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LATE PALEO-INDIAN ACTIVITY AT THE LUBBOCK LAKE SITE

by

Eileen Johnson and Vance T. Holliday

ABSTRACT

Excavations at Lubbock Lake (41LU1), Southern High Plains of Texas, revealed the presence of a complex, late Paleo-Indian feature containing a camping area and bison (Bison antiquus) kill/butchering locale. The feature is found within a cienega or marsh deposit and dates from 8300 to 8600 years. At least two camping episodes are indicated, separated by the kill/butchering event. Camp debris consists of a projectile point midsection, unifacial and bifacial tools, and flakes. Faunal debris includes remains of butchered pronghorn antelope, rabbits, ducks, grouse, and turtles. The kill/butchering locale contains remains of four bison and three fetuses, a bone expedience tool, a reworked projectile point base, unifacial butchering tools, and flakes. Projectile points, other lithic tools, and age of the feature indicate a Firstview occupation. From faunal and geologic data, site environs are reconstructed as a marshland rimmed by a narrow border of wet meadows grading into a mixed grass prairie. Although several late Paleo-Indian kill/butchering locales are known on the Southern High Plains, this feature is the first late Paleo-Indian camp.

INTRODUCTION

Numerous Paleo-Indian localities are reported on or near the Southern High Plains (Llano Estacado) in eastern New Mexico — western Texas (Fig. 1). The majority of these sites occur in the various draws that traverse and form the drainage system for the Llano Estacado. Perhaps the most famous Paleo-Indian locality for this geographic region is the Clovis site, Blackwater Draw Locality No. 1 (Hester 1972). A "sister site" to this locality in...
Lubbock Lake, situated in an old meander bend of Yellowhouse Draw on the northern outskirts of the City of Lubbock, Texas (Fig. 1). Blackwater and Yellowhouse draws join in the City of Lubbock, forming Yellowhouse Canyon which is a tributary of the Brazos River.

Lubbock Lake, long known as a Paleo-Indian locality (Sellards 1952; Black 1974), records in its stratified deposits a complex cultural, faunal, and geological history covering the past 12,000 years. This complex sequence, at least for the Paleo-Indian period, is similar to that known for Blackwater Draw Locality No. 1 (Johnson 1976; Hester 1972).

During the past eight years, The Museum of Texas Tech University has been conducting intensive excavations at the site. Primary excavation emphasis of the Lubbock Lake Project has been within Paleo-Indian deposits, although testing efforts also are conducted within more recent time periods. Numerous activity areas dating from 8,000 to 12,000 years have been located, most representing either kill/butchering locales or processing stations.

A stratified geocultural sequence of activity areas is being uncovered in one particular part of the site (Area 6) that represents Clovis to late Paleo-Indian occupations (Fig. 2). The activity area at the top of the sequence is designated feature FA6-3 (Fig. 3). Approximately 100 square meters have been opened into the activity area. The known western boundary is an arbitrary one, created by 1930s dredging operations that revealed the buried site (Holden 1974).

**PHYSICAL SETTING**

Five general geologic units are identified and described at the site (Stafford 1977, 1978). The Paleo-Indian sequence is contained in strata 1 (12,000 to 11,000 years) and 2 (11,000 to 8,000 years). Late Paleo-Indian material is found in upper stratum 2 (substratum 2C).

Stratum 2 contains exclusively lacustrine and marsh sediments, reflecting downstream damming of the drainage and a reduction in available moisture through time. The basal member (substratum 2A) consists of laminated diatomite and clays and diatomaceous earth.

A massive un laminated diatomaceous earth unit (substratum 2B) conformably overlies 2A. This unit represents a change in sedimentation within the lake basin whereby higher amounts of silt and clay were deposited relative to diatomite. The homogeneity of the unit also indicates water turbulence which prevented development of storm bedding.

Continuing silt and clay deposition decreased the pond's relief until water was shallow enough to permit widespread growth of aquatic and semiaquatic plants, forming a cienega or springfed marsh (substratum 2C). This cienega generally represents the termination of stratum 2.

Substratum 2C also is identified as the Firstview soil, the oldest in a sequence of buried soils identified at the site (Holliday and Allen, in press). The soil is characterized by a highly organic B horizon. The zone is dark grayish brown (10YR3/2, moist) and ranges from a silty clay to clay loam. It overlies a C horizon of diatomaceous earth (substratum 2B).

Cultural material is located near the base of substratum 2C and at the 2C/2B contact. Discovery of the feature in this position indicates that, at times, ground surface was stable and dry enough to support occupation. Presence of the material also indicates that this period (or periods) of surface stability occurred at the termination of 2B deposition or early in cienega development. An obvious surface at the 2B/2C contact is lacking. Cienega development probably destroyed the evidence.

A vertical distribution plot of lithic material (Fig. 4) demonstrates occasional placement differences within a unit or adjacent units, indicating an undulating surface. Generally, however, there is a single clustering of material along the contact. The plot clearly shows the north-south incline of the paleosurface and southerly increasing concentration of materials. This situation indicates that the main activity area was on more southerly, higher ground.

**CHRONOLOGY**

Eight radiocarbon dates (humate fractions) are available from upper substratum 2B and substratum 2C (Table 1). The feature project

Table 1. Lubbock Lake Radiocarbon Dates from Contact 2B/2C and Substratum 2C

<table>
<thead>
<tr>
<th>Stratigraphic Location</th>
<th>Radiocarbon Dates</th>
</tr>
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<tbody>
<tr>
<td>FA6-3</td>
<td>8655 ± 90 years B.P. (IS-4177)</td>
</tr>
<tr>
<td></td>
<td>8095 ± 230 years B.P. (ISU-6827)</td>
</tr>
<tr>
<td>2B/2C contact</td>
<td>8300 ± 300 years B.P. (ISU-830)</td>
</tr>
<tr>
<td></td>
<td>7890 ± 100 years B.P. (ISU-302)</td>
</tr>
<tr>
<td>lower 2C</td>
<td>7970 ± 70 years B.P. (ISU-262)</td>
</tr>
<tr>
<td>middle 2C</td>
<td>7255 ± 75 years B.P. (ISU-3204)</td>
</tr>
<tr>
<td>upper 2C</td>
<td>6705 ± 95 years B.P. (ISU-4178)</td>
</tr>
<tr>
<td></td>
<td>6400 ± 80 years B.P. (ISU-544)</td>
</tr>
</tbody>
</table>
Feature 3, Area 6
Vertical Distribution of Lithic Material (Looking East)

Fig. 4. Vertical distribution plot of lithic material from feature FA6-3, showing north-south incline of paleosurface.

