased moisture. Gunn et al. (1982) use a rather varied array of climatologial indicators (from atmospheric radiocarbon, to Arctic glacial chronology, to a "south Texas climatic threshold") to predict a series of expected long-term wet and dry periods in south Texas. In truth, we do not have enough data to understand past climatic fluctuations in south Texas.

One possible indication of climatic conditions is the identification of charred botanical remains from archaeological sites in south Texas. Dering (1982), Holloway (1986) and Jones (Section VII: Analysis of Macrobotanical Materials) have identified most of the charred materials from the archaeological sites they have studied as common species present in the area today, such as acacia, mesquite, persimmon, hackberry, elm, and others. Holloway and Jones interpret this as indicating a stable environment. This author would strongly disagree. The fact that the wood species present several thousand or several hundred years ago are the dominant species today only provides evidence that no dramatic changes have occurred. For example, while a major climatic shift would no doubt bring new species into south Texas, a long drought or an extended period of moist conditions would probably change only the species abundance, not the occurrence. In particular, the major trees present in the area, acacia and mesquite, will both thrive under more moist conditions (witness the lake shore concentrations of these trees in south Texas!). Thus, environmental stability cannot be inferred by the presence or absence of hardy, prolific species. What is needed is data on climatically sensitive species such as grass species.

In lieu of pollen preservation in southern Texas (cf. Hester 1977; Holloway, Section VII: Pollen Analysis), phytoliths seem to hold the most promise for environmental reconstruction (Brown 1984). Unfortunately, only a few preliminary studies of phytoliths in south Texas have been published to date (Robinson 1979, 1982). Robinson has studied samples from 41 JW 8 (Section VII). He believes that the samples from the occupation zone in the WTA (Col. 1) show a large number of grass phytoliths (Pooideae) which are characteristic of cooler seasons and winter rainfall. The increase in this type of phytolith has been found at several other sites; Robinson (1979, 1982) suggests that this indicates cooler/wetter conditions. Samples from above and below the occupation zone apparently have smaller amounts of the Pooideae phytoliths. Unfortunately, Robinson has not done the final step of his analysis, the quantification of the biosilica assemblage. Final interpretation of the phytolith data awaits publication of the completed studies of 41 JW 8 and other sites.

Another type of data that may provide environmental data is faunal material. In the Choke Canyon area, Steele (1986) used the presence of diverse species (characteristic of western and eastern biotic provinces) in Late Prehistoric and Late Archaic contexts to argue that the Tamaulipan Biotic Province has been established in the region for several thousand years. Furthermore, Steele suggested that the greater diversity during the Late Prehistoric may indicate a more temperate climate with milder summers and winters. Particularly significant to the present argument, is Steele's identification of a number of species in Late Prehistoric contexts which are no longer present in the region.

Steele identifies several species from 41 JW 8 that may indicate a wetter environment, including the least shrew (**Cryptotis parva**), the eastern mole (**Scalopus aquaticus**), the muskrat (**Ondatra zibethicus**), and possibly the pine vole (**Microtus** cf. **M. pinetorum**). The Hinojosa site is on the southwestern or southern margin of all of these species ranges. The least shrew and the muskrat have not been previously documented in the area. Taken together these species indicate that the local environmental conditions were much wetter/cooler during the occupation of the site than today. However, it should be noted that the presence of a running stream may have been responsible for the local occurrence of most of these species.

Other probable indications of a perennial stream include mussel shells, and the bones of fish, water turtle, aquatic bird, water snake, and raccoon. There seems to be little doubt that Chiltipin Creek was a permanent stream during the site occupation. The mussel species that were recovered (Section VII: Freshwater Bivalves) suggest a shallow stream with a muddy bottom and possibly an artesian source. This confirms Brune's (1981) suggestion that the Amargosa Springs, upstream from the site, was formerly (prior to the recent historic era) active on a year-round basis.

Numerous animal species also suggest an extensive grassland habitat in the site vicinity. Bison, pronghorn, least shrew, cotton rat, and pine vole are all primarily grassland species. The presence of bison in deep south Texas is considered particularly significant by this author. Dillehay (1974) presented a model of long-term fluctuations of bison on the Southern Plains. He suggested three general periods of bison presence separated by two periods of bison absence. Of interest here are Dillehay's Absence Period II (A.D. 500-1200-1300) and Presence Period III (A.D. 1200-1300-1550). Dillehay suggested that climatic shifts between wetter and drier conditions were responsible for shifts in the bison range. He cites a large number of sites in the Southern Plains that show a major increase in bison around A.D. 1200-1300. He also cites evidence from the southwest that suggests that bison were moving south and east away from areas suffering from a major drought at about this time.

This author would suggest that the combined evidence at 41 JW 8 indicates a wetter environment in the vicinity of the site. Much of this evidence can be attributed to a reliable spring-fed stream. However, a substantial grassland can also be inferred in the site vicinity. It is suggested that during the 14th century, much of south Texas (as well as much of the Southern Plains) had increased rainfall (or at least more consistent rainfall) that allowed a short-term improvement of the grasslands. The inferred climatic shift to a slightly wetter environment encouraged both the movement of bison and, perhaps, of people into the area.

SITE FUNCTION

The Hinojosa site is interpreted as a major campsite, or base camp. The site obviously served as a focus for activities that often involved travel to adjacent areas in search of various animal, plant, and mineral resources. At 41 JW 8, we see evidence of chert collecting and hunting trips that involved travel to within 50 km away. The immediate site vicinity was the scene of many different activities. Most of these have been discussed elsewhere in this report: cooking; animal butchering, processing, and disposal; land snail and mussel collecting; plant gathering and processing; tool making and resharpening; fire building; shell ornament manufacturing; basketry weaving; and leather working to name only the more obvious. The breadth of these activities and the concentrated nature of the deposits suggest that the site may have been occupied for extended periods (perhaps several weeks or months) at a time.

TOYAH HORIZON PEOPLES

One question which seems pertinent is "who were the people who lived at 41 JW 8 and other Toyah horizon sites in southern Texas?" Were they central Texas peoples moving into south Texas as some have argued? Or were they native south Texans who merely adopted certain technologies of central Texas peoples?

Of course, we may never know the answer to this question. The earliest descriptions of the Indians in the area were provided by Cabeza de Vaca (Campbell and Campbell 1981). The Campbells believe that Cabeza de Vaca passed through south Texas very near Jim Wells County in the 1530s. The Indian groups he described for the area, the Mariames, the Avavares, and possibly several others, appear to have been most interested in harvesting the prickly pear cactus fruit as discussed in Section V. The problem is that although some known behavioral aspects of these groups (like snail collecting) are evidenced at 41 JW 8, no conclusive links can be made. We did not find any obvious evidence of cactus fruit collecting. Cabeza de Vaca did not, of course, describe **Perdiz** arrow points, and he did not even mention pottery. Hence it is very difficult to say whether the group that inhabited the Hinojosa site survived in the area until the 16th century.

The alternative possibility is that the Hinojosa site was occupied by central Texas peoples. Prewitt (ms.) believes that the Rowe Valley site in Williamson County was occupied by Wichita-speaking Tonkawa groups long after Cabeza de Vaca had passed through southern Texas. The Toyah phase has also been tentatively linked to the Tonkawa by Suhm (1959). Does the fact that the 41 JW 8 assemblage strongly resembles the Toyah phase materials from central Texas suggest that the Tonkawa camped in Jim Wells County? Hester and Parker (1970) posed the same question for the Berclair site in Goliad County. As they note, some early historic accounts do mention the presence of Tonkawa bands in various portions of the South Texas Gulf Coastal Plains. At the present time we simply cannot link the Toyah horizon to the Tonkawa or any other group, no matter how tempting it may be. We lack the data necessary to make a direct link between the prehistoric assemblage and the historic peoples.

