III. A.7

DESCRIPTIONS OF SITES AND SCATTERED ARTIFACT FINDS

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The following site descriptions are taken from both the computer coded and written field forms (III.A.4). In the interests of brevity, pertinent information is presented in a standardized format. Frequency data are not given due to the varied collection areas and techniques. However, the collection areas are mentioned, and potentially permit comparisons. Site locations are presented in Fig. 34.

SITE DESCRIPTIONS

41 BX 36

Location: Site is located on a terrace at the edge of the Salado Creek flood plain, currently flowing only seasonally. It extends onto the colluvial slope and shelf, ca. 100 m southeast of the creek.

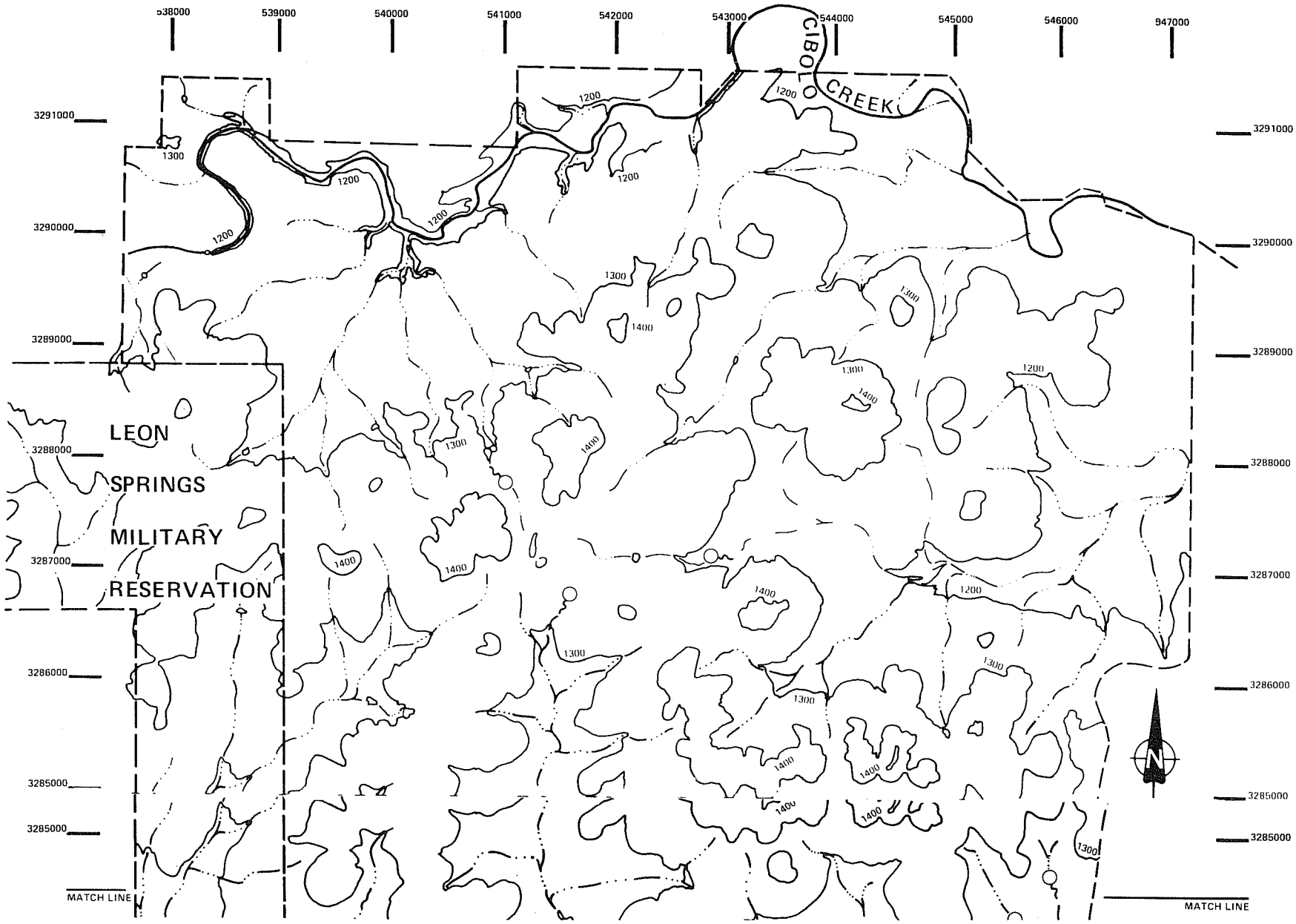
Elevation: 1050'

Environment: Vegetation on and around the undisturbed areas of the site includes live oak, hackberry, huisache, juniper, persimmon and moderately heavy grass cover. The flood plain soils are a deep dark loam.