There is some variation and apparent reversals in the dates. Considering the time transgressive nature of 2C and distribution of the samples within the site, the sequence of dates is acceptable. Termination of 2B deposition ranges from about 8000 to 8600 years B.P. while dates on initiation of 2C layers were placed in the butchering locale. Elevation ranges were established for each bone cluster. Material occurring outside a cluster range was considered camp debris. Undoubtedly, there is some error in this somewhat arbitrary separation. However, most butchering tools were in clusters. Furthermore, this separation allows an analysis of the feature in terms of possible behavioral patterns represented.

occupation. Burial of the Firstview soil and end of its development occurred between 6300 and 8600 years B.P. The actual date could be younger since dates on A horizons incorporate older and younger carbon.

The number of occupations is unknown. However, nature and horizontal distribution of certain materials strongly indicate presence of two different kinds of activities occurring. A widespread scatter of lithic debris and small amount of flake debris is located in the northern section of the excavated area. The partial remains of four bison and three fuses are located in the southern section (Fig. 3). Butchering tools were recovered among the remains, several of the bones demonstrating some form of butchering evidence. Animals were killed and butchered in the area and do not represent a camp accumulation of miscellaneous elements from many individuals.

While these two activities may represent separate, contemporaneous loci of the main activity, they could also represent seasonal use of the area or different use of the area over a long period of time. From the attempt to separate the butchering locale, it appears that possibly three occupations had taken place (two camping events and the kill).

METHODOLOGY

Materials recovered from feature FA6-3 are discussed as coming from either campdr or the butchering locality. Separation of the two was not always clear as neither horizontal or vertical lines could be drawn to delineate sharply the butchering locale. Lithic material occurs both above and below what was considered the butchering level. Changing surface ground had to be considered.

Clustering of bone from various individual sites were placed in the campdr locality. Elevation ranges were established for each bone cluster. Material occurring outside a cluster range was considered camp debris. Undoubtedly, there is some error in this somewhat arbitrary separation. However, most butchering tools separate from within bone clusters. Furthermore, this separation allows an analysis of the feature in terms of possible behavioral patterns represented.

Preliminary lithic analysis of feature FA6-3 is based on material description. Most terms are common ones (Crabtree 1972). Comments on these technologies and butchering are based on Johnson (1976, 1978, 1980).

SHARED CHARACTERISTICS

Several generalities emerge that are shared by both groups of lithics in the feature. First, there is a great dependence on silicified caliche and quartzites. Second, almost all tools and many flakes are broken, representing discard material. Third, flakes were produced by percussion and most have a single faceted platform. Fourth, utilized flakes make up a large part of the debitage recovered from each activity locus.

A number of lithic items are silica encrusted. Reasons for this differential encrustation are not known. One possibility, however, may be the proximity of lithic materials to marsh plants whose roots were silicified. Substratum 2C is rich in silica.

Another unusual situation is the use of caliche for tools. Caliche, at best, is a poor resource and difficult if not impossible to work. However, flake scars and shaping are evident on several items. This material now is so soft that washing can obliterate flake scars. A tenable hypothesis is that indurated caliche, exposed in local outcrops, was used as a resource material. The wet, acidic environment of the ciénega could have softened the calcium carbonate of the stone (C.C. Reeves Jr., personal communication).

ACTIVITY AREA

Excluding numerous, unmodified chunks/blocks of silicified caliche (burned and unburned), total lithic collection consists of 168 items. The majority of tools and debitage were placed in the campdr debris, accounting for 83%, of recovered lithic material, indicating that Flakes and utilized flakes were the most Flakes and utilized flakes are the most numerous of cores and numerous items, followed by cores and numerous items, followed by cores and.

Some tools, such as scrapers (unifacial tools). Some tools, such as scrapers (unifacial tools).

The backed blade, appears to be for delicate, the backed blade, appears to be for delicate finish work; others, such as the core finishing work; others, such as the core finishing work, probably were for heavy duty tasks.
Camping Debris

A projectile point midsection (TTU-A7563) was recovered in the camping debris. Made from a chert of unknown source, the point is lenticular in cross section and approaches a median ridge. Flaking is irregular collateral (Fig. 5a). A broken, bifacially flaked, denticulate (TTU-A2980). Edwards Formation chert, is lenticular in cross section. It was reworked by removal of large flakes from the dorsal side, particularly along the left edge. This reworking produced a scalloped edge (Fig. 5b). Use damage flake scarring is apparent along both sides, with heaviest use on the right edge.

A broken backed blade (TTU-A15901), made from chalcedony, has steep angle retouch along both sides, with use damage flank retouch on the right edge (Fig. 5c). Lateral grinding produced the backing. A burin facet on the left edge may have occurred when the blade snapped. The blade continued to be used after the facet was removed since a few use damage flake scars crosscut it.

Scrapers (unifacial tools) are the most numerous tool type recovered. Most are broken and appear to be made on flakes. Ten flake scrapers for which shape can be determined are of different forms. Eight of these have their working edge along a side, one has a lateral and distal edge, and the last has a distal working edge. Of the total 17 scrapers recovered, 11 were made from chert, 3 from silicified caliche, 2 from quartzite, and 1 from caliche. A variety of cherts were used, Edwards Formation being the most common.