There is considerable evidence at the Hinojosa site that, whoever the peoples who camped there were, they were very familiar with south Texas. For example, the lithic materials at the site suggest that at least two source areas were used, the Nueces River east of the site and the hilltop gravels to the west and northwest of the site in Duval County or beyond. The Hinojosa site collection does not contain a single artifact made of a material that suggests a central Texas origin; all the raw materials are found in south Texas. Other indications of southern Texas familiarity are the Z-beveled knife, the Olmos biface, and the asphaltum and fugitive red decorated pottery. There are also indications of coastal contact. The marine shell ornaments, tools, and fragments, as well as the asphaltum pebble and decoration on the pottery and stone pipe, evidence at least trade with coastal peoples. Toyah horizon sites have been documented in San Patricio County (Chandler, personal communication) and Nueces County (Mokry, personal communication). Hence it is likely that the peoples who camped at 41 JW 8 also visited the coast at times.

Thus, the question of who were the peoples that camped at the Hinojosa site, cannot yet be answered. They did have an artifact assemblage dominated by tool forms that originated far to the north in central Texas. However, they also used tool types found only in southern Texas. Whoever they were, the peoples who lived at the Hinojosa site and many other Toyah horizon sites in southern Texas, left behind some of the more distinctive archaeological remains yet documented in the region.

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While most of this report was written by the author on his Zenith (Z100) computer using **WatchWord**; many of the tables and the editorial changes were made by Ann Young and Mary Lou Ellis using **WordStar**.

EDITORS

Thomas R. Hester, Carol Graves, Sharon Quirk, and Stephen L. Black edited this report.

BOOKKEEPERS

Loyce Jurney and Kathy Hodgin kept the books straight.

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APPENDIX 1

PROVENIENCE DATA: LOT NUMBERS

Appendix 1 is a listing of all the lot numbers (catalog numbers) assigned to the materials recovered during the 1981-1982 season at 41 JW 8 (Lots 56-473). Lot numbers 1-55 were assigned during the initial testing of the site (Hester 1977).

All of the units listed in the lot number list are 1-m^2 cells. All of the coordinates refer to the datum (grid southwest) corner of each cell. Also given are level numbers and in some cases comments. Lot numbers were assigned to feature materials within the various units and levels. Thus, Lot 126 contains the regular level recovery from N107 E98 L.2 while Lot 156 contains additional material recovered from Feature 2 in the same unit-level. Lot numbers were also assigned to matrix samples, CVS (constant volume samples), and occasionally charcoal or rock samples. Abbreviations used are the same as elsewhere in the report and listed in Section I.

Lot Number	Unit	Level	Comment	Lot Number	Unit	Level	Comment
56			Surface	105	N79 E90	6	
57	N78 E91	1		106	N124 E106	7	Matrix
58	N79 E90	1		107			Surface
59	N79 E91	1		108	N125 E92	3	
60	N78 E90	1		109	N125 E92	4	
61			Surface	110	N125 E92	5	
62			Surface	111	N125 E92	6	
63	N78 E90	2		112	N125 E93	3	
64	N78 E91	2		113	N125 E93	4	
65	N79 E91	2		114	N125 E93	5	
66	N79 E90	2		115	N125 E93	6	
67	N79 E90	3	Bags acciden-	116	N126 E92	3	
	N79 E91	3	tally combined	117	N126 E92	4	
68	N78 E91	3		118	N126 E92	5	
69	N78 E90	3		119	N126 E93	3	
70	N125 E92	1		120	N126 E93	2	
71	N125 E92	2		121	N126 E93	4	
72	N125 E93	1		122	N126 E93	5	
73	N125 E93	2		123	N106 E98	1	
74	N126 E92	1		124	N106 E98	2	
75	N126 E92	2		125	N107 E98	1	
76	N126 E93	1		126	N107 E98	2	
77	N123 E106	1		127	N106 E99	1	
78	N123 E106	2		128	N106 E99	2	
79	N123 E106	3		129	N107 E99	1	
80	N123 E106	4		130	N107 E99	2	
81	N123 E106	5		131			Surface
82	N123 E106	7		132	N125 E92	4	F.1 Matrix
83	N123 E106	8		133	N125 E92	4	Matrix 75 cm NE F.1
84	N124 E106	1					
85	N124 E106	2		134	N126 E92	6	
86	N124 E106	3		135	N126 E92	7	
87	N124 E106	4		136	N126 E92	8	
88	N124 E106	5		137	N126 E92	9	
89	N123 E106	6		138	N126 E92	10	
90	N124 E106	7		139	N126 E92	11	
91	N124 E106	8		140	N126 E93	6	
92	N78 E90	4		141	N126 E93	7	
93	N78 E90	5		142	N126 E93	8	
94	N78 E91	4		143	N126 E93	9	
95	N78 E91	5		144	N126 E93	10	
96	N79 E90	4		145	N126 E93	11	
97	N79 E90	5		146	N125 E92	7	
98	N79 E90	7		147	N125 E92	8	
99	N79 E90	6		148	N125 E92	9	
100	N79 E91	7		149	N125 E92	10	
101	N79 E91	5		150	N125 E92	11	
102	N79 E91	4		151	N125 E93	7	
103	N124 E106	6		152	N125 E93	8	
104	N79 E91	6		153	N125 E93	9	

Lot Number	Unit	Level	Comment
154	N125 E93	10	
155	N125 E93	11	
156	N107 E98	2	F.2
157	N92 E92	1	
158	N107 E98	3	
159	N107 E98	4	
160	N107 E98	5	
161	N107 E98	6	
162	N107 E99	3	
163	N107 E99	4	
164	N107 E99	5	
165	N106 E98	2	F.2
166	N106 E98	3	
167	N106 E98	4	
168	N106 E98	5	
169	N106 E98	6	
170	N106 E99	3	
171	N106 E99	4	
172	N106 E99	5	
173	N101 E94	1	
174	N101 E94	2	
175	N100 E93	1	
176	N100 E93	2	
177	N101 E93	1	
178	N100 E94	2	
179	N100 E94	1	
180	N106 E98	3	F.3 Matrix
181	N107 E98	2	F.2 Matrix
182	N107 E98	2	F.2
183	N106 E98	2	F.2
184	N106 E98	3	F.3
185	N107 E98	2	F.2
186	N92 E92	2	
187	N93 E92	1	
188	N93 E92	2	
189	N92 E93	1	
190	N92 E93	2	
191	N93 E93	1	
192	N93 E93	2	
193	N95 E82	1	
194	N96 E82	1	
195	N96 E83	1	
196	N95 E83	1	
197	N100 E94	3	
198	N100 E94	4	
199	N100 E94	5	
200	N100 E94	6	
201	N100 E93	3	
202	N100 E93	4	
203	N100 E93	5	
204	N100 E93	6	
205	N101 E94	3	
206	N101 E94	4	
207	N101 E94	5	
208	N101 E94	6	
209	N101 E93	2	
210	N101 E93	3	
211	N101 E93	4	
212	N101 E93	5	
213	N101 E93	6	
214	N80 E102	1	
215	N80 E102	2	
216	N80 E102	3	
217	N80 E102	4	
218	N80 E102	5	
219	N81 E103	1	
220	N81 E103	2	
221	N81 E103	3	
222	N80 E103	1	
223	N80 E103	2	
224	N80 E103	3	
225	N80 E103	4	
226	N81 E102	1	
227	N81 E102	2	
228	N81 E102	3	
229	N93 E92	3	
230	N93 E92	4	
231	N93 E92	5	
232	N92 E92	3	
233	N92 E92	4	
234	N92 E92	5	
235	N93 E93	3	
236	N92 E93	3	
237	N100 E94	6	F.4
238	N100 E93	6	F.4
239	N95 E82	3	
240	N95 E83	2	
241	N95 E83	3	
242	N96 E82	2	Matrix
243	N100 E93 and E94		F.4 Matrix
244	N95 E82	2	
245	N96 E83	2	
246	N96 E82	2	
247	N96 E82	3	
248	N96 E83	3	
249	N95 E83	4	
250	N96 E83	4	
251	N96 E83	5	
252	N110 E92	1	
253	N110 E92	2	

