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ARTICLES

Hematite Axes of Northeast Texas

Robert L. Turner

ABSTRACT

Northeast Texas is a discrete region within the state where hematite grooved axes occur. This area has a geology that contains the ferruginous sandstone from which the axes are made. The manufacture of these axes extended to the Red River basin of Southwest Arkansas and Northwest Louisiana.

The axes are most plentiful along the middle Sabine River and its tributaries, on Cypress Creek, and in a region south of the Sulphur River and White Oak Creek, a major tributary of the Sulphur. One major site is located on a tributary of the Trinity River in Anderson County. Other axes are found in small numbers in the counties south of the Sabine River, which have the same geology.

HEMATITE AXES OF NORTHEAST TEXAS AND THE ADJOINING REGION OF ARKANSAS AND LOUISIANA ALONG THE RED RIVER

Hematite grooved axes within Texas are unique to Northeast Texas. Figure 1 shows the region (Sandy Hills) where the axes are found and provides a comparison of the topography within Texas and that of nearby states. Story (1981) refers to the hilly mountain region, which is the Weches formation, as the Weches Ironstone Hills.

Figure 2 is a Texas Hillshade map that shows the nature of the terrain, the major rivers and streams, and the presently known outer boundary where the hematite axes are found. In addition, the white spots in Southwest Arkansas and Northwest Louisiana are sites where at least one hematite axe was found. In Arkansas and Louisiana the axes are found in the bluffs or hilly areas adjacent to the Red River floodplain or on major tributaries which empty into it. Table 1 lists the sites shown in Figures 2 and 3.

Figure 3 is a digital elevation model of this region compiled from the National Elevation Data set. It emphasizes the hilly nature of the land where the axes are found. The white coloration on the map are the hills and ridgelines from which the streams flow into the river systems. The higher mountain elevations range from 400-600 feet above

Table 1. Sites with axes on Figures 2 and 3.

Texas site names. Read counterclockwise starting at Sulphur River near Louisiana line, Figures 2 and 3.

1. East of Knights Bluff—Cass Co.
2. Grandma Jones site—Cass Co.
3. Bryan's Mill site—Cass Co.
4. C. Smith site—Morris Co.
5. 41HP1–Culpepper site—Hopkins Co.
6. Kintchloe Branch site—Hopkins Co.
7. 41VN6–Yarbrough site—Van Zandt Co.
8. 41AN115—Furman-Amick site—Anderson Co.
9. Lake Sam Rayburn—Angelina Co.
10. Lake Naconiche—Nacogdoches Co.
11. Carthage—Panola Co.
12. Buck Branch—Panola Co.

Arkansas and Louisiana site names. Read north to south on Figures 2 and 3.

1. Schall site, Howard Co., Ark.
2. Columbus site, Hempstead Co., Ark.
3. Grassy Lake, Hempstead Co., Ark.
4. Bois D'arc Bayou, Hempstead Co., Ark.
5. 3MI56, Miller Co., Ark.
6. Fort Lynn, Miller Co., Ark.
7. McKinney site, Caddo Parish, La.
8. McCrocklin, Bossier Parish, La.
9. Webb Collection, NWLSU, Caddo Parish, La.
10. 16BI19, Conly site, Bienville Parish, La.

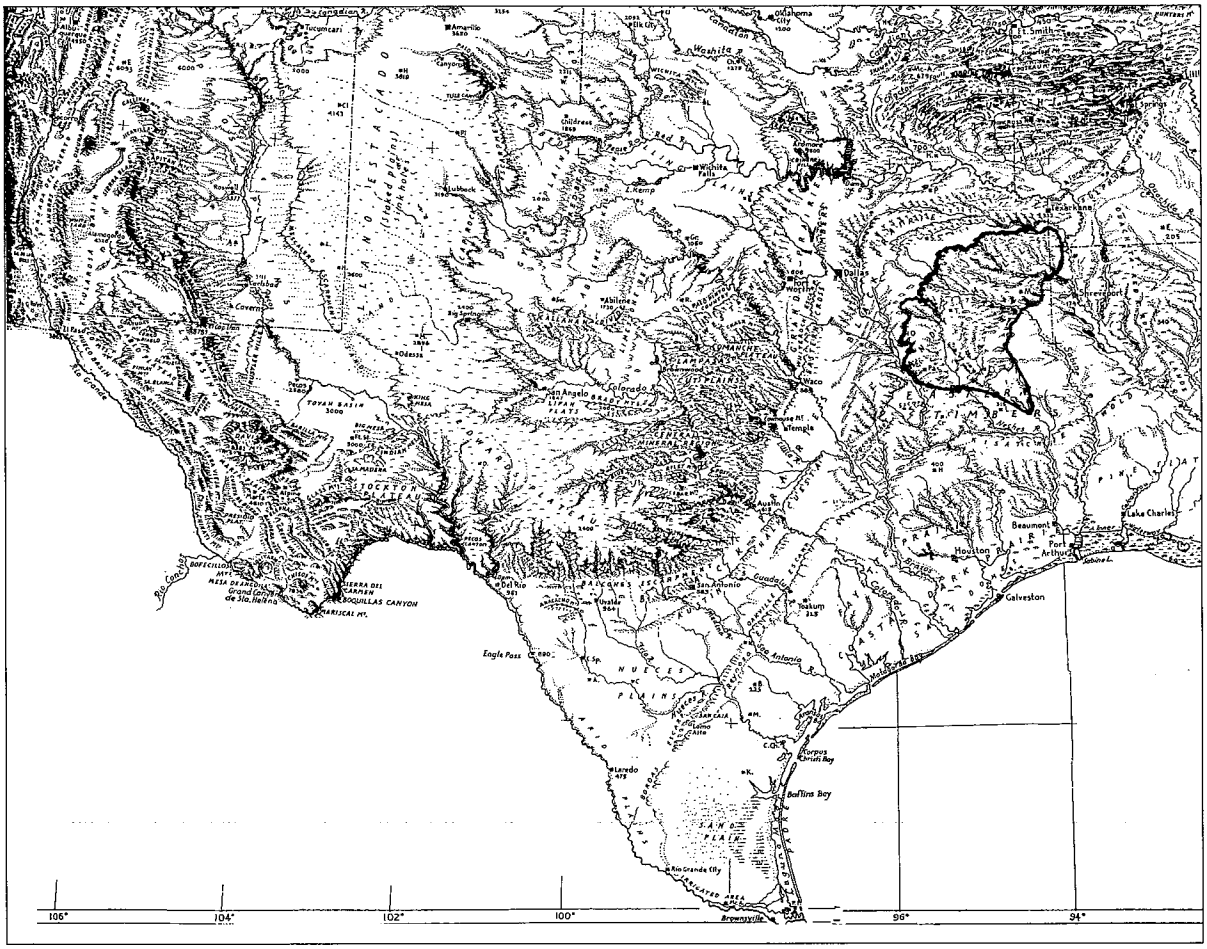


Figure 1. Topographic map of Texas and the region adjacent to Northeast Texas.

sea level (asl) in Cass County to 650 feet asl in Rusk County and 650-725 asl in northern Nacogdoches County. The general terrain slopes downward from the northwest toward the east and southeast as the rivers run.

This region was formed during the Eocene period (Bureau of Economic Geology 1992), about 50 million years ago. Erosion has shaped the rolling hills, ridges, and river bottoms as they are today. The formations within this region (Bureau of Economic Geology 1966) are the Weches Formation, Queen City Sand, Reklaw Formation, the Sparta Sand, the Carrizo Sand, and the Wilcox Group. These formations contain ferruginous sandstone, ironstone concretions, ledges of ironstone, and limonite and siderite ore.

The hematite axes are all found within this region, as it is the only available and easily workable stone. There are no chert deposits. The only lithic materials other than ferruginous sandstone and silicified wood are small stream and river pebbles and nodules of quartzite that are extremely hard and difficult to shape other than by flaking to make dart or arrow points. Very few axes of quartzite have been found.

The hematite axes in Northeast Texas and along the Red River in Arkansas and Louisiana should be called ferruginous sandstone axes; ferruginous sandstone contains an appreciable fraction of hematite. This is the material from which the axes are made. Like a gold necklace is described as gold even though it may be only plated or contain a partial gold content, a hematite axe may contain only a major fraction of iron in the form of ferric oxide (hematite), but these axes by common usage are described as hematite and will be called by that name in this article.

This study of the stone axes of Northeast Texas and the adjoining Red River valley of Arkansas and Louisiana included measuring, weighing, and photographing as many hematite axes as possible. Information was obtained from published reports (e.g.,

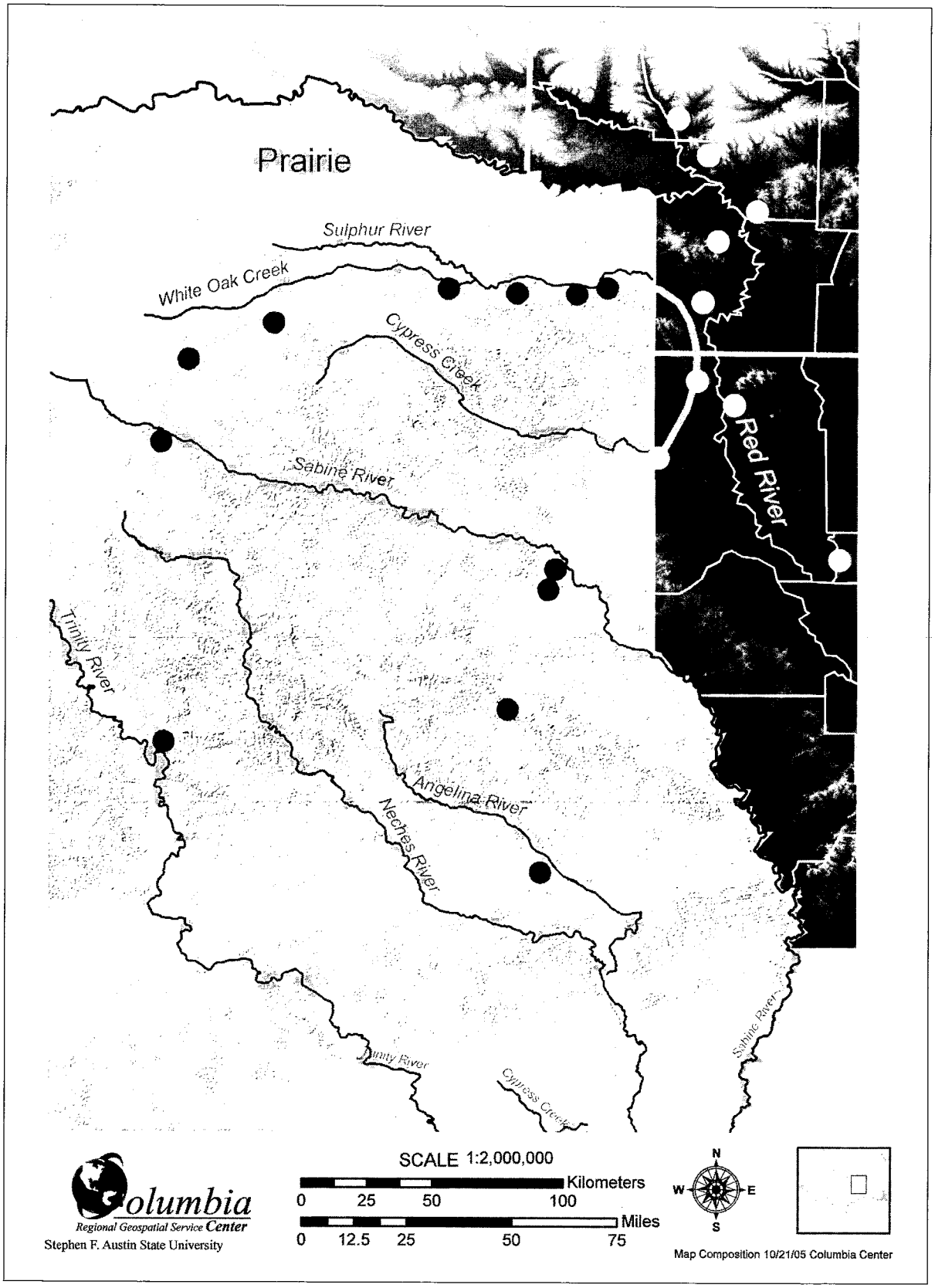


Figure 2. Texas Hillshade map and sites with hematite axes. Also shown are Arkansas and Louisiana sites along the Red River where hematite axes have been found.

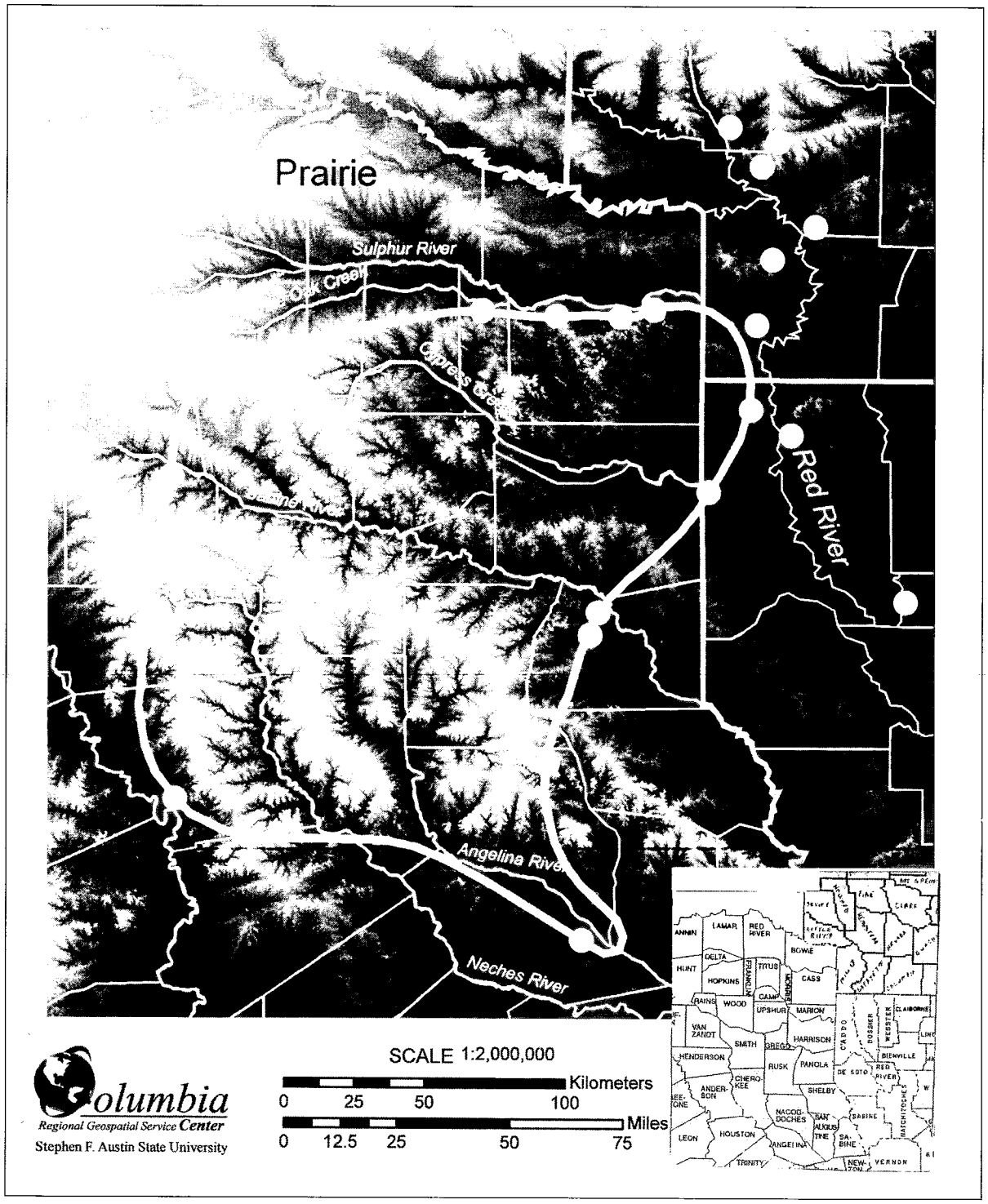


Figure 3. Digital elevation map of the region that emphasizes the terrain as well as state, county, and parish boundaries.

Johnson 1961; Perttula 2005; Webb et al. 1969), and University and Museum collections, but most came from the collections of individuals.

Within the bounds of Northeast Texas (see Figures 2 and 3), 218 axes were located. Of this total, 185 or 84.9% were of hematite; 21 or 9.6% are completely similar in size and shape to the hematite axes, but are from foreign stone, usually a fine-grained sandstone that originated outside the boundary of the region. Another 12 axes (5.5%) are

percussion-flaked double-bitted axes associated with the Fouche Maline Culture (Schambach 2001, 2002). A few of the double-bitted axes are of quartzite but most are of a foreign stone. The hematite axe is clearly the resident axe. In addition to the Texas axes, 14 hematite celts and three hematite adzes were also noted.

In Southwest Arkansas and Northwest Louisiana, along the Red River, the proportion of hematite and hardstone axes is reversed. Of a total of 37 axes from this region, 46% are hematite and 54% a different stone, mainly a fine-grained sandstone. Also, four hematite celts were from two Northwest Louisiana parishes. Along the Red River ferruginous sandstone from the red hills and bluffs was exploited, but the gravel bars of the river were also an easily available source. From the collections of the Arkansas Archeological Survey (Southern Arkansas State University, Magnolia) the camp debris from numerous Archaic sites from the bluffs along the river is predominantly from river gravels and not from ferruginous sandstone. Tables 2 and 3 list the axes and the counties and parishes in which they are found.

Hematite artifacts occur elsewhere in Texas but not in great numbers. Moseley (1996) describes small hematite celts from North Central Texas. These small celts are attributed to the Henrietta focus (ca. A.D. 1300-1600). Forrester (1989) reported on a site in southwestern Stephens County where 22% of the artifacts were of hematite and over 50 small hematite celts were found. Within the site bounds was an outcropping of nodular hematite. This is believed to be the source of the material for the celts described by Moseley (1996).

THE AXES

Figure 4 shows the largest and smallest of the axes in this study, and Figure 5 is a plot that shows length versus weight. From this it may be seen that most axes weigh less than 1 kg and are less than 15 cm in length.

Typical axes of the region have rounded or semi-rounded polls (Figure 6). Figure 7 shows axes with flat polls and axes from Southwest Arkansas and Northwest Louisiana.

The coloration is fairly uniform on each axe but they may be mottled. Generally they are earth-toned in color with shades of chocolate-brown to red-brown to a few of dark gray, almost black.

The axes of these figures are identified by the counties of the region in which they were found except for the Jones collection. The Calvin Jones collection is in the Gregg County Historical Museum in Longview, Texas. Based on some knowledge of Mr. Jones and his collections it is assumed that most of his artifacts were collected within a radius of 30 or so km from Longview: including not only Gregg County but portions of Harrison, Rusk, Smith, and Upshur counties which includes a 60 km stretch of the Sabine River.

More axes are rounded on the poll than are flat. Some axes show battering on the poll but many none at all. The same is true of the Figure 6f axe bit; the bit was broken away but was still used for battering after that event. The poll also shows major use. The flat poll shape of axes show the same battering pattern as those that are rounded.

Figure 4. Size range of the axes in this study.

Table 2. Axes from Northeast Texas Counties.

County	Hematite Axe	Other Stone	Double Bitted	Hematite Preform	Hematite Celt	Hematite Adze
Anderson	7	1	–	1	–	–
Angelina	1	–	–	–	–	–
Bowie	2	–	3	–	–	–
Camp	24	1	1	2	2	–
Cass	22	7	2	–	4	1
Cherokee	1	–	–	–	–	–
Franklin	5	3	1	–	–	–
Gregg	5	–	–	–	2	–
Harrison	11	–	–	–	1	2
Hopkins	5	–	–	–	–	–
Marion	3	–	–	–	1	–
Morris	21	1	–	–	1	–
Nacogdoches	1	–	–	–	–	–
Panola	2	1	–	–	–	–
Rusk	7	–	1	–	–	–
Smith	5	–	–	–	1	–
Titus	6	1	3	–	1	–
Upshur	12	1	–	–	–	–
Van Zandt	3	–	1	–	–	–
Wood	5	–	–	–	–	–
Fields Coll.	10	–	–	–	–	–
Jones Coll.	27	5	–	4	1	–
Totals	185	21	12	7	14	3

In Figure 7 the Arkansas axes are described by Perino (1967) and their locations are noted in Table 1. Axes 7p and 7r on Figure 7 are in the collections of Northwest Louisiana State University. Axe 7p is from the Williamson collection and axe 7r from the Clarence F. Webb collection. Axe 7q is from the Neils collection at the Louisiana State Exposition Museum in Shreveport.

The hematite axes of this study are all fully grooved but one; the groove completely encircles the axe. This grooving configuration is described as 4/4. An axe with one flat side and three grooved would be a 3/4. The single axe not fully grooved is from Nacogdoches County and is 3/4 grooved. There is a question of whether this axe was intentionally made this way or whether a break during use broke off one side.

Figure 8 pictures axes with additional grooves. Axe 8f is from the Jones collection and the Grace Creek site (Jones 1957). This axe is nearly identical to the Arkansas axe shown in Figure 7m. Double grooved axe 8g-g' (Anderson County) is unique with its groove arrangement. Axe 8h (Wood County) has a second groove below the larger main groove on both sides.

Axes a-e on Figure 8 each have a groove across the poll in addition to the full groove. Brown (1926) named this style an Aberdeen axe. Brookes (2004, 2005) also discusses these axes, which occur in northeastern Mississippi. The name was given by Brown as they were found near Aberdeen, Monroe County, Mississippi. Brown (1926:149) said "a thong of leather or a withe of wood passing over the back of the axe in the groove, would serve to hold it in place

Table 3. Axes of Southwest Arkansas and Northwest Louisiana.

Arkansas Counties	Hematite Axe	Other Stone	Hematite Celts
Howard	1	–	–
Hempstead	4	–	–
Miller	3	–	–
Columbia	–	3	–
Louisiana Parishes			
Bienville	1	–	–
Bossier	1	2	2
Caddo	5	13	2
Claiborne	–	1	–
De Soto	–	1	–
NW Louisiana	2	–	–
Totals	17	20	4

and keep it from being driven from its setting in its handle when used for chopping or bruising."

I have located a total of seven of the Aberdeen axes in Texas. Perino (1967) pictures two of these axes from Hempstead County, Arkansas (see Figure 7o).

In Figure 8, axe 8b has a circular ground and polished depression which is approximately 28 mm in diameter and 2-3 mm deep. A similar depression is in an axe from Miller County, Arkansas. In both cases the depressions are on one side of the axe only. These depressions were pecked and polished. Their function is unknown.

In Figure 8i-p, axes are the percussion-flaked double-bitted axes associated with the Fouche Maline culture of eastern Oklahoma and Southwest Arkansas (Schambach 2002). Schambach (personal communication) states these axes are gardening tools and not heavy duty woodworking

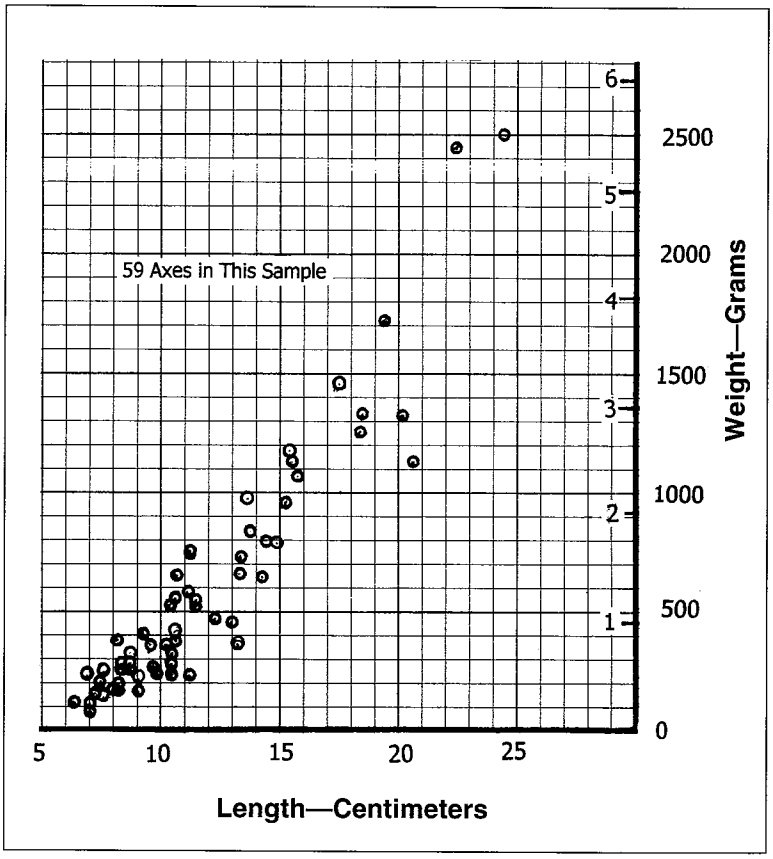


Figure 5. Hematite axe weight as a function of length.

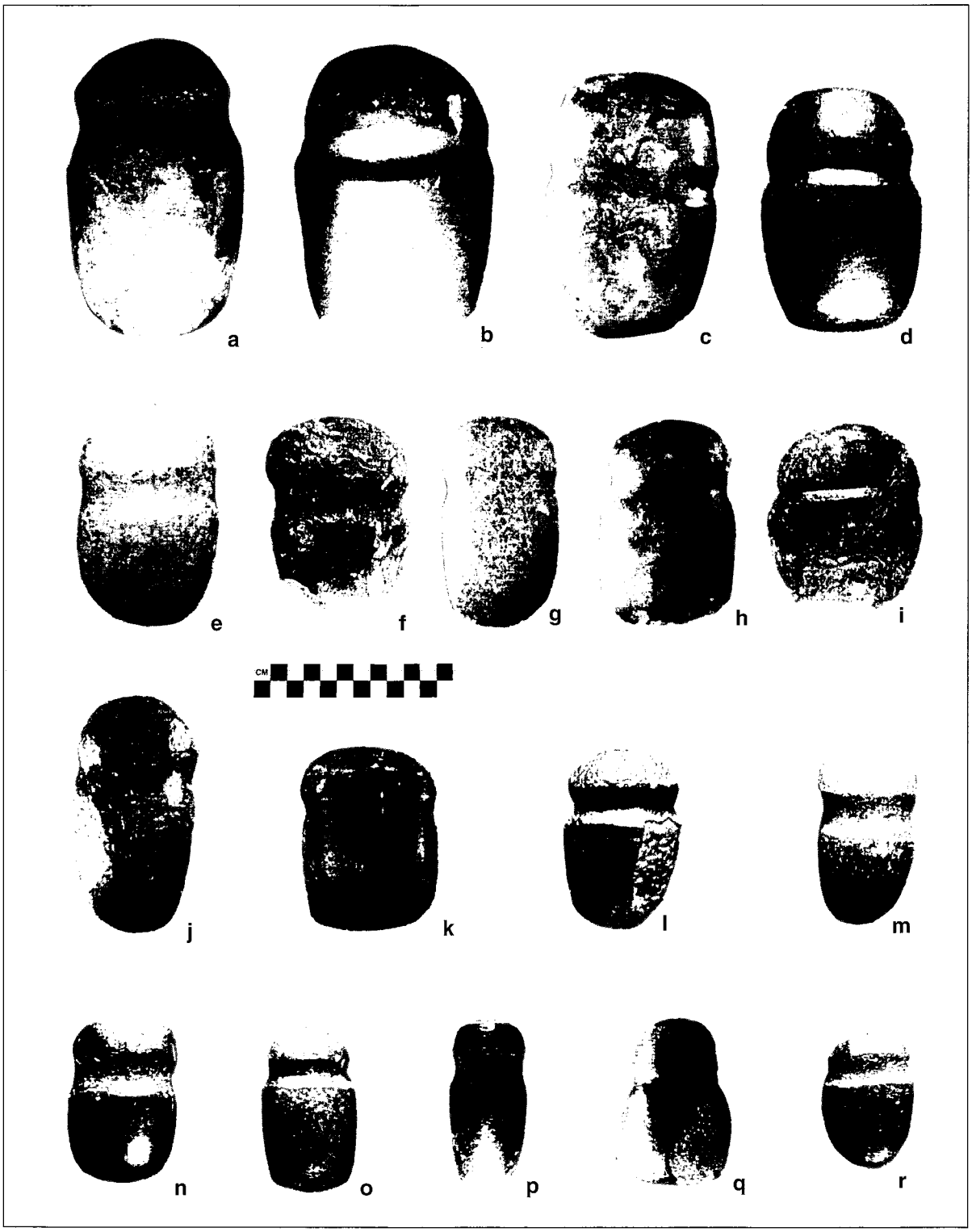


Figure 6. Hematite axes shaped by pecking and polishing with rounded to semi-rounded polls. Camp County: a, d, f, m-r; Upshur County: b, e; Marion County: i, l; Titus County: k; Jones Collection: c, g-h, j.

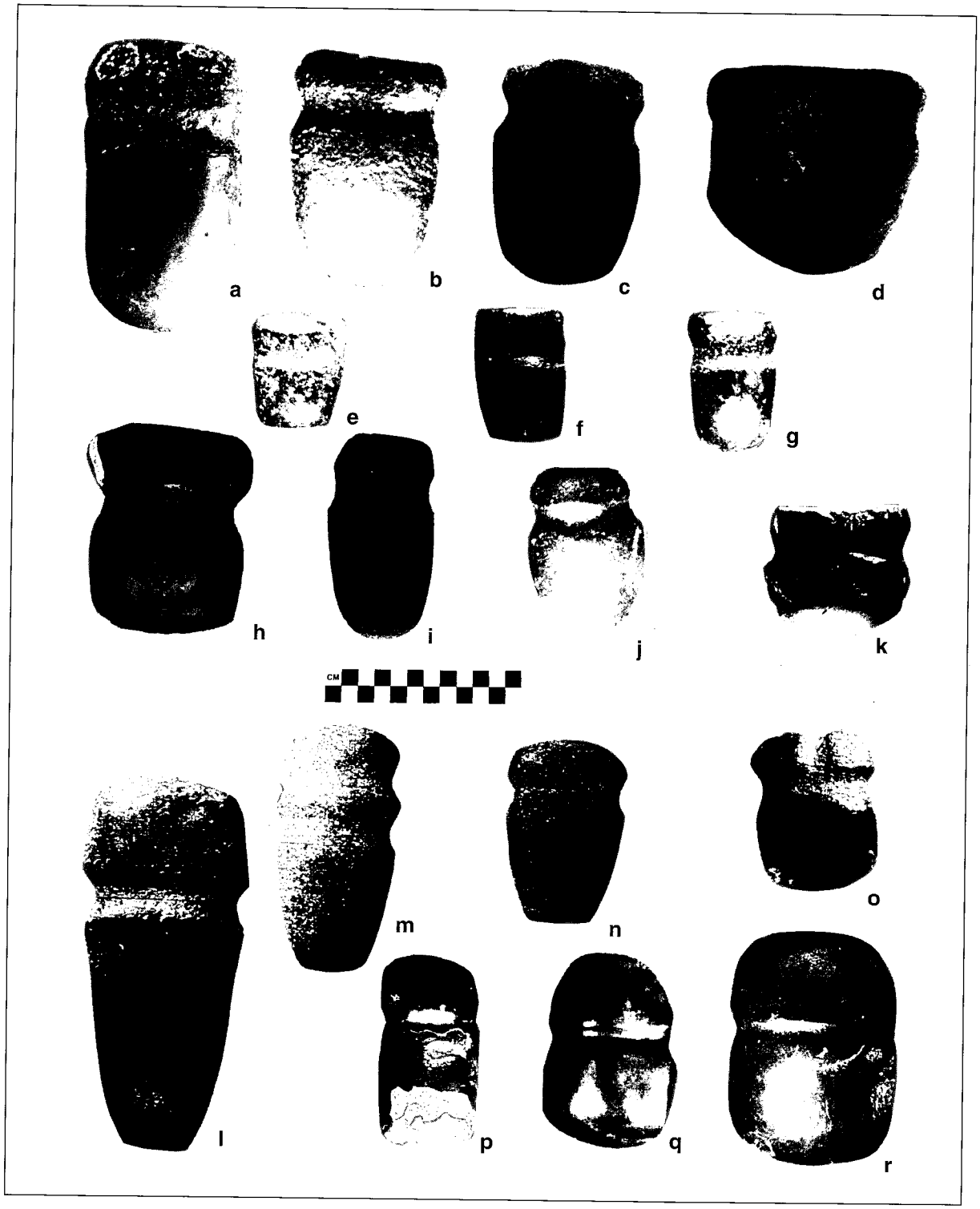


Figure 7. Top three rows are hematite axes with flat or nearly flat polls. All axes have polished surfaces except d, which is smoothed but not polished. The bottom two rows are hematite axes from Arkansas and Louisiana. Camp County: a, e-g, k; Hopkins County: b; Franklin County: c; Upshur County: d, h-i; Morris County: j; Hempstead County, Arkansas: l, n-o; Howard County, Arkansas: m; Caddo or Bossier Parish, Louisiana: p-q; Caddo Parish, Louisiana: r.

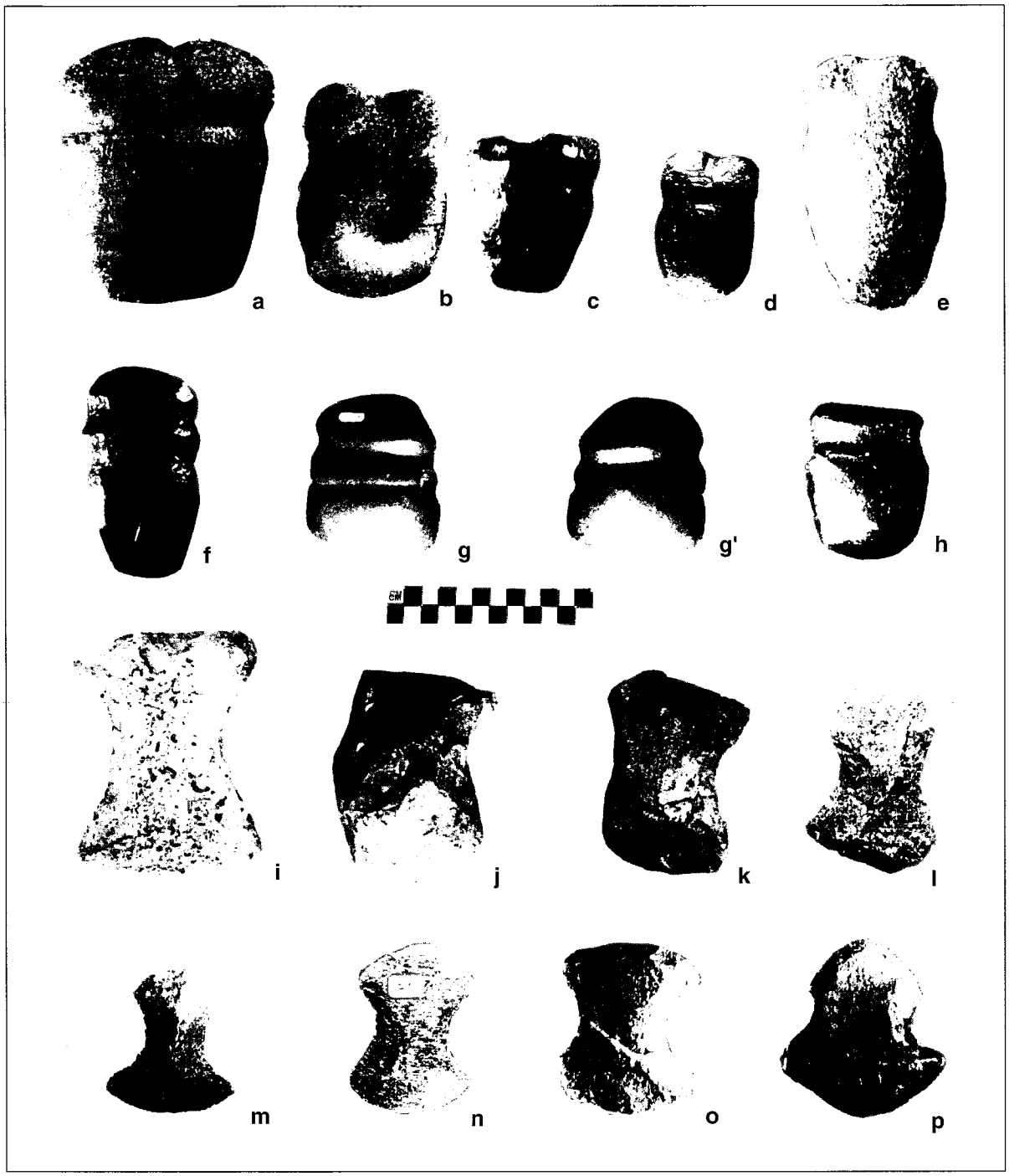


Figure 8. Hematite axes with additional grooves, and percussion-flaked double-bitted axes (not hematite). Jones Collection: a, c, f; Panola County: b; Cass County: d; Wood County: e. h; Anderson County: g-g'; Titus County: i, k; Camp County: j; Franklin County: l; Cass County: m; Bowie County: n-p.

implements. His studies indicate these axes were used for about 900 years between approximately 400 B.C. and A.D. 500.

Other Hematite Artifacts

In addition to hematite axes, ferruginous sandstone was used to make other artifacts. In quantity, pitted stones and pitted manos outnumber all other artifacts. Small to large grinding slabs follow in number, along with gouges, and small and large percussion-flaked blades that are generally elliptical in form with parallel sides and rounded ends. Present in Northeast Texas but few in number are: boatstones, bannerstones, plummets, and gorgets (usually elliptical in shape with drilled holes in each end for suspension), and finally dart points.

Walters, in Perttula (2005), discusses ground stone tools that are mostly of ferruginous sandstone, from the Pilgrim's Pride site (41CP304) on Big Cypress Creek in Camp County. Rogers and Perttula (2004) describe the large quantity of pitted stones, pitted manos, and grinding slabs from the Oak Hill Village site (41RK214) in Rusk County. Turner and Smith (2002) provide photographs of a gouge and a medium-sized percussion flaked blade from the Harold Williams site (41CP10) in Camp County.

A BRIEF BACKGROUND ON HEMATITE AXES

Warren K. Moorehead (1912), curator of the Department of Archaeology at Phillips Academy, Andover, Massachusetts, published a monograph entitled *Hematite Implements of the United States Together With Chemical Analysis of Various Hematites*. Figure 9 is Moorehead's map that defines the area, as known at that time, where hematite artifacts occur. His monograph almost exclusively pertains to the heart of the region where hematites occur. Moorehead used the term "hematites" to cover all tools and objects made from hematite. His basic study covered celts, grooved axes, plummets, and cones. He mentioned other items which he believed were "ornamental or problematical" such as tablets, bicaves, chipped discs, pendants, effigies, and winged and perforated artifacts.

His information was compiled primarily from correspondence with individuals, museums, and universities which had collections of hematite artifacts. His study determined within which regions and areas the various artifacts occurred and their quantities (Table 4).

Moorehead concluded that the celt is the most widespread implement of iron ore in the United States. The plummet and the cone, while widely distributed, cover no such area as the celt. The axes are confined to a narrow belt in Missouri with exceptions in Illinois, Kentucky, or Ohio.

The counties within this belt in Missouri occupy a region with a radius of approximately 110 km, centered on St. Louis. It commences and ends to the north and south of St. Louis at the Mississippi River (see Figure 9). In addition, axes occur in counties bordering the Missouri River and extending westward from St. Louis for about 200 km.

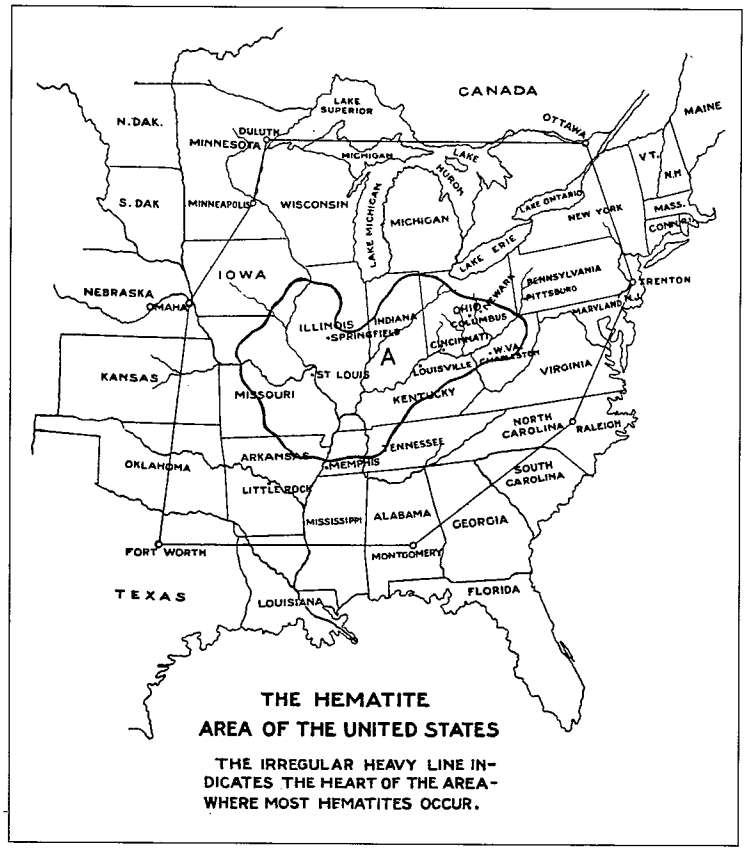


Figure 9. Moorehead's (1912) map of the hematite area.

Table 4. Location of artifacts from Moorehead study.

States	Grooved Axes		Celts		Plummets		Cones	
	No.	%	No.	%	No.	%	No	%
Missouri	592	94	630	49	404	65	203	46
Illinois	24	4	50	4	44	7	34	8
Indiana	4	–	–	–	3	–	–	–
Ohio	9	1	471	36	150	24	153	34
Tennessee	2	–	11	–	–	–	–	–
Kentucky	–	–	4	–	4	–	11	2
W.Virginia	–	–	130	10	17	3	45	10
Total	631		1296		622		446	
Grand Total	2995							

Table 4 includes only hematite artifacts, including axes. Hardstone axes occur in states which may or may not have hematite axes. The 1986 *Central States Archaeological Journal* reported that the Payne collection of Springfield, Illinois, contained over 13,000 stone axes before it was dispersed after 1932.

Hothem (1991), in discussing hematite, considers the highest quality of hematite is dark-hued and steel-gray in color. This gray and black hematite seems to be the hardest and is relatively free of faults and inclusions and was a favorite for early Indian toolmakers. According to Hothem, the axe material was found scattered about the surface and was not mined as was hematite used for paint. Hothem (1991) noted that more hematite axes are full grooved than three-quarter grooved, the opposite from the hardstone axes. In addition, hematite artifacts comprise only a small percent when compared to hardstone axes and celts.

HEMATITE AXE MANUFACTURING

There were two very different techniques used in shaping the hematite axes. Each began from a preform (Figure 10).

The first technique shaped the preform by the removal of large percussion flakes (see Figure 10a-b) and the second was by pecking away the unwanted material (see Figure 10c-e).

Figure 11 illustrates axes manufactured by percussion flaking. After the flaking was completed they were smoothed and then polished. Some of the largest were polished only on the bit or blade region. Some were only side notched. Even when polished all over they frequently have scars where large flakes had been removed.

Another distinguishing feature of the percussion-flaked axe is the thinned sides of the blade that continue from the bit region to the side notches or groove. These sides are not as sharp as the bit but nevertheless are purposely thinned. This results in the bi-convex cross-section of the blade. Some of the largest axes in this study (Figure 12) are percussion-shaped axes and are larger than those shaped by pecking.

The percussion-flaked axes have no trace of pecking and conversely the pecked axes have no trace of flaking. The pecked axe is certainly more symmetrical when completed. Some of the flaked axes resemble oversized dart points with their notched sides and flaking along the blade edges.

Hothem (1991) discusses the manufacture of pecked axes in general, not just hematite axes, but does not mention flaking as a technique. According to Hothem, the axes were made using a four step process. The first step was selection, then pecking, smoothing, and finally polishing.

These steps apply equally well to the hematite axes of this study. In selecting a stone for an axe the closer the raw material size was to the size axe the craftsman wanted, the less pecking would be required. The pecking would be done with a hammerstone of a harder material than that of the axe. In Northeast Texas the hammerstone most often found is a quartzite nodule.

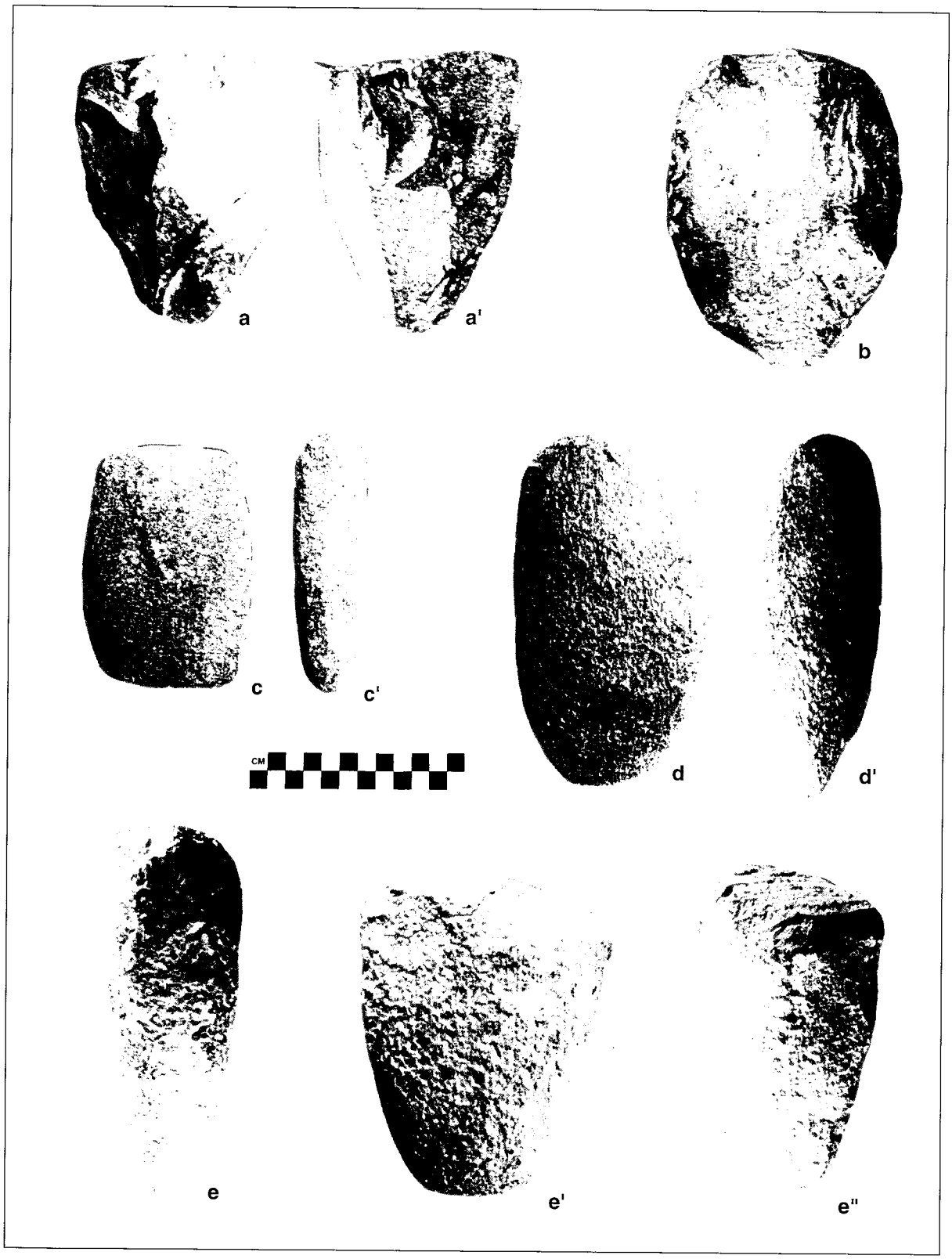


Figure 10. Hematite axe preforms: a-a': two sides of percussion-flaked preform, Jones collection; b, percussion-flaked preform, Jones collection; c-c', pecked preform, Camp County; d-d', Anderson County pecked preform; e-e", pecked preform, Jones collection.

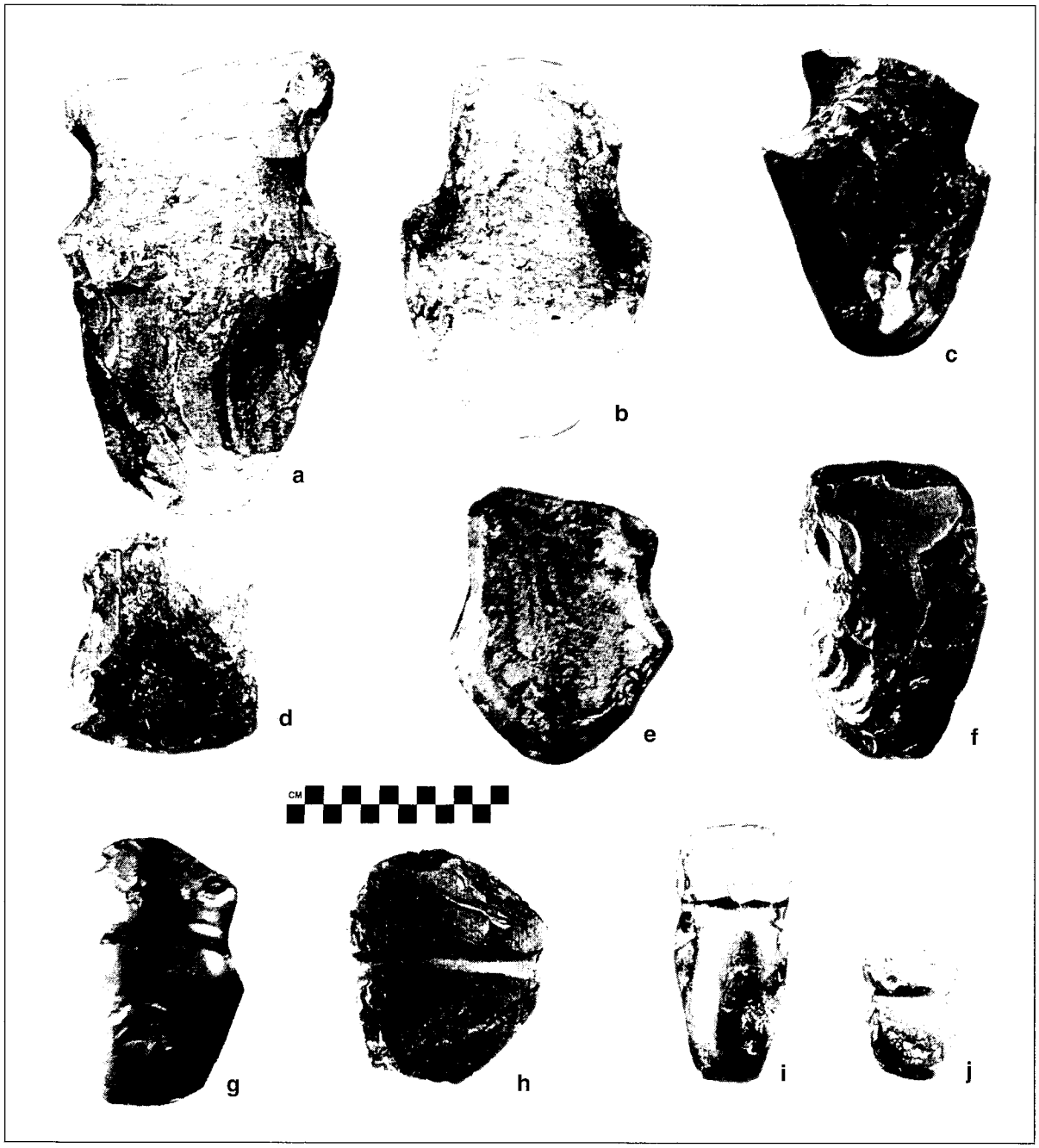


Figure 11. Percussion-flaked hematite axes. Top two rows are side-notched and without the groove. Bottom row is percussion-flaked but are polished and grooved. Titus County: a-b; Jones Collection: c-h; Cass County: i; Camp County: j.

After the preform was completed by pecking, the final shaping was started (see Figure 10d; this preform was being reduced to final form at the bit end first). Figure 13 shows an axe completely shaped by pecking but not yet smoothed. The smoothing of the pecked axe was likely done by rubbing the axe back and forth on a grinding slab or abrading it with an appropriately coarse stone to obliterate most but not all of the small depressions remaining from the pecking process.

Weber (1971) describes an outcropping of sandstone near a water source in Clark County, Arkansas (3CL61) that was covered with more than 150 grooves. The grooves ranged from 15-51 cm long and most were 4-5 cm wide; a very few were 8-10 cm. They were 2.5-4 cm in depth or

Figure 12. Very large hematite axes. Smith County: a; Titus County: b-c; Camp County: d, f; Panola County: e; Jones Collection: g. Axes b, e-f are shaped by pecking.

less. This was certainly an axe or celt manufacturing work station. No such site is known to the author in Northeast Texas.

The final polishing of the axes likely used a fine sand mixed with fat and applied using a skin or braided rope as a polishing strip. A shoe-shine-like back and forth motion was probably used in the groove in particular. Low magnification indicates that the surfaces of the axes are not porcelain-smooth but are covered with short stroke polishing striations. Within the groove where polishing has worn away, or partially worn away, the pecked craters, the striations are parallel and in the direction of the groove around the axe. On the axe body most striations appear to be random in direction and were formed by a polishing stone or skin held in one hand while the axe was held in the other. The striation direction seems to be directed at the spot where polishing was needed, with one hand rotating and positioning the axe while the other did

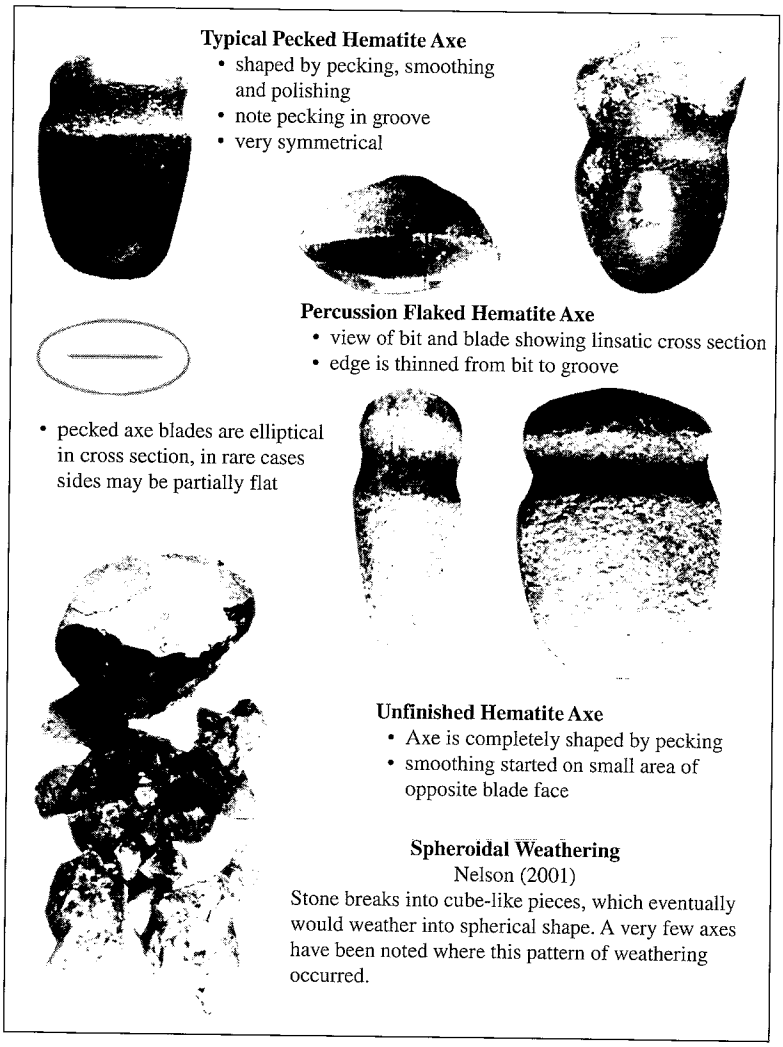


Figure 13. Miscellaneous axe facts.

the abrading. Thus, the shoe shine technique does not hold up for the body as it does in the grooves. The striation pattern is frequently vertical on the rounded blade edges and sometimes criss-crossed, roughly parallel to the bit edge, and sometimes not.

The flaked axes usually have a finely smoothed and contoured groove that blends into the poll and blade. Certainly a skin or rope was used to polish these grooves.

THE FERRIC OXIDE (HEMATITE) AND IRON CONTENT OF THE AXES

In his report, Moorehead (1912) asked James C. Graham, head of the Department of Science at Andover, to analyze a number of fragments of hematite from several broken artifacts (Table 5). Graham (1912:51) concluded that "In general the composition is ferric oxide (Fe_2O_3) mixed with more or less silicon (SiO_2). The mixture is usually so intimate that after the solution of the iron in acid, a skeleton of the silica of the original form of the specimen remains."

Using the Table 5 data, and end points of specific gravity 5.24 for 100% hematite and 2.32 for 100% silicon dioxide sandstone, Figure 14 was constructed. By entering on the graph the measured specific gravity of a hematite axe, or other hematite artifact, one can intercept the curve and thus determine its hematite content. This applies only to materials of ferruginous sandstone in which hematite and silica are present and other elements are of insignificant amount.

In this study, the specific gravity of artifacts was determined by weighing the artifact (in grams) on a small postal scale. The volume of the artifact, in cubic cm, was determined by water displacement measured in a chemist's beaker. Thus, weight in grams divided by the volume in cubic cm is the specific gravity.

The specific gravity of 56 axes as well as their hematite and iron content is summarized in Figure 15. This shows, for instance, that a group of axes with specific gravities of 3.10–3.19 represent 7% of the total axes. For this same group, the average hematite in the axes is 63%, and the iron content is 44%; 70% of the content of hematite is iron. Most of this sample of axes contain lesser amounts of hematite and iron than the example above.

Hematite occurs in two forms. The most common is red and earthy in color, while the other is black and micaceous. The black form is known as specular hematite or specularite. Both give a red streak when rubbed against a suitable surface. Hematite is non-magnetic. On Mohs' scale it has a hardness of 6 and a specific gravity of 5.24.

Specularite is used as a semi-precious stone for jewelry. When polished it has a highly attractive

finish, and when made into beads and a necklace it resembles black pearls.

The axes of Northeast Texas are all of the red earthy coloration. From the descriptions of axes by Moorehead (1912) and Hothem (1991), many of the Missouri hematite axes are of the black specularite that seemed to be a highly prized material, probably because of its high iron content weight and strength.

THE FERRUGINOUS SANDSTONE SOURCE

The Weches formation, Sparta Sand, Queen City Sand, Reklaw Formation, Carrizo Sand, and Wilcox Group (see Bureau of Economic Geology 1966) cover the part of Northeast Texas where the axes are found, and contain the ferruginous sandstone that is the raw material used for axe manufacture.

Ferruginous sandstone sedimentary rocks are roughly parallel-sided and 3-8 cm thick, and appears to be the most selected material for the axes, celts, pitted nutstones, pitted manos, and grinding slabs. This material is widespread in the area and is usually found in pockets at the juncture of the above noted sands and the underlying very hard red clay. Today road cuts frequently expose this material. In prehistoric time gullies, creeks, and other washes would have exposed it.

In addition to this ferruginous sandstone source a second major source for tool material is large concretions. The larger the concretion the less curvature of the selected preform for the particular tool. Figure 12c shows a very large axe probably made from a concretion fragment. Concretions usually have a thin layer of limonite on their inner surface, thus, a yellow surface which if not completely removed from the artifact marks the raw material source. This limonite cortex is often visible on large blades as well as gouges. Concretions are different shapes but many are somewhat like a turtle shell, or tending to be a somewhat flattened ball. Other shapes may be elongated, and at least as long as 2 m, which is the largest I have observed. The thickness of the shell may be from quite thin to at least 3 cm.

Gravel deposits contain hematite nodules, rounded and smoothed from millennia of stream tumbling, and sized from pea gravel to axe size. These deposits would have been an excellent source for selecting axe material if available to the Indians. These usually buried deposits would have to be exposed by washes.

A fourth source of ferruginous sandstone is tabular sections that are parallel-sided and are usually 1-4 cm thick. These have been observed at 1-2 m depth in cutbanks into hard red clay. With the many sources of ferruginous sandstone available for axes and other tools there would be no difficulty in finding a local supply.

Figure 15 summarizes the specific gravity (and thus hematite and iron content) for the axes. Table 6 lists the measured specific gravity for various selected groups of hematite artifacts as well as for the raw material from several sources. The large blades and gouges have a higher average specific gravity than the pitted manos. This indicates that when the raw material was chosen for the blades and gouges, the craftsman was selective in his choice.

Table 5. Hematite Analysis.

Origin	Color	Specific Gravity	% Hematite	Hardness
Missouri	black	5.0	98	5.5
Ohio	red	4.49	90.4	3-5
Missouri	black	4.86	98.2	6
Ohio	red	3.84	86.4	5-6
Union Co., Illinois	black	3.64	84.7	5.5
Union Co., Illinois	red	2.97	51.6	4.5
Ohio	red	3.65	82.6	4

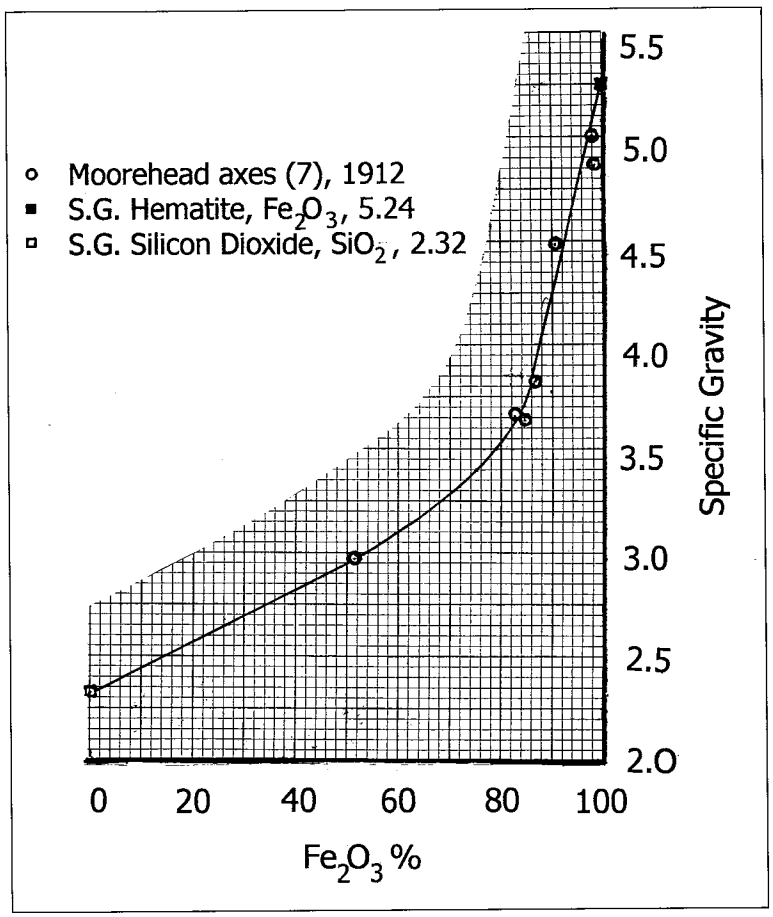


Figure 14. Hematite content and specific gravity of various stone axes.

THE EXFOLIATION OF HEMATITE AXES

Hematite axes are nearly all surface finds. Of the 185 hematite axes in this study 10% are subsurface finds. Of these, two caches of two axes each are known and many were found in the machine scraped areas of major sites such as Oak Hill (41RK214) and the Pilgrim's Pride site (41CP304) (see Perttula 2005; Rogers and Perttula 2004). Many of those found on the surface show exfoliated areas where a layer is peeled off, like the layers of an onion (Figure 16).

On observation, the first conclusion reached is that this tool in Figure 16 was formed, somehow, and then the final highly polished outer skin added. The second observation is usually that this tool would certainly shatter if used for cutting or splitting wood. The first observation is incorrect and the second is correct. A number of these axes in the author's collection and in collections of others were found 50-70 or more years ago. Many curious farm boys who first found these would haft them and start chopping. This usually resulted in damage to the bit edge.

The exfoliation may occur over a large area of the axe or sometimes as small spalls or areas where a farm implement strike has dislodged a section of the outer skin. In addition, cracks in the outer skin would allow water to enter. After freezing, water volume increases by about 9%, thus enlarging the crack and eventually breaking the outer shell.

The axes of Figure 16 have the appearance of a single inner core with one outside layer. This is not the real case. Figures 17 and 18 provide a picture of the present day internal structure of these axes. When the original axe was made the material was a homogeneous mixture of hematite and sandstone; that is, it was ferruginous sandstone. Thus the original composition was the same strength throughout, and no layering was present.

Over the millennia a chemical weathering has occurred (Birkland 1974; Pidwirny 2002; Nelson 2001). This weathering involves the change of the chemical and mineralogical composition of the weathered material. Processes which result in chemical weathering are hydrolysis, oxidation, carbonation, and solution.

Hydrolysis is the reaction that occurs when the two surfaces of water and material meet. Rain water combines with carbon dioxide in the atmosphere to form carbonic acid H_2CO_3. This acidic rain water (pH=5.5) is more efficient at doing chemical work than pure water. Chemical weathering is also enhanced by heavy rainfall and warm climate. This describes Northeast Texas as well as the southern states.

A cross section of a hematite axe shows tree ring like concentric rings (see Figure 17 and 18). The correct name for these concentric elipses are Liesegang Rings. R. E. Liesegang, a German chemist, observed and reported this repetitive chemical phenomena (Liesegang 1896).

Liesegang Rings, as described by MacRae

Table 6. Specific Gravity of Various Artifact Classes and of Ferruginous Sandstone from Several Sources.

Location	Artifacts	Specific Gravity low	av.	High
Camp, Wood, Morris & Hopkins Counties	Large Blades 10-15 cm (n=15)	2.27	3.19	3.66
Morris Co.	Gouges (n=13)	2.81	3.22	3.78
Camp Co.	Pitted Manos (n=15)	2.77	2.87	3.05
Nacogdoches Co.	Pitted Manos (10)	2.39	2.65	3.00
Ferruginous Sandstone Source				
Nacogdoches Co.	Sparta Sand (n=2)	2.73	2.77	3.66
Upshur Co.	from gravel pit (n=10)	2.53	2.97	3.41
Morris Co.	Weches Formation (n=9)	2.21	2.68	3.11
Upshur Co.	concretions (n=5)	2.69	2.84	3.33
Bossier Parish	tabular slabs (n=3)	2.68	2.86	3.10

(2003), are concentric bands of alternating coloration, typically found in sandstones, and typically with an orange, red, or brown color. They are usually composed of iron oxides (hence the color) and form when oxygen-bearing water diffuses in through porous rock. The water and oxygen processes diffuse inward along a discrete front whose position varies depending upon the water and oxygen supply. Deposition of iron oxides is enhanced at the interface between oxygen-bearing and oxygen-depleted water, leaving a concentric zone of iron oxide minerals not unlike the rings of a bathtub, except the process occurs in three dimensions.

In the case of the axes, the termination of each cycle is marked by a layer of ocher that is a mixture of various proportions of iron oxide and clay. When ocher is yellowish the iron oxide is limonite and when red it is hematite.

These rings surround a limonite core in the center of the axe. Limonite ($2Fe_2O_3 \cdot 3H_2O$) is the hydrated variety of hematite and is about 60% iron when pure. It is not a true mineral but a mixture of similar hydrated iron oxide minerals, thus its variation in specific gravity.

In the axes this central core of limonite indicates that the water that diffused through the axe combined with the resident hematite. Whether, as time passes, a few hundred or thousand years, the limonite would grow outward to absorb the surrounding rings or whether the rings would continue to grow inward and change the limonite will be commented on later.

In 1970 John Gustafson published a paper titled "An Unusual Grooved Laminar Axe." Gustafson was given a small severely damaged axe found near Hartselle in northern Alabama. The axe was exfoliated on both the bit and poll ends. Several layers of laminations were exposed similar to Figure 18a-c. An X-ray was made of the axe to determine the extent of the layers, and seven layers were visible. It is remarkable that this axe could be penetrated by X-ray and show this layering.

Gustafson enlisted the aid of Dr. Frank J. Soday to help determine what caused the laminations.