Description: The site consists of a disturbed and partially destroyed burned rock accumulation with high densities of chipped stone and bone. Remaining portion of the site measures approximately 60 x 40 m and is adjacent to the natural terrace slope. The maximum depth of the site is currently 110 cm; some overburden or cultural fill may have been removed during construction activities.

Investigation: Although no surface collections were conducted due to disturbances, a total of 23 1 m^2 units was excavated (Fig. 35). These consisted in several cases of blocks of four units, in which the southwestern-most unit served as a control unit (see III.A.4). Table 10 presents the artifact types and frequencies per level in each unit.

The deposits appear to be badly mixed in some units as shown by the presence of historic material to a maximum depth of 50 cm below the ground surface. This is also revealed in the lack of chronological (projectile point) stratigraphy or natural stratigraphy.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LEON SPRINGS MILITARY RESERVATION
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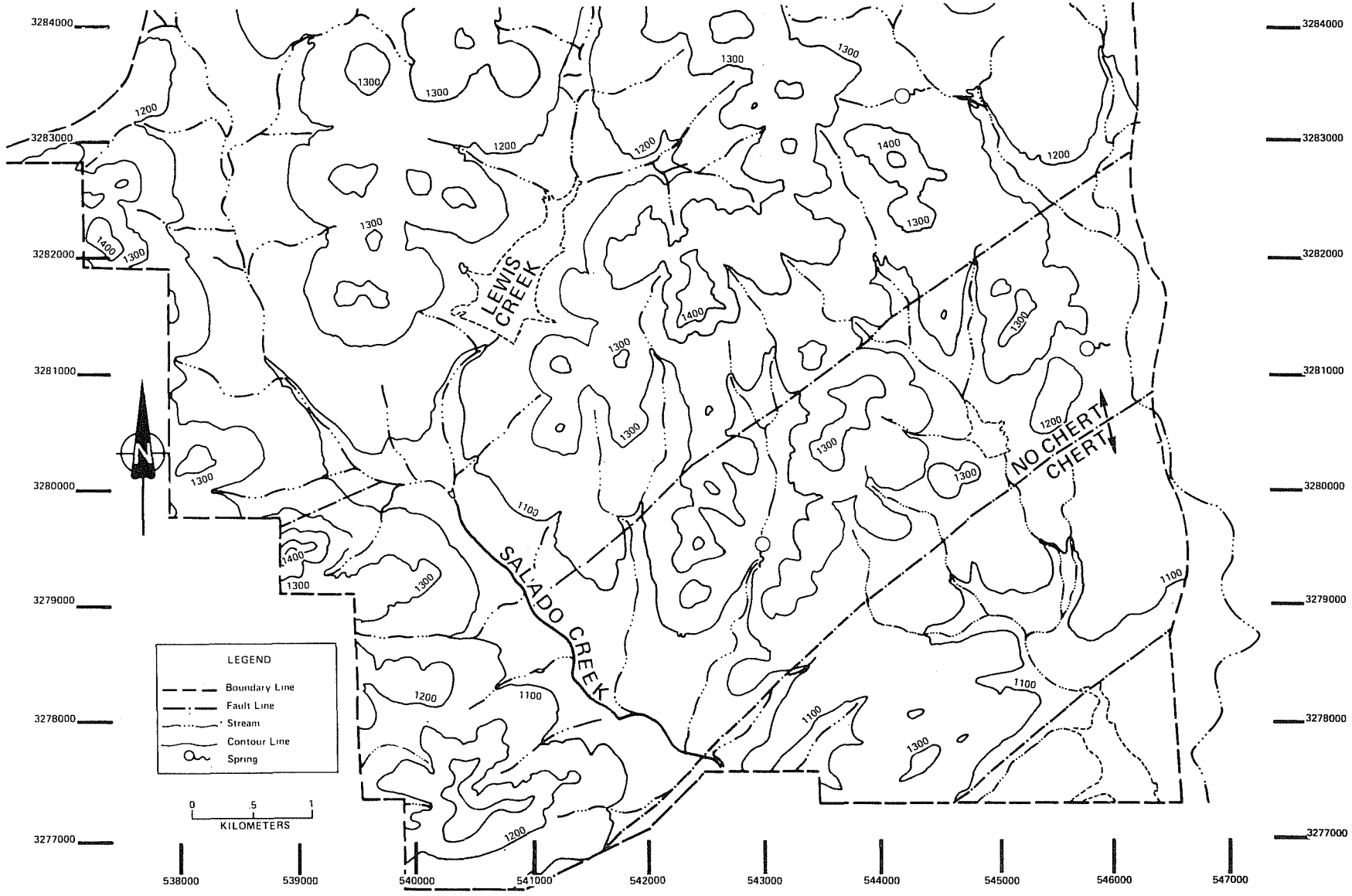