Scrapers TTU-A7541 (Edwards Formation) has steep retouch along the sides, with heavy use wear along the left distal edge. Three scrapers (TTU-A13359, Potter chert; TTU-A19293, Tecovas chert; TTU-A19823, quartzite) have steep retouch along the left edge, with use damage flank scarring evident. Two others have steep retouch along the right edge; one (TTU-A13313, petrified wood) with heavy use flake scarring, the other (TTU-A21667, silicified caliche) having a minimal amount.

Scrapers TTU-A22743 (silicified caliche) exhibits steep retouch along the left anterior border, with some use damage flank scarring. Another (TTU-A21976, Alibates chert) has a distal working end, with steep retouch and use damage flank scarring evident. Flake scraper TTU-A29555 (silicified caliche) exhibits steep retouch on the left lateral and distal ends, with use damage flaking along the distal end and left lateral-distal corner.

Scrapers TTU-A21815 (Edwards Formation) is triangulately shaped with retouch along the three edges (Fig. 5d). Neither bulb nor platform are present, evidently removed in retouch. The tool is steeply retouched along the posterior two-thirds of the left and right sides to the apex. These edges appear to have been dulled (crushed and rounded, particularly along the left edge), perhaps for hafting purposes.

The distal end and anterior one-third of the sides exhibit low angle retouch, along with heavy use damage flank retouch and edge crushing. Several large flakes were removed parallel to the working edge along the anterior half of the tool on the ventral border. A few smaller ones are perpendicular to this edge.

This action apparently was taken in order to flatten the ventral side. The one scraper (TTU-A7529) of caliche has several large flakes removed along the left edge. However, wear pattern is impossible to determine because of the nature of this material.

Six remaining scrapers are broken, distal ends. The Albates specimen (TTU-A7623) has steep angle retouch along one edge, with heavy use damage flake scarring. Intense utilization also occurred along the opposite edge. Scraper TTU-A21975 (chalcedony) shows steep retouch along the distal end, with heavy use damage flank scarring, edge crushing, and rounding. It also exhibits intense utilization damage along the left side. Scraper TTU-A21814 (quartzite) has steep retouch along three adjacent edges on the ventral side. There is some edge crushing and use damage flank scarring.

Of the three scrapers made from Edwards Formation material, one (TTU-A7618) is a broken hinge flake that has retouch flakes removed along the center of the hinge, with use damage flank scarring. Another (TTU-A15936) demonstrates steep retouch along unbroken sides, with heavy use damage flank scarring along left and distal edges. The entire edge is scalloped, with worn and heavily used points. Scraper TTU-A15936 has steep retouch along right and distal edges and left distal corner; heavy wear is restricted to the distal end.

Sections of three bifaces and two unifaces were recovered. One of the bifaces (TTU-A15862) and a uniface (TTU-A13321), Edwards Formation chert, are small sections showing a few flakes removed. Biface TTU-A13306 (Alibates chert) is flaked along one edge, the opposite edge being cortex. More flakes were removed dorsally. Wear along the edge is lacking. Biface TTU-A7622 (silicified caliche) demonstrates several large flakes removed from both sides, creating a sinuous edge, but wear damage is lacking. Uniface TTU-A22771 is a chunk of silicified caliche that has a flat ventral surface. Several large flakes are removed along the lateral edges; wear damage is minimal.

Three core choppers were recovered, exhibiting minimal wear. Two cores are biconical (TTU-A7535, Potter chert; TTU-A13352, quartzite) and the third (TTU-A7625, quartzite) conical. The latter is a unidirectional core along one face. Two core choppers were made from cobbles which still retain cortex. A multidirectional core (TTU-A13070, Tecovas chert) exhibits utilization damage along an edge.

Six unmodified cores and a core segment also were located in the camping debris. Several are broken; core segment TTU-A13364 (Potter chert) is a section removed either to prepare or rejuvenate a core. Three cores (TTU-A7555, silicified siltstone; TTU-A7616, TTU-A29695, silicified caliche) are multidirectional ones; cores TTU-A13400 (quartzite) and TTU-A15988 (silicified caliche) are bidirectional. Core TTU-A7651 (chalcedony) is biconical in shape.

Eighty-five flakes were recovered, 26 of which were utilized. Additionally, 19 broken, distal ends of flakes were recovered, 7 of which were utilized. A variety of combinations of edges and sides were utilized, demonstrating use damage flank scarring. Some combinations did not appear preferential. Eight flakes were utilized along the right edge, four of which had scraping on the ventral side; five were utilized along the distal end; four on the left distal corner; and two on the left proximal corner.

Other combinations, represented by one specimen each, include utilization along the left edge on ventral side; left edge and left distal limb; left distal corner and right distal end of ventral side; left and right edges; and left and distal edges with use of broken (proximal) edges on ventral side. Shallow indentations were used as notches in two utilized flakes. Notches occurred along the left edge of one flake and along the ventral right proximal edge of a second.

Figure 6 summarizes various tabulations for both utilized flakes and utilized/unused flakes. In general for utilized flakes, tereftary flakes of silicified caliche were favored, even when quartzites and cherts are grouped together, preference still is pronounced. Morphology appears to have played some part in flake selection for utilization, with rectangular and contracting ones being more common. There is no pronounced preference for use of tertiary flakes over the other categories, both with whole flakes (54%) and when data from broken pieces are included (55%). On the other hand, tertiary
flakes were more abundant (63%) so that opportunity for utilization was greater.

Within flakes as a whole, in addition to the high yield of tertiary flakes, preferred material is silicified caliche (45%). Although a variety of cherts are represented, emphasis is overwhelmingly (80%) on local resources. Morphological distribution shows a selection for rectangular and contracting flakes. Divoid flakes are least numerous. Although apparently not a desired flake shape, nevertheless, two of the three divoid flakes were utilized.