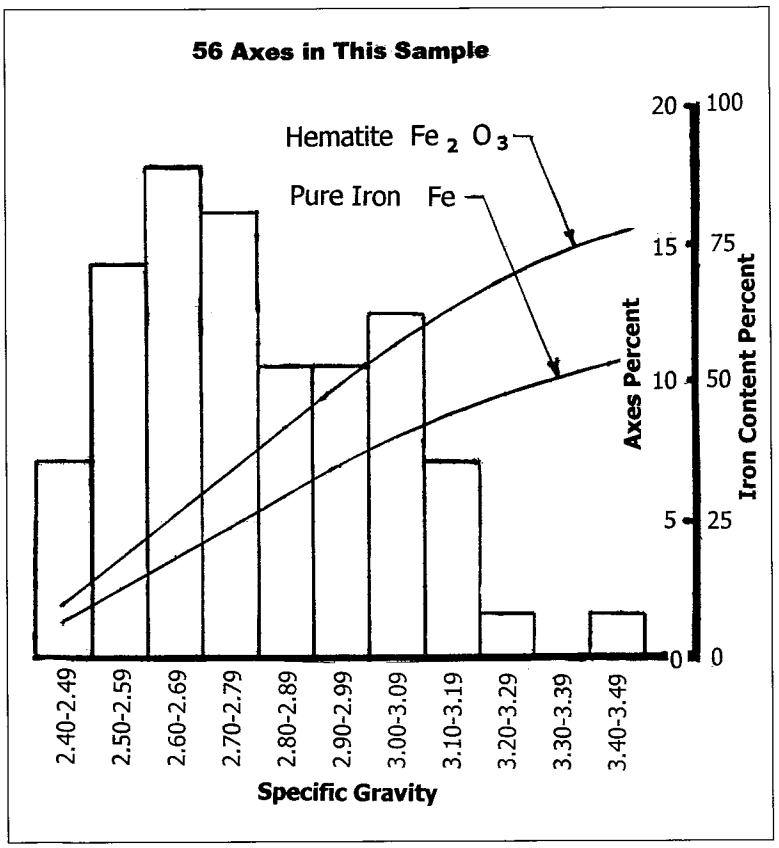


Figure 15. Percentage of axes of measured specific gravity and hematite and iron content of each group. Specific gravities are the lowest and the highest and the numerical average for the particular set listed.

ers were removed from the axe, which were each about 1/16-inch thick; second, by water displacement the density of the axe or specific gravity was determined to be 2.504 g/cc (345.5 g/138 cc). This size and specific gravity are about the same as the small axes of this study; third, an X-ray fluorescence analysis indicated numerous elements (including iron, silicon, manganese, magnesium, calcium, titanium, potassium, barium, and strontium) were present (iron was considered the only major elemental component); fourth, a simplified quantitative analysis was used to see if large differences in the composition of the four layers existed. Combined oxides, silica calcium oxide, and magnesium oxide were about the same in each of the four layers; and fifth, each layer was analyzed for iron content using the "mercapoacetic acid" technique. The iron contents were: layer 1 – 16.4% : layer 2 – 14.8% ; layer 3 – 15.5%; layer 4 – 16.4%. These are insignificant differences. Gustafson's conclusion was that Soday (Gustafson 1970:129) said:

> that in soil such artifacts go through alternate periods of internal solution and deposition of hydrated iron oxide. The deposition is presumed to be a colloidal phenomenon and follows a rhythmic pattern as the deposition proceeds from the surface to the artifact interior.

Soday did not know of a specific explanation in the literature but believed the result to be an example of Liesegang Rings. To obtain evidence for a cause of the laminar structure several evaluations were conducted by Soday: first, samples of the outer four lay-

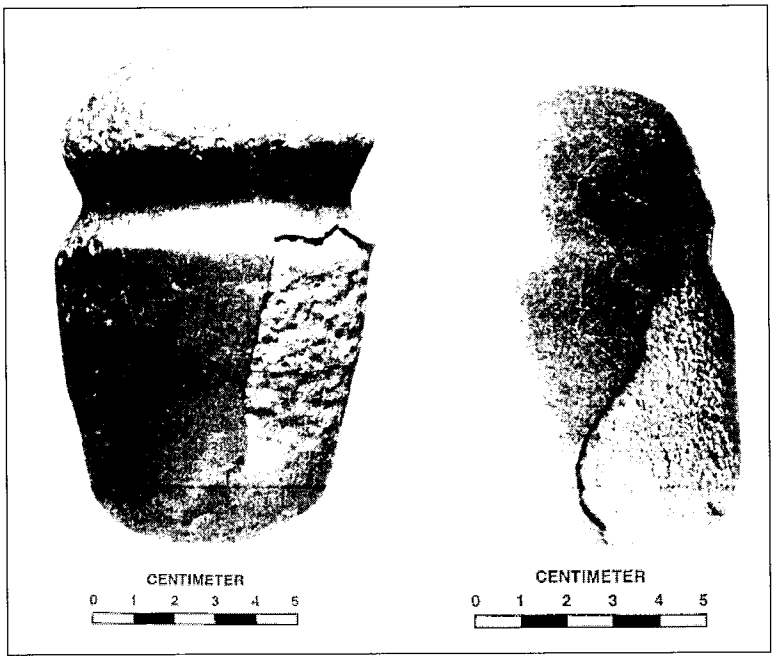
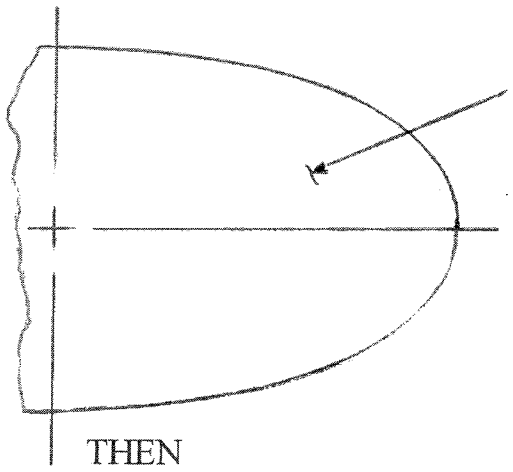
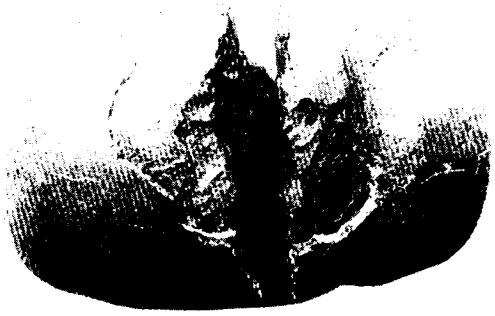


Figure 16. Exfoliation on two axes.

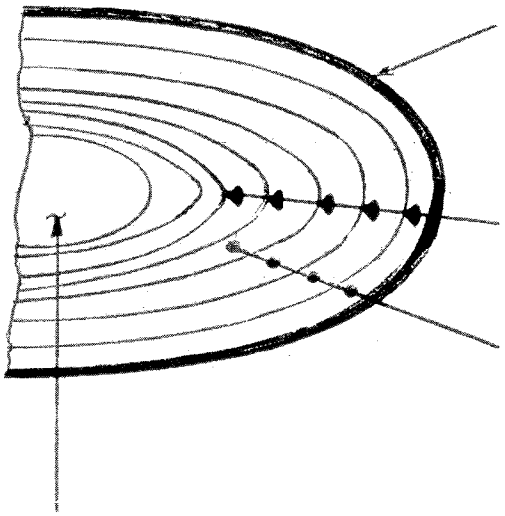


THEN

- Ferruginous sandstone, a homogeneous mixture of Fe_2O_3, i.e.: iron oxide (hematite) and SiO_2, i.e.: silicon oxide (sand)



NOW



- 1–2 mm thick shell of SiO_2 with a small admixture of iron which provides the color: tan, brown, or reddish-brown to dark gray, usually.
- Thin layers of red to orange ocher. This is the parting plane where exfoliation occurs.
- Base material, ferruginous sandstone, from which some iron has migrated to the ocher layers.

Limonite Core

- 2 Fe_2O_3 • $3H_2O$, i.e., pure hydrous ferric oxide
- color—yellow, orange, reddish-brown, brownish-black
- S.G. variable 2.9 – 4.3 as function of the different hydrated ferric oxides present

Figure 17. The composition of the hematite axe.

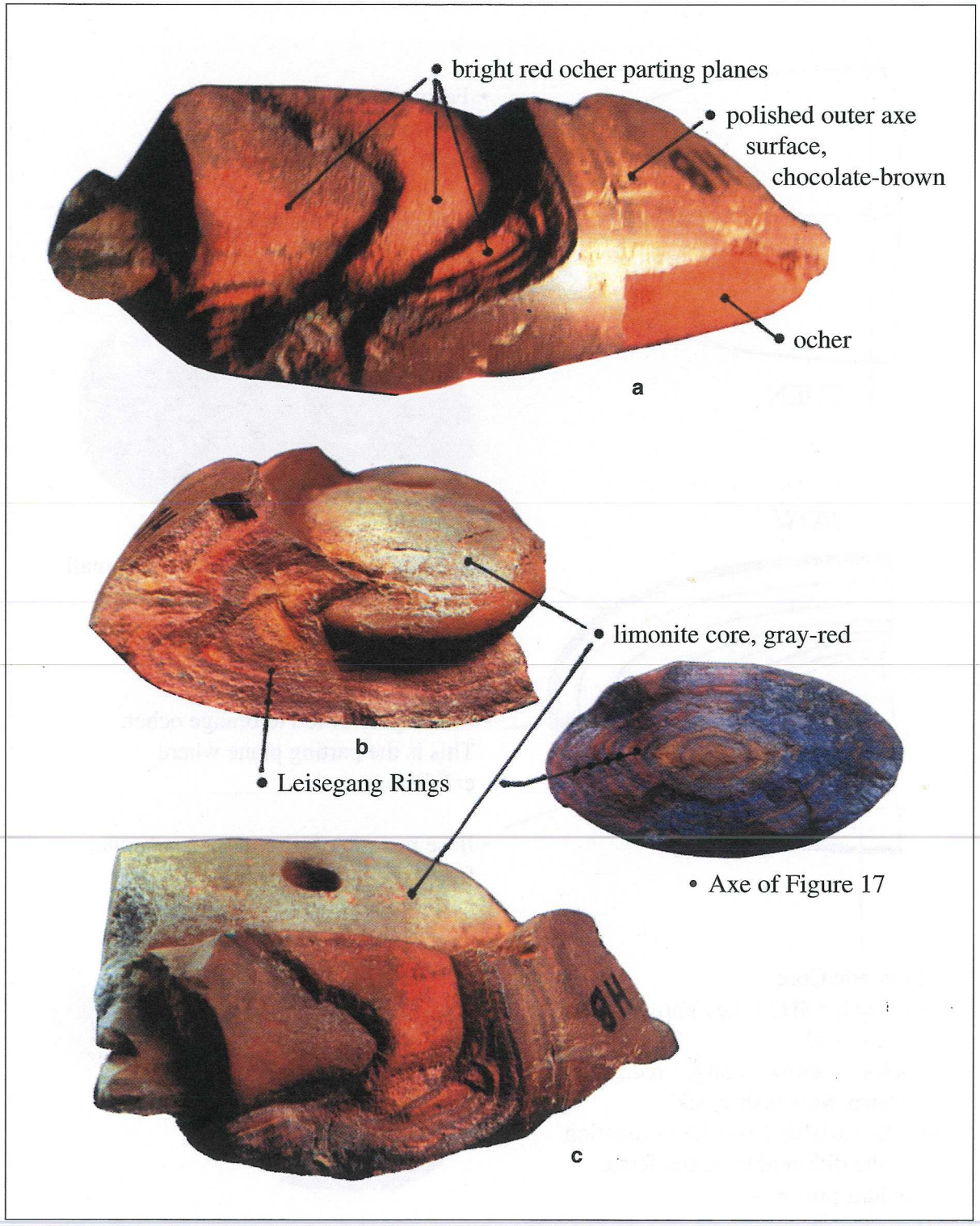


Figure 18. The internal structure of a weathered hematite axe. The limonite core, ocher parting planes, and outer surface are shown. The drilled hole showed that the limonite core is homogeneous.

the layer-influencing phenomenon remained a mystery. He concluded by stating that only the layers were considered while the layer interfaces may hold the answer.

HOW OLD ARE THE AXES?

Radiometric dates from sites with hematite axes are available for only three sites within this study area: 41AN115 (see Furman and Amick 2002; Perttula 2002); the Resch site (41HS16, see Webb et al. 1969); and the third is the Conly site (16BI19, see Girard 2000) in Bienville Parish, Louisiana. At other sites, I compare axe and dart projectle point associations.

The Furman-Amick site (41AN115)

The Anderson County site is the farthest southwest of the sites shown in Figures 2 and 3. It is on an alluvial terrace on the western side of Town Creek, and about 6 km in the closest direction to the Trinity River.

The site was being commercially mined for sand when Furman and Amick received permission to collect artifacts being exposed. Two axes had previously been found by the equipment operators. In the course of their collecting they recovered projectile points spanning the Late Paleoindian to the Woodland period. In addition, Archaic tools such as gouges, grinding slabs, knives, pitted stones, and pitted manos were found. Three hematite axes were also found as well as an axe preform (see Figures 8g and10d).

A mining cut exposed a concentration of ash in a vertical wall. Furman and Amick excavated the feature (an ash lens at 107-122 cm bs). Associated with this were a flake knife, a scraper, a broken biface, and several lithic flakes. Charcoal from the ash provided a calibrated age range of 4000-4400 B.P. (Perttula 2002). Unfortunately no hematite axes were nearby or associated with the feature.

The Resch site (41HS16)

The Resch site is located approximately 15 km south-southwest of Marshall on a 7 or 8 foot terrace above the floodplain on the east side of Potters Creek. Webb et al. (1969) describes the site and the archeological work in detail.

Among the artifacts from the site were bifaces, pointed pebble tools, pebble choppers, as well as unifacial tools. Ground and shaped tools, mostly of ferruginous sandstone, included mortars, pitted stones, mullers, mauls or hammerstones, anvils, and flat slabs. Two polished hematite axes and a hematite celt were found as well as a polished hematite gouge. The axes were in level 8 (42-48 inches bs) and level 9 (48-54 inches bs). At these levels, which are below a midden, in addition to the axes, were four pitted stones, three pointed and chipped pebbles, three small flake tools, two Ellis, two Palmillas, one Kent, and seven Gary points. In level 7, directly above the axe levels, were 132 dart points. Included in this group were nine Yarbrough points.

Radiocarbon dates were determined from charred nut hulls from levels 3 and 4 (combined for a sample), from level 5, level 6, and combined levels 7 and 8. The results and Dr. Webb's comments, were:

> Tx-482 Level 3 & 4 date: 2250 ± 140 B.P. (300 B.C.). Comment: date earlier than expected;
>
> Tx-484 Level 5 date: 2360 ± 130 B.P. (410 B.C.). Comment: earlier than anticipated from this level, which should not date before Marksville times;
>
> Tx-481 Level 6 date: 2150 ± 130 B.P. (200 B.C.). Comment: date consistent with occurrence of Tchefuncte sherds in this level, but by stratigraphy should be earlier than Tx-484;
>
> Tx-483 Level 7 & 8 date: 1850 ± 90 B.P. (100 A.D.) Comment: too recent in view of dates from higher levels and indications of pre-Tchefuncte or Tchefuncte time range.

According to Webb, the dates are generally satisfactory in that the major occupation is contemporaneous with the Marksville and Tchefuncte periods, judging from trade sherds. Based on the radiocarbon dating of the nutshells from level 7-8, where one of the axes was found, a date of 1850 B.P. was recorded that is too recent. Thus, we do not have a reliable radiometric date for these axes from the Resch site, only that the axes were associated with dart point types Ellis, Palmillas,

Yarbrough, Gary, Kent, and Delhi. The Delhi point is found in Poverty Point sites in Northeastern Louisiana. The point is dated from 2500 to 4500 B.P. The axes likely date within this period.

The Conly site (16BI19)

Girard (2000) reported on the Conly site. The site is the farthest south of the sites shown in Louisiana (see Figures 2 and 3). It is located on the eastern side of Loggy Bayou, which heads at the dam of Lake Bistineau and discharges into the Red River. It is located approximately 10 km upstream of the juncture with the river.

The buried landform of the site is overlain with 2.6 to 3.8 m of multiple clay layers with a deep cap of silt. Thus, the site is a sealed time capsule. Concerning the chronology of the site, Girard (2000:62) wrote:

> Eight radiocarbon dates indicate that occupation of the Conly site took place primarily in the period between 7500 and 8000 years ago. One result is slightly anomalous given its context and the other results. The landform on which the site is located was available for occupation prior to this time but there is no firm evidence that the site was used prior to the Middle Holocene. No other site in Northwest Louisiana is known to sample a discrete period of time this early in prehistory.

Within the midden were various tools including grinding stones, both pitted and unpitted, abraders, hammerstones, scrapers, dart points, and the proximal 60% of a hematite axe. The axe is full grooved and manufactured by pecking and grinding to shape. The color of the axe is a yellow tan, and the surface can be easily scratched. The weight is 252 grams and it displaces 70 cubic cm. Thus, its specific gravity is 3.6 g/cc, which is well within the range of limonite (see Figure 17). Because of the age of this tool, chemical weathering has changed it completely from its original composition as ferruginous sandstone to limonite. In this process, the original silicon oxide is still present but the hematite or ferric oxide has combined with the water to become limonite. Whether or not this axe weathered through the exfoliation stages or directly to limonite is not known.

In addition to the axe, several scrapers and 12 dart points were recovered. One classic Albany scraper was also found. Girard (2000:42) describes the dart point assemblage as follows:

> The Middle Archaic period residents of the Conly site primarily used stemmed dart points with squared to slightly barbed shoulders. Stems were rectangular to slightly expanding with straight or slightly convex bases. These points were made from local pebble cherts. Although some specimens resemble Evans points in overall form, the distinctive blade notching of that type was not used. Given that (1) the raw material isn't of the highest quality, (2) shapes of blade margins probably varied with resharpening, and (3) shoulders may have been broken and rechipped, the morphological variation present in the collection is not surprising. I do not think that it is necessary to assume that the variation is related to different stylistic traditions. Rather it could have resulted simply from the different skills of individual knappers and from varying wear and re-sharpening histories of the specimens.
>
> The novaculite points. . . however do seem to be stylistically different. They appear to relate to the Johnson type, a form more prevalent in Arkansas and eastern Oklahoma than in Louisiana and northeast Texas. If dart point styles reflect social or other cultural variation, it is possible that the Conly site inhabitants were culturally-distinct contemporaries of, and in contact with, their Tom's Brook culture neighbors to the north.

Schambach (1998) has noted that the Johnson points were found in the earliest occupations at the Cooper and Paw Paw (3OU22) sites in the Ouachita River drainage in southern Arkansas. Schambach (2002) found a stone grooved axe, in situ, at the Paw Paw site. The axe pertain to the Middle Archaic Tom's Brook culture. From this same stratum, hickory nut shells yielded a radiocarbon date of 6640 ± 70 B.P. This date calibrates to 7614-7655 B.P., which indicates that the people of the Paw Paw site and the Conly site were roughly contemporaneous. *So are the axes of the two sites.*

Brookes (2005) commented that in Mississippi grooved axes are most common in the northeast

hills. At one site with axes in Monroe County, all but two of 150+ dart points were Middle Archaic in age. Of these two, one was a Dalton and the other an Early Archaic Plevna type. Of the Middle Archaic points, 95% were of the Sykes type with a few Benton points present. Sykes points are earlier than Benton points (Lewis and Lewis 1961). In Pontotoc County a series of dates for a Sykes component ranged from 5650-5320 B.C., or 7270-7600 B.P.

On the Monroe County Sykes point site, a number of grooved axes and fragments of grooved axes were found. All were of locally available sandstone. The material graded into limonite and some into a conglomerate. Brookes assumes the large number of axes were associated with the major Sykes component at the site. All of the axes are fully grooved.

Brown (1926) defined the Aberdeen axe types (see Figure 8). The specimens noted by Brown were made of a "heavy dark ferruginous sandstone." Brookes (2004) indicates that the Aberdeen axes, which have been associated with Benton Culture artifacts, are slightly later in time than the full grooved style. He further suggests that in Mississippi grooved axes appeared fairly suddenly around 5500 B.C. and disappeared just as suddenly around 3000 B.C.

The Yarbrough site (41VN6)

The Yarbrough site (Johnson 1961) is located in the Sabine River drainage in Van Zandt County (see Figures 2 and 3). The site was on a naturally formed rise on the Sabine floodplain. Johnson (1961) analyzed the artifacts, including naming various subtypes for some of the dart point forms. Based on artifact depths he recognized that changes in popularity of types occurred from excavation bottom to the surface, in four periods: Period 1 had Clovis, Plainview, Meserve, and San Patrice dart points, and was a Paleoindian period. Period 2 had the Archaic points Yarbrough, Ellis, Edgewood, and Morrill (*var. San Pedro*). All but Morrill (with straight stem) are expanding stem dart points. Period 3 was marked by contracting stem points, the *Runge* variety of Gary, Yantis points, along with Period 2 points. Period 4 has pottery sherds (n=50) with a few arrow points (n=4). The dart points from Periods 2-3 continue through Period 4 but become smaller in percent as Gary, Kent, and Morrill (*var. Slocum*) increase in number.

Four hematite axes were found at the Yarbrough site. Two were polished axes with a full groove. One had apparently been shaped by percussion flaking, then ground smooth. One had been shaped by pecking and then ground smooth. Two broken axe blade sections were found, and one appears to be a Fouche Maline style double-bitted chipped stone axe (see Figure 8). The other large bit fragment was percussion-flaked from a probable parallel-sided ferruginous sandstone slab. This blade has a limonite cortex on its photographed side and was lightly ground on both faces (see Figure 12 for an example of a similar axe).

One axe was found at a depth of 44 inches, another at 47 inches, and two axes were at only 11 inches bs. Within the midden, and between 38-53 inches bs, which is both above and below the axe levels, the following artifacts were found at the Yarbrough site: one grinding slab, three ferruginous sandstone gouges, four knives, 12 scrapers, 12 Yarbrough points, three Ellis points, three Edgewood points, one Trinity point, one Wells point, and one Morrill point (*var. San Pedro*).

The Jim Bayou site (41MR79)

This Marion County site is located about 2 km north of Caddo Lake and 1 km west of the Louisiana-Texas boundary line and is on the east side of the bayou. Pam and Danny Stanfield had excavated two 1 x 1 m squares at the site, and one was excavated to 135 cm below surface (bs) to the underlying clay, in which at 4 or 5 cm was a hematite axe. The second square was excavated to 140 to 150 cm bs to the clay, and at that juncture another hematite axe was found. The bit of one axe had been broken in antiquity about 8 to 10 mm back from its probable original cutting edge. The other axe bit was unbroken but was well worn with a rounded edge of 1-2 mm radius; it was not sharp.

A very few pottery sherds were near the surface. Between 40-50 cm bs was an Ellis point, at 60 cm was an unidentified expanding stem point, while between 60-80 cm was a biface, a biface scraper, two distal ends of dart points, two dart point stems (probably of the Gary type), and a broken biface proximal end. At 80 cm the proximal end of an unidentified expanding stem dart point was located. Between 80-100 cm bs were the proximal ends of three Edgewood points. Two bifaces were in these levels. At 100 cm bs was a single flake biface. The deepest artifact found, other than the axes, was an Ellis point. This was the first artifact above the axe level and was at 120 cm bs.

All dart points from the depth of the axes upward in the units are Ellis, Edgewood, or expanding stem points except for possible Gary stems between 60-80 cm bs. The closest artifacts to the axes in depth are all expanding stem points as at the Yarbrough site.

Chronological Conclusions

The Louisiana, Arkansas, and Mississippi dates from sites with axes indicate grooved axes were present between 7500-8000 B.P. (Figure 19), with other sites with axes dating sometime after that. Within the Northeast Texas area 41AN115 provided a date which probably is within the span of hematite axe manufacture and use, namely the late part of the Middle Archaic. The Resch site dates pertain more to the pottery complexes at the site than to the age of the axes found there.

To better determine the association between the axes and various artifacts and thus arrive at a better understanding of the age of hematite axes in Northeast Texas sites, I examined differences in dart point styles at several sites in the region (Table 7). From these sites, the highest number of the Middle Archaic points associated with the axes are Yarbrough, Ellis, Edgewood, Wells, Morrill, and Bulverde types (Figure 20). These are either expanding stem or straight stem dart points. Calf Creek points were found in three of these sites (see Table 7). Collins (1995:376) has dated Bulverde points in Central Texas to ca. 3300-4000 B.P., and the Bell-Andice-Calf Creek points to 5000-6000 B.P.

Of the sites, all but the Oak Hill site had ferruginous sandstone gouges (see Table 7). The gouges are more plentiful than the axes and are probably contemporary with them. During the Late Archaic and Woodland periods, Gary dart points predominate on the surface of these sites and may be associated with the axes found on the surface. This Late Archaic period was a time of population growth in the area (Cliff 1998), and thus a time of more dart point loss.

The presence of axes on the surface of these sites can be accounted for by the churning of soils that has occurred over thousands of years. The upward and downward movement of artifacts caused by rodent and other animal burrowing and digging and the effect of the upheaval caused by uprooted trees can move artifacts to the surface. Trees are uprooted in the East Texas sandy soil after soaking rains and the high winds of storms and tornados. By personal observation, uprooted trees, pines and hardwoods both, bring to the surface a fat pancake of soil from 5-7 feet in diameter. In general, the older the artifact originally deposited on a non-aggrading sandy surface the deeper the artifact will be found. This is exemplified by the Yarbrough site analysis by Johnson (1961). Bruseth and Perttula (1981) provide a description of the bioturbation phenomena in the region.

More radiometric data are needed from Northeast Texas sites that contain hematite axes and contemporary artifacts. Eventually, alluvium-covered buried sites which meet this criteria will be found.

SUMMARY AND CONCLUSIONS

The hematite axes occur within Northeast Texas, with the highest concentration along and north of the Sabine River drainage (see Figures 1-3). Within Arkansas and Louisiana, along the Red River, the terrain where the axes are found are sand-covered red clay hills containing ferruginous sandstone, as in Northeast Texas, except for the Conly site in a riverine setting.

Axes are found in association with expanding stem dart points Yarbrough, Edgewood, and Ellis as well as straight-stem Bulverde, Wells, and Morrill, *var. San Pedro* (see Table 7 and Figure 20). These points are believed to date between ca. 2500-6000 B.P. In Northeast Mississippi, the Aberdeen style axes are part of the Benton Culture, which dates from 6000-7000 B.P. If the Aberdeen axes of Mississippi and Texas are coeval in time, then the axes in the study area were made as early as 7000 years ago. Radiometric dates and dated artifacts associated with the hematite axes range through the Early-Late Archaic, and it appears that the hematite axes were made and used during the entire Archaic periods.

ACKNOWLEDGMENTS

The people listed below, with the institutions with which they are affiliated, all provided the axes from their collections for me to photograph and measure. Most gave hours of their time helping me with the hands-on part of the project. In addition they contributed their knowledge concerning hematite axes, which was considerable, and which I have built on and used. Without their help this report would be lacking.

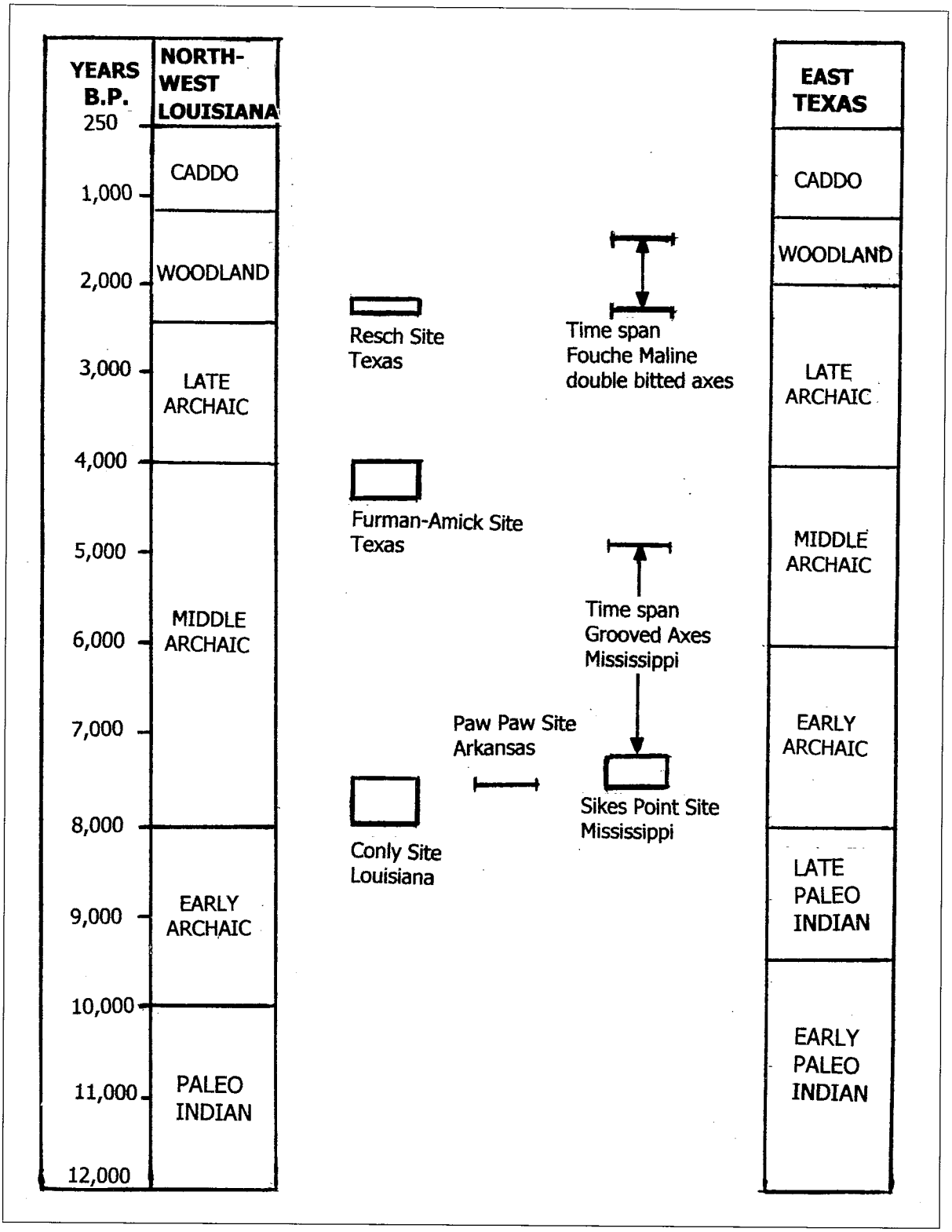


Figure 19. Chronological charts, Perttula (2005) for East Texas and Girard (2000) for Northwest Louisiana. Radiometric dates for several previously discussed sites and time spans for two axe forms are also shown.

Table 7. Association of the hematite axe with various dart points ands ferruginous sandstone gouges.

Dart Pts.	Furman-Amick 41AN115 MS*	Yarbrough 41VN6 EX	Highway 21 41CP19 S	Williams 41CP10 EX/S	Pilgrim's Pride 41CP304 EX/MS	Oak Hill 41RK214 EX/MS	Resch 41HS16 EX	Grace Creek #1 EX/S	Grace Creek #2 S	Jim Bayou EX
Late Archaic and Woodland										
Gary	23	88	117	40	31	20	276	211	53	2
Kent	6	9	13	1	3	14	42	13	2	–
Elam	5	2	–	–	3	–	8	3	2	–
Ensor	6	1	–	–	–	–	–	8	2	–
Middle Archaic										
Yantis	–	3	7	–	–	–	2	–	–	–
Bulverde	5	3	1	2	1	4	1	12	9	–
Trinity	2	2	11	–	–	–	1	2	–	–
Edgewood	4	17	6	1	1	1	–	2	2	3
Wells	6	5	6	–	4	19	5	24	3	–
Morrill	1	14	1	4	–	7	–	6	–	–
Ellis	–	8	3	–	1	11	45	93	29	2
Yarbrough	2	52	17	9	6	58	15	32	25	–
Calf Creek	3	–	1	–	3	–	–	–	–	–
Misc. Exp. Stemmed	–	2	2	–	11	–	–	–	–	2
Axes	5	4	2	3	3	4	2	5	6	2
Gouges	8	13	6	1	3	–	1	9	11	–

S=surface collection; EX=excavations; MS=machine-scraped

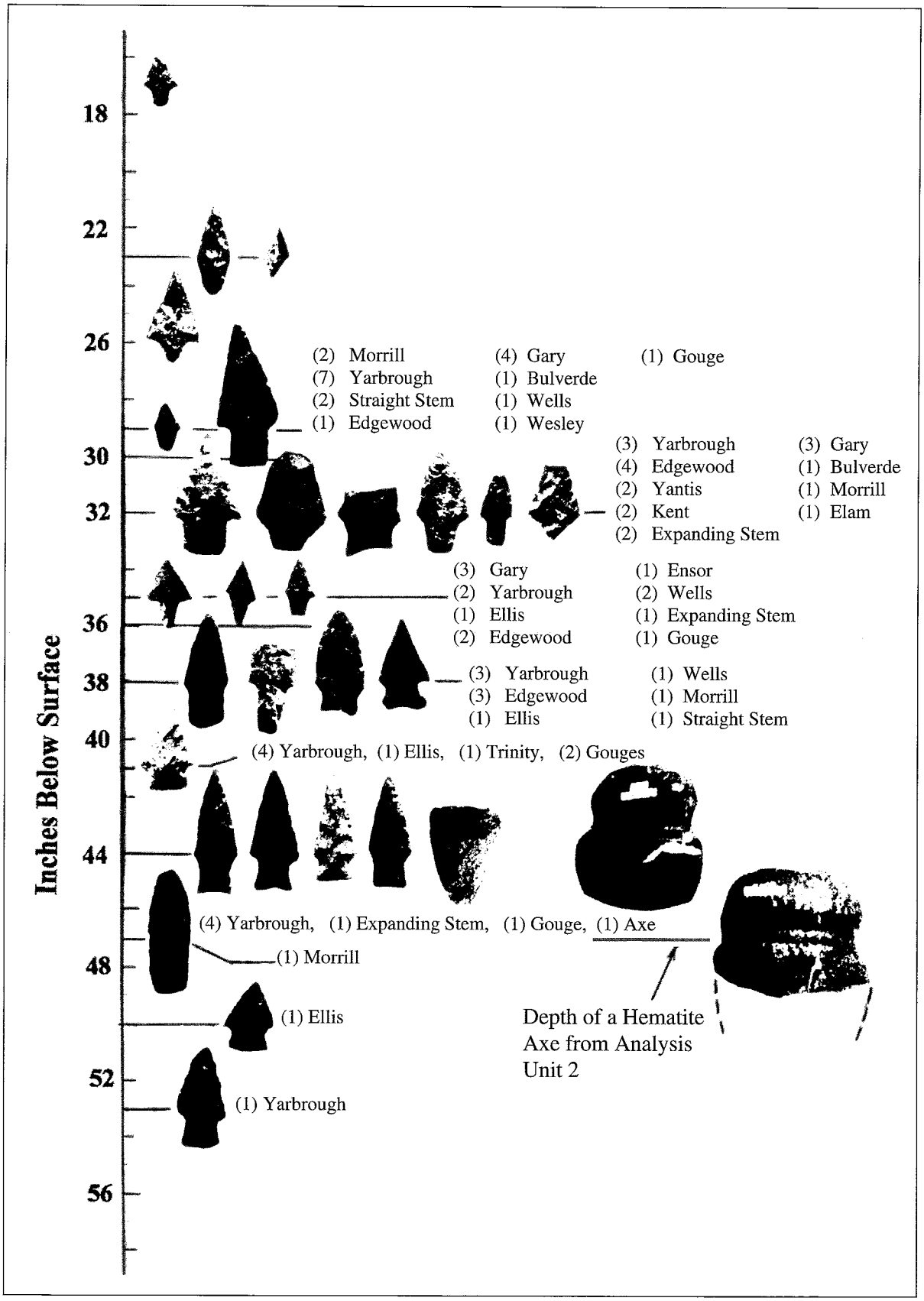


Figure 20. The depth below the surface of axes, dart points, and gouges from Analysis Unit 1 at the Yarbrough site.

Institutions

Arkansas Archeological Survey; Southern Arkansas University, Magnolia, Arkansas (Frank Schambach and David Jeane)

Bossier Parish Library Historical Center, Bossier City, Louisiana (Nita K. Cole, Curator and Archivist)

Franklin County Historical Association, Mount Vernon, Texas (B. F. Hicks, Trustee)

Gregg County Historical Museum, Longview, Texas (Genia Northcut, Director)

Louisiana State Exhibit Museum, Shreveport, Louisiana (Mary Zimmerman, Director)

Mount Pleasant Public Library, Mount Pleasant, Texas (Janet McCoy, Curator of the Cross Collection)

Northeast Texas Rural Heritage Museum, Pittsburg, Texas (Vernon Holcomb, Vice President)

Northwestern State University of Louisiana, Natchitoches, Louisiana (Hiram F. Gregory and Jeffery S. Girard)

Texas Archeological Research Laboratory, The University of Texas, Austin, Texas (Darrell G. Creel, Director; Laura Nightengale, Curator; Michael Collins)

Texas Historical Commission, Austin, Texas (Mark Parsons)

The Texas Historical Commission Archeological Stewards listed below all gave me help by providing artifacts for this study, or information, both positive or negative, concerning the whereabouts of hematite axes. I appreciate the help they have given me: Bryan Boyd, Gregg County; Lee Green, Hopkins County; Patti Haskins, Gregg County; Tom Middlebrook, Nacogdoches County; Pam Stanfield, Marion County; and Mark Walters, Smith County.

The following people allowed me to study their axe or collection of axes for this article. Again, the discussions we had provided many clues as to which direction I should look to make this paper interesting. Every one of them has made a contribution: Bill Adams, Clyde Amick, Sam Brookes, Preston Combest, Willie Fields, George French, L. H. Henderson, B. F. Hicks, Vernon Holcomb, Dorothy Hudnall, Marvin Hudson, Tommy Johns, Jay Jones, Floyd Kent, Steve Moore, Bo Nelson, J. W. Oglesby, Jim Rohus, Charles Smith, Fred Smith, and Teri Wilson.

Special thanks are due several individuals for help on this project. Nancy Kenmotsu provided the first hillshade map (Figure 2). This led to the digital elevation map by P. R. Blackwell of Figure 3. Michael Collins discussed hematite axes with me. Collins had a copy of Gustofson's paper which concerned the exfoliation of the axes. I had been searching for a copy of this article without knowing the author or title after being given a clue to its existence by Larry Banks. In addition, personal observations by Collins, on the dispersion of iron oxides in sandy soil, was an eye opener.

Vernon Holcomb's broken axe, Figure 17, was a near perfect example of the Liesegang Ring phenomena, and the change of composition of the axe with time. This started my search for the cause of exfoliation. Bo Nelson has contributed axes and preforms for this study. His unmatched knowledge of the Archaic sites of Northeast Texas, which he shared, and the association of axes with other artifacts, was a great help.

Mark Walters loaned me a text on pedology and weathering which was pertinent to understanding exfoliation. Mark had also heard of the Liesegang Ring phenomena but only remembered the word started with an "L." It was fun chasing this down. Eventually we both found it. Mark introduced me to Sam Brookes' papers which contained the axe information from Mississippi. Brookes sent an updated revision of one of his papers as well as a copy of Brown's chapter which included the Aberdeen axes of Mississippi.

I could write an interesting page about each person who has assisted on this project, but will end by saying I thank all of you.

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Excavations at Presidio Nuestra Señora de Loreto de la Bahía del Espíritu Santo

Anne A. Fox and Steve A. Tomka,
with contributions by Harry J. Shafer, Helen Dockall, Johanna Hunziker, Mark Wolf, Kristi Ulrich, and Cecil Calhoun

ABSTRACT

In 1968 the seventh Texas Archeological Society Field School was held at the second location of Presidio Nuestra Señora de Loreto de la Bahía del Espíritu Santo on the left bank of the Guadalupe River near Victoria. The presidio was occupied between 1726 and 1749. A combination of hand-excavated 5 x 5 ft. units and shovel- and trowel-excavated trenches produced a large number of Euro-American and Native American-made artifacts from the southern and central portions of the site. Excavations in the northern portion of the landform sampled a multi-component prehistoric site that yielded a rich Austin phase component.

BACKGROUND TO THE 1968 TEXAS ARCHEOLOGICAL SOCIETY FIELD SCHOOL

In June of 1968 the seventh annual Texas Archeological Society (TAS) Field School was held at Presidio Nuestra Señora de Loreto, on the left descending, or east, bank of the Guadalupe River about 12 km north of the city of Victoria (Figure 1). The site, 41VT8, was first recognized and visited by Cecil Calhoun, Virgil Branch, and Smitty Schmiedlin in 1963 after E. E. Studer, a local collector, showed them Goliad ware and majolica fragments picked up in the area. It was recorded by Calhoun in 1966 and identified by him as the second location (1726 to 1749) of Presidio Nuestra Señora de Loreto de la Bahía del Espíritu Santo. At the time of its discovery, the site consisted of scattered limestone remains and Spanish Colonial artifacts in a mott of anaqua trees, extending into a sandy field on the edge of an old river terrace (Figure 2). Surface collections from the site included sherds of Spanish Colonial and Indian ceramics, and fragments of clay daub and marine shell (Site Survey form on file at Texas Archeological Research Laboratory [TARL], The University of Texas at Austin).

For many years historians had not known the exact location of this site. However, speculation fueled by the research and random excavations of local history enthusiast John Jarratt threatened to make its location common knowledge in the Victoria area, thus inviting trespassing and digging by artifact collectors. The existence of an Archaic site on the edge of the terrace just north of the historic site added to the attraction of the location and brought further urgency to the systematic investigation of the site. In April 1968 Calhoun contacted E. Mott Davis of the University of Texas at Austin, and suggested that the TAS hold its upcoming field school at the site.This publication summarizes the investigations carried out at the site and the results of the analyses of several artifact categories, including historic and prehistoric artifacts, and faunal remains recovered from the site.

THE 1968 FIELD SCHOOL

Calhoun's suggestion for a TAS field school at the site was well received by an enthusiastic Davis and after considerable correspondence and a certain amount of arm-twisting, the following roster of officials was announced:

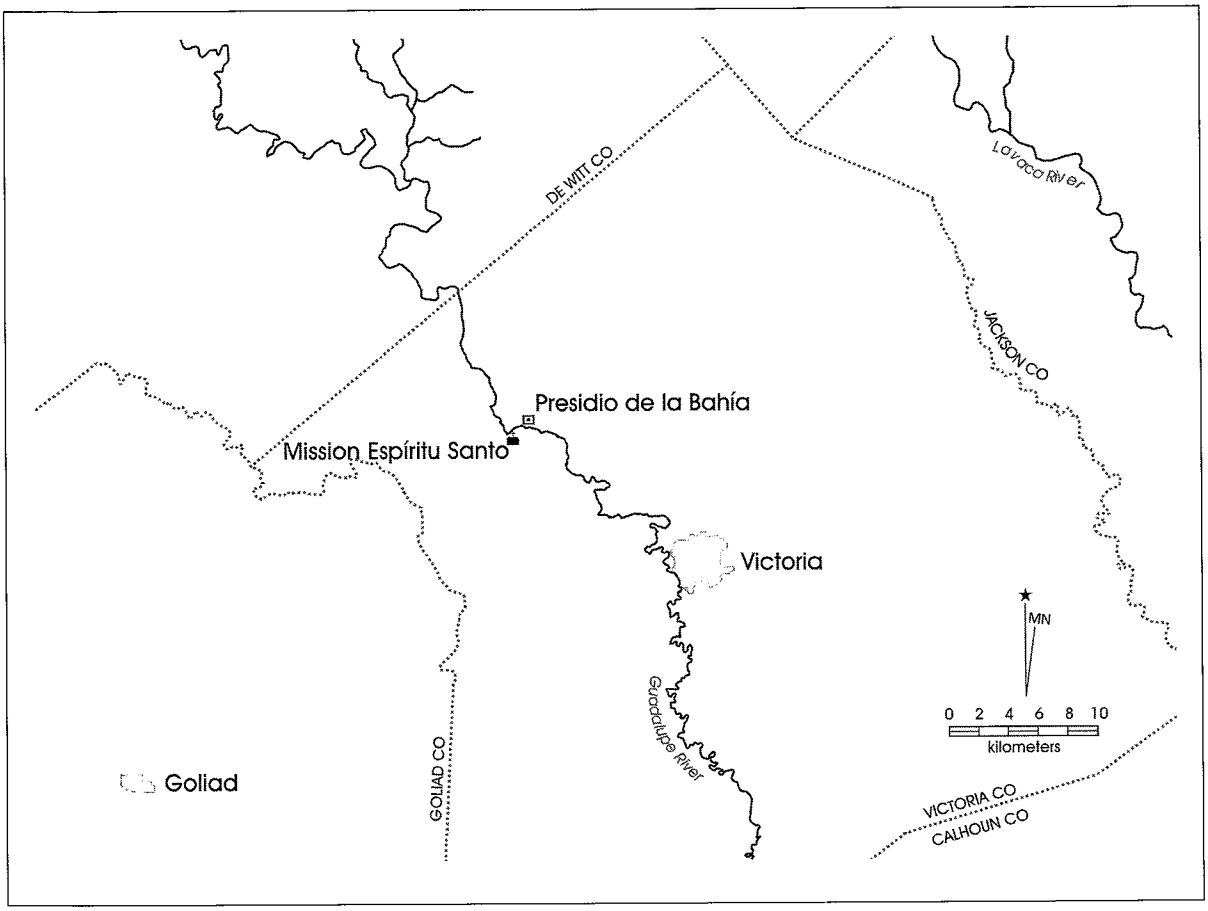

Figure 1. Location of Presidio Nuestra Señora de Loreto de la Bahía del Espíritu Santo and Mission Espíritu Santo de Zuñiga.

Field School Director — Dr. E. Mott Davis

Camp Director — Turkey Zoeller

Crew Chiefs — Charles Bandy, Claude Brown, Dick Bowen, Charlie Bollich, C. K. Chandler, Lou Fullen, Paul Lorrain, Smitty Schmiedlin, Bob Turner, and Jim Word

Laboratory Directors — Joe Ann Calhoun and Dorothy Word

During preparatory planning, the decision had been made to concentrate this field school on training participants in site survey, mapping, and record keeping. Many of these practices were to be instituted for the first time in the short history of TAS field schools with the hope that repeated exposure of members to these methods would create a group of individuals who would be capable of recording sites and carrying out salvage excavations should such need arise.

Before the participants arrived, a group of volunteers from Corpus Christi had mowed, sprayed, and cleared brush to prepare a large mott of anaqua trees for the camp site and cleared the archeological areas so that crews could immediately engage in learning to pace off and map the site. The field school began on Friday, June 15, and ended on the following Saturday, June 23, just hours before Tropical Storm Candy made landfall.

Under Mott's direction, every participant was required to spend the first day attending a talk on the history of the site and the reasons for locating the field school there, learning to fill out a survey form, and drawing a map of the entire site. The work day consisted of a morning segment from 7:00 to 11:00 AM followed by an afternoon session from 1:00 to 3:30 PM. Free time was enjoyed by all until 6:00 PM with dinner scheduled at that time, followed by an evening lecture at 8:00 PM. A number of the planned evening lectures were cancelled due to rain showers through the later part of the week.

About 147 people in all were present during the week. Of these, about 70 or 80 participated on the dig each day. They were divided into crews averaging eight people to a crew. TAS members with field experience were chosen to be crew chiefs, with the responsibility of overseeing the excavations, teaching excavation techniques, and ensuring that every crew member kept a daily log.

CONDITIONS ON THE SITE

In the beginning the weather was warm and dry and the sandy soil near the surface passed easily through the screens. As the rain increased, screening was more difficult and the deeper levels contained a larger percentage of clay mixed with the sand, which also increased the screening difficulty. The sandy soil was also a natural habitat for numerous gophers (Attwater's Pocket Gopher or *Geomys attwater* [Davis and Schmidly 1994:124-125]). These small, dark brown animals were burrowing everywhere on the site, and it appeared that they had been doing this for a long time. Of course, the presence of artifacts in their backdirt was probably the main reason why the site was first recognized. They continued burrowing even as the field school participants were excavating, not hesitating to throw dirt into the faces of those of us drawing profiles. The result of their constant activities was quite a bit of disturbance in what would otherwise have been the stratification in the site, which should be kept in mind while reading this article.

Figure 2. Site as it looked prior to the inception of the field school.

REGIONAL HISTORIC BACKGROUND

Spanish Activities within the Region

Presidio Nuestra Señora de Loreto de la Bahía del Espíritu Santo was first built in 1722 on the site of La Salle's Fort St. Louis on Garcitas Creek (Figure 3; Castañeda 1936:136). Mission Espíritu Santo de Zúñiga was built nearby to minister to the Karankawa Indians. After the local Indians revolted, murdered the captain, and deserted the mission, the mission was moved in 1726 to the Guadalupe River north of the present town of Victoria (Hindes 1995). Shortly afterward, a larger mission was established about 12.3 km to the north on the west side of the river in what is now Mission Valley. The presidio was moved from Garcitas Creek to a spot across the Guadalupe, about three-quarters of a league (ca. 2 miles) downstream from the mission (Oliver 1931:26). The move involved about 200 people, including the missionaries, the officers, soldiers and their families, and four private citizens (Governor Almazan to Viceroy Casafuerte, July 4, 1726. Archivo General de Mexico, Provincias Internas CCXXXVI).

General Pedro Rivera visited the presidio the following year and was impressed with the way the presidial commander, Captain Juan Antonio Bustillo y Cevallos, was running the fort. There were 90 soldiers stationed there, and he observed their uniforms and drill and remarked on their skill in managing their weapons. He did, however, recommend that the number of soldiers be cut to 40 because "this place has no enemies against whom it needs to guard itself" (Naylor and Polzer 1988:249), and the shallow bay and swampy shores in the area acted as a natural defense against foreigners.

In 1730 Don Gabriel Costales became captain of the presidio. In 1743 Costales resigned because of illness, and was followed by Don Joachin de Orobio y Basterra, an energetic, resourceful, and industrious leader. During his administration Governor José de Escandón of the new province of Nuevo Santander was granted territory along the Gulf Coast as far north as the Bay of Espíritu Santo,

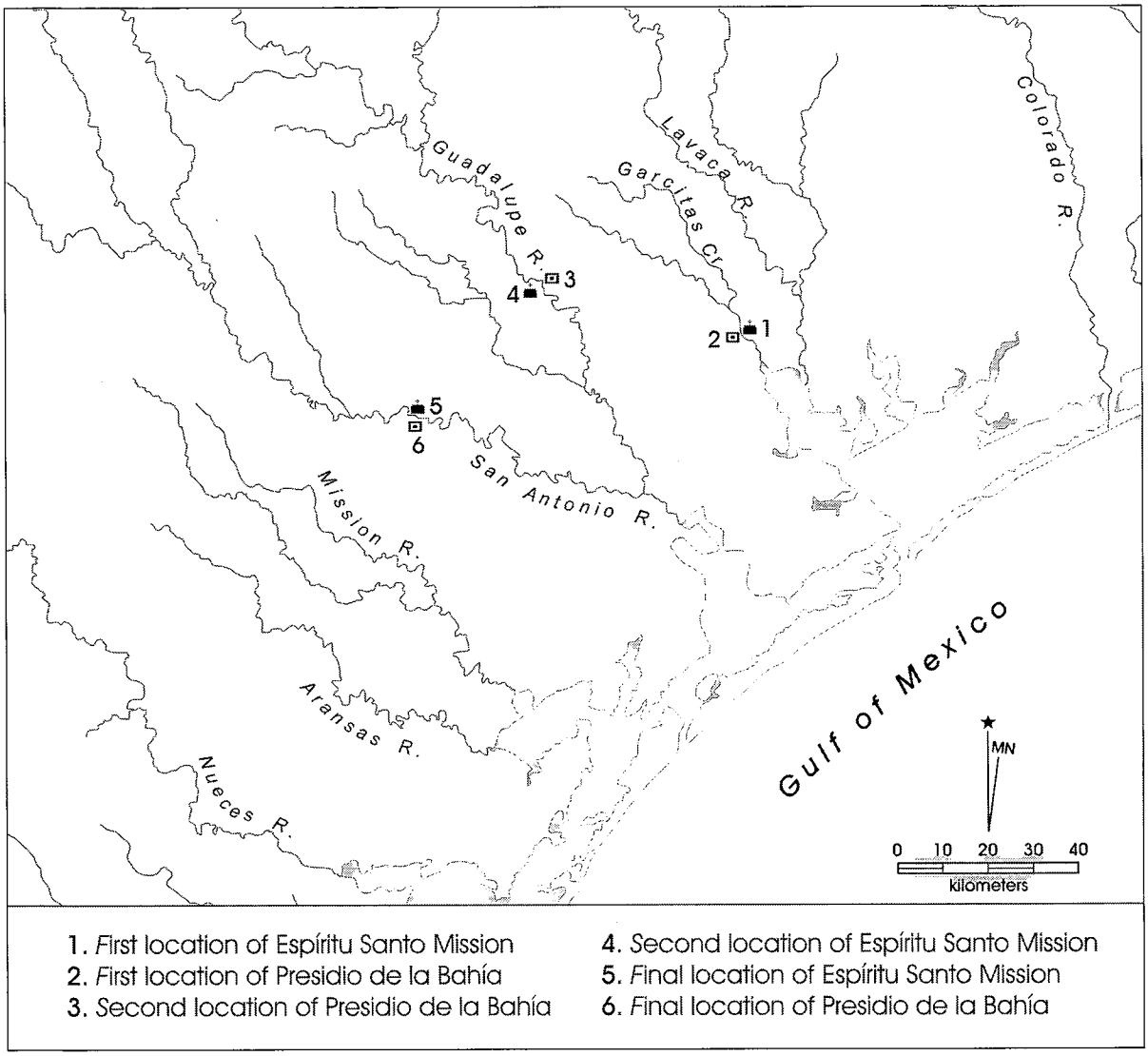

Figure 3. Approximate location of the three sites of Presidio Nuestra Señora de Loreto de la Bahía del Espíritu Santo and Mission Espíritu Santo de Zuñiga.

which included Presidio Loreto (José de Escandón to the viceroy, February 10, 1749. Archivo General de Mexico, Historia XXIX). In 1746 Escandón sent the Loreto commander with a complement of soldiers to explore the area between the Guadalupe and the Rio Grande rivers (Bolton 1970:293). Their report resulted in an order in 1749 to remove the presidio to the San Antonio River to guard the road to the Rio Grande. The mission and presidio were moved to the location of the present town of Goliad that same year. The move was accomplished in record time, the men carting off "the bells, doors and everything that was moveable" (Ramsdell 1934:13) to the new site.

Both before and during the field school there was considerable speculation about the shape and size of the presidio, since there was little evidence visible on the surface. Spanish military engineers had been designing complex fortifications based on the French pattern since the early 18th century. In Texas, the first site of Presidio Los Adaes, built in 1721, had a hexagonal plan with three bastions (confirmed in Gregory 1973:Figure 3). The first site of Presidio Loreto on Garcitas Creek built in 1722 under the supervision of the Marqués de Aguayo and confirmed by recent Texas Historical Commission excavations, was octagonal with four bastions (Gilmore 1973:Figure 5). The presidio at

San Antonio, also planned by the Marqués de Aguayo in 1722, was intended to be built in the form of a square with four bastions, but was never completed (Gomez 1991).

History of the Presidio

No record has been found of what was planned for Presidio Loreto when it was moved to the Guadalupe in 1726. By 1744, Governor Thomás Phelipe Winthuisen reported that the presidio had "always been in a state of deterioration, due to the scarcity of stone and timber," (Magnaghi 1984:174) and roofs thatched with *zacate* (grass) had caused many fires. The picture the governor paints suggests that Governor Almazán's enthusiastic description of the area in 1726 may have exaggerated the possibilities that ample stone could be found based on his observation that there was an abundance of stone two leagues distant from the proposed site (Oliver 1931:93-94). Since several reports bemoan the lack of building stone in the area, it seems likely that many of the buildings at Presidio Loreto would have been primarily of jacal construction, consisting of vertical logs set in trenches and chinked with mud. Only archeology could reveal these and whether there was a palisade fortification wall such as the one recently found at the first site on Garcitas Creek. Unfortunately, no such trenches or walls were found during the field school excavations. The only deposits of stone observed on the site were concentrated in Divisions 36, 37, 45, and 46 where the local historian had done his investigations. Since 19th century burials were found there, it seems likely that this was the chapel of the presidio. Evidently the custom of burying people in recognized, earlier church sites was not unusual at that time.

The only other description of the presidio found so far is included in a report by Captain Orobio in 1748 telling of the observation of the death of King Philip the Fifth and the coronation of King Ferdinand the Sixth (Ramsdell 1934:5). The various activities involved the guardhouse, the church, the officers' quarters, and the plaza, suggesting at least a minimal formality in the arrangement of the fort. No mention is made of the housing of the soldiers. A map of Presidio La Bahía by Joseph de Urrutia as it looked at Goliad in 1767 shows soldiers' houses scattered over an area to the north of the fort (Moorhead 1975:Plate 14). Since the local Indians in the Mission Valley area were not considered to be threatening, perhaps the same sort of arrangement around the presidio itself was acceptable at the 1726-1749 location as well.

Life at the Presidio

The tempo of life for the average presidial soldier depended primarily on the character of the commander. The disaster at the first site on Garcitas Creek was generally acknowledged to be the result of lax discipline by the commanding officer (Castañeda 1936:170). Therefore, Captain Bustillo appears to have made an extra effort to improve the situation at the new site, as is reflected in the complimentary remarks by Rivera the following year.

Moorhead (1975:178) has described the presidial soldiers as follows:

> They were neither elite troops nor raw recruits, but hard-bitten, homegrown vaqueros who were at ease in the saddle, inured to the harsh and lonely terrain in which they served, and accustomed to the cruel and unconventional tactics of Indian warfare.

Each soldier was expected to take his turn at guard duty at the fort and the missions, guarding the horse herd, and accompanying the pack train that brought supplies from Mexico. Additional responsibilities included participating in regular surveys of the coast to report on possible French or English activities. In order to accomplish these duties each soldier was required to have six horses (Oliver 1931:101). When on patrol he must wear a *cuera* (a heavy buckskin knee-length, sleeveless coat) and carry an *andarga* (an oval bull-hide shield 22 inches high and 25 inches wide) and he must carry a lance, a broadsword, a brace of pistols, and an *escopeta* (a smooth-bore, muzzle-loading musket; Moorhead 1975:186-189). Soldiers had to purchase all their own provisions, equipment, and uniforms from the supplies ordered by the captain.

The supply problem at the presidios directly affected the morale of the troops. Their pay often was not sufficient to cover the requirements of the job, particularly since most soldiers brought a family to the frontier (Marqués de Aguayo to the King, June 13, 1722. Archivo General de las Indias, Audiencia de Guadalajara). As soon as the presidio was settled on the Guadalupe River, Captain Bustillo

opened a new road to San Juan Bautista on the Rio Grande, considerably shortening the trip of the supply trains (Oliver 1931:95). Several times a year the garrison's quartermaster then led a detachment of seven to 10 soldiers to Mexico City, then to San Luis Potosí or Saltillo to collect the payroll and obtain supplies (De la Teja 1991:45). The captain bought the supplies and ran a community store, often making extra money by overcharging the soldiers. Extensive lists of recommended prices were occasionally published, including mentions of many of the provisions recovered during archeological excavations. These included chocolate, beads, muskets, broadswords and scabbards, knives, stirrups, spurs, bridles, earthen pots, copper pans, and cauldrons (Antonio de Andres to Viceroy Casafuerte, 1729; Naylor and Polzer 1988:282-286). The fact that many soldiers' families were present increases the number and types of ceramic vessels and other personal artifacts one might expect to find on the site. However, the fact that the women packed up and moved everything they owned to a new site meant that there might not be many personal artifacts left behind.

LATE HISTORY OF 41VT8 AND ENVIRONS

Cecil A. Calhoun

After the final relocation to the San Antonio River near present Goliad, Presidio Nuestra Señora de Loreto de la Bahía became a prominent pivot point of events for over 50 years during the twilight of Spanish Texas. The previous site of the presidio, dismantled and abandoned on the Guadalupe River, is seldom mentioned in surviving archives of the post-1749 period, and then is referred to only as a general landmark. For nearly three-quarters of a century the area along the lower Guadalupe remained unsettled and largely ignored. It is known to have been traversed on numerous occasions by military patrols and scouting parties from the presidio at Goliad. The terrain was apparently quite familiar to them and the activities of the local Indians required but little attention; therefore, few details were documented regarding such routine matters. Ranchos of missions Espíritu Santo and Rosario at Goliad extended south to the coast and northwest toward Bexar by the late 1700s, but no reference has been found to any establishment to the east along the Guadalupe. Families of retired presidial soldiers tended to settle in the Goliad vicinity.

In 1805 the Atascosita Road was established as a more direct route between Goliad and the lower Trinity River, fording the Guadalupe somewhat north of present Victoria (Yoakum 1855:128 and Map 1). In that same year Martín de León, a Tamaulipan ranchero born of wealthy Castilian heritage in Burgos, Mexico in 1765, saw Texas for his first time as he passed through this locale while driving livestock to Louisiana. He returned to Texas in 1807 with his family and a few kinsmen and established ranches on the unoccupied lands between the Aransas and Nueces rivers (Webb 1952:484).

In September 1821, Stephen F. Austin and his party crossed through the area while exploring the coastal plain for the purpose of selecting a suitable location for his colony of Americans. According to his diary they spent the night of Tuesday, September 4, "encamped on the Bank of the Guadalupe" (Austin 1904) in the near vicinity of 41VT8. Austin described the gently rolling prairie and was impressed by the wide, heavily timbered river bottoms with an abundance of deer and fish (Austin 1904).

Apprised of the liberal new colonization law, Don Martín de León petitioned for a grant to establish a colony of deserving Mexican citizens between the lower Guadalupe and Lavaca rivers. His application dated April 13, 1824 was approved by the commanding general at Goliad and later confirmed by the government of the State of Coahuila and Texas. The empressario, together with his eldest son, Fernando, laid out the town site of Guadalupe Victoria in October 1824. Don Martín's contract called for 41 families to be settled in his colony. Each was to receive head rights to one league (4428.4 acres), which included a labor (177.1 acres) of arable land and a building lot in the town site. Titles were issued as soon as the individual tracts were properly surveyed, a task which required nearly 10 years before it was completed. Don Fernando de León was Land Commissioner for the colony, and José M. J. Carbajal, a descendant of the original Canary Island settlers and Don Martín's son-in-law, was appointed surveyor. The new colony was distinctive as the only one composed entirely of Mexican citizens and the only one in which Mexican customs and traditions prevailed.

The land upon which 41VT8 is located was included in the league selected for his head right by

colonist Fulgencio Bueno. A native of Bexar, Bueno was a close friend of the Carbajal brothers. He received legal title to the property by Colonial Grant of March 25, 1833. He and his wife did not reside on the land but lived in a house built on their lot within the town of Victoria. Described by a contemporary as a very colorful person, Bueno was obviously never as industrious as some of his fellow colonists. Improvement to his land, one requirement of the colonization laws, consisted only of some stock pens. Bueno was killed while away on a tobacco trading expedition in October 1833. He possessed a few horses, mules, cattle, and a number of large debts at the time of his death. Bueno's widow, Maria Jesus (or Luz as she preferred) married widower Fernando de León, whose first wife had been the first of the colony to die.

Don Fernando had a large and successful ranch operated by his vaqueros and their families near the eastern edge of the colony along Garcitas and Arenosa creeks. He also had a house in town and resided at both places. The ranch, which his wife inherited as the widow of Fulgencio Bueno, was maintained as her separate property and used for grazing land.

In 1833 and 1834 an epidemic of cholera had swept across Louisiana and Texas, causing the death of Don Martín and his youngest son, Agapito. Upon the death of his father, the Mexican colonists turned to Don Fernando as their new patron, although Placido Benavides, his brother-in-law, was appointed by the government to be the successor to Don Martín. While Don Martín had been contemptuous of the settlement of Americans and others in Texas, Don Fernando was much more open-minded. In November 1835, immediately following the outbreak of armed hostilities with the Mexican government, he went with José Carbajal and Peter Kerr, a merchant from the Austin colony, to New Orleans to charter a ship and purchase munitions to supply the Texas Volunteer Army. A Mexican brig near Paso Cavallo captured their schooner and arrested de León and Carbajal and had them imprisoned at Brazos Santiago. However, both soon managed to escape and make their way back to Victoria (Linn 1883:259; Webb 1952:951).

Meanwhile, Placido Benavides and Fernando's brother, Silvestre, captains of the local militia, organized a company of other ranchers from the colony and hurried to reinforce the Texas Army against General Perfecto de Cos at the Battle of San Antonio. Appointed 1st Lieutenant of the Cavalry, Benavides took part in the Battle of Agua Dulce in 1836 and was the one who delivered the first information to Colonel James Fannin at Goliad of the approach of a large force under General Urrea (Rose 1883:105; Huson 1953:256; O'Connor 1965:119). During the following several years Don Fernando was alternately arrested and released several times by the Mexican Army. He and other family members were arrested by Commander-in-Chief Thomas J. Rusk of the Texas Army, accused of complicity with the Mexican Army, and were forced to leave the country.

Members of the leading families of Victoria boarded a ship in Lavaca Bay in June 1836 and went into exile in Louisiana (Rose 1883:105, 155). Placido Benavides died in Louisiana in 1837, as did Doña Silvestre de León. Fernando de León returned briefly to Victoria in 1841 to sell some of his lands on Garcitas Creek. In 1843 he and his wife moved back to Victoria, and took up residence on the old Fulgencio Bueno tract. He raised some livestock and cultivated part of the ranch, but the precise location of the fields is not documented. Victor M. Rose, an early Victoria newspaperman and author who had known Don Fernando, states that Fernando called his ranch the Escondida (Victoria County Deed Records Book 1:200, 203, 206, 405; Victoria County Statistical Records Book 4:219).

In January 1857 Don Fernando's widow, Luz Escalera de León, sold the land on which she resided, the one originally granted to Fulgencio Bueno, to Dr. Joseph Weisiger, an immigrant from Kentucky. Weisiger and his sons introduced stock from their home state and engaged in raising thoroughbred horses. Manley H. Williams, Sr. purchased the land from the Weisiger Estate in 1897. At the time of the TAS Field School in 1968, it was owned by Williams' granddaughters and managed by their mother, Mrs. W. L. Joyce (Victoria County Deed Records Book 7:39).

Approximately 300 m southwest of 41VT8, and on the edge of a low terrace along the Guadalupe River bottom land, is a small house site, designated 41VT14. The site occupies part of a knoll (a detached terrace remnant), which is about 30 m long and 25 m wide. The knoll is thickly wooded and the surface is covered with forest litter and dense undergrowth, making it impossible to accurately estimate the dimensions of the former structure. Occupation materials, including sherds of glass, glazed earthenware, and scattered fragments of limey sandstone, appear in an area about 13 m square. Virgil

Branch, who found the site in 1967, and the author dug two small test pits where an animal burrow had exposed a concentration of sherds near the north margin of the site. Beneath the historic material was a deposit of dark, ashy soil containing small gravels, bone fragments, and lithic artifacts and debitage typical of local prehistoric middens. The historic artifacts from this site indicate a date of ca. 1850. There seems to be little question that the occupation of the house site was contemporaneous with the ownership and residence upon the land by Don Fernando de León and his family.

FIELD AND LABORATORY METHODS

The Grid System

Shortly after the arrival of the crews on site, a site datum was set in concrete along the western edge of the site. Elevations for all subsequent excavations were measured from the datum that had an arbitrary elevation of 100 ft. Next, Miles Locke and his survey crew laid out a 100 ft. square grid system over the site (Figure 4). For ease of record keeping, each 100 ft. square was designated a Division. In this manner, the site was divided into 48 divisions. 41VT8 was located east of the datum and was contained within divisions (i.e., grid units) 18-48.

Each division was further subdivided into 5 x 5 ft. units. Within each division, the west-east coordinate was identified by an alphabetical designation running from A-T, while the north-south coordinate was identified numerically running from 1-20. In this manner, each individual 5 x 5 ft. unit or square (e.g., Unit 30D4) was identified based on its division designation (30), and its west-east alphabetic identifier (D) and north-south number (4). The field notes also suggest that at least in some instances, selected 5 x 5 ft. units were further subdivided and excavated in 2.5 x 2.5 ft. quadrants, although provenience was maintained to the larger unit.

In addition to the 5 x 5 ft. individual units, manually excavated trenches were also positioned in selected divisions. Thirteen such trenches were excavated using either shovels or trowels (Figure 5). A fourteenth trench (No. 8) was only probed and its precise location was never plotted on site maps. Finally, in Divisions 38, 43, and straddling 45/46, large areas were excavated with shovels while following apparent features (see Figure 4). These areas did not follow the grid system and excavations did not occur in 5 x 5 ft. units or in 6 inch levels and therefore, they tend to have amorphous shapes.

After the end of the field school, local TAS members visited the site and collected artifacts from the surface. Later at the TARL laboratory, the appropriate division number was assigned to each of these artifacts. These were then catalogued and added to the collection. These artifacts were provenienced to the surface of the site and likely represent artifacts that had been shallowly buried or deposited in the backdirt of trenches and exposed by repeated rains. In addition, a large group of artifacts collected from the site was donated to TARL in 1973 by avocational archeologist Virgil Branch of Victoria. These artifacts were collected sometime after the close of the field school. Some of these artifacts were assigned to specific divisions within the site, while the specific provenience of others was not identified.

In April 1969 equipment operators hauling away sand from the property mistakenly strayed onto the site and severely disturbed three areas along the southwestern and west-central portions of the site (see Figures 4 and 6). Calhoun and Branch immediately added the borrow pits to the site map, and recovered all the artifacts they observed on the surface of the borrow area and the mounds of backdirt. The artifacts are provenienced to the borrow pit and have no subsurface information. These artifacts were all turned over to TARL. They also observed and mapped a section of a stone foundation in Division 20 and an area of scattered rubble in Division 26 (see Figure 4). For the above reasons, there are several large artifact samples inventoried as general collections with little provenience information. However, all artifacts recovered from the site are included in the descriptions and analysis sections since it is obvious that they are all related to either the prehistoric or the colonial occupations, and those related to the later landowners were found in a relatively small, recognizable area.