Figure 34. *The Camp Bullis Survey Area.* In order to protect the sites at Camp Bullis, their locations are not plotted on this version of the map. Qualified researchers may obtain site locations from the Center. Adapted from the USGS Camp Bullis 7.5' topographic map. Note match line.

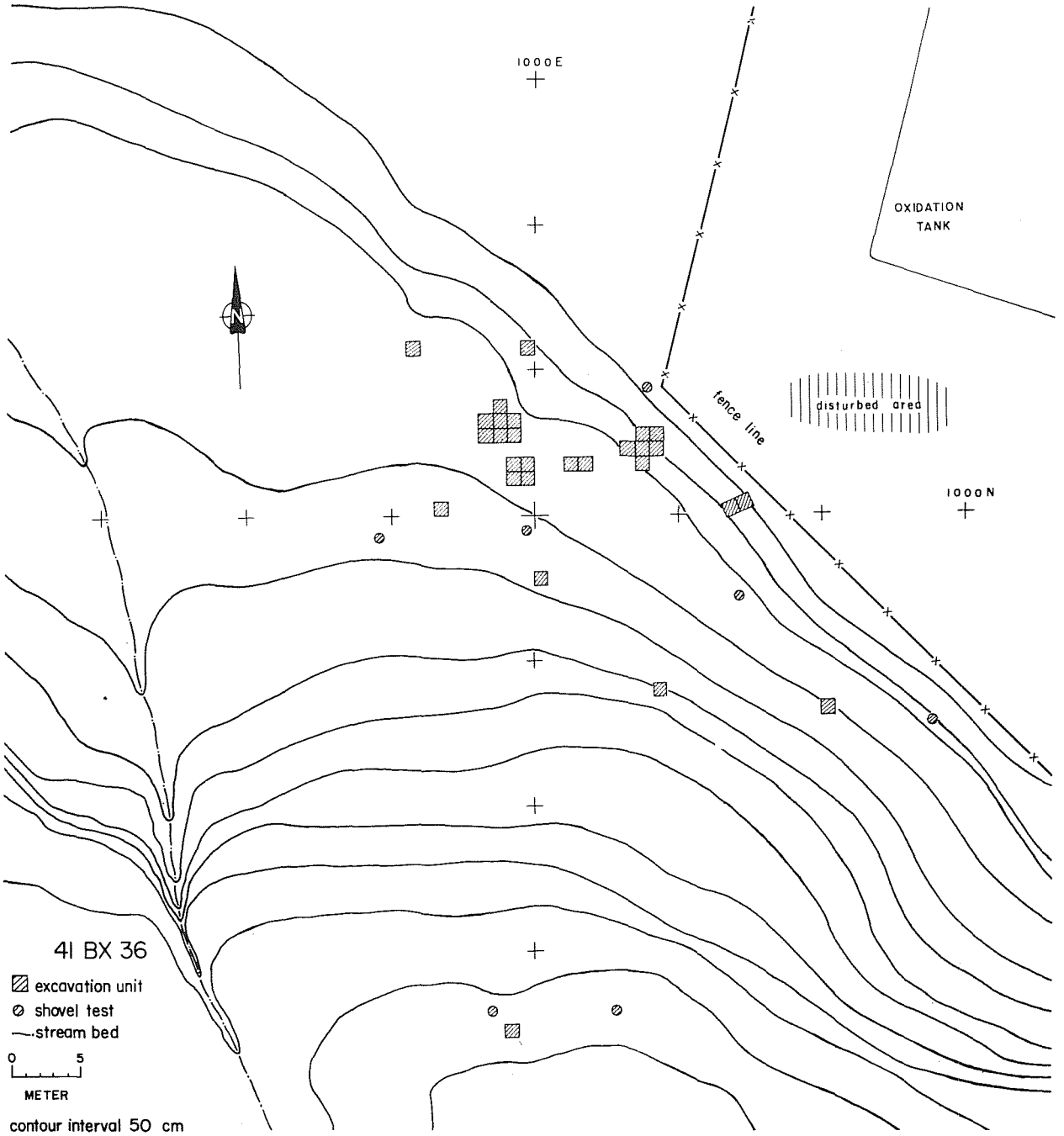


Figure 35. *Site 41 BX 36, Camp Bullis.* Plan of the 1977 excavations.

TABLE 10. ARTIFACT PROVENIENCE AT 41 BX 36

Unit	Depth below Datum	Level (cm)	Screen Size	Historic Material (*=Presence)	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
T.P.1	3 cm	0-10	1/4"	*	5	18	170	Biface, Chunk
(E1000,		10-20	1/8"	*	19	19	247	Biface, Chunk
N995)		20-30	"	*	0	8	31	Biface, Retouched flake, *Pedernales*
T.P.2	146 cm	0-10	1/4"	*	4	17	78	Retouched flake, Chunk, *Scallorn*
(E1008,	above	10-20	"		4	20	107	Preform (3), Quarry blank (2), Side scraper (2), Core, Retouched flake (2), Chunk
N987)		20-30	"		2	2	20	Chunk
		30-40	"		3	0	4	Chunk
T.P.3	23 cm	0-10	"	*	6	27	162	Chunk, *Perdiz* (2)
(E998,		10-20	"		5	23	202	Biface, Chunk, *Pedernales*
N1000)		20-30	"		6	13	104	Chopper, Biface
		30-45	"		4	5	54	Core, Biface, Chunk
		45-55	"		1	3	10	Retouched flake
		55-65	"		0	2	4	-
		65-75	"		0	0	0	-
1	80 cm	0-10	"	*	27	58	384	End/side scraper, *Edwards*
(E997,		10-20	"	*	32	63	441	Biface, Core, *Scallorn*
N1007)		20-30	"		37	41	365	Biface, Retouched flake, *Perdiz*
		30-40	"		0	10	163	*Castroville*, *Martindale*, *Nolan*
		40-50	"		0	6	122	Biface (2), Core
		50-60	"		0	2	134	Core, *Castroville*