Percentage of utilization within shape varies. Divoid flakes have the highest percentage of use (66.6%). Other use percentages are: 38% for contracting flakes; 31% for ovate and expanding forms; 27% for trapezoid; and 25% for rectangular ones.

Data can be manipulated in a variety of ways. The important aspect is that the material represents waste products, discards from the camp. Three preferences stand out: use of percussion techniques; selection of silicified caliche; and production of tertiary flakes.

Several features were noted on some flakes during initial sorting, the most common being hinge fracturing. Eleven flakes showed this feature, four of which are of silicified caliche. Five flakes (quartzite) are split flakes, broken perpendicularly through the bulb. One split flake also has a hinge fracture. One large core rejuvenation flake (quartzite) was found in two pieces (split flake), but treated as one in all tabulations except total number in collection. Lastly, two flakes, (quartzite and Edwards Formation chert) have adjacent, double bulbs of percussion.

These features were noted on flaking debris created during knapping experiments by Shafer (1973). His (1973:91-94) explanation points out several items. One, features are characteristic of hard hammer percussion technique. Second, flakes of this nature were produced from large pebbles to small cobble sized cores. Third, the smaller the core, the greater effect cushioning (from the hand) has on the fracture pattern. This altered fracturing pattern results in hinged flakes.

The significance of these remarks points to the limited availability of lithic resources in large form and great use of small nodules of local caliche and Pleistocene river gravels as sources. On the other hand, they also suggest a conservation of lithic material since even chert cores are reduced to a very small size.

Remains from various game animals that were hunted and processed for food were recovered from the area of camping debris. These animals include: pronghorn antelope (Antilocapra americana), cottontail (Sylvilagus sp.), blacktail jackrabbit (Lepus californicus), mallard (Anas platyrhynchos), gadwall/pintail (A. strepera or A. acuta), teal (A. discors or A. cyanoptera), and prairie chicken/grouse (Tympanuchus/Pedioceutes or Centrocercus).

Only a few elements from each animal were recovered, as would be expected from trash midden. Antelope remains bear cut lines and blow marks (Fig. 7); bones of other animals are broken in a standard pattern or burned. Turtles, particularly ornate box (Terrapene ornata), may have been a food source. Most shell material recovered is broken across suture lines.

Ducks and turtles provide some information on possible season of accumulation of camping debris. Mallards, gadwalls, pintails, and teal winter over in the Lubbock region today, available from August to May (Petersen 1963). Summers are the most active time for turtles, but at least box turtles can be found from March to November (Stebbins 1966).

Overlapping of available time periods suggests an early spring or late fall occupation, yet a summer activity cannot be ruled out. Ducks occasionally occur in the area during summer. Not enough data are available yet to determine this part of the occupational pattern and relationship between the activity loci.

Butchering Locale

Lithic material from the butchering locale (Fig. 3) is much less numerous than from the camp, accounting for 17% of the collection. The limited amount may be due in part to restrictions placed on determining which lithics belong to which locus. However, in comparing total number (29) of items to those recovered from other Paleo-Indian kill/butchering locales at the site, the amount is concordant, if not higher, with them. The majority of the tool assemblage consists of percussion flake scrapers (unifacial cutting tools) and utilized flakes.

Flake tools and unmodified flakes have single faceted platforms and were produced by hard hammer percussion. There is a variety of morphological shapes and wear patterns. These unmodified flake tools were utilitarian in nature, with function and ease of production the more important criteria.

Frison (1974:34) points out "...the choice of a cutting tool in communal bison butchering sites was mainly a large percussion flake tool that could be held securely in the hand, sharpened easily with a soft hammer, and discarded when no longer functional. There was a minimum of effort in manufacture and preparation..." Furthermore, "It was preferable to utilize tools that were nearly equally functional, less esthetic and upon which there was little investment in time and effort." Although speaking of Northern Plains mass kills, the concept is applicable as well to Southern Plains small kills.

Of the five scrapers recovered, one is a core scraper (TTU-A15939). It is a unidirec-
tional core made from silicified caliche. Numerous hinge fractures along the left dorsal surface attest to flake removal attempts. Retouch appears along the left side with damage flake scarring, particularly along the left distal edge (Fig. 8a).

The rest are unifacial flake tools which show a variety of materials and wear patterns. One scraper (TTU-A15645, quartzite) has retouch and use damage flake scarring along three sides. Another (TTU-A19119, silicified caliche) has retouch and some use damage flake scarring along the left edge and a worn and rounded, scalloped right edge. Scraper TTU-A7542 (Alibates chert) was made on a hinge flake. It has steep retouch along the ventral right edge and use damage flake scarring (Fig. 8b). Use damage flake scars also are evident along the ventral distal end.

Scraper TTU-A2999 (chert of unknown source) is a contracting flake. It shows steep retouch along the right edge, with use damage flake scarring along the right side and left apex edge.

Two stylized lithic tools (Tecovas quartzite) were recovered in the butchering locale, a projectile point (TTU-A19228), and a knife (TTU-A13401). The projectile point is the basal section (Fig. 8c). It appears to have broken during manufacturing (H.M. Wormington, personal communication) and then reworked into a butchering tool. It has a slightly concave base with basal and lateral grinding and probably parallel sides.

Both sides were resharpened into a scalloped edge. Scallop points are worn and some use damage flake scarring is evident, particularly along the right edge. Condition of this point is reminiscent of the treatment given Kersey points at the Jurgens site (Wheat 1976, 1979; Greiser 1977) when reused as butchering tools.

The knife, alternately beveled, with damage flake scarring along both edges, is subtriangular in shape, with a blunted proximal end (Fig. 8d). From its form, size, thickness, and shape, it was probably hafted.

Cultural affinities are obscured by reworking of the point and possibly nature of material. However, use of Tecovas quartzite in manufacturing these stylized tools points out both the skill and craftsmanship of the group and their great dependence on locally available materials. The knife was recovered from adult bison #1 bone pile; the reworked point was located between fetal individulas #2 and #3 (Fig. 3).