EXCAVATIONS CONDUCTED AT 41VT8

The excavations conducted at the site ranged from isolated units to concentrations of units designed to explore large blocks through contiguous

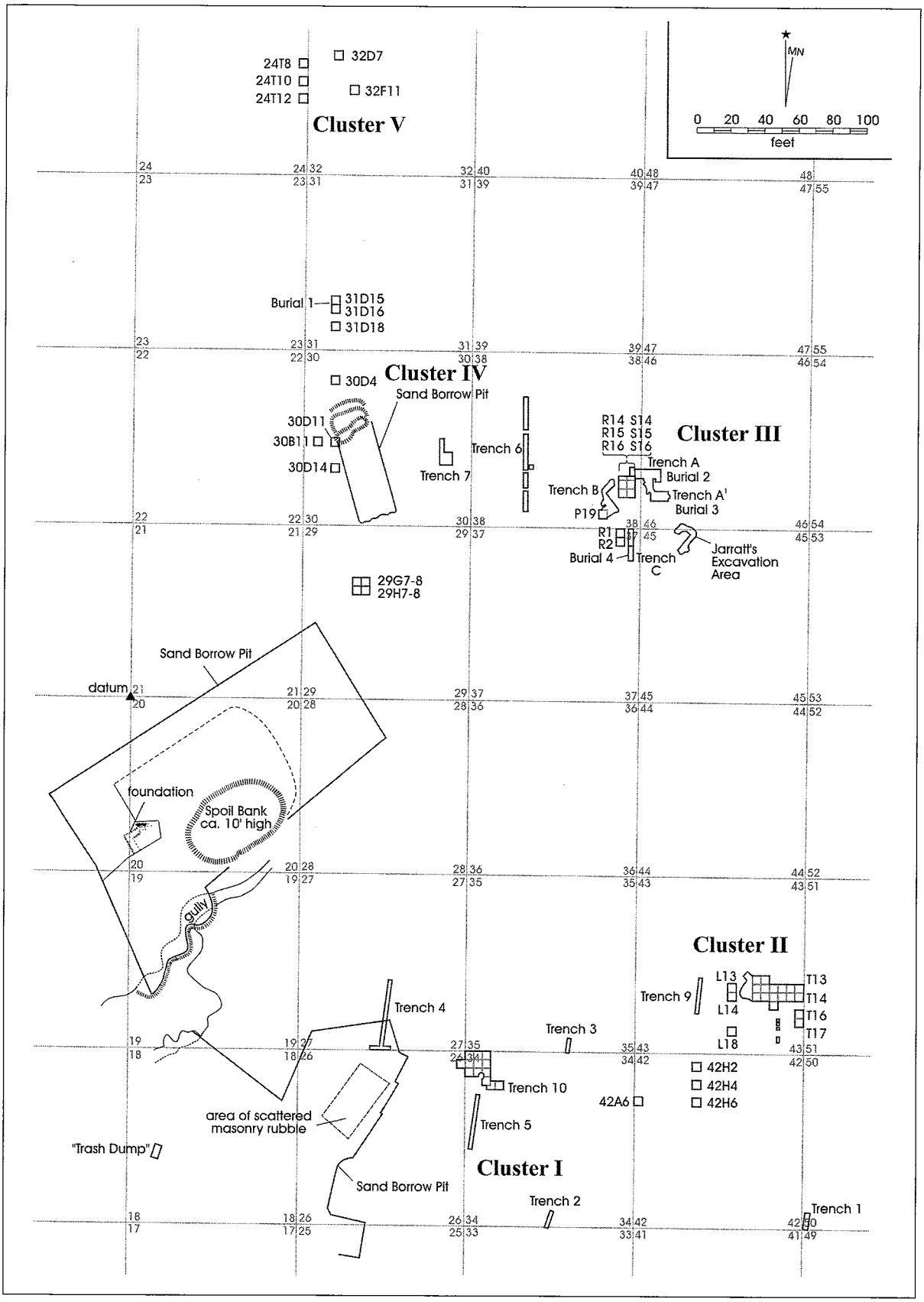

Figure 4. Map of 41VT8 showing grid and excavation clusters within site.

Figure 5. Field school participant manually excavating one of the trenches at 41VT8.

Figure 6. Portion of site heavily disturbed by sand borrow area.

or closely spaced units. The excavations conducted on the site can be grouped into five clusters of units and trenches (see Figure 4). Clusters I and II are located in the south-central and southeastern sections of the site, respectively. Clusters III and IV are in the east-central and west-central portions of the site, while the fifth cluster (V) is in the extreme north-central portion of the site. The summary of the excavations carried out at the site presented below will be organized by these divisions. The number of levels excavated within each 5 x 5 ft. unit, the dimensions of the trenches, the methods, and the depths of the excavations carried out on site are listed in Tables 1 and 2, respectively.

Cluster I

The first cluster (Figure 7), located in the south-central portion of the site, includes a contiguous block of eleven 5 x 5 ft. units located in Divisions 34 (n=10) and 26 (n=1) and five trenches scattered across four divisions (27 [n=1], 34 [n=3], and 35 [n=1]). Trench 2, measuring 2 x 10 ft., was excavated against the southern boundary of Division 34. It was excavated to a depth of 2 ft. using shovels. None of the matrix derived from the trench was screened. Trench 3 was a 2 x 9.8 ft. trench located roughly in the south-central portion of Division 35. It was hand excavated using trowels to a depth of 2 ft. Trench 4 excavated in Division 27 consisted of a 40 ft. long north-south test trench intersected by a 12 ft. east-west trench. Both trenches were 2 ft. wide. The north-south trench was dug to a depth of 1 ft. near its southern end and 2 ft. in the northern half. The depth of the east-west trench exceeded 1 ft. but exact figures are not available. Both trenches were dug using trowels but no matrix was screened from either of the two trenches. Approximately 10 ft. south of the cluster of contiguous units, a 2 x 32.4 ft. trench (Trench 5) was excavated to a depth of 2 ft. with trowels. Trench 10, a 5 x 10 ft. trench, was situated at the southeast corner of the block excavations. It was excavated using trowels to a depth of 1 ft. (Levels 1 and 2). All matrix was screened. With the exception of Trench 10, all other trenches were oriented to magnetic north. The excavations occurred under the supervision of E. H. (Smitty) Schmiedlin.

Cluster II

The second cluster consists of 24 5 x 5 ft. units, four 1 x 1.5 ft. units, and two trenches (Figure 8).

Table 1. Summary of unit provenience and levels excavated within each unit at 41VT8.

Cluster	Division	Unit	Levels
I	26	T2	1
I	34	A1	2
I	34	A2	1
I	34	A3	2
I	34	B1	2
I	34	B2	1
I	34	B3	1
I	34	C1	2
I	34	C2	2
I	34	C3	2
I	34	C4	2
II	42	A6	3
II	42	H2	2
II	42	H4	3
II	42	H6	4
II	43	L13	1
II	43	L14	2
II	43	L18	1
II	43	O12	4
II	43	O13	4
II	43	O14	Not excavated by level
II	43	P12	4
II	43	P13	4
II	43	P14	4
II	43	Q13	4
II	43	Q14	4
II	43	Q15	3
II	43	R13	4
II	43	R14	3
II	43	S13	4
II	43	S14	Not excavated by level
II	43	T13	3
II	43	T14	3
II	43	T16	3
II	43	T17	3
III	37	R1	1
III	37	R2	1
III	38	P19	6
III	38	R14	6
III	38	R15	6
III	38	R16	6
III	38	S15	6
III	38	S16	6
III	38	S14	6

Table 1. *(Continued)*

Cluster	Division	Unit	Levels
III	38	T14	6
IV	29	G7	8
IV	29	G8	8
IV	29	H7	8
IV	29	H8	8
IV	30	B11	3
IV	30	D4	6
IV	30	D11	5
IV	30	D14	1
IV	31	D15	6
IV	31	D16	6
IV	31	D18	7
V	24	T8	17
V	24	T10	7
V	24	T12	19
V	32	D7	14
V	32	F11	18

Fifteen of the 5 x 5 ft. units formed a block along the east-central portion of Division 43 and five other units of the same size also fell in this division. Of the 15 contiguous units that formed the block, nine (O12, O13, P12, P13, Q13, R13, S13, P14, Q14) were dug to four levels below the surface (hereafter, "bs") while four others (R14, Q15, T13, and T14) were excavated only to the bottom of Level 3. Two other units (O14, S14) were not excavated by level and the matrix was not screened, although samples of artifacts were collected. Finally, one level each was excavated and screened in units 43L13 and 43L18, two levels in Unit 43L14, and three levels each in units 43T16 and 43T17. All matrix from these units was screened.

In addition, four small, rectangular shovel tests that measured 0.8 x 1.6 ft., 0.8 x 1.3 ft., 1.0 x 1.5 ft., and 1.0 x 2.0 ft., respectively, were dug with a square-bladed shovel to ca. 1 ft. in depth. The matrix was screened. This line of units began 5 ft. south of Unit 43Q15.

Finally, four additional 5 x 5 ft. units were excavated in Division 42. All of the matrix was screened. The excavations were carried out by a group of younger participants, traditionally called The Beaver Patrol, under the supervision of Jim Word.

The first of the trenches, Trench 1, was excavated adjacent to the southwest corner of Division 50. It measured 2 x 10 ft. and was excavated using shovels to a depth of 1 ft. Trench 9, a 2 x 20 ft. trench, was excavated using shovels in the west-central portion of Division 43, west of the contiguous units. The trench was excavated to a depth of 2 ft. bs. Both trenches were oriented to magnetic north. The deposits from the two trenches were not screened for artifacts, but artifacts were recovered as observed.

An additional irregularly shaped area, measuring approximately 100 square ft., adjoining Units O12, O13, and O14, was excavated with shovels without screening, but artifacts were recovered as they were encountered during excavation and in the backdirt. This area did not receive a formal designation. All of the excavations within this cluster occurred under Schuetz's supervision.

Cluster III

The third cluster of units extended across Divisions 37, 38, 45, and 46 (Figure 9). Lou Fullen supervised the excavation of a contiguous block of six 5 x 5 ft. squares and three 2.5 x 5 ft. units laid

Table 2. Dimensions, depth, and method of excavation of trenches at 41VT8.

Trench Designation	Division	Dimensions (ft.)	Depth	Shovel/Trowel	Remarks	Volume Excavated (ft^3)
1	50	2 x 10	1.0 ft.	Shovel	No artifacts	20
2	34	2 x 10	2.0 ft.	Shovel	7 colonial artifacts	40
3	35	2 x 9.8	2.0 ft.	Trowel	217 artifacts	39.2
4	27	2 x 40 and 2 x 12	1.0-2.0 ft.	Trowel	452 artifacts	156
5	34	2 x 32.4	2.0 ft.	Trowel	247 artifacts	130
6	38	2 x 65	1.5-2.0 ft.	Trowel	378 artifacts	195
7	30	2 x 15 and 5 x 5	1.5 ft.	Trowel	168 artifacts	82.5
8	36	2 x 20	Probed	Probed only	No artifacts	Unknown
9	43	2 x 20	2.0 ft.	Shovel	25 artifacts	80
10	34	5 x 10	1.0 ft.	Trowel	924 artifacts	50
A	38 and 46	5 x 15	2.0+ ft.	Trowel	48 artifacts, Burial 2	150+
A'	46	5 x 10	2.0 ft.	Trowel	Burial 3	100
B	38	approx. 4.5 x 20	2.0 ft.	Shovel	1 artifact	180
C	37	3 x 20	1.0 ft.	Trowel	Burial 4	40
Four Shovel Tests	43	1.6 x 0.8; 1.3 x 0.8; 1.5 x 1; 2 x 1	1.0 ft.	Shovel	233 artifacts	Unknown
Trash Dump	18	4 x 8	11.0-19.5 inches	Shovel	Unknown	22.6

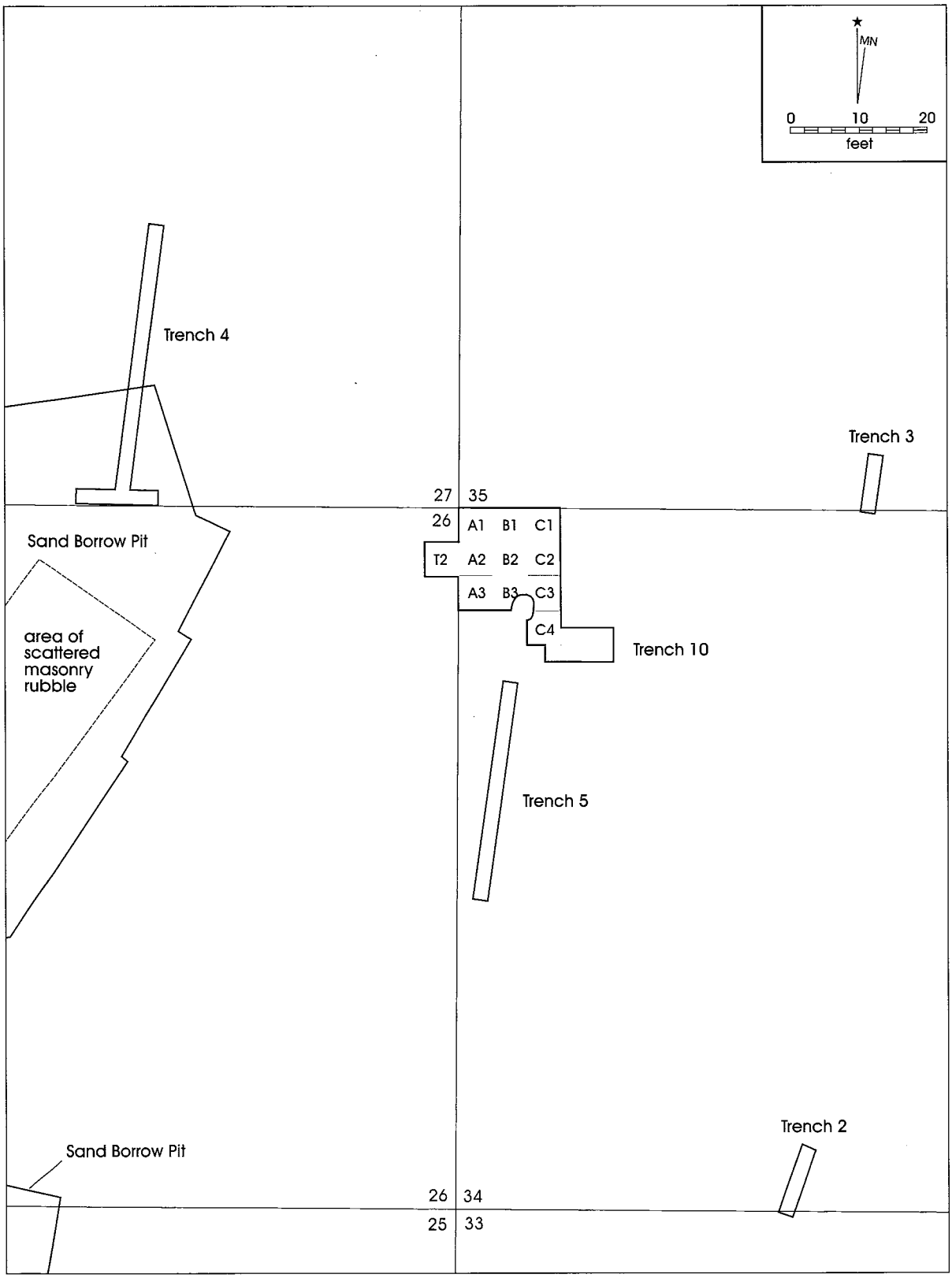

Figure 7. Location of excavation units and trenches in Cluster I.

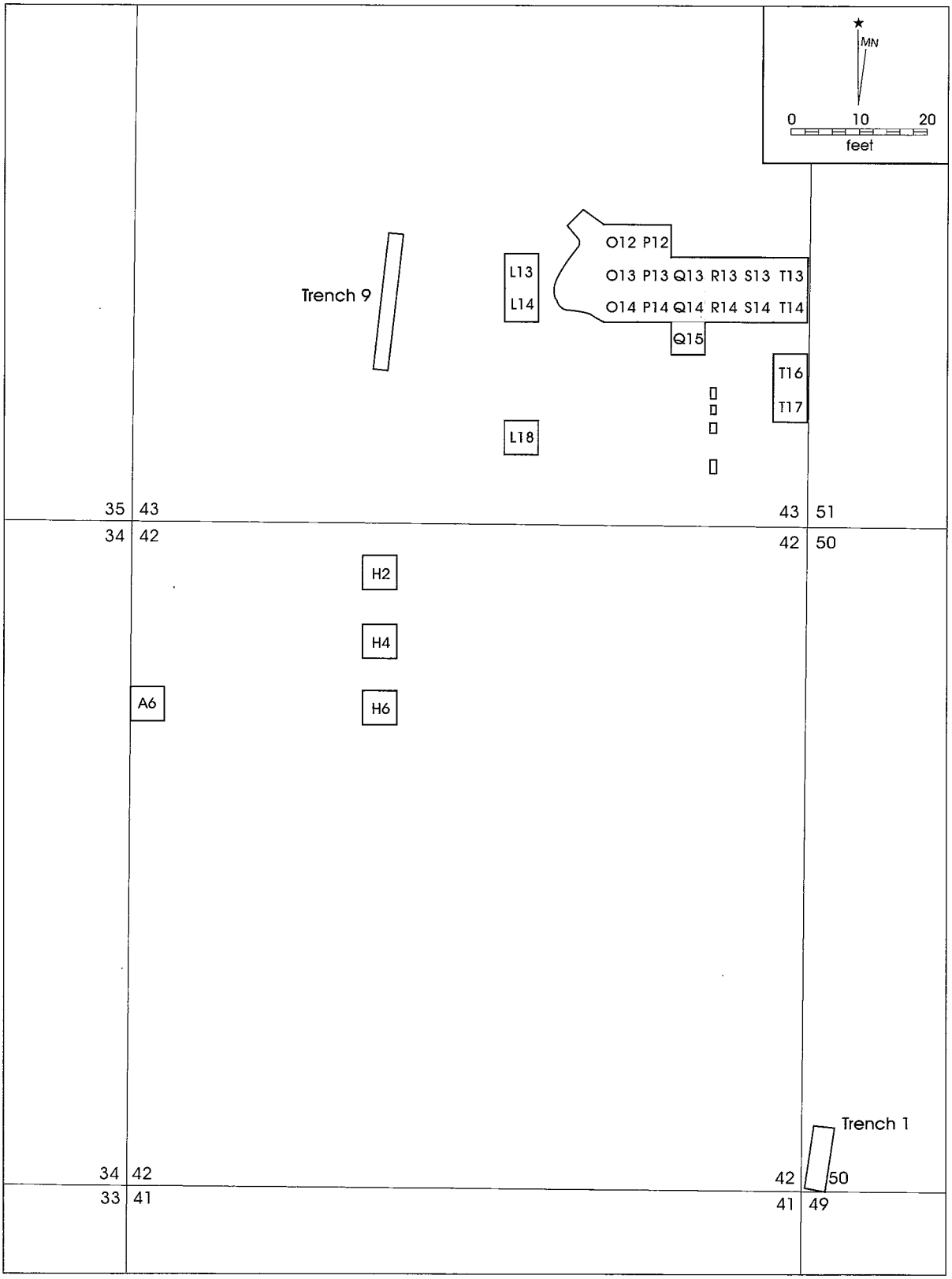

Figure 8. Location of excavation units and trenches in Cluster II.

out in an area of sandstone rubble that was thought to be the location of the chapel in Division 38. The units in Division 38 were excavated in 6 inch levels to a terminal depth of 3 ft. (Level 6). The two units in Division 46 were excavated in 6 inch levels to the bottom of Level 4 (2 ft. bs).

Five trenches were also excavated in the vicinity of the units in Divisions 38 and 46. Trench A consisted of three contiguous 5 x 5 ft. squares oriented east-west and excavated to a depth exceeding 2 ft. The westernmost of these three units adjoined Unit 38S14 while the eastern end of the trench ended in Division 46. A 2 x 6 ft. north-south unit was excavated at the eastern end of this trench to remove Burial 2. The two units at the eastern end of this trench were extended south by a partial, irregularly-shaped, roughly 2.5 x 8 ft. unit to follow a partially exposed feature. And finally, this irregular north-south unit was extended eastward by two 5 x 5 ft. units (B17 and C17) that formed Trench A'. The units forming Trench A' were excavated with trowels to a depth of 2 ft.

Southwest of the units in Division 38 but still within the sandstone rubble, a roughly L-shaped exploratory test area, Trench B, was excavated with shovels, hoping to trace the outline of the rubble and ash layer at ca. 1 ft. bs. Its northeasterly extension measured 4.5 x 20 ft. with its southern end terminating at Unit 38P19, a 5 x 5 ft. unit. Trench C in Division 37 was excavated south of the contiguous block to search for additional burials within this area. It was a 3 x 20 ft. trench excavated with trowels to a depth of 1 ft. bs (Levels 1 and 2). Two 5 x 5 ft. units (37R1 and 37R2) were partially excavated immediately west of Trench C using shovels. The partial excavation of these units was terminated at 6 inches bs on top of a layer of rubble found throughout the partially exposed segments of the two units. Finally, Trench 6, 50 ft. to the west of the block units, consisted of four sections 2 ft. wide that extended 64 ft. 5 inches north-south. The sections were separated by 1 ft. wide balks with the first section measuring 12.5 ft., the second 11 ft., the third 22 ft., and the fourth 20 ft. in length. The southern end of the third section was extended to the east into a 3.5 x 3 ft. unit to investigate a cluster of animal bones identified in the trench. The trench and its eastern extension were excavated with shovels to a depth ranging between 1.5-2 ft. bs. Bob Turner supervised these trench excavations.

In addition, site maps show a roughly rectangular excavation area at the boundary between Divisions 45 and 46. J. Jarratt excavated this area with a shovel from surface to roughly 6-8 inches bs. None of the matrix was screened.

Cluster IV

The fourth cluster of excavation units encompasses Divisions 29, 30, and 31 (Figure 10). Charles Bollich, Roy Schuetz, and Jack Klatt excavated a 10 x 10 ft. test unit in Division 29 (G7-8 and H7-8). The unit was shaved in layers with shovels, none of the dirt was screened, but artifacts encountered were saved. Four 5 x 5 ft. squares were excavated in Division 30 under the supervision of Bob Turner. Trench 7, 50 ft. to the east in Division 30, consisted of a 2 x 15 ft. trench with a 5 x 5 ft. extension to the east. Finally, three 5 x 5 ft. units were excavated in Division 31 under the supervision of C. K. Chandler. Six levels were excavated in these units terminating at 3 ft. bs. Burial 1 was encountered in Level 6 of adjoining units D15 and D16.

Cluster V

The fifth cluster of units was excavated in the extreme north end of the site in Divisions 24 and 32 (Figure 11). Three units were excavated in Division 24 under the supervision of Paul Lorrain, whose excellent field notes greatly facilitated the detailed descriptions of these excavations. Two 5 x 5 ft. units in Division 32 were excavated to examine the extent and character of the prehistoric component at the site. Charles Bandy was in charge of work in this division.

Miscellaneous Other Units

Trench 8 located in Division 36 was laid out as a 2 x 20 ft. unit. However, while it was probed, excavations were never undertaken within it and it was never subsequently drawn on the site map.

Smitty Schmiedlin and Bill Birmingham excavated a 4 x 8 ft. unit in a gully in Division 18 (see Figure 4). The unit is identified as the "trash dump" in field notes. The terminal depth of this unit ranged from 11 to 19.5 inches bs.

Excavation Methods

For the majority of the 5 x 5 ft. units and some of the trenches, excavations were conducted by

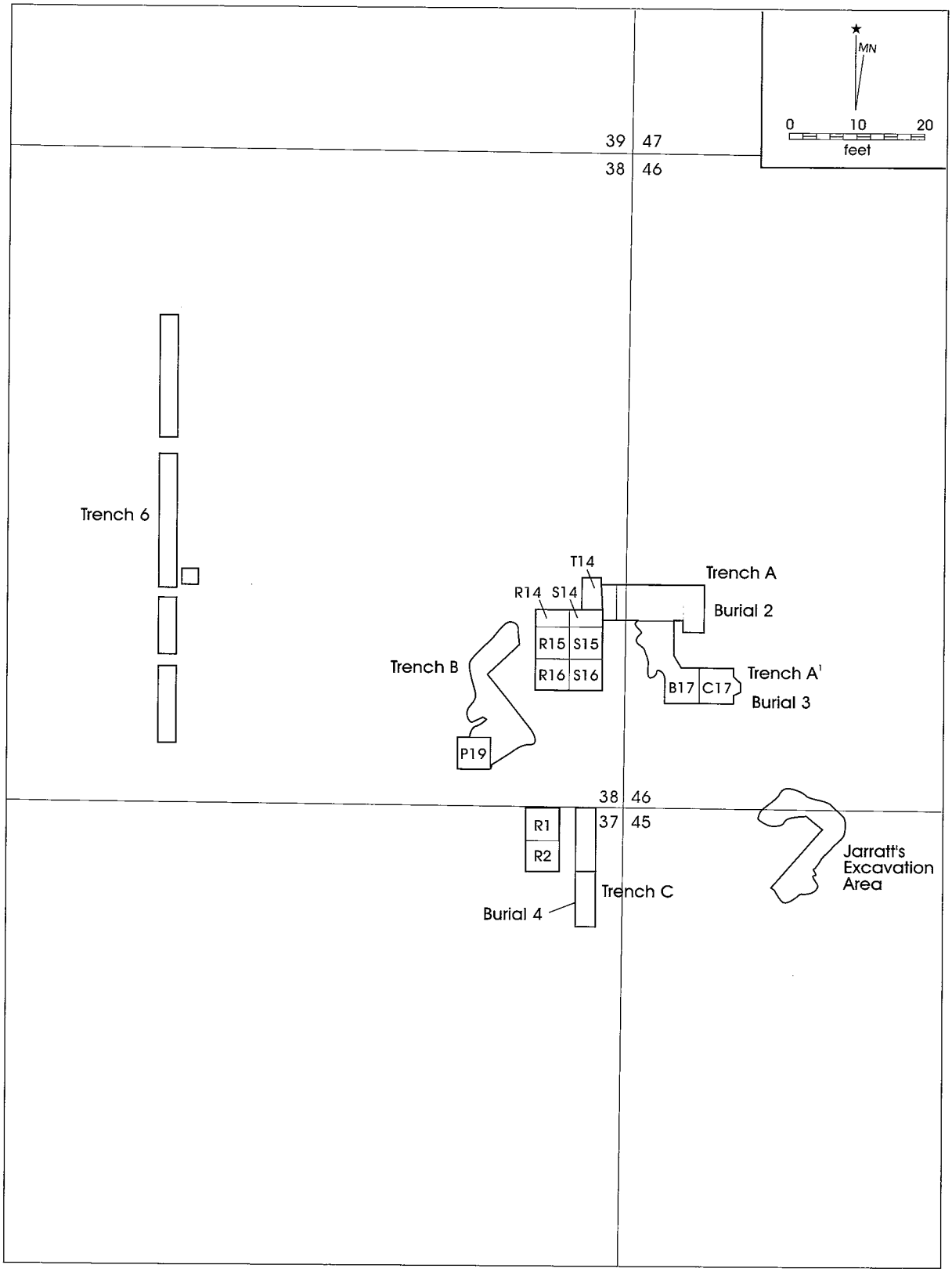

Figure 9. Location of excavation units and trenches in Cluster III.

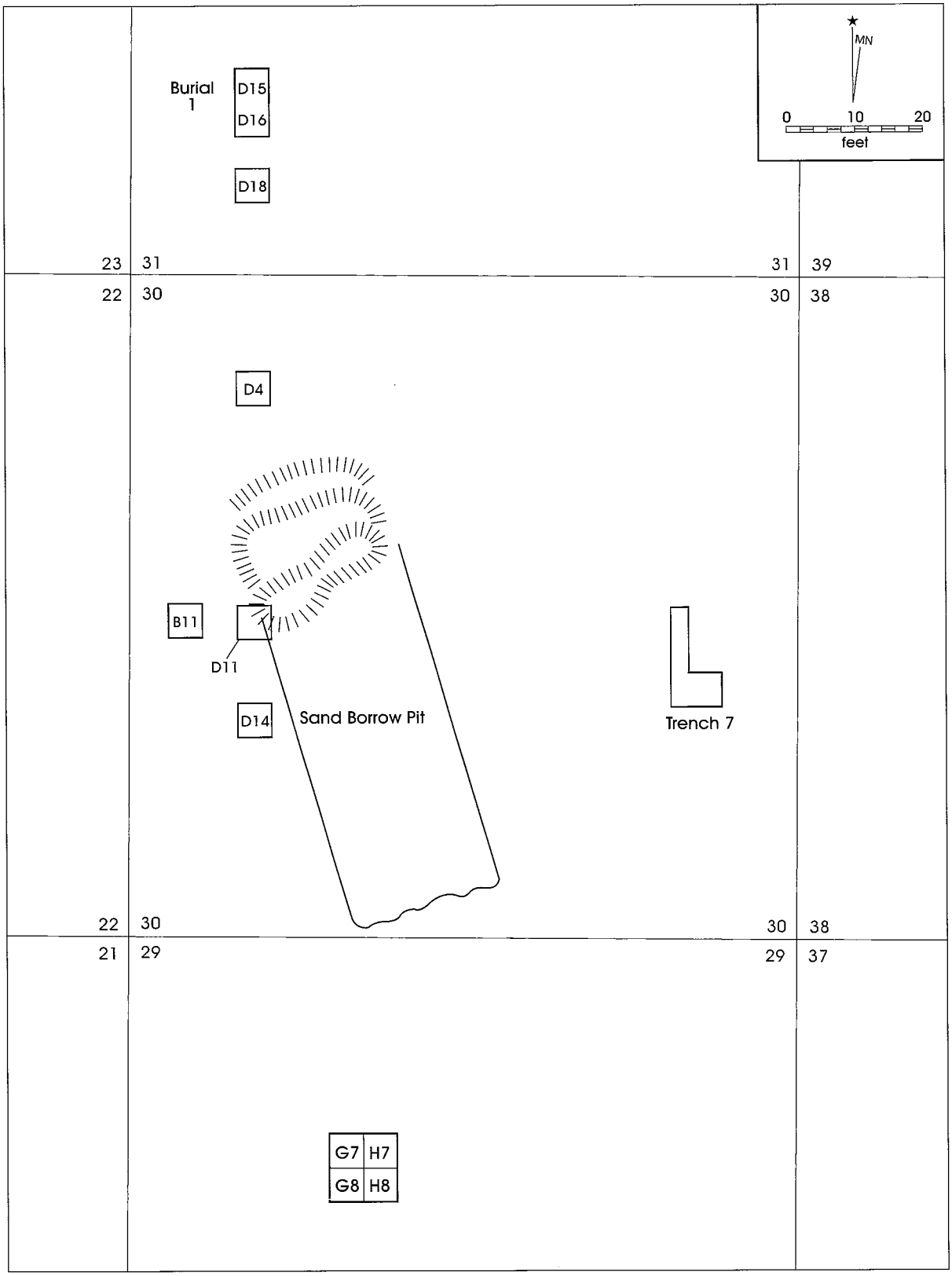

Figure 10. Location of excavation units and trenches in Cluster IV.

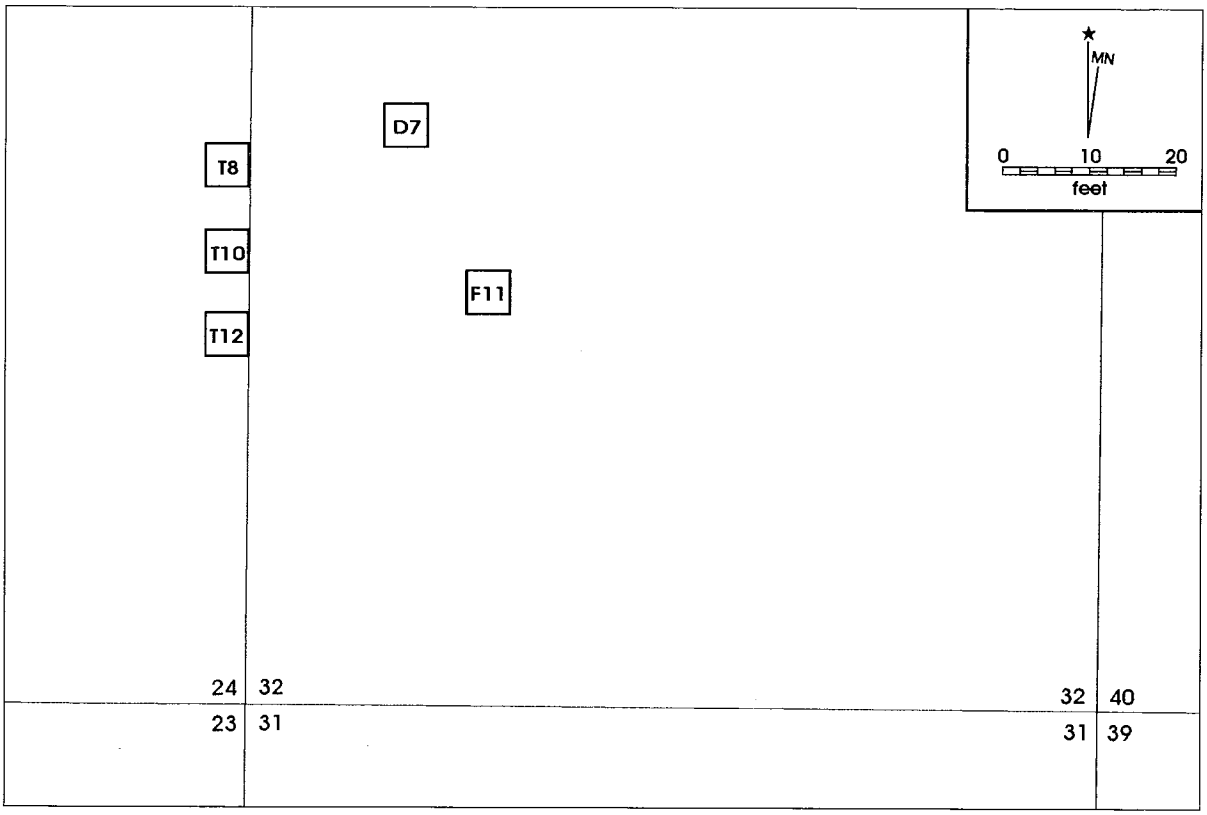

Figure 11. Location of excavation units and trenches in Cluster V.

hand using trowels or shovels and progressing in 6 inch levels. The dirt was screened through 1/4-inch mesh screens. Artifacts recovered were placed into paper bags labeled with the unit, level, and excavator information. Everybody was expected to take notes. According to E. Mott Davis, it was the first TAS field school where this was the policy and many participants felt that it was "cruel and unusual."

The notes consisted of Daily Logs, General Field Record Sheets containing notes about the status of excavations, and floor plans of features within the excavation area. Profile Data Sheets provided details regarding profiles drawn of excavation units, and Square Reports contained general information on the number of levels excavated; the surface and terminal depth of excavations; features; and general observations about each unit. Finally, Level Report forms contained information on each level excavated within each unit. Each form contained information on the dates of excavation, beginning and ending elevations, whether the matrix was screened or not and using what mesh size, features identified, soils, and artifact recovery.

Laboratory Methods

The washing and initial sorting of the artifacts occurred in the on-site laboratory (Figure 12) under the direction of Joe Ann Calhoun and Dorothy Word. There the contents of each bag were carefully washed and dried, making sure to keep each bag in company with its contents on a drying screen. As the artifacts were dried, they were replaced in their bag and carefully stored in the laboratory. As the weather became increasingly damp, more and more care was taken to see that the bags and their contents were dried as thoroughly as possible before they were put away. When the air became too moist to allow proper drying of the bags, a supply of plastic tubing was obtained and each bag was carefully wrapped in plastic, preserving the contents and bag together with the labeling on the bag. Fortunately, all the bags were marked with "Magic Markers" which ensured that the labels were not smeared, smudged, or damaged despite the dampness.

When the Field School closed down, the artifacts were taken to the laboratory of the Witte Museum in San Antonio for cataloging. There,

Figure 12. On-site laboratory for preliminary processing of artifacts.

Mardith Schuetz and Anne Fox sorted the contents of each bag into categories and cataloged them. The artifacts were packed in cardboard boxes, and taken to TARL for storage, along with all the related paper work, maps, and Daily Logs of the participants in the field school.

The collection of materials and records that arrived to the Center for Archaeological Research (CAR) laboratory consisted of photocopies of selected notes, level forms, specimen inventory sheets, and bags of artifacts that had been labeled during or following the field school. Minimal processing occurred in the CAR laboratory; instead, catalogue sheets were completed for the different classes of artifacts during their analyses and the data entered into an Excel database to create the inventory database used in all subsequent analyses.

RESULTS OF EXCAVATIONS

This section discusses the few features discovered during the excavations, provides general observations regarding the stratigraphy of the various areas tested, and summarizes the large quantity of materials recovered. A review of all archeological excavations conducted within each division is provided in tabular form in Tables 1 and 2.

Little information is available regarding the reasons for placing excavation blocks and units within specific areas of the site. While a map of the site drawn before the TAS field school began showed no definite surface features, we know from narratives presented in daily notes that surface exposures of rubble suggestive of structure foundations, walls, and even entire buildings (i.e., a possible church in Cluster III) did exist on the site. These concentrations of rubble directed the placement of at least some of the excavation blocks during the field school. For instance, some of the units (i.e., 30R15 and R16; 30S15 and 16) and trenches (i.e., Trench B, Trench 7) were dug to search for assumed corners and/or walls of the presidio; similarly Bollich, Schuetz, and Klatt excavated four adjoining 5 x 5 ft. units in Division 29 (29G7 and G8 and 29H7 and H8) where the fourth corner of the presidio was hypothesized to be (the Tunnell-Davis hypothesis). In contrast, the units within the deep sediments on the northern edge of the site (supervised by Lorrain and Bandy) were intended to sample the prehistoric component at this location. The Beaver Patrol units were located at the southern edge of the site in an area that was free of potentially complex architectural features.

Features

Twelve features were identified during the excavations, although not all of them were defined as features at the time of the fieldwork. They consist of living surfaces (n=2), hearths (n=2), burned surfaces (n=1), architectural elements (n=3), and burials (n=4).

Feature 1

A cluster of animal bone, chipped lithic tools and debitage, Goliad, lead-glazed, and majolica sherds found at the bottom of Level 3 (1.5 ft bs) in the northern half of Unit 30B11 has been designated as Feature 1 (Figure 13). The feature consisted of 11 pieces of animal bone, one miscellaneous biface, one bifacial celt, one Goliad sherd, a piece of unglazed ceramics, a single lead-glazed pottery sherd, two pieces of unmodified debitage, and seven natural pebbles. Large fragments of animal bone, lithic debitage, Goliad pottery fragments, lead-glazed, and majolica sherds also were recovered

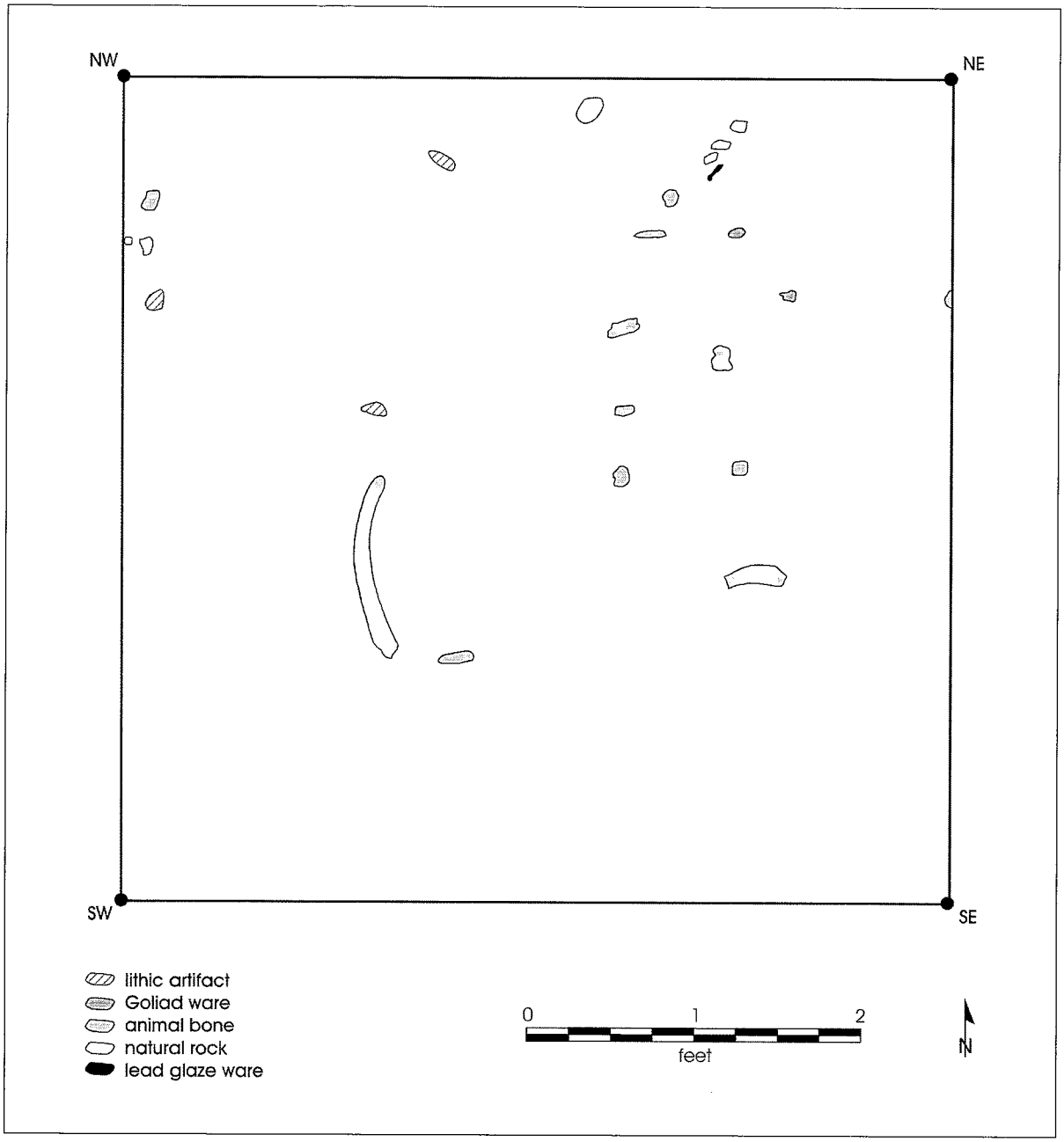

Figure 13. Feature 1, occupation surface in Unit 30B11, Cluster IV.

near the top of Level 3 (15 inches bs) in the adjacent unit (30D11). The wider distribution of artifacts at roughly the same depth in these adjoining units suggests the presence of a living surface somewhere within this level. However, while it is possible that the living surface extended over more than just Unit 30B11, only the concentration in 30B11 was defined in the field as part of the feature.

Five shovels-full of matrix from Level 3 of Unit 30B11 were water-screened through window screen to search for glass beads. None were recovered through this process. It is unclear whether there was any notable change in the matrix in the bottom of the level or whether the feature was defined purely on the basis of the concentration of artifacts. Therefore, while a number of additional artifacts were recovered from the level, it is not possible to determine whether they were associated with the materials identified as part of the feature.

Feature 2

A similar living surface may be indicated by a concentration of artifacts noted in Trench 6 between 8 and 15 inches bs (Figure 14). Trench 6 consisted of a series of four closely spaced, north-south running segments in Division 38. While the segments were separated by 6-12 inches, overall they extended 65.5 ft. in length and were 2 ft. wide. The trench segments were excavated to a depth of between 1.5-2 ft. bs. The layer of cultural material was noted in a 6 inch thick zone buried 9-15 inches bs. The material-rich layer contained a mixture of animal bones, chipped lithic artifacts, limestone and sandstone cobbles, and at least one small concentration of ash. While the material-rich zone was not identified as a feature in the field, it may represent the remnants of a living surface similar to that identified as Feature 1.

Feature 3

This feature consists of an irregularly shaped area of burned soil in the south-southeastern portion of Trench 7 and its easterly extension (Figure 15). Trench 7, found in Division 30, was oriented north-south and was originally planned as a 10 x 2 ft. trench. The encounter of alignments of rocks and a small patch of reddish, oxidized soil at the southern end of the original trench resulted in the southern extension of the trench by an additional 5 ft. and the excavation of a 5 x 5 ft. block adjoining its southeastern end (see Figure 15). This unit was later extended to the north by a 2 x 5 ft. segment. The purpose of the trench was to search for the hypothesized north wall of the presidio. The trench was dug to a depth of 18 inches bs but it is unclear whether its eastern extension was also excavated to this depth.

The organically enriched matrix in the northern portion of the trench was rich in midden materials including chipped lithic artifacts, Goliad and Spanish Colonial ceramic sherds, and animal bone. A gunflint, several fragments of heavily patinated glass, and two forged nails were also recovered from the northern half of the trench. The charred sand identified in the southern portion of the original trench extended in an irregular pattern to the south and east. Small particles of charcoal, bone fragments, and heat-spalled debitage, square nails, Goliad, majolica, and lead-glazed pottery fragments were present in the matrix as was a small, apparently drilled, river pebble.

The top of the charred material was buried to a depth of only 1.5 inches bs while artifacts continued well below this depth, although proveniences are not provided in 6 inch levels for artifacts recovered from the trench. It is also unclear which artifacts assigned to the trench came from the trench proper as opposed to its extension.

Feature 4

A second area of burned soil that also contained at least three circular arrangements of stone interpreted as structures was observed in Division 43, exposed in several 5 ft. squares (Figure 16). The burned, sandy soil was blackened and contained abundant charcoal, and extended from the surface to the bottom of Level 3 or 4 (18-24 inches bs). The burned area began at the eastern edge of the division and extended 35 ft. to the west. It covered approximately 30 ft. north-south with its limits extending 5 ft. past the northern and southern limits of the excavations. According to the notes, the feature included burned building stones and ashy soil. Glazed colonial and unglazed Goliad ware fragments and heat-spalled pieces of flint were present throughout the matrix but appeared to have been most common in the top of Level 2 (6-8 inches bs), which was identified as the probable living surface.

Three circular arrangements of stone have been defined as structures within the units: Structures A, B, and C. Based on the photograph, the diameters of each of the three circles of stone are estimated to range between 5-8 ft. (see Figure 16). The base elevation of the foundation stones of Structure A varied from 21.75 inches to 25.50 inches below datum (bd), while the bases of the rocks forming Structure B varied from 13.50 inches to 20.50 inches. The bases of the rocks forming Structure C were located between 16.50 inches and 27 inches bd. Schuetz apparently suggested in the field that one of the circular arrangements might have been the base of a watchtower that collapsed and was rebuilt. The other stone patterns may have been foundations for rooms or perhaps the remains of other collapsed towers. There was no indication of foundations below the surface upon which the stones rested. It was suggested that Structure A likely predated B, which may have been built in part from

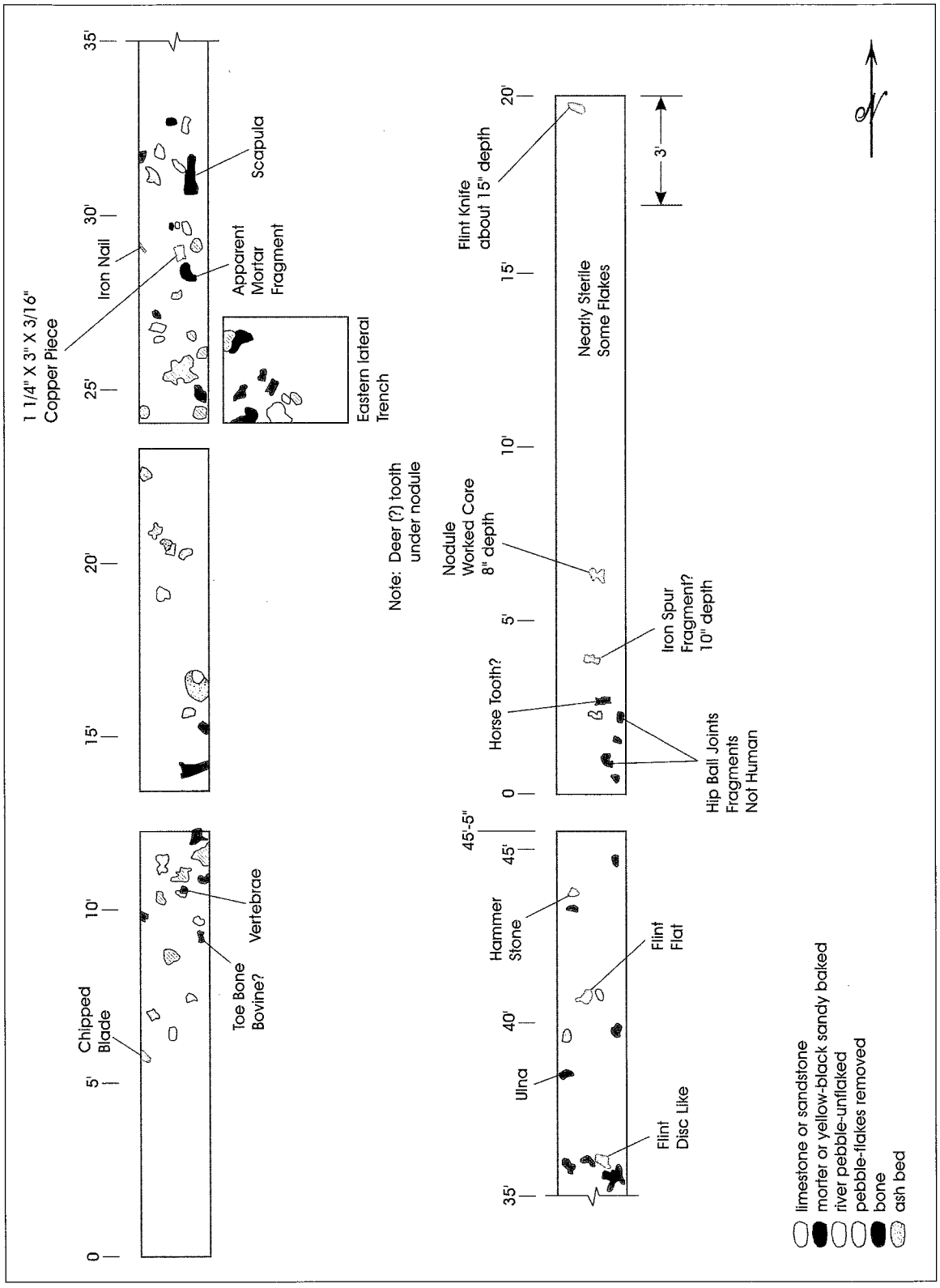

Figure 14. Feature 2, occupation surface in Trench 6, Cluster III. All objects are in a strata which lies between 8–15 inches below surface.

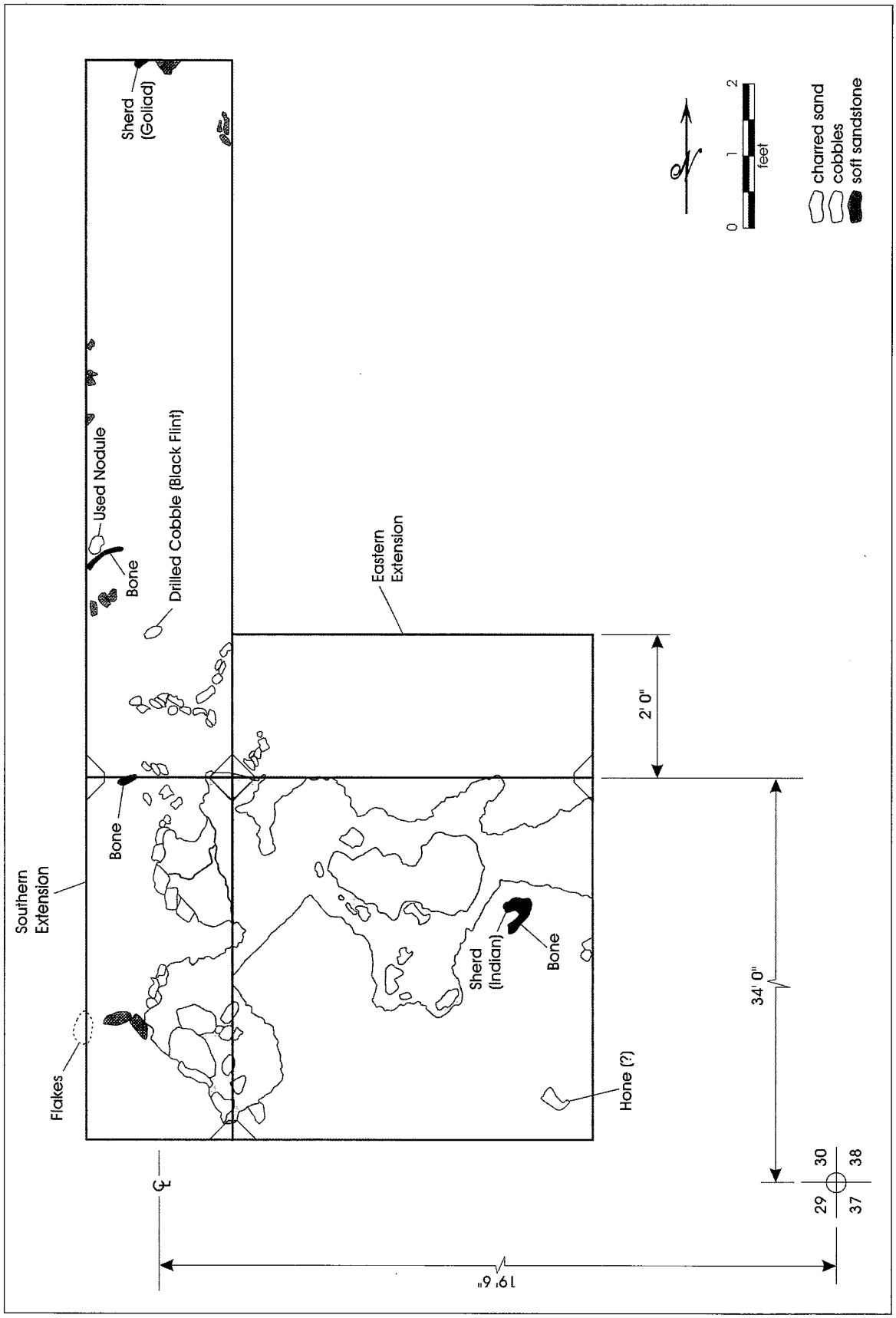

Figure 15. Feature 3, irregularly shaped area of charred sand in Trench 7, Cluster IV. Charred depth approximately 1.5 inches; ranges in color from black to yellow-orange.

Figure 16. Feature 4, cluster of three possible structure foundations in Division 43, Cluster II.

rocks taken from the rubble of Structure A. Unfortunately, structure designations cannot be correlated with circular rock alignments in feature illustrations.

Feature 5

This feature is a circular arrangement of sandstone rocks measuring approximately 10 ft. in maximum diameter noted in Division 34 (Figures 17 and 18). A smaller, circular grouping of rocks near the northern edge of the larger arrangement of rocks appeared to be a small hearth. The tops of the rocks were identified about 6 inches bs in Level 1 in Units B1-B3 and C1-C3. It is unclear from the notes whether the rocks that formed a single layer were entirely within Level 1, which terminated at 10.25 inches bs, or extended into Level 2 of the excavation units. A Perdiz arrow point was found in Level 1 of Unit 34C1 outside of the stone circles and does not appear to be associated with the feature. A small flint drill was recovered from Level 2 of Unit 34C3; however, it is unclear whether the find was from within or outside the circular arrangement of stones. Glass beads were also recovered from some of these units. Deer and bison bone fragments were present in the Level 2 matrix of units 34C2 and 34C3. None of these artifacts can be securely associated with the feature.

Feature 6

A cluster of burned sandstone rocks first noted in Level 2 (6-12 inches bs) and continuing into Level 3 (12-18 inches bs) of Unit D16 in Division 31 was defined as the remnants of a hearth (Figure 19). The oval cluster measures 2 x 2.5 ft. and was contained entirely within the unit. Charcoal and charcoal-stained matrix were present under the rocks.

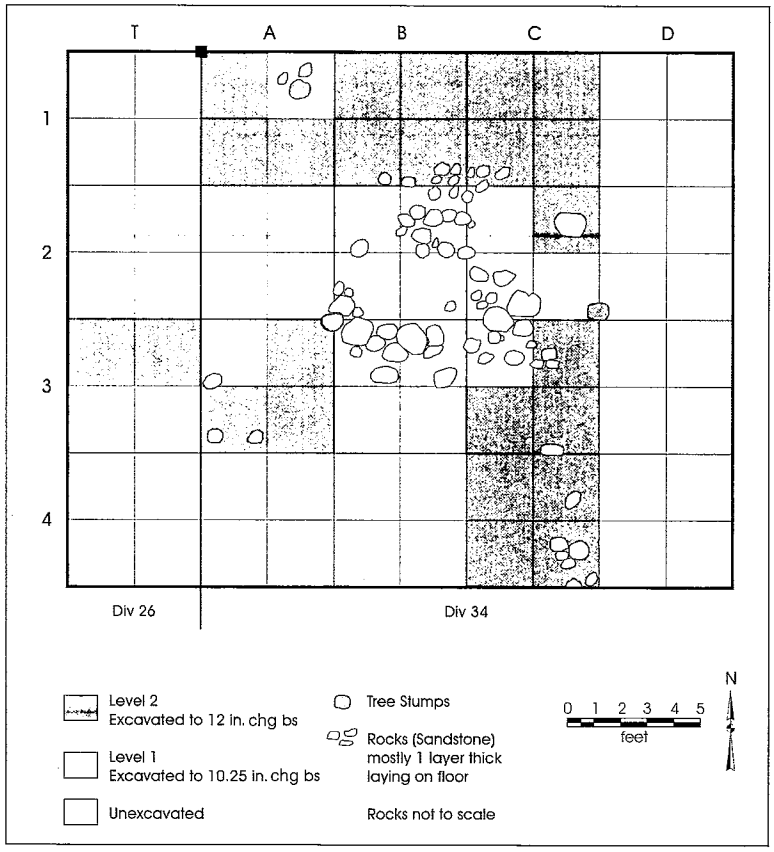

Figure 17. Feature 5, circular arrangement of sandstone rocks, possible structure in Division 34, Cluster I.

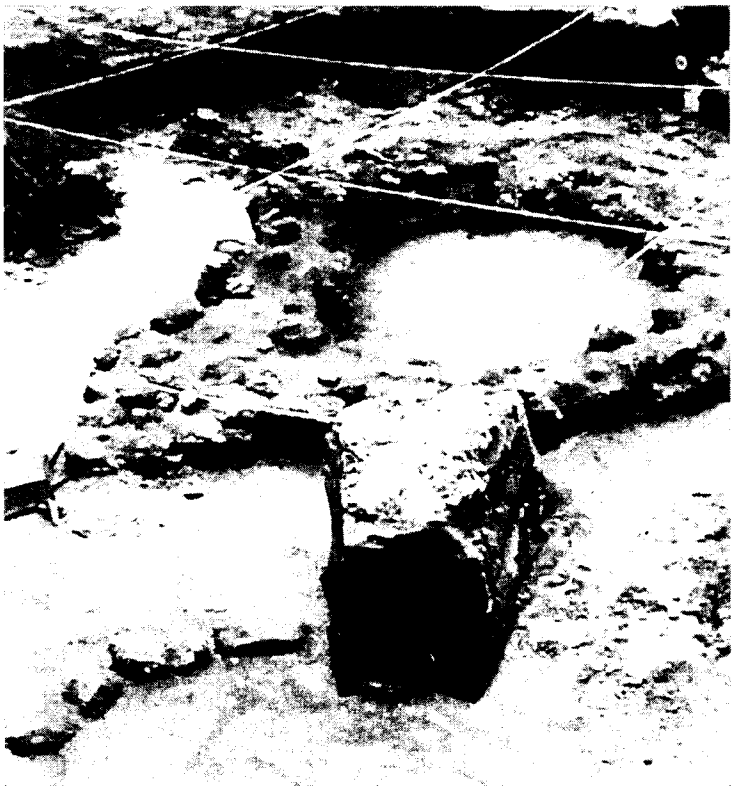

Figure 18. Feature 5, looking south.

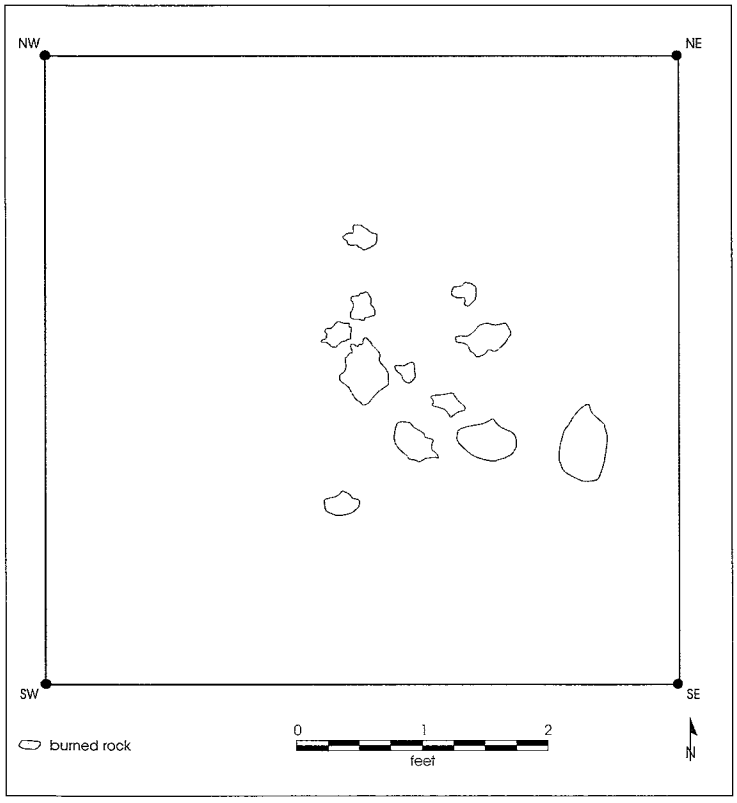

Figure 19. Feature 6, cluster of burned sandstone rocks.

Feature 7

A second cluster of burned rock, located in the northeast corner of Unit D18 in Division 31 also was identified as a hearth (Figure 20). The cluster extends 3.5 ft. north-south and is 2 ft. at its widest. The burned rock and hearth extended both to the north and east into adjacent units. Its full extent cannot be defined because the units immediately to the north (D17) and east (E16), respectively, were not excavated. The tops of the rocks were noted near the top of Level 2 (7-8 inches bs) and they sat 18 inches bs at the base of Level 3.

As in the case of Feature 6, charcoal staining was present in the soil under the rocks. Upon the discovery of similar materials coupled with the presence of lithic debitage, and an arrow point fragment in D16, it was suspected that an extensive living surface was uncovered. The surface was searched for post holes, upon the removal of the burned rocks and the pedestals of soil supporting them. However, no signs of such features were identified.

Feature 8

A layer of stone, most likely representing wall-fall rubble, was uncovered on the floor of Level 1 in Unit B17 in Division 46 (Figure 21). The rubble covered approximately 60% of the southern portion of the unit. Burned clay daub and mortar, as well as scattered charcoal, were common among the apparent building stones. The tops of the rocks were found 5.5- 8.5 inches bs in the southern half of the unit. The bases of the rocks were never uncovered.

A similar layer of building rubble appears to have been uncovered in the irregularly shaped unit excavated by John Jarratt near the boundary between Divisions 45 and 46 (see

Figure 9). The rubble appeared between 4.5 and 5.0 inches bs in Level 1 and was evident in the longest southwest-northeast trending trench. The rubble was not assigned a feature number at that time because it was poorly documented and little specific information exists on the extent of the rubble layer.

Feature 9 (Burial 1)

This burial was a flexed, prehistoric burial found in Level 6 (30-36 inches bs) of Units 31D15 and 31D16. The head of the interment was oriented to the south and it was facing east. The burial pit was evident at the bottom of Level 6. The grave pit fill was found to be slightly lighter in color and noticeably softer than the surrounding clay soil.

It is unclear from what elevation the pit was dug, however, a single human bone was recovered in Level 5 in the eastern half of the unit indicating that the pit may have originated from at least 24-30 inches bs. Nine Goliad ware sherds were recovered from the matrix of this level. None can be directly associated with the burial. Similarly, no clearly associated artifacts were recovered with the remains from Level 6.

A triangular projectile point, identified as a Tortugas, two bifacial adzes, two miscellaneous bifaces, and a serrated flake were recovered from Level 6 of the unit. Approximately four gallons of matrix from around the skull were water screened through window screen mesh in search of beads. None were recovered. The soil around the burial was excavated below the level of the bottom of the burial in order to allow undercutting for its removal. Plaster was then applied and the burial was removed for transportation to TARL.

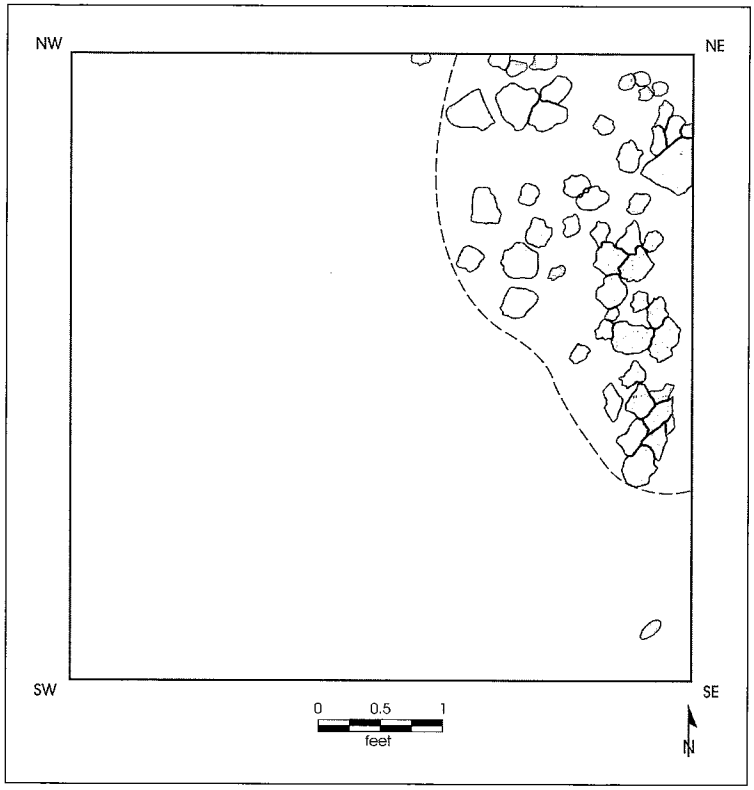

Figure 20. Feature 7, cluster of burned rock in northeast corner of Unit 31D18, Cluster IV.

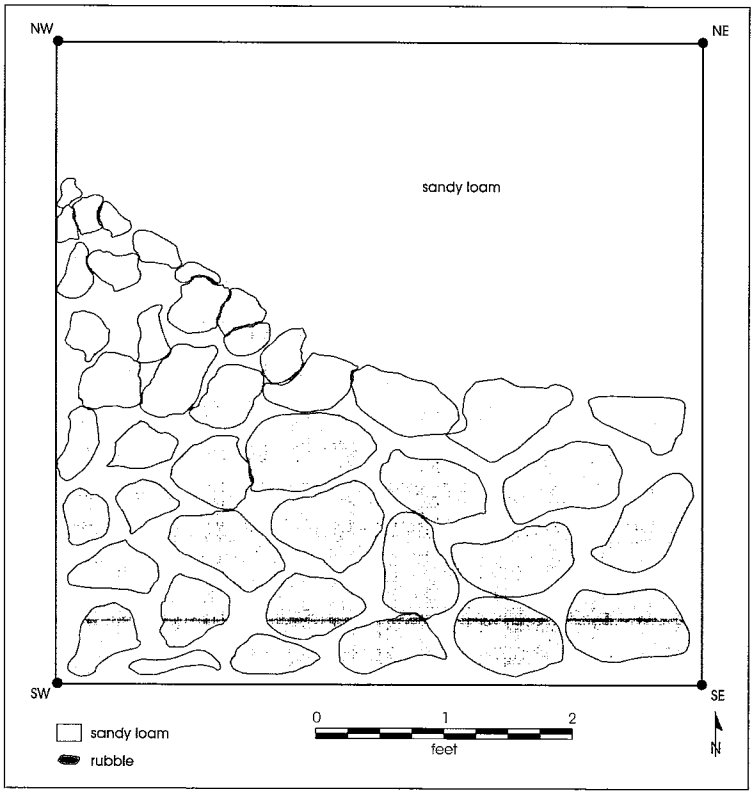

Figure 21. Feature 8, probable wall-fall in Unit 46B17, Cluster III.

During the removal of the remains associated with this burial, the bones of a second interment were noted in the walls of the unit approximately 10 inches east of the skull of the first interment. The bones included limb and arm bones that appeared to be well preserved. These remains were covered and the burial was left in place. No burial number was assigned to this interment.

Feature 10 (Burial 2)

This interment was an extended, historic burial found in Trench A in Division 46. It was estimated to be an adult male. Nine coins and nine buttons were associated with the burial. The nine coins were found stacked and near the inside of the upper right femur. The coins consisted of a U.S. half dollar dated 1849, a U.S. 50 cent piece dated 1829, a large, silver Mexican coin dated 1848, and six other coins ranging in date from 1821 to 1849. The nine buttons consisted of seven bone buttons, a brass (gold leaf) "Texas Navy" button, and a large metal button. Four of the buttons were found lined up and down the right tibia of the interment. The coins in particular suggest that the burial dated to the mid-19th century. There was no indication of a coffin. While the depth below surface of the top of the burial pit was not noted, its base is at 4 ft. bs. The burial was recorded, removed, and taken to TARL.