		60-70	"		0	4	112	Biface
		70-80	"		3	2	80	-
		80-90	"		0	1	32	Biface
		90-100	"		0	3	28	-
		100-110	"		1	0	15	-

TABLE 10. (continued)

Unit	Depth below Datum	Level (cm)	Screen Size	Historic Material (*=Presence)	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
2	83 cm	0-10	1/4"	*	7	46	277	Biface (3), *Edwards*
(E998,		10-20	"	*	15	36	324	Unknown point
N1006)		20-30	"		7	29	337	End/side scraper, *Scallorn*
		30-40	"		7	13	226	Retouched flake, *Montell*
		40-50	"		2	14	148	Retouched flake
		50-60	"	*	1	2	90	*Pedernales*
3	85 cm	0-5	1/8"	*	2	8	70	Ground stone, Side scraper, Retouched flake, Chunk
(E998,								
N1-05)		5-10	"	*	3	3	202	Uniface, Retouched flake, Ground stone, Chunk
		10-20	1/4"	*	1	10	264	Biface, Retouched flake, Chunk, *Perdiz*
		20-30	"		1	11	140	Biface, Retouched flake, Chunk, *Edwards*, *Uvalde*
		30-40	"		0	7	97	Biface, Chunk, *Marcos*
4	67 cm	0-5	1/8"	*	0	15	26	-
(E996,		5-10	"	*	0	13	149	Core
N1006)		10-15	"		0	30	280	Retouched flake, *Perdiz*, *Ensor-Frio*
		15-20	"		1	22	236	Retouched flake, Core
		20-25	"	*	0	6	79	-
		25-30	"		4	13	148	Retouched flake (2), *Frio*, *Ensor-Frio*
		30-35	"		0	7	35	*Frio*
		35-40	"		1	3	38	-
		40-45	"		0	4	24	Retouched flake
		45-50	"		0	2	10	-
		50-55	"		1	4	28	-
		55-60	"		2	5	30	-
5	69 cm	0-10	1/4"	*	12	38	208	Core, Perforator, *Perdiz* (2)
(E997,		10-20	"		11	36	338	*Perdiz* (2), Retouched flake
N1005)		20-30	"		5	18	177	Dart point fragment
		30-40	"		4	9	69	-
		40-50	"		0	6	64	*Montell*
		50-60	"		2	0	12	-