Lot Number	Unit	Level	Comment
254	N110 E92	3	
255	N110 E93	1	
256	N110 E93	2	
257	N110 E93	3	
258	N111 E92	1	
259	N111 E92	2	
260	N111 E92	3	
261	N111 E93	1	
262	N111 E93	2	
263	N111 E93	3	
264	N104 E97	1	
265	N104 E97	2	includes F.10 bone
266	N105 E99	1	
267	N105 E99	2	
268	N105 E99	3	
269	N105 E98	1	
270	N105 E98	2	
271	N104 E99	1	
272	N104 E99	2	
273	N104 E99	3	
274	N104 E98	1	
275	N104 E98	2	
276	N104 E98	3	
277	N105 E97	1	
278	N105 E97	2	
279	N106 E97	1	
280	N107 E97	1	
281	N107 E97	2	
282	N108 E97	1	
283	N108 E97	2	
284	N109 E97	1	
285	N108 E98	1	
286	N108 E98	2	
287	N108 E99	1	
288	N109 E99	1	
289	N109 E98	1	
290	N106 E97	2	F.6 Matrix
291	N104 E97	3	includes F.10 bone
292	N104 E97	4	includes F.10 bone
293	N105 E97	3	
294	N107 E97	3	
295	N108 E97	3	
296	N108 E98	2	
297	N108 E99	3	
298	N109 E98	2	
299	N109 E98	3	
300	N109 E99	2	
301	N109 E99	3	
302	N109 E97	3	
303	N108 E98	3	
304	N109 E98	2	F.5
305	N105 E98	3	Matrix
306	N109 E98	2	F.5 Matrix (upper)
307	N109 E98	2	F.5 Matrix S 1/2
308	N109 E98	2	F.5 Matrix N 1/2
309	N109 E98	3	F.5 Matrix S 1/2
310	N104 E94	1	
311	N105 E94	1	
312	N105 E95	1	
313	N104 E95	1	
314	N104 E96	1	
315	N105 E97	4	
316	N105 E96	1	
317	N106 E94	1	
318	N107 E94	1	
319	N107 E95	1	
320	N106 E95	1	
321	N106 E96	1	
322	N107 E96	1	
323	N107 E97	4	
324	N108 E94	1	
325	N109 E94	1	
326	N109 E95	1	
327	N108 E95	1	
328	N108 E96	1	
329	N108 E97	4	
330	N109 E96	1	
331	N109 E97	4	
332	N73 E92	1	
333	N73 E92	2	
334	N73 E92	3	
335	N74 E92	1	
336	N74 E92	2	
337	N74 E92	3	
338	N75 E90	1	
339	N75 E90	2	
340	N76 E90	1	
341	N76 E90	2	
342	N76 E91	1	
343	N76 E91	2	
344	N75 E91	1	
345	N75 E91	2	
346	N75 E92	1	

Lot Number	Unit	Level	Comment
347	N75 E93	1	Not analyzed
348	N75 E93	2	Not analyzed
349	N76 E93	1	Not analyzed
350	N75 E94	1	Not analyzed
351	N76 E92	1	
352	N105 E98	3	
353	N75 E92	2	
354	N76 E92	2	F.7
355	N107 E97	4	Matrix
356	N76 E92	2	F.7 Matrix
357	N108 E97	4	Matrix
358	N76 E92	2	F.7 Matrix
359	N106 E96	2	Matrix 50 cm West of F.6
360	N106 E97	2	F.6 Matrix
361	N105 E96	1	WTA CVS COL.2
362	N105 E96	2	WTA CVS COL.1
363	N108 E96	1	WTA CVS COL.2
364	N75 E90	3	
365	N76 E90	3	
366	N76 E91	3	
367	N75 E91	3	
368	N104 E95	2	
369	N104 E94	2	
370	N104 E94	3	
371	N105 E94	2	
372	N105 E94	3	
373	N105 E95	2	
374	N105 E95	3	
375	N104 E95	3	
376	N104 E96	3	
377	N105 E96	3	
378	N108 E96	2	WTA CVS COL.2
379	N106 E94	3	
380	N107 E94	2	
381	N107 E94	3	
382	N107 E95	2	
383	N107 E95	3	
384	N106 E95	2	
385	N106 E95	3	
386	N106 E96	2	
387	N106 E96	3	
388	N107 E96	3	
389	N108 E94	3	
390	N109 E94	3	
391	N109 E95	3	
392	N108 E95	3	
393	N108 E96	3	
394	N108 E100	1	
395	N109 E100	1	
396	N109 E96	3	
397	N106 E96 and E97	2	F.6
398	N104 E94	2	Charcoal
399	N106 E97	2	F.6 Matrix S 1/2
400	N106 E97	2	F.6 Matrix C
401	N106 E97	2	F.6 Matrix D
402	N108 E96	3	WTA CVS COL.2
403	N104 E97	3	WTA CVS COL.1
404	N106 E97	2	F.6 Matrix E
405	N106 E97	2	F.6 Matrix A
406	N106 E97	2	F.6 Matrix B
407	N106 E97	2	F.6 Matrix F
408	N106 E97	2	F.6 Matrix N 1/2
409	N106 E97	2	F.6 Rocks
410	N105 E94	4	
411	N105 E95	4	
412	N104 E95	4	
413	N104 E96	4	
414	N105 E96	4	
415	N106 E94	4	
416	N107 E94	4	
417	N107 E95	4	
418	N106 E95	4	
419	N106 E96	4	
420	N106 E97	2	
421	N106 E97	3	
422	N106 E97	4	
423	N107 E96	4	
424	N108 E94	4	
425	N109 E94	4	
426	N109 E95	4	
427	N108 E95	4	
428	N108 E96	4	
429	N108 E100	2	
430	N108 E100	3	
431	N109 E100	2	
432	N109 E100	3	
433	N109 E101	1	
434	N108 E101	1	
435	N108 E101	2	
436	N108 E101	3	
437	N108 E102	1	
438	N108 E102	2	
439	N109 E96	4	
440	N109 E102	1	
441	N109 E102	2	
442	N110 E100	2	

Lot Number	Unit	Level	Comment
443	N110 E101	2	
444	N110 E102	1	
445	N110 E102	2	
446	N111 E100	1	
447	N111 E101	1	
448	N111 E101	2	
449	N111 E102	1	
450	N111 E102	2	
451	N104 E96	4	WTA CVS COL.1
452	N108 E96	4	WTA CVS COL.2
453	N106 E97	3	F.6 Matrix
454	N75 E92	3	
455	N104 E94	4	
456	N104 E94	5	
457	N108 E102	3	
458	N110 E100	1	
459	N110 E101	1	
460	N110 E101	3	
461	N110 E102	3	
462	N111 E100	2	
463	N111 E100	3	
464	N111 E101	3	
465	N111 E102	3	
466	NPS	1	
467	NPS	2	
468	NPS	3	
469	NPS	4	
470	NPS	5	
471	NPS	6	
472	N108 E102	3,4	F.9
473	N109 E101	2	
474	N109 E101	3	
475	N108 E102	4	
476	N108 E103	1	
477	N108 E103	2	
478	N109 E102	3	
479	N109 E102	4	
480	N110 E100	3	
481	N110 E102	3	F.8
482	N110 E102	4	
483	N111 E101	4	
484	N111 E102	4	
485	N109 E102	3	F.8
487	N110 E101	4	
488	N109 E101	2	F.8 Matrix
489	WFNP	Z.1	

Lot Number	Unit	Level	Comment
490	NSP		Z.2
491	WFNP		Z.2
492	N78 E90		North Wall Matrix Z.3
493	WFNP		Z.3
494	N110 E101	3	F.8 Matrix
495	N123 E106		Z.2 Matrix
496	N110 E102	3	F.8 Matrix
497	N110 E101	3	F.8 Matrix
498	N80 E102		South Wall Matrix Z.2U
499	N78 E90		North Wall Matrix Z.2L
500	NPS		Z.1
501	N80 E102		South Wall Matrix Z.1
502	NPS		Z.3U
503	N78 E90		Z.2U
504	N80 E102		Z.2L
505	N123 E106		Matrix Z.3
506	N78 E90		North Wall Matrix Z.1
507	NPS		Z.3L
508	N123 E106		Matrix Z.1
509	N75 E91	4	
510	N75 E92	4	
511	N75 E93	4	Not analyzed
512	N76 E93	2	Not analyzed
513	N76 E92	3	
514	N104 E96	2	
515	N105 E96	2	
516	N107 E96	2	
517	N108 E94	2	
518	N109 E94	2	
519	N109 E95	2	
520	N108 E95	2	
521	N108 E96	2	
522	N109 E96	2	
523	N106 E94	2	
524	N109 E101	2	F.8
525	N110 E101	3	F.8
526	N110 E102	3	F.8
527	N110 E100	3	F.8 Rocks
528	N106 E97	2	F.6 Charcoal
529	N109 E97	2	