Feature 11 (Burial 3)

This was an extended historic burial found in Trench A', south of Burial 2. The remains belonged to a small child in a wooden coffin. The burial was sitting at a depth of 2 ft. bs. The remains were removed and taken to TARL.

Feature 12 (Burial 4)

This burial was discovered in the profile of the east wall of Trench C in Division 37. Eight inches of one end of a burial pit containing a wooden casket were inadvertently removed during excavation of the trench. The burial was sitting at a depth of only 1 ft. bs. The location and orientation (east-west) of this burial were recorded and the trench was backfilled. The comparative size of the pit suggested that this was an infant burial.

STRATIGRAPHY AND MATERIALS RECOVERED: CLUSTERS AND DIVISIONS

This section describes the general stratigraphy of the deposits of the site and provides summaries of the materials recovered by cluster and division. The reader is reminded that the number of 5 x 5 ft. units and the number of levels excavated within each unit are presented in Table 1. In addition, the number and dimensions of the trenches, the methods, and the depths of the excavations carried out on site are listed in Table 2.

A total of 26,474 artifacts have been examined in the course of this analysis. The majority (n=18,604, 70%) were collected from and assigned to specific divisions within the site. The remaining specimens (n=7,870, 30%) were collected from the surface and can only be assigned to the general surface or general quadrants of the site. We begin our discussion with those that can be assigned to a specific division.

Cluster I: Divisions 26, 27, 34, 35

A total of 20 levels were excavated in the 11 units within the cluster. The deepest excavations extended through two levels with Level 1 representing a 10.25-inch thick zone and Level 2 (6-12 inches bs) being a 6 inch level. Excavations began using shovels, but once the top of Feature 5 was noted in Unit 34B3, a shift to trowels was made.

The soil was loose, dark brown and silty near the surface, changing to light brown sand in the second 6 inch level, where excavations ceased when no further artifacts were found.

A large concentration of colonial artifacts was recovered from the 5 x 5 ft. units (Table 3). By far the most numerous were ceramic sherds (n=3724). These were dominated by Goliad ware (n=80%), probably made by residents of the mission. One sherd of coastal Rockport ware was also found. In addition to the probably locally made Goliad wares, some unglazed types (such as the 89 fragments recovered from the site), may represent wares made in and imported from Mexico. The moderate number (n=417) of Mexican-made, lead-glazed ceramics included one fragment of an incised bowl used as a mortar or *molcajete* and one sherd from an olive jar. Majolica sherds are also present in low numbers (n=223). The majolica sherds represent the total time period of occupation of the presidio,

Table 3. Artifacts Recovered from Cluster I, by Level, from Divisions 26, 27, 34 and 35.

		Level						
Class	Type	1	2	1, 2	Surface	Unassigned	Trenches	Total
Arms						1		1
Bead						1		1
Biface		1	1				2	4
Bone		307	1	213		18	610	1,149
Burnished	Red burnished	9	3	1			5	18
	Tonalá	28	7	3		3	8	49
Burnished Total		37	10	4		3	13	67
Charcoal		6	4	1			1	12
Core			1	1				2
Daub		111	45	46	1	4	205	412
Debitage		44	10	1			35	90
Faience	Polychrome II		1					1
	Rouen	1						1
	Undecorated	1					1	2
Faience Total		2	1				1	4
Glass		8		1		1	8	18
Gunflint		1					1	2
Jewelry		1					1	2
Lead-Glazed	Brown on yellow						2	2
	Galera Type	18	6	2		1	2	29
	Gray paste	67	39	5	3	5	38	157
	Miscellaneous	78	27	10	3	3	23	144
	Molcajete		1					1
	Olive jar		1					1
	Painted						1	1
	Pipe	1						1
	Red Brown	30	8	9		2	17	66
	Sgraffito	4	3	1	1	1	5	15
Lead-Glazed Total		198	85	27	7	12	88	417
Majolica	Abo Type B		1					1
	Huejotzingo	1	1				9	11
	Puebla Blue on White	20	3				14	37
	Puebla Polychrome		1				1	2
	San Agustín	1	1				4	6
	San Luis Polychrome	1	4		1	2	6	14
	Undecorated	26	4	5			24	59
	Unidentified Blue on White	35	8	1		5	29	78
	Unidentified Polychrome	9	1			1	4	15
Majolica Total		93	24	6	1	8	91	223
Metal	copper	1	1				4	6
	iron	6	4	2		1	3	16
	lead	2	2					4
	unidentified	2					9	11
Metal Total		10	7	2		1	16	36
Native American Ceramic	Goliad ware	1,588	430	129	25	69	736	2,977
	Goliad ware handle						1	1
	Pipe fragment						1	1
	Rockport	1						1
Native American Ceramic Total		1,589	430	129	25	69	738	2,980
Porcelain	Blue on white	2	1				2	5
	Polychrome	2	1				1	4
Porcelain Total		4	2				3	9
Projectile Point	Darl-like						1	1
	Fairland-like						1	1
	Perdiz	1						1
	Untypable Arrow Point	1						1
Projectile Point Total		2					2	4
Stoneware	Brown spatter						2	2
Tool	Chopper		1					1
	End Scraper	2		1				3
	Retouched Flake	1						1
	Perforator		1					1
Tool Total		3	2	1				6
Unglazed Ceramic	Miscellaneous	30	6	1		2	16	55
	Sandy paste	12	4	1			12	29
	Tan paste	2						2
	Valero		2				1	3
Unglazed Ceramic Total		44	12	2		2	29	89
Grand Total		**2,461**	**635**	**434**	**34**	**120**	**1,846**	**5,530**

Note: does not include mussel shell weight

and are the largest assortment of these from any excavation on the site. A few sherds of Chinese porcelain (n=9) and French faience (n=4) indicate imported trade items, and would also have come from Mexico.

Large numbers of animal bones were also recovered, representing the diet of the presidio inhabitants. Also, more than 400 fragments of burned clay daub from this area would seem to indicate a jacal-type structure once stood somewhere nearby.

Only a small number (n=90) of lithic debitage was recovered during excavations in Cluster I. Non-debitage lithic artifacts included two dart points, two arrow points, four bifaces, and six tools consisting of three end scrapers, a chopper, a retouched flake, and a perforator.

Of the 1846 artifacts recovered from trenches, the largest numbers (n=924; 50%; 18.5 artifacts/ft^3) came from Trench 10, followed by Trenches 4 (n=452; 24%; 2.9 artifacts/ft^3) and 5 (n=247; 13%; 1.9 artifacts/ft^3). Work in Trench 3 yielded 217 artifacts (12%; 5.5 artifacts/ft^3) while only seven artifacts (0.17 artifacts/ft^3) were recovered in Trench 2 that was excavated with shovels. The higher recovery in four of the five trenches is due to the use of trowels during excavation and the screening of the deposits. However, the decrease in the density of artifacts in Trenches 2 and 5 compared to trenches excavated in the northern portion of Cluster I do correlate with observations of a decrease in relative artifact recovery in the southern half of the cluster. Coupled with a decrease in artifact density, the dark brown soil characteristic of the northern half of the cluster became lighter in color and sandier in the southern half of the trench. In addition, the clusters of sandstone noted in the 5 x 5 ft. test unit block and Trenches 3 and 4, are absent in Trench 10 and further south in the cluster. Finally, excavations in Trench 4 also recovered a high concentration of fired daub (n=183), suggesting the likelihood that a wattle and daub structure may have stood nearby. In all but Trench 4, Goliad ware ceramics and animal bones made up the bulk of the recovered materials. In Trench 4 the most common artifact was daub.

Of the more than 5,500 artifacts recovered from the cluster, 3,097 (56%) were assigned to specific excavation levels. More than 79% (n=2,461) of these artifacts are from Level 1, while less than a third come from Level 2. This pattern suggests that the bulk of the occupation debris is from Level 1 and occupation intensity appears to decrease with increased depth below surface.

Cluster II: Divisions 42, 43, and 50

A block of 20 units, each five feet square, was hand excavated in Division 43 under the supervision of Mardith Schuetz. The area was extensively burned with signs of burning extending ca. 5 ft. north and south of the block excavations. The soil was black due to the heavy ash concentration. Numerous groups of sandstone were revealed in the excavations, forming what appeared to be partial foundations of structures that were identified as part of Feature 4. The burning in the area had been so intense that in many places the sandstone seemed to be oxidized to a red powder. The surface upon which the stones rested averaged approximately 20 inches bs.

A total of 4,620 artifacts have been recovered from excavations in this cluster (see Table 4). The majority of artifacts come from Levels 1 (0-6 inches bs; n=1,580) and 2 (6-12 inches bs; n=1,314). Moderate numbers of artifacts are present in Level 3 (12-18 inches bs; n=998) while Level 4 contained fewer specimens (18-24 inches bs; n=221).

Here, as in Cluster I, ceramics (n=2,254) far outnumber the other artifacts recovered and the Goliad ware is the most prominent (n=1,986; 88%). Five Patton Engraved sherds have been identified among the Native American wares. The assortment of Mexican-made types is much the same as noted in Cluster I. Majolica (n=93) and lead-glazed (n=79) specimens are relatively common as are unglazed ceramic fragments (n=72) that may have been made by Mexican potters. Burnished wares are infrequent (n=7), as are faience (n=8) and porcelain (n=4).

Over 500 fragments of burned clay daub were recovered. Nearly half of the fragments come from Level 2 of the block excavation. The counts drop rapidly in the two deeper excavation levels.

Unit 42A6, located at the west edge of Division 42, contained a similar assortment of ceramics, some fragments of daub, but little else.

The four small, rectangular test units dug in Division 43 yielded a combined total of 97 sherds of Goliad ware, 18 colonial sherds, two glass fragments, and a chert biface, as well as 115 animal bone fragments and a few fragments of shell and daub. From the content of these units it was apparent

Table 4. Artifacts Recovered from Cluster II, by Level, from Divisions 42, 43, and 50.

Class	Type	Level								
		1	2	3	4	2,3	Surface	Unassigned	Trenches	Total
Biface				1						1
Bone		684	402	399	75	46	2	19	126	1,753
Burned rock									11	11
Burnished	Red burnished	1	1							2
	Tonalá	2	1		1				1	5
Burnished Total		3	2		1				1	7
Charcoal		5	3	3	2	1		1		15
Cork		1								1
Daub		137	203	56	46	3		32	55	532
Debitage		3	3		1	2	1			10
Faience	Blue on White			2						2
	Rouen	1	2							3
	Undecorated	2	1							3
Faience Total		3	3	2						8
Glass		3	4	1					2	10
Gunflint		1					1			2
Jewelry		1			1					2
Lead-Glazed	Galera Type	1			1	1	3			6
	Gray paste	6	11	6		2			3	28
	Miscellaneous	7	5	5	5					22
	Pipe		1							1
	Red Brown	6	5	1	1			2	1	16
	Red Brown painted			1						1
	Sgraffito	2	2	1						5
Lead-Glazed Total		22	24	14	7	3	3	2	4	79
Majolica	Puebla Blue on White	12	5	2					2	21
	Puebla Unidentified		2							2
	San Agustín	2	1							3
	Undecorated	7	4	4	1		1		1	18
	Unidentified blue on white	10	13	10	2	1	1		7	44
	Unidentified Polychrome	2	3							5
Majolica Total		33	28	16	3	1	2		10	93
Metal	Copper	4	1					1		6
	Iron	3	4	6		1				14
	Lead	2	1	1				1		5
Metal Total		9	6	7		1		2		25
Native American Ceramic	Goliad ware	655	617	460	83	40	23	10	98	1,986
	Patton Engraved			5						5
Native American Ceramic Total		655	617	465	83	40	23	10	98	1,991
Porcelain	Blue on White	2	2							4
Projectile Point	Fresno		1							1
Tool	Chopper			1						1
	Drill				1					1
	Utilized Flake	1								1
Tool Total		1		1	1					3
Unglazed Ceramic	Gray paste			1						1
	Miscellaneous	5	10	3						18
	Sandy paste	10	4	3						17
	Tan paste	2	2	26	1				5	36
Unglazed Ceramic Total		17	16	33	1				5	72
Grand Total		**1,580**	**1,314**	**998**	**221**	**97**	**32**	**66**	**312**	**4,620**

that the artifactual deposit in the block continued for some distance to the south (see Figure 8).

The soil in that area of the four Beaver Patrol excavation units (A6, H2, H4, and H6) was light tan and sandy, from the surface to the bottom of the third level. Evidence of rodent activity was observed throughout the area. A large number (n=740) of artifacts were recovered from the four units in Division 42 (Table 5). Goliad wares represent the most numerous artifact category (n=465) followed by daub (n=215). The density of both artifact categories was higher in Level 2 compared to the top level, and overall, Level 2 had higher artifact counts than Level 1. Artifact densities declined relatively rapidly in the deeper two levels.

The soil encountered in Trench 9 was light brown and sandy. Very few artifacts were present. The nearly total absence of artifacts suggests that the area was near the edge of the colonial occupation, and that perhaps there was a corner of the presidio here where the occupation area turned to the west toward Schmiedlin's area in Cluster I. This observation is supported by the fact that Trench 1 to the southeast in Division 50 was 1 ft. deep and contained no artifacts. However, it is contradicted by the fact that the four Beaver Patrol units produced relatively high numbers of artifacts (n=740). The

Table 5. Artifacts Recovered from Cluster II, by Level, from the "Beaver Patrol" Units (Division 42).

Class	Type	Level 1	2	3	4	Total
Burnished	Tonalá	1				1
Charcoal			1	1		2
Daub		62	122	11	20	215
Debitage		1	2			3
Faience	Undecorated		1			1
Glass				1		1
Jewelry		1				1
Lead-Glazed	Gray paste	1	2	1		4
	Miscellaneous		1	1	4	6
	Pipe		1			1
	Red Brown		2	1	1	4
	Sgraffito		1	1		2
Lead-Glazed Total		1	7	4	5	17
Majolica	Puebla Blue on White	4	1			5
	San Agustín		1			1
	Undecorated	3			1	4
	Unidentified Blue on White	3	2	4		9
	Unidentified Polychrome	1				1
Majolica Total		11	4	4	1	20
Metal	Iron	1				1
	Lead	1				1
Metal Total		2				2
Native American Ceramic	Goliad ware	79	234	62	51	465
Shell						
Tool	Drill				1	1
Unglazed Ceramic	Miscellaneous		3	2		5
	Sandy paste	3	2	1		6
Unglazed Ceramic Total		3	5	3		11
Grand Total		**161**	**376**	**86**	**78**	**740**

more likely explanation is that artifact recovery rates were low in Trench 9 because it was excavated with shovels and none of the matrix was screened.

Cluster III: Divisions 37, 38, and 46

Over 700 artifacts were recovered from the 5 x 5 ft. units and trenches excavated within this cluster (Table 6). Only 148 (21%) came from 5 x 5 ft. units, with the remainder (n=569; 79%) recovered in trenches. Of those artifacts from 5 x 5 ft. units, only 116 (16%) can be assigned to one of four excavation levels.

Levels 1, 3 and 4 contain moderate numbers of artifacts, while Level 2 contained only small numbers. While daub constitutes a large proportion (60%) of the artifacts that can be assigned to an excavation level, the drop in artifacts in Level 2 is evident not only in the daub counts, but also in metal artifacts and Goliad ware ceramics.

Artifacts recovered from Trench 6 constitute the largest percentage (69%) of those derived from trenches (Table 7). As in the case of the 5 x 5 ft. units, fragments of daub make up the largest number of artifacts, followed by Goliad ware ceramics and animal bone. Majolica and lead-glazed ceramics are infrequent and Puebla Blue on White is the most numerous majolica type.

To the east of the 5 x 5 ft. units in Division 38, three 5 x 5 ft. squares (oriented east-west) constitute Trench A. A clay-filled burial pit (Feature 10 [Burial 2]) was found in the eastern third of the unit. The soil above the burial contained a small amount of the usual assortment of chert, daub fragments, and ceramic sherds found elsewhere on the site (see Trench A column in

Table 6. Artifacts Recovered from Cluster III, by Level, from Divisions 37, 38 and 46.

Class	Type	Level						Trenches	Total
		1	2	3	4	Surface	Unassigned		
Biface								2	2
Bone					1			162	163
Burnished	Red burnished							2	2
	Tonalá							1	1
Burnished Total								3	3
Buttons								12	12
Charcoal						1		3	4
Daub		19	4	33	14	2	21	135	228
Debitage						1		8	9
Fabric/button								1	1
Faience	Polychrome I							2	2
Glass								1	1
Lead-Glazed	Black luster							1	1
	Galera Type							1	1
	Gray paste					1		2	3
	Miscellaneous	1						4	5
	Olive jar							1	1
	Red Brown	1						3	4
Lead-Glazed Total		2				1		12	15
Majolica	Abo Type B							1	1
	Puebla Blue on White							5	5
	Puebla Polychrome	1							1
	San Luis Polychrome					1		1	2
	Undecorated							3	3
	Unidentified Blue on White	1						8	9
	Unidentified Polychrome							1	1
Majolica Total		2				1	1	19	23
Metal	copper							4	4
	iron		1	2	14			3	20
	lead							5	5
	unidentified							3	3
Metal Total			1	2	14			15	32
Native American Ceramic	Goliad ware	12	2	7		3		174	198
Porcelain	Polychrome							2	2
Projectile Point	Guerrero					1			1
Tool	Retouched Flake							1	1
	Utilized Flake							2	2
Tool Total								3	3
Unglazed Ceramic	Miscellaneous	1						8	9
	Sandy paste							5	5
	Tan paste	1							1
	Valero							2	2
Unglazed Ceramic Total		2						15	17
Wood					1				1
Grand Total		**37**	**7**	**42**	**30**	**10**	**22**	**569**	**717**

Table 7). When the top of the clay-filled pit was encountered, the excavations were extended to the south to trace the complete outline of the burial, which was found to be oriented north-south. The burial was then excavated to the bottom of the pit, which was ca. 4 ft. bs. It was resting in sandy clay. There were no signs of a coffin.

Trench A', located directly south of Trench A in Division 46 consisted of two 5 x 5 ft. squares. When cleared off, this area was determined to contain another, smaller grave. Time did not allow excavation of this grave, designated Feature 11 (Burial 3). A return trip was made to the site the following February by Mott Davis and several of the field school participants, at which time this burial of a small child was also removed and taken to TARL.

In the east wall of Trench C, in Division 37, the outline of the end of another burial was observed (Feature 12 [Burial 4]), extending about 8 inches into the trench. A fragment of coffin wood and 14 coffin nails were recovered during the excavation of the area, and then the burial, designated Burial 4, was covered and left in place.

Table 7. Artifacts Recovered from Cluster III Trenches and Burial 2.

Class	Type	Burial 2	Trench 6	Trench A	Trench A'	Trench B	Trench C	Total
Biface			2					2
Bone			162					162
Burnished	Red burnished		1	1				2
	Tonalá		1					1
Burnished Total			2	1				3
Buttons		12						12
Charcoal			1	1	1			3
Daub			16	64	52	3		135
Debitage		1	1	6				8
Fabric/button		1						1
Faience	Polychrome I		2					2
Glass				1				1
Lead-Glazed	Black luster		1					1
	Galera Type		1					1
	Gray paste		2					2
	Miscellaneous		3	1				4
	Olive jar		1					1
	Red Brown		3					3
Lead -Glazed Total			11	1				12
Majolica	Abo Type B		1					1
	Puebla Blue on White		4		1			5
	Puebla Polychrome							0
	San Luis Polychrome		1					1
	Undecorated		3					3
	Unidentified Blue on White		7			1		8
	Unidentified Polychrome		1					1
Majolica Total			17		1	1		19
Metal	copper		2	1			1	4
	iron			2		1		3
	lead		4			1		5
	unidentified		3					3
Metal Total			9	3		2	1	15
Native American Ceramic	Goliad ware		154	19		1		174
Porcelain	Polychrome		1	1				2
Projectile Point	Guerrero							0
								0
Tool	Retouched Flake		1					1
	Utilized Flake			2				2
Tool Total			1	2				3
Unglazed Ceramic	Miscellaneous		8					8
	Sandy paste		5					5
	Tan paste							0
	Valero		2					2
Unglazed Ceramic Total			15					15
								0
Grand Total		**14**	**394**	**99**	**54**	**7**	**1**	**569**

Judging from the size of the coffin, it was speculated that this was an infant burial.

Burials dating to the 19th century have also been found within the original church at Mission Espíritu Santo across the Guadalupe River (Walter 2000:82-83). Evidently this was not unusual at the time. No colonial military burials were found at this site. It appears that colonial burial practices at a presidio were not the same as those at the missions, where the floor of the church has often been found to be full of colonial period burials (Schuetz 1968; Tennis 2002).

Supervised by Bob Turner, two test trenches were laid out west of the burial area in an attempt to intersect a possible north wall of the presidio. One of these was Trench 6. At the outset, Trench 6, 50 ft. to the west, consisted of three sections 2 ft. wide that extended north-south 45 ft. 5 inches in Division 38. It was trowel-excavated to 1.5-2.0 ft. bs. A large number of ceramic sherds were collected and a few other artifacts were mapped in place, and then also collected. When it was determined that no indications of an east-west wall were present, an additional 20 ft. section of trench was extended to the north, excavated, and recorded in the same manner. The number of artifacts decreased rapidly in the northern 15 ft. of the new section. No evidence of a wall was present. The second trench, Trench B, was placed to the southwest of the units in Division 38 but still within the sandstone rubble. It was excavated hoping to trace the outline of the rubble and ash layer found ca. 1 ft. bs. No further burials were found there. Four colonial artifacts and three daub fragments were recovered. No clear indication of the edge of the rubble layer was detected.

Cluster IV: Divisions 29, 30, and 31

A total of 2,425 artifacts was recovered from excavations within the three divisions that are encompassed within this cluster (Table 8). While there were no inter-divisional differences within the other clusters already discussed, the samples of artifacts derived from Divisions 29 and 30 are quite different from the artifacts of Division 31.

Only 33 artifacts have been examined from the cluster of four units excavated by Charles Bollich, Roy Schuetz, and Jack Klatt in Division 29 (see Figure 10). These artifacts are assigned to Levels 7 and 8 and it is possible that the collections examined do not contain all of the artifacts from this provenience. As clay was exposed below the sandy topsoil, it was found to be full of depressions and mounds that appeared to be part of a natural formation rather than a man-made surface. A number of chert artifacts, including 21 pieces of debitage, one biface, and two dart points were recovered, as well as nine colonial ceramic sherds.

Clearing the surface in the west half of Division 30 in preparation for laying out the four test units yielded 122 artifacts (Table 9) consisting of a mixture of chipped lithic debitage (n=15), an arrow point, colonial lead and tin-glazed (majolica) ceramics (n=11 and n=30, respectively), and Goliad ware sherds (n=45). A similar mix of artifacts was present in Levels 1-3, with the highest number of artifacts found in Level 2 (see Table 9). Interestingly, Feature 1, an activity surface, was identified near the bottom of Level 3 in Unit B11 and continued east into Unit D11. The count of artifacts recovered from Level 4 dropped significantly with no lead-glazed specimens recovered and only three majolica sherds found at this depth. Native-made Goliad ware sherds (n=22) and lithic debitage (n=18) made up the two most common artifact categories. Artifacts continued to be recovered through Levels 5 and 6, with only one piece of Goliad ware and an unglazed sherd representing colonial materials; nine other specimens consisted of chipped lithics, including a Morhiss point and a celt. This artifact recovery pattern suggests that a purely prehistoric component underlies the colonial deposits in this division.

Excavations in the three 5 x 5 ft. units in Division 31 yielded 322 artifacts (Table 10). In contrast to artifact recovery patterns in Divisions 29 and 30, in this division colonial lead and tin-glazed sherds constitute only one percent (n=3) of the specimens and even Goliad and unglazed sherds (n=28 and n=3, respectively) comprise only 10% of the total. Debitage, bifaces, projectile points, and lithic tools constitute 87% of the sample. Two burned rock hearths were identified in Levels 2 and 3 in units D16 and D18. Feature 6 was contained entirely within D16 while Feature 7 was noted in the northeast corner of D18 and likely continued to the north and east. In addition, Feature 9 (Burial 1), a prehistoric burial, was identified and excavated from Level 6 of Units D15 and D16. The pit may have been excavated from Level 5. An additional burial, noted in the east wall of D16, was left in place.

Table 8. Artifacts Recovered from Cluster IV, by Level, from Divisions 29, 30 and 31.

		Level																
Class	Type	1	2	3	4	5	6	7	1, 2, 3	1-3	4, 5, 6	4w	5 & 6 (SE)	5 (NE)	7, 8	Surface	Trenches	Total
Arms	lead															1		1
Biface		7	2	3	2	2	3		1		2	3		1				26
Burnished	Red burnished		1															1
	Tonalá		2	2													1	5
Burnished Total			3	2													1	6
Charcoal		1	1	1	1							1						5
Core		2	1															3
Daub		4	7	2	2												313	328
Debitage		61	69	63	42	30	28	13	6	2	10	20		8	21	15	15	403
Faience	Polychrome II		1	1														2
	Undecorated															1		1
Faience Total			1	1												1		3
Glass		1	1	2												7	1	12
Gunflint		1															1	2
Lead-Glazed	Black Luster			1													1	2
	Galera Type	2	2														1	5
	Gray paste	3	18	13												2	11	47
	Miscellaneous	6	14	15	1											4	7	47
	Red Brown	3	5	2														10
	Sgraffito	2	1													5		8
Lead-Glazed Total		16	40	31	1											11	20	119
Majolica	Huejotzingo															1		1
	Puebla Blue on White	4	1		2										1	13	2	23
	Puebla Polychrome																1	1
	San Agustín														1			1
	Undecorated	3	6	1											1	6	4	21
	Unidentified Blue on White	4	12	6	1										1	8	3	35
	Unidentified Polychrome	1	2	2												1		6
	Unidentified type															1		1
Majolica Total		12	21	9	3										4	30	10	89
Metal	copper		1	2														3
	iron			3	1												5	9
	lead	1		3	1													5
	indeterminate	1																1
Metal Total		2	1	8	2												5	16
Native American Ceramic	Goliad ware	240	515	372	22	9				1		1		3	2	45	94	1,304
	Lug handle	1																1
	Red washed								1									1
Native American Ceramic Total		241	515	372	22	9			1	1		1		3	2	45	94	1,306
Porcelain	Blue on White		1													6	1	8
	Polychrome	2	1													1	1	5
	Undecorated		1													1		2

Table 8. *(Continued).*

Class	Type	Level																
		1	2	3	4	5	6	7	1, 2, 3	1-3	4, 5, 6	4w	5 & 6 (SE)	5 (NE)	7, 8	Surface	Trenches	Total
Porcelain Total		2	3													8	2	15
Projectile Point	Andice														1			1
	Angostura														1			1
	Blank Arrow Point		1	1	1										1			4
	Fairland-like													1				1
	Morhiss						1											1
	Perdiz	1	1	1												1		4
	Scallorn									1								1
	Tortugas						1											1
	Untypable Arrow Point	1		1														2
	Untypable Dart Point			1														1
	Untyped Dart Point		2								1							3
Projectile Point Total		2	4	4	1		2			1	1			1	3	1		20
Stoneware	Brown spatter																1	1
Tool	Adze				1		2	1										4
	Celt						1				1							2
	Hammerstone												1					1
	Retouched Flake			1	1	1												3
	Serrated Flake						1											1
	Utilized Flake	1	2	1	1													5
Tool Total		1	2	2	3	1	4	1			1		1					16
Unglazed Ceramic	Gray paste														1			1
	Miscellaneous	1	10	4	1		1	1		1					2		13	34
	Sandy paste	1	6	1												4	2	14
	Tan paste																3	3
Unglazed Ceramic Total		2	16	5	1		1	1		1					3	4	18	52
Unknown					2													2
Grand Total		**355**	**687**	**505**	**82**	**42**	**38**	**15**	**8**	**5**	**14**	**25**	**1**	**13**	**33**	**123**	**481**	**2,425**

Table 9. Artifacts Recovered from Cluster IV, Division 30.

		Level										
Class	Type	1	2	3	4	5	6	1-3	5 & 6 (SE)	5 (NE)	Surface	Total
Biface		7	1	1						1		10
Burnished	Red burnished		1									1
	Tonalá		2	2								4
Burnished Total			3	2								5
Charcoal					1							1
Core		1	1									2
Daub		4	7	2								13
Debitage		32	18	25	18	3	4	2		8	15	125
Faience	Polychrome II		1	1								2
	Undecorated										1	1
Faience Total			1	1							1	3
Glass		1	1	2							7	11
Gunflint		1										1
Lead-Glazed	Black Luster			1								1
	Galera Type	2	2									4
	Gray paste	3	18	13							2	36
	Miscellaneous	6	14	15							4	39
	Red Brown	3	4	2								9
	Sgraffito	2	1								5	8
Lead-Glazed Total		16	39	31							11	97
Majolica	Huejotzingo										1	1
	Puebla Blue on White	4			2						13	19
	Undecorated	3	6	1							6	16
	Unidentified Blue on White	4	12	6	1						8	31
	Unidentified Polychrome	1	2	2							1	6
	Unidentified type										1	1
Majolica Total		12	20	9	3						30	74
Metal	copper			2								2
	iron			3	1							4
	lead	1		3	1							5
	unidentified	1										1
Metal Total		2		8	2							12
Native American Ceramic	Goliad ware	236	505	369	22			1		3	45	1,181
	Lug handle	1										1
Native American Ceramic Total		237	505	369	22			1		3	45	1,182
Porcelain	Blue on White										6	6
	Polychrome	2									1	3
	Undecorated		1								1	2
Porcelain Total		2	1								8	11
Projectile Point	Fairland-like									1		1
	Morhiss						1					1
	Perdiz	1	1								1	3
	Scallorn							1				1
	Untypable Arrow Point	1										1
Projectile Point Total		2	1				1	1		1	1	7
												0
Tool	Adze				1							1
	Celt						1					1
	Hammerstone								1			1
	Retouched Flake				1							1
	Utilized Flake	1	1									2
Tool Total		1	1		2		1		1			6
Unglazed Ceramic	Miscellaneous		10	4	1			1				16
	Sandy paste	1	6	1							4	12
Unglazed Ceramic Total		1	16	5	1			1			4	28
Indeterminate					2							2
Grand Total		**319**	**615**	**455**	**51**	**3**	**6**	**5**	**1**	**13**	**122**	**1,590**

Trench 7, in Division 30, consisted of a 2 x 15 ft. trench and a 5 x 5 ft. extension to the east. Excavations in the extension exposed Feature 3, an area of charred sand that was buried only about 1.5 inches bs. A total of 481 artifacts was recovered from the trench (see Table 8). Goliad ceramics (n=94) were common, while lead (n=20) and tin-glazed (n=10) ceramic sherds occurred in low frequencies. The excavations extended to 1.5 ft. bs, and although they did not uncover any indication of a wall, a large number of daub pieces were recovered, suggesting that a wattle and daub wall may not have been far away.

The overall pattern in artifact contents within the three divisions of Cluster IV indicate that a prehistoric component underlies the colonial deposits that tend to be found in Levels 1-4. In addition, the colonial artifact density tends to

Table 10. Artifacts Recovered from Cluster IV, Division 31.

Class	Type	Level										Total
		1	2	3	4	5	6	7	1, 2, 3	4, 5, 6	4w	
Biface			1	2	2	2	3		1	2	3	16
Charcoal		1	1	1							1	4
Core		1										1
Daub					2							2
Debitage		29	51	38	24	27	24	13	6	10	20	242
Lead-Glazed	Miscellaneous				1							1
	Red Brown		1									1
Lead-Glazed Total			1		1							2
Majolica	Puebla Blue on White		1									1
Metal	Copper		1									1
Native American Ceramic	Goliad ware	4	10	3		9					1	27
	Red washed								1			1
Native American Ceramic Total		4	10	3		9			1		1	28
Porcelain	Blue on White		1									1
	Polychrome		1									1
Porcelain Total			2									2
Projectile Point	Arrow Point Blank		1	1	1							3
	Perdiz			1								1
	Tortugas						1					1
	Untypable Arrow Point			1								1
	Untypable Dart Point			1								1
	Untyped Dart Point		2							1		3
Projectile Point Total			3	4	1		1			1		10
Tool	Adze						2	1				3
	Celt									1		1
	Retouched Flake			1		1						2
	Serrated Flake						1					1
	Utilized Flake		1	1	1							3
Tool Total			1	2	1	1	3	1		1		10
Unglazed Ceramic	Miscellaneous	1					1	1				3
Grand Total		**36**	**72**	**50**	**31**	**39**	**32**	**15**	**8**	**14**	**25**	**322**

decrease as one moves north within the cluster and prehistoric deposits come to dominate the sample of artifacts within Division 31.

Cluster V: Divisions 24 and 32

This area, on the edge of a 15 ft. drop-off into the river valley, was once much closer to the river channel, which evidently has been meandering gradually to the west over time. In prehistoric times it would have been an excellent occupation site, providing water and chert cobbles from the river as well as access to game from both the river and the surrounding flat lands to the east.

Three units were excavated in Division 24 and two in Division 32 within what was perceived as a purely prehistoric component identified in this part of 41VT8. Because the contents of the units within the two divisions were virtually identical, the artifact recovery patterns are discussed together.

The first two levels were dug through light colored sand while Level 3 encountered a darker shade of brown sandy soil that continued through Level 11. In Level 12 the soil became lighter and sandier. In Level 15, a small fragment of rusted iron showed up, no doubt a product of the occasional gopher burrowing that had been evident throughout the excavation. Excavations continued through Level 21 but beginning with Level 19, the three deepest levels were sterile.

As anticipated, the large majority of the artifacts recovered from this cluster are prehistoric (Table 11). Two lead-glazed sherds, a single majolica fragment, and five pieces of metal are the only artifacts that are clearly colonial in age. Interestingly, 221 Goliad ceramic sherds also were recovered from these units. Eighty-six percent (n=190) of these specimens come from Level 1 of Unit F11, suggesting that the fragments may represent a single vessel. In addition to Level 1, Goliad ceramic sherds are present in Levels 4 (n=15) and 5 (n=4) and occur through Level 12, rarely exceeding more than one specimen per level. A single Poynor Engraved sherd was also recovered from Level 8 of Unit F11. The units in Cluster V were excavated in 5 and 10 cm levels.

Surface Artifacts

Some 7,870 artifacts were recovered from the surface of the site. A breakdown of these artifacts by broad provenience within the site indicates that the largest sample comes from 12 parts of the site (Table 12). In descending order of abundance, the six most abundant artifact categories collected from the surface are: Native American ceramics (n=4,434), daub (n=956), lead-glazed ceramics (n=571), majolica ceramics (n=526), unglazed ceramics (n=341), and animal bone (n=329).

The largest quantity of artifacts came from the borrow pit areas (n=4,177) followed by samples collected from across the surface of the site (n=3,032).

Division 18 "Trash Dump"

Smitty Schmiedlin and Bill Birmingham excavated a 4 x 8 ft. unit in a gully to the south of the datum and west of Schmiedlin's Division 34 excavations. The artifacts mostly represented the late 19th century, including a large stoneware crock and various pieces of horse harness. In a letter to Mott Davis after the field school, Cecil Calhoun quoted the landowner as saying that there were once an old tin barn and an old house in that general area. This may explain the stone foundation fragment and the area of scattered masonry rubble revealed by the post-field school sand recovery operation (see Figure 4).

ARTIFACT DESCRIPTIONS: HISTORIC AND PREHISTORIC ARTIFACTS

A large number and diverse grouping of artifacts have been recovered from the excavations conducted at the presidio. The bulk consists of historic artifacts and chipped stone artifacts.

Historic Artifacts

Anne A. Fox

An interesting collection of artifacts was recovered from 41VT8 by the participants at the field school in June 1968 and by local folks afterward. The author's years of experience in excavations at Spanish missions did not totally prepare her for the difference in the artifact assortment present on a presidio site compared to a mission. Where a mission was made up of two Franciscans and a group

Table 11. Artifacts Recovered from Cluster V, Divisions 24 and 32.

		Level																						
Class	**Type**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**14-15**	**16-17**	**TH**	**Total**
Biface	Gahagan				1		5	1																7
	Miscellaneous		2	3	11	13	9	12	5	2	12	5	1	8			2							85
Biface Total			2	3	12	13	14	13	5	2	12	5	1	8			2							92
Bone		11	12	41			70	167	81	185					194		11		1					773
Charcoal						1	1	1	1	1				1	1									7
Core				3	1	1		2	4	1	5	2	3		1									23
Debitage		10	30	57	67	94	81	74	79	54	80	37	66	31	21	14	13	1	7		2	2	25	845
Lead-Glazed	Miscellaneous	1																						1
	Unidentified			1																				1
Lead-Glazed Total		1		1																				2
Majolica	Undecorated	1																						1
Metal	iron			1			1									1								3
	lead								1															1
	Unidentified					1																		1
Metal Total				1		1	1		1							1								5
Ceramic	Goliad ware	190	3		15	4	1	1	3	2	1	1	1											221
	Poynor Engraved								1															1
Projectile Point	Arrow Point Blank		1	3	11	12	3	1	4	2		1	3	2	2									44
	Darl-like														1									1
	Fresno					2								1										3
	Marcos													1										1
	Morhiss										1													1
	Pedernales																						1	1
	Perdiz					1		1		1		1												4
	Scallorn		2	2	6	3				2		1		3										19
	Untypable Arrow Point	1		1	6	1	3					1												13
	Point													1										1
Projectile Point Total		1	3	6	23	19	6	2	4	5	1	4	3	8	3								1	89
Seeds														5	1									6
Tool	Adze					1																	1	2
	Celt	1							1						1			1					1	5
	Clear Fork																						1	1
	End Scraper			2		4		1																7
	Hafted knife					1																		1
	Retouched Flake				1																			1
	Serrated Flake			1			1				1		1											4
	Utilized Flake							1			1	1	2										1	6
Tool Total		1		3	1	6	1	2	1		2	1	3		1			1					4	27
Grand Total		**215**	**50**	**115**	**119**	**139**	**175**	**262**	**179**	**250**	**101**	**50**	**77**	**53**	**222**	**15**	**26**	**2**	**8**	**0**	**2**	**2**	**30**	**2,091**

Table 12. Artifacts Recovered from the Surface Proveniences Across Site.

		Provenience/Unit												
Class	**Type**	**Borrow Pits**	**Branch**	**Div. 20**	**Div. 20 SE quad**	**General Surface**	**NE Quad**	**NW & NE Quad**	**NW Quad**	**Road**	**SE Quad**	**SW Quad**	**SW Quad Gully**	**Total**
Arms						2						1	1	4
Bead						2								2
Biface		108	2			24			4			1		139
Bone		50				148		99			32			329
Burnished	Red burnished					1								1
	Red burnished (1 black)					4								4
	Tonalá	14				4								18
Burnished Total		14				9								23
Construction						5								5
Daub						952					4			956
Debitage		30	1			19		2	21	1	2	8		84
Faience	Blue on White I			1	1	3								5
	Blue on White II			1										1
	Polychrome I					2								2
	Polychrome II					2								2
	Rouen										1			1
	Undecorated	1			2	4								7
Faience Total		1		2	3	11					1			18
Glass		13		1		36			2			1		53
Gunflint		11												11
Horse equipment												26		26
Jewelry											1			1
Lead-Glazed	Brown on yellow	3				5								8
	Brown yellow					1								1
	Clear											8		8
	Galera Type					5								5
	Gray paste	175				30					5			210
	Miscellaneous					71					5			76
	Molcajete					1								1
	Olive jar	4												4
	Painted	3												3
	Red Brown	57				36								93
	Sandy paste misc.	151												151
	Sgraffito	7		3							1			11
Lead-Glazed Total		400		3		149					11	8		571
Leather													19	19
Limestone		9												9
Majolica	Gray paste											1		1
	Huejotzingo			10		6					3			19

Table 12. *(Continued)*

Class	Type	Provenience/Unit												Total
		Borrow Pits	Branch	Div. 20	Div. 20 SE quad	General Surface	NE Quad	NW & NE Quad	NW Quad	Road	SE Quad	SW Quad	SW Quad Gully	
	Puebla Blue on White	3		21	1	33		1						59
	Puebla Polychrome					3				1				4
	San Agustín			7		3						1		11
	San Luis Polychrome					4					2			6
	Undecorated	23		25		73					3	1		125
	Unidentified Blue on White	60		62	4	125			1		4			256
	Unidentified Polychrome	5		7	2	28	2				1			45
Majolica Total		91		132	7	275	2	1	1	1	13	3		526
Metal	Copper	17									2	1		20
	Iron	35				2	2				3	33	22	97
	Lead	28				8					5			41
	Indeterminate					18								18
Metal Total		80				28	2				10	34	22	176
Native American Ceramic	Goliad ware	3,050				1,251	1	5	5		90	22		4,424
	Patton Engraved	5							2		1			8
	Rockport					2								2
Native American Ceramic Total		3,050				1,253	1	5	7		91	22		4,434
Ocher		3												3
Porcelain	Blue on White	11		1		4					3			19
	Polychrome	5				2								7
	Undecorated	1				5								6
Porcelain Total		17		1		11					3			32
Projectile Point	Abasolo					1								1
	Big Sandy					1								1
	Blank	1				1			1					3
	Golandrina					1								1
	Hoxie								1					1
	Marcos	1												1
	Morhiss	2	1											3
	Padre					1								1
	Perdiz	6				1			1					8
	Scallorn										1			1
	St. Mary's Hall								1					1
	Tortugas	1												1
	Untypable	3				1								4
	Untyped	1				1								2
	Untyped Lanceolate	1												1
Projectile Point Total		16	1			8			4		1			30
Red ware	Flower pot					1								1
														0

Table 12. *(Continued)*

Class	Type	Provenience/Unit												Total
		Borrow Pits	Branch	Div. 20	Div. 20 SE quad	General Surface	NE Quad	NW & NE Quad	NW Quad	Road	SE Quad	SW Quad	SW Quad Gully	
Stoneware	Albany/Bistol	1												1
	Bristol glaze					1								1
	Brown spatter	2				3					1			6
	Jug											7	7	14
Stoneware Total		3				4					1	7	7	22
Tool	Adze	3							1					4
	Clear Fork	2							1					3
	End Scraper	3				1						1		5
	Gahagan	10												10
	Guadalupe Adze Preform	1												1
	Indeterminate	2	1			1			2	2				8
Tool Total		21	1			2			4	2		1		31
Unglazed Ceramic	Caddo-like	6												6
	Miscellaneous	144				45			1		1			191
	Patton Engraved										1			1
	Red painted	5				6								11
	Sandy paste	82				27								109
	Tan paste	9				2					1			12
	Valero	9				2								11
Unglazed Ceramic Total		255				82			1		3			341
Volcanic stone		5												5
Whiteware	Banded slip					1				1				2
	Flow blue					1								1
	Hand painted									1				1
	Undecorated									5				5
	With gold band					7								7
Whiteware Total						9				7				16
Yellow ware	White interior					2				1				3
Grand Total		**4,177**	**5**	**139**	**10**	**3,032**	**5**	**107**	**44**	**12**	**173**	**112**	**49**	**7,870**

of Indians not too far from their aboriginal way of life, Presidio Loreto was essentially a multi-racial community made up of military officers, soldiers, and Mexican families unified by their isolation and their traditional customs.

The artifacts from the presidio and the burials within it are described first, then those from the prehistoric site. The artifacts from the later 19th century area are described last.

Food Preparation

Metal Objects (n=287)

In a presidio made up of both single men and families, the preparation of food would have taken place both in a central kitchen and in the individual houses. The principal metal that was used in the kitchen and possibly for objects used in the chapel appears to be copper. Most of the larger copper objects were found by Virgil Branch during his thorough search of the site with a metal detector after the field school. From the large numbers of copper vessel fragments recovered, we can deduce that copper cooking vessels did not hold up well over time. Obviously, when the presidio moved to the San Antonio River, everyone took everything still usable, leaving little on the site except broken pieces of pots and utensils.

Copper vessels used in the central kitchen would have included large cauldrons and cooking pots. Several pieces of one such pot were found scattered around the site. The rim was turned outward and curled under. Evidence of a large, heavy handle once attached with two rivets, and a patch riveted over a broken spot, demonstrate the hard life this pot endured before it was finally discarded. One entire copper pot rim that once was ca. 32 cm in diameter is reinforced by a heavy iron bar 3 mm thick and 2.5 cm wide, riveted to the edge of the pot every 6 cm around the rim. A flattened copper pan was once ca. 18 cm in diameter. It bears no evidence of a handle attachment. Another deeper pan was ca. 17 cm across and 6 cm deep and once had a single handle. A similar pan 20 cm across and 8 cm deep has been restored to its original shape by Bill Birmingham (Figure 22). This one had one handle that once was attached and evidence on the opposite side of the vessel for another. It had an outward-rolled rim. A basin with a flat, everted rim 13 mm wide is ca. 18 cm in diameter and 5 cm deep. Schuetz (1980:139 and Plate 2:29A and B) recovered several similar vessels at Mission San Juan Capistrano.

A domed copper object 8 cm across has a flange to control the depth of its insertion into a vessel neck or spout (Figure 23). This object is perforated with four circular rows of small holes in order to allow the sprinkling of wet or dry material.

A small copper vessel ca. 10 cm across and 4 cm deep has 16 crude holes punched in the bottom, suggesting its use for straining liquids (Figure 24). Another large, spoon-shaped vessel ca. 12 cm across and 30 cm long is punctured with 5 mm holes. Simmons and Turley (1980:123) identify such an object as a skimmer.

Every donkey-borne shipment to the frontier included a ration of chocolate to be used in making a popular beverage. A copper *chocolatero* restored to its original shape by Bill Birmingham is in the Branch collection (Figure 25). Four handles for these pots (Figure 26a) and thin copper fragments from them were also found scattered over the site. One fragment still bears a tin surface on the inside

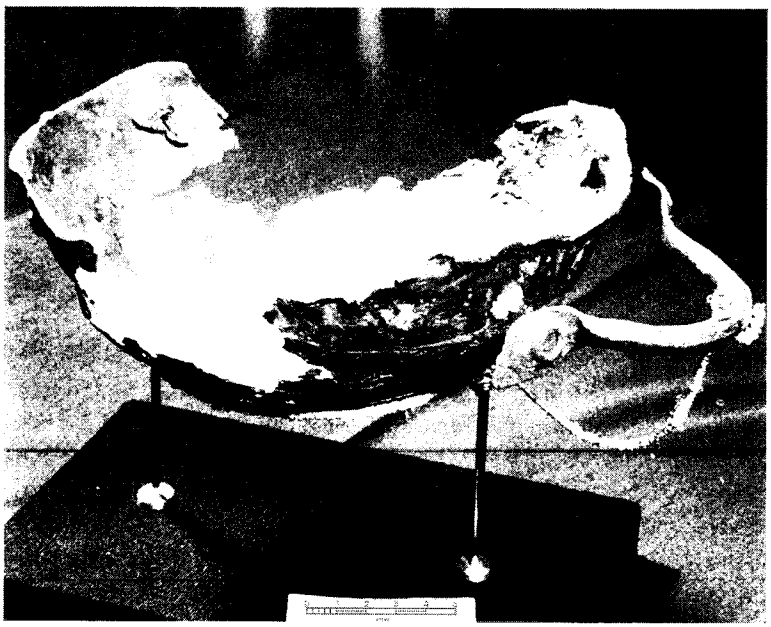

Figure 22. Reconstructed copper pan matching one recovered from 41VT8.

Figure 23. Domed copper object.

curve. Copper vessels used for cooking were sometimes tinned on the interior to protect against ingestion of copper salts (Woodhead 1978; Noël Hume 1970:176). In the years before the mid-18th century, chocolate was prepared by heating in a special copper vessel and whipped to froth with a wooden beater. For some reason, the copper vessels changed to ceramic ones at mid-century, although the shape remained the same. The presence of copper *chocolateros* and the near absence of fragments of ceramic ones on this site confirm the belief that there was this change in *chocolateros* some time around the 1749 move to Goliad.

A heavy copper bail handle could once have been attached to a pot ca. 25 cm in diameter. One heavy copper handle attachment (see Figure 26b) recovered by Branch may have been intended to accept this bail handle or one very similar. A heavy 2 cm wide copper strip, 25 cm long, may have been intended to reinforce the rim of a copper pan. Two heavy copper bars are 12 mm in diameter; a third is 15 mm in diameter. They may once have been handles for kitchen utensils, although they seem too heavy for that use. A relatively straight copper bar 9 mm in diameter and 11.5 mm long has been chisel-cut at one end and broken off a copper object at the other. It does not appear to be a pot handle.

Five copper patches vary in shape and maximum size from 10-19 mm across. They are identified by the presence of rivets around the edges that would have attached them to a vessel to repair a hole. Patches of this type, usually cut from discarded pots, are found on almost all Spanish Colonial sites.

One U-shaped iron handle (see Figure 26c) came from the upper level of Unit 34C4 in Cluster I. It has an iron rivet at the end of one side, and where it was attached to an iron object. Similar handles were attached to iron *comales* or griddles. Rectangular metal *comales* were generally used on the frontier and in larger Mexican cities, in place of the traditional round ceramic ones used elsewhere. These *comales de fiero* have been found on the frontier from East Texas to California (Simmons and Turley 1980:117).

An iron spoon (see Figure 26d) was recovered from the borrow pits opened by the sand removal operation. The handle is broken off halfway through a twisted area such as those illustrated by Simmons and Turley (1980:Plates 13 and 14). The bowl appears to have been made by hammering out the end of the handle, since there is no sign of a joint.

An iron knife (see Figure 26e) from which the tip has been broken has a tang in line with the back of the blade and a definite slope downward near the tip. This is unusual in knives illustrated in other reports. Schuetz (1980:Plate 2:20E), however, recovered a similar knife at Mission San Juan Capistrano, and Simmons and Turley (1980:Plate 3) illustrate a knife of similar shape that is in the collections at Presidio La Bahía at Goliad.

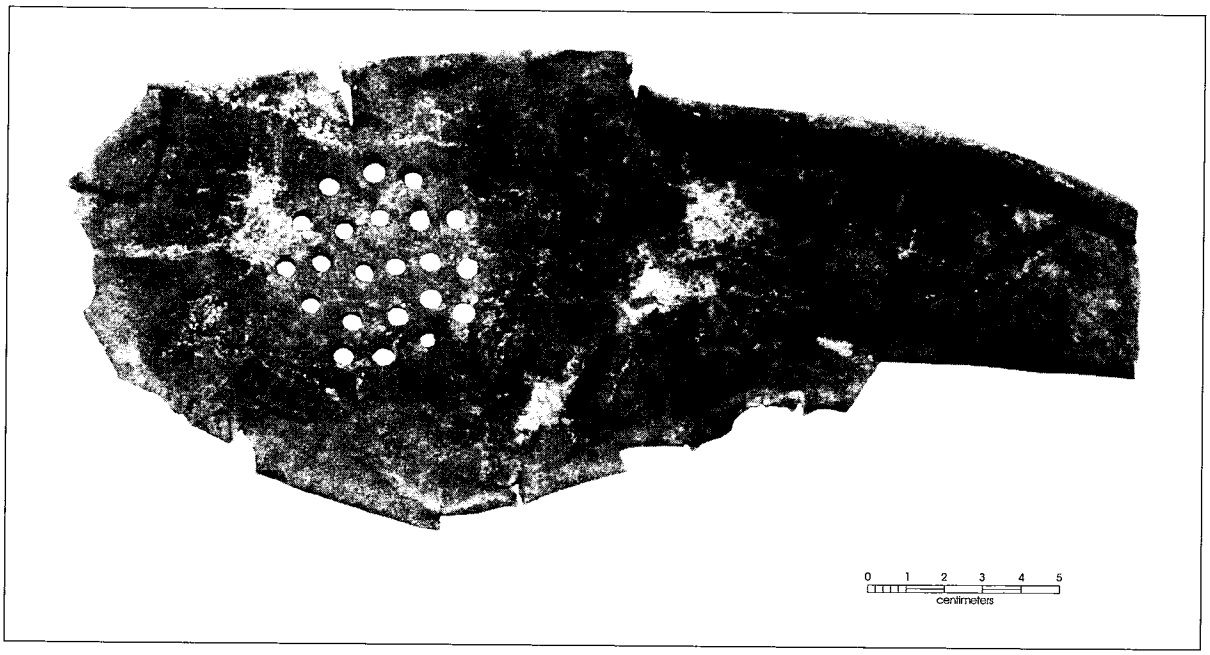

Figure 24. Small copper vessel, with holes.

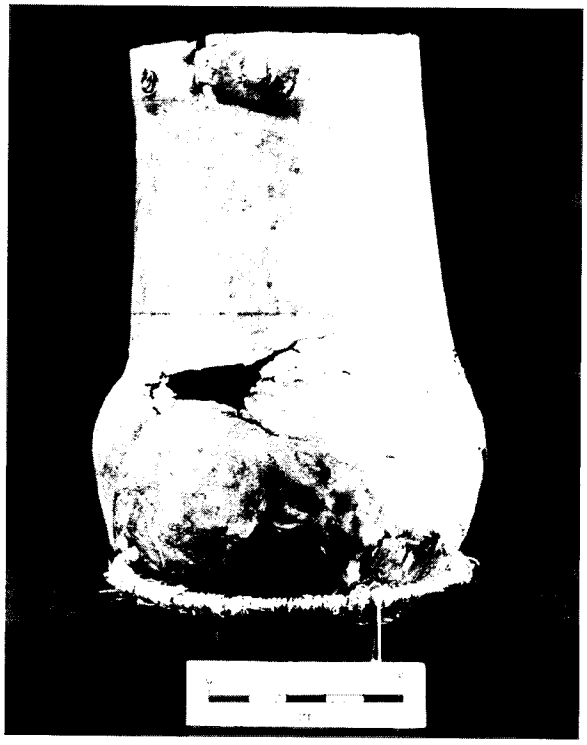

Figure 25. Restored copper chocolatero matching one recovered from 41VT8.

Thin iron fragments were recovered from most of the excavation units, and larger ones from Branch's metal locator survey. None of them provide any clue about the objects from which they disintegrated.

Grinding Objects (n=9)

Although none of them were found during the excavations, nine large fragments of metates (grinding stones) were uncovered during the sand mining operation in 1969 and added to the site collection. Four of these and one fragment of a mano are made of the basalt used throughout Mexico. Five are fragments of limestone metates traditionally used by Indians and prehistoric peoples and might also have been used by soldiers' wives. Three limestone manos, probably recovered from the riverbed, also came from the borrow pits.

Ceramics

Ceramic vessels were by far the most fully represented of all the artifact types on the site. The assortment and the sherd totals are overwhelming to one accustomed to mission sites, particularly in relation to the comparatively small number of the excavation units undertaken during the field school. This has provided a particularly interesting and important opportunity to study a collection that has a limited time period, and to compare this collection with the one recovered by a similar study at the related mission (Mission Espíritu Santo) across the river in operation during the same period.

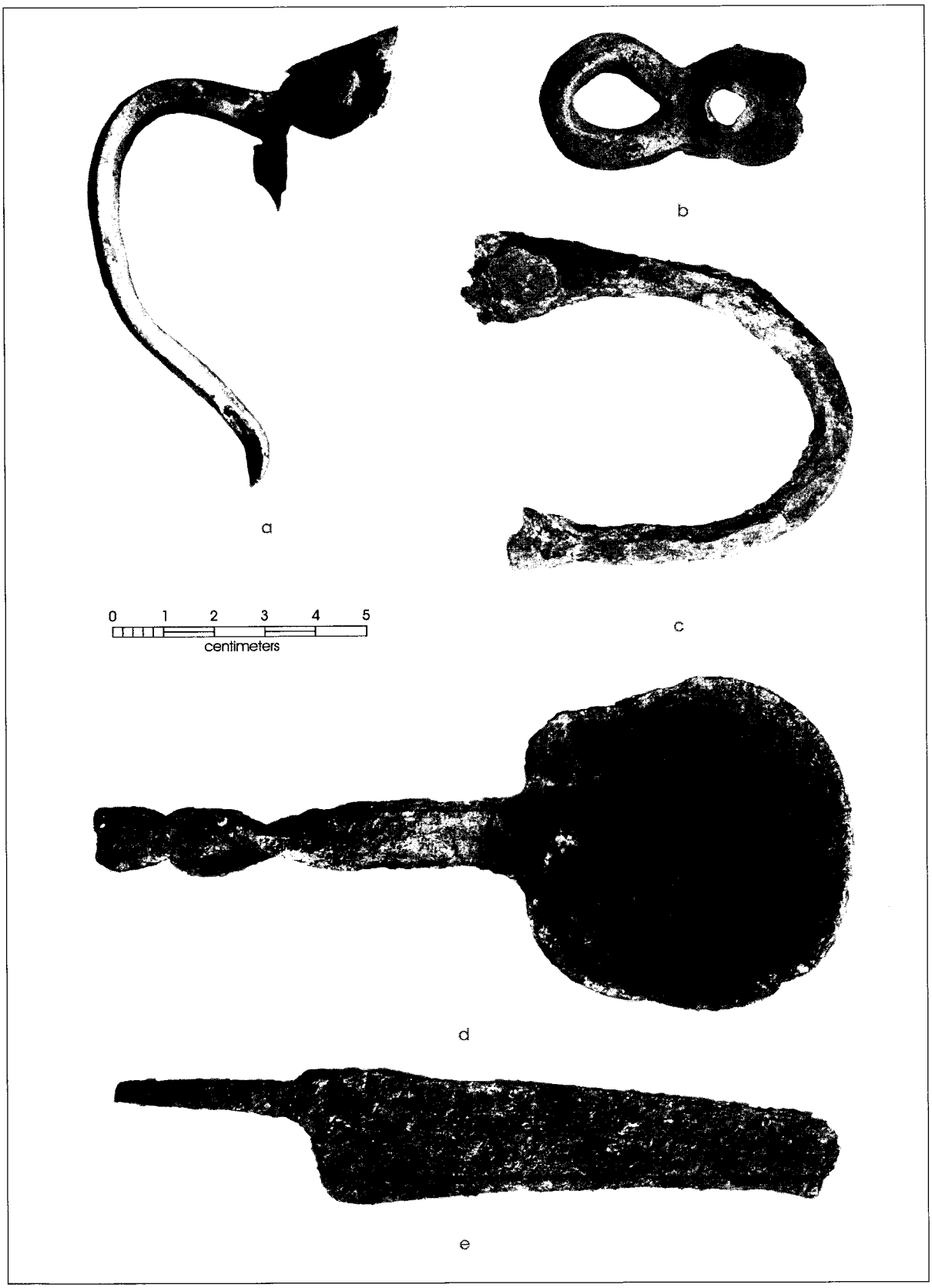

Figure 26. Metal cooking objects: (a) *chocolatero* handle; (b) handle attachment; (c) iron *comal* handle; (d) iron spoon; (e) iron knife.

Native American Types

Goliad Ware (n=11,169)

By far the largest number of sherds found during these excavations and the following surface collections, this ceramic type is common on colonial sites in San Antonio and Goliad. Evidently this pottery is merely a continuation of that made and used by the Late Prehistoric people in south-central Texas. There is no visible difference between the sherds of this type recovered during excavation of the prehistoric site on the riverbank and those found on the presidio site. The characteristics of this type include evidence of hand building with coils of clay rather than construction on a pottery wheel, the inclusion of ground, burned bone in the clay, and the presence of incomplete firing due to the use of open fires rather than kilns which would have better controlled the heat (Figure 27a). This type of pottery displays a wide range of thickness, color, and polishing, which reflect the individual potter's skill and their personal preferences. Later references to potters at Mission Espíritu Santo in Goliad suggest that it was the women who were making the pottery. The shapes most commonly found are simple, small bowls and jars with vertical loop handles attached by pushing the ends through the wall of the vessel and smoothing over the joints on the inside.

At the mission site, Goliad ware composed 98% of the total sherd count (Lakeman 2001:38). At this site it was about 80% of the sherds.

Rockport Ware (n=3)

A few sherds of a tan, sandy paste ware that can be positively identified as coming from the Texas coastal people were found on the site, two from the general surface and one from the first level of Unit 34B1. This can be tentatively classified as Rockport Black on Gray, having asphaltum on the interior surfaces (Suhm and Jelks 1962:131).

Lakeman (2001:38) identified about 2% of the Native American sherds at the mission as Rockport ware, all with asphaltum on the inner surface. How coastal pottery came to these sites is hard to explain, but it is not unusual to find a few sherds of this type on San Antonio's colonial sites as well.

Patton Engraved (n=13)

An interesting group of sherds from the Hasinai or East Texas Caddo people were found primarily in the southeast quadrant of the site (see Figure 27b), namely Patton Engraved ware (Suhm and Jelks 1962:117). Two of these still bear traces of red pigment in the engraved lines. Patton Engraved is the principal Caddo fine ware in ca. A.D. 1650-1800 Allen phase sites in the Neches and Angelina river basins in the East Texas Pineywoods.

Thirteen sherds of this type were found at the mission site. They probably were introduced to this area through trade, judging by their location on that site (Lakeman 2001:50-52).

Poynor Engraved (n=1)

One sherd of Poynor Engraved, another ceramic type made by the East Texas Caddo, was found in Cluster V excavations. Poynor Engraved is found in both Frankston phase (ca. A.D. 1400-1650) and Allen phase contexts in the Neches and Angelina river basins, accounting for more than 30% of the whole vessels in known Allen phase cemeteries (Kleinschmidt 1982: Table 19).

Unglazed Wares (n=563)

Miscellaneous (n=307)

Low-fired with a dark core and a sandy paste, these hand-made sherds appear to be locally produced from the clay on or near the site and fired over an open fire. The paste varies from smooth to granular and contains black inclusions that smear like charcoal. They may very well be the product of the soldiers' wives for use in their homes. There do not appear to be any of this type on the prehistoric site, nor on the mission site across the river.

Red Painted Ware (n=11)

This resembles the type above, but the paste is darker and the sherds are painted red-brown on one or both sides. They were mostly found on the surface or in the borrow pits.

Valero Red Ware (n=16)

This is a Mexican wheel-turned, kiln-fired reddish-tan ware with no obvious inclusions. The

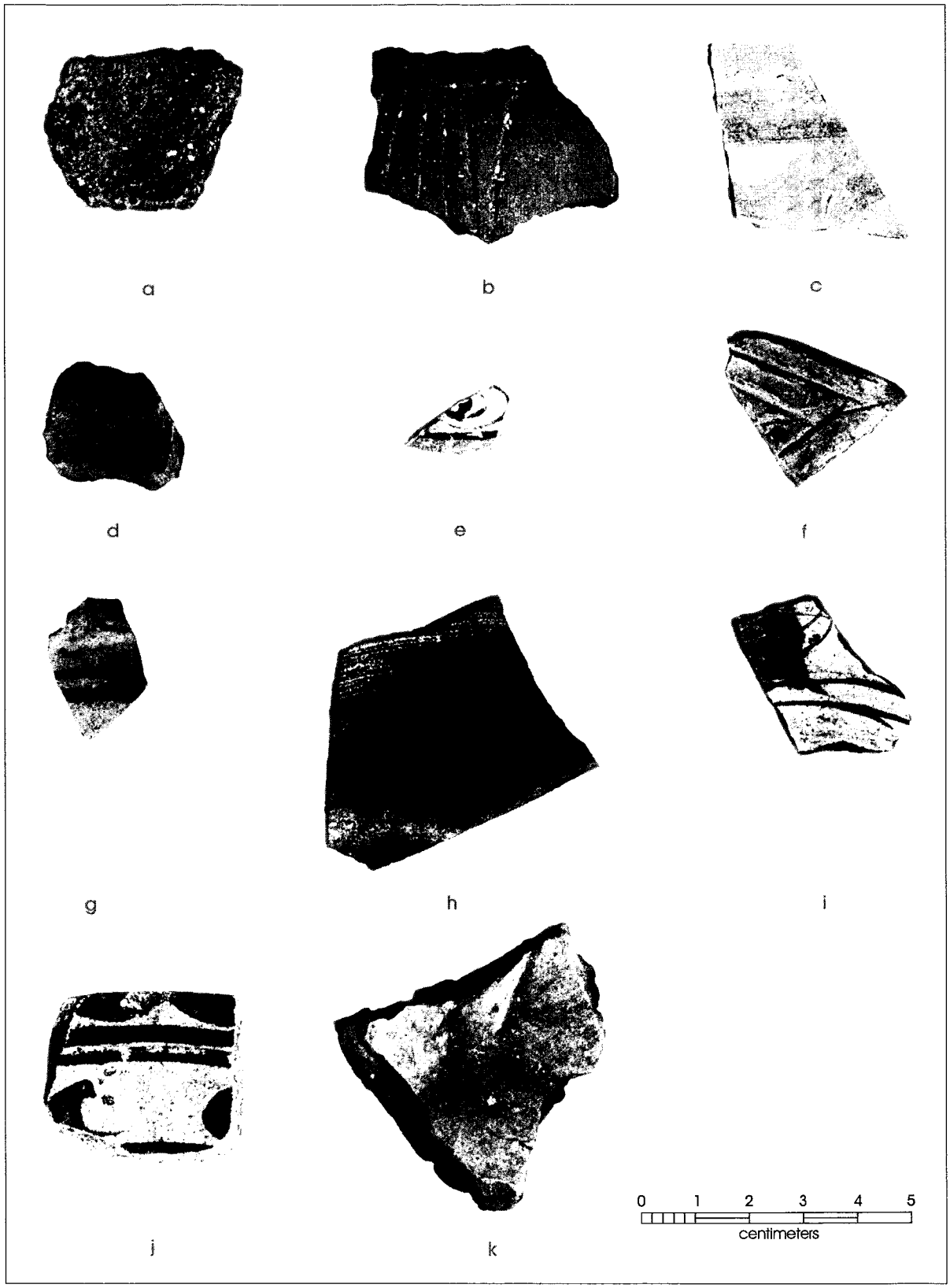

Figure 27. Unglazed and lead-glazed ceramics: (a) Goliad Ware; (b) Patton Engraved; (c) Valero Red Ware; (d) Red Burnished Ware; (e) Tonalá Burnished Ware; (f) Lead-Glazed Molcajete; (g) Galera Ware; (h) Red Brown Ware; (i) Tonalá Sgraffito Ware; (j) Brown on Yellow Lead-Glaze Ware; (k) Olive Jar.

sherds average 7 mm in thickness. The vessels represent relatively large, bulbous pots that may be water jars. They are decorated with red-brown painted lines swiped informally across the outside surface (see Figure 27c). They are often found on 18th century sites in the San Antonio and Goliad areas (Fox 1992:31; Tomka et al. 1999:56). Eleven of these sherds came from the borrow pits and the general surface collection, and five were scattered elsewhere on the site.

Plain Sandy Paste Ware (n=174)

These kiln-fired, wheel-made sherds contain very fine sand and in many ways resemble Valero ware without the red painted lines. They were found particularly in Divisions 34 and 42-43 in the southeast quadrant of the site, but many have no provenience except general surface or from the borrow pits. They may correspond to some of the three "unglazed utilitarian sherds" described by Lakeman (2001:56) from the mission site.

Unglazed Tan Paste Ware (n=54)

This type is a pale pinkish-tan in color, well-fired, and wheel-turned. It has no obvious inclusions. The sherds vary in thickness from 5 mm to 10 mm. Most of this type was found in the southeast quadrant of the site.

Unglazed Shell-Tempered Ware (n=1)

This sherd is 7 mm thick, obviously wheel-thrown and the same pink color throughout. It contains shell fragments that react violently to acid. No other examples of this type were found.

Burnished Wares (n=109)

Red Burnished Ware (n=31)

These vessels are dark red or occasionally black. The red paste is coated with a thin red slip that has been highly burnished (see Figure 27d). Matte areas on the interior of bowls and the exterior of larger containers have been decorated with burnished spirals and curvilinear designs. Two of the sherds recovered are black, but with the same decoration. This type was found primarily in the southeast quadrant of the site.

Twenty-six of these sherds were found on the mission site (Lakeman 2001:58).

Tonalá Burnished Ware (n=78)

This ware has a fine gray to tan paste that has a sweet, earthy fragrance when damp. Most vessels of this type have thin walls that are highly burnished and delicately painted with black, red, and occasionally yellow designs (see Figure 27e). There is no evidence of use of the potter's wheel, and they have been traditionally made with convex molds (Charlton and Katz 1979:47). This type also came from the southeast quadrant, particularly from Division 34.

Lakeman (2001:57) refers to this as Guadalajara ware and reports that 21 such sherds were recovered at the mission.

Lead-Glazed Wares (n=1,021)

Classification of lead-glazed wares has been a problem for archeologists throughout the area settled by the Spanish. One reason is the fact that what some call "coarse earthenwares" were made in many Mexican locations and at various times, so that a classification system for one time period does not necessarily transfer to a different time period. In fact, archeologists in Florida have combined most of these wares into one type, which they call El Morro ware (Smith 1962:68; Deagan 1987:50-51), when dealing with lead-glazed wares from the 17th to early 18th century. Careful examination of lead-glazed wares in this collection has resulted in a combination of the types first suggested by Fox (1974:55-59) and some generalized types where there is too much confusion to separate them. It appears that some of the types of lead-glazed ware later described for sites in the mid-18th century were just beginning to come into Texas in the first quarter of that century. By far the majority of these wares were recovered from Divisions 34 and 42-43 in the southeast quadrant of the site.

Miscellaneous Lead-Glazed (n=295)

The obvious use of the potter's wheel and probable firing in a kiln are the criteria for identification of these sherds. The paste is often sandy with various mineral inclusions. The glaze is

relatively thick and varies from yellow through brown to green with some even displaying evidence of immature or careless firing that resulted in a dull grayish-brown surface. Most vessels are relatively heavy bowls and pitcher forms that were probably used for storage and food preparation. Some have rounded bases, some flat bases, and one sherd has a ring foot. They include two fragments of *molcajetes* (see Figure 27f). They came from the surface and from Level 2 of Unit 34A3. *Molcajetes* are small, three-footed, sandy paste, lead-glazed bowls with the interior roughened by deep incising with linear patterns. Various seasonings were ground in these vessels with small basalt pestles. Such vessel fragments are commonly found on Spanish Colonial mission and presidio sites.