Of the debitage recovered from the butchering locale (21), 16 are whole flakes, 5 of which are utilized. Generalizations are difficult with such a small sample size. A clear preference pattern was not noted other than use of tertiary flakes. The majority of flakes are either contracting or rectangular, but other common shapes also are represented. Silicified caliche quartzites, and cherts are equally common. If broken pieces are considered (5), then cherts are more abundant (38%), Alibates in particular. However, three Alibates items are tiny resharpening debitage that may have come from the same tool.

Utilized flakes consist of two trapezoid and one each of contracting, ovoid, and rectangular forms. Most are from a different lithic source: silicified caliche, quartzite, and Alibates (2) and Potter cherts. Two flakes are utilized along the distal end. A third has use damage: flake removed along the distal end in alternate sections where shallow indentations were used as notches. Another flake exhibits use damage flake scarring along the ventral anterior left edge where an indentation was used. The contracting flake has an area with use damage flake removal along the left edge near the apex. Lastly, a broken section from a utilized flake has a damage flake scarring along the working edge.

One bone expedience tool (TTU-A21523) was recovered (Johnson 1976, 1980). Made from an anterior border section of a left scapula (bison), several retroflakes were removed from the anterolateral edge. Use damage flake scarring and some wear polish is evident (Fig. 9). This tool was located within the bed of the femur #2 (Fig. 3).

Partial remains of four bison (Bison antiquus) and three fetuses were recovered from the exposed section of the butchering locale (Table 2). The semiarticular forequarters of an adult, disarticulated elements of a second adult, and partial carcass of a fetus were placed in discrete piles. Other fetuses were disarticulated and spread across the surface (Fig. 3). None of the fetal material showed butchering damage in terms of cut lines or blow marks. However, carcasses were probably processed given context of recovery, associated butchering tools, and skeletal disarticulation.

Two juvenile bison are represented by two partial right scapulae within fetal grouping #3 and a few scattered elements (Table 2). One scapula has a blow mark at the base of the acromion along the neck region and both have an acromion and spine removed. This damage is the result of loosening attachments in removal of scapular muscles.

Bones from the adult carcasses show some butchering damage. In adult #1, the left ulna has a blow to the olecranon, an action which would have resulted in severing several shoulder and arm muscles. The left humeral shaft has a series of shallow, defleshing cut lines, resulting from muscle stripping. Blow marks appear at the base of vertebral spines, and spinal tips are broken. This type of damage is a result of loosening muscle attachments along transverse processes and removing the ligamentum nuchae. Mandibles were broken at the symphysis surface; the left coronoid process was damaged. Damage of this type is a result of loosening facilitate muscle attachments and tongue removal (Johnson 1976, 1980).

The semiarticular nature of the remains and minimal bone damage indicate an incomplete butchering process. Complete carcass resources (meat and byproducts) were not utilized, suggesting selectivity of meat cuts.

With adult #2, damage also is minimal but butchering of the major units (Johnson 1980) is indicated. The forequarter unit received the most attention (damage), with severing of shoulder and arm muscles. The major trochanter of the humerus was partially trochanter of the humerus was partially modified through controlled breakage, with parts of the cancellous bone removed in marrow retrieval. The right scapula had the blade and spine removed through pounding. Blade and spine segments were found scattered through the concentration. The spine had been broken in four places during removal attempts.

Transverse processes of a cervical and several vertebrae were damaged or removed; vertebral spine segments were located throughout the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. Pounding of the concentration. 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Table 2. Inventory of Bone Concentrations in Firstview Bison (Bison antiquus) Kill/Butchering Locality (FA6-3, Lubbock Lake

Adult #1
mandibles, right and left
hyoid section
atlantal vertebra
axis
cervical vertebrae (4)
lumbar vertebrae (2)
rib sections
scapula, left
humerus, left
radius, left
ulna, left
metacarpal, left
capitate-trapezium, left
unciform, left
scaphoid, left
carpal cuneiform, left
accessory carpal, left
articulated forefoot, phalanges and sesamoids, left
articulated foreleg, humerus to third phalanges, right

Fetus #1
vertebrae
humerus, right
radius, left
ulna, right
metacarpal, left
lateral malleolus, right
metapodial
second phalanges, right and left

Fetus #2
maxillae, right and left
mandibles, right (2) and left (2)
hyoid, left
cervical vertebrae (2)
thoracic vertebrae (8)
caudal vertebrae
ribs
scapula, left
humeri, right and left
humeri, distal epiphyses, right and left
radius, right and left
radii, distal epiphyses, right and left
ulnae, right and left
metacarpals, right and left
carpal, distal epiphysis, right and left
lunars, right and left
scaphoids, right and left
unions, right and left
carpal cuneiforms, right and left
pelvis, right and left
femora, right and left
tibia, right and left
fibula, right and left
calcaneum, right
first tarsal, right and left
cubonaviculare, left
femur, right
second phalanges, right and left
third phalanges, right (2)
metapodial section
sesamoids (4)
Cervical
skull parts
scapulae, right (2)
metacarpal shaft
astragalus, right and left
first phalanges, left

Table 3 is a species list of vertebrates identified from feature FA6-3. Avifauna was identified by Amadeo Rea (in press), snake and lizard by Thomas Van Devender (University of Arizona). The rest of the fauna was identified by the senior author.

The fauna is almost a modern one. All but one of the animals either range in the Lubbock area today or did historically before intensive Anglo settlement. Bison chronospecies occupied the same niche and relationship in the assemblage as modern bison. Interpretation of presence and subsequent absence of the crake is difficult since so little is known about fossil distribution (Olsen 1974) and habitat parameters (other than a marshlands form). Preceding faunal assemblages at the site are composed of numerous extinct forms or the animals which no longer range into the Lubbock area. This Late Paleo-Indian fauna probably reflects the onset of modern climatic conditions (Johnson 1976, in press a).