APPENDIX 2
DATA TABLE

Appendix 2 provides a complete breakdown of all of the artifactual material recovered from all excavation units with the exception of the two noise pits (virtually no cultural material was recovered from these two units). The abbreviations used for the item headings follow; most are the artifact codes used in the text and discussed in detail in Section VI. The data table is divided into two sections: the WTA units and the remaining (miscellaneous) units. Within each of these sections the units are listed in order of smallest to largest north (N) number and from smallest to largest east (E) number. The levels from a given unit are listed in the order excavated (i.e., L.1, L.2, etc.).

DATA TABLE CATEGORIES

A1	**Perdiz** arrow points
A2	Expanding stem arrow points
A3	Triangular arrow points
A4	Arrow point fragments
B1	Beveled knives
B2	Triangular finished bifaces
B3	Perforators
B4	**Olmos** bifaces
FB1	Round proximal biface fragments
FB2	Miscellaneous proximal biface fragments
FB3	Miscellaneous biface fragments
S	Pottery sherds
MD1	Modified debitage (trimmed)
MD2	Modified debitage (minutely retouched/utilized)
MD3	Modified debitage (retouched with concave edge)
D1	Debitage (primary flakes)
D2	Debitage (secondary flakes)
D3	Debitage (tertiary flakes)
D4	Debitage (corticate chips)
D5	Debitage (decorticate chips)
D6	Debitage (chunks)
U1	End scrapers
U2	Miscellaneous unifaces
C	Cores
Rab	**Rabdotus** snail shells
Mu	Mussel umbos
BRW	Burned rock weight (in grams)
AW	Average weight per rock (in grams), calculated only for certain units
PC	Pebble count
BCW	Baked clay weight (in grams)
H	Historic materials (m) = metal fragment (n) = nail (g) = glass fragment (c) = ceramic fragment (fs) = fence staple
MS	Nonchert modified stone (MS1) = ground stone (MS3) = abrader (MS2) = hammerstone (MS4) = smoking pipe

[illegible] Trail [illegible] Data

Lot	Provenience	Elevation	Feature	A1	A2	A3	A4	B2	B3	BD	B4	F21	F22	F23	4	MG	MG2	N23	D1	D2	D3	D4	D5	D6	L1	S	U	Kcs	Ms	DEP	Au	FC	DCM	H	PS
137	M105 E99 L.1	0-10					1							1			3		2		2	4	4							66		2		Hlastm	
140	M105 E99 L.2	10-20							1								1			1	11	6	20					18		106		1		Pm/Lg	
170	M105 E99 L.3	20-30												1			1			1	1	1	1					24		64		1			
171	M105 E99 L.4	30-40																										17		33					
172	M105 E99 L.5	40-50																										17		40			1		
318	M107 E96 L.1	Surface-99.97												1	6	2	4			5	10	6	24	1	1			1		574		3		Sm	
360	M107 E94 L.2	99.97-99.87					1								2		2	1		4	14	16	23	2				222		995		3	1	Ih	
361	M107 E94 L.3	99.87-99.77					1										3				3	5	2	3				145		87					
416	M107 E94 L.4	99.77-99.67																			2	1	3					26		74					
339	M107 E95 L.1	Surface-99.87					1							3	6	1	2			1	34	54	52	3	1			29		545		1	5	Lt,Lr	
362	M107 E95 L.2	99.87-99.57															1			9	29	5	41	1				246	1	121		4			
388	M107 E95 L.3	99.67-99.77		1											2					1	4	5	5					157	1	81		1	1		
417	M106 E95 L.4	99.77-99.57																		2	1	4					1	40		35					
375	M106 E96 L.1	Surface-99.87		1			2							2	2		7			12	32	15	15	1				75		381		2	1	Lf	
515	M106 E96 L.2	99.87-99.57												7	19		2	1		12	20	11	12	4				162	8	315		5			
335	M106 E96 L.3	99.67-99.77													2		1			2	2	2	15	2				114		183					
423	M107 E96 L.4	99.77-99.67												1								2	2					53		135					
283	M107 E97 L.1	420-10		1											1		6	1		6	35	9	10					21		64		1		2m,2Tc	
291	M107 E97 L.2	0-10		1			2						1	1	2	1	12	4		21	80	33	80	1	1		1	119	6	223		5	4		
294	M107 E97 L.3	99.87-99.77		1			1							2	7		1		1	5	35	7	12					107	6	221		1	3		
292	M107 E97 L.4	99.77-99.67																		2	5	2	5					17		49			1		
135	M107 E98 L.1	0-10		1			1					1		3			11			11	25	10	40					4		70		11		Hlastm	
136	M107 E98 L.2	10-20		7										2			32		2	15	35	11	74					38		1278		5		Hlastm	[illegible]
166	M107 E98 L.2	10-20	3																																
302	M107 E98 L.2	10-20	2																																
356	M107 E98 L.2	10-20	2									1					5			1	3		9		1			12		14					
358	S107 E96 L.3	20-30		1													1			3	4	4	5		1			30		152		1	1		
359	S107 E96 L.4	30-40																		1		1	2				1	18	3	264		1			
362	S107 E98 L.5	40-50																			1		1					11		262		1	1		
363	S107 E98 L.5	50-60															1				1	1						9		66			6		
129	M101 E56 L.1	0-10															1			2	4	6	4					1		32					
132	M101 E56 L.2	10-20												1			4			5	9	6	41					15		112		6			
142	M101 E56 L.3	20-30														1						2	4					11		209				Tn	
143	M101 E55 L.4	30-40																			2		1					5	1	111		2	3		
144	M101 E55 L.5	40-50															2				1							10	1	149		4	3		
321	M106 E44 L.1	Surface-99.97											1	2	1		4			5	14	15	53	1				99		517		5	2	1Fa	
317	M108 E44 L.2	99.97-99.87		1											3	1	6		1	15	31	15	24					179		117		6	4		
389	M108 E44 L.3	99.87-99.77		1													3			4	10	1	12					124		171		2	4		
424	M108 E44 L.4	99.77-99.67																			2	1	1					20		32			3		
327	M108 E45 L.1	Surface-99.97		1											12		6			15	42	34	50	1	1	1		52		491		3		1Fa,2m,1g	
320	M108 F95 L.2	99.97-99.87													1					2	30	1	7					14	1	241		5	1		
397	M108 F95 L.3	99.87-99.77													1		1			6	30	1	5					64		90		2	15		
421	M108 F95 L.4	99.77-99.67																			1	1	1					26	1	4		1			
328	S108 E96 L.1	Surface-99.97		2		1	1							1	12		4		1	14	57	22	49	1				57	5	206		4	4	2Tc	
523	S108 E96 L.2	99.97-99.87															2			7	29	8	16					332		229					
358	S108 E96 L.3	99.87-99.77																		4	15	14	10	1				350		16					
435	S108 E96 L.4	99.77-99.67																										34		36		1			
282	M108 E97 L.1	120-0													2		3			5	13	4	16					9		82		3		Sm	
283	M108 E97 L.2	0-10		1			1								5		16		1	12	33	21	30	3	1			233	1	153		2		1Tc	
295	M108 E97 L.3	99.87-99.77															2			7	9	10	5	1				133		628			1		
324	M108 E57 L.4	99.77-99.67														1				1	4	2	4					10		40			1		
344	M108 E59 L.1	0-10					3	3								1	6			11	15	17	55				1	12		106		5		Hlastm/Lg	
286	M108 E59 L.2	10-20												1	1		7		1	18	18	17	25	4				42		47		3	1		
305	M108 E59 L.3	99.77-99.67																		1	4	2	1	1				15		30		1	11		
287	M108 C99 L.1	0-10												2			5			1	4	6	7	1				1		51					
296	M128 E99 L.2	99.87-99.77														1	1			7	14	9	51	1				35		104		4		Sm	
297	M128 E99 L.3	99.77-99.67																		1	5		2					18		26					
346	M128 E100 L.1	99.97-99.87		3																1	5	4	4	1				4		57				Ip,Lh	
429	M128 E100 L.2	99.87-99.77		2			1												1	3	6	4	12	3				47		199		6			
450	M128 E100 L.3	99.77-99.67																		2	4		3					19		18					
434	S128 E101 L.1	100.10-99.87		2			1								5	2	4		1	22	11	11	47	4				24		147		5			
455	S128 E101 L.2	99.87-99.77		2															1	5	12	8	8					76		41		1			
456	S128 E101 L.3	99.77-99.67																				2	3	1				56		48					
457	S128 E102 L.1	100.10-99.67		1			1													3	13	5	15	2			1	3		38		5		Im	
438	M106 E102 L.2	99.97-99.87													1		2		1	5	21	4	21	2			1	15		158					
457	M106 E102 L.3	99.87-99.77																		4	3	4	6	1				15	2	55		2			
472	M106 E102 L.3	99.87-99.77	5														1																		
475	M106 E102 L.4	99.77-99.67					2									1			1	1	3	4	6	3				26		131					
472	M106 E102 L.4	99.77-99.67	5																																
476	M106.5 E103 L.1	100.09-99.87		1										1						1		4	2					7		33		1			
477	M106.5 E103 L.2	99.87-99.77																			1		3					3		14					

Major Trait Assemblages

Lot	Provenience	Elevation	Features	A1	A2	A3	A4	B1	B2	B3	B4	FB1	FB2	FB3	S	Mul	Mid	Adz	D1
319	N104 E94 L.1	Surface-99.97													1		1		
369	N104 E94 L.2	99.97-99.87									1			2	5		5		
375	N104 E94 L.3	99.87-99.77					1		1								5		
455	N104 E94 L.4	99.77-99.67		1												1	1		1
465	N104 E94 L.5	99.67-99.57		1															
323	N104 E95 L.1	Surface-99.91		1			1								2		4		
368	N104 E95 L.2	99.91-99.87					1										6		
376	N104 E95 L.3	99.87-99.77															3		1
413	N104 E95 L.4	99.77-99.67															1		
334	N104 E96 L.1	Surface-99.97					2							1	9		4	1	
314	N104 E96 L.2	99.97-99.87		1											3				5
376	N104 E96 L.3	99.87-99.77																	
413	N104 E96 L.4	99.77-99.67																	
264	N104 E97 L.1	400+0					2							2			4	1	1
276	N104 E97 L.2	0-10												2	1		4		
291	N104 E97 L.3	99.87-99.77	Inv. F.13														1		
292	N104 E97 L.4	99.77-99.67	Inv. F.13																
272	N104 E98 L.1	0-10															5	1	
275	N104 E98 L.2	10-20															1		
276	N104 E98 L.3	20-30																	
271	N104 E99 L.1	0-10												1			4		1
272	N104 E99 L.2	10-20													1		4		
278	N104 E99 L.3	20-30																	
317	N105 E94 L.1	Surface-99.97												1	4	2	3		
373	N105 E94 L.2	99.97-99.87					1							1	1		3		
432	N105 E94 L.3	99.87-99.77																	
430	N105 E94 L.4	99.77-99.67																	
329	N105 E96 L.1	Surface-99.97		2			3							1	4		10		
373	N105 E96 L.2	99.97-99.87														2	1		
374	N105 E96 L.3	99.87-99.77														1	2		
411	N105 E95 L.4	99.77-99.67																	
315	N105 E95 L.1	100.18-99.97		1											3	2	4		
315	N105 E95 L.2	99.97-99.87													1				
377	N105 E95 L.3	99.87-99.77																	
414	N105 E95 L.4	99.77-99.67												1			1		
277	N105 E97 L.1	400-0													2		3		
273	N105 E97 L.2	0-10					2								4		4		
285	N105 E97 L.3	10-20												1					
315	N105 E97 L.4	99.77-99.67																1	
269	N105 E98 L.1	0-10															4	2	
270	N105 E98 L.2	10-20		1													2		
352	N105 E98 L.3	20-30																	
288	N105 E99 L.1	0-10												2			2		
287	N105 E99 L.2	10-20															3		
296	N105 E99 L.3	20-30																	
311	N106 E94 L.1	Surface-99.97		3										1	2		7		
529	N106 E94 L.2	99.97-99.87		2										2	6				
539	N106 E94 L.3	99.87-99.77		2															
415	N106 E94 L.4	99.77-99.67																	
320	N106 E96 L.1	Surface-99.97		1				2							12		4		1
384	N106 E96 L.2	99.97-99.87		1			1								2				1
386	N106 E96 L.3	99.87-99.77																	
435	N106 E96 L.4	99.77-99.67					1										1		
321	N106 E95 L.1	Surface-99.97		1			1	1						1	1		5	1	
358	N106 E95 L.2	99.97-99.87												2	2				
447	N106 E95 L.2	99.97-99.87	6				1							1	1		1		
357	N106 E95 L.3	99.87-99.77													4				1
419	N106 E95 L.4	99.77-99.67																	
279	N106 E97 L.1	400-0		1											1		7	1	
420	N106 E97 L.2	0-10	6									1		1	3	1	2		1
421	N106 E97 L.3	99.87-99.77					1					1			1				
422	N106 E97 L.4	99.77-99.67													1				
123	N106 E98 L.1	0-10					1							2		1	3		
124	N106 E98 L.2	10-20															4		
155	N106 E98 L.2	10-20	2																
165	N106 E98 L.2	10-20	2																
150	N106 E99 L.3	20-30															1		
164	N106 E99 L.3	20-30	5																
167	N106 E99 L.4	30-40															1		
168	N106 E99 L.5	40-50															1		
169	N106 E99 L.6	50-60																	

Lot	D2	D4	D5	D6	D8	E1	E2	C	Mag	My	MHP	Ag	AC	MCM	H	MS
319	4	21	6	11					5		269		1		Im,Ig	
369	5	27	8	21	1				118		330		3	1		
375	3	4	7	8					145	2	142		12	8		
455	4	4	3	5	1				71		556		2	2		
465		2		4					52	1	177		5	2		
323	5	21	14	51	1			1	6		258		1		Ig	
368	5	13	4	16		1			112	1	46			4		
376	3	32	11	17		2			254	2	414		3	1		
413	9		2						37	1	12					
334	2	13	8	26	1	1			34		366		1		Im	
314	5	18	8	28					139		288		2			
376	1	1	2	4					57	2	88		1	1		
413			1	3					20		46					
264	5	9	6	20		1		1	17		150		2			
276	3	21	4	19					41	5	200		2		Im	
291	4	3	4	6					44	1	46		3	1		
292	1	3	2	3					50	2	1555		1	15		
272	3	3	10	10		1			4		73		10		Sm,2Ifs,Im	
275	3	1	5	5	2	1			29	2	43				Im,Ifs	
276	3	3	1	3					35	1	83		2	1		
271		3	2	3					2		108				Ig	
272	4	9	5	8					21		72				Ig	
278				2					26	1	44			1		
317	7	13	7	24	2	1			5		358		1		Im	
373	3	17	12	25	1				110	1	219		8	5		
432	5	8	6	4					168	2	124					
430		3	1	3					34		102		2			
329	13	25	15	27				1	14		459		2		Im,Ifs	
373	11	24	10	27					290		210		2	4	Im	
374	4	11	3	4					127	3	92			2		
411		1	3	4					40		33		3			
315	7	23	20	35		2			57		471				Ifs	
315	2	10	5	13	1			1	55		154					
377	1	4	4	3	1				78		35		3			
414			2	2	1				20	1	61					
277	1	10	10	11	1				12		174				Im,Ig	
273	3	24	10	20	2				79	1	213		17	2		
285	1	4	9	2					67	2	16					
315	1	9		1					71	2	259			2		
269	3	12	12	32	1	1			2		282		1		Sm	
270	5	4	5	14					35	1	52		2	1	Sm,Ig,Im	
352									2							
288	1	3	5	3					1		29				Im	
287	7	9	5	4					26	1	354		2		Sm	
296		1	1						26		378		1			
311	8	17	19	51	4				6		457				Ifs	
529	11	25	16	57		1			226		440		1			
539	3	6	6	7	1				186		140		3	3		
415		3	2	2	1				38		49					
320	13	26	18	24	1	5		1	22		591		4			
384	9	16	15	25	4				376	1	144		1	2		
386	3	7	6	4					133		123		2	3		
435		3	1	4					30		15					
321	13	10	20	41				1	68		380		6		Ifs	
358	13	30	8	24		1			141		97					
447																
357	3	16	4	2					112		78					
419	4	8							43		55				Ifs	
279	5	5	14	27		1			12		85		3	1	Sm	
420	14	28	16	57		2			142		274				Sm	
421	4	14	5	25					81		228					
422	3	3	2	4					39		27					
123	3	15	17	14					5		133		7		Im,Ifs,Sm	
124	1	6	12	24	2			1	45				9		Im,Shell	
155	1								2				1			
165																
150		3	1	3					17		59		2	2		
164																
167	3	3	1	5					39	2	777		4			
168				3					13		187			2		
169	1	1	1						73		207		3	12		

Major Trait Area Units

Lot	Provenience	Elevation	Feature	A1	A2	A3	A4	B1	B2	B3	B4	B01	FA2	FA5	G	MD1	MD2	MD3	D1	D2	D4	D3	D5	D6	E1	E2	C	Roh	Pu	BBP	Al	TC	DCH	H	M4
525	N120 E94 L.1	Surface-99.47		1										1	5	1	5	2		4	18	18	20	1				413		400		4	1	5m	
516	N120 E94 L.2	99.97-99.87												4	6		5		1	20	23	18	26	1				174		576		1	2		
501	N120 E94 L.3	99.87-99.77														1	2			4	4	2	8	1				124		324			2		
495	N124 E94 L.4	99.77-99.67																			1							34		190					
475	N120 E96 L.1	Surface-99.87		1										1	6	1	7	1	1	34	45	35	62		1		1	41		856		3			
506	N120 E96 L.2	99.97-99.87		1	11(A2:1)			1						1	2					17	93	30	29				1	276		1047		2	1		
383	N120 E96 L.3	99.87-99.77																		1	6	1	5					180		890		2	1		
435	N120 E96 L.4	99.77-99.67					1							1							2	2	1					72		145					
333	N109 E96 L.1	Surface-99.97												1	3	1	4	1		13	26	27	41	2	1			66		590		3		2m	
322	N109 E96 L.2	99.97-99.87					1								3		1	1	2	3	20	9	25	1				211		567		1	2		1(455)
378	N109 E96 L.3	99.87-99.77																		5	6	5	9	2				360		36					
489	N109 E96 L.4	99.77-99.67																		1	4	2	1	1				55		36					
344	N109 E97 L.1	100-0						1					1		2		5			3	12	2	6		1		1	7		94		1	2	2Pb	
509	N109 E97 L.2	0-10																	1	12	38	20	24	3				263		173				1m	
332	N109 E97 L.3	99.97-99.77												1					1		5	2	6					94	2	300		4	6		
331	N109 E97 L.4	99.77-99.67																			4	2	2		1			44		159					
289	N103 E98 L.1	0-10		1									1	1			2		2	4	10	12	23	3				9		355		3		20m,4Pb	
286	N103 E98 L.2	10-20												1	1		1		1	8	36	19	34	1				83		141		1		3m	
304	N103 E98 L.3	99.87-99.76	5		10(A2:1)										1																				
299	N103 E98 L.3	99.77-99.67																		2	4	3	1					34		60					
296	N120 E99 L.1	0-10					1													2	12	5	10	1						21		4		3m	
300	N120 E99 L.2	99.87-99.77														1	7			9	18	23	14					34		55		1		1m	
301	N120 E99 L.4	99.77-99.67																			6	1						6		13					
395	N120 E100 L.1	99.99-99.87					1										2			4	6	4	3	3						35					1(455)
431	N109 E100 L.2	99.90-99.77			11(A2:1)										1	1	2			7	10	4	16	2				34		22		2	3	1Pb	
453	N109 E100 L.3	99.77-99.67															1				2	2	1					39		38					
455	N109 E101 L.1	100.08-99.87					3	2			1			1	9		5		1	16	42	41	62	5	2			34		211		6		1m	
479*	N109 E101 L.2	99.87-99.77	Inc. 5				1										4			2	5	5	12		1			64		600		1	2		
474	N109 E101 L.3	99.77-99.67																			5		2					43		93			2		
440	N109 E102 L.1	100.15-99.97		1										1	1		2		1	5	14	5	22					27		61				1m	
441	N108 E102 L.2	99.99-99.87													1	1	1			7	13	3	21					7		330		3	1		
478	N108 E102 L.3	99.87-99.77				1											2			1	13	4	11					26		85					
445	N105 E102 L.3	99.87-99.77	4	1																	3							5		288					
479	N105 E102 L.4	99.77-99.67															2				1	1	5					90		262		1			
253	N100 E92 L.1	0-10		2			1							1	11	1	3			7	17	11	35		1			71	1	396		3	1	1p	
252	N100 E92 L.2	10-20					1							1	1		11			7	19	22	21	2				206		574		4	2	1Pb,1m	1(455)
254	N100 E92 L.3	20-40		1											2		1			4		2	5					88		75		1	2		
255	N100 E93 L.1	0-10		1			2	1						2	17		4			13	21	15	40	3				12		408		5	2	1	
256	N100 E93 L.2	10-20					1							1	5		3		1	15	29	15	35					127		137		1	1		
257	N100 E93 L.3	20-30													1		1			3	4		4					77		72			1		
458	N110 E100 L.1	100.01-99.87															2			2	11	5	15	1				1		93		4			
442	N110 E100 L.2	99.87-99.77													1		2		1	5	15	1	21	2				35		141		1		1m	
450	N110 E100 L.3	99.77-99.67																		2	4							13		77					
456	N110 E101 L.1	100.08-99.87					1								3		4	1		5	13	3	19	2				1	3	168		5			1(455)
443	N110 E101 L.2	99.87-99.77		3										1	1		4			5	35	17	24	4				25	1	332		1			
452	N110 E101 L.3	99.77-99.67		1															7		13	1	6					29		24			9,5		
525	N110 E101 L.3	99.87-99.77	6				1							1			2				6	4	5	1				23	1	33		1			
487	N110 E101 L.4	99.77-99.67		1			1														3	1						10		39					
484	N110 E102 L.1	100.06-99.97					1									1	3	1		5	10	3	7	2				9		25		2	6		
444	N110 E102 L.2	99.97-99.87		1											4		3		2	4	11	14	28					14		325		2	2		
481	N110 E102 L.3	99.87-99.77															1			1	6		4					21		71		9	2		
481	N100 E102 L.3	99.87-99.77	5																	1	1	1	1					6		13					
5?6	N100 E102 L.3	99.87-99.77	4																																
482	N100 E102 L.4	99.77-99.67					1				1						2				1	2	2					26	7	47		3	3	1m	
266	N111 E92 L.1	0-10					1							1	14		12	2	1	4	22	22	37	3	1			71		454		3	2		
269	N111 E92 L.2	10-20		2										2	9		1		1	11	30	53	34	2				159		733		4			
280	N111 E92 L.3	20-40												1	1		1			9	10	3	7					164		92		3			
293	N111 E93 L.1	0-10					1					1		1	16	1	13	3		12	22	23	28		1			33		478		4	1	1m,1g	
292	N111 E93 L.2	10-20					1					1			6		5	1		31	45	12	36					366	4	464		5	3	1Pb,1m	
223	N111 E93 L.3	20-30													1					7	9	6	9					139		31					
448	N111 E100 L.1	100.08-99.87			11(A2:2)										2		1		1	3	15	5	13					1		40		2		1m,1p	
452	N111 E100 L.2	99.87-99.77	Fea. 6				1										1			15	18	2	11	2				74		70		5	1	5m	
444	N111 E100 L.3	99.77-99.67																		4	2	2	2					35		32					
447	N111 E101 L.1	100.08-99.87		1															2	4	2	2	7	1				1		51		1			
448	N111 E101 L.2	99.87-99.77													6		3		3	7	20	14	37	4				24		269		1			
451	N111 E101 L.3	99.87-99.77												1						1	1	8	9					30		55		1			
493	N111 E101 L.4	99.77-99.67																		1	6	3	2					39		2					
494	N111 E102 L.1	100.06-99.97																		3	2	3	4					1		3					
491	N111 E102 L.2	99.97-99.87		1			1							1	3		3			4	10	24	37					6		137		2			
485	N111 E102 L.3	99.87-99.77					1								3		1			2	3	4	11	1				14		6		2			
484	N111 E102 L.4	99.77-99.67																		1	5	3	6					34		20		1	2		

*Includes Lot 524.

Miscellaneous [illegible]

Lot	Provenience	Elevation	Feature	A1	A2	A3	A4	B1	B2	B3	B4	FB1	FB2	FB3	S	MD1	MD2	MC3	D1	D2	D3	D4	D5	D6	I1	U2	O	Rab	Mu	DPm	RM	FC	DCW	H	NC
234	N92 E92 L.5	40-50																										6		45					
189	N92 E93 L.1	0-10		1			3					1			5		10		1	8	28	17	31	1			1	9		333		2		1n	
190	N92 E93 L.2	10-20													4		3			5	7	4	12	1				44		66			1		
236	N92 E93 L.3	20-30		1											2		1			3	1		9					17		36			5		
187	N93 E92 L.1	0-10		1										2	4		6			33	35	19	28	2	1			8		333		2	2	3m-2g	1(NEO)
188	N93 E92 L.2	10-20													5		3	2		6	11	6	38					38	1	385			2		
229	N93 E92 L.3	20-30																			2		3					17		28					
230	N93 E92 L.4	30-40																		1		1						7		87		5	1		
231	N93 E92 L.5	40-50																										4		20		1	5		
191	N93 E93 L.1	0-10		1										3	12		13	1		24	31	22	47	1	1			7	1	842		1	1		
192	N93 E93 L.2	10-20												2	5		3			4	7	2	16	4				44		74					
235	N93 E93 L.3	20-30																		2	3	1						13		39			1		
193	N95 E92 L.1	0-10		1											2	1	6		5	2	21	6	16	1				30		295					
244	N95 E92 L.2	10-20													1		4	1		8	33	6	33	1				124		1334			1		
239	N95 E92 L.3	20-30															3			3	7	5	8					40		133			2		
196	N95 E93 L.1	0-10													7		8		2	12	27	14	55					34		529		3	3	4s	
240	N95 E93 L.2	10-20												1			4		1	4	12		1	1			3	91		324		2	1	[illegible]	
241	N95 E93 L.3	20-30																			3	1	1					14		61		1	2		
242	N95 E93 L.4	30-40																				1						1		3			1		
194	N96 E92 L.1	0-10		2										3	4	1	4		1	6	27	8	25		1			23		655				2s	
246	N96 E92 L.2	10-20		1										1		1	2			3	39	6	19		1			145	2	3340			1		
247	N95 E92 L.3	20-30													1				1	3	5	9	1					37		244					
195	N95 E93 L.1	0-10		1											2		9		1	10	24	9	40		1		1	32		856					
245	N95 E93 L.2	10-20		2													5			3	12	7	20					91		550		1	2		
248	N96 E93 L.3	20-30						1									2			1	3		2					75		181					
250	N96 E93 L.4	30-40																																	
251	N95 E93 L.5	40-50																																	
175	N100 E96 L.1	0-10					1							1	12		9			4	23	16	40					14		508		1	2	1n	
176	N100 E96 L.2	10-20													7					8	4	6	8					23		250		1	2		
201	N100 E96 L.3	20-30															3			2		2	2					34		77			1		
202	N100 E96 L.4	30-40																					4					4		59		1	1		
203	N100 E96 L.5	40-50																			1			5				5		129			1		
204+235	N100 E96 L.5	50-60	Inc. F.4											1			2											1		9533			6		
179	N100 E94 L.1	0-10		2										9	7		9	1	1	3	8	11	29				2	75		580		3			
178	N100 E94 L.2	10-20															1			9	5		6					41	1	282		3			
197	N100 E94 L.3	20-30																		2	3			1				40		186			1		
198	N100 E94 L.4	30-40																		2	1	1	2					36	1	59					
199	N100 E94 L.5	40-50																			2	1						9		68			4		
200	N100 E94 L.6	50-60																		1	4									337			4		
[illegible]	N100 E94 L.[illegible]	[illegible]	4																											551					
238	S100 E90 L.6	50-60	4																																
177	S101 E90 L.1	0-10												3	3		8		1	6	25	25	38	2				4		518		4		4m	
206	S101 E90 L.2	10-20															6				7	6	11	1				53		255					
230	S101 E90 L.3	20-30												1			2				5	3	5					49		56			1		
231	S101 E90 L.4	30-40																			1							17		129			1		
232	S101 E90 L.5	40-50																		1	2		1					22	1	65			2		
233	S101 E90 L.6	50-60																			4	1	4					7		63			25		
173	S101 E94 L.1	0-10					3							4	7		11		2	5	27	11	46	2			1	33		661		3	1	2m	
174	S101 E94 L.2	10-20																	1	1	5	1	3					45	1	52		1			
205	S101 E94 L.3	20-30															1				4		1					22		39					
[illegible]	S101 E94 L.4	30-40										1			1					1								15		58			1		
[illegible]	S101 E94 L.5	40-50																		[illegible]	1							[illegible]		216			[illegible]		
208	S101 E94 L.6	50-60																			2		2					7		641			12		
77	N125 E108 L.1	15-25																		1	4	1	2					5		1					
78	N125 E108 L.2	25-35																			3		1					6		16		5			
79	N125 E108 L.3	35-45													1						1							3	1	1		1	1		
80	N125 E108 L.4	45-55																			1							22	1	16		5	1		
81	N125 E108 L.5	55-65				1											1				1							37				2			
[illegible]	N125 E108 L.6	65-75																		1			1					23	1	17		5			
82	N125 E108 L.7	75-85		1																		1						42		46		2			
83	N125 E105 L.0	[illegible]																										51		210		1			
84	N124 E106 L.1	15-25																			2							6		22					
85	N124 E106 L.2	25-35																										1		13		1			
86	N124 E106 L.3	35-45															1				1							1		1		1			
87	N124 E106 L.4	45-55																										4				1			
88	N124 E106 L.5	55-65																			1							33		8		1			
219	N124 E106 L.6	65-75																			1							11		7		1			
90	N124 E106 L.7	75-85																			2							28		146					
91	N124 E106 L.8	85-95																		1								50		279					
78	N126 E95 L.1	0-10					1								2	1	2			4	12	5	12		2			11		536		1			2(FSL)

Miscellaneous Units

Lot	Provenience	Elevation	Feature	PL A2 A3 A4 C1 C2 C3 C4 FAL FAP FAS S MB1 MB2 MB3 B1 B2 B3 B4 B5 B6 I1 I2 D Sab Mu Gra Wt Ch Ldw Tp RK
332	N75 E92 L.1	0-10		[illegible]
333	N75 E92 L.2	10-20		[illegible]
334	N75 E92 L.3	99.62-99.52		[illegible]
335	N75 E92 L.1	0-10		[illegible]
336	N75 E92 L.2	10-20		[illegible]
337	N75 E92 L.3	99.62-99.52		[illegible]
338	N75 E90 L.1	99.85-99.72		[illegible]
339	N75 E90 L.2	99.72-99.52		[illegible]
364	N75 E90 L.3	99.62-99.52		[illegible]
344	N75 E91 L.1	99.84-99.72		[illegible]
345	N75 E91 L.2	99.75-99.60		[illegible]
357	N75 E91 L.3	99.62-99.52		[illegible]
505	N75 E91 L.4	99.55-99.42		[illegible]
348	N75 E92 L.1	0-10		[illegible]
349	N75 E92 L.2	10-20		[illegible]
474	N75 E92 L.3	99.62-99.52		[illegible]
510	N75 E92 L.4	99.52-99.42		[illegible]
340	N76 E91 L.1	99.85-99.72		[illegible]
341	N76 E91 L.2	99.72-99.62		[illegible]
342	N76 E91 L.3	99.62-99.52		[illegible]
352	N80 E91 L.1	99.85-99.72		[illegible]
353	N80 E91 L.2	99.72-99.62		[illegible]
360	N80 E91 L.3	99.62-99.52		[illegible]
391	N80 E92 L.1	0-10		[illegible]
392	N80 E92 L.2	10-20		[illegible]
413	N80 E92 L.3	20.52-99.52		[illegible]
40	N81 E93 L.1	0-10		[illegible]
41	N81 E93 L.2	10-20		[illegible]
42	N81 E93 L.3	20-30		[illegible]
43	N81 E93 L.4	30-40		[illegible]
92	N78 E93 L.5	40-50		[illegible]
37	N78 E91 L.1	0-10		[illegible]
64	N78 E91 L.2	10-20		[illegible]
66	N78 E91 L.3	20-30		[illegible]
92	N78 E91 L.4	30-40		[illegible]
95	N78 E91 L.5	40-50		[illegible]
98	N78 E93 L.1	0-10		[illegible]
66	N79 E90 L.2	10-20		[illegible]
67	N79 E90 L.3	20-30		[illegible]
96	N79 E90 L.4	30-40		[illegible]
97	N79 E90 L.5	40-50		[illegible]
100	N79 E90 L.6	50-60		[illegible]
98	N79 E90 L.7	60-70		[illegible]
99	N79 E90 L.8	70-80		[illegible]
59	N79 E91 L.1	0-10		[illegible]
65	N79 E91 L.2	10-20		[illegible]
107	N79 E91 L.4	20-30		[illegible]
102	N79 E91 L.5	30-40		[illegible]
103	N79 E91 L.6	40-50		[illegible]
104	N79 E91 L.7	50-60		[illegible]
213	N79 E91 L.7	60-70		[illegible]
214	N80 E102 L.1	0-10		[illegible]
215	N80 E102 L.2	10-20		[illegible]
216	N80 E102 L.3	20-30		[illegible]
217	N80 E102 L.4	30-40		[illegible]
218	N80 E102 L.5	40-50		[illegible]
222	N80 E103 L.1	0-10		[illegible]
223	N80 E103 L.2	10-20		[illegible]
224	N80 E103 L.3	20-30		[illegible]
225	N80 E103 L.4	30-40		[illegible]
220	N81 E102 L.1	0-10		[illegible]
227	N81 E102 L.2	10-20		[illegible]
228	N81 E102 L.3	20-30		[illegible]
219	N81 E103 L.1	0-10		[illegible]
220	N81 E103 L.2	10-20		[illegible]
221	N81 E103 L.3	20-30		[illegible]
187	N82 E92 L.1	0-10		[illegible]
188	N82 E92 L.2	10-20		[illegible]
232	N82 E92 L.3	20-30		[illegible]
233	N82 E92 L.4	30-40		[illegible]

Lot	Provenience	Elevation	Feature	A1	A2	A3	C4	SL	B2	B3	S4	FD1	FD2	FD3	G	PD1	PD2	PD3	D1	D2	D3	D4	D5	D6	U1	U2	C	Deb	Mu	DBM	AP	FC	BCV	T	NS
															Miscellaneous Lithics																				
71	N125 E92 L.2	10-20													5	1	5			5	11	12	13					35		226		3			1(NS1)
128	N125 E92 L.3	20-30															1			2	5	5	5		1			64		540		47	2		
129	N125 E92 L.4	30-40													1					1	5		3		1			170	5	219		32	1		
130	N125 E92 L.5	40-50		1											2						3		3	1	1		1	133	4	414		45	5		
131	N125 E92 L.6	50-60		1											1				1	3	2	1	1		1			104		146		10			
146	N125 E92 L.7	60-70												1			2			1	1		4					69	5	149		7			
147	N125 E92 L.8	70-80												1			1			1	1		5					111	6	533		4	3		1(NS1)
148	N125 E92 L.9	80-90												1	2		2			1	4	7	9	1				154	5	420		13	11		
149	N125 E92 L.10	90-100													1		1			1	5	3	1					108	6	373		5			
150	N125 E92 L.11	100-110															1				2		2					84	4	219		3	2		
72	N125 E93 L.1	0-10					1								12		5			9	24	13	37	5				36		574		5		1	
73	N125 E93 L.2	10-20													2		8			5	7	4	11					40	2	914					
112	N125 E93 L.3	20-30												1			1			1	8	1	5					45	5	387			1		
113	N125 E93 L.4	30-40									1			1		1	1				3		2					63	5	250		2			
114	N125 E93 L.5	40-50																			2		2					57	5	175		3			
115	N125 E93 L.6	50-60																			8	3						57	9	315		2			
151	N125 E93 L.7	60-70																			4		2					52	1	348		3			
152	N125 E93 L.8	70-80													1						1		2					62	2	558			81		
153	N125 E93 L.9	80-90																		1	5							84	2	1773			3		
154	N125 E93 L.10	90-100												1														57		3989		13	3		
155	N125 E93 L.11	100-110																										87	4	4570		4	15		
74	N126 E92 L.1	0-10		1										2	1		4			6	27	5	20	3			1	9		490		1	1	1	
75	N126 E92 L.2	10-20													2		4	2		6	5	4	5					54	3	178		2		2	
116	N126 E92 L.3	20-30															3			2	1	1	2	1				56	8	191		2			
117	N126 E92 L.4	30-40									1						1				1	2	1					51	6	139					
118	N126 E92 L.5	40-50															1			2	1	2	2	1				70	5	290					
134	N126 E92 L.6	50-60																			1		1					57	4	350					1(NS1)
135	N126 E92 L.7	60-70															1						2	1				60	9	607					
136	N126 E92 L.8	70-80																		2		1						70	1	152			1		
137	N126 E92 L.9	80-90																		1			1					66	9	734		1	1		
138	N126 E92 L.10	90-100																			1	1						70	5	150		3	3		
139	N126 E92 L.11	100-110																			1		1					64	4	270			2		
76	N126 E93 L.1	0-10								1				1	2	2	5			6	5	9	16	2				7	1	818		1			
120	N126 E93 L.2	10-20		1											1		4			2	10	3	8					58	3	372		1	1		
119	N126 E93 L.3	20-30															1				2	2	2					50	4	147			2		
121	N126 E93 L.4	30-40												1		1	1				1	1	1	1				46	8	239			1		
122	N126 E93 L.5	40-50														1	1			1	2	1	3					55	7	282					
140	N126 E93 L.6	50-60																		1			1					53	5	302			12		
141	N126 E93 L.7	60-70															2											72	2	379			7		
142	N126 E93 L.8	70-80																		2	1	1					1	74	5	398			11		
143	N126 E93 L.9	80-90																			2		3					51	7	315		2			
144	N126 E93 L.10	90-100															1											64	3	282		3	7		1(NS1)
145	N126 E93 L.11	100-110																					1					49	5	2728		3	7		
131	General Surface						1	1		1				25	22																			*	*
61	General Surface			2								1		1	6										1		7							*	*
133	General Surface			1	1(NS2)										5																			*	*
58	General Surface							1				1	1	1	3																			*	*

NS = 5c; NS = 1(NS1), 4(NS2), 2(NS3), 1(NS4).