Gray Paste Lead-Glazed Ware (n=445)

These sherds have been separated from others by the difference in the paste, which contains very fine sand, some with small white inclusions that do not appear to be shell or bone, and is always a dull gray. They have a very thin lead glaze, and show evidence of use of the wheel by the potter. The sherds are slightly thinner than the ones described above and may represent bowls and serving dishes.

Galera Ware (n=44)

This term has been used for years across the Southwest (Gerald 1968:53-54) for a thin, molded ware with a lead glaze on the interior that laps over the rim and down onto the outside. The outer surface from the rim to the shoulder is generally decorated with brown designs (see Figure 27g), to which were later added ones in cream, green, and yellow. It first seems to appear at the mid-18th century in *chocolateros* that gradually took the place of copper vessels used for the same purpose. The fact that it began to appear on this site along with the copper ones before the move to Goliad demonstrates gradual changes were taking place in the use of copper vs. ceramic vessels. Other vessels such as bean pots and casseroles for serving food appeared in the last quarter of the 18th century. One sherd of this type recovered from Division 20 is probably from the 19th century site, since it is shaped and decorated much like a later casserole dish found at Mission San Juan (Schuetz 1969:Plate 25A).

Red Brown Ware (n=188)

Another type with red paste, this has a red-brown tinted glaze and exhibits distinct throwing rings (see Figure 27h). It was first identified by Schuetz (1969:51) as Guadalajara ware. The sherds vary from 4 to 6 mm in thickness, and vessels are primarily shallow bowls and small jars with everted rims, glazed only on the interior.

Tonalá Sgraffito Ware (n=39)

This appears to be an early version of Tonalá Glazed ware. The red body is covered with a white or cream-colored slip over which is applied a clear lead glaze and green, red-brown, and black designs (see Figure 27i). The fragrance of the body when moist identifies it as coming from Tonalá. Rex Gerald (1957:173) and Mark Barnes (1980:101) describe this as Tonalá Polychrome Glazed ware and date it ca. 1780-1830. It has since been noted at the San Antonio missions (Zapata et al. 2000:40), which would push the date a bit earlier. Some of the sherds from 41VT8 have been decorated by scribing designs through the slip revealing the red body beneath.

Brown on Yellow Ware (n=1)

The fine-grained paste of this ware is yellow to orange, and the lead glaze is colorless, just bringing out the color of the paste. It is decorated with swirling brown designs on the interior of shallow bowls (see Figure 27j). The sherd was recovered from the surface by one of the borrow pits. The type appears at the mid-18th century in other Texas sites.

Black Luster Ware (n=3)

Schuetz (1969:52) first reported this type from Mission San Juan Capistrano, stating that it was made in Santa Fe, Michoacan, with a buff, bone-tempered body, and in Puebla with a terra cotta body. Barnes (1980:100) has stated that a black-glazed ware on a reddish body came from Santa Fe, Michoacan, dated between 1750-1850. The three sherds from this site are all on a red body.

Olive Jar (n=6)

These represent large, heavy ceramic jars used for shipping wine and olive oil from Europe (Goggin 1964). The sherds from this site, which may all be from the same vessel, have a green lead glaze on the inside and a white coating on the outside (see Figure 27k). The paste is a coarse reddish-brown.

Mexican Tin-Glazed Wares (n=950)

All Mexican tin-glazed wares, commonly called majolicas, were made on a potter's wheel and fired in a kiln, then covered with a lead glaze to which tin had been added to produce an opaque surface for decoration, then fired again. Archeologists have been studying these wares for over 50 years because the designs can be dated sufficiently to help date sites and the deposits within them. A detailed study of the majolicas from this site has been published by Calhoun (1999:339-354).

San Luis Polychrome (n=22)

Designs on this ceramic type are floral sprays in green and brown on a cream background (Figure 28a). Vessels include deep-brimmed plates and small bowls. It has only been found in early 18th century deposits in Texas.

Abó Polychrome (n=2)

There are two types of Abó Polychrome. Type A, first described by Goggin (1968:159-161), was not present on this site, but was illustrated by Calhoun (1999:Figure 5a). Type B has an orange rim band bordered with brown lines, from which are suspended small sprays of blue petals (see Figure 28b). The vessels are primarily deep plates. The interior design in the center of the plate is either a floral arrangement or a polychrome human or animal figure. The estimated dating for this type is ca. 1720 to 1750 (Smith 1965:91-93). Only two majolica sherds of this type have been identified from the 41VT8 collection, although several other small, unidentified polychrome fragments might also be included (Calhoun 1999:Figure 5b-c). Lakeman (2001:75-77) reports a majolica type from the mission site that is probably also Abó Polychrome B.

Puebla Polychrome (n=8)

Decorated surfaces are painted with blue swaths over white enamel surrounded by lace or cobweb effects in thin black lines (see Figure 28c). Tentative dating is from the last half of the 17th century into the 1720s.

Puebla Blue on White (n=145)

This type is decorated with designs painted in dark and light blue over white enamel (see Figure 28d). The vessel shapes are predominantly deep plates and small cups. The plate rim has two blue bands from which are suspended a row of blue petals alternating with single blue flowers. In the center of the plate is a flower or a long-legged bird. This is an 18th century type common on all the colonial sites in Texas.

San Agustín Blue on White (n=21)

This type is covered with smooth, chalky white enamel decorated with floral designs in dark and light blue (see Figure 28e). The dark blue predominates, with the lighter shade shadowing the darker designs. The blue designs completely cover the interior and light blue loops cover the outside of the plates. At first it was thought that this was only made from 1700 to 1730. Its presence on the presidio site at Goliad suggests extending the date to post-1749.

Huejotzingo Blue on White (n=31)

The decoration on deep plates and cups consists of a single blue band on the outside of the lip of an otherwise plain white vessel (see Figure 28f). This type dates throughout the 18th century on all Spanish Colonial sites.

Unidentified Blue on White (n=422)

A large percentage of the majolica sherds have touches of blue too small to identify the type.

Unidentified Polychrome (n=72)

A collection of the majolica sherds has touches of polychrome colors too small to identify the type.

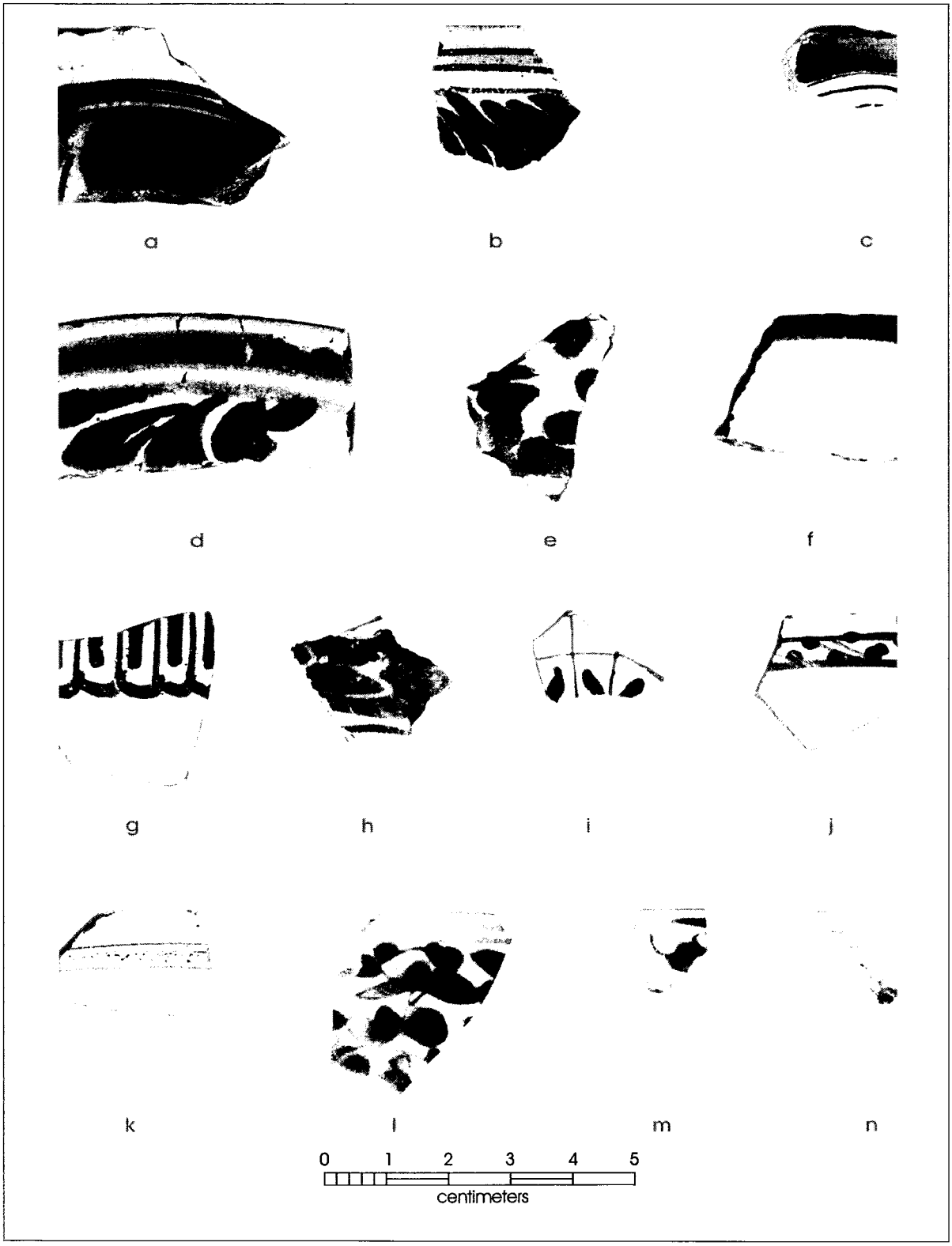

Figure 28. Porcelain and tin-glazed ceramics: (a) San Luis Polychrome Majolica; (b) Abó Majolica Type B; (c) Puebla Polychrome Majolica; (d) Puebla Blue on White Majolica; (e) San Agustín Blue on White Majolica; (f) Huejotzingo Blue on White Majolica; (g) Rouen Faience; (h) Unclassified Polychrome I Faience; (i) Unclassified Polychrome II Faience; (j) Unclassified Blue on White I Faience; (k) Unclassified Blue on White II Faience; (l) Blue on White Porcelain; (m) Blue and Red on White Porcelain; (n) Polychrome Porcelain.

Undecorated Majolica (n=227)

Many sherds appear to be totally undecorated. A large percentage of these may well be just undecorated portions of otherwise decorated types. However, small bowls, cups, and chamber pots of white majolica ware were produced throughout the colonial period (Lister and Lister 1974:30).

Faience (n=33)

Tin-glazed earthenwares were also made in France. The simply decorated French tin-glazed wares made in the 17th and 18th centuries referred to as *faience blanche* were used as table wares. All of the faience recovered from this site is included in this variety. The classifications are those used by Calhoun (1999:350-352).

Rouen Faience (n=5)

The enamel on the surfaces is flat white and the decoration consists of bright and dark blue designs (see Figure 28g). The paste is pale pinkish-yellow and relatively soft. The glaze has a tendency to flake off occasionally. This type was made in the town of Rouen.

Unclassified Polychrome I Faience (n=4)

The surfaces of this type are covered with opaque enamel with a blue-gray tint. Floral decoration consists of green leaves, dark blue petals, and red stems (see Figure 28h).

Unclassified Polychrome II Faience (n=5)

The paste of this type is cream-colored with a dirty white glaze. The decoration consists of small flowers painted in pink, yellow, and dark red with green leaves, or elements in dark red and dark blue (see Figure 28i).

Unclassified Blue on White I Faience (n=5)

This type has a strip of geometric blue decoration just inside the rim on a grayish-white enamel surface and a cream-colored paste (see Figure 28j).

Unclassified Blue on White II Faience (n=1)

A single sherd of this type is from a large, thin plate that is decorated with a single blue band just inside the rim. The background enamel has a bluish caste (see Figure 28k).

Undecorated Faience (n=13)

As with the majolicas, there are a large number of undecorated sherds. Many of these probably come from blank areas on decorated vessels.

Chinese Porcelain (n=62)

Porcelain vessels were regularly transported on galleons from the Philippines to Acapulco throughout the 18th century (Deagan 1987:96). Chinese porcelain can usually be differentiated from European porcelain by its slightly blue-gray tint and the delicate thinness of the sherds.

Most of the porcelain on 18th century colonial sites can be dated to the Ch'ing Dynasty, 1644-1912 (Deagan 1987:99). Decoration on the porcelain from this site can be grouped into three categories according to the colors in its decoration. The largest number of sherds is decorated with blue on white (see Figure 28l). Another group includes blue decoration with red touches (see Figure 28m) and sherds with pale green and red designs (see Figure 28n). There are also a smaller number of sherds with no decoration.

Personal Objects

Included in this category are things that would have been used by individuals or worn on clothing. This also includes objects that would have been carried about and somehow lost or discarded.

Two fragments of a ceramic smoking pipe were found in Level 2 of Unit 42A6 and Level 1 of Unit 34C3. Although the fragments are small, they appear to have come from the same pipe bowl, which had a molded design. The paste is a dark gray and the outer surface has a thin glaze.

A small sleeve-sized button from Burial 2 bears the emblem of the Texas Navy (Figure 29a). On the back is stamped "SCOVILL." The Texas Navy was in existence from 1835 to 1843 (Albert 1969:250), suggesting that the burial took place sometime in the mid-to-late 19th century. The only

18th century button in the collection came from Trench 3. It is a brass compound button consisting of a hemispherical upper part with a raised pinwheel in the center, brazed to a cast, one-piece brass back with a drilled shank typical of early 18th century buttons.

A 19th century compound metal button came from Burial 2 (see Figure 29b). The face of the button was stamped with an elaborate floral design. A wire loop was brazed to the back half. A small fragment of the fabric to which the button had been attached was preserved by sticking to the back. The fabric is tightly woven and relatively thin.

A plain, flat, gilded button from the same burial has "EXTRA SUPERFINE" stamped on its back, surrounding a brazed loop.

Fourteen bone buttons were also found with Burial 2 (see Figure 29c-f). All of these were four-hole buttons of similar design. Two of these measure 1.5 cm in diameter, one is 1.8 cm across. Seven of these buttons were located below the waist of the burial, one at the end of the left femur, and the others were recovered during the excavation of the grave. Bone buttons have been used on underwear since the 18th century (Albert and Kent 1949:25). They were still common in the last half of the 19th century.

A small, brass thimble was recovered in Division 26 by Branch (see Figure 29g). It closely resembles one found by Tunnell at Mission San Lorenzo de la Santa Cruz (Tunnell and Newcomb 1969:62), but is a few centimeters smaller in diameter.

Two interesting keys were found on the site. One is a barrel key (Simmons and Turley 1980:155) used on a chest or a cupboard door (see Figure 29h). The other is called a pin key (Simmons and Turley 1980:156), and it would have been used on the lock of a door that needed to be opened from both sides (see Figure 29i).

Two metal tinklers were found, one made of iron, from the second level of Unit 34C1, and one

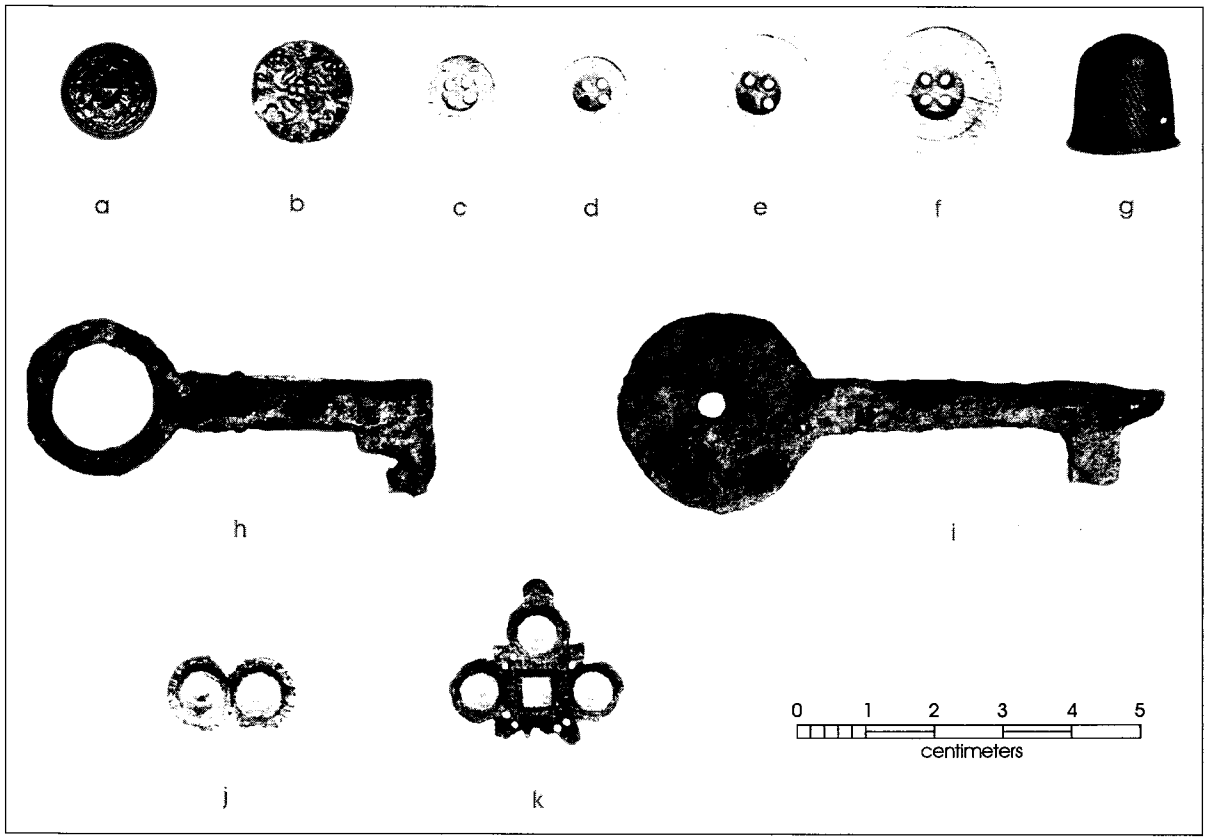

Figure 29. Personal objects: (a) Texas Navy button; (b) 19th century metal button from Feature 10, Burial 2; (c-f) bone buttons from Feature 10, Burial 2; (g) thimble; (h) barrel key; (i) pin key; (j) cufflinks of copper with glass sets; (k) part of crucifix, copper with glass sets.

of copper from Division 30. They were made by rolling small pieces of thin metal into cone-shaped objects to be suspended from clothing or earrings. Such objects have been found on many Spanish Colonial sites (see Schuetz 1969:18) and on historic Indian sites "throughout most or all of the plains" (Jelks 1967:92).

Hawk bells were also commonly found on Spanish and Indian sites. One half of such a bell was found by Branch in Division 30. It is the lower half of a flush-edge bell that would have been soldered to an upper half that had a loop for fastening (Jelks 1967:87-89). The bell is 2 cm in diameter and has two holes with a slit between them.

Nine coins were recovered from Burial 2. Of these, eight were U.S. silver half dollars dated from 1821 to 1849. One was a Mexican silver coin marked "8 R. PI. 1848. A-M-10Ds-20Ds." The coins were stacked and bonded together when they were uncovered. Their location within the burial suggested that they had been in a pants pocket. The close dates on them point to a burial not long after 1850.

Four fragments of copper jewelry, each having a glass set, came from Units 34C3, 42H2, 43Q15, and Division 45, respectively. They are similar to jewelry fragments found at the Texas missions. A pair of cuff links (see Figure 29j) from Division 45, and the top portion of a crucifix (see Figure 29k), have clear glass sets. They are identical to those found at Mission San Juan Capistrano (Schuetz 1969:44). Two objects identical to the crucifix piece were found at Santa Rosa Pensacola (Smith 1965:Plate 26b). A delicate silver mounting for suspension of a jewel or glass object was found on the surface of Division 43.

Four glass beads were spotted by sharp eyes in the backdirt after screening at Divisions 34 and 42 and on the general surface. They have been identified from the Harris bead charts as follows:

> No. 126, an extra small, Bluebird Blue, opaque, donut-shaped garter bead of simple construction (Harris and Harris 1967:151);
>
> No. 80, a small Peacock Blue, opaque, donut-shaped garter bead of simple construction (Harris and Harris 1967:147);
>
> No. 83, a small, emerald green, translucent, donut-shaped garter bead of simple construction (Harris and Harris 1967:147); and
>
> No. 43, a large, clear, barrel-shaped, mandrel-wound necklace bead with probably pressed facets of simple construction (Harris and Harris 1967:143).

Religious Objects

Two identical heavy, square brass plates and a portion of another, each with a centered hole, were found in Divisions 34 and 37 as part of the Branch collection (Figure 30a). Since a projection at one end of a turned object exactly fits into the hole in the brass plate, it seems likely that they are a candlestick and its base. Similar turned objects have been excavated at several of the other San Antonio missions. They may well have been part of the standard religious articles provided for the frontier churches.

A turned brass object (see Figure 30b) was recovered similar to two found during the 1930s reconstruction at Mission San José (Schuetz 1969:29 and Figures 3C and 3D). Schuetz identified these as parts of an aspergillum, an object used in the church for sprinkling holy water.

A turned brass lid for some sort of container was found by Branch in Division 26. A central knob on this object is pierced by a hole through which a ring or chain was probably passed in order to facilitate lifting the lid, or even the vessel. Three holes in the edge of the object would have allowed secure attachment to the vessel for which it was intended, and there is one 5 mm hole in the lid between the knob and the rim.

Two fragments of another turned brass object of a slightly larger diameter, with a 10 mm hole in about the same relationship to the center, displays no means of attachment to a vessel. This object came from Trench 10 on the edge of Schmeidlin's excavations on the south side of the site.

Schmeidlin found a religious medallion (see Figure 30c-d) on the site in 1966 (Calhoun to Tunnell 1966). It has a woman's head on one side and a man's head on the other. A border of small doves encircles each one.

Horse Equipment

Metal bits, spurs, and stirrups were objects necessary to the presidial soldier who depended on the horse to carry out his responsibilities. Bridle bits in

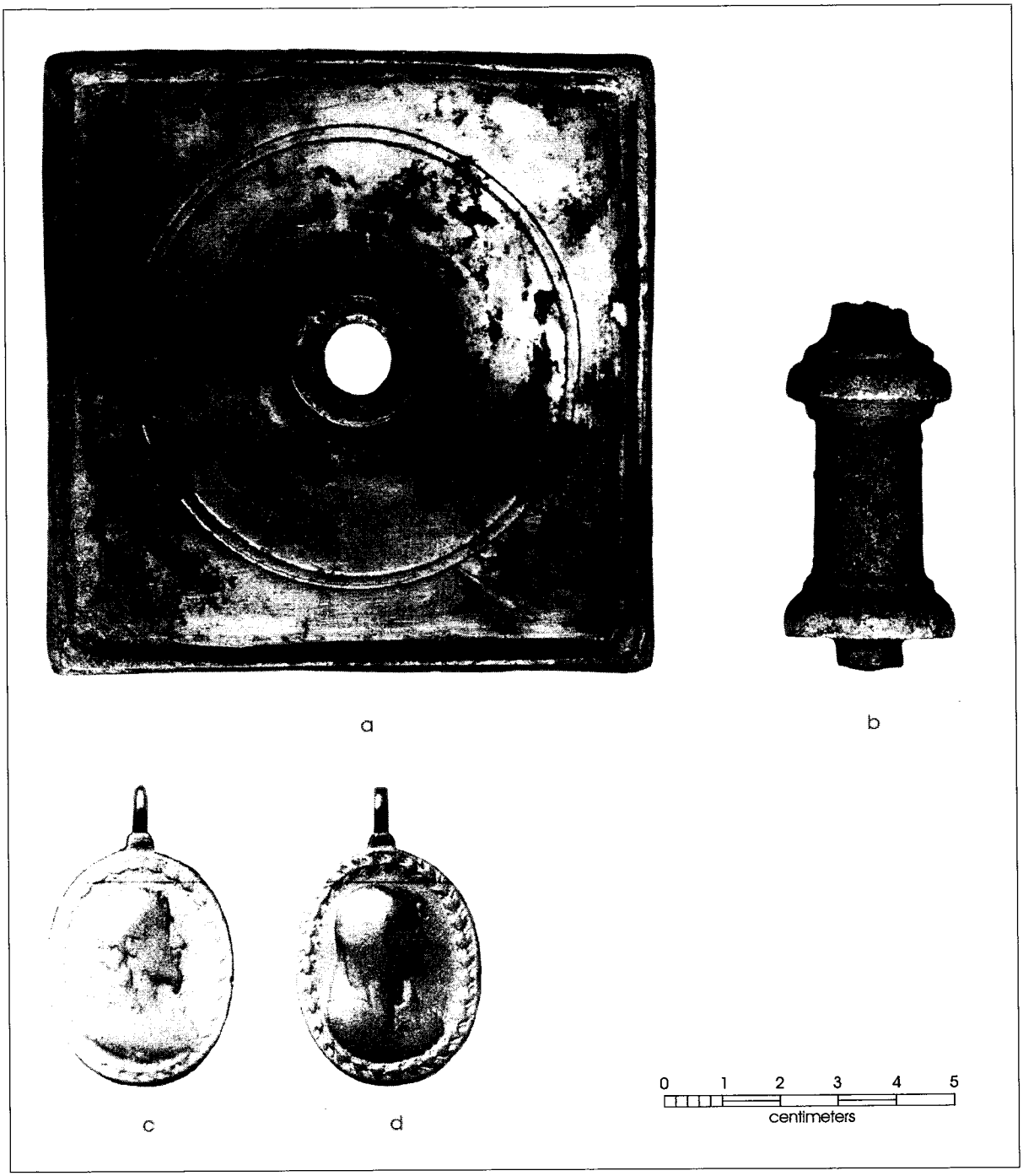

Figure 30. Religious objects: (a) candlestick base; (b) candlestick fragment; (c-d) both sides of a religious medallion.

use during the 18th century were primarily ring bits (*frenos de argolla*). These were popular for a long time, and in fact are still made in parts of Mexico today (Simmons and Turley 1980:102). The following detailed descriptions are intended to aid others in identifying the miscellaneous fragments that appear on 18th century Spanish Colonial sites.

Decorative copper ornaments for harness leather (Figure 31a-c), with prongs on the back for attachment (Noël Hume 1970:242), came from Divisions 30 and 45. The only parts of spurs in this collection are the small heel chain (Trench 10 and Division 32), buckle attachments, and one button (Division 34) to hold the spur leathers (see Figure

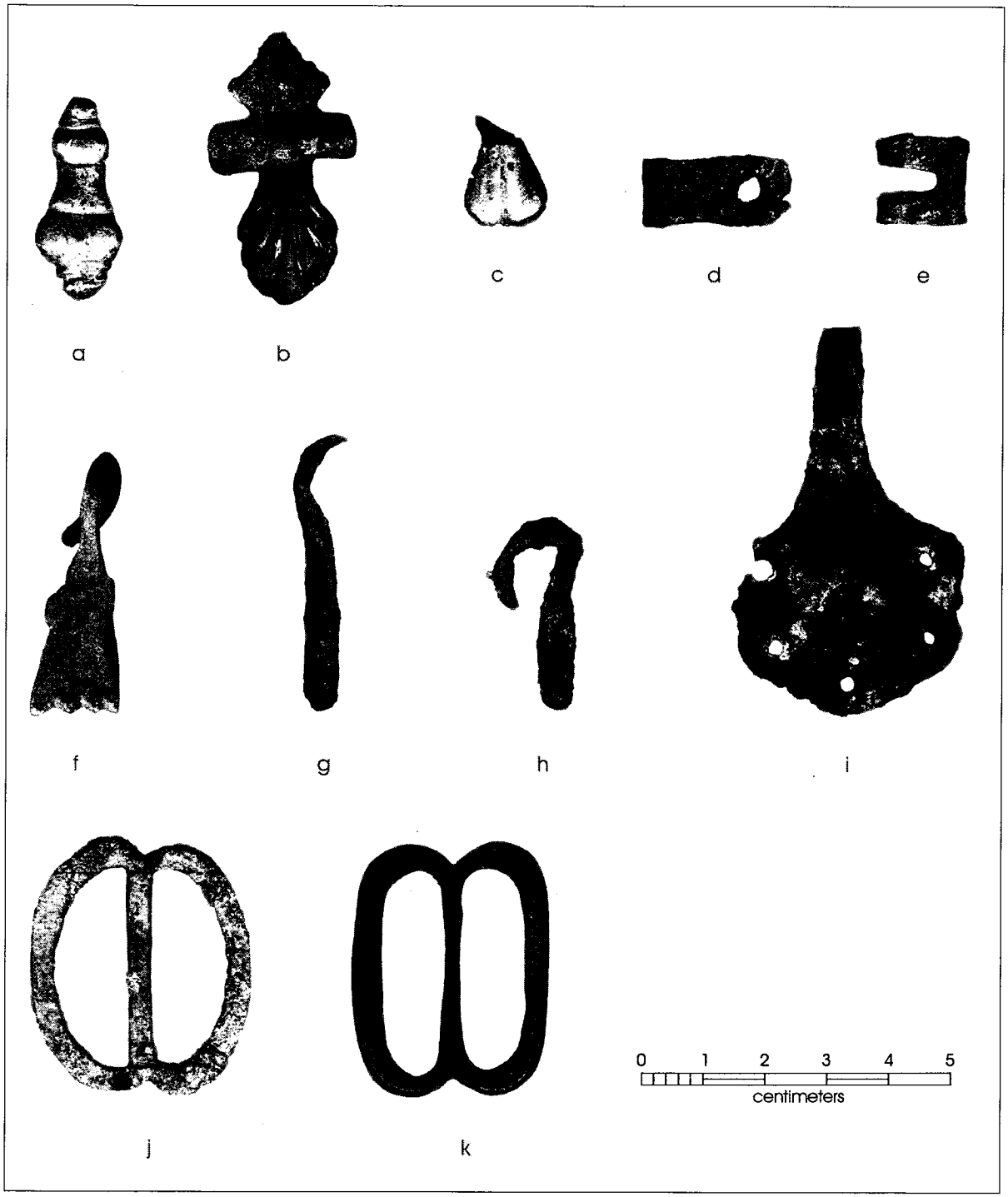

Figure 31. Horse equipment: (a-c) copper ornaments; (d) heel chain attachment for spur; (e) buckle attachment for spur; (f-h) *coscojos*; (i) tab for attachment of slack chains; (j-k) buckles.

31d-e; Simmons and Turley 1980:110).

One fragment of a bridge or *puente* that hung below the horse's nose to support a row of jinglers or *coscojos* (Simmons and Turley 1980:103) came from Level 1 of Division 34. Six *coscojos* that came from various locations on the site could have hung from the bridge of a bit or from a spur (see Figure 31f-h).

Four fragments of curb ring bits were recovered from the borrow pits. Two fragments of curb

rings from ring bits came from the borrow pits and from Trench 3, and a tab for attachment of slack chains to the ring was also found in the borrow pits (see Figure 31i). Small iron rings used to attach parts of these bits were found in Trench 10 and in the surface collection. Two S-shaped chain links from rein chains were also excavated from the units in Division 34.

In relation to the leather parts of a harness, two buckles from Division 21 could only be from horse harness (see Figure 31j-k).

A large iron artifact recovered by Branch has been identified as a portion of a cruciform stirrup or *estribo de cruz* (Figure 32). Commonly called a "conquistador stirrup" today, these were actually used by militia in the 17th century but discontinued when their use was prohibited by regulation in 1722 (Simmons and Turley 1980:106).

Horseshoes in colonial times had a wider web than later American horseshoes, and had square, counter-sunk nail holes (Noël Hume 1970:239). Horseshoes are relatively rare on Spanish Colonial sites, probably due to the fact that few of the horses were shod (Simmons and Turley 1980:61).

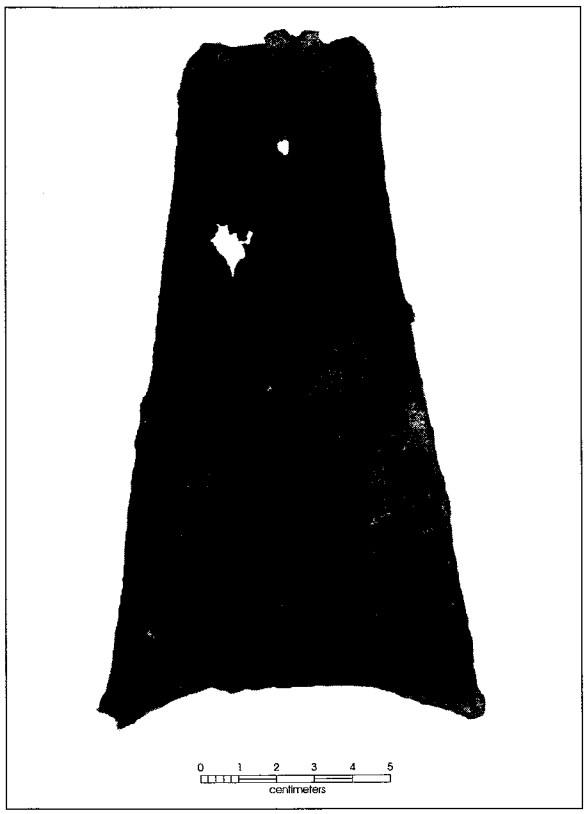

Figure 32. Part of cruciform stirrup.

Only one horseshoe and one horseshoe nail were recovered from the borrow pits during the field school. A much smaller donkey shoe also came from the borrow pits. According to Simmons and Turley (1980:66), donkeys rarely were shod.

Arms

One of the largest and most interesting artifacts recovered from the borrow pits is the hilt of a broadsword (Figure 33a) such as each soldier was required to carry (Brinckerhoff and Chamberlain 1972:79 and Plate 144). This sword was listed in the regulations as the *espada ancha*. "It was a short, wide-bladed heavy instrument much akin to the modern machete" (Faulk 1971:53).

Various miscellaneous gun parts are also in the collection. Portions of a brass trigger and trigger guard, and a ramrod pipe, came from Division 30 (see Figure 33b). An iron side plate (see Figure 33c) came from Trench 3 and a brass gun stock decoration (see Figure 33d) was found in Division 38. Finally, an iron trigger plate came from the borrow pits (see Figure 33e).

Thirteen musket balls came from various locations on the site. Seven are .59 caliber musket size, four are .49 caliber pistol size, and one is .41 caliber pistol size (Nesmith 1992:57). One ball is too flattened from impact to measure.

The tip or chape of a knife sheath was recovered from the surface in Division 34. A similar one was reported from the previous site of the presidio by Gilmore (1973:Figure 23m).

Construction Materials and Hardware

Many of the 35 forged nails recovered from various excavation units as well as from the borrow pits no longer had heads or were merely the heads with perhaps a cm or so of the body still attached, suggesting that they may have been forcibly removed. Others had been clinched (bent over on the opposite side of a wall or door). This could mean that the structures were torn down and the remains burned when the presidio was moved in 1749.

Fourteen cut nails that date to the late 19th or early 20th century came from the coffin for Burial 3. Coffin nails are usually recognizable because of the fragments of wood still clinging to the nails, preserved in the coat of rust on the nails.

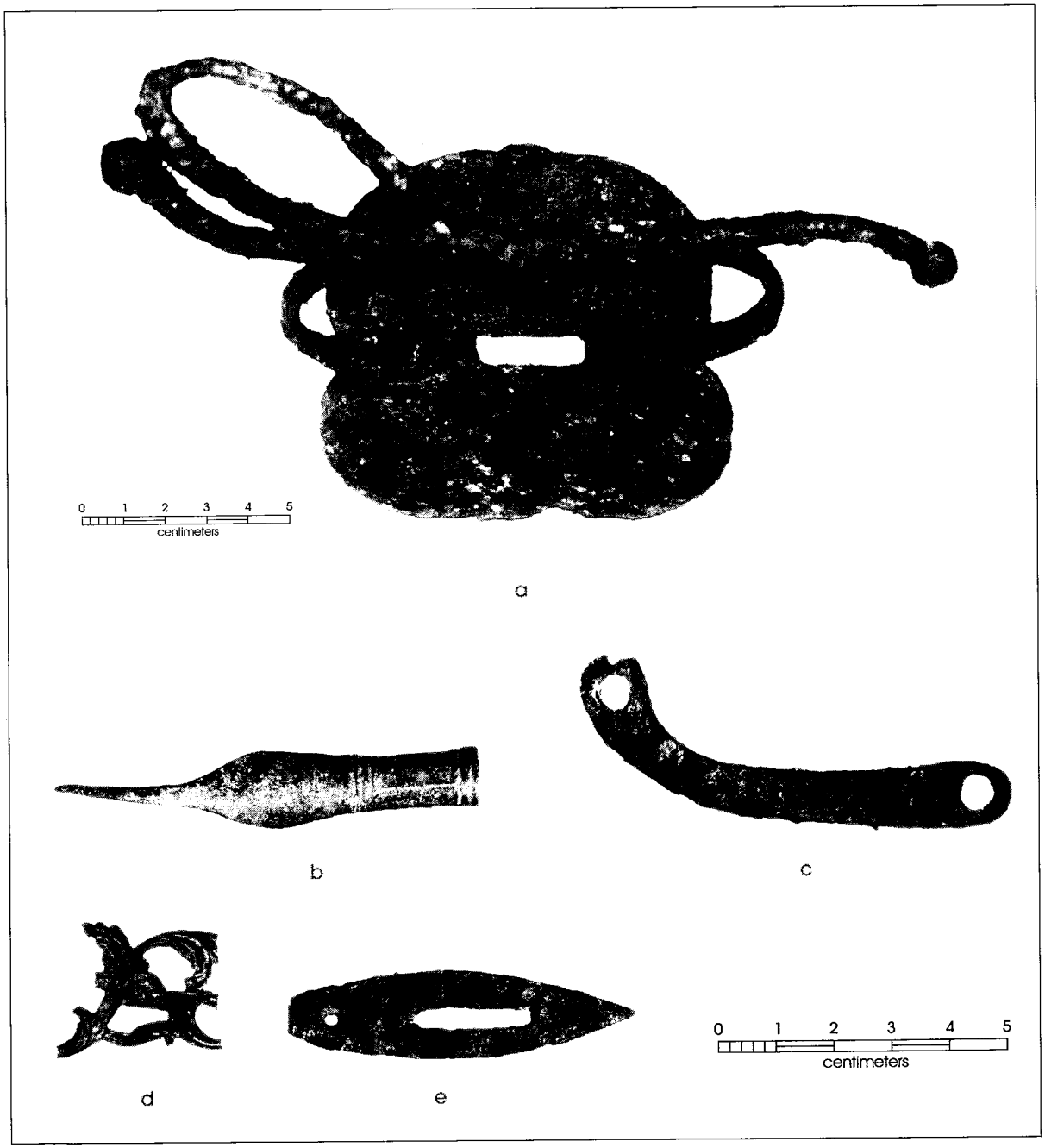

Figure 33. Arms: (a) broad sword hilt; (b) ramrod pipe; (c) side plate; (d) gun stock decoration; (e) trigger plate.

Six identical copper tacks were recovered, one from the surface of Division 20, one from the surface of Division 34, three from Division 43, and one from the borrow pits. Tacks such as these were often used as decoration on furniture and are referred to as furniture tacks. It is hard to imagine furniture of this sort at a frontier presidio. One iron tack, 3 cm long, was recovered from Division 38.

Only one half of an iron snipe hinge or *gozne* was recovered (Figure 34a); it is one half of a pair that interlocked. One was driven into a door and the other into its jamb (Simmons and Turley 1980:137 and Figure 1). The one in this collection would have had the spike driven into a door, and then spread apart and clinched. Measuring the length between the eye and the clinched end on this hinge tells us that the door was 2.5 cm thick.

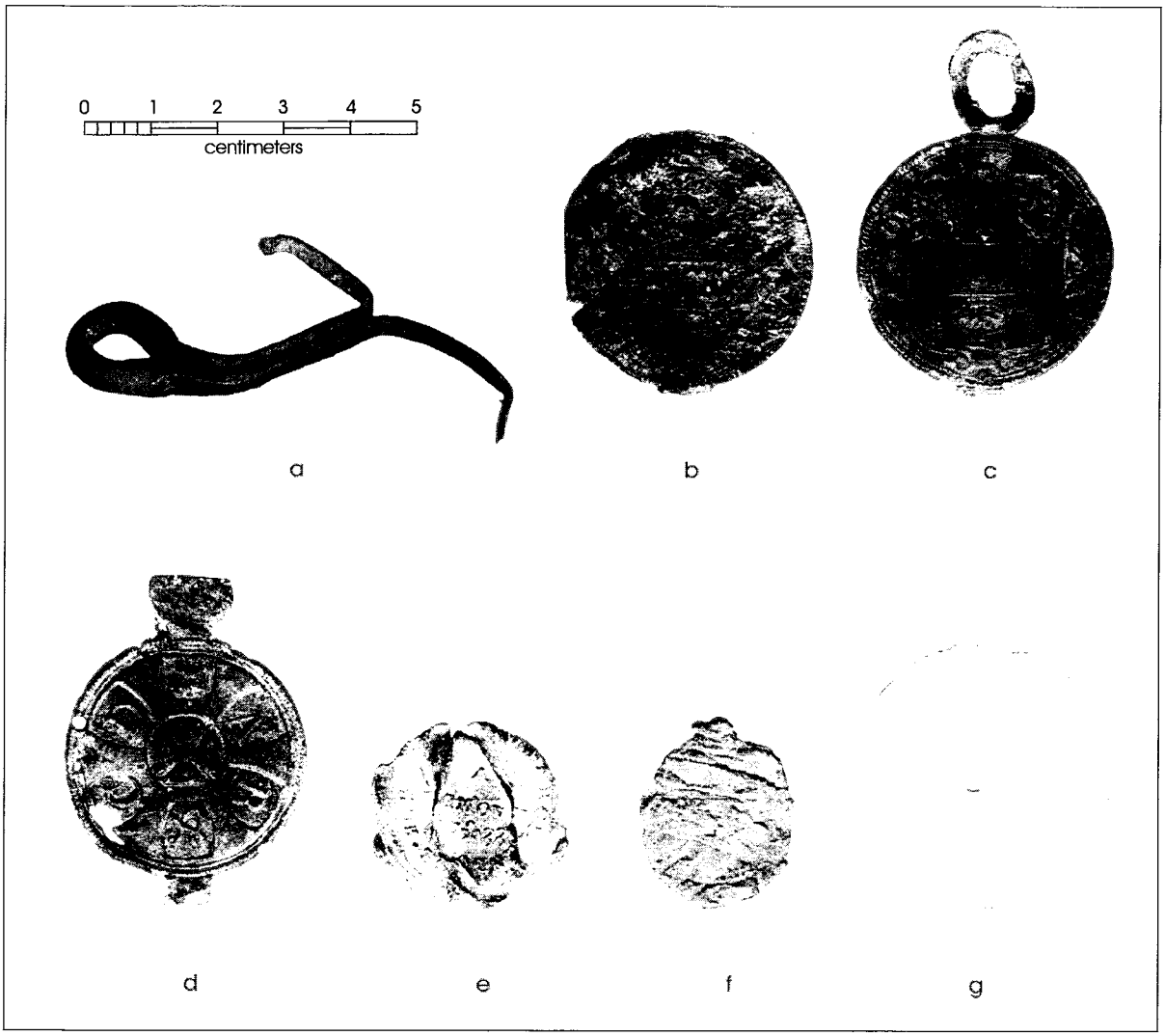

Figure 34. Construction hardware and lead objects: (a) snipe hinge; (b-c) British seals; (d) lead seal, probably British; (e-f) French seals; (g) lead disk.

The demolition of this presidio may well account for the nearly total absence of metal building hardware in the collections recovered by the field school, in contrast to the unusually large collection of such hardware in the artifact collection at the Goliad site of Mission La Bahía. Evidently all metal hardware was removed from the buildings as they were destroyed.

A heavy iron object 7 x 8 cm in size, and 5 mm thick, has a hole 3 cm across in its center. This may have been used as a socket to receive a turning pin on the top or bottom of a door or gate.

Two iron bar fragments 4 mm in diameter came from Trenches 5 and 6. An unidentifiable piece of iron 8 mm in diameter and 3 cm long was excavated from Schmeidlin's area in Division 34. An unidentified iron tool fragment came from Trench 6. It appears to be part of a chisel, perhaps used by a blacksmith or a farrier. An iron bolt with hexagonal head, and threaded at the opposite end, may have fallen from a 19th century machine that crossed the area.

Lead Objects

Lead Seals (n=5)

Lead seals were placed on merchandise at various stages of manufacture from medieval times to the early 19th century. They were the hallmarks of the textile trade. They indicated that taxes had been paid, the cloth had been measured, the town

of manufacture, and even the company that was shipping the bales. Once the cloth or bales reached the consumer the seals were broken off and discarded. The ones that were not recycled into musket balls and window leading are now found at archeological sites all over colonial America.

There are five artifacts identified as lead cloth/bale seals. Two are definably British, one is probably British, one is French, and one is unidentified at this time.

The first two are similar to each other, each 4 cm in diameter (see Figure 34b-c) with a "post-1707" British royal escutcheon. A garter with the motto "HONT SOIT QVI MAL Y PENSE" surrounds the shield, a lion dexter and a unicorn sinister supporting, a helmet above. The reverse is blank. A similar one was found in the Thames River, London, and identified by Dr. Geoff Egan of the Museum of London; it had a rose and crown on the reverse side.

The third seal measures 3.5 cm, with a cross pattée in the center and six petal-like spokes with the letters A B & C D and a St. Edward's Crown in the sixth petal (see Figure 34d). This is similar in design to several found in various sites in Texas and other New Spain mission and presidio locations. Those had the letters S S & F C, identified as South Sea & Fisheries Company, a trading company founded in 1711 (Egan 1994). They did a large volume of illicit trade with New Spain colonies.

The fourth seal measures 2.5 cm and is French, from Ville de Limoux (see Figure 34e-f). It is dated 1733. The obverse has the words "MARCHANDIZE FOR A" encircling the centered "A LIMOIX 1733". It is folded at the hinge and is the only one with the reverse attached. The reverse side has a circle motif with three fleurs-de-lis and surmounted by a crown.

The fifth seal has not been identified at this time. It measures 2.5 cm and is encrusted/worn and is difficult to make out details. It appears to be a robed and bearded figure holding a cross/staff with a column on his right and a leaf garland on his left.

Other Lead Objects (n=222)

A surprising amount of lead was recovered from the site. By far the most (2675.43 g) was found by the Branch metal survey. Combining fragments of sprue and small, flattened fragments, the total number of lead fragments in that collection is 50. During the unit excavations 48 sprue and lead fragments were recovered but they were much smaller pieces, the total weighing 457.48 g.

In addition, 12 lead disks measuring from 20 to 31 cm in diameter are in the Branch collection. At least four of these are equal in size to bale seals but contain no markings. The unit excavations found 11 of these unmarked disks. At least four of these, equal in size to bale seals, may have been intended as pads for holding gunflints.

One of the disks from the Branch collection has two holes in the center and resembles a button or a noisemaker (see Figure 34g), sometimes traditionally called a "whirligig" (Noël Hume 1970:320). A string passed through the holes, twisted, then pulled tight, made a buzzing sound.

Prehistoric Artifacts

Harry J. Shafer

The goals for the 41VT8 analysis are to provide a description of the sample of prehistoric artifacts and to examine the assemblages that apparently have the most promising integrity with regards to temporal intervals. The reason for emphasizing the descriptive study is that few lithic samples have been described for the central coastal plain region of Texas. Likewise, the emphasis on what appears to be an intact Austin Interval (or Austin phase, see Prewitt 1981) assemblage will provide comparative and interpretive information on the tool forms, technology, and assemblage composition. This kind of information can be used as a baseline for both temporal and spatial comparisons of sites across the central coastal plain of Texas. The descriptive data are presented in narrative form followed by tables with provenience and metric data. The interpretive section of the study will follow the descriptive section.

Methodology

To meet the research objectives outlined above it was necessary to sort and classify the lithic collection and place the items into their respective proveniences. This distributional information was used to identify the levels in each hand-excavated unit selected in this analysis. It is on the basis of this information that the Austin Interval or phase

analysis unit was defined and will be the focus of the assemblage analysis. The collection, however, contains diagnostic artifacts spanning nearly 9,000 years, and basic descriptions of these diagnostics are provided.

Cultural materials were buried in a sandy loam deposit capping a high terrace of the Guadalupe River. Stratigraphic geological units at the site were not discrete and did not provide a straightforward means for separating components. No site formation studies have been conducted at the site, and such studies were not in vogue in 1968 when the excavations occurred. Despite these documentary shortcomings, there appears to be some stratigraphic integrity to the cultural materials even with the evidence for bioturbation within the deposits.

No stratigraphic connections were made in the field between excavated units, and it is apparent from the unit data that the stratigraphy was not uniform across the north end of the site. Therefore, each unit will be treated separately in the analysis.

The lithic artifacts and debitage were collected from 1/4-inch screens. All lithics were sorted in the TAS field laboratory and later processed. Chipped stone artifacts and suspected artifacts such as blades and cores were sorted from the debitage; the latter was weighed and bagged.

Regional Chronology

There is currently no established lithic chronology for the central coastal plain region (Table 13). The stratified deposits at the Berger Bluff site (41GD30A) yielded a partial Late Archaic and Late Prehistoric sequence (Brown 1983:Figure 18). Borrowing from systematics and chronologies from the greater central and coastal bend regions of the state, however, allows for a tentative sequence of diagnostic artifacts to be proposed. Despite the apparently long chronological history represented in the diagnostic artifacts, the prehistoric components at 41VT8 are not, however, good test cases for the proposed chronology due to the absence of good stratigraphic separation of temporal components. I have introduced a working chronology and placed the 41VT8 diagnostic lithics into that sequence.

The most current summary of the coastal bend chronology is that of Brown (1983) and Ricklis (1995b:265-300). For greater Central Texas, Collins' (1995:Table 2) general sequence will be followed with the caveat that this sequence probably will not hold up on the interior coastal plain. It is simply the best broad chronology available at this writing. Between these two chronologies, it is possible to propose a partial lithic chronology for the interior coastal plain in the general region of 41VT8.

Lithic Technology at 41VT8

The debitage sample initially provided for analysis was obviously selected. Analysis was conducted on a sample of the debitage in the collection for the purpose of becoming familiar with the technologies present. It is readily apparent that the collection of debitage was selectively sorted by the excavators and does not represent a statistically valid sample in any of the units. This is quite unfortunate since the sample contains some intriguing patterns that could be formally defined for the prehistoric assemblages had adequate samples been available for analysis. Therefore, the debitage and technological analyses will be more qualitative than quantitative.

One of the surprising findings from the debitage analysis was the presence of a core-blade technology. This can be expected with the Toyah Interval or phase component (Hester and Shafer 1975; Ricklis 1995a). What was not expected is the prevalence of a prismatic blade technology in the Austin phase and earlier components. The production of a prismatic blades also varied. Single platform blade cores reduced by a hard hammer are expected and are present. What was surprising was the number of blades produced using either a soft hammer or punch (probably the latter) from cores with narrow platforms. There is no mistake that these are intentional. Blade-like biface thinning flakes are not uncommon, but blades produced by bending-initiation fractures characteristic of soft hammer flaking were produced from cores that had been deliberately prepared for blade removal. Due to the fact that only a portion of the debitage was made available for analysis, all that can be done in describing this blade technology is to note that it is present in Late Prehistoric components. The same might be said regarding biface thinning and biface retouch flakes. Flakes produced in the course of biface manufacture account for the majority of the debitage sample, which is not surprising given the respectable numbers of

Table 13. Lithic chronology for the interior coastal plain of Texas.

Period	Estimated date BP	Diagnostic Types	References	Present at 41VT8
Paleoindian I	11,600-10,900	Clovis	Collins 1995	
Paleoindian II	10,900-9000	Golondrina, St. Mary's Hall, Big Sandy	Collins 1995	Golondrina, St. Mary's Hall, Big Sandy
Early Archaic I	9000-7500	Angostura, Hoxie		Hoxie
Early Archaic II	7500-5800	Uvalde, Gower	Ricklis 1995b	
Middle Archaic	5800-4000	Andice, Bell, Early Triangular	Collins 1995; Ricklis 1995b	Andice
Late Archaic I	4000-2500	Morhiss, Pedernales	Collins 1995; Hudler et al. 2002	Morhiss, Pedernales
Late Archaic II	2500-1500	Marcos, Marshall, Ensor	Collins 1995; Ricklis 1995b	Marcos, Side-notched
Late Archaic III	1500-1100	Fairland-like, Darl-like	Ricklis 1995b	Fairland-like, Darl-like
Late Prehistoric I	1100-600	Scallorn, Granbury, Friday	Story 1968; Ricklis 1995b	Scallorn, arrow point preforms (Granbury), Gahagan (Friday)
Late Prehistoic II	600-300	Perdiz, Guerrero	Ricklis 1995b; Story 1968; Walter 2000	Perdiz, Guerrero

bifaces broken at all stages of manufacture. Largely missing in the sample available are core preparation cortex and secondary cortex flakes removed using hard hammers. It is very likely that these types of flakes are present in the unanalyzed debitage at TARL. One would expect that such flakes would at least be present in respectable numbers given the local availability of chert cobbles. While some secondary cortex flakes do occur, they do not occur in the numbers that might be expected if a full reduction sequence were present. Burned flakes constitute a minor component of the debitage assemblage, but again, I suspect this is due to the selective nature of the sample at hand. Here again, I suspect that burned flakes will be prominent in the unanalyzed debitage. Chert and far less common, quartzite, are dominant rocks in the Guadalupe River gravels based on my own inspection (also see Collins 2002). Chert would readily be exposed to hearth fires, use as boiling stones, and possibly even as hearthstones. Burned chert is a common constituent of prehistoric midden deposits in this section of the coast (cf. Hudler et al. 2002).

Flakes identified as produced by biface thinning and biface retouch were grouped together in the sorting. Biface thinning flakes have the characteristic lipped platform, arched profile, and multi-faceted exterior. Flakes of biface retouch may not have all of these attributes but the origin is clearly from the surface of a biface since multiple flake facets occur on the exterior surfaces.

Core Reduction and Debitage Analysis

An accurate profile of the lithic technology based on core and debitage analysis is not possible without having all of the material available for analysis. The debitage is currently in storage at TARL. Quantitative sampling and technological analyses based on complete lithic artifact analysis involving cores, flakes, production failures, and complete artifacts had just begun in Texas archeology, and had not become a standard procedure when the 1968 TAS Field School was held. E. Mott Davis is to be credited for having the foresight to include debitage collecting in the research design. Jeremiah Epstein can be credited for alerting Texas archeologists to the potential information that could be gained through debitage studies. Collecting flakes from 1/4-inch screens became a standard procedure in the mid-1960s in archeological salvage operations although debitage analysis was just beginning to catch on. Debitage was sorted primarily for burins and burin spalls which Epstein had discovered in his investigations at Centipede and Damp Caves (Epstein 1962), and modified flakes. Following Epstein, Johnson (1964) examined debitage from Devil's Mouth site noting the presence of biface (billet) flakes. Honea's (1965) analysis of debitage in East Texas first brought attention to bipolar technologies in that part of the state. The first thorough technological analysis of debitage came from Shafer's work at Robert Lee Reservoir (Shafer 1969, 1971), and at the George C. Davis site (Shafer 1973).

Despite the lack of an appropriate analytical sample for debitage and cores, the collection was examined for any trends that might be observed. The biface sample contained numerous examples of bifaces broken in manufacture. Therefore, flakes produced during the course of biface reduction such as biface thinning flakes and biface retouch flakes would be expected. In this cursory examination, flakes identified as produced by biface thinning and biface retouch were grouped together.

The initial goals of the debitage analysis were as follows:

1. Total flake count and distribution of all flake debitage by unit and level from hand-excavated units;
2. Distribution of all burned debitage by unit and level;
3. Frequency graph showing proportion of biface thinning and biface retouch flakes compared to core/platform flakes; and
4. Number and distribution (unit/level) of flakes with over 50% cortex, and 10-50% cortex. Also, what is the overall percent of 50% plus cortex flakes?

These data were to be shown in graphs to support the arguments that: (1) most flake debitage was the product of middle and late stages of biface reduction; and (2) retooling consisted mostly of projectile point finishing and replenishing hunting kits.

This research design proved not to be feasible given that only a subset of 597 pieces of debitage

was available for analysis. This subset was analyzed, however, to gain a sense of what was present. Ideally, all debitage from two of the deeper units at the north end of the site (i.e., Units 32D7 and 32D11) should provide indication of changes in the chipped stone technologies through time. It would be informative to examine for changes in artifact density on the basis of debitage counts in excavated units, and to see if there are specific technological signatures associated with the Austin phase component. Despite this shortcoming and while no formal analysis was conducted on all of the flakes from excavated units, an attribute analysis was conducted of flakes selectively pulled from the excavation units by the TAS laboratory personnel. The purpose of the analysis was to obtain a general feel and idea of the flintknapping strategies and trajectories represented in the prehistoric components at the site. Flakes without cortex (n=509, 85%) dominated the collected sample, and when examined it was found that 247 (48.55%) of these specimens were produced during biface thinning and retouch. Interestingly, some 134 (22%) blades also were identified during the categorization of the debitage by reduction strategy. The relatively high frequency of blades was rather surprising given the lack of a consistent sampling strategy.

Cores (n=28; Table 14)

Twenty-eight artifacts are identified as cores, masses from which flakes or blades were removed for the purpose of further use. Eleven have bi-directional platforms, eight have multi-directional platforms, and eight others are classified as uni-directional while one is a multi-platform biface core. Ten of the total are described as micro-cores since the flakes and blades removed from them were less than 3 cm in length. Both specimens from Unit 24T10 came from Austin phase deposits and include a bi-directional core and a uni-directional blade core. Eighteen cores came from Unit 32F11 from Levels 5, 7-12, and 14. Austin phase levels (8-11) yielded all core types.

Blade Core Rejuvenation Flake (n=1)

This flake was removed from the platform of a blade core that appears to have been polyhedral, or at least bi-hedral. The longest blade facet of the other blades is 43.4 mm, and the shortest is 25.8 mm. The flake was recovered from Level 2 in Unit 24T8, an Austin and Toyah phase deposit.

Blade Technology

One surprising finding was the high frequency of blades and micro-blades in the assemblage. This is especially true with the Austin phase material, but holds throughout the excavations. The technologies for producing blades varied from the straightforward approach of preparing uni-directional cores by removing a series of cortex and secondary cortex blades to set up the arrises or ridges for removal of blades from the interior of the cores. Blade cores are present in the collection, but typically these have been thoroughly reduced. Blade cores were also trimmed to set up blade removal, and a core rejuvenation flake is also in the collection. There is no question that a core-blade technology was present at 41VT8. A second method of producing blades was either by using a punch or a billet and removing blades from a core with an acute platform angle. These are the more common blades in the collections (3 to 15 cm long; Collins 1999:10). Because the same techniques were used in soft hammer blade removal and biface thinning, it was often a judgment call as to which process produced the flake with blade characteristics. When possible, I based the decision on those blades without intersecting flake scars that might otherwise indicate a biface origin. The problem is complicated by the fact that blades can intentionally be produced from bifaces. The research design did not include a thorough analysis of the blades, but excellent examples of backed blades and extensively utilized blades for cutting are present in the collection.

Biface Technology

Ample representation of biface thinning flakes and bifaces (n=259) in the collection, broken or abandoned at all stages during the linear course of reduction, provide solid evidence that biface tool production and rejuvenation was an important functional component at 41VT8. The sample includes proximal (n=68), medial (n=35), distal (n=100), longitudinal (n=5), and complete (n=51) bifaces. All stages of reduction are represented (Goode 2002:29-38). Stage I specimens (n=18) are regarded as blanks and represent the initial stage of reduction. Stages

Table 14. Provenience, dimensions and general characteristics of the cores from 41VT8.

Lot	Division	Unit	Level	Maximum Dimension (mm)	Minimum Dimension (mm)	Thickness (mm)	Core type
12	32	32F11	5	47.38	42.35	32.08	Bi-directional; Micro; Blade
25	32	32F11	7	71.63	37.37	27.73	Multi-directional; Micro
26	32	32F11	8	77.14	65.92	33.06	Bi-directional
26	32	32F11	8	84.75	50.72	33.35	Bi-directional; Blade
26	32	32F11	8	43.51	37.30	17.67	Uni-directional; Micro
26	32	32F11	8	76.82	67.08	32.91	Multi-directional
27	32	32F11	9	56.77	47.88	40.57	Bi-directional; Micro
28	32	32F11	10	69.07	58.81	41.55	Bi-directional
28	32	32F11	10	47.41	37.70	27.49	Uni-directional; Micro
28	32	32F11	10	55.75	42.11	31.13	Bi-directional; Micro
28	32	32F11	10	45.00	32.68	24.29	Microblade
28	32	32F11	10	88.84	58.91	52.35	Uni-directional
29	32	32F11	11	79.13	57.72	45.75	Bi-directional
29	32	32F11	11	61.83	49.69	21.48	Biface; Multi-platform
30	32	32F11	12	54.55	38.28	21.34	Uni-directional; Micro
30	32	32F11	12	51.65	49.93	40.25	Multi-directional; Micro
30	32	32F11	12	54.18	34.19	18.33	Multi-directional; Micro
32	32	32F11	14	53.46	41.97	36.36	Bi-directional
40	24	24T8	3	53.62	46.18	42.68	Multi-directional
40	24	24T8	3	43.40	32.92	20.60	Multi-directional
40	24	24T8	3	69.80	69.38	31.85	Uni-directional
56	24	24T10	4	69.59	63.12	52.52	Bi-directional
59	24	24T10	7	47.20	46..16	32.00	Uni-directional; Blade
93	31	31D18	1	60.90	47.44	31.24	Multi-directional
121	34	34A3	2	50.53	44.14	21.57	Multi-directional
134	34	34C4	2	55.41	55.25	39.36	Bi-directional
143	30	30D14	1	68.09	55.73	22.03	Uni-directional; Blade
145	30	30D4	2	68.60	54.55	39.07	Bi-directional

II (n=78) and III (n=77) are intermediate stages represented by partial removal of cortex (II) and complete removal of cortex (III). Stage IV (n=64) is an advanced stage and probably represents a preform stage. Stage V (n=22) is regarded as the completed stage for thinned bifaces. Specimens in the sample classed as Stage V are probably distal tips to dart points. Inspection of a 50% random sample of bifaces suggests that the majority of the bifaces were broken by snap fractures, mostly during the process of reduction and thinning. Other causes of failure noted in the sample include overshot, material flaw, and platform collapse. Bifaces were recovered from all excavated units and components.

Lithic Artifact Descriptions: Formal Tools

Formal tools were sorted on the basis of technological and typological characteristics. Typological sorting was based on previously defined diagnostic classes and types using regional site reports and such typological guides as Suhm et al. (1954) and Turner and Hester (1999), among others, when specific artifact classes dictated. Technological criteria included relative degrees of reduction of bifaces, and manner of reduction (soft hammer or pressure), and attributes attributed to reduction such as blade serration. Typological, technological, and stylistic criteria were used in making judgments regarding types and variants within types.

The chipped stone artifact assemblage yielded some interesting surprises, notably the presence of Gahagan bifaces and production failures. The presence of Gahagan bifaces in this area of the coastal plain has not previously been reported.

One formal tool class defined in this section is biface celts, a tool type not traditionally recognized in this part of the state. These interesting tools are oval bifaces that required only Stage III biface reduction due to the desired attributes of thickness. They are characteristically oval with wider bit ends; poll ends usually lack finishing. I suspect this tool type is most often overlooked as a discarded preform, but bit workmanship, impact wear, and lateral edge dulling to facilitate hafting, are characteristic of chipped stone celts (Shafer 1994; Dockall 1994).

The sorting follows customary procedures of dividing chipped stone artifacts into either bifaces or unifaces, although this sorting always encounters problematic items. The sorting that I used is not always consistent according to logic, but is consistent according to accepted procedures in chipped stone artifact analysis in Texas.

Projectile Points

Stemmed bifaces or projectile points are divided into two stemmed classes based on technology and size: arrow points and dart points. Typological classification follows that of Suhm et al. (1954) and Turner and Hester (1999) unless otherwise stated.

Arrow Points

Fresno (n=4; Table 15; Figure 35a)

These triangular artifacts are unstemmed arrow points. They are sorted from arrow point preforms based on their finer degree of finishing.

Table 15. Provenience and metric data for Fresno arrow points.

Lot	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Fragment
174	42A6	2	19.31	12.69	2.50	Complete
64	24T12	5	14.36	14.26	3.48	Proximal
91	32D7	13	16.40	19.60	3.72	Proximal
64	24T12	5	35.62	14.98	4.97	Proximal

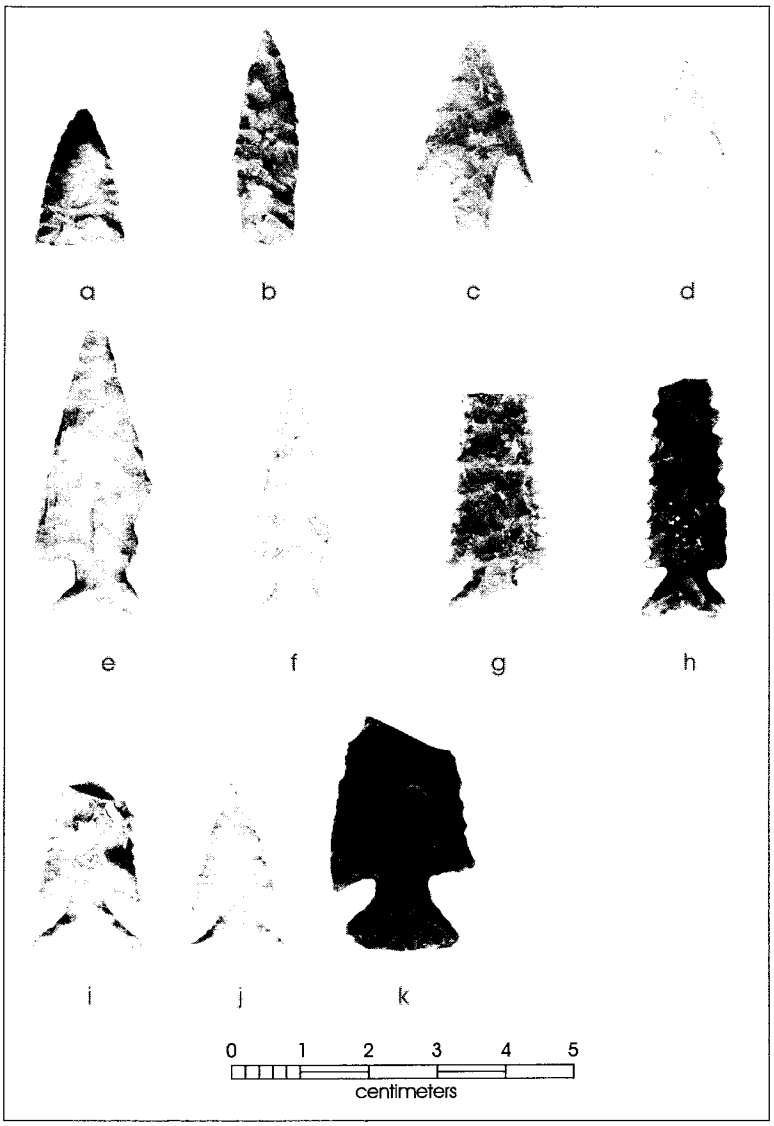

Figure 35. Arrow points recovered from 41VT8: (a) Fresno; (b) Padre; (c-d) Perdiz; (e-k) Scallorn.

Technologically, two lack the fine edge-pressure retouch seen on finished Scallorn points, and therefore, may be late-stage Scallorn preforms. Another reason to support this interpretation is that they consistently occur with Scallorn. One specimen (Unit 24T12, level 5), however, can be classified either as a Fresno or Guerrero based on appearance. Contextually, however, it was recovered from the Austin phase analysis unit.

Guerrero (n=1)

The oblique parallel flaking served to identify this point fragment (surface, Units 38S14/T14) as Guerrero. The tip is missing. It was lanceolate in form and exceptional in flaking skill demonstrated. It measures 27 mm in length, 1.6 mm in width, and is 3.24 mm thick.

Padre (n=1; Figure 35b)

This small, narrow point has a slightly contracting stem, straight base, no shoulders, and a narrow blade. It is probably an extensively reworked Perdiz arrow point, but one cannot be certain of this interpretation. The closest comparison to a formally defined point is the Padre point defined for Padre Island (Corbin 1974; Turner and Hester 1999:226), but is proportionally narrower than the reported type examples. It was recovered from the surface and measures 30.79 mm long, 9.18 mm wide, and 2.68 mm in thickness.

Perdiz (n=16; Table 16; Figure 35c-d)

Perdiz are identified on the basis of the contracting stems. Seven were recovered from controlled excavations. All are made on thin flakes and were shaped entirely by pressure. There are two sub-groups in the sample. One sub-group (n=12) has rounded to almost straight bases, and the second sub-group (n=4) has pointed stems. The latter sub-group is most descriptive of Perdiz, but the rounded base sub-group may represent a regional, yet undefined, stylistic variant. Five were aborted during the course of late-stage retouch; they were broken in the process of manufacture. The blades on two are reworked, and the diagonal distal break on one was lightly retouched in field repair. The manufacture on thin flakes by pressure was far more expedient that that seen in the manufacture of Scallorn arrow points. This shift in manufacturing technology and technological style (Lechtman 1977) has not previously been explained, and is

Table 16. Provenience and metric data for Perdiz arrow points.