TABLE 10. (continued)

Unit	Depth below Datum	Level (cm)	Screen Size	Historic Material (*=Presence)	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
6	71 cm	0-10	1/4"	*	8	21	186	*Castroville*, *Nolan*
(E996,		10-20	"		11	40	259	Retouched flake, *Nolan*
N1006)		20-30	"	*	8	22	278	Side scraper
		30-40	"		2	12	102	*Angostura*, *Early Corner Notched*
		40-50	"		1	10	122	-
		50-60	"		2	8	55	*Marshall*
7	75 cm	0-10	"	*	8	38	268	Core
(E997,		10-20	"		10	37	325	Biface (2), Retouched flake, *Montell*
N1006)		20-30	"		14	20	463	Core, Retouched flake, *Nolan*, *Martindale*
		30-40	"		8	13	133	*Pedernales* (2)
		40-50	"		6	12	111	Biface
		50-60	"		0	5	24	-
8	73 cm	0-5	1/8"	*	10	23	258	Biface, Retouched flake, Chunk
(E1002,		5-10	"	*	6	35	469	Biface, Retouched flake, Chunk, *Fresno*, Unknown dart point
N1003)		10-15	"		15	16	335	Biface, Retouched flake, Chunk
		15-20	"	*	16	32	508	Core, Chunk, Retouched flake, Biface
		20-25	"	*	10	28	276	Biface, Retouched flake, Chunk
9	73 cm	0-10	1/4"	*	11	58	739	Ground stone, Retouched flake, *Ensor*, *Perdiz*
(E1003,		10-20	"	*	21	76	744	Biface (2), *Edwards* (2)
N1003)		20-30	"	*	7	30	382	Core (2), *Travis*
		30-40	"		2	13	193	-
		40-50	"	*	2	12	122	End/side scraper
		50-60	"		0	27	0	-
		60-70	"		0	1	17	Biface
		70-80	"		7	0	0	-
		80-90	"		1	4	11	-
10	62 cm	0-10	1/8"		1	6	111	Biface, Retouched flake, Chunk, *Perdiz*, *Marcos*
(E998,		10-20	"		2	39	276	Biface, Retouched flake, Chunk, *Edwards*
N1003)								

TABLE 10. (continued)