Another situation reflected in the assemblage is the changing environments of the valley floor. Animals within the assemblage represent various habitats prevalent in the draw and point to an expanded mixed grassland. Catfish inhabited shallow waters, while frogs, turtles, garter snakes, rails, and surface feeding ducks shared marsh and riparian wet meadows. Brushy areas in the grasslands are indicated by presence of Mexican ground squirrels, woodrats, and cottontails. Grassland forms dominate the assemblage and denote, from cotton rats to bison, a mixed grass prairie. Along the waterway, the interconnected ponded ponds of the immediately preceding period (Johnson 1976, in press a). Johnson and Holiday (1980) 1976, in press a. Johnson and Holiday(1980) 1976, in press a.)

ENVIRONMENTAL RECONSTRUCTION

Faunal material is not restricted to game animals. All excavated sediment is water processed through a series of fine mesh screens in a modified operation developed by Guilday and McCrady (Guilday et al. 1964). All vertebrate classes have been recovered from feature concentrates. Analysis is preliminary since concentrate materials have not been separated into the two loci. Nevertheless, several statements can be made concerning faunal assemblage and environmental considerations.

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ENVIRONMENTAL RECONSTRUCTION

Faunal material is not restricted to game animals. All excavated sediment is water
Table 3. Species List, Feature FA6-3, Firstview Period, Lubbock Lake.

**Mammalia**
- Sylvilagus sp.
- Lepus californicus (Gray)
- Spermophilus tridecemlineatus (Mitchell)
- Spermophilus mexicanus (Erxleben)
- Cynomys ludovicianus (Ord)
- Geomys bursarius (Shaw)
- Dipodomys ordi (Woodhouse)
- Onychomys leucogaster (Weid)
- Sigmodon hispidus (Say and Ord)
- Neotoma cf. microcarpa (Baird)
- Neotoma cf. albipila (Hartley)
- Antilocapra americana (Ord)
- *Bison antiquus* (Leidy)

**Aves**
- Anas platyrhynchos (Linnaeus)
- Anas strepera (Linnaeus) OR
  - *A. acuta* (Linnaeus)

**Aves**
- Anas cyanopterus (Vieillot) OR
  - *A. discors* (Linnaeus)
  - *Tympanuchus cupido* (Linnaeus) OR
  - Centrocercus urophasianus (Bonaparte)
  - *Tympanuchus OR Pedioetes phasianellus* (Linnaeus)
  - Poxana carolina (Linnaeus)
  - *cf. Laterallus exilis* (Temminck)
  - Agelaius phoeniceus (Linnaeus)

**Reptilia**
- Kinosternon flavescens (Agassiz)
- Chrysemys scripta (Schreiber)
- Terrapene ornata (Agassiz)
- Eumeces obsoletus (Baird and Girard)
- Lampropeltis getulus (Linnaeus)
- Thamnophis cf. sirtalis (Linnaeus)

**Amphibia**
- Rana catesbeiana (Shaw)
- *Rana pipiens* (Schreber)

**Pisces**
- cf. Ictalurus spp.

*No longer occurs in the area
*Extinct

by a narrow border of wet meadow grading into a mixed grass prairie (Fig. 10). Lastly, the earlier Rolling Plains biotic encroachment to the modern biota of the eastern draws of the Llano Estacado (Johnson 1976, in press a; Johnson and Holliday 1980).

The fauna does not indicate the situation on the flat uplands. Uplands at this time were probably also a grasslands, but its distributional pattern and community associations would be different than those of the draw, if for no other reasons than topography and available water.

cottontail
- black-tailed jackrabbit
- 13-lined ground squirrel
- mexican ground squirrel
- black-tailed prairie dog
- plains pocket gopher
- Ord's kangaroo rat
- northern grasshopper mouse
- hispid cotton rat
- southern plains wood rat
- white-throated wood rat
- pronghorn antelope
- extinct bison

mallard
- gadwall or pintail
- cinnamon or blue-winged teal
- prairie chicken or sage grouse
- prairie chicken or sharp-tailed grouse
- sora
- grey-breasted crake
- red-winged blackbird
- yellow mud turtle
- pond slider
- ornate box turtle
- great plains skink
- milk snake
- common garter snake
- bull frog
- leopard frog
- catfish

Definite typological determination is not possible on recovered projectile points since one is a misidentification and the other a reworked base. However, Wheat (1972:147-152) utilized a variety of indices based on certain dimensions of late Paleo-Indian projectile points to aid typological classification. These indices combined with other characters are useful in typing Lubbock Lake specimens. The misidentification has parallel sides, a width/thickness index of 33, and irregular collateral flaking (Fig. 5a). The base section has parallel sides, slightly concave base, basal and lateral sides, slightly concave base, basal and lateral sides, and a width/thickness index of 29 grinding, and an asymmetrical/length index of 29.

**CULTURAL AFFILIATIONS**

The late Paleo-Indian (post-Folsom) period at Lubbock Lake dates from about 8,000 to 10,000 years ago. Specifically, feature FA6-3 is a manifestation of the Firstview culture (Wheat 1972). Assignment of this feature to the late Paleo-Indian period/Firstview culture is based on presence of certain diagnostic artifacts and geochronological and stratigraphic information.

Firstview culture, found on the Southern and Central Plains, is typified by Firstview points. Other material that define the culture include large hammerstones, large flake knives, swnuboned end scrapers, bone needles, denticulate edges, and stone and
bon dates for the feature indicate an age between 8,300 and 8,600 years B.P.; in line with Wheat’s (1972:156-158) terminal date (8,500 B.P.) for Firstview.