Lot	Area	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Comments
1	General surface	Surface	0	36.68	15.88	4.32	Base, barb missing
12	NW Quad	32F11	5	38.96	13.96	3.49	Complete, unfinished?
25	NW Quad	32F11	7	32.88	18.10	3.48	Complete, failure?
27	NW Quad	32F11	9	32.40	18.30	2.87	Complete
89	NW Quad	32D7	11	42.03	15.63	4.02	Complete
101	NW Quad	31D16	1	24.11	16.04	2.69	Tip of stem missing
129	Div. 34	34C1	1	0	15.76	2.70	Proximal half
137	Div. 30	Surface	0	26.69	12.17	3.17	Complete
153	NW Quad	30D11	2	0	0	2.95	Base portion only
216	NW Quad	Surface	0	24.25	16.44	3.49	Tip/edge missing
228	SW Quad	Borrow pit	0	21.63	16.39	2.75	Complete, blade reworked
228	SW Quad	Borrow pit	0	0	16.60	2.17	Proximal half
228	SW Quad	Borrow pit	0	0	0	2.43	Stem fragment
228	SW Quad	Borrow pit	0	0	18.45	2.86	Proximal half
228	SW Quad	Borrow pit	0	39.47	20.25	3.92	Barb missing, preform
228	SW Quad	Borrow pit	0	29.10	16.00	2.54	Shoulder broken

discussed in more detail in the Scallorn point description below.

Perdiz consistently occur either stratigraphically mixed or above Scallorn at 41VT8. Some admixture can be expected owing to the sandy loam deposits, and to both cultural and animal disturbances.

Scallorn (n=22; Table 17; Figure 35e-k)

Scallorn constitutes the largest typed sample of arrow points from 41VT8. Considerable variation occurs within the sample and one specific sub-group may have regional implications with regards to technological style. Bases are straight on six, convex on three, and concave on 10; bases are missing on three and are unclassifiable. Blades on 10 are serrated, and of these, four have straight bases, four have concave bases, and two have missing bases. Serrations may be deep or very fine. The remainder all have blades with straight edges.

Scallorn points are made from small, bifaced preforms rather than flakes. The preforms are expertly thinned, probably using punches, likely the same technology to thin Gahagan bifaces. Preforms were further thinned and shaped by pressure-flaking. It is noteworthy that Scallorn manufacture was not expedient as was the case in the production of Perdiz arrow points. The stages of Scallorn manufacture are more like those seen in the production of Late Archaic dart points, suggesting that arrow point manufacture was incorporated into a Late Archaic technological style. This does not mean that arrow points date to the Late Archaic, but rather that the technological style of biface manufacture used in Scallorn point production had been present in this area of Central Texas for quite some time.

Table 17. Provenience and metric data for Scallorn arrow points.

Lot	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Serrated
27	32F11	9	0	15.67	3.88	Yes
27	32F11	9	34.80	16.74	3.41	No
29	32F11	11	34.14	13.11	3.58	No
39	24T8	2	0	13.33	3.00	No
39	24T8	2	29.40	15.34	4.10	Yes
41	24T8	4	0	16.42	2.75	Yes
41	24T8	4	23.30	11.24	3.05	No
41	24T8	4	39.41	15.38	3.34	Yes
56	24T10	4	24.42	14.40	3.95	No
58	24T10	6	36.72	18.49	3.75	No
62	24T12	3	34.80	15.69	3.55	Yes
62	24T12	3	34.88	13.32	4.47	Yes
63	24T12	4	36.44	16.22	3.80	Yes
63	24T12	4	41.42	16.60	3.66	No
64	24T12	5	32.11	14.61	3.47	No
64	24T12	5	25.55	14.23	3.13	No
64	24T12	5	33.31	21.47	4.28	No
91	32D7	13	36.74	13.06	3.73	No
91	32D7	13	24.44	13.78	3.60	Yes
91	32D7	13	0	0	3.57	Yes
147	30D4	3	0	20.69	3.95	No
220	Surface	0	32.15	15.45	3.60	Yes

Arrow Point Fragments (n=20; Table 18)

Twenty small biface fragments could clearly be identified as arrow points based on the evidence of notching or blade treatment. While these specimens could not be typed they can at least be considered the products of Late Prehistoric activities on site.

Arrow Point Blanks (n=50; Table 19)

In addition to arrow point fragments, a group of 51 small bifaces were identified as arrow point blanks based on their small size. Only six (12%) of these are completed and they were discarded due to failures to properly thin the small biface. Proximal (n=23) and distal (n=18) fragments dominate the collection with medial specimens being in the minority (n=3).

Dart Points

Abasolo (n=1; Figure 36a)

The stem is contracting and the base is straight. The blade has been bifacially beveled from retouch to the extent that the blade edges actually expand to meet the base.

Andice (n=1; Figure 36b)

This classic Andice point has the characteristic long, bifacially beveled stem and wedge-shaped base. The blade has been extensively reworked and the long barbs were lost. A small, reworked barb survives on one shoulder while a more pronounced barb has been broken off the other, opposite shoulder. The specimen was recovered from unit 29G, H, levels 7 and 8.

Table 18. Provenience and metric data for arrow point fragments.

Lot	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Break	Part
63	24T12	4	28.02	10.68	2.67	Snap	Distal
63	24T12	4	20.46	8.73	2.49	Snap	Distal
63	24T12	4	12.73	7.00	2.48	Snap	Distal
64	24T12	5	32.74	11.94	2.69	Snap	Distal
38	24T8	1	24.82	10.13	2.70	Snap	Distal
1	Surface	0	25.04	12.64	3.11	Snap	Medial
228	Borrow pit	0	29.40	11.11	2.62	Snap	Distal
24	32F11	3	24.97	13.93	2.60	Snap	Distal
101	31D16	3	24.82	11.97	2.24	Snap	Medial
11	34C2	1	0	9.69	2.83	Snap	Distal
43	24T8	6	17.38	14.27	3.95	Snap	Proximal
63	24T12	4	22.81	20.24	2.57	Snap	Medial
16	32F11	6	27.94	17.67	3.69	Snap	Medial
14	32F11	4	19.93	13.40	2.56	Snap	Medial
58	24T10	6	35.61	18.26	3.74	Snap	Proximal
228	Borrow pit	0	33.98	12.20	3.85	Snap	Distal
228	Borrow pit	0	21.22	12.70	2.49	Snap	Medial
15	30D11	1	10.57	6.97	1.56	Snap	Distal
56	24T10	4	16.42	15.76	3.00	Snap	Proximal
29	32F11	4	20.23	10.43	2.42	Snap	Medial

Angostura (n=1; Figure 36c)

The tapering blade edges, ground stem edges, indented base, and collateral pressure-flaking identifies this point base as Angostura. It was recovered from Unit 29G, H, levels 7 and 8.

Big Sandy (n=1; Figure 36d)

Side notches, slightly indented base, and ground base edge identify this point as a Big Sandy, a Late Paleoindian/Early Archaic diagnostic in the Trans-Mississippi South, but rarely found in the Texas Coastal Plain (Turner and Hester 1999:81). The specimen was recovered from the surface. Big Sandy is easily confused with wide-based Ensor points, but the basal edge smoothing and overall workmanship easily distinguishes the two types in this author's opinion.

Darl-like (n=2; Figure 36e)

These two points differ from the Darl as originally described by Miller and Jelks (1952) in that the stems are formed by broad, shallow corner notches. Bases are convex. Blades are lanceolate in outline, pressure retouched, and the edges on one are serrated. Traces of asphaltum occur on the base of the longer specimen. This point form may represent a regional variant chronologically equivalent to Darl in Central Texas. One was recovered from controlled excavations (Lot 92, Unit 32D7, level 14) stratigraphically below the Austin phase analysis unit.

Fairland-like (n=4)

Each of these points has a slightly expanding stem, slightly indented base, and moderate to

Table 19. Provenience and metric data for arrow point blanks.

Lot	Unit	Level	Stage	Length (mm)	Width (mm)	Thickness (mm)	Part	Break
90	32D7	12	4	30.07	28.52	4.84	Proximal	Snap
90	32D7	12	4	0	0	4.00	Medial	Snap
91	32D7	13	4	0	0	4.20	Medial	Snap
91	32D7	13	4	36.58	27.76	7.91	Distal	Snap
92	32D7	14	4	42.00	16.91	3.86	Complete	N/A
92	32D7	14	4	31.65	21.16	4.56	Proximal	Thermal
27	32F11	9	4	23.48	28.52	3.88	Proximal	Snap
27	32F11	9	4	0	0	4.55	Distal	Snap
56	24T10	4	4	34.68	24.03	4.32	Proximal	Snap
57	24T10	4	3	24.15	29.66	5.18	Proximal	Snap
57	24T10	4	3	22.71	23.53	4.36	Proximal	Snap
57	24T10	4	3	0	0	5.65	Distal	Snap
57	24T10	4	3	0	0	4.45	Proximal	Thermal
59	24T10	7	4	32.38	23.70	5.65	Proximal	Snap
26	32F11	8	4	0	22.68	3.64	Proximal	Snap
29	32F11	11	4	40.09	22.35	7.47	Complete	Platform
40	24T10	3	4	0	0	6.02	Distal	Snap
40	24T10	3	4	0	0	2.16	Distal	Snap
42	24T8	5	3	38.73	22.69	6.62	Proximal	Snap
39	24T8	2	4	0	23.00	3.84	Proximal	Snap
41	24T8	4	4	0	25.30	4.10	Proximal	Snap
41	24T8	4	4	0	25.62	2.97	Proximal	Snap
41	24T8	4	4	0	23.75	4.80	Distal	Snap
41	24T8	4	4	0	17.24	3.31	Distal	Snap
63	24T12	4	4	44.02	20.04	3.40	Complete	N/A
64	24T12	5	4	26.78	21.23	5.86	Proximal	Snap
64	24T12	5	4	30.34	29.01	4.87	Proximal	Snap
64	24T12	5	4	28.78	25.31	5.71	Proximal	Snap
64	24T12	5	4	29.90	29.79	4.89	Proximal	Snap
64	24T12	5	4	24.77	16.29	4.68	Distal	Snap
64	24T12	5	4	24.61	18.69	4.96	Distal	Snap
64	24T12	5	4	26.56	12.55	3.19	Distal	Snap
62	24T12	3	4	34.85	27.09	6.46	Proximal	Snap
65	24T12	6	4	26.63	17.44	4.26	Proximal	Snap
65	24T12	6	3	52.06	23.84	5.66	Complete	N/A
1	Surface	0	4	35.60	21.80	3.68	Proximal	Snap
1	Surface	0	4	22.58	25.84	5.07	Proximal	Snap
155	29G, H	7, 8	4	32.62	15.45	4.28	Distal	Snap
109	31D15	4	4	23.83	19.45	3.68	Distal	Snap
107	31D15	2	4	27.73	17.21	3.77	Distal	Snap
108	31D15	3	3	0	17.17	3.00	Distal	Snap
216	NW Quad	0	3	34.03	14.00	3.94	Complete	N/A
228	Surface	0	3	37.24	22.26	5.21	Complete	N/A

Table 19. *(Continued)*

Lot	Unit	Level	Stage	Length (mm)	Width (mm)	Thickness (mm)	Part	Break
30	32F11	12	3	27.93	24.00	4.67	Proximal	Snap
58	24T10	6	3	27.57	28.60	4.40	Proximal	Snap
63	24T12	4	4	0	0	3.76	Medial	Snap
63	24T12	4	4	0	0	4.58	Distal	Snap
63	24T12	4	3	0	0	4.60	Distal	Snap
63	24T12	4	3	0	0	5.56	Distal	Snap
63	24T12	4	3	0	0	4.80	Distal	Snap

barbed shoulders. One is complete and the others lack either portions of, or all of, the blade. One exhibits the characteristic fractures of impact (snapped blade, burin scars at the shoulders). One is represented by the stem only.

These are classed as Fairland-like because the stems are narrower that the wide-based classic Fairland points in the Austin area for which the type was originally named. Here again, this is likely a regional variant of a Late Archaic point form. Three came from controlled excavations: one from Unit 30D4, level 5, stratigraphically beneath Scallorn; one from Unit 24T8, stratigraphically with Scallorn; and one from Unit 5T20, level 3, with no other diagnostics.

Golondrina (n=1; Figure 36f)

This base exhibits the classic attributes of Golondrina: thinned base, slightly flared basal corners, and lightly ground stem. Unfortunately, it was recovered from the surface.

Hoxie (n=1)

The blade on this much retouched point has been extensively reduced in width by bifacial retouch to the width of the stem. The stem is slightly tapered with ground stem edges. It was recovered from the surface. The point is classified here as Hoxie since it fits the overall description, but in truth the point is probably a reworked Angostura. The typological problems exist with the Early Archaic Angostura and Early Split Stem points partly due to a paucity of large, well provenienced collections from this part of the state.

Marcos (n=2)

Both Marcos points have the classic form of deep corner notches that form an expanding stem, small barbs, and triangular blades. One has a slightly convex base and the other a straight base. One was recovered from Unit 24T12, level 13, well beneath the Scallorn analysis unit in Late Archaic deposits.

Morhiss (n=5; Figure 36g)

Morhiss points have straight or slightly convex stem edges, and convex (n=3), straight (n=1), or slightly concave (n=1) bases (cf. Hudler et al. 2002:94-98). Shoulders on four are prominent, and are entirely missing on one (Lot 47) that has an extensively reworked blade. One is made of reddish quartzite. Two were recovered from controlled excavations: one was from level 4 in Unit 24T8, and the other was from level 6 in Unit 30D4.

Pedernales (n=1; Figure 36h)

This point is a classic Pedernales with slightly convex base edges and indented base. Shoulders once had slight barbs. The stem form compares closest to Form 2 of Tomka et al. (2003), which has been documented in both Williamson and Uvalde counties in the Texas Hill Country. It was found in Unit 32F11, unknown level.

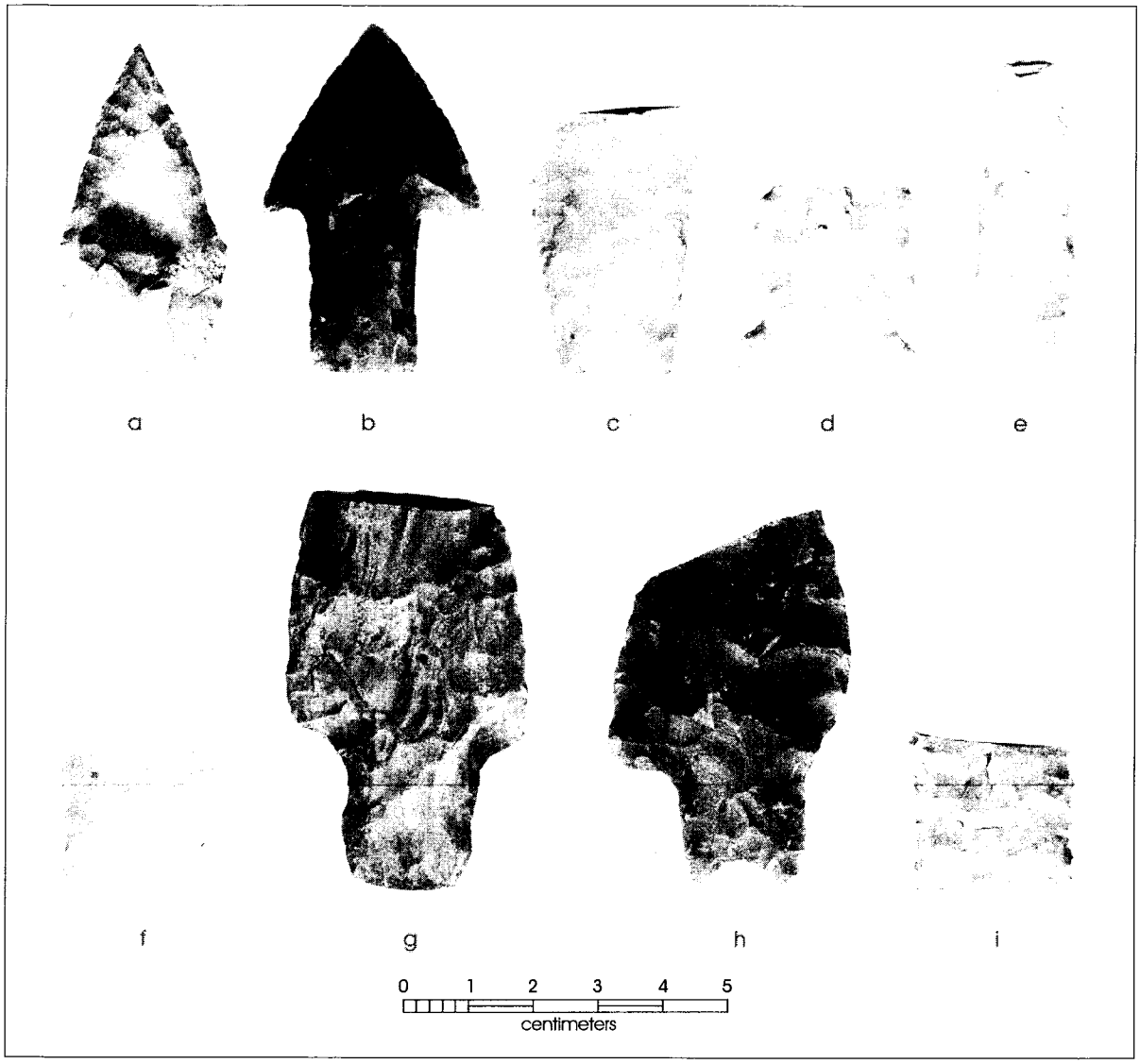

Figure 36. Dart points recovered from 41VT8: (a) Abasolo; (b) Andice; (c) Angostura; (d) Big Sandy; (e) Darl-like; (f) Golondrina; (g) Morhiss; (h) Pedernales; (i) St. Mary's Hall.

St. Mary's Hall (n=1; Figure 36i)

The stem edges of this St. Mary's Hall (Hester 1991) basal fragment are faintly concave near the base, perhaps due to basal grinding. The point is relatively thick in cross-section (7.05 mm) at the point of the break. The point was recovered from the surface.

Tortugas (n=2)

Both points fit the description of Tortugas (Turner and Hester 1999:188) but differ in blade treatment. One (Lot 103, Unit 31D, level 6) has a thinned base and a bifacially beveled blade. The second (Lot 228, general surface provenience) also has bifacially retouched blade edges but is thinner and more finely made.

Untyped Dart Points (n=6)

This group of points cannot be classified into established types. They are described separately.

Untyped Triangular (n=1)

This point is a finely worked triangular point with a thin base and finely pressure-flaked blade edges. The blade has been retouched. It is not

classed as a Tortugas because it lacks the beveled blade edges characteristic of that type, although it probably fits into that genre. Also, it may be a discarded knife rather than a point. It was recovered from Unit 32D7, level 13.

Untyped Corner-Notched (n=2)

Both of these points have broad corner notches. The base on one complete example is straight, but is broken on the second due to impact. The specimen with a broken base could easily be classed as a Marcos, as it well might be. The complete specimen resembles an Ensor, but the notches are much too broad and the workmanship too crude to fit the Ensor type. Both are surface finds.

Untyped Side-Notched (n=1)

This is a proximal fragment with shallow side notches and a convex base. It was recovered from the surface.

Untyped Lanceolate (n=2)

One is a complete point with a tapered base and faintly convex stem edges, lightly ground stem, and a slightly concave base. It does not fit any recognized Early Archaic type, but may be a Middle Archaic triangular form. It was recovered from level 2 in Unit 31D16. The second specimen (Lot 228, general surface) is the proximal end of a long, narrow point. It has an indented base. Base edges are not ground.

Untyped Rectangular Stem (n=1)

The distinguishing feature on this point is its short rectangular stem. The point is thin and well worked. It is possible the stem has been reworked into its present shape. The provenience of the point is Units 31D15, 16, levels 4-6.

Untypable Dart Point (n=1)

The stem on this specimen is broken, preventing further classification. It was recovered from Unit 31D15, level 3.

Other Formal Tools

Gahagan Bifaces (n=17; Table 20 and Figure 37)

One unexpected find in the 41VT8 collection was the presence of Gahagan bifaces. Gahagan bifaces occur in early Caddo assemblages in East Texas (Shafer 1973:224-231) and in contemporary Late Prehistoric assemblages in Central Texas (Shafer 2003), the primary source area for the Caddo items. The term Gahagan-like is used here to describe bifaces similar to Gahagan but that may not be temporally or spatially related. Gahagan bifaces are expertly thinned, with straight or slightly indented bases, and often have mildly recurved blade edges. Blade edges are finely pressure-flaked, often resulting in slight serrations. All of the specimens in the collections are fragmentary, lacking the distal tips. All exhibit visible evidence of wear under low magnification (10X) in the form of smoothing and abrasion. Three were recovered from controlled test units, and in each case the association is with the Austin phase.

The largest comparative sample of Gahagan bifaces has been reported from the George C. Davis site in Cherokee County, Texas (Shafer 1973), and the chert types for many of the Davis site specimens compare to Edwards chert found in western Bell, Coryell, and Williamson counties. Although none of the 41VT8 specimens are complete, the size range falls within the smaller of the George C. Davis site sample, and most probably fell within the 90-100 mm size range when complete (see Table 20). All of the Gahagan bifaces are broken, but projected lengths are well within the range of Edwards chert cobbles from the Guadalupe River gravels and Willis Formation (Collins 2002). Furthermore, the technological system for Gahagan bifaces is in place at 41VT8. In other words, not only are finished knives present in the sample, but preforms are as well, clearly indicating that the knives were made at the site and were part of the technology of the occupants.

These artifacts are classed as Gahagan knives rather than Friday knives (Jelks 1962) because the term Friday is specific to the Austin phase as originally defined by Jelks (1962). There is little doubt that the Gahagan and Friday knives are one and the same, typologically and technologically. Subsequent

Table 20. Provenience and metric data for Gahagan bifaces.

Lot	Division	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Fragment Type	Wear	Break type
43	24	24T8	6	60.51	92.71	5.83	Proximal	Present	Snap
43	24	24T8	6	48.49	33.12	8.49	Proximal	Present	Snap
228	Borrow pit	–	0	85.00	37.47	8.39	Proximal	Present	Snap
228	Borrow pit	–	0	58.76	30.37	6.47	Proximal	Present	Snap
228	Borrow pit	–	0	77.43	36.85	6.79	Proximal	Present	Snap
228	Borrow pit	–	0	57.48	26.85	9.52	Proximal	Present	Snap
228	Borrow pit	–	0	–	37.93	8.35	Base	Present	Snap
228	Borrow pit	–	0	0	33.80	6.05	Base	Present	Snap
228	Borrow pit	–	0	0	37.36	6.76	Base	Present	Snap
228	Borrow pit	–	0	0	38.93	7.43	Base	Present	Snap
228	Borrow pit	–	0	0	25.07	5.00	Base	Present	Snap
65	24	24T12	6	0	75.57	41.25	Proximal	Absent	Snap
65	24	24T12	6	0	25.98	5.13	Medial	Absent	Snap
59	24	24T10	7	56.45	35.34	6.47	Proximal	Absent	Snap
58	24	24T10	6	76.76	43.15	9.10	Proximal	Absent	Manufacture
56	24	24T10	4	53.00	54.97	7.82	Proximal	Absent	Manufacture
216	NW Quad	–	0	67.30	49.82	8.98	Proximal	Absent	Snap

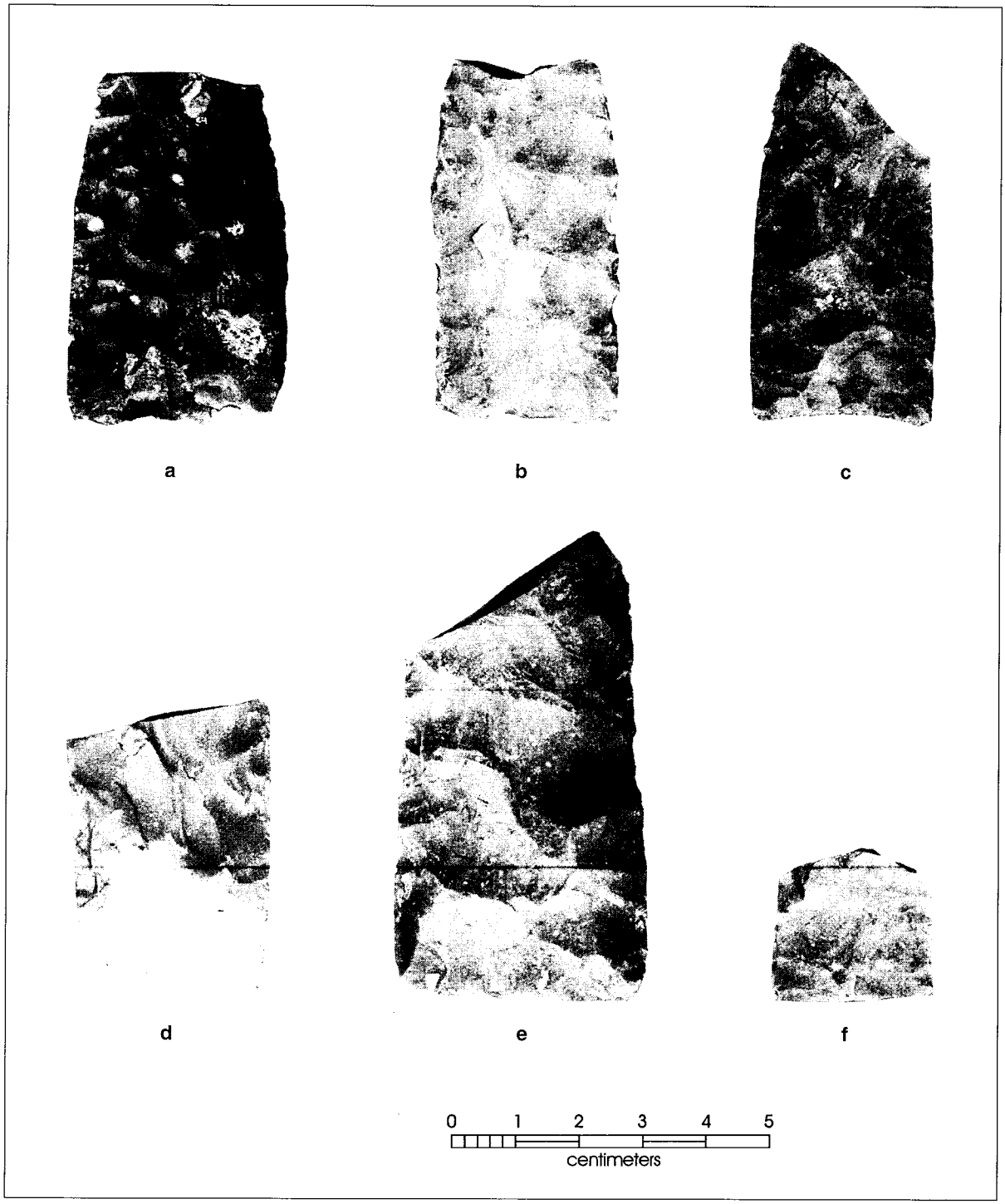

Figure 37. Gahagan bifaces.

archeological investigations have shown that the knife form is more widespread geographically than Jelks originally thought and its temporal span is consistent throughout its distribution. Applying the term Friday to these knives would obscure the geographical significance of their occurrence at 41VT8 and elsewhere.

This tool type has not been reported in the Gulf coastal plain region prior to this study, and reporting its presence increases the knowledge of the

geographic distribution for this class of artifacts. Gahagan biface or knife manufacturing areas are eastern Williamson County at the Hoxie Bridge site (Bond 1978), and in western Bell and Coryell counties (Shafer 2003). The overall distribution of Gahagan-like bifaces includes much of the southern Caddo region as defined in early Caddo times. The distribution extends from the Gahagan site in Louisiana to western Bell, Coryell, Williamson, and Hays counties, southeastward to Polk County (Shafer 2003). The occurrence of Gahagan bifaces in the Central Texas prairies is in a component that contains Bonham-Alba arrow points and early Caddo pottery (Shafer 2003). The projected date for this component is A.D. 1100-1230. Gahagan knives postdate the Austin phase and predate the Toyah phase. The 41VT8 Gahagan-like bifaces are associated with the undated Austin phase component, however, and it is not possible to compare their temporal placement with the Gahagan knives of Central and East Texas. Therefore, how the Victoria County production area ties into the Caddo-Central Texas interaction sphere is an issue that remains to be explored, but it is not unlikely that this portion of the state was within the early Caddo interaction sphere.

Perforators (n=5; Table 21 and Figure 38a-c)

The perforators are made on thin flakes by either bifacial (n=3) or unifacial (n=2) pressure-flaking. The tip on one bifacially made perforator (Lot 132; Figure 38b) is oxidized from burning. Flake perforators are a diagnostic element of Toyah phase assemblages. Three of these specimens came from controlled excavations: one (Lot 132), Level 2 in Unit 34C3, the second (Lot 183) is from Level 4 in Unit 42H6, while the third (Lot 111) was from Level 6 of Unit 31D15. None of the three lots yielded Toyah or Austin phase diagnostics. While the association of the perforators with the Toyah phase assemblage at 41VT8 is likely, it cannot be demonstrated.

Adzes (n=16; Tables 22-23)

Adzes are triangular to sub-triangular tools with the wider end being unifacially beveled or trimmed. The larger subgroup (n=12) is more variable is size, form, and technology (Table 22). Its members are identified as adzes based on the treatment of the bit end, lateral edge treatment (smoothing and dulling), and occasional traces of bit wear. Some of these could easily be mistaken as unfinished bifaces and are sorted out specifically from the latter here to draw attention to this tool class.

The second subgroup (n=4; see Table 23 and Figure 38d-e) has the distinctive, unifacially beveled bit end characteristic of Clear Fork tools (Turner and Hester 1999:246-249). Unfortunately, none were recovered from controlled excavations. It is very likely that the Clear Fork adzes are associated with the Early Archaic components (Collins et al. 1998: 211-270).

Guadalupe Adze Preform (n=2)

Two early stage preforms for Guadalupe adzes (Turner and Hester 1999:256-259) have been recovered. In both instances, the elongated cobble had been "quartered" or truncated to create the characteristic bit angle. In one instance, efforts to remove the cortex had begun, apparently in haste as the artifact was broken by a mis-hit with the

Table 21. Provenience and metric data for perforators.

Lot	Unit	Division	Level	Length (mm)	Width (mm)	Thickness (mm)	Remarks
183	42H6	42	4	36.57	17.16	4.60	Flake drill
111	31D15	31	6	36.44	16.33	9.02	Proximal
1	Surface		0	47.20	14.00	3.53	Flake drill
132	34C3	34	2	54.04	34.06	6.40	Flake drill
228	Borrow pit		0	37.25	26.24	9.40	Flake drill

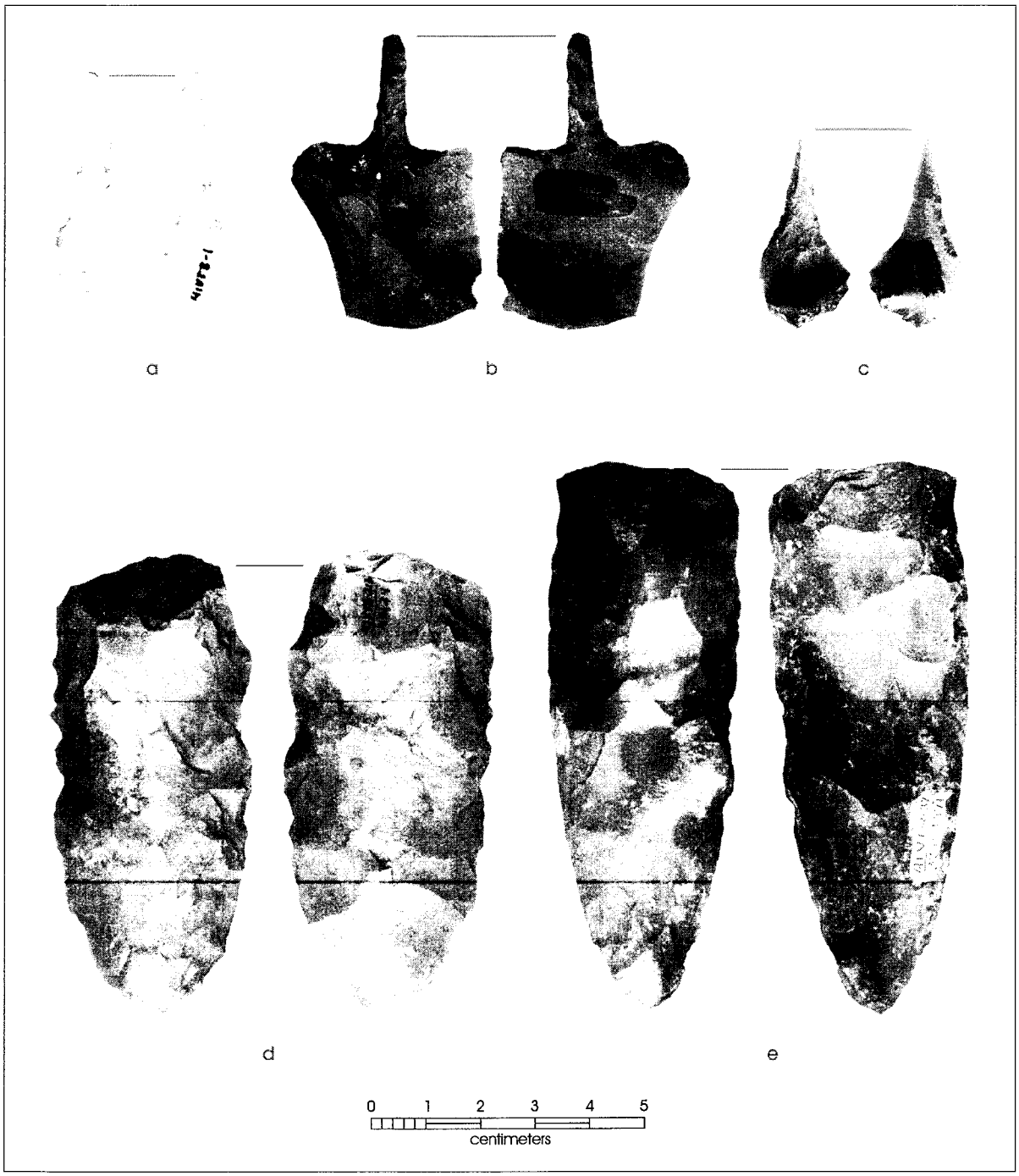

Figure 38. Perforators and adzes recovered from 41VT8: (a-c) perforators, d-e) Clear Fork adzes.

hammerstone that removed too much of the striking platform and ruining the desired form. The artifact was recovered from the borrow pit (Lot 228) and not from controlled excavation. In the case of the second artifact, also from the borrow pit, the triangular cross-section is well developed but the bit has been re-flaked, apparently in an effort to create a more suitable angle.

Chipped Stone Celts (n=9; Table 24)

Each of these artifacts exhibits edge and/or bit end attributes that identify them as a chipped stone celt or axe. The outlines are tear-drop-shaped with the wider end being the bit end and the tapered end the poll end; the cross-sections are lenticular. Lateral edges have been dulled or smoothed to

Table 22. Provenience and metric data for adzes.

Lot	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Fragment Type	Wear
141	30D11	4	45.22	33.70	9.40	Distal	Present
103	31D16	6	66.55	44.92	12.04	Complete	Present
103	31D16	6	14.50	24.80	6.01	Distal	Present
105	31D15,16	4-6	54.51	37.11	11.94	Proximal	Present
216	14W24	0	66.81	45.64	19.82	Complete	Absent
57	24T10	7	94.71	48.70	18.17	75% complete	Present
37	32F11	TH	69.60	18.18	9.38	Complete	Present
98	31D18	7	–	30.60	11.56	Proximal	Absent
44	24T8	7	72.96	30.80	14.73	Complete	Present
228	Borrow pit	0	82.18	29.79	20.06	Complete	Present
228	Borrow pit	0	61.70	51.09	15.48	Complete	Present
64	24T12	5	63.87	45.23	22.06	Complete	Present

Table 23. Provenience and metric data for Clear Fork adzes.

Lot	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Fragment Type	Wear
37	32F11	TH	100.39	36.37	19.45	Complete	Present
216	14W24	0	83.99	38.64	19.47	Complete	Present
228	Borrow pit	0	69.20	34.10	17.28	Complete	Present
228	Borrow pit	0	59.60	33.80	18.35	Proximal	Present

Table 24. Provenience and metric data for chipped stone celts.

Lot	Unit	Level	Stage	Length (mm)	Width (mm)	Thickness (mm)	Part	Wear	Break
203	43R13, S13	2	4	78.64	39.81	16.87	Complete	Present	
105	31D15, 16	4-6	3	76.66	41.38	23.23	Complete	Present	Retouch
150	30D4	6	2	91.58	55.79	19.33	Complete	Absent	Shatter
154	30B11	3	4	74.80	45.44	16.31	Complete	Present	
92	32D7	14	4	88.62	49.24	27.20	Proximal	Present	Snap
38	24T8	1	4	55.90	38.68	13.70	Proximal	Present	Snap
67	24T12	8	3	66.83	48.25	16.32	Distal	Present	Snap
37	32F11	TH	4	38.98	38.38	16.32	Proximal	Present	Snap
35	32F11	17	2	131.31	70.27	44.50	Complete	Present	

facilitate hafting. Bit ends are rounded and either exhibit bifacial trimming and sharpening or evidence of direct impact fractures. Direct impact fractures, often minute, are present on four. The pole ends on five are blunted, left unfinished, or are not as completely finished as are the bit ends.

Chipped stone celts are rarely reported in the coastal plain region, and are only recently recognized in east-central Texas (Smith Bridge). The Erath biface (Story and Shafer 1965; Bond 1978; Tomka et al. 2003; Turner and Hester 1999:253) is a comparable tool and should rightfully be described as a celt. All from 41VT8 were recovered from controlled excavations, and two were from Late Archaic components.

Other Biface Artifacts

Artifacts described under this heading are not regarded as formal in the sense that they are crafted to a specific form. The present form was achieved mostly through use and retouch, or as expedient tools.

Beveled Knife (n=1)

This small, oval biface is unifacially retouched along both lateral edges giving the profile a plano-convex appearance. Extensive smoothing occurs along the right edge (beveled face up) and moderate smoothing is observed on the opposite edge. Some smoothing also occurs along the base as well. It was recovered in level 12 of Unit 32D7 (Lot 90). It is 59 mm long, 17 mm wide, and 7 mm thick.

Stemmed Knife (n=1)

This most interesting specimen is a stemmed knife created from a large, finely made Lange point. Resharpening has left the blade slightly asymmetrical. The cutting edge exhibits unifacial pressure-retouch and a high glossy sickle sheen-like polish. It was recovered from level 5 in Unit 24T10 in the Austin phase analysis unit.

Hand Knife/Chopper (n=1)

An elongated cobble was carefully bifaced on one end to create this unique cobble tool. The poll end is unworked but retains the cortex of the original cobble. The opposite end is carefully flaked bifacially to create a convex cutting bit that became blunted from impact. The expedient tool was recovered from level 4 in Unit 24T10.

Unifacial Artifacts

End Scrapers (n=19; Table 25)

End scrapers from 41VT8 fall into two classes: large (40 mm or larger in length; n=14) and small (less that 40 mm in length; n=5). It is uncertain if size carries a functional difference, but they probably do. Seven are on the ends of blades. Small end scrapers are made on curved flakes, but not all of the unifaces classed here are on the ends of flakes or blades. In two instances (specimens from level 5, Unit 32F11 and the general surface), the curved edge occurred on the side of a flake. Both are on broad flakes with the scraping edge made on a lateral margin. The scraping edges on the remainder are at the distal portion of the flake or blade. Fourteen specimens exhibit evidence of use-wear (smoothing, nicking) on the rounded edge.

Serrated Flakes (n=5; Table 26)

This artifact class consists of thin flakes, usually derived from thinning bifaces, that exhibit one or two deeply serrated lateral edges. Wear is not consistent within the sample and varies from sharp serrations to serrated teeth virtually worn down through wear. The provenience data suggests that this artifact class is associated with the Austin phase. Certainly the technology of blade serrations is present in this component, and it is conceivable that three of these examples that do not show evidence of wear were in fact practice pieces for learning the technique to serrate arrow points. The association and lack of wear is suspicious. Three (level 10, Unit 32F11; level 12, Unit 32F11; and level 3, Unit 24T12) were recovered from the Austin phase analysis unit, and two were likely with the analysis unit as well although no diagnostics were recovered in association.

Retouched Flakes (n=10; Table 27)

Ten flakes exhibiting purposeful retouch have been recovered from a variety of contexts across the site. Only half of the sample comes from

Table 25. Provenience and metric data for end scrapers.

Lot	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Part	Wear	Break	Remarks
12	34A3	2	41.36	30.19	5.12	Complete	Present	N/A	End scraper
12	34A3	2	43.70	31.78	8.95	Complete	Present	N/A	End scraper
12	34A3	2	86.31	54.55	16.44	Complete	Absent	N/A	End scraper
25	32F11	7	60.18	45.31	12.48	Complete	Present	N/A	End scraper
107	31D15	1	56.84	36.69	10.81	Complete	Present	N/A	End scraper on blade
109	31D15	4	36.30	20.50	3.45	Complete	Present	N/A	End scraper on blade
119	34A2	1	26.50	28.50	8.12	Complete	Present	N/A	End scraper on blade
129	34C1	1	46.33	38.24	4.61	Distal	Present	Snap	End scraper
131	34C3	1	58.02	50.97	12.18	Complete	Present	N/A	End scraper
134	34C4	1-2	43.46	24.78	14.39	Complete	Absent	N/A	End scraper on blade
142	30D11	5	31.43	18.34	6.23	Complete	Present	N/A	End scraper on blade
227	Surface	0	32.74	22.50	6.12	Complete	Present	N/A	End scraper on blade
219	SW	0	49.17	26.20	8.80	Complete	Present	N/A	End scraper on blade
64	24T12	5	42.57	39.87	12.34	Complete	Present	N/A	End scraper on flake
228	Borrow pit	0	42.75	229.34	7.17	Complete	Absent	N/A	End scraper on flake
228	Borrow pit	0	–	34.14	9.09	Distal	Present	Snap	End craper on cortex flake
228	Borrow pit	0	47.12	54.14	15.32	Complete	Present	N/A	End scraper on flake
40	24T8	3	86.17	57.01	19.06	Complete	Present	Use	End scraper on flake
40	24T8	3	73.51	51.16	13.07	Complete	Present	Use	End scraper on flake
228	Borrow pit	0	37.54	68.92	12.28	Complete	Present	N/A	End scraper on short flake

Table 26. Provenience and metric data for serrated flakes.

Lot	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Wear	Comments
43	24T8	6	32.52	26.04	3.44	Absent	Biface thinning flake
30	32F11	12	35.32	16.80	2.76	Absent	Blade core trimming flake?
62	24T12	3	29.89	18.71	2.98	Present	Biface retouch flake
103	31D16	6	49.46	27.97	5.33	Present	Biface thinning flake
28	32F11	10	32.73	24.64	5.67	Absent	Flake blade fragment

Table 27. Provenience and metric data for retouched flakes.

Lot	Division	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Break	Blank Type
2	Road		0	33.61	54.53	14.09	Snap	Flake
2	Road		0	37.38	28.14	5.79	Complete	Blade
8	31	31D16	5	52.56	30.54	13.40	Snap	Blade
17	38	Trench 6	0	34.81	22.02	6.97	Snap	Blade
56	24	24T10	4	64.59	39.83	12.80	Complete	Blade
94	31	31D18	3	59.04	29.51	7.77	Complete	Blade
128	34	34B3	1	53.72	34.18	8.08	Complete	Flake
141	30	30D11	4	52.38	30.29	13.60	Snap	Blade
216	NW 2		0	–	58.23	24.61	Edge fragment	Blade
386	Branch		0	44.65	50.16	17.17	Complete	Flake

excavated context, while the remainder are surface finds (Table 27). Although five of the specimens are complete, the purpose of the retouch could not be determined, and it is likely that these items were discarded due to failed manufacture attempts or they simply do not fit into the artifact categories hitherto identified at the site.

Utilized Flakes (n=16; Table 28)

Sixteen flakes showing evidence of use have been recovered from the northern prehistoric portion of the site. These so-called expedient tools represent the use of unmodified lithic debitage for the performance of short duration tasks. Twelve (75%) of the specimens exhibit micro-flaking derived from scraping activities. Two were used to cut and one other has evidence of both cutting and scraping on two different edges. Since evidence of cutting activities are typically more difficult to identify and differentiate from post-depositional modifications on debitage, it is likely that the number of expedient tools used in cutting tasks is under-estimated.

Gunflints and Strike-Alites (n=19; Table 29; Figure 39)

This lithic artifact class is most certainly associated with the Presidio Loreto occupation. All of the gunflints are frontier-made of local Edwards Plateau chert. Only two were recovered from controlled excavations (Units 43O12 and 34B3), both from Level 1. All are sub-rectangular in shape. Six are mostly unifacial and one of these was possibly made on a blade. The remainder are bifacial, three of which were made on blades. Use-wear is consistent with that expected on used

Table 28. Provenience and metric data for utilized flakes.

Lot	Dvision	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Fragment Type	Wear	Blank Type
25	32	32F22	7	38.60	20.12	3.86	Proximal blade fragment	Scraping	Blade
30	32	32F11	12	38.53	27.70	4.36	Distal blade fragment	Scraping	Blade
30	32	32F11	12	33.64	18.94	6.72	Proximal blade fragment	Scraping	Blade
37	32	32F11	TH	65.26	40.12	11.72	Complete	Scraping	Flake
88	32	32D7	10	67.36	21.66	6.03	Proximal blade fragment	Scraping	Blade
89	32	32D7	11	95.18	34.34	12.61	Complete	Scraping	Blade
107	31	31D15	2	42.89	34.60	9.30	Distal	Scraping	Blade
108	31	31D15	3	52.97	31.22	7.75	Complete	Scraping	Blade
109	31	31D15	4	60.56	22.64	4.94	Complete	Scraping and cutting	Blade
143	30	30D14	1	64.58	42.00	19.00	Complete	Cutting	Flake
145	30	30D4	2	69.11	33.74	10.51	Complete	Scraping	Blade
164	46	Trench A	0	73.84	37.47	15.45	Complete	Cutting	Blade
164	46	Trench A	0	121.31	39.13	22.45	Complete	Scraping	Blade
173	42	42A6	1	45.22	20.23	7.36	Complete	Scraping	Blade
216	NW24	–	0	48.40	47.76	16.18	Complete	Scraping	Flake
228	Borrow pit	–	0	52.87	27.32	6.79	Complete	Scraping	Blade

Table 29. Provenience and metric data for gunflints and strike-alites.

Lot	Division	Unit	Level	Length (mm)	Width (mm)	Thickness (mm)	Condition	Use
156	30	Trench 7	n/a	33.75	25.22	8.48	Complete	Gunflint
228	Borrow pit		n/a	33.90	18.89	6.65	Complete	Gunflint
228	Borrow pit		n/a	29.88	21.18	4.66	Complete	Gunflint
228	Borrow pit		n/a	34.07	18.06	6.43	Complete	Gunfint
228	Borrow pit		n/a	27.88	18.38	4.76	Complete	Gunflint
228	Borrow pit		n/a	26.40	23.59	7.28	Burned	Gunflint
228	Borrow pit		n/a	21.57	21.18	6.69	Snapped	Gunflint
228	Borrow pit		n/a	29.10	18.46	4.86	Complete	Gunflint
228	Borrow pit		n/a	35.71	28.72	10.20	Complete	Gunflint
228	Borrow pit		n/a	39.04	28.95	11.84	Complete	Gunflint
136	Trench 10		n/a	26.17	23.80	7.78	Complete	Gunflint
228	Borrow pit		n/a	46.14	37.74	9.66	Complete	Gunflint
228	Borrow pit		n/a	30.89	18.02	6.96	Complete	Gunflint
200a	43	43O12, O13, P12	1	28.24	22.16	12.04	Complete	Gunflint
128	34	34B3	1	42.26	30.51	13.19	Complete	Gunflint
221	Surface		n/a	30.77	23.70	6.14	Complete	Gunflint
138	30	30D11, B11	Surface	24.14	17.48	6.10	Fragment	Gunflint
18	34	34A1	2	51.72	31.19	10.02	Blade Fragment	Strike-Alite
197	43	43Q15	2	31.76	23.17	6.43	Complete Flake	Strike-Alite

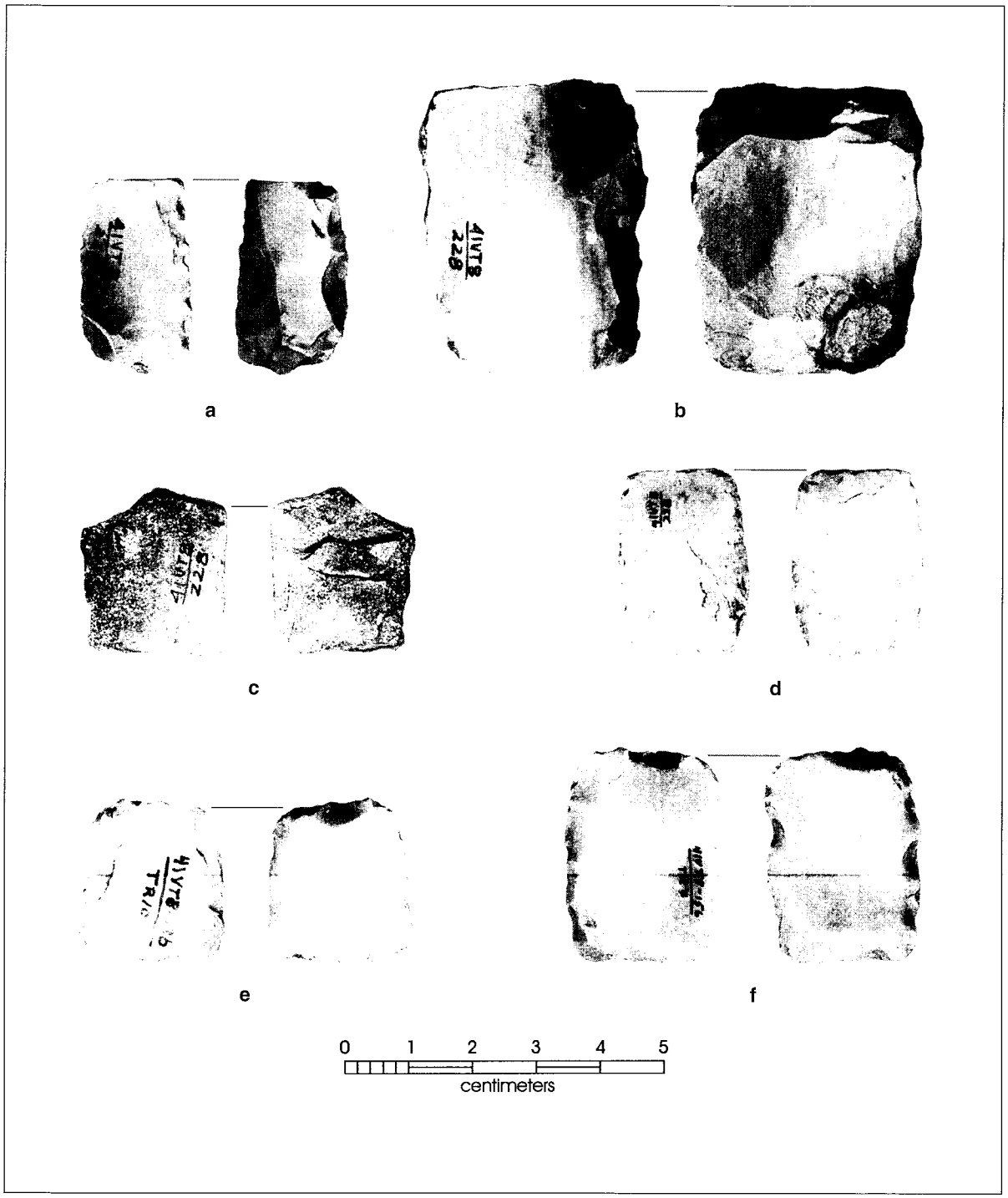

Figure 39. Selected Spanish gunflints.

gunflints, and consists of crushing, heavy step flaking, and coarse smoothing (Kenmotsu 2000). All show evidence of use on two opposed edges along the longer axis. They fit the description of Native American gunflints (Kenmotsu 2000). The manufacturing technology varies considerably in the sample and includes sectioned and retouched blades, spalls, and shaped bifaces. Some of these gunflints, including some made on blades, may have been on recycled prehistoric artifacts that were abundant on the surface around the presidio compound.

The production of Native American gunflints at Presidio Loreto is problematical. There is no question that Native Americans were supplying the presidio population with ceramics (Anne Fox, personal communication), but it is highly doubtful that they were supplying the Spanish soldiers with gunflints. Furthermore, we also must assume that at least some of the Native Americans had muskets by this time on the frontier (Berlandier 1969:Figures 16-18). The notion that native-made gunflints were made by Mexican Indians as argued by Villalobos (2003) is rejected here in favor of local production by both Spanish and Native Americans who shared knowledge of gunflint production. The technologies were similarly variable as to be indistinguishable. Blade technology was present in Late Prehistoric populations in the coastal bend region of the state (Hester and Shafer 1975) and is abundantly present in the Late Prehistoric assemblages at 41VT8. Blade technology only accounts for five of the specimens in the sample, all of which are of local cherts. The technology of production varied enormously within the 41VT8 sample as to suggest expedient production by whoever was using the rifles. Comparing this sample to "native made" gunflints recovered from other Spanish Colonial sites and contact period Wichita Indian sites (Blaine and Harris 1967; Blaine 1993) suggests a greater consistency in technology and dimensions in Native American gunfints recovered from Wichita sites. Wichita gunflints are rectangular in form and are carefully bifaced (Blaine and Harris 1967). This technology contrasts with the remarkable variability in technology, form, and size of gunflints from 41VT8. Only one 41VT8 specimen compares well to the Wichita Indian specimens. I suggest that part of the variability at 41VT8 is due to the Spanish frontiersmen manufacturing their own gunflints, and is the reason that the type of gunflints in Table 29 is described as "Spanish" although the sample probably includes both Spanish and Native American-made gunflints.

In addition to the 17 gunflints, also recovered were two artifacts that are classified as Strike-Alites (see Table 29). One of these is a blade fragment while the other is a flake. They both exhibit extensive crushing and step fracturing of one or more edges. The wear is more extensive than that typically seen on gunflints and is most consistent with that expected on chert used as a Strike-Alite. The unifacial raking motion leaves a unifacially crushed edge with an almost 90% angle. Strike-Alites are flints that are struck against steel bars to produce a spark that lights flammable materials to aid in starting a fire. Strike-Alites apparently represent the use of unmodified lithic debitage of appropriate sizes and edge shapes.

Lithic Chronology

The chronological sequence at 41VT8 extends from Late Paleoindian (Golondrina and St. Mary's Hall Intervals) to the Historic period. Although all of the Late Paleoindian points were recovered from the surface, two Early Archaic diagnostics (Angostura and Andice) were recovered from controlled excavations in Unit 29G and 29H, levels 7 and 8. There is a strong likelihood that an intact Early Archaic deposit occurs in this area of the site.

Middle Archaic components are absent in the inventory of diagnostic artifacts. Morhiss and Pedernales points indicate an early Late Archaic component. Marcos, untyped side-notched, Fairland-like, and Darl-like also indicate a relatively strong Late Archaic manifestation at the site. The strongest prehistoric material component is the Austin phase identified by the presence of Scallorn arrow points, sub-triangular arrow point preforms, serrated flakes, and Gahagan bifaces. A Toyah phase component is recognized by Perdiz arrow points, a beveled knife, and end scrapers. This component could not be isolated stratigraphically, however, although it does overlie the Austin phase deposits in units 32D7 and 32D11.

The Spanish Colonial component also is represented by the presence of Spanish or frontier-made gunflints. Based on the recovery of the gunflints, bone-tempered Goliad ware, and Spanish Colonial ceramics, this is largely a surface component at the site. Locally made biface gunflints are generally assumed to have been made by Native Americans, but this assumption is logically flawed. Biface gunflints are the most prevalent forms found in Spanish Colonial sites, and it would be technologically inconsistent for the soldiers not to be able to maintain their own weapons and to have a Native American following along to create their gunflints.

Austin phase

The research design specifically emphasized the opportunity to isolate and assess the Austin

phase component at 41VT8. This is a significant component at the site and the sample of artifacts provides an opportunity to examine the constituents of the assemblage in this part of the coastal plain. Given the geographic distance from the region in which this phase was originally defined in Central Texas (Jelks 1962; Ricklis and Collins 1994), it would be naive to assume the same assemblage occurs in the coastal plain owing to environmental and social factors.

Six units, and specific levels within those units, were selected for analysis: 24T8 (Levels 2-6), 24T10 (Levels 4-7), 24T12 (Levels 3-6), 30D4 (Level 3), 32D7 (Levels 12-14), and 32F11 (Levels 8-11).

Corner-notched arrow points are the earliest arrow points to occur throughout much of Texas, the Southern Plains, and the Southwest. The presence of Scallorn as the first arrow point form to occur in the central coastal plain follows this broad pattern. The general similarities, namely finely bifacially fashioned and pressure-flaked points with moderately deep corner notches, give way to variably finished blades (straight or deeply serrated edges), convex, straight, concave, or flared basal corners to provide regional variation. With regards to the regional variations, one most certainly stands out: the deeply serrated blades. These occur on blades with different bases (straight and flared basal corners), and therefore, the base variations may not be as significant as are the serrated blades in defining a regional variant. Scallorn points are well represented in reported collections in this part of the coast (Story 1968; Ricklis 1995b; Hudler et al. 2002) and examples with serrated blades consistently occur in this area of the coastal plain. Mapping the distribution of this Scallorn variant is beyond the scope of this study, but is a project that might help to geographically isolate a technological style of Scallorn.

Story (1968) recovered sandy paste pottery associated with the Austin phase at the Anaqua site. I re-examined all of the sherds recovered from the Austin phase analysis units at 41VT8 under a 10X-40X magnification. All of the sherds were originally identified as Goliad ware, a catch-all category for plain, bone-tempered, Native American pottery recovered from Spanish Colonial period sites. Ceramics identified as Goliad ware are highly variable, however, and probably include more than one technological style. Goliad is described as having an abundance of pulverized bone (Mounger 1959). Ceramics from Unit 32F11, levels 6-11, included five plain body sherds with coarse sand temper, and no bone. One bone-tempered sandy paste Poynor Engraved sherd was recovered from level 8. Unit 24T8, level 2, yielded two sandy paste sherds and one Goliad Plain sherd. Unit 24T10, level 4 had one Goliad Plain and two coarse sandy paste sherds. Unit 24T12, level 4, had three sandy paste sherds with possible traces of bone, one with asphaltum on the exterior and one with asphaltum on the interior. The possible bone in these sherds is in marked contrast to the large pieces commonly seen in Goliad ware. Unit 32D7 yielded one sherd of Goliad ware in levels 7 and 8, and one coarse sandy paste sherd in level 12.

Inspecting the ceramics from the above units confirmed the suspicion that prehistoric ceramics are present at 41VT8. The coarse sandy paste ware fits the description of the plain sand-tempered pottery from the Anaqua site, and is tentatively associated here with the Austin phase. The Poynor Engraved vessel sherd is not associated with the Austin phase component at 41VT8. Poynor is a late and/or protohistoric Caddo type that occurs in the Neches and Angelina river basins in contexts that date from ca. A.D. 1400-1650, although later varieties of Poynor Engraved may date as late as the early 18th century (Kleinschmidt 1982). It is likely associated with the later Toyah phase occupation at the site or with the presidio occupation. Patton Engraved, an Historic Hasinai Caddo pottery type, was reported from the Spanish Colonial ceramic assemblage.

Scallorn arrow points and Gahagan (or Friday knife) bifaces provide a means of temporal comparison, but the similarities essentially end at that level. The distinctive characteristics of the 41VT8 Austin phase assemblage include deeply serrated Scallorn arrow points, sub-triangular arrow point preforms, serrated flakes, core-blade technology, and Gahagan bifaces. There is a rather consistent admixture of plain, coarse sandy paste ceramics in the analysis units, with a slight admixture of Goliad ware. The latter is not surprising given the abundance of Goliad ware on or very near the surface; bioturbation may explain the admixture.

The connection between the central coastal plain and the southern Caddo area turns out to be a most interesting one. A possible Gahagan source area for the southern Caddo is herein identified, and interaction with the southern Caddo peoples seems to have continued into later times, including

with the presidio occupation as shown by the presence of Patton Engraved pottery, and possibly the Poynor Engraved sherd.

SPECIALIZED ANALYSES: NATIVE CERAMICS, FIRED DAUB, FAUNAL MATERIALS, AND HUMAN REMAINS

This section presents the results of specialized analyses that were conducted on four distinct artifact categories recovered from 41VT8: native ceramics, fired daub, faunal materials, and human remains.

Native Ceramics from 41VT8

Kristi M. Ulrich

At the present time, historic archeologists lump all mission-derived ceramics into a single catch-all: Goliad ware or type. This is done even in the face of the fact that Goliad collections derive from several missions and presidios spread throughout Texas. In many cases these sites were inhabited by ethnically distinct groups and represent anywhere from 15 to 60 years of occupation, or even longer, during the 18th and early 19th centuries. Given this variability in geographic location, ethnic composition of populations, and length of occupation, it would be expected that a significant degree of variation exists within the Goliad type. Yet, to date, very little careful characterization of Goliad ceramics has been conducted to determine the degree of variability within this broadly inclusive type (cf. Perttula 2002; Ricklis 1999, 2000; Córdova et al. 2005; Ulrich et al. 2005). The causes of any observable variability may be somewhat difficult to explain given that variability within local clays, technological variability related to form and function, and variability related to cultural/ethnic traditions of manufacture could all contribute to the pattern. Nonetheless, at the present time, only a limited detailed knowledge of the characteristics of Goliad wares exists. Paralleling these broad research interests are specific suggestions from the ethnohistoric record (Cardenas 1783) that Aranama potters from Mission Espíritu Santo may have made and furnished wares to other missions including Rosario and Refugio (Perttula 2002, Ricklis 1999, 2000). To add to the currently available characterization of Goliad ceramics, a collection of rim sherds from 41VT8 was examined.

Analytical Methods

A collection of 190 Goliad ceramic sherds from Presidio Loreto, the second location of Presidio La Bahía, was examined during the course of the study. The ceramic assemblage was composed of a collection of rim sherds that were previously identified as Goliad. Each ceramic sherd was measured and weighed, and formal, stylistic, and technological attributes were recorded. Only sherds larger than 2 cm (20 mm) in maximum dimension were utilized for this study.

Formal Attributes

Formal attributes recorded included vessel form, size, and wall thickness. Body and base sherds of native ceramics usually convey very little information concerning the vessel form; therefore, rim sherds were the only fragments examined. Rim form was recorded as everted, inverted, deep bowl, shallow bowl, straight, or unknown. Typically, vessel forms can be inferred based on the rim sherd form and degree of curvature. Everted rims are characteristic of ollas and jars. Inverted rims usually indicate neck-less jars and certain bowl forms. Straight rims are indicative of tall jars and bottles. Shallow and deep bowls are distinguished by the degree of curvature on the rim. A downward curve greater than 25 degrees from a perpendicular plane can be classed as a shallow bowl, whereas a degree of curvature less than 25 degrees are considered a deep bowl (Ricklis 2000). When rim sherds were too small to determine rim or vessel form, they were coded as "Unknown."

Lip form was another attribute recorded for rim sherds. Four lip form categories were used: pointed, flat, flared, and rounded. Lip form may be an indicator of the style of an individual or of cultural groups of potters. Orifice diameter was recorded for rim sherds that were large enough to determine the rim arc. To determine vessel orifice diameter, the sherd was placed rim down on a concentric circle template, positioning the sherd so that the lip rested on the flat surface. The concentric circle template was composed of graduated 1 cm rings, and the rim sherd was fitted to the closest diameter.

Maximum thickness of each sherd was taken in millimeters (mm) using digital calipers. In general, ceramic analysts assume that thicker vessel walls increase the impact resistance of the vessel (Rice 1987; Skibo 1995; Braun 1981). Such a characteristic may be advantageous for vessels that are often moved and therefore it may correlate with high levels of mobility. Similarly, it is assumed that thinner walls increase thermal shock resistance, that is, the ability to withstand repeated heating and cooling before cracking. This characteristic may in turn be significant for vessels that are primarily used for cooking (Rice 1987; Ulrich 2004:46).

Technological Attributes

Technological attributes refer to characteristics associated with the preparation of clays and the firing of the vessel. Information recorded included the type of aplastic inclusions, the relative quantity of the inclusions, and the firing atmosphere of the vessel.

Aplastic inclusions consist of particles present in the clay body. Aplastic inclusions seen in the sample include crushed bone, sand grains, burned sandstone fragments, feldspar, quartz, and plant fiber. During the analysis, inclusions were grouped into the following categories: bone, bone/sand, and sand. In addition, each sherd also was examined for other materials such as plant fiber, sandstone, and feldspar, and their presence was noted.

While it is assumed that bone is a purposeful tempering additive, in the case of some constituent elements present in ceramic sherds (e.g., sand) it is difficult to determine whether the substance represents a purposefully added tempering agent or is contained within the parent source of the clay (Rice 1987). Therefore, we chose to refer to sherds containing sand particles as "bone-tempered sandy paste wares" when they exhibited both bone and sand, or as "sandy paste wares" rather than sand-tempered wares when no bone was noted. The density of sand within the sherds examined varied, therefore not indicating a purposeful addition of the sand to the clay.

As part of the analysis, each sherd was freshly broken allowing for a clean view of the interior of the sherd. The sherd was examined under 40X magnification to determine the type and density of the aplastic inclusions present. In keeping with the guidelines set by other investigations concerning Toyah (Black 1986), Rockport (Ricklis 1995a), and Goliad (Ricklis 2000) ceramics, sparse presence of inclusions was estimated at less than 5% of the clay body, between 5% and 25% was considered moderate, and abundant was greater than 25%.

The color of the interior surface, exterior surface, and core of the sherds were examined to help determine the firing atmosphere of the vessel. Colors that fell in the range of buff to red-orange were recorded as oxidized. If the sherds contained shades of gray to black, they were recorded as reduced. Fire clouding, the result of uneven firing, vessels touching during firing, or organic materials in contact with the vessel during firing, were also recorded as a firing atmosphere attribute.

Stylistic Attributes

Surface finish and treatment were the two types of stylistic attributes recorded. Surface finish categories included smooth, rough, and brushed; the finishes included application of organic coating and smudging. The presence of these stylistic attributes was recorded for both the interior and exterior surfaces of all sherds.

Discussion of Results

The patterns within the attributes recorded during the course of the examination are presented below. Previous investigations of native ceramics at Mission Espíritu Santo (Ricklis 2000; Ulrich et al. 2005), Mission Rosario (Ricklis 2000), and Mission San Juan de Capistrano (Córdova et al. 2005) have also provided comparative data.

Vessel Forms

Each rim sherd was closely examined in an attempt to determine the original form of the vessel. The majority (n=138, 73%) of the rim sherds examined were too small and therefore could not be assigned to a vessel form. These sherds were categorized as "Unknown." The remaining 52 sherds were identified as bottles (n=6), jars (n=9), deep bowls (n=17), and shallow bowls (n=20). Consistent with the vessel forms found at other mission and presidio sites, shallow and deep bowls appear to be the dominant forms (Ricklis 2000; Córdova et al. 2005). This pattern

in vessel form breakdowns suggests that serving vessels were more common than temporary storage vessels (i.e., jars and bottles) within the domestic wares of the presidio. It also suggests that most food was prepared fresh and consumed soon thereafter, and there was little need for the temporary storage of foodstuffs, at least at the household level.

Thickness

The average thickness of the rim sherds recovered from 41VT8 is approximately 5.56 mm. The average thickness is consistent with the findings from Mission Rosario (Ricklis 2000; mean=5.47 mm) and Mission San Juan de Capistrano (Córdova et al. 2005; mean=5.58 mm). However, on average, these sherds do appear to be thinner than those recovered from Espíritu Santo (Ricklis 2000, mean=5.99 mm; Ulrich et al. 2005, mean=7.00 mm). These figures suggest that although small differences between assemblages from different missions do exist, overall the thickness patterns are quite similar. To some degree, this similarity may be derived from underlying technological prerequisites of ceramic manufacture. It is also possible that the similarities are indicative of a limited number of manufacture localities or sources or may be a product of the small number of functional types that were utilized by the inhabitants of the presidio and missions. Finally, the thickness patterns also suggest that no apparent differences in degree of mobility exist between populations living in the missions and presidios.

Comparison of the Goliad sherds from this analysis with two samples of Leon Plain rim sherds reveals only minimal differences. A small sample (n=15) of Leon Plain rim sherds from the Biesenbach site (41WN88) examined by Ulrich (2004) had a mean thickness of 6.27 mm. Leon Plain rim sherds from the Hinojosa site (41JW8) averaged 6.1 mm in thickness (Black 1986). These comparisons indicate that on average, the Goliad rim sherds recovered from Presidio Loreto are thinner (5.8 mm) than Leon Plain wares from the Biesenbach and Hinojosa sites. These findings suggest that a decrease in vessel thickness accompanies sedentism, a trend that would be expected if vessel thickness responds to failure probability under more mobile land use practices.