Unit	Depth below Datum	Level (cm)	Screen Size	Historic Material (*=Presence)	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
11 (E999, N1003)	64 cm	0-10	1/4"	*	9	37	286	Biface, Chunk, *Edwards*
		10-20	"		0	38	195	Biface, Preform, Chunk, Retouched flake
12 (E998, N1002)	57 cm	0-5	1/8"	*	2	13	0	Biface, *Guadalupe* tool, *Perdiz*
		5-10	"		0	23	82	Biface, Chopper, Chunk, *Early Corner Notched*
		10-15	"	*	1	9	99	Core, Chunk
		15-20	"		0	13	52	Biface, Chunk, *Ensor-Frio*
13 (E999, N1002)	59 cm	0-10	1/4"	*	1	13	166	Biface, Retouched flake, Chunk
		10-20	"	*	9	21	199	Biface, Chopper, Core, Retouched flake, Chunk, *Perdiz*, *Langtry*
14 (E1007, N1004)	83 cm	0-15	"		11	42	512	Biface, Retouched flake, Chunk
		15-25	"		4	10	84	Chunk
		25-35	"		7	4	62	Biface, *La Jita*
		35-45	"		0	0	13	Core
		45-55	"		1	2	58	Core, Retouched flake
15 (E1007, N1003)	62 cm	0-10	"		14	5	368	Biface, Retouched flake, Chunk, *La Jita*, *Pedernales* (2), *Frio*
		10-20	"	*	8	15	179	Chunk, *Kinney*
		20-30	"		5	12	74	*Nolan*, *Pedernales*
		30-40	"		4	8	63	Chunk, *Frio*, *La Jita*
16 (E998, N964)	460 cm above	0-10	"	*	5	14	101	End/side scraper, Retouched flake, Chunk, *Edwards*
		10-20	"		4	9	105	Chunk
		20-30	"		0	0	2	-
17 (E1008, N1004)	150 cm	0-10	"	*	2	0	27	End/side scraper, *Castroville*
		10-20	"		0	11	55	*Edwards*, *Ensor*, *Nolan*
		20-30	"		6	15	116	Biface, Chunk

TABLE 10. (continued)

Unit	Depth below Datum	Level (cm)	Screen Size	Historic Material (*=Presence)	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
18 (E1006, N1004)	92 cm	0-10	1/4"		6	40	374	Biface, Preform, Chopper, End/side scraper, *Ensor*
		10-20	"		9	18	266	Biface, Side scraper, Ground stone, Retouched flake, Chunk, *Scallorn*, Unknown dart point
		20-30	"		8	12	117	Retouched flake, Chunk
19 (E1008, N1003)	178 cm	0-10	"		10	32	297	Biface, Side scraper, Chunk, Retouched flake, *Edwards*
		10-20	"		4	2	53	Chunk
20 (E991, N1011)	84 cm	0-10	"	*	3	16	97	Chunk
		10-20	"	*	Unknown			Biface
		20-30	"	*	9	18	118	Chunk
21 (E999, N1011)	136 cm	0-10	"	*	12	8	124	Core, Chunk
		10-20	"		0	12	126	Preform, Retouched flake, Chunk, *Travis*
22 (E1020, N986)	40 cm	0-10	"		1	7	17	-
		10-20	"		0	6	26	-
		20-30	"		2	8	44	Ground stone
		30-40	"		1	3	26	-
		40-50	"		0	2	9	-
		50-60	"		2	2	13	-
		60-70	"		2	4	37	Ground stone
		70-80	"		0	1	7	-
23 (E1007, N1005)	133 cm	0-10	"		24	82	681	End/side scraper, Biface, *Scallorn*, *Perdiz*, Unknown (2)
		10-20	"	*	5	24	253	Retouched flake, *Meserve*
		20-30	"		7	11	148	Biface
		30-40	"		5	12	132	Retouched flake, Ground stone
		40-50	"		1	5	128	-

‡One specimen unless otherwise indicated.

1°, primary flake; 2°, secondary flake; Int., interior flake.

Early observations (before modification) indicate that the site was originally very large (see III.A.3). The remaining segment, although yielding large quantities of artifactual material, must be only the very edge of the site. Several burials were reputedly uncovered during the process of destruction; however, none of the materials are available and they were not documented.

Although little can be said regarding the manner in which the site was constructed, it is suggested that this is a segment of a large base camp area. Long-term and intensive use is indicated by the projectile point types present and by high frequencies of chipped stone, burned rock and bone (see III.A.12).

Occupation Period: Late Paleo-Indian through Late Prehistoric.

41 BX 371

Location: Upland margin site; less than one km to nearest water source, a permanent waterhole in Cibolo Creek.

Elevation: 1300'

Environment: Vegetation is predominantly grasses with clumps of juniper and live oak. Soil cover is very thin with areas of bedrock outcrops.

Description: Low density lithic scatter consisting of points, unifaces, biface fragments and flakes. Some scattered burned rock is present. The site has no depth. Dimensions of the site are approximately 75 x 50 m.

Investigation: All visible diagnostic artifacts and worked chert were collected.

Occupation Period: Pre-Archaic.

41 BX 372

Location: Flood plain site; nearest permanent water (Cibolo