**LLANO ESTACADO LATE PALEO-INDIAN SITES**

At least five other late Paleo-Indian localities are known on the Llano Estacado. These sites are Plainview (Sellards et al. 1947), Milnesand (Sellards 1956), Blackwater Draw Locality No. 1 (Hester 1972), San Jon (Roberts 1942), and Rex Rodgers (Hughes and Willey 1978) (Fig. 1). Plainview and Milnesand are not considered since these type sites date from the earlier part of the late Paleo-Indian period (ca. 10,000 years ago). Feature FAB-3 is considerably younger, typologically distinct, and stratigraphically higher than the Plainview level at Lubbock Lake (Figs. 2; Johnson and Holliday 1980).

A variety of late Paleo-Indian projectile point types are reported as coming from water. Feature Draw Locality No. 1. These types include Eden, Scottsbluff, San Jon, Plain- view, Milnesand and Firstview (Agogino and Agogino 1969; Agogino et al. 1976; Haynes and Agogino 1966; Sellards 1952, Stevens 1973). Several problems are encountered in dealing with this material.

Hester (1972) points out classification problems and difficulties in determining exact stratigraphic relationships. Virtually nothing is known of the cultural context of points recovered prior to the 1970s. E.g., type of activity area with which they were associated. In trying to assign artifacts to particular groups, Sellards’ (1952) “Portales Complex” is of little useful as it is an anomalous, containing a variety of distinctly different projectile point types.

Geological situation of artifacts similarly is nebulous. Unit E has four associated radiocarbon dates: 9,890 ± 290 years B.P.; 8,740 ± 6,230 ± 150 years B.P.; and the first two dates are from the top of the apparently separate facies of Unit E, Hester (1972:174). The last two are from an upper and (1972) points out that the latter dates may typologies suggest that Unit E spans the entire late Paleo-Indian period.

Work thus far reported for Blackwater Draw Locality No. 1 lacks indication of camping features in the carbonate silt. Few features of any kind were reported from this level, but those that are known are bison kills. Sellards (1952) encountered an extensive bone bed in the upper portion of the carbonate silt (Hester 1972:36-39), recording several “Portales Complex” points. Little is known of the nature of the bone bed, although it appears to have been a communal mass kill (Hester 1972:37). This feature would appear to be different from the bison kill/butchering locale in FAB-3. Differences between the two would include size of kill, bone disposal pattern, and number of people involved.

Recent excavations at the locality (Stevens 1973; Agogino et al. 1976) uncovered part of a bone deposit in the upper carbonate silt. Both this feature and the preceding one are on the south end of the locality, about 100 meters apart. Apparently a small kill, a feature illustration (Agogino et al. 1976:217, Fig. 4) indicates discontinuatics and broken remains (nonfetal). Associated lithic material includes a Firstview point. Bone appears to have been extensively marrow processed.

This situation varies from that seen in the bison kill/butchering locale in feature FAB-3. Remains were semiarcticulated to disarticulated and most not marrow processed. Furthermore, while there seems to be some clustering of bone in the Blackwater Draw Locality No. 1 feature, there is not the definite stacking present in the FAB-3 locale. The San Jon site (Roberts 1942), north of Blackwater Draw Locality No. 1, is on the northwestern edge of the Llano Estacado (Fig. 1). Taxonomy of projectile points recovered at this site presents some problems. The type San Jon point apparently was found within the same stratum as a Folsom point. A reputed Scottsbluff point was recovered stratigraphically above this level. Hext (1976) demonstrated that San Jon are worked Firstview points.

Little else is known of occupational features associated with either Scottsbluff or San Jon points. Both are associated with bison kills, but kill size, patterns, and other pertinent data were not determined. Three radiocarbon dates available from the site are 17,300 ± 600 years B.P.; 9,700 ± 650 years B.P.; and 2,670 to 2,580 ± 380 years B.P. are considered unreliable (Hester 1972:19-20).

The only other documented late Paleo-Indian locality on the Llano Estacado is the Rex Rodgers site (Willey et al. 1978), located in Tule Canyon (Texas). The site is on the eastern edge of the Llano Estacado, approximately 80 miles north of Lubbock (Fig. 1). Rex Rodgers is a bison kill/butchering locale containing remains of at least six animals killed during the winter. Evidence of a camping area is lacking (Sper 1978).

Two varieties of projectile points (lanceolate and side hollowed) were recovered. A radiocarbon date of 9,831 ± 83 years B.P. determined on bone apatite (Sper 1978). However, Willey et al. (1978) consider the site to date closer to 10,000 years. Cultural affinities are not clear. The Rodgers point (side hollowed) may have typological affinities with Brazos Fishtail of Central Texas (Watt 1978), San Patrice of East and Southeast Texas, or a variety of eastern U.S. types (Willey et al. 1978:66).

The Rex Rodgers bone bed was covered by rapid deposition of silt and wash material which may have displaced some remains (Sper 1978:70). The locale also was disturbed by erosion and only parts of animals recovered. Nevertheless, several similarities exist between this locale and the one in feature FAB-3. Similarities include apparent small kill size, butchering techniques (Johnson 1978), articulated units, and slight to nonexistent marrow processing damage. One difference is the lack of distinct bone piles at Rex Rodgers. This absence may be due to feature location in an area which might restrict the area in which stacking could occur.

The camping area in feature FAB-3, then, is the only well documented late Paleo-Indian camping locality on the Llano Estacado. Others are certain to exist. Bison kills are the principal late Paleo-Indian feature known for the area. The two at Blackwater Draw Locality No. 1 are distinctly different both from each other and the FAB-3 locale. However, these may be roughly contemporaneous and perhaps have typologically similar lithic artifact inventories. At Rex Rodgers, the bone deposit shares a number of similarities with the FAB-3 kill/butchering locale. There are typological differences and Rex Rodgers dates earlier than the Lubbock Lake late Paleo-Indian feature.