Sherd thickness also was examined in relation to temper type and vessel form (Table 30). Sherds with sand inclusions tend to be, on average, slightly thicker than their bone or bone-tempered sandy paste counterparts. Jars (5.902 mm) and shallow bowls (5.894 mm) are on average slightly thicker than other vessel forms. This trend appears to be consistent with the earlier-mentioned expectation that serving and storage vessels that tend to be handled more and are not consistently exposed to dramatic changes in temperature should have thicker walls than cooking vessels. However, the fact that deep bowls are on the average thinner than their shallower counterparts suggests that the relationship between vessel thickness and functional type is more complex. To shed more light on the situation, this collection of ceramics should be compared with a sample from 41GD7 (Presidio de Nuestra Señora de Loreto de la Bahía) in future

Table 30. Mean rim sherd thickness by vessel form and temper type.

Vessel Form	Temper Type			Mean (mm)
	Bone (mm)	Bone/Sand (mm)	Sand (mm)	
Bottle (n=6)	5.628	5.030		5.329
Deep Bowl (n=17)	5.424	5.643		5.534
Jar (n=9)	5.902			5.902
Shallow Bowl (n=20)	5.321	5.952	6.410	5.894
Unknown (n=138)	5.549	5.510	5.861	5.640
Mean (mm)	5.565	5.534	6.136	

studies to determine if there are any distinct shifts in the manufacturing of ceramics between the two presidio sites.

Aplastic Inclusions

The 190 rim sherds were grouped into three categories based on aplastic inclusions: bone-tempered (n=150, 79%), bone-tempered sandy paste (n=34, 18%), and sandy paste (n=6, 3%) wares. As evident from these numbers, the most common inclusion in the clay matrix was calcined bone. Of the 190 sherds examined, 184 contained crushed bone either as the lone aplastic inclusion or in combination with sand.

Bone-tempered Ceramics

Of the 150 bone-tempered sherds, 35 specimens (23%) were considered to have abundant bone, 91 (61%) contained moderate amounts, and 24 (16%) were deemed to contain sparse amounts of bone tempering.

Bone-tempered Sandy Paste Ceramics

Approximately 18% of the 190 sherds examined contained a mix of bone and sand within the clay matrix. Again, however, while it is assumed that the bone is a purposeful additive, it is not clear whether the sand is a natural component of the clays employed in making the vessels or whether the sand is a tempering agent. Regardless, the presence of sand does influence the ability of vessels to withstand thermal shock (Rice 1987). Of the 34 sherds, two (6%) were classified as having an abundance of both bone and sand, two had abundant bone but sparse sand, 15 (44%) had moderate quantities of both, and 15 (44%) others contained sparse quantities of both.

Sandy Paste Wares

Six ceramic sherds contained sand as the only inclusion in the clay matrix. Of these six, four sherds (67%) have abundant sand inclusion, and one each was classified as containing moderate and sparse amounts of sand inclusions.

The distribution of tempering and inclusions by vessel form is shown in Table 31. It is evident that the majority of the sherds (80%) that could not be classified into a vessel form are bone tempered. Only 16% contain bone tempering and sand inclusions and only 4% contain no bone and the tempering is entirely sand. All jar fragments and 83% of the bottle sherds are bone-tempered and contain no other inclusions. On the other hand, a small portion (18%) of the sherds from deep bowls contain sand inclusions in addition to bone temper and 45% of the sherds (n=9) from shallow bowls contain either only sand (5%) or have sand inclusions in addition to bone tempering (40%).

The relatively common occurrence of sand inclusions within sherds derived from shallow bowls is intriguing since these wares are assumed to be serving vessels and failure from thermal shock is a lower risk than among cooking vessels such as possibly the deep bowl form.

Table 31. Distribution of bone tempering and sandy inclusions within the rim sherd sample.

	Temper Type			
Vessel Form	Bone	Bone/Sand	Sand	Total
Bottle	5	1		6
Deep Bowl	14	3		17
Jar	9			9
Shallow Bowl	11	8	1	20
Unknown	111	22	5	138
Total	150	34	6	190

Other Inclusions

Other inclusions noted in several sherds included plant fiber, burned sandstone, feldspar, and quartz. The substance that was described as plant fiber appeared in the sherds as very fine, amber-colored threads. Some examples had small, amber-colored spheres attached to the fibers. The presence of the fiber may or may not have been purposely added to the clay as a tempering agent. Fifteen sherds were identified as containing plant fibers. Burned sandstone appeared as soft, bright red-orange, grainy particles within the ceramic paste. The presence of sandstone was noted in one sherd. Feldspar was identified as hard, tan-colored particles with a slight iridescence. Feldspar was identified in one specimen. Quartz was differentiated from sand granules by its angular, crystal characteristics. Quartz was identified in two specimens.

Firing Atmosphere

Table 32 presents the firing data from the assemblage of ceramics from Presidio Loreto. The percentages of specimens that exhibit a reduced firing atmosphere on both the interiors and exteriors is nearly equal (44% and 42%, respectively), and consistently higher than the percentage of sherds showing oxidized firing atmospheres (34% and 32%, respectively). In addition, roughly a quarter of the ceramic sample exhibits fire clouding on their interiors (22%) and exteriors (26%). The proportion of reduced atmosphere sherds in this sample is consistently higher than the percentages seen in the Mission Espíritu Santo collection (Ulrich et al. 2005). Similarly, the appearance of fire clouding on the sherds is greater in this sample of ceramics than those collected from Espíritu Santo (Ulrich et al. 2005). The large majority (84%) of the rim sherd cores exhibit a reduced firing atmosphere (Table 33).

These patterns suggest that the ceramics utilized at 41VT8 were fired for shorter periods of time than needed for complete oxidization of the clay. This finding is typical for ceramics that are fired in open pits rather than closed kilns. This same trend of reduced firing atmospheres was noted in ceramics collected from excavations at Espíritu Santo (Ulrich et al. 2005), and within samples from Mission Rosario (Ricklis 2000).

Surface Finish and Decorations

Most sherds exhibited some level of smoothness (Table 34). A few specimens (n=10) have "rough" surfaces, though it is possible this "roughening" was due to erosion of the sherd rather than a purposeful finishing technique used by the potter. No highly burnished fragments were identified. Three fragments exhibited brushed surfaces. The "brushing" consisted of striations that may have resulted from the potter wiping the leather-hard surface with straw or grass brush before firing.

Very few decorated rim sherds were noted in this sample (see Table 34). The majority of the sherds had no decoration either on their exteriors (n=184) or interiors (n=182). Six sherds had organic coating treatments to the surface. On four of these sherds, the organic coating was on the interior of the sherd, possibly acting as a sealant. Six sherds exhibited "smudging" (two on interior only, two on exterior, and two had both surfaces) which appears as charred organic material rubbed into the surface pores. The substances used in the coating treatments and smudging are unidentified organics, based on preliminary scanning electron microscopic analysis. At first believed to be asphaltum, the substances possessed different chemical make-ups when compared to known pieces of asphaltum. Specifically, the smudged pieces lacked sulfur, an element that is characteristic of asphaltum, and was present in the comparative specimen.

Summary of Ceramic Analysis

The Goliad ceramic sherds examined from 41VT8 are characteristically very similar to the ceramics found at missions Espíritu Santo, Rosario, and San Juan Capistrano. Examples of the similarities include the use of calcined crushed bone as the principal tempering agent for clays that contain no sand inclusions. In a few instances, the clays utilized may have contained sand but in small proportions. It is unclear whether the sand was added as a purposeful tempering agent or was a natural component of the clays used in making these vessels. However, the low proportion of sand inclusions suggests that sand is a constituent element in the clay rather than a purposeful additive. Regardless, the influence of the inclusions in terms of vessel performance is the same. Calcined crushed bone is added to the sandy clays as a

Table 32. Distribution of the interiors and exteriors of rim sherds by firing atmosphere and vessel form.

	Vessel Form	Firing Atmoshpere: Fire Cloud	Oxidized	Reduced	Total
Interior	Bottle	2	1	3	6
	Deep Bowl	4	6	7	17
	Jar	-	7	2	9
	Shallow Bowl	5	4	11	20
	Unknown	31	46	61	138
	Total	**42**	**64**	**84**	**190**
Exterior	Bottle	2	-	4	6
	Deep Bowl	4	6	7	17
	Jar	4	4	1	9
	Shallow Bowl	10	2	8	20
	Unknown	29	49	60	138
	Total	**49**	**61**	**80**	**190**

Table 33. Distribution of rim sherd cores by firing atmosphere.

	Firing Atmosphere			
Vessel Form	Oxidized	Reduced	Zoned	Total
Bottle		6		6
Deep Bowl	1	15	1	17
Jar		9		9
Shallow Bowl	1	17	2	20
Unknown	10	113	15	138
Total	12	160	18	190

Table 34. Surface treatment and decoration on the interiors and exteriors of rim sherds.

Surface Finish	Interior	Exterior	Surface Treatment	Interior	Exterior
Brushed	1	2	Organic Coated	4	2
Rough	5	5	Smudged	4	4
Smooth	183	183			
None	1	0	None	182	184
Total	190	190	Total	190	190

tempering agent, creating a vessel that is different in performance characteristics (i.e., reduced shrinkage during firing; see Rice 1987:94-96) than a purely bone-tempered vessel.

The presence of bone tempering in the Goliad sherds collected from Mission Espíritu Santo supports Ricklis' (2000:103) claim that "tempering was almost consistently accomplished by adding crushed bone to the clay body." Ricklis notes, though, that the majority of the vessels from Mission Espíritu Santo lack any sort of sand inclusion to the paste. Findings from this study reveal that there are a few examples of sand appearing in the clay matrix, although the ceramics are predominantly bone-tempered. Given the predominance of bone tempering to the exclusion of all other inclusions in the clays, it is clear that the clays used in the manufacture of most presidio specimens is naturally free of sand. Some 18% of the sherds (n=34) contain sandy inclusions in addition to the larger quantities of bone tempering. Bone tempering was moderate to high in 19 of these specimens and sand inclusions were sparse in only two of the 19 pieces. On the other hand, the 15 pieces with sparse quantities of bone tempering also contained sparse quantities of sandy inclusions. Given the variability in bone temper and sandy inclusions within these specimens in combination with the number of specimens with abundant to moderate sandy inclusions, it is suggested that sand is a purposeful additive to the clays rather a natural component of sandy clays. There are no differences in the spatial distribution of bone-tempered, bone-tempered sandy paste, and sandy paste ceramic sherds across the site. Finally, given that bone is entirely missing as a tempering agent in six sherds, and instead abundant to moderate proportions of sand are the only inclusions present (in five of the six sherds), the data suggests that these specimens are part of a very different manufacturing process suggestive of either difference in ethnic traditions or functional wares. The consistent use of bone tempering may be indicative of a continuance of the Toyah phase pottery technology with the similarity reflecting strictly technological traits rather than cultural affinities. Information collected during the study

confirm that though there is slight variation within the individual sherds of Goliad, there is not enough information at this point to divide the Goliad classification any further. The sand-only tempered fragments appear to be related to the Miscellaneous Unglazed wares previously described by Anne Fox in the ceramic typology section.

Analysis of Fired Daub

Mark R. Wolf

Fired daub was the most common building material found at 41VT8. This is to be expected as the site was occupied for over 20 years and little if any evidence was found to indicate that structures other than *jacales* were erected. The material was found in the majority of units, with some units yielding significant quantities. This preliminary review of the fired daub will focus on general descriptions based on visual inspection of the collected material. Detailed analyses are recommended following recovery of a larger sample of fired daub from the site.

The collection consists of 1,505 pieces of fired daub, of which four could be puddled adobe and numerous small pieces could be fired earth (Table 35; Tunnell and Newcomb 1969:11). The daub was located in every level, from the surface to Level 4 of some units. Cross-referencing the daub count per unit with the site map, the highest concentrations of fired daub occur within map grids (i.e., Divisions) 30, 38/46, and 34/42/43, and suggest structure locations in these areas (see Figure 4). Smaller concentrations were found in the west section of Divisions 30 and 31. Trench 4, in Division 27, revealed a very dense sample in one concentrated area, suggesting a wall feature was uncovered.

The daub fragments range in size from 0.2 cm to 7.7 cm, with the majority of pieces ranging from approximately 1.5 cm to approximately 2.5 cm. The large fragments as a whole provided information suggesting general construction techniques and features. The smaller fragments also provided information regarding material composition, structural and organic impressions, and extent of material firing or destruction.

Definitions

Applied in a similar fashion as contemporary stucco/plaster onto a framework of wooden posts and branch lathing, daub was a quick, economical material made from the earth and soil at hand. It provided a sturdy, solid, smooth-faced, water and rodent resistant wall surface for a variety of small building types. With occasional maintenance requiring reapplication of the mud-like material, daub could last for quite some time. Similar in general finish to plastered stone of adobe wall surfaces, daub walls could also be treated with a slip-like fine finish that could be painted or whitewashed for further decoration or weather protection.

Daub has been associated with *palisado* and *jacal* structures of Spanish Colonial vintage (George 1975:28-30; Hindes et al. 1995). The large Spanish community of San Luis in western Florida—which included mission, presidio, and village occupations—was constructed of wattle and daub with a whitewash finish. A bit later than the 1749 abandonment of this site, a 1788 map of St. Augustine lists two structures made of *cujes y harro* (wattle and daub) in which a wooden framework, with a secondary woven mesh of horizontal branches, was covered with daub. Similar structures found in the West Indies indicate this construction type is rather strong and durable (Manucy 1978:71-73).

Items referred to as fired daub have a matrix composition of fine sand, clay, small pebbles, and amounts of organic binder. The texture is lightly abrasive, similar to fine sandstone. Discussed in more detail later, there appear to be numerous definitive mixture ratios present in the collection, suggesting multiple application dates or different artisans working on different structures.

Items referred to as fired earth have a very dense, tight matrix composition as a result of intense heating. The material is found in thin sections, longer than they are wide, and generally in a light grey color range. The texture is completely different than fired daub with random, rough edges; thus, also different from stone or pebbles.

Descriptions

Because of its composition, daub has very limited tensile strength, relying on its more resilient wooden framework to absorb lateral forces and thus perform effectively as a building wall system component. Thus it can be assumed that the material collected was affected by two forces that heavily influenced the collapse of the daub-treated jacal structures at the presidio site: burning and structural movement.

Table 35. Observations of fired daub recovered at 41VT8.

Lot	Location	Count	Descriptions/Observations
1	Surface	39	11 burned pieces, 2 exterior surfaces, 2 structural impressions, 1 piece with sand
1	Unknown	3	1 exterior surface?; some burning, reed impressions, color range 5YR5/2
3	Trench 2	1	
6	Trench 4, 24 ft. north of south end	183	1 exterior surface, 1 finger impression, 1 piece with 90 degree opposing structural
7	Trench 3	9	7 burned pieces
9	43P13/14 L2	13	Lighter color matrix
11	34C2 L1	24	Pebble matrix, reed impressions, different matrixes
13	Trench 5	6	1 burned piece, 1 possible corner piece
15	30D11 L1	4	1 possible corner piece
17	Trench 6	16	Quartz pebbles in matrix, charred pieces, light color range from 10YR9/2 to 10YR5.5/2
18	34A1 L2	7	Small pieces (10YR7/2), 1 burned piece
20	34C1 L1	9	Large pieces with structural impressions, organic impressions; color range from 5YR7/2 to 5YR3/5 (burned)
109	31D15 L4	2	Small pieces, lath impressions
112	5T20 L2	3	Small pieces, pebbles in matrix
117	34 surface	1	
119	34A2	20	2 pieces with matching leaf impression—vertical & rectangular—organic binder impressions, color range 10YR7/2
120	34A3 L1	10	Small pieces, most charred, sandy matrix; color range from 5YR4.5/3 to 10YR3/1 (charred)
121	34A3 L1	22	Diagnostic exterior surface with structural impressions, organic binder impressions; color range 10YR7/2
122	34B2 L1	10	Small pieces with organic impressions
123	34B2 S/E	4	Small pebbles in matrix, 2 sandy burned pieces
125	34B1 L1	11	4 charred
126	34B1 L2	7	1 exterior surface, all pieces charred, organic impressions; small pebbles in matrix
128	34B3 L1	20	2 large pieces with structural impressions, lighter color range: 10YR7/2, 19 dense matrix with small pebbles, 1 soft
129	34C1 L1	10	Small pieces, soft matrix, organic impressions
131	34C3 L1	6	Small pieces, organic impressions on 2 pieces, standard orange/brown coloring
134	34C4 L1,2	4	Small pieces, 2 with organic impressions
134	34C4 L1,2; burned soil	42+soil	2 structural impressions on largest piece, unstable, crumbling, lack of clay, 5YR4.5/1, small pieces (assumed low temperature slow burn of high sand, low clay daub matrix with adjacent soil residue)
135	Trench 9	35	Good representation of daub specimens, basketweave impression on 1 piece, organic impressions, air holes, charring
136	Trench 10	6	Exterior surface, organic impressions (binder), small pebble matrix
139	30D11 L2	7	Small pieces
154	30B11 L3	2	Small pieces, sand matrix
156	Trench 7	313	Excellent sampling of daub, all sizes, wide range of color & charring, structural impressions, organic impressions, variety of matrix compositions; multiple construction events?
157	38P19 L1	3	1 large piece with exterior surface, organic impressions, pebble matrix
158	38P19 L2	4	Very small pieces
159	39R14 L1	8	Small pieces
160	38R15, 16 L1	16	1 large piece with structural impressions; 1 piece burned earth?
162	38R15, 16 L3	33	1 piece with good binder impressions; small pieces
163	38S14/T14, surface	2	Small crumbling pieces, charred
164	Trench A	2	Small pieces
164	Trench A	11	1 large piece with structural impression; 4 heavily charred pieces, pebble matrix

Table 35. *(Continued)*

Lot	Location	Count	Descriptions/Observations
164	Trench A	19	16 heavily charred pieces; 1 piece with smooth structural impression
165	Trench B	3	Small charred pieces
166	46B17	43	Heavily charred, low clay matrix with pebbles; 2 large pieces with structural impressions, organic impressions, 1 exterior surface
167	46C11	14	Small heavily charred pieces, 1 structural impression
168	46C17	9	1 large piece, pebble matrix, 2 exterior surfaces, 1 Spanish Colonial mud dauber's nest
173	42A6 L1	3	Small pieces
175	42A6 L3	3	Very dense small pieces, organic impressions
176	42H2 L1	62	Small pieces, pebble matrix, 1 burned earth?
177	42H2 L2	81	Small pieces, organic impressions
179	42H4L2	21	Small pieces
180	42H4 L3	11	Small pieces
181	42H6 L2	20	Small pieces
183	42H6 L2	20	Small pieces
184	43L13, 14 L1	7	Small pieces, pebble matrix, 1 exterior surface
185	43L14 L2	5	1 exterior surface, 2 color types
186	43L18 L1	4	Very small charred pieces
188	43P13, 14 L3	3	Small pieces, soft sandy matrix
189	43Q13 L1	8	Small pieces, lighter coloring, some charring
190	43Q13 L2	19	Distinct off-white matrix: 10YR8/2-8.5/2; 1 burned earth?
190(b)	43Q13 L2	81	2 off-white matrix, 2 yellow-orange matrix, 2 soft charred pieces, all with pebble matrix (separate construction events?)
191	balk between 43Q13 & 14	32	Wide variety of daub color: 18 soft off-white, 10 dense pale red-orange, 3 soft tan; organic impressions, 1 stone
192	43Q14 L1	1	Small heavily charred pieces
195	43Q14 L4	26	3 distinct colors: 6 medium grey, 2 red-orange, 18 off-white (separate construction events?)
196	43Q15 L1	1	Small off-white piece
198	43Q15 L3	6	Small off-white piece
200	43O12 L1; 43O13 L1; 43P12 L1	49	29 small off-white pieces: 10YR8/2, 1 large off-white piece: 10YR7.5/3, 1 piece with basketweave impression, structural impressions, organic impressions, 4 soft burned pieces, pebble matrix
200b	43O12/13; 43P12 L2	36	Small pebbles in matrix, 1 charred piece, 90 degree & curved structural impressions, wide variety of sizes
202	43R13, S13 L1	5	Small pieces, pebble matrix, 1 off-white
204	43R13, S13 L3	2	Small pieces
207	43R14 L3	2	Off-white pieces, both have exterior surfaces
211	43T13, T14	32	Small pieces, 1 exterior surface, 28 off-white, 2 burned earth?
215	43 Trenches	11	4 large pieces with structural impressions
215	Floor sample puddled adobe; SW circular structure in Unit 43	6	2 exterior surfaces, 2 puddled adobe?
215	43 Trenches daub in SW circular structure	3	2 exterior surfaces
220	SE43	4	1 small piece with organic impressions, 2 red-orange pieces with structural impressions, 1 tan piece with exterior surface
Unspecified lot		10	1 large piece with structural/organic impressions, 4 red-orange pieces, 6 tan pieces
Total		**1505**	

As is described in primary Spanish documents, the use of thatch roofing materials contributed to fires within some structures. It is also known that structures were burned and destroyed when the Spanish abandoned sites. The daub collected supports these statements since a majority of the collection shows a wide range of heat-induced damage. The result of this damage is that the majority of the daub, with its high sand/clay content, was essentially fired to a pottery-like hardness.

As the buildings burned, the wooden superstructures and intermediate lathing suffered fatigue and began to collapse. The daub most likely assisted in holding the structures together for some time, both as a heat insulating fire retardant and secondarily as a structural support. However, at some point during the burning of the structure, the fire accomplished its mission and the burning wooden framework began to collapse, causing lateral structural forces to be imposed on the daub material. The resultant weight loading and movement was more than the material could withstand. As the buildings began to collapse, the fired daub shattered into small pieces, falling to the ground. The remaining now-exposed wooden frame was then vulnerable to the flames.

A controlled burn of a similarly constructed 19th century Serbian wattle and daub cottage recorded the roof structure burned in less than 20 minutes; roof embers burned, smoldered, and reignited for over 6 hours; and the walls burned intermittently, with few—not all—posts burning to the ground. This could explain why the quantity of daub excavated at 41TV8 does not equate to the amount needed for the wall construction. The result of the Serbian example was "a very localized baking of the wall clay, and the destruction of one post here and another there" (Noël Hume 1982:250). While this cottage's structure was perhaps more seasoned and thus readily burned, it is safe to assume the burning of the presidio buildings was more deliberate than experimental (the cottage was only ignited once to understand the amount of burn created by a single event) and therefore a more deliberate burn could have caused more focused destruction, resulting in more fired daub.

Typical Characteristics

Numerous physical characteristics are evident with all daub collected. The following are the most apparent and consistent features:

1. The vast majority of all pieces have been subjected to enough heat to effectively fire the daub matrix. It is assumed obvious heat-induced chemical reactions have altered the original matrix;
2. there are many pieces which appear less affected by fire. These pieces are significantly softer, to the point of crumbling on contact in some instances. The pieces exhibit burning characteristics, mainly due to oxygen-reduced heating;
3. the daub appears lighter in weight than its mass would indicate, compared to rock or clay of the same mass; and
4. the daub is lightly abrasive to the touch, similar to fine-grained sandstone.

There appear to be four main types of matrix composition: (1) a soft high sand content, (2) a denser high sand content, (3) a dense high clay content, and (4) a very durable off-white high sand content. Color characteristics are fairly uniform with the different matrixes, indicating the possibility of separate construction events with different material gatherings. Excavation of more samples is required to examine this in detail.

The vast majority of the pieces exhibit impressions of organic, vegetal material used as a binding agent in the matrix. The impressions range from curved surfaces of structural and lathing members to finely chopped grasses, reeds, and small branches. The actual organic material has long decayed, leaving detailed information of the profiles of the organic material. Small pebbles were also used in the matrix though more material needs to be collected to establish any patterns as to their inclusion.

All pieces are irregular in shape, none exactly alike in appearance. However, all share similar features of pockmarks, indentations, very small air holes, and nodular surface projections.

It is apparent that the daub was applied in a wet, pasty, highly malleable form. The concentrations of clays within the matrix, when thoroughly saturated, allowed the matrix to securely adhere to (literally grasp in some cases) the wooden structural framework. Thus, especially in the higher clay

content material, the fired daub readily exhibits many features of the solid structures onto which it was impressed. Having been "fired," the daub now displays detailed, precise imprints of long-decayed bark, wood grain, branches, twigs, reeds, leaves, and grasses upon its exposed surfaces. The samples have numerous impressions of each of these, most observed to be in a haphazard, asymmetrical fashion. The organic impressions, when clustered on the surfaces of a piece of daub, are usually on less than 50% of the total surface area, indicating failure along the area of burning material.

Relatively few of the specimens are of a very dense, clay-rich consistency. Gray in color, these pieces are attributed to being burned earth as they do not have the ingredient mixture of the daub pieces.

Color Characteristics

The daub specimens have multiple distinct color ranges, mainly relating to the different matrix compositions mentioned above. In order to maintain objectivity and provide a universal reference guide for determining color, the colors were reviewed and selected by visual reference to the Rock Color Chart, distributed by the Geological Society of America.

Four distinct color ranges were noted. The lightest color of fired daub, an almost off-white material recovered from a certain area of Division 43, was of a color range between very pale orange (10YR8/2) and between pale yellowish-brown and very pale orange (10YR7/2), with the lightest color sample being identified as 10YR9.2. The more typical lighter (higher clay content) color was in the color range of 10YR5.5/2. The more typical, browner (high sand content) color was in a color range between grayish orange pink (5YR7/2) and pale brown (5YR5/2). The daub that showed a burned characteristic was in a moderate brown color range between 5YR4.5/3 and 5YR3/5. The most severely burned daub, almost charred, was in the color range of 5YR3/1, close to a grayish-brown.

Soot and Burn Features

A large majority of the daub fragments have a sooty, carbon residue on their surfaces, or they exhibit a charred discoloration, distinctively separate from the true color of the daub. Both conditions are consistent with the burning event to which the buildings were subjected. Each of these conditions could have occurred independently of each other. But they suggest the daub may have been exposed for some time to thick smoke or a smoky fire prior to or after it crumbled from its original location.

This discoloration affects each piece uniquely, from simply a single edge to replacing the color of almost the entire piece. Although giving the impression of being the result of fire damage, the color also seems to come from within the piece. This could be due to the smoke actually permeating the daub matrix. This color change would be the result of the slow, smoldering burn of organic material, the binder of the daub itself. Many of the pieces have what at first glance were considered to be air holes, but which are now determined to be the cavities that once contained small reeds or grasses. As this material burned slowly due to its oxygen-reduced, smoke-filled environment, the phenomena affected the color of the surrounding daub. This is very similar to the carbon deposits which result from the low-temperature, oxygen-reduction firing techniques of the contemporary Santa Clara Indian potters of New Mexico (LeFree 1975:63). The less oxygen allowed during the firing of the daub, the darker black the daub surface becomes.

This process is clearly seen in trenches 4, 6, 9, and A. In fact, two pieces of a sample from Trench 9 were actually one piece which failed along a "fault," evidently caused by the interior burning of organic material, possibly a small reed. When the pieces were rejoined, the dark residue was completely hidden within the newly linked piece, indicating that less intense, low-heat burning occurred both in a very localized as well as a more general environment.

Architectural Features

No substantive stone or adobe features have been discovered at 41VT8 to date. Therefore, discussion in this part will be limited to descriptions relating to *jacal* structure construction and the impressions observed in the fired daub collection. Of this construction type, similar in structure to the palisade, Eugene George (1975:28) notes the wall construction of *jacales* in the South Texas Falcon Reservoir basin as:

> consisting of a fence of closely spaced vertical palisades or pickets placed into a

continuous trench in the ground defining a single room. The fence would serve as a base on which a surface of adobe plaster would be spread on the inner, as well as the outer, surfaces. The result was a tight, substantial wall.

Because of the simplicity of construction techniques and materials, it can be assumed the structures were rapidly built. The daub was moist enough to be placed in a plastic form, yet dry enough to adhere to the wooden framework and remain in place. The daub was cured by simply air drying and baking those walls that received exposure to the sun.

While the daub collected and observed appears to be fragments of wall construction, there are a few pieces which suggest other features. The following descriptions attempt to identify, in general terms, the types of features discovered.

Exterior Surfaces

Evidence on some daub samples reveals there were attempts to smooth and finish the final surface, which indicates treatment of exterior surfaces (Figure 40). Indications of scraping or brushing the surface, perhaps after the daub had set up but before it had completely dried, are found on several pieces. These pieces also show a thin layer of fines at the exterior surface which is denser than the remaining matrix, indicating a rubbing or troweling of the final wall surface.

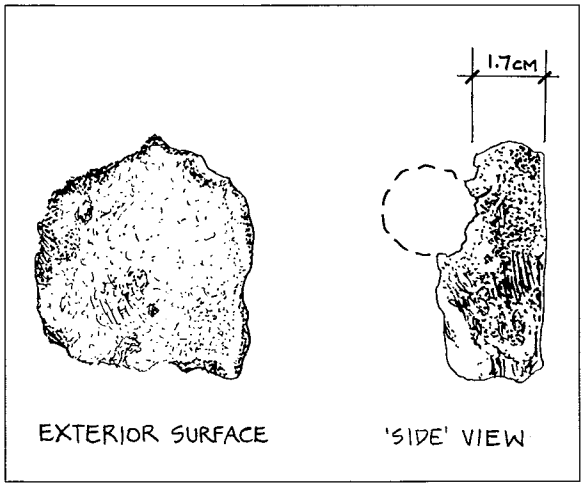

Figure 40. Daub surface fragment.

Structural Diameters

Review of all the daub fragments revealed some consistent structural diameters on those pieces that were adjacent to the wooden framework (Figure 41). The diameters suggest a larger frame was built for the main structure (e.g., corner posts, door, and window openings) which was infilled with a mesh or lath of smaller branches, in some cases exhibiting a basket weave design (Figure 42). Early 20th century postcard photographs fortunately recorded *jacal* structures with a wide variety of construction techniques that literally reveal the layers of construction (Figure 43). All of these natural materials were readily available on site at 41VT8 and would have easily been exploited.

Organic Impressions

Eugene George (1975:30) also writes, regarding wall construction: "The palisades (vertical wooden supports of the wall construction) could be separated slightly to permit a screening partition of horizontal

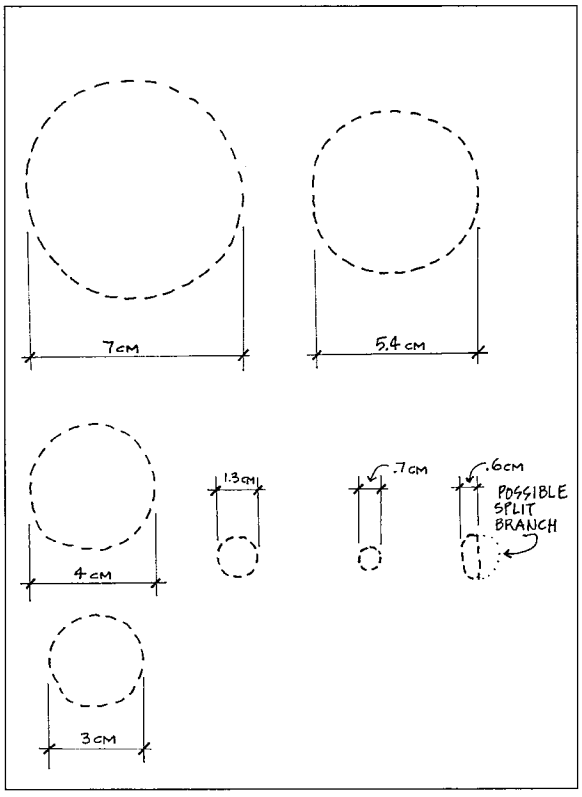

Figure 41. Diameters of daub structural impressions.

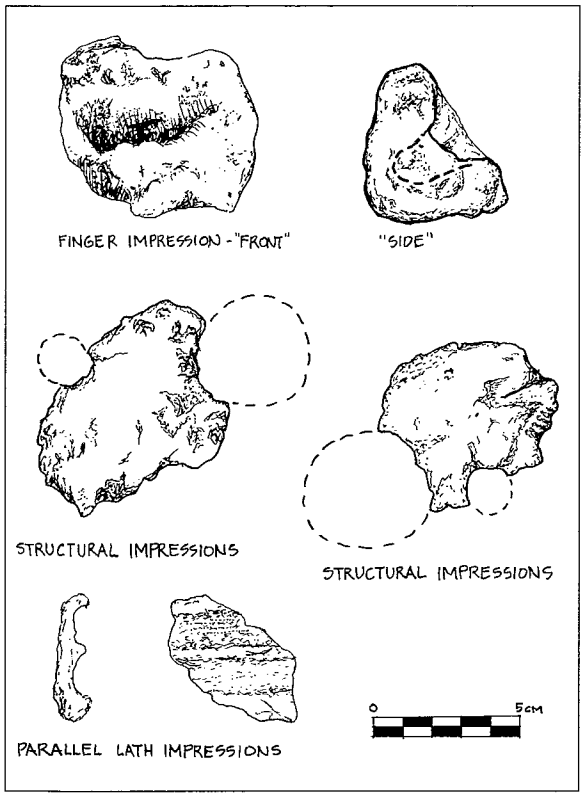

Figure 42. Daub impressions.

wood members composed of interwoven twigs, branches, split wood, or even bundles of grass." This construction technique is evident in early 20th century photographs of occupied *jacal* buildings (see Figure 43). As mentioned previously, abundantly evident are a range of organic impressions that include twigs, leaves, grasses, and reeds. These impressions are on the outer, as well as inner, surfaces of most fragments, large or small. The impressions are not as readily apparent on those fragments in which the matrix has a higher proportion of sand.

Puddled Adobe/Fired Clay

Also previously mentioned are very few fragments that are of a more dense, clay-rich composition, grayer in color, and of a thin, horizontal shape. These fragments represent less than 2% of the collection. Tunnell and Newcomb (1969:11) report on puddled adobe found at Mission San Lorenzo de la Santa Cruz, near Camp Wood, Texas, which approximates the description of this material. The horizontal aspect of the fragments suggests a layered formation of the material in a manner which did not bond it to adjacent surfaces. Most of the surfaces of these fragments are coarse and irregular on one face with the opposite, "underside" face being smoother. Due to the limited count of these pieces, it is not possible to define their location within a structure, if in fact they actually are from a structure. If so, this could be puddle adobe used for a roof or floor surface. If not, it could simply be fired clay, created from the soil adjacent to the structures which, when subjected to heat, became fired similar to the daub material.

Suggestions for Future Research

Far too little is known about the building construction techniques, sequencing, or layout at 41VT8 to make any determinations regarding the density, placement, or extent of this versatile building material. But what we do know suggests a substantial usage of, and reliance on, the *jacal* structure with daub plaster walls as a major building type at the presidio. Additional excavations should carefully record the subsurface distribution of the daub scatter for possible outlines of buildings as well as determinations of floor levels. Collection of more fragments, which will no doubt reflect the architectural features mentioned above, will provide more insight and clarity on construction techniques, and their possible evolution, at the presidio site. It is hoped, since no subsequent occupations have occurred at this site, that further work and analysis of the daub will reveal valuable information yet unknown on the initial establishment of primary Spanish Colonial sites.

Thin section analysis of the various daub matrixes mentioned above is recommended. The differing matrix ingredient composition ratios could be obtained and ingredients defined. Site identification of the different matrixes could assist in determining a chronology of construction events. Expert analysis of the impressions in the daub, as well as analysis of the extant organic material, would aid in identification of the various botanical species used during construction. Also, examination of pollen or phytoliths contained within the daub may shed light on the plant life originally found at the site as well as the time of year the structures were constructed.

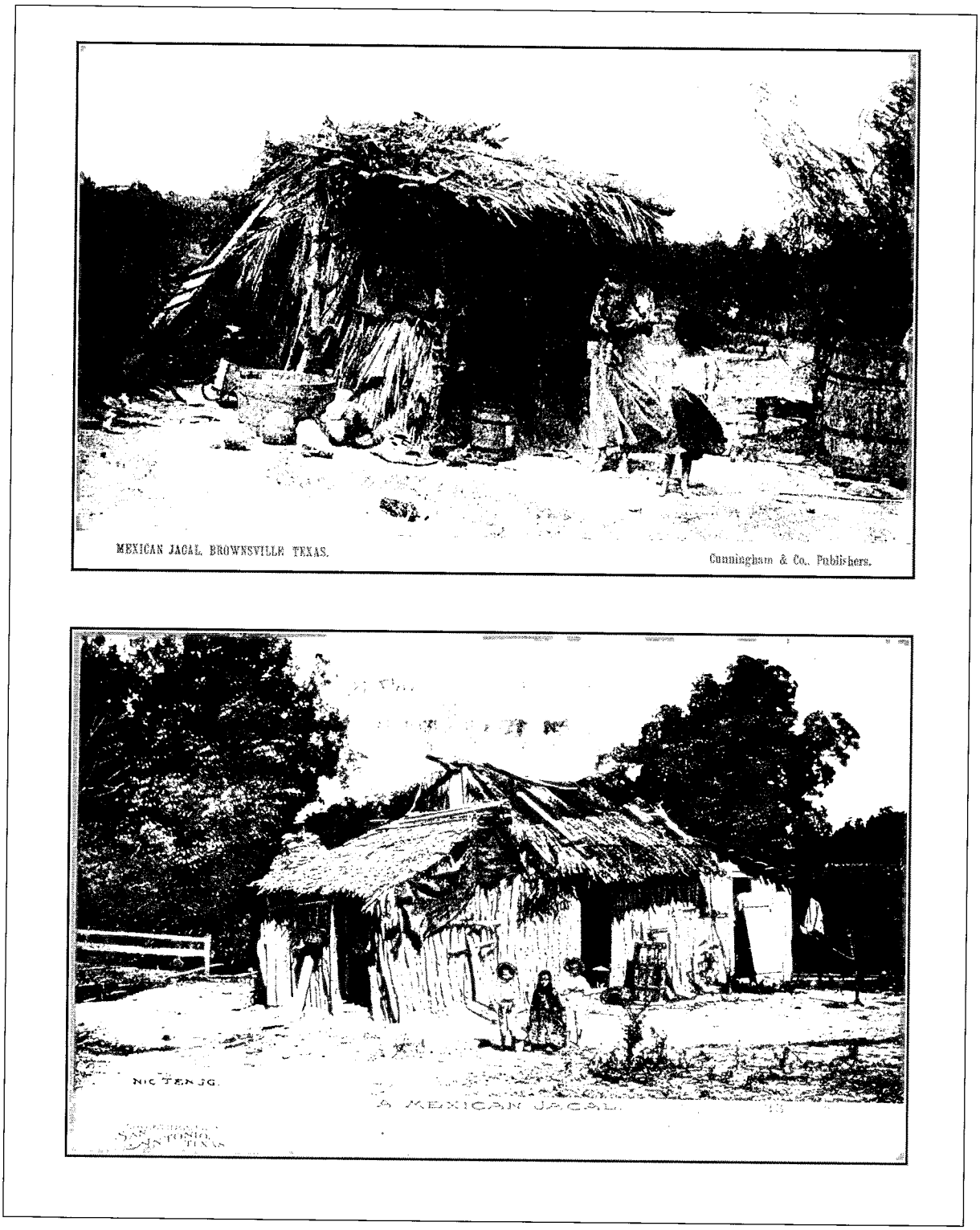

Figure 43. Postcards containing photographs of historic daub structures.

Analysis of Vertebrate Faunal Remains

Johanna Hunziker

Characteristics of the Collection

The vertebrate faunal remains from 41VT8 were originally identified by Bill McClure. The remains were identified to the lowest taxonomic level possible and only counts were recorded. A total of 10,521 vertebrate remains were recovered along with two specimens identified as crab shell. Fifty-one different genera were identified and include a wide variety of turtles, fishes, snakes, birds, and small and large mammals, including several domesticated species (Table 36).

Working with bone counts alone can give a misleading representation of actual faunal diversity, since without information on the elements identified, it is unknown how many individual animals could have produced the assemblage (Grayson 1984). For this analysis, we looked at the presence or absence of taxa within the different excavation blocks across the site. The northernmost excavation units were identified as containing an isolated prehistoric component based on diagnostic lithic tools (Scallorn arrow points) and aboriginal ceramics. The southern excavation blocks produced mainly colonial materials.

The Austin phase component was identified in the following units and levels: 24T8, levels 2-6; 24T10, levels 4-7; 24T12, levels 3-6; 32D7, levels 12-14; 32F11, levels 8-11; and 30D4, level 3 (no faunal remains were recovered from 30D4). Discounting all unidentified remains, only one bone from a positively identified domesticated animal (horse) was recovered from the northern group of units. The horse bone came from level 4 of Unit 32D7—well above the Scallorn component. No positively identified domesticated species were recovered from the levels of the Austin phase component (Table 37). All other identified domestic taxa (n=2) were recovered from the surface of the northern part of the site or from the excavations to the south. The domesticated species identified at the site include cow, horse, goat, sheep, pig, and chicken.

Due to the similarities between *Bos* sp. (cow) and *Bison* sp., it is extremely difficult to distinguish the two species from fragmented remains (Balkwill and Cumbaa 1992), thus the majority of the bovid elements were identified as "*Bos* or *Bison*." The unequivocally bison elements (n=2) were recovered from level 5 of 32F11 and Trench 5, respectively. The identified cow elements came from level 4 of 43Q14 (n=1), Trench 5 (n=2), Trench 6 (n=1), and the surface of the southwestern portion of the site (n=6). Of the 222 "*Bos* or *Bison*" specimens, only 20 (11.1%) came from the excavations in the northern part of the site. Five of these 20 came from the Austin phase levels in 24T8 and three came from the Austin phase levels in Unit 24T12. Figure 44 shows the distribution of domesticated ungulates across the site, from north to south.

The presence/absence and relative abundance of non-domesticated ungulates was compared across the site, since these species would most likely have been obtained at other locations and brought back to the presidio and/or prehistoric campsite, unlike the numerous riverine resources to be found in close proximity to the site. The three species of identified wild ungulates include pronghorn antelope (*Antilocapra americana*), white-tailed deer (*Odocoileus virginianus*), and *Bison* sp. Pronghorn were recovered from three units in Division 34 (n=10), Trenches 4 and 10 (n=3), and all of the northern units (n=16; 7 from the Austin phase levels).

White-tailed deer were recovered from seven units in Division 34 and Trenches 5 and 10 (n=16), six units and the trench in Division 43 (n=6), all of the northern five units (n=325), and from the surface in the northern part of the site (n=3). Within the northern units, 191 specimens (59%) were recovered from Austin phase levels in all five units. Thirteen percent (n=44) of the specimens were recovered from above the Austin phase component and 28% (n=90) were recovered from below it. Taking into consideration that these frequencies are counts and may be biased depending on the element represented and butchering techniques, it appears that although there was some reliance on deer throughout the Spanish colonial occupation, it was much heavier during prehistoric times. Of the total 350 deer bones identified, 93% came from the prehistoric area of the site, with 55% from the Scallorn component alone. Three additional unidentifiable artiodactyl specimens (pronghorn/deer/sheep/goat) came from Units 24T8 and 24T10, and the surface of the northwestern portion of the site. The specimens from the units came from the Austin phase component or below and most likely represent pronghorn or deer. Figure 45 shows the relative frequency of deer and pronghorn across the site from north to south.

Table 36. Scientific and common names of faunal taxa identified at 41VT8.

Scientific Name	Common Name
Alligator mississippiensis	alligator
Anas sp.	ducks
Antilocapra americana	antelope
Antilocapra or *Ovis/Capra*	antelope or sheep/goat
Atractosteus sp.	broadhead gars
Atractosteus spatula	alligator gar
Bison sp.	bison
Blarina carolinensis	southern short-tailed shrew
Bos or *Bison*	cow/bison
Bos taurus	cow
Bufo sp.	toads
Callipepla squamata	scaled quail
Canis sp.	canid
Capra hircus	goat
Castor canadensis	beaver
Cathartes sp.	vultures
Chaetodipus hispidus	hispid pocket mouse
Chelydra sp.	snapping turtles
Chrysemys sp.	painted turtles
Crotalus atrox	western diamondback rattlesnake
Dasypus novemcinctus	nine-banded armadillo
Didelphis virginianus	opossum
Equus sp.	horse
Gallus gallus	chicken
Geomys attwateri	Attwater's pocket gopher
Ictaluras punctatus	channel catfish
Ictaluras sp.	catfish
Ictiobus bubalus	smallmouth buffalo fish
Ictiobus sp.	buffalo fishes
Ictiobus virginianus	buffalo fish
Kinosternon sp.	mud turtles
Lampropeltis sp.	kingsnake
Lepisosteus osseus	longnose gar
Lepisosteus sp.	slender gars
Lepomis sp.	sunfishes
Lepus californicus	blacktailed jackrabbit
Lepus sp.	jackrabbit
Lynx rufus	lynx
Meleagris gallopavo	turkey
Mephitis sp.	skunk
Micropterus salmonides	largemouth bass
Neotoma sp.	wood rats
Nerodia sp.	water snakes
Odocoileus virginianus	white-tailed deer
Ovis aries	sheep

Table 36. Scientific and common names of faunal taxa identified at 41VT8.

Scientific Name	Common Name
Ovis or *Capra*	sheep or goat
Ovis sp.	sheep
Procyon lotor	raccoon
Rana catesbeiana	American bullfrog
Scalopus sp.	eastern moles
Scaphiopus sp.	spadefoot toads
Sciurus carolinensis	Eastern gray squirrel
Seiurus motacilla	Louisiana waterthrush
Sigmodon hispidus	Hispid cotton rat
Sternotherus odoratus	common musk turtle
Sternotherus sp.	musk turtles
Sus scrofa	pig
Sylvilagus floridanus	cottontail rabbit
Sylvilagus sp.	rabbit
Terrapene sp.	box turtles
Trionyx sp.	soft-shell turtles
Urocyon cinereoargentus	gray fox
Viperidae	pit viper
genus unknown	crab

A total of 1,719 turtle remains was recovered from the site; they include box turtles (n=706), painted turtles (n=153), soft-shell turtles (n=88), mud turtles (n=72), musk turtles (n=9), snapping turtles (n=1), and unidentified turtle remains (n=609). Figure 46 shows the distribution of turtle remains across the site from north to south. Ninety-seven percent (n=1,672) of the turtle remains were recovered from the northern five units on the site. Fifty-three percent (n=867) of the turtle bone within the northern five units came from within the identified Austin phase component. Twenty-three percent (n=387) and 24% (n=398) came from above and below this component, respectively. Other reptile species recovered from the site (other than snakes) include alligator (n=15), recovered from Unit 32F11, Levels 7 and 8.

A relatively large number of fish bones were recovered (n=339). Most of the fish bones are unidentified, but various species of gar (n=51), catfishes (n=42), buffalo fishes (n=21), bass (n=2), and sunfishes (n=1) are present in the assemblage. The distribution of recovered fish remains is similar to that of turtle. Ninety-five percent (n=321) of the fish bones recovered came from the northern five units (Figure 47). Within those five units, 49% (n=156) were recovered from the levels of the Austin component. Twenty-four percent (n=78) and 27% (n=87) were recovered from above and below the Austin component, respectively.

A variety of small mammals, birds, and snakes were identified in the assemblage. Many of these were most likely not used as food sources (i.e., mice, moles, frogs, vultures) but were commensal or scavengers visiting the site during and after occupation. Numerous gophers and gopher burrows were noted on site during the excavations, and the gopher remains found in various levels within the excavations are likely the result of natural deaths. Armadillo remains (n=10) were recovered from Unit 24T8 from Levels 3 through 17. The remains consist of a single scapula and nine bone plates. Armadillos are originally native to South America and were uncommon or absent from southern and eastern Texas before the 19th century (Davis and Schmidly 1994). The armadillo remains represent a later disturbance to the prehistoric levels.

Table 37. Domesticated species recovered from 41VT8.

	Unit and Level																	
	32D7	34A3		34B2	34B3	34C2	34C3	42H6	43 Trenches	43Q14	43T13, 14		43T16, 17	NE and NW quads	SW quad	Trench 10	Trench 5	Trench 6	
Species	4	1	2	1	1	2	2	4		4	1	3	1	Surface	Surface				Total
Bos taurus (cow)										1					6		2	1	10
Capra hircus (goat)		1					1												2
Ovis aries (sheep)									1					2					3
Ovis sp.																1	1		2
cf *Ovis*																1			1
Ovis or *Capra*											1				1				2
Equus (horse)	1	1	1					1	1			1	4						10
Gallus gallus (chicken)			1																1
Sus scrofa (pig)				1	1	1	1												4
Total	1	2	2	1	1	1	2	1	2	1	1	1	4	2	7	2	3	1	35

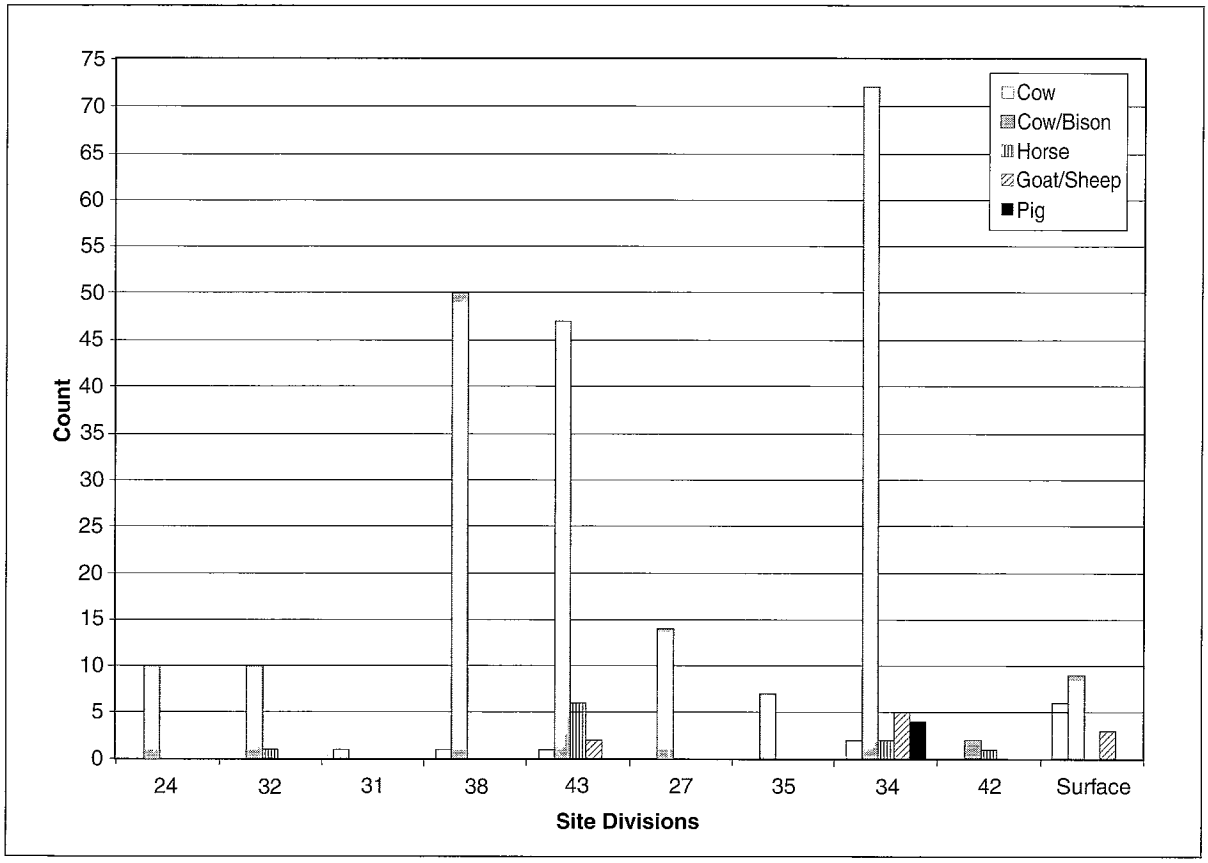

Figure 44. Distribution of domesticated ungulates north (left) to south (right) by division within the site.

The most common small mammals recovered from the site were cottontail rabbits (n=47) and jackrabbits (n=11). All of the jackrabbit remains were recovered from the northern five units, as were 37 (79%) of the cottontail bones. Of the jackrabbit remains, one specimen was recovered from a Austin phase component level and the rest from below it. Of the cottontail remains from the northern units, two were recovered from Austin phase levels and the rest were from deeper deposits.

Discussion of Results

The northern area of the site produced more than half of all the bone recovered (Table 38), although the majority of it is turtle and fish. Turtle carapaces and plastrons tend to naturally break into individual pieces, which lead to high individual bone counts. Fish bones tend to remain whole and allow for easy identification as fish. Of the total vertebrate bone count, 1,925 (18%) are classified as unidentifiable mammal. Butchering practices and processing of bones are likely to impact the preservation of larger mammal remains, making their identification more difficult. Although working only with bone counts can lead to misleading conclusions about abundance and diversity of species, the general trend in the assemblage is that the northern portion of the site produced most of the wild taxa—food and non-food species—and the southern part of the site produced nearly all of the domesticated species.

It is interesting to note the differences in species diversity between the southernmost two block excavations (Divisions 34 and 43). No fish remains and only two turtle bones were recovered from the units and trenches in Division 43. The majority of the bone from this division is unidentified mammal and vertebrate specimens, and the range of identified taxa is rather narrow. Remains of cow, cow/bison, horse, sheep/goat, pig, deer, raccoon, gopher, rabbit, and soft-shell turtle were recovered from Division 43 excavations. The range

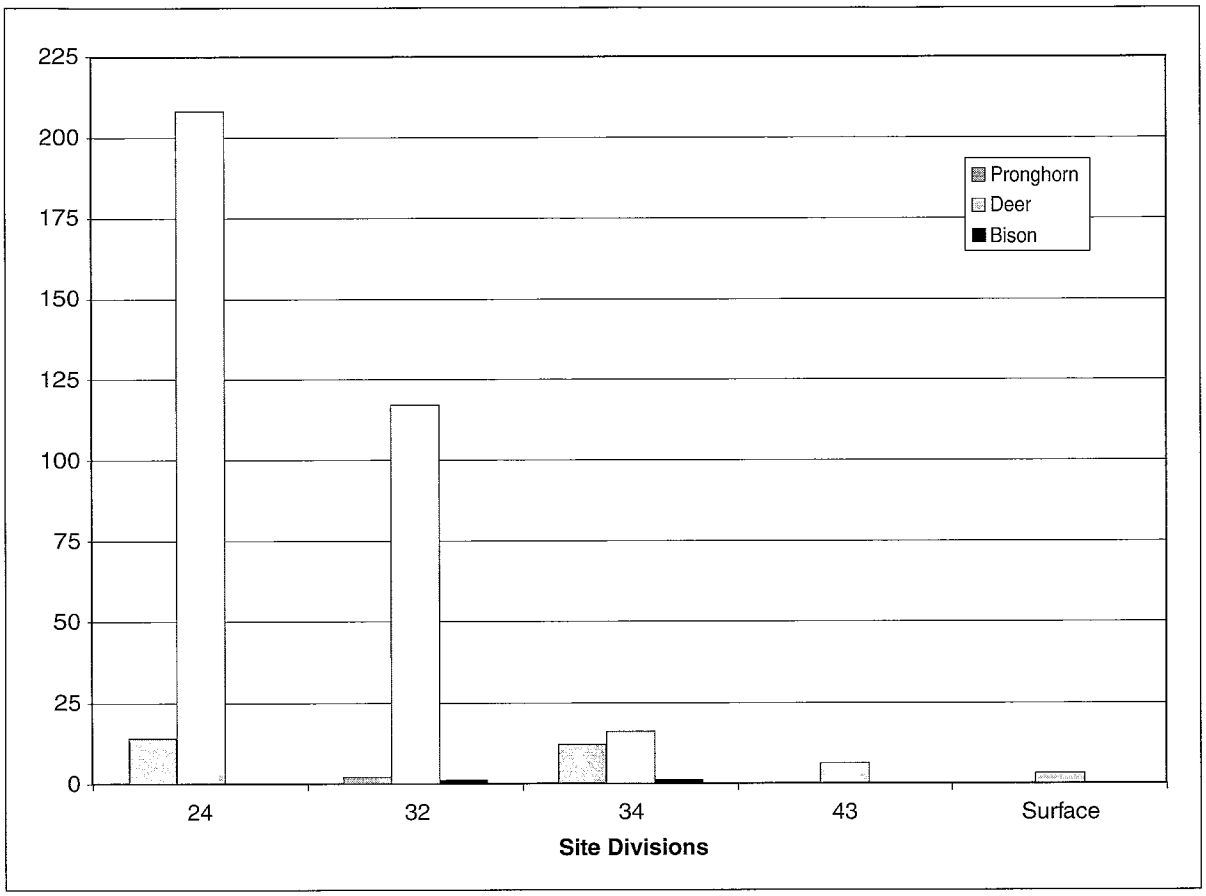

Figure 45. Distribution of wild ungulates north (left) to south (right) by division within the site.

of species identified in Division 34 units and trenches is considerably more diverse. The taxa identified from Division 34 include cow, bison, cow/bison, horse, sheep, goat, pig, deer, pronghorn, lynx, rabbit, gopher, three species of fish, three species of turtle, kingsnake, chicken, and waterthrush. Several of these taxa (i.e., lynx, gopher, snake, waterthrush) were probably not food items, but there is a larger variety of wild food species represented. This may be a result of the larger number of bones recovered from Division 34 (n=2,241) as opposed to Division 43 (n=1,679), but a larger area was excavated in Division 43, and the majority of the units went to 2 ft. bs as opposed to 1 ft. bs in the Division 34 units. The greater species diversity and number of bones in Division 34 supports the conclusion that this area was used for discard/dumping.

It is likely that the majority of the cow/bison and unidentified very large and large mammals from the southern excavation blocks are in fact cow. A brief scan of the larger pieces of bone in the collection indicated butchering marks on some of the specimens. It may be that cattle were being intensively processed, resulting in a highly fragmented collection making identification difficult.

The faunal assemblage from the prehistoric area includes both animals from the surrounding uplands and from the river valley. The people living there were hunting deer, pronghorn antelope, wild turkeys, and rabbits. There was a heavy reliance on riverine species such as turtles and fish, and even alligators. The bones of gophers and armadillos are probably the product of natural deaths in burrows, and may well have arrived later during the historic period.

Animals consumed by the occupation of the Spanish at the presidio also included deer, pronghorn, and rabbits. Cow and/or bison would have arrived at a later period and no doubt were the main source of meat for the families living there. In addition, domesticated sheep, goats and pigs came

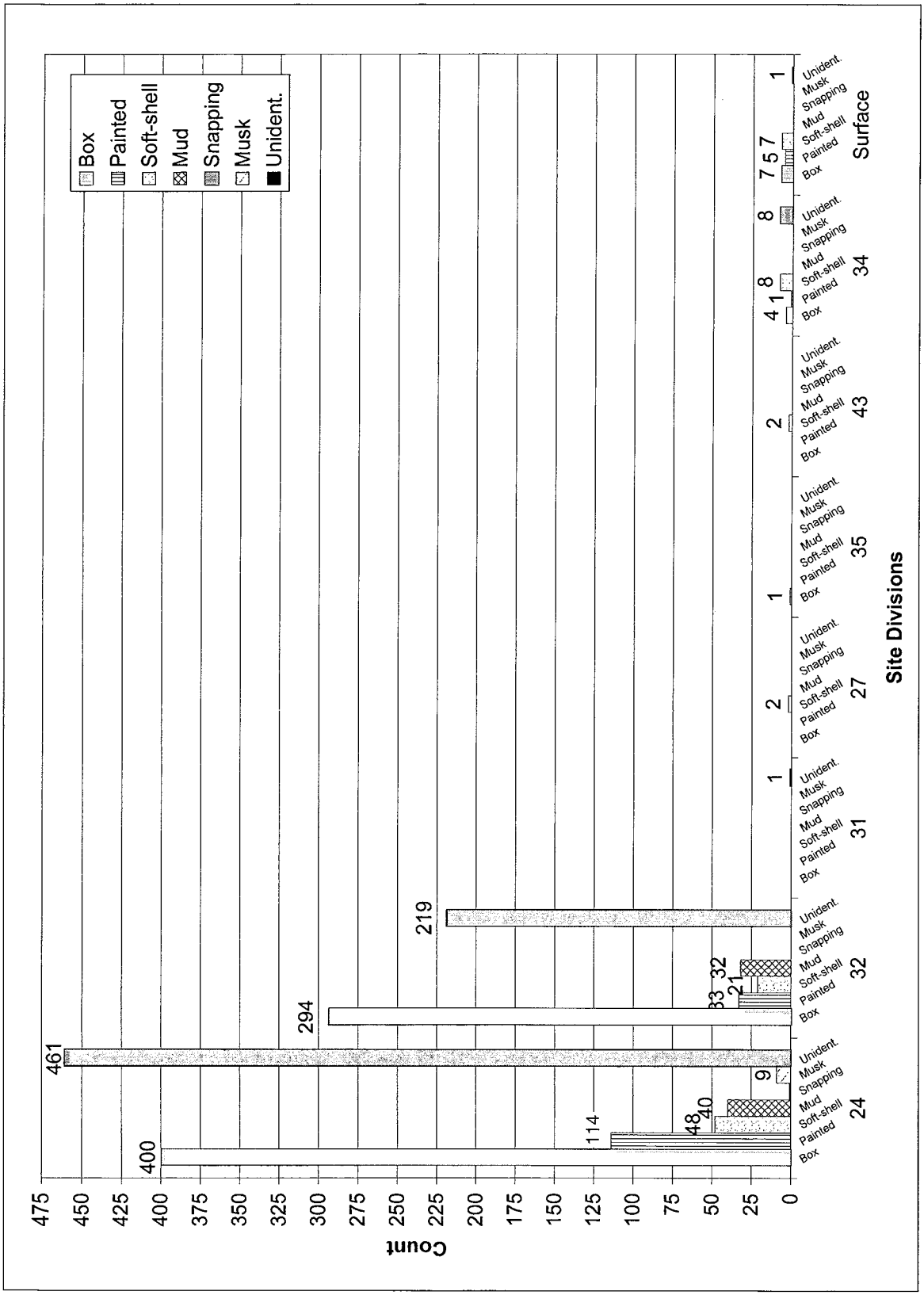

Figure 46. Distribution of turtle remains north (left) to south (right) by division within the site.

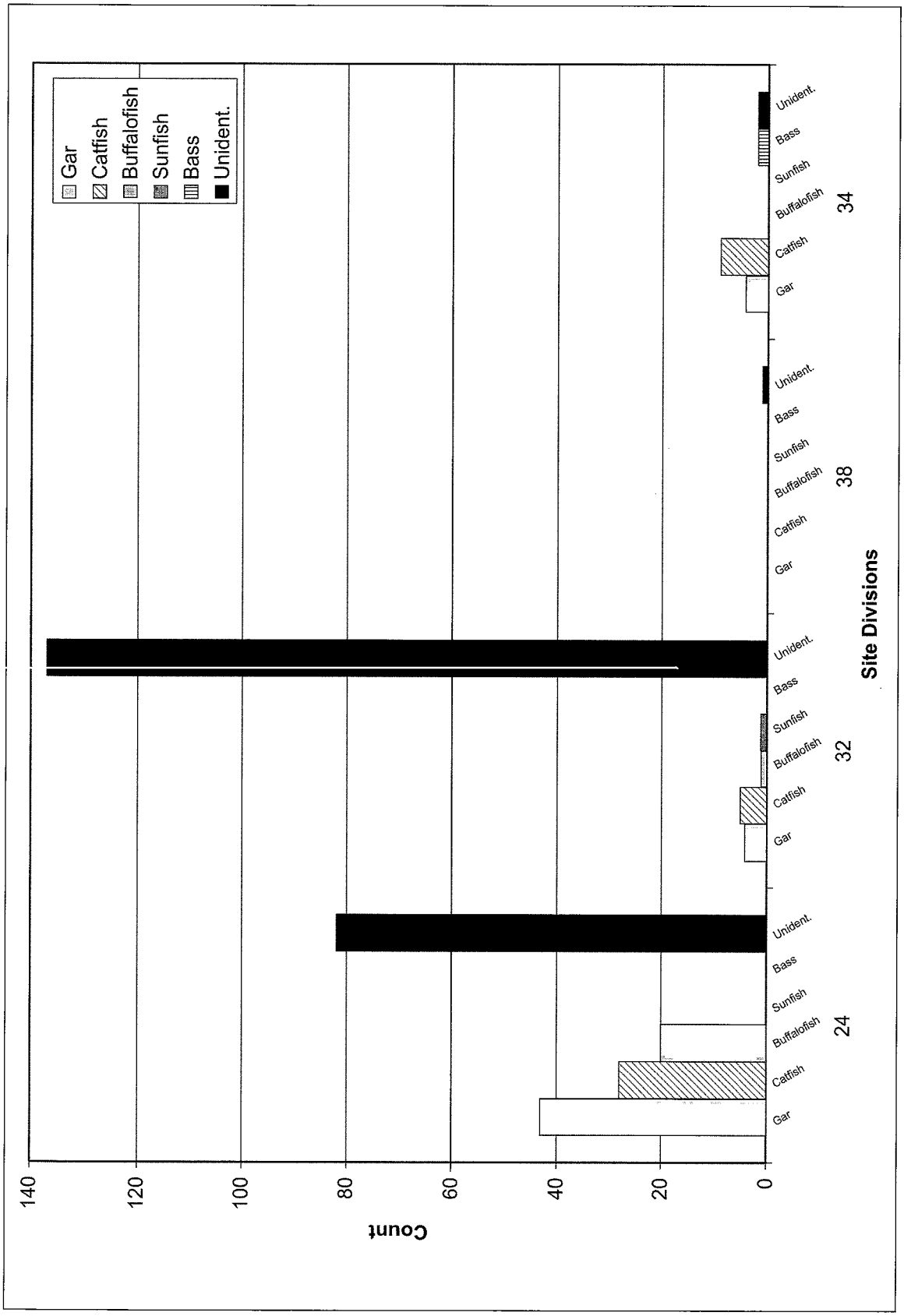

Figure 47. Distribution of fish remains north (left) to south (right) by division within the site.

Table 38. Locations of bone recovery.

Area of Site	Division	Count
Northern (Prehistoric)	24	3,739
	32	1,929
	Total	5,668
Central	31	83
	38 Trench 6	163
	Total	246
Southern (Colonial)	27 Trench 4	117
	35 Trench 3	90
	43	1,553
	43 Trenches	115
	43 Trench 9	11
	34	1,835
	34 Trench 5	146
	34 Trench 10	260
	42	124
	Total	4,251
Surface		358
Grand Total		10,523

with the settlers. The occupants of the presidio also acquired turtles and fish from the river.

Analysis of Historic Human Skeletal Remains

Helen Danzeiser Dockall

Introduction

Excavations at Presidio Loreto (41VT8) yielded the remains of three individuals. One of the individuals is represented by a flexed, prehistoric burial, while the other two represent historic interments. The prehistoric burial (Burial 1) is not analyzed in this report. The burial was so poorly preserved that in order to bring it in from the field it was necessary to surround it in a plaster jacket. When this jacket was later removed the remains disintegrated. Field notes indicate that the individual was interred on its right side in a north-south orientation with the skull to the south and facing east. Apparently spinal bones, hands, and feet had deteriorated prior to excavation.

This analysis focuses on the two historic burials recovered from the site. One of these burials (Burial 2) is represented by a male aged in his late teens or early twenties. The other individual (Burial 3) is a sub-adult approximately three years old. Both individuals are relatively well preserved, perhaps due to the added protection of being interred in coffins. This section will include an inventory of the skeletal remains associated with each burial, age and sex determinations, an examination of biological affinity of the sample, and a discussion of medical disorders associated with the individuals.

Burial Inventory

Burial 2

Curated Remains

Recovered remains include almost all bones present in a human skeleton. A complete cranium and a mandible were recovered, as well as all elements of the chest and shoulder girdle. All long bones were found, in addition to a complete pelvic girdle. Hands and feet were recovered as well. Cranial measurements (Table 39) dental measurements (Table 40), and postcranial measurements (Table 41) were taken on Burial 2 and are included for comparative data purposes.

Table 39. Cranial and mandibular measurements of Burial 2.

Cranial Measurements	mm
Maximum Length	173.0
Maximum Width	144.5
Minimum Frontal Width	96.5
Basion-Bregma Height	142.0
Basion-Nasion Height	101.0
Basion-Prosthion Length	99.5
Upper Facial Height	74.5
Orbital Height*	36.0
Orbital Width*	35.0
Nasal Height	61.0
Nasal Width	24.5
Palate Length	57.0
Palate Width	71.0
Mandibular Measurements	**mm**
Mandibular Length	81.5
Bicondylar Breadth	121.5
Ascending Ramus Height	61.0
H. Ramus Height (M1)*	30.5
H. Ramus Width (M1)*	17.0

*Measurements taken on left side

Sex

Burial 2 is identified as a male. The cranium, however, is very gracile. The forehead is straight and the browridge region is quite smooth and undeveloped. In addition, the occipital area is not as well developed as that of males in general. However, the mastoid process is large and the chin is very square in shape. Also, the gonial angle and the degree of gonial eversion tend toward masculine dimensions.

The pelvis of Burial 2 is masculine in morphology as indicated by the sciatic notch and pubic shape. There is a preauricular sulcus, but it appears to be a groove of ligament (GL) rather than a groove of pregnancy (GP). Houghton (1974) denoted these two different types of preauricular grooves. Males may exhibit only one type, while females may exhibit both varieties. The GL may be found in both sexes. It is distinguishable from the GP, seen only in females, because it is narrow, straight-edged, and shallow. The groove is formed at the attachment area of the inferior portion of the ventral sacro-iliac ligament. The GP, on the other hand, looks as if it has been formed by the grouping and combining of small pits in the bone and is the result of physiological processes that occur during labor. Post-cranial measurements also indicate that this burial is male. For instance, measurements taken on the left talus and calcaneus support with 89% accuracy (Steele and Bramblett 1988) that the individual is male. The diameter of the femoral head (45 mm) provides additional support.

Age

All age indicators show that Burial 2 was a young adult at the time of death. Teeth evidence little wear, especially the third molars. Canines and incisors exhibit some wear, exposing the dentin in small patches. An assessment of the pubic symphyseal face, using the Suchey-Brooks technique, indicates an age of 18.5 ± 2.1 years. Based on results gathered from the remaining skeletal material, there is more support for the upper end of that range. An analysis of the auricular surface (following Lovejoy et al. 1985) produces an 21-24 year age estimate based on the granularity and organization of the bone.

Many age changes are apparent postcranially. For instance, the first pair and one of the last pairs of ribs are beginning to fuse, while many other rib heads remain unfused. Rib head fusion usually occurs by 18-24 years of age (Steele and Bramblett 1988), with the fusion of the first and second and tenth through twelfth ribs fusing earlier. The epiphyseal ends of all long bones are fused to the diaphysis, but the line of fusion is still apparent. This supports an age between approximately 18-20 years. The sternal end of the clavicle is unfused, with no evidence of the epiphysis at all. The sternal morphology fits Szilvassy's (1979) description of Phase I, which also supports an age determination of 18-20 years old.

Table 40. Dental measurements of Mesio-Distal (M/D) and Bucco-Lingual (B/L) dimensions of Burial 2.

	Right		Left	
Tooth	M/D	B/L	M/D	B/L
I_1	5.2	6.4	5.1	6.3
I_2	6.7	6.7	6.3	6.8
C-	7.4	8.3	–	–
P_3	7.7	8.5	7.6	8.8
P_4	7.5	9.1	7.4	9.1
M_1	12.1	11.5	11.5	–
M_2	12.1	–	11.8	–
M_3	11.3	–	12.2	–
I^1	8.5	8.1	9.2	–
I^2	7.9	7.5	7.7	7.0
C^-	8.6	8.9	8.7	9.2
P^3	–	10.3	7.7	10.2
P^4	–	10.3	7.4	9.8
M^1	10.3	12.3	10.7	12.5
M^2	10.6	13.0	10.6	13.0
M^3	10.7	11.5	–	11.6

All teeth were present except the lower left canine. Other measurements that were not taken were affected by glue that had previously been applied to the teeth and could not be removed.

signs of calculus deposition, ranging in form from small discrete areas to moderate (coalesced) depositions. Resorption of the alveolus is minimal in most teeth and is not present at all in the area of the third upper and lower molars. The left maxillary third premolar has been crowded out of the dental row, and is located more bucally than expected.

Post-cranial disorders of Burial 2 include an injured left clavicle. An injury to the deltoid occurred that resulted in pits and a foramen in the acromial portion of the bone. In addition, two of the toe phalanges are fused together, probably as the result of a traumatic injury. The exact toe cannot be determined, except to note that it was not the first or fifth one. Enthesophytes on the humerus indicate that the pectoralis major muscles were used a great deal. Enthesophytes are enlargements of structures at areas of muscle attachment, and on Burial 2 the enthesophyte on the right humerus is larger than that on the left. One rib exhibits a small area of periosteal reaction.

Several of the vertebrae exhibit the effects of Schmorl's nodes, including four thoracic and two lumbar vertebrae. Schmorl's nodes are the result of a probable extrusion of the nucleus pulposus into adjacent vertebral bodies (Ortner and Putschar 1981), and are indicative of some sort of stress, possibly occupational in nature, to the back. Three thoracic vertebrae show the effects of a node on the inferior surface and one on the superior surface. Lumbar 1 has a Schmorl's node on the superior surface that covers a large portion of the vertebral body. The only other disorders in the vertebral column involve very slight arthritic lipping in the lumbar area.

Stature

When including all long bones in the formula, stature for Burial 2 is estimated at 163.74 cm (approximately 5 ft. 4 inches tall) using Genoves' formula (from Bass 1987). Based on individual long bones, estimates are quite consistent, ranging from 161.53 cm (5 ft. 3.5 inches tall) as determined by the right femur to 162.43 cm (5 ft. 9 inches) for the left femur (Table 42).

Medical Disorders

The mandibular second molars of Burial 2 have two small pit caries on each tooth. Left mandibular molar 1 also has a small pit cavity. Other than these small caries the teeth appear to be in relatively good condition with no abscesses and only small amounts of calculus built up on some teeth. Only the incisors, canines, and first premolars have any

Burial 3

Curated Remains

Recovered remains include a fragmentary cranium and mandible, portions of ribs and some

Table 41. Postcranial measurements of Burial 2.

Measurements	Left (mm)	Right (mm)
Humerus		
Maximum Length	292.5	296.5
Minimum Circumference	62.5	63.0
Minimum Diameter	19.0	19.5
Vertical Maximum Diameter	43.0	41.0
Transverse Diameter of Head	39.5	40.5
Biepicondylar Width	57.5	59.0
Radius		
Maximum Length	230.0	231.0
Minimum Circumference	40.5	42.0
Minimum Diameter	14.0	15.0
Ulna		
Maximum Length	248.0	253.0
Minimum Circumference	37.5	38.5
Minimum Diameter	11.5	11.0
Clavicle		
Maximum Length	153.0	151.0
Midshaft Circumference	37.5	37.0
Femur		
Maximum Length	425.0	420.0
Midshaft Circumference	84.5	86.5
Anterior-Posterior Diameter	27.5	27.0
Transverse Diameter	27.5	30.0
Anterior-Posterior Subtr. Diameter	24.5	24.0
Transverse Subtr. Diameter	32.0	31.0
Head Diameter	45.0	45.0
Biepicondylar Width	79.0	81.0
Tibia		
Maximum Length	350.0	348.0
Circumference at Nutrient Foramen	89.0	89.0
Anterior-Posterior Diameter at Nutrient Foramen	32.5	33.5
Transverse Diameter at Nutrient Foramen	24.0	24.5
Fibula		
Maximum Length		337.5
Sacrum		
Anterior-Posterior Diameter	28.0	
Transverse Diameter	54.0	
Maximum Anterior Height	110.0	
Maximum Anterior Breadth	118.0	
Talus		
Maximum Length	55.0	54.5
Maximum Width	42.0	42.5
Calcaneus		
Body Height	38.5	38.5

Table 42. Estimated stature of Burial 2 using Genoves' (1967) formula.*

Element	Side	Estimated Stature (cm)	Range (cm)
Femur	Right	161.5 ± 3.4	158.1-164.9
Femur	Left	162.4 ± 3.4	159.0-165.8
Tibia	Right	162.0 ± 2.8	159.2-164.8
Tibia	Left	162.4 ± 2.8	159.6-165.2
All Bones	Right	163.7 ± 2.6	161.1-166.3

* From Bass 1987

vertebrae, as well as a complete set of long bones. Most elements of the pelvic girdle were also present. Maximum length measurements of the long bones are provided in Table 43.

Sex

The sex of Burial 3 is indeterminate. Determining the sex of any subadult, even when represented by as much skeletal material as this burial, is difficult (Bass 1987; Hunt and Gleiser 1955). The majority of skeletal sexing techniques have been applied to adults rather than subadults and are based on the presence of secondary sex traits (Bass 1987), which makes them inappropriate for use with prepubescent skeletons. The few sexing techniques that have been applied to subadults are not appropriate for use with the remains of Burial 3. For instance, Reynolds'(1947) study demonstrated sex-specific differences in the pelvis, but the technique relies on the angle of the pelvis as it is held together by cartilage. Fazekas and Koȼsa (1978) have done extensive work on the sexing of subadult remains, but they have concentrated solely on fetal material. Their data cannot be used with Burial 3 because of its age.

Age

Age information from Burial 3 comes primarily from dentition. A portion of the right mandible contains erupted deciduous premolars 3 and 4. An open socket for the unerupted first molar is present, but the tooth is not near the surface. A portion of the left mandible contains erupted deciduous premolar 4. It also has an open socket for the unerupted first molar. The right maxilla contains erupted deciduous premolars 3 and 4. Like the mandible, the first molar is visible but not erupted. The left maxilla is fragmented and the teeth were lost postmortem. The deciduous teeth from this burial show no wear and all teeth except the incisors exhibit open roots. Based on the dental eruption and development, the child is aged in the range of two to four years old, but is most likely three years old.

Medical Disorders

This burial has no medical disorders recorded on the bone.

Table 43. Maximum length of long bones of Burial 3.

Bone	Right (mm)	Left (mm)
Humerus	NC	NC
Radius	99.5	NC
Ulna	NC	NP
Femur	180.0	180.0
Tibia	145.0	145.0

NC= not complete; NP=not present

Biological Affinity

Biological affinity, like sex, is very hard to determine in children. Therefore, this section will focus only on Burial 2. The biological affinity of this individual could provide valuable information pertaining to the site. For instance, it might be beneficial in understanding the history of 41VT8 to know whether the burial represents a young Native American, Hispanic, or even mestizo. Unfortunately, this data is impossible to determine from the remains. The burial exhibits quite pronounced shoveling on the central and lateral maxillary incisors, as well as incisal winging. Double shoveling is apparent on the central upper incisors. These traits occur in a much higher frequency in Mongoloids and Native Americans than in Caucasoids. However, it is not possible to determine whether admixture had occurred in this individual.

Burial Practices

No mention is made in the field notes of an associated coffin with Burial 2. However, the individual was buried in an extended position, arms crossed over the chest with the right hand below the left forearm. Head orientation was to the south with feet towards the north. Several buttons were found in association with this burial. These include six bone buttons and two brass buttons with gold plating. There was also mention of a metal button in the right pocket area. Several coins were also found in the region of the right pocket, including one dated to 1849 and one possibly dated to 1821.

Burial 3 was interred in a rectangular wood coffin in an extended position. Hands were folded over the lumbar region and the head pointed west with the face pointing to the right. Legs were slightly bent at the knees. No mention is made of associated grave goods with the exception of some coffin nails.

Taphonomy

Preservation of the historic material at 41VT8 is very good. Burial 2 is in an excellent state of preservation with even the most fragile facial bones being preserved. Burial 3 is not as well preserved as Burial 2 but the bones are relatively sturdy despite their fragmented nature. The skull of Burial 3 is in several pieces but is still in a relatively good state of preservation, especially considering the subadult status of the material. No rodent gnawing and little root damage were observed on either of the historic burials. Preservation of Burial 1, the prehistoric individual, was quite poor, however. This poor preservation eventually led to the destruction of the remains. The differential preservation of the material may be related to the temporal difference between the prehistoric burial and the two historic interments.

Age and Sex Distribution

Sex

Only two burials were examined in this report and of these only one (Burial 2) could be assigned to a specific sex (male). Since Burial 3 is a subadult, no sex determination could be made. Due to the small sample size, no evaluation of the sex distribution at 41VT8 is possible.

Age

The two historic individuals examined in this report represent a young adult aged in his early 20s and a sub-adult of approximately three years of age. Since the sample size from this site is quite small no pattern relating to mortality can be determined. The lack of older adult material at the site may be a function of sampling error or it may reflect actual burial practices at the site.

Medical Disorders

The material from 41VT8 has few medical disorders. Burial 2 has two fused toe phalanges and an isolated periosteal reaction on one rib. In addition, there does appear to be some stress in the lumbar region of the back as evidenced by depressions made by Schmorl's nodes and some slight arthritic lipping. Aside from that, however, other disorders relate to caries. The caries are quite small, which may be related to the young age of the individual. Dental attrition is relatively minor, especially on the molars. Using Smith's (1984) dental attrition scoring technique, the molars and premolars all exhibit Stage 1 dental wear, meaning that no dentine is exposed. The only exception to this is the right mandibular first molar which shows very moderate dentine exposure. The incisors and

canines have slightly more wear than most molars, as they have all been assigned to Stage 3 and show a line of dentine. Only the mandibular central incisor exhibits so much wear that it can no longer be called a discrete line. Burial 3 showed no signs of disorders on the recovered bone. The sample from the site is too small to draw any conclusions relating to health of the group.

Summary

The historic material from 41VT8 consists of two individuals in a good state of preservation. Burial 2 is a young adult male, while Burial 3 is a subadult ranging in age from two to four years of an indeterminate sex. Medical disorders are not common on the material. Because of the small sample size no conclusions could be made about the population in terms of age and sex distribution, biological affinity, or medical disorders.

Including the prehistoric burial and Feature 12 (Burial 4), the site has a minimum number of four individuals (MNI).

SUMMARY AND CONCLUSIONS

The seventh annual Texas Archeological Field School took place in June 1968 near Victoria. The site chosen for investigation was thought to be the location of the second site of Presidio Nuestra Señora de Loreto de la Bahía del Espíritu Santo. While many historians and archeologists had speculated about the location of the presidio before the field school, few individuals suspected that the ceramic sherds and historic artifacts found in the grassy field strewn with oak stands represented the lost site of the second presidio. Perhaps the principal contribution of the field school was that by the time of its completion, the site was confirmed as the location of the second site of Presidio La Bahía.

Confirmation came in the form of the large quantity of colonial period Euro-American artifacts that fit both the time period as well as the character of the presidio's occupation. The number of artifacts that are associated with arms and armaments attest to the military component of the site. The thousands of lead-glazed and majolica ceramic sherds reflect the domestic component of the occupation and are consistent with the accompaniment of many of the frontier soldiers by their families. The large number of Goliad wares and triangular arrow points, coupled with debitage and expedient lithic tools, found in the southern and central, colonial, portion of the site derive from the native population that also may have inhabited the presidio and were present in large numbers at the nearby mission.

Although no clear-cut architectural evidence of the presidio has been uncovered, the analysis of the artifacts and the daub recovered has resulted in a tentative conclusion about the approximate boundaries of the presidio. This is based on the density of colonial artifacts and daub in Divisions 30, 34, 38, and 43, compared to their rapid decline in excavations and trenches to the north, east, and south of these units. Based on these estimations, the presidio appears to have measured ca. 350 ft. north-south. Insufficient excavations along the western perimeter of the site make it impossible to estimate a western boundary. It does not appear to have been surrounded by a palisade, since no indications of wall trenches were found in any of the excavations. Insufficient excavations throughout the site make it impossible to identify specific buildings such as the commander's headquarters, but the concentration of so many colonial artifacts in the southeast corner of the site may correlate with where the quarters for the soldiers and their families were located.

Architecture at the site has been frustratingly difficult to reconstruct. There was not sufficient stone rubble present to indicate construction of a stone fort. Although Schuetz uncovered outlines of what appeared to be stone foundations in Division 43, no footings were found beneath them that would have been necessary to support them. This may reflect the temporary nature of the constructions on site, a trait that also characterizes the architecture of all missions during the early years of their establishment. However, the rubble area in Divisions 37, 38, and 46, plus the burials there, strongly suggest that a stone chapel once stood there.

The large deposits of burned daub in roughly the same units that contained colonial artifacts indicate that the structures demolished when the presidio was moved were *jacales*. The relatively large area of extensive burning in Division 30 may indicate where logs and timbers were piled and burned during the demolition. The presence of *jacales* is congruent with the relatively short occupation span of the second location of the presidio and may also suggest that there may have been some displeasure with the location during

much of its use since few more permanent structures appeared to have been built on site.

The large quantity of lead-glazed and tin-glazed ceramics recovered from the site bracket extremely well the documented occupation span of the presidio. The tin-glazed majolicas such as San Luis Polychrome, Abó Polychrome, Puebla Polychrome, and San Agustín Blue on White reflect wares that were manufactured during the late 17th and early 18th centuries (approximately 1650-1725) while the lead-glazed types such as Galera and Red Brown ware reflect wares that were manufactured after 1725. The presence of small numbers of Tonalá Sgraffitto and Brown on Yellow wares that were made after 1750 suggests a thin veneer of post-1750s occupation of the site. The recovery of the historic burials on site does corroborate this observation.

The Native American-made ceramic assemblage is also instructive. The catch-all Goliad wares dominate the collection but the detailed technological analysis of the rim sherds does indicate some variability within the large group. While the bulk of the specimens contain only bone tempering, the presence of moderate to abundant sandy inclusions in some of the specimens suggests the purposeful addition of sand as a tempering agent. This reflects a technological tradition that may be quite different than that which produced the bulk of the bone-tempered vessels. In addition, the presence of small amounts of sandy inclusions in some bone-tempered sherds, when the bulk of them have no sandy inclusions at all, does suggest that perhaps at least two clay procurement localities are represented, or two clay preparation techniques (i.e., one that removes all sand and one that retains small quantities of sand in the clay) are represented in the collection.

The small number of Rockport wares is intriguing in the collection and suggests that the Native American population that was brought together at the presidio did not contain a large coastal component, in contrast to Mission Espíritu Santo (Lakeman 2001). The presence of a few sherds of Patton Engraved and Poynor Engraved sherds in the assemblage attests to contact with protohistoric and historic Caddo groups.

The large number of lithic artifacts recovered from the site document a long sequence of prehistoric occupations, particularly concentrated in the northern half of the site overlooking the active channel of the Guadalupe River. Late Paleoindian/Early Archaic, Late Archaic, and Late Prehistoric projectile point forms are present in the collection. The presence of chipped stone celts, with affinities to East Texas Erath bifaces, from Archaic-aged deposits at the site is relatively uncommon. The most cohesive collection of lithic artifacts consists of a well represented Austin phase component that contains a large number of Gahagan bifaces (or Friday knives), Scallorn arrow points including variants with serrated blade edges, and a large frequency of blades and micro-blades.

Finally, the analysis of the large quantity of faunal remains recovered from all portions of the site also contributes to our understanding of prehistoric and colonial period subsistence patterns. A relatively broad range of species was procured and consumed by the prehistoric inhabitants of the site, including taxa that were obtained in the uplands and river valley. In addition, fish, turtles, and even potentially alligators were consumed from the nearby river. While the presidio inhabitants were to depend to a large extent on the domesticated animals furnished by the mission ranch, the faunal assemblage recovered from the colonial component suggests that supplies were not dependable and perhaps infrequent. In addition to deer, pronghorn, and rabbits, the presidio inhabitants also consumed cow or bison, sheep, goats, pigs, and even fish and turtles from the river. This broad range of taxa may have helped alleviate the intermittent dips in presidio-furnished subsistence resources and it attests to how unpredictable life must have been on the Spanish frontier.

Overall, while many years have passed since the seventh annual 1968 TAS Field School was held at Presidio Nuestra Señora de Loreto de la Bahía del Espíritu Santo, through the hard working efforts of the dozens of participants, and under the careful watch of the 10 crew chiefs, the skills of two lab directors, and under the direction of an enthusiastic field director, a very successful field school was had by all. It was successful not only because it began the process of teaching participants the importance of detailed record keeping but also because it is based on these original records that we are able some 38 years later to reconstruct the results of the investigations and make a useful contribution to colonial period archeology.

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Holocene Pollen Data for Sea Level and Climate Change at Swan Lake, Aransas County, Texas, and Implications for the Cultural Ecology of the Central Texas Coast

Bruce M. Albert

ABSTRACT

A vegetation history of the Central Texas Coast is reconstructed from pollen data from marsh sediments at Swan Lake on Copano Bay as well as supporting sequences from Nueces Bay and the Lower Guadalupe River valley (Core P1). These data are used to test an ecologic model which posits that fluctuations of sea level in the Holocene have impacted ecologic conditions for human occupation of the coast. Primary pollen analyses at Swan Lake identify major fluctuations in the abundance of salt marsh versus freshwater marsh plants in the region, as defined by high levels of salt-tolerant *Chenopodiaceae* (glasswort) in sediment cores. Analyzed spectra indicate that the Gulf Coast has been inundated by marine waters after 7100, 4900, and 3450 (cal.) B.P., while in contrast, periods of low marine influence are defined by high levels of freshwater grass, sedge, and cattail pollen. The latter phases are also associated with maxima of *Quercus* (live oak) pollen, which reflect the development of sandy mottes. Significantly, long-term still stand conditions are attained after 3050 B.P., which encourage barrier island formation, low bay salinities, and the establishment of biotically productive freshwater, estuarine marshlands. Regionally, the demographic effects of these ecologic conditions are reflected archeologically in the formation of massive shell middens in the Late Archaic and macro-settlements of the coastal Karankawa in the Late Prehistoric period.

INTRODUCTION AND METHODOLOGY

Subsistence economies of coastal zones in both Pleistocene and Holocene times have been substantially affected by sea level fluctuations (cf. Butzer 2004; Ricklis 1995a). Regarding the Holocene ecology of the Central Texas Coast in particular (Figure 1), a basic distinction can be made between marine-influenced biomes (such as the Baffin Bay area) and fresh-water-influenced estuarine marsh biomes (such as the San Antonio Bay area) protected by barrier islands. Differences in the biotic productivity of these biome types may be greater than an order of magnitude, and are consequent upon a high rate of photosynthetic activity in freshwater estuarine shallows which also support a variety of wildlife (Stickney 1984). Incidentally, barrier islands that harbor these conditions also supply sources of sediment for sandy mottes that support *Quercus* (live oak) communities.

In contrast, coasts lacking barrier island development or major (freshwater) inlet channels are vegetated by a narrow range of plants, particularly halophytes such as glasswort (cf. *Chenopodiaceae*), and support a low biomass of wildlife (Britton and Morton 1989). Because barrier island development and the formation of shallows in intercostal bays are realized only under stable or lowered sea levels, high levels of biotic productivity and a substantial human settlement of coasts will be associated with periods of marine still stand or regression. Conversely, marine transgressions will incur a reduced biotic productivity of coasts and a restricted subsistence base for aboriginal populations.

Respecting historical changes in biotic productivity levels of the Central Texas Coast, an ecologic model posits that a fluctuating intensity of occupation results from factors of sea level change (cf. Ricklis 1995a, 1995b; Ricklis and Blum 1997). Under this model, marine transgressions (rises of sea level) promote an emergence of low-productivity halophytic biomes, while still stand conditions lead to an emergence of high-productivity estuarine marshes. Empirically, this model is supported by cultural evidence, including radiocarbon and artifact chronologies of settlements on the Central

Texas Coast, as well as marine geological evidence, including the identification of depositional episodes associated with high stand conditions in the Gulf of Mexico (especially Frazier 1974; Anderson and Thomas 1991; Paine 1991). These data suggest that marine transgressions are generally coeval with phases of reduced coastal settlement during multiple periods in the Holocene. Thus, in calibrated terms, a low level of cultural occupation of the coast after marine transgressions is posited between 7000 and 6000 B.P., as well as around 4000 B.P. In contrast, intervals of increased settlement are aligned with sea level stillstand conditions, first in the Bell-Andice archeological period (ca. 6000-5100 B.P.), with an appearance of lenses or small shell middens of *Rangia flexosa*, and subsequently during a longer period of increasing settlement density beginning in the Late Archaic after 3000 B.P. (cf. Story 1968), with an emergence of substantial shell middens of *Rangia cuneata*. At greater time depth, further geoarcheological evidence from South Africa shows that sea levels also fluctuated during multiple periods in the Eemian Inter-Glacial (Butzer 2004). Multiple sea level fluctuations may thus be a consistent feature of both Inter- or Post-Glacial environments.

Independent of archeological evidence, primary data for Holocene sea level fluctuations may also be derived from bio-stratigraphic studies. Bio-stratigraphic data from pollen, foram, and diatom

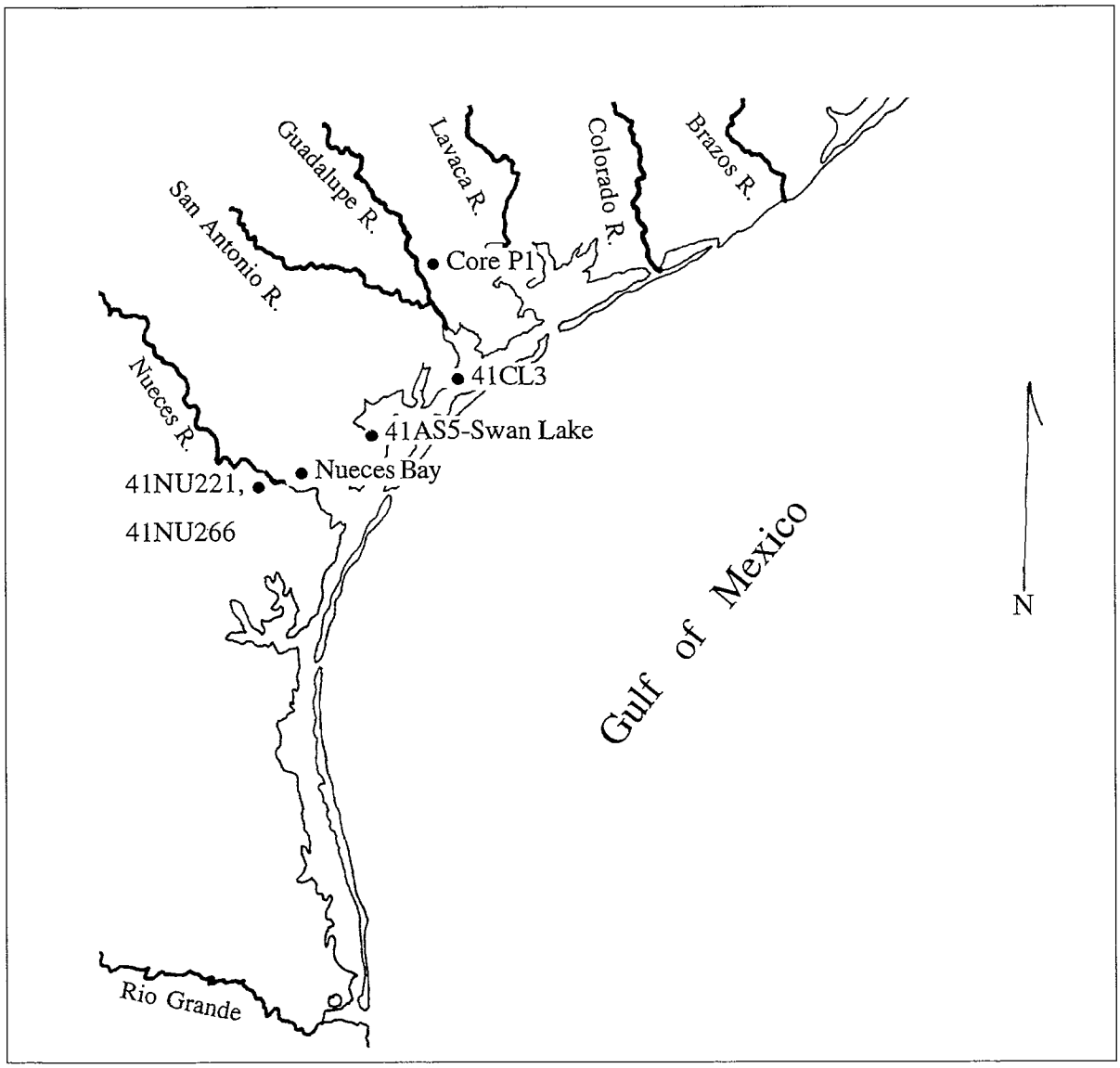

Figure 1. Select pollen and archeological sites in the Central Texas Gulf Coast region.

analyses have been employed towards the high resolution reconstruction of sea level fluctuations in maritime Europe (Horton et al. 2000, Shennan et al. 2000). In this respect, forams and diatoms reconstruct variations of tidal ranges and salinity levels locally, while pollen analyses record floral change in the regional environment. As a test of the ecologic model, the present study, done in tandem with Coastal Environments Inc.'s testing at 41AS5 by Swan Lake in Aransas County, Texas, provides such pollen evidence for Holocene sea level change as well as changing levels of biotic productivity in this coastal region (cf. Ricklis and Albert 2005).

Table 1. Swan Lake general stratigraphy.

Depth range (cm bs)	Characterization of sediments
0-11.5	Black fines with humus (developing soil)
11.5-53	Light gray sand (IV)
53-80.5	Black paleosol
80.5-285	Gray fines
285-305	Light gray sand (III)
305-459.5	Gray fines
459.5-480	Light gray sand (II)
480-525	Gray fines
525-548	Light gray sand (I)

FIELD AND LABORATORY WORK

Two sediment cores for pollen analysis were obtained in the field by means of a tractor-mounted Geo-probe device from cord-grass and cat-tail marshlands at Swan Lake adjacent to the West End of 41AS5. "Core Site 1," retrieved from the edge of the marsh, recovered 355 cm of unconsolidated sediments (mostly of fine clay) upon reaching an unconformable contact of the Beaumont formation, while the primary pollen core or "Core Site 2," only 5 m south, towards the marsh interior from the first core, retrieved 548 cm of unconsolidated sediment without reaching the Beaumont contact (Figure 2). This declining Beaumont contact indicates that the drainage local to the coring site has been deeply incised prior to an Early Holocene sea level rise.

A stratigraphic description of the sequence, recognizing a distinction between fine sediments of silt and clay on the one hand, and coarser, sandy accumulations on the other, is presented in Table 1. One radiocarbon and three AMS dates have been assayed through the depth of the main 548 cm pollen core (Site 2), whereby an average rate of sedimentation of ca 7.8 cm per century is calculated. Depths and 2-sigma ranges of these assays are detailed in Table 2. Sampling has focused upon the reduced fine sediments, as these are more likely to contain concentrated and well-preserved pollen in estuarine settings. Factors favoring pollen deposition in such sediments include indicated water flow-rates suitable for the fallout of such grains from suspension (Allen 1965). Pollen samples of 10 cubic cm volume from Core Site 2 were first filtrated and then reduced by a standard HF treatment (cf. Faegri et al. 1989). Counts of ca. 200-250 grains

Table 2. Swan Lake AMS and radiocarbon dates.

Lab number	Sample depth (cm bs)	2-sigma date range (BP)	Material assayed
Beta 194902 (AMS)	490-510	7170-6890	bulk sediment
Beta 194901 (AMS)	425-450	5960-5760	bulk sediment
Beta 194899 (AMS)	250-280	4440-4240	bulk sediment
Beta 194900	80-102	290-0	bulk sediment

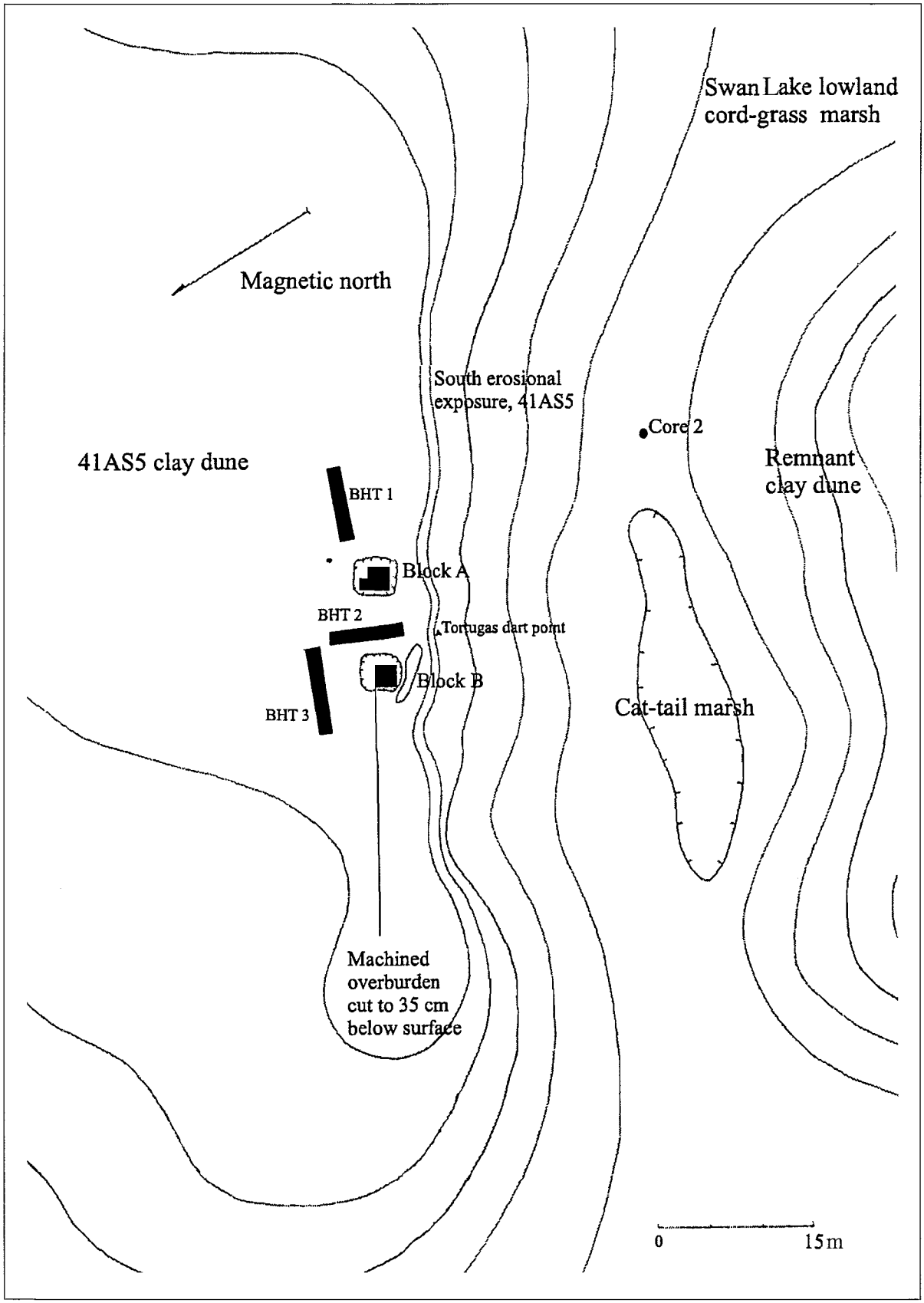

Figure 2. Topographic situation of Pollen Core 2 in relation to West End excavations at 41AS5. Contour interval is 33.3 cm.

were achieved by means of light microscopic work at x400 magnification, although some pollen identifications were also made at x1000 magnification with an addition of low viscosity immersion oil. Notably, the concentration of pollen in the core is variable with respect to defined pollen zones or relative levels of degradation-resistant pine (Table 3), although analyzed exines (the hard-shell of the pollen wall, which is usually the part used for identification purposes) exhibit a uniformly pristine condition of preservation.

Laboratory Results—Pollen Zonation

Pollen zones at Swan Lake are defined by fluctuations of (halophytic) *Chenopodiaceae* pollen and the responses of other taxa. These floral variations make ecologic sense in that halophytes rise and fall together (co-vary) in anti-correlation with taxa of freshwater biomes. It thus appears that marshland vegetation has evolved in relation to changing degrees of saltwater vs. freshwater influx in the Swan Lake region. Taken together, principal covariations of pollen taxa may be defined in terms of saltwater marine (M), and freshwater riverine (R) components. Firstly, the M-component (zones with *Chenopodiaceae* pollen greater than a site average of 45% TLP; TLP is total land pollen, used to calculate all pollen percentages) is allied with a positive response of the following taxa: 1. *Avicennia* (black mangrove), tropical exotic, presently restricted to the Rio Grande delta; and 2. *Bataceae* (saltwort), a brackish-water indicator, and a herbaceous aspect of mangal.

In ecologic terms, the M-component equates with pollen flora of the modern salt marsh environment, although mangrove pollen in particular is also indicative of a climate more tropical than that of today. In geologic terms, a high M-component pollen response equates with a sea level rise or high stand period lacking insignificant barrier island development. Conversely, a second R-component (zones with *Chenopodiaceae* pollen less than a site average of 45% TLP) is allied with a positive response of the following taxa: 1. *Gramineae* (grasses), including freshwater grasses and *Spartina* (cord-grass) of near-brackish environments; 2. *Cyperaceae* (sedges); 3. *Typha*

Table 3. Swan Lake, Pollen Core 2, pollen concentrations.

Sample depth	pollen grains per cubic cm	Pine pollen percentage	Cheno. pollen percentage	Pollen zone
10 cm	3,189	16.4	27.0	PAZ 6
56 cm	330	4.3	22.7	PAZ 6
114 cm	1,284	41.9	27.5	PAZ 6
213 cm	146	13.8	24.7	PAZ 6
230 cm	3,583	5.7	65.1	PAZ 5
247 cm	142	9.1	19.2	PAZ 4
284 cm	3,600	11.8	58.8	PAZ 3
369 cm	1,310	4.9	81.3	PAZ 3
381 cm	750	5.4	42.4	PAZ 3
402 cm	3,792	6.3	50.6	PAZ 3
408 cm	3,269	7.9	63.6	PAZ 3
415 cm	7,050	5.5	59.6	PAZ 3
425 cm	384	2.8	38.4	PAZ 2
452 cm	236	17.6	3.5	PAZ 2
481 cm	11,677	8.7	48.2	PAZ 1
501 cm	1,119	2.9	58.9	PAZ 1
514 cm	2,342	3.0	68.9	PAZ 1
525 cm	783	3.9	68.5	PAZ 1

(cat-tails); 4. *Quercus* (live oak mottes); 5. *Betula* (birch), boreal and presently exotic to South Texas; and 6. *Alnus* (alder), boreal and presently exotic to South Texas.

The R-component is comprised of plant species of freshwater aquatic and forested environments that are dominated by cord-grasses, sedges, and cat-tails in low-lying areas, and by live oak communities on sandy mottes. Environmentally, a positive response of the R-component is reflective of barrier island formation, progressive bay sedimentation, lower saltwater influx into coastal marshes, and higher rates of effective precipitation. In geologic terms, high R-component pollen levels generally equate with a sea level still stand or regressionary periods. After the defined M- and R-components, six pollen assemblage zones (PAZ) defined at Swan Lake span a period from 7100 B.P. until present and are summarized in Table 4 and below (Figure 3). Finally, primary pollen counts by depth are also enumerated in Table 5.

PAZ 1 (M-component dominant, 7100-6650 B.P., 525-481 cm) *Chenopodiaceae-Bataceae-Avicennia*: this zone is dominated by the *Chenopodiaceae* (48.2-68.9%), with a continuous presence of *Avicennia* (0.4-1.0%) and *Bataceae* (0.4-5.3%) pollen. Arboreal pollen levels are relatively low (5.5 to 17.9%), and are comprised of *Quercus* with isolated grains of *Salix* (525-514 cm) and *Betula* (501 cm). Freshwater pollen levels, consisting of *Gramineae*, as well as isolates of *Cyperaceae* and *Typha*, are initially low (3.9%), rising to moderate values (24.9%) towards the terminus of this zone.

PAZ 2 (R-component dominant, 5800-5400 B.P., 452-425 cm) *Quercus-Chenopodiaceae*: this zone witnesses a dramatic decline of *Chenopodiaceae* pollen to an absolute minimum of 3.5%, in tandem with an increase in tree and shrub pollen to between 33.7% and 62.1% of TLP. Importantly, a *Quercus* maximum in this zone is accompanied by a significant response of *Betula* pollen (3.1%) as well as trace values of *Alnus* (0.9%). Other isolated arboreal elements represented include *Celtis* (hackberry) and *Myrica* (Myrtle). Finally, moderately high levels of freshwater pollen, consisting of *Typha (*Cat-tail*)*, *Cyperaceae*, and *Gramineae* are expressed in this zone.

PAZ 3 (M-component dominant, 4900-4250 B.P., 415-284 cm) *Chenopodiaceae*: this zone witnesses a major rise of *Chenopodiaceae* to its absolute maximum of 81.3% of TLP, while concurrently, freshwater marsh pollen flora declines to an absolute minimum of 1.5% (at 369 cm). Similarly, *Quercus* declines to a secondary minimum of 3.9% at the same depth, while a paucity of other arboreal elements is significant. The lower limit of this zone (415 cm) contains an isolated grain of *Avicennia*, while finally, an isolated *Prosopis* grain is also notable at 369 cm, coeval with the above maximum of *Chenopodiaceae*.

PAZ 4 (R-component dominant, ca. 3650 B.P., 247 cm) *Quercus-Chenopodiaceae-Asteraceae*: this (sub-) zone reverses prior floral trends with a rise in *Quercus* pollen to 26.0% of TLP, a major fall in *Chenopodiaceae* pollen to 19.2%, and a rise in freshwater aquatic pollen (especially *Gramineae* and

Table 4. Swan Lake, Pollen Core 2, pollen zone depth, age, and taxonomy.

Zone	Zonal depth range (cm bs)	Estimated chronological span of pollen zone	Primary and definitive constituents (in order of % value)
1	481-525	7100-6650 BP	*Chenopodiaceae-Bataceae-Avicennia*
2	381-452	5800-5400 BP	*Quercus-Chenopodiaceae*
3	284-369	4900-4250 BP	*Chenopodiaceae*
4	247	ca. 3650 BP	*Quercus-Chenopodiaceae-Gramineae*
5	230	ca. 3450 BP	*Chenopodiaceae*
6	213-10	3050 BP to recent	*Quercus-Chenopodiaceae-Asteraceae*

Table 5. Swan Lake absolute pollen counts.

Depth (cm)	10	56	114	213	230	247	284
Zone	6	6	6	6	5	4	3
Long-distance transport							
Pinus	26	6	96	24	12	20	24
Ephedra	1	–	–	–	–	–	–
Mangroves							
Avicennia	–	–	–	–	1	–	–
Salt marsh							
Bataceae	–	–	–	–	1	–	–
Chenopodiaceae	43	32	63	43	136	42	120
Freshwater marsh							
Nymphaea	–	1	–	–	–	–	–
Typha	9	4	–	–	–	6	–
Cyperaceae	5	15	–	3	1	–	2
Gramineae	29	32	10	23	41	38	14
Potamogeton	–	–	–	1	–	–	–
Polygonum hydropiper	–	–	–	–	–	–	–
Trees							
Quercus	27	27	44	67	5	57	18
Ulmus	–	–	–	–	–	–	–
Celtis	–	1	–	–	–	13	–
Myrica	–	–	1	–	–	–	1
Carya	2	1	–	2	–	2	1
Prospois	–	–	–	–	–	–	–
Fraxinus	–	–	–	–	–	3	–
Salix	–	–	–	–	–	–	2
Alnus	1	–	–	1	–	–	–
Betula	–	–	–	1	–	–	–
Prairie forbs							
Asteraceae	34	17	11	2	10	30	11
Senecio-Arctium	8	–	2	7	–	5	5
Ambrosia	–	–	–	–	1	3	3
Taraxicum	–	2	–	–	1	–	1
Umbelliferae	–	2	–	–	–	–	–
Artemisia	–	–	2	–	–	–	–
Opuntia	–	1	–	–	–	–	–

Depth (cm)	369	381	402	408	415	425	452
Zone	3	3	3	3	3	2	2
Long-distance transport							
Pinus	10	11	20	25	13	6	40
Ephedra	–	–	1	–	–	–	–

Table 5. *(Continued)*

Depth (cm)	369	381	402	408	415	425	452
Zone	3	3	3	3	3	2	2
Mangroves							
Avicennia	–	–	–	–	1	–	–
Salt marsh							
Bataceae	–	–	–	–	–	–	–
Chenopodiaceae	165	87	160	201	140	81	8
Freshwater marsh							
Nymphaea	–	–	–	–	–	–	–
Typha	–	–	–	–	–	–	5
Cyperaceae	–	2	1	1	2	4	4
Gramineae	3	29	86	57	45	73	10
Potamogeton	–	–	–	–	–	1	–
Polygonum hydropiper	–	–	2	–	–	–	–
Trees							
Quercus	6	62	23	10	22	27	121
Ulmus	–	1	–	–	–	–	–
Celtis	–	3	2	1	–	1	2
Myrica	–	–	–	–	–	1	1
Carya	1	–	–	–	–	–	8
Prosopis	1	–	–	–	–	–	–
Fraxinus	–	–	–	–	–	–	–
Salix	–	1	–	3	–	–	–
Alnus	–	2	2	2	–	–	–
Betula	–	–	–	–	–	–	7
Prairie forbs							
Asteraceae	8	–	10	14	11	17	7
Senecio-Arctium	4	–	5	–	–	–	–
Ambrosia	5	–	2	1	1	–	–
Taraxicum	–	–	–	–	–	–	1
Rumex	–	–	–	–	–	–	–
Umbelliferae	–	–	–	–	–	–	–
Artemisia	–	–	–	–	–	–	4
Opuntia	–	–	2	1	–	–	6

Depth (cm)	481	501	514	525
Zone	1	1	1	1
Long-distance transport				
Pinus	22	6	12	8
Ephedra	–	–	–	–
Mangroves				
Avicennia	1	2	4	1

Table 5. *(Continued)*

Depth (cm)	481	501	514	525
Zone	1	1	1	1
Salt marsh				
Bataceae	1	11	20	4
Chenopodiaceae	122	122	277	139
Freshwater marsh				
Nymphaea	–	–	–	–
Typha	–	–	1	–
Cyperaceae	4	–	–	–
Gramineae	59	21	48	8
Potamogeton	–	–	–	–
Polygonum hydropiper	–	–	–	–
Trees				
Quercus	24	36	20	29
Ulmus	–	–	1	–
Celtis	–	–	–	–
Myrica	–	–	–	–
Carya	–	–	–	–
Prosopis	–	–	–	–
Fraxinus	–	–	–	–
Salix	–	–	1	2
Alnus	–	–	–	–
Betula	–	1	–	–
Prairie forbs				
Asteraceae	17	4	15	8
Senecio-Arctium	–	3	1	3
Ambrosia	–	1	2	1
Taraxicum	–	–	–	–
Rumex	1	–	–	–
Umbelliferae	–	1	–	–
Artemisia	1	–	–	–
Opuntia	1	–	–	–

Typha). In addition to *Quercus*, arboreal pollen elements represented include *Carya* (0.9%), *Fraxinus* (1.4%), and significant quantities of *Celtis* (5.9%).

PAZ 5 (M-component dominant, ca. 3450 B.P., 230 cm) *Chenopodiaceae*: this (sub-) zone exhibits a major recovery of *Chenopodiaceae* to 65.1%, while *Quercus* declines to 2.4% of TLP. Occurrences of isolated *Avicennia* (0.5%) and *Bataceae* (0.5%) pollen grains are also notable at 230 cm.

PAZ 6 (R-component dominant, 3050 B.P. to recent, 213-10 cm) *Quercus-Chenopodiaceae-Asteraceae*: this zone exhibits continuously low *Chenopodiaceae* values between 23.1 and 27.5% of TLP, and moderate-to-high *Quercus* values between 14.5 and 38.5%. Only trace values of other arboreal pollen taxa, including *Celtis*, *Carya*, *Myrica*, *Alnus*, and *Betula* occur in this zone. Freshwater vegetation is well represented by *Typha* (rising to 4.8%) and *Cyperaceae* (rising to 10.6%), as expressed in the upper two spectra. Finally, a rise in *Asteraceae* pollen to 18.3% of TLP is also notable.

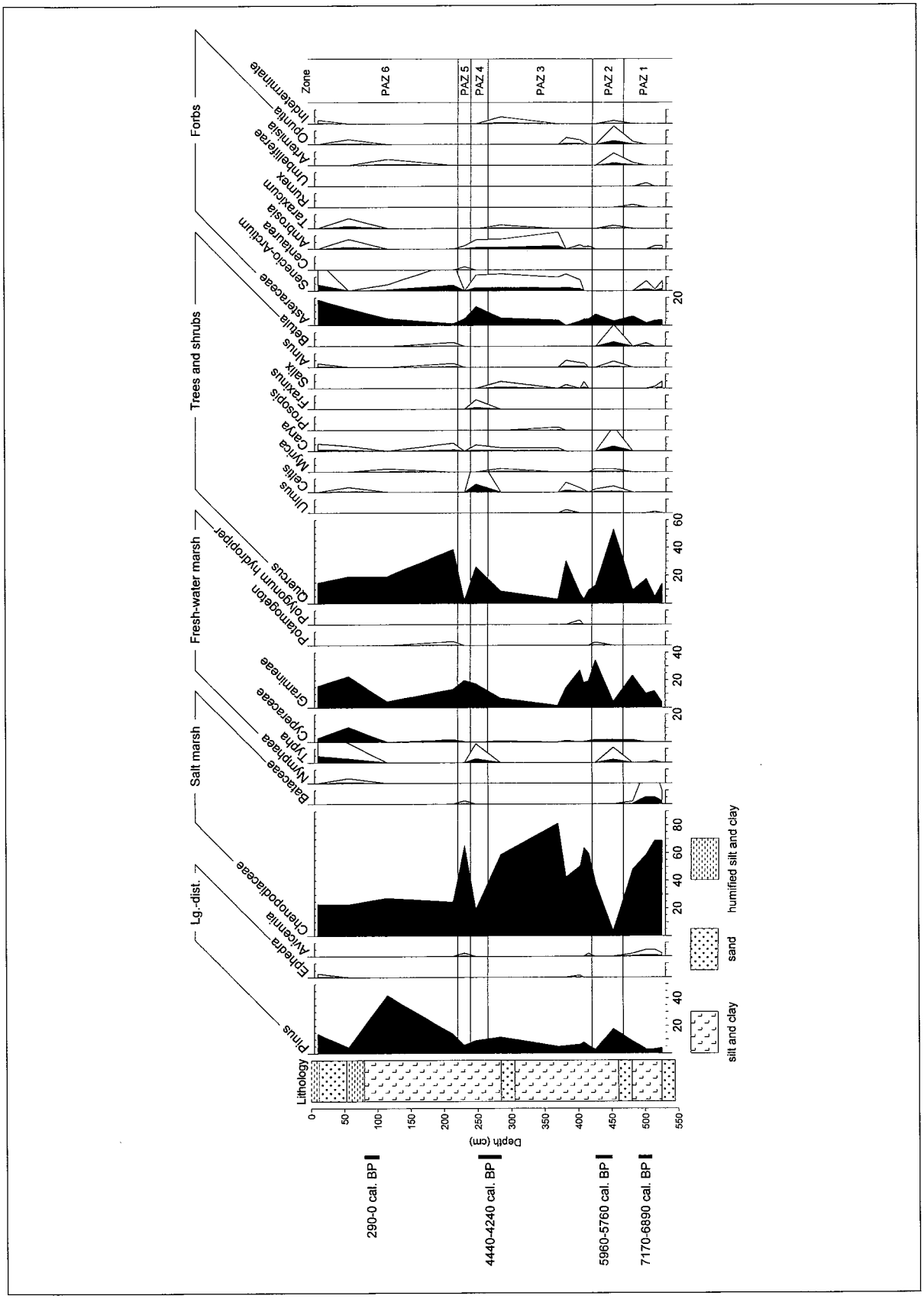

Figure 3. Swan Lake, Pollen Core 2 diagram.

SAMPLING AND ANALYTICAL RESULTS: MANGROVE ANALOGS

In order to assess the indicative value of *Avicennia* pollen response levels in the Swan Lake core samples, modern analog samples from a black mangrove swamp near Bahia Grande in the Rio Grande delta have been analyzed after laboratory reduction. This mangal represents the largest expanse of *Avicennia germanians* on the South Texas coast, extending about 10 hectares in a depression containing brackish waters with a herbaceous component comprised of saltwort (*Batis maritima*). Pollen samples were taken from a central mangal context and from the edge of the mangal (Table 6). The pollen response of *Avicennia* in both contexts is low (ca. 1-2%). With a view to the Swan Lake data, the Bahia Grande analogs indicate that insect-pollinated *Avicennia* is a poor pollen producer, and moreover, that earlier Holocene black

Table 6. Black mangrove swamp analog samples, Bahia Grande, absolute pollen counts.

Context	Swamp center	Swamp margin
Long-distance transport		
Pinus	3	12
Mangroves		
Avicennia	4 (1.7%)	3 (1.5%)
Salt marsh		
Bataceae	210	6
Chenopodiaceae	15	33
Freshwater marsh		
Typha	–	4
Cyperaceae	–	5
Trees		
Quercus	1	9
Ulmus	–	4
Celtis	–	10
Prosopis	–	1
Prairie forbs		
Gramineae	2	50
Asteraceae	2	40
Senecio-Arctium	–	2
Leguminosae	–	1
Plantago	–	1
Opuntia	2	16
Varia		
Indeterminate	–	5
Total land pollen	239	202

mangrove pollen levels in Zone 1 at Swan Lake signify a substantial mangal, and not mere isolated trees, with *Bataceae* pollen deriving from the understory of the mangal. Later isolates of *Avicennia* pollen from Zones 3 and 5 also probably represent more than isolated trees, although these may be less-substantial and shorter-lived.

DISCUSSION: INFERRING SEA LEVEL AND CLIMATE CHANGE

Three periods of marine influence at Swan Lake, first at 7100 B.P. (PAZ 1), then at 4900 B.P. (PAZ 3), and finally at 3450 B.P., are defined by high values (to 80%) of *Chenopodiaceae*, reflecting the effects on flora of marine transgressions. During these high salinity periods, marshlands around Copano Bay are vegetated almost entirely by glassworts to the exclusion of cat-tails and sedges, while levels of *Quercus* pollen (from live oak, thriving mostly on sandy mottes) are also low, reflective of only isolated stands after a reduced sand deposition, in the absence of barrier islands. Grasses and forbs thus prevail inland.

In climatic terms, low arboreal and freshwater pollen levels in Zones 1 also reflect low effective precipitation, while black mangrove pollen in Zone 1 further attests to warmer conditions. Only with a mostly tropical climate will more than short-lived, isolated stands of black mangroves occur, and given the low pollen productivity level of *Avicennia* generally, it is highly unlikely that isolated trees surviving under present conditions would express even trace pollen values (cf. Richardson 1990; Tomlinson 1986). In other words, a warmer climate approximating that of the Rio Grande region today was extant as far north as Copano Bay between 7100 and 6650 years ago (Table 7). Significantly, *Avicennia* isolates also occur in later saline zones (3 and 5), which is suggestive of a necessary connection between higher sea levels and warmer climates in the Gulf region.

In contrast, marine still stands are defined in three zones, characterized by low *Chenopodiaceae* values, high freshwater aquatic pollen levels, and high levels of *Quercus* pollen: first from 5800 to 5400 B.P., then ca. 3650 B.P., and finally from 3050 B.P. until present. Marshland expanses of cat-tail and sedges are reconstructed, while expanses of live oak exceeding modern distributions are inferred in Zone 2 (5800-5400 B.P.). In climatic terms, the latter zone also contains a maximum (3.1%) of exotic *Betula*, which thrives today only in upper coastal regions under a higher annual rainfall. Thus the Swan Lake pollen data indicate that high rates of effective precipitation were enjoyed on the Central Texas Coast from ca. 5800 to 5400 B.P. (cf. Bartlein et al. 1986; Toomey et al. 1993). It may thus be of further interest to compare these reconstructions of changes in coastal environments to inland pollen records from a paleo-channel deposit (Core P1) in the lower Guadalupe River valley (Albert 2002).

Respecting the latter record, a decidedly xeric climatic period with high salt-bush pollen levels is defined ca. 6900 B.P. at Core P1. This dry land pollen flora is reflective of warm or dry climates with high rates of evaporation, and thus supports reconstructions of a warmer (Zone 1) climate at Swan Lake. Similarly, the subsequent Zone 2 mesic flora is also coeval with bison exploitation at 41NU221, the latter faunal evidence reflecting a mesic condition of inland grasslands (Ricklis 1988). Pertinent here are further inland pollen data from Core P1, which indicate a mesic climate after low

Table 7. Swan Lake sea level and climatic historical phases after pollen data.

Marine phase definition	Chronology	Climatic reconstruction
Earlier Holocene rise	7100–6650 B.P.	More tropical
Earlier Holocene still stand	5800–5400 B.P.	Mesic, high effective precipiatation
Middle Holocene high stand	4900–3850 B.P.	Sub-tropical to tropical
Mesic interval and regression	ca. 3650 B.P.	Mesic, high effective precipitation
Xeric interval and rise	ca. 3450 B.P.	More tropical
Modern still stand	3050–0 B.P.	Mesic to sub-tropical

forb and high birch pollen levels around 5400 B.P., again conforming with the coastal environmental record at Swan Lake.

In general, the developmental history of coastal flora outlined at Swan Lake is one of oscillatory change resulting from sea level fluctuation. A concurrence is moreover noted between the coastal botanical and the Gulf marine geologic data (Frazier 1974; Anderson and Thomas 1991; Paine 1991), in that sea level still stands and high stands defined by both lines of evidence are closely aligned chronologically. However, this comparison excludes from consideration a raised beach deposit on Copano Bay itself, where forams of probable secondary origin have been assayed (see Blum et al. 2001). Importantly, analog studies indicative of an unreliability of such dates come from the Bahia la Choya, where forams retrieved from tidal flats produced AMS dates of 2000 B.P. at the modern surface (Martin et al. 1996, Martin et al. 1995), due to a re-working of these organisms in a high energy setting (Springer and Flessa 1996). Reassessing then the dating of the Copano Bay raised beach in the light of these analogs, forams assayed from the former deposit may *pre*-date their sedimentary matrices by up to 2000 years. Significantly, this correction places the dating of the Copano Bay raised beach into conformity with bio-stratigraphic and marine depositional data, which are indicative of a high stand around 4000 B.P. Finally, it should be noted that a still stand defined after 3050 B.P. at Swan Lake compares well chronologically with a defined still stand after the general Gulf geologic evidence (Balsillie and Donaghue 2004).

Regarding then the general nature of Holocene sea level change in the Central Texas coastal region, it is pertinent that an undated pollen core from Nueces Bay provides further (relative) evidence of successive marine transgressions and still stands, after *Chenopodiaceae* response levels and other data patterns. Significantly, higher *Quercus* pollen values in this undated sequence are aligned (like at Swan Lake) with higher values of fresh-water taxa, including *Polygonum hydropiper* and *Typha domingensis*. Also after an abundant presence of *Rangia flexosa* bivalves in the lower half of the (792 cm deep) core, it is hypothesized (in Ricklis 1998) that the Nueces Bay record reflects events of a Middle Holocene time-depth (minimally). This hypothesis is supported by archeology, which indicates an absence of this clam species from regional *Rangia* middens after ca. 4500 B.P., although obviously, the sheer depth of this sedimentary sequence additionally argues for a significant time depth.

In global terms, mesic, low salinity floras defining still stands at Swan Lake correlate with cold phases defined in hemispheric records. Thus, a correlation may be made between Zone 2 and cold climates of the twin Piora oscillations (I-II, dated at ca. 5700 and 5300 B.P., respectively), while a similar correlation is discernible between a secular mesic interval of Zone 4 (ca. 3650 B.P.) and the Loebben cold oscillation (dated after 3700 B.P.). During these prehistoric cold periods, it is further significant that Alpine glaciers advanced 150 m downslope of their historic Little Ice Age positions (Frenzel 1991, 1993; Grove 1988). Given also that ice-mass build-up during the Little Ice Age (ca. A.D.1600-1800) actually effected a lowering of global sea level, it is entirely possible that still more emphatic cold phases of prehistory effected similar if not more significant regressions. Conversely, a xeric climatic oscillation in the North Atlantic ca. 3400 B.P. produced summer temperatures up to four degrees Celsius warmer than today in temperate Europe after pollen transfer data (Huntley n.d.), as well as high Gulf Stream surface temperatures within the hemisphere (cf. Huntley et al. 1989). At polar latitudes, such sea-surface temperature differentials are likely to produce a rapid rise in eustatic sealevel (Anderson and Thomas 1991; Bucha 1984). Potentially, this phenomenon is observable in the regional context, after a secular phase of marine influence reflected in a halophytic flora in Zone 5 at Swan Lake.

CONCLUSIONS: CULTURAL ECOLOGICAL HISTORY, LAG EFFECTS, AND DATING LIMITS

Bio-stratigraphically defined changes in environment and biotic productivity on the Central Texas Coast corroborate the ecologic model as follows. First, an earlier Holocene sea level rise (cf. PAZ 1) aligns generally with a poverty of regional settlement evidence, when a low level of biotic productivity is evidenced in a pervasive halophytic flora, although an attenuated occupation is indicated at near coastal sites such as 41NU266 until 6800 B.P. (Ricklis 1995b). Conversely, initial reoccupations of the coastal zone *after* 6000 B.P. are well-aligned with a defined (cf. PAZ 2) still stand from about 5800-5400 B.P., when estuarine conditions are established after extant freshwater marsh flora and a near-exclusion of halophytes.

Empirically, a fit of the coastal ecologic model with the pollen is also seen in a dating of a Middle Holocene high stand culminating in the maximum extent of a salt marsh flora of low biotic productivity ca. 4700 B.P. at Swan Lake (in PAZ 3), while the regional archeology indicates a hiatus of settlement beginning after 4500 B.P. (Ricklis 1995a, 1995b). Significantly, a mesic floral spectrum, with lower levels of *Chenopodiaceae,* is defined subsequently at 3650 B.P. (PAZ 4), and aligns chronologically with evidence for re-emergent settlement in the San Antonio Bay area (Ricklis and Weinstein 2005), in addition to initial occupation at 41AS5 itself (at 3810-3730 B.P., cf. Ricklis and Albert 2005). It should be critically observed, however, that differences of scale are reflected in these respective occupations. For example, shell lenses and occupational traces extant in the Nueces-Corpus Christi Bay area (e.g., at 41SP120) ca. 4500 B.P. (at a *terminus* of Middle Holocene coastal occupation) and as well as later occupational traces during a *short* mesic interval ca. 3650 B.P. in the San Antonio and Copano Bay areas compare very poorly in mass to post-3000 B.P. occupations in these regions, which are aligned with a longer still stand period (cf. PAZ 6).

Correlations between biotic productivity and settlement density are thus significant. After a consideration of potential lag factors, including (1) necessary lag periods between changes in biotic resource and human demographic levels and (2) necessary lag periods between changes in sea level and bay sedimentation, responses of coastal settlement patterns to sea level change can be better defined. After Factor 1, natural population growth will lag behind increases in biotic productivity by a time span determined by sustained rates of population growth (r). Thus, respecting hunter-fisher-gatherer populations, a maximum growth rate will rarely exceed an annual growth rate of 0.5% under favorable conditions (Hassan 1981), although rates of in- or out-migration by Native groups may also enhance rates of regional demographic change (cf. Neustupny 1982). Finally, a denudation of coastal resources will induce a reduced use of coastal zones which may not result in their wholesale abandonment. Regarding Factor 2, the establishment of still stand conditions may pre-date full barrier island formation, bay sedimentation, and consequent high biotic productivity by a considerable time, while initial sea level rises may similarly pre-date maximum inundation and consequent denudation of biotic resources.

Accounting then for these potential phase lag factors, a refinement of the Holocene ecologic history of the Central Texas Coast is proposed. After earliest settlement traces on the Gulf Coast, a more tropical climate and attendant sea level rise in the Early Holocene (before 6650 B.P.), leads to a reduced use of the coast with attenuated occupations at sites such as 41NU266 (i.e., in major river valleys). A sea level still stand is subsequently established by 5800 B.P., along with a transformation of regional climates to a much more mesic condition. Inland biomes at this time see a replacement of grasses and forbs by a long-grass prairie with expanses of live oak on sandy mottes, while moisture-requiring birch is also present in riparian areas. These elements reflect a very high annual rate of effective precipitation in the region broadly contemporary with increased bison hunting of the Bell-Andice archeological period.

A marine transgression and a return to a xeric inland environmental condition then emerges in later Middle Holocene times with a second phase of reduced coastal occupation. After the Swan Lake pollen flora, an absolute maximum of high salinity flora at 4700 B.P. predates somewhat a regional settlement hiatus beginning ca. 4500 B.P. In this phase, an apparent phase lag of about two centuries is thus expressed between the attainment of minimum biotic productivity and an absolute lapse in settlement, with a continuity of occupation at sites such as 41SP120 on Nueces-Corpus Christi Bay. Notably, however, shell remains from the latter site include a significant representation of high salinity taxa such as whelk and quahog, suggesting that bay salinities at 4500 B.P. are already somewhat more marine than estuarine. A subsequent marine high stand and halophytic coastal flora continue until about 3800 B.P.

In contrast, more abrupt changes in sea level and a reduction of phase lags are reflected in a mesic interval at 3650 B.P., as well as in a marine interval at 3450 B.P. at Swan Lake. These are correlated respectively with a near-contemporaneous presence and absence of coastal settlement remains in the region; however, less-than fully estuarine conditions are still reflected in the nature of settlement remains from the earlier period, which at 41AS5 are comprised of high salinity ecofacts such as lightning whelk (Ricklis and Albert 2005). Thus, a time limitation in the bay sedimentation (after lag factor 2) may be reflected

in this phase. Compared with hemispheric records, it is of further interest that the subsequent phase of marine transgression at 3450 B.P. is aligned chronologically with a major (xeric) climate oscillation beginning around 3400 B.P. noted above. With a potentially rapid rise of global sea level in this secular xeric interval (cf. Anderson and Thomas 1991), an inundation of bay environments may occur relatively rapidly, consequently displacing settlement of the Central Texas Coast in a similar fashion.

Ultimately, the last 3,000 years of more sustained estuarine conditions on the Central Texas Coast produce a qualitative increase in population levels, culminating in the major settlements of the contact period Karankawa, where semi-annual concentrations of up to 500 individuals are evidenced (Ricklis 1996). In this period, a cultural lag factor on the order of 1,000 years is expressed in the full development of estuarine fishing economies. At Mustang Lake (41CL3) and other sites, fishing economies emerge only after 2000 B.P., based on fish otolith densities (Ricklis 1995a). Importantly, these regimes greatly increase carrying capacities of coastal populations which had formerly relied to a much greater degree on much less productive shellfish resources.

In the final analysis, empirical limits of geologic and archeological dating should be realized. Of these, marine geology is beset by a poor understanding of the taphonomy of dated organisms (cf. Blum et al. 2001), while archeology is limited by a poor resolution of artifact chronologies (Hester 1995) and a misapplication of deep-water calibrations in the dating of organisms whose carbon intake is actually at equilibrium with the atmosphere (Ricklis 1999). Once these factors are accounted for, limits of correlations between data sets are then imposed by sigma ranges of individual assays, which may contain an error margin of more than one century. Within this margin of error, dating discrepancies between the pollen data and expectations of the ecologic model are rendered less significant, and in fact, dating error itself may account for some apparent lag effects noted above. Only further bio-stratigraphic work and a better definition of archeological chronologies on the Central Texas Coast will distinguish potential dating errors from actual ecological relationships between prehistoric humans and their environment.

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Letter to the Editor

Dear Editor:

I have recently received a copy of the 2005 review of my husband's book, *We Came Naked and Barefoot: The Journey of Cabeza de Vaca Across North America*, published in Volume 76 of the *Bulletin of the Texas Archeological Society* (pp. 280-281). I would like to thank the reviewer for the favorable review of the book and the recognition of it as a significant contribution to the history and prehistory of the area.

At the same time, I would like to point out two errors in the review—one rather major and the other small but irritating. The reviewer states that "none of the references cited in Hester's Foreword or his Afterword were in the References Cited section of the book." Unfortunately, the reviewer did not look far enough. All those references were cited in the Supplemental References titled "Relevant Publications After 1954." This was done because the book was my husband's dissertation, written in 1954, which of course, did not contain references to works published later. No error was committed either by the University of Texas Press or by me as editor of the book.

The second error in the review was the repeated misspelling of my husband's name in the initial paragraph. This is particularly noticeable and perplexing since it occurs adjacent to a picture of the book's dust jacket, was not repeated later in the review, and one would think would be picked up in proof reading. Also, Alex Krieger had a long and I think major role in the history of the Texas Archeological Society, albeit in the last century!

Thank you for your attention to these matters.

Sincerely yours,

Margery H. Krieger

Comments on Mary Jo Galindo's Review of *From a Watery Grave*: *The Discovery and Excavation of La Salle's Shipwreck, La Belle,* Bulletin of the Texas Archeological Society 76 (2005):304-306

James E. Bruseth and Toni S. Turner

Mary Jo Galindo provides an in-depth review of our book *From a Watery Grave: The Discovery and Excavation of La Salle's Shipwreck, La Belle.* Galindo concludes that the book is a "good read," and we appreciate her generally positive appraisal. But she takes us to task for making "unsubstantiated assertions, particularly regarding the stranded French crew's alcohol consumption," which she suggests could be based only on "stereotypical supposition and bias." While we fully understand that a book review is to point out both positive and negative aspects of a work, we take issue with Galindo's statements that cast doubt on the integrity of our research and use of the documentary evidence.

The passages Galindo offers as examples of unsubstantiated assertions relate to events surrounding the loss of *La Belle* and the crew's attempts to get off the ship. We wrote the following about the ship's captain: "Tessier controlled the supplies of brandy and wine, including a large barrel of Spanish wine meant for religious sacrament; he drank greedily and remained in a stupor" (p. 4). A few paragraphs later, we wrote:

> A new, more solid raft was constructed, which successfully carried several men ashore, where they finally found fresh water. The remaining crew disembarked. Tessier, however, remained on board for several more days under the pretense of helping to offload all of the cargo. In reality, he was finishing off a barrel of brandy (p. 5).

These passages are based on the journal of Henri Joutel, a member of La Salle's expedition who kept an almost daily log of events, which was recently translated and published (Foster 1998). In describing the wreck of *La Belle,* Joutel wrote that Tessier "took possession of the wine and filled his gullet well indeed. According to Chefdeville's report, he hardly spent a day that he was not drunk" (Foster 1998:136). Joutel adds:

> Thus, it seemed that all sorts of misfortune occurred to thwart the enterprise. However, all of this happened only because of great rashness and lack of direction, for all this disorder would not have occurred without the drunkenness of the master [Tessier]. But, in brief, the next day it became a matter of making another raft. . . As it was not large, not many things could be unloaded at once. Besides, they had to indulge the caprice of the master who was usually drunk. He had put the case of brandy that he had seized on the poop deck, and he alone handled it. This meant that as long as it lasted, he was in no hurry to leave the ship. He used the pretext that he was staying until all of the cargo was unloaded (p. 137).

The description of events in our book, therefore, fairly represents Joutel's account. We did not make "unsubstantiated," "stereotypical," or "biased" statements. If Galindo had only checked Joutel's now widely available journal, which we cited in the endnotes as our source, she would have avoided making statements that are themselves "unsubstantiated" and "biased."

Some national journals, such as *Historical Archaeology,* have established the policy of allowing authors to read reviews of their works before they are published, in part to identify obvious inaccuracies in the reviews. Perhaps the *Bulletin of the Texas Archeological Society* should adopt a similar policy.

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