**DISCUSSION**

At Lubbock Lake, the late Paleo-Indian period includes Plainview (ca. 10,000 years B.P.) and Firstview (8,600 to 8,300 years B.P.) cultures. Continuing research into the late Paleo-Indian period at Lubbock Lake and on the Southern High Plains leads the authors to agree with Wheat’s (1972, 1976, 1977) basic hypothesis concerning this period on the Southern Plains.

Southern Plains late Paleo-Indian tradition is distinctly different from contemporary Northern Plains cultures. A major difference can be seen in terms of projectile point typology, morphology, and manufacturing technology. Briefly, Southern Plains projectile point styles appear to be wider and thinner pointed than those in the north. Broken points are rejuvenated with a new base or tip and commonly reused as butchering tools. Because of these traits, individual collections (e.g., Plainview type collection) are less typologically distinct within themselves but the general style persists much longer than a given Northern Plains complex (e.g., Cody). Validity of Wheat’s (1972) hypothesis (specifically the Firstview complex) was challenged by Stevens (1973) and Agogino et al. (1976) but arguments are unconvincing. A significant revision of Firstview might be in its dating, at least on the Southern High Plains. Dates for this period (from Lubbock Lake and Dates for this period (from Lubbock Lake and Blackwater Draw Locality No. 1) indicate a Blackwater Draw Locality No. 1) indicate a range of perhaps 10,000 to 8,500 years B.P. The date of 10,150 ± 500 years B.P. from the Firstview type locality (Olsen-Chubbuck; Wheat 1972) is in general agreement with this range. However, the date is difficult to interpret since it is a single determination on bone with a 1,000 year standard deviation.

In addition to the broader cultural affiliations, an initial integration of Lubbock Lake data provides a glimpse of the lifestyle patterns of a late Paleo-Indian cultural group. The two loci were probably used by the same people, perhaps reflecting different seasonal or yearly activities. Time between activities is minimal and camp debris was located above and below the butchering level. Furthermore, although not conclusive, projec-
tile points do not indicate different cultural groups and debitage recovered from each locus follow the same pattern.

The butchering locale is small, with a minimum four bison (and fetuses) being slaughtered (small cow-calf group). The trash accumulation area is not as constructed as the butchering locale, yet is not extensive. These activities probably represent those of a residential unit (perhaps an extended family) with only a few people involved. Residential unit size is speculative and quantification attempts based on lithic or faunal debris. Wilmsen (1974:117-118) estimates 10 people (composed of two or three families). What's (1972:123) various ratios of people involved in the communal kill at Olsen-Chubbuck indicate that the Lubbock Lake butchering locale may have been handled by one to three adults (active males of a residential unit).

Only a few animals were killed at any one locale at Lubbock Lake (synchronously and diachronically); indications of massive slaughters are lacking. Furthermore, these few individuals were killed near a watering area, along pond and marsh margins. This water association is a pattern seen by Wheat (1971:25) for most Paleo-Indian kill/butchering localities throughout the Plains and Southwest. Evidence of traps at Lubbock Lake is lacking; bison killed at the FA6-3 locale (as well as at others in the site) probably were stalked. Pattern of occupation by a probable residential unit and small kill/butchering locales was established early at the site and continued throughout Paleo-Indian occupation (Johnson 1975, in press b).

Territorial extent of a residential unit is unknown (closest recorded site with Paleo-Indian downstream from Lubbock Lake is 2 miles). However, Hester and Grady (1977:92) estimate a 120 miles radius on the Llano Estacado. With miles would place the closest known outliers of cherts and Tecovas quartzite within band Paleo-Indian sites are within the draws (Hester and Grady 1977) and band territories may extend along the drainageways. Lithic resources would be limited to Plio-Pleistocene gravel beds and caprock calcite sources.

Trade (or travel) with bands to the north and south could procure cherts and high quality quartzes.

Limited availability and conservation of cherts and dependence on quartzites and silicified calcite may be more a product of band territories than preference. However, at Blackwater Draw Locality No. 1 (Hester 1972:142) during this time period, Edwards Formation, Allabates, and Tecovas cherts are favored materials. Quartzites are at a minimum without reported use of silicified calcite. Under these circumstances, band territory and preference both may be factors in the use of particular lithic resources, albeit not the only ones involved.

The Paleo-Indian occupational pattern is one of intense use of the draws. Only a few known sites, such as Miami (Sellards 1938 and Elda (Warnica 1961), are reported from around upland playas. Draws offer a concentration of resources: fresh water, variety of game, some limestone material, harvestable plants, fuel supply, and shelter. They also offered typographic opportunities for band level communal mass kills, such as at Plainview (Sellards et al. 1947). A few sites were occupied repeatedly for various purposes.

SUMMARY

At Lubbock Lake, feature FA6-3 represents a multiple use of an area perhaps at different seasons of the year. Seasonality of occupation is not clear because of inconclusive evidence. Based on overlapping availability of ducks and turtles in the region today, camping activities could have occurred during early spring or late fall (although summer cannot be ruled out). Fetal material indicates a probable spring use of the butchering locale.

The Lubbock Lake late Paleo-Indian occupation is one of only a few known for the Southern High Plains. Activities at the site give an incomplete and partial view of the life-style of the particular group involved. Material occurs along a southerly incline around a marshy ledge. Excavated portion of the feature consists of two loct: a camp and a bison kill/butchering locale. Each may have been occupied at different times of the year and the camp probably reused several times. Butchering evidence indicates selectivity of meat cuts and limited use of available resources of a bison carcass. Dependence on locally available silicified calcite and quartzite is noticeable. Orientation of a part of the lithic technology to the use of small nodules (pebbles and cobbles) influenced debitage being created.

The area was occupied by a small group of people who focused their activities on the ecotonal interface of marsh — wet meadow— and dryland. Climatic conditions began to moderate; and these people interacted with a nearby modern fauna in an area dominated by grasslands. This initial analysis provides a glimpse of the Llano Estacado late Paleo-Indian lifeway pattern and forms the basis for future, more detailed investigation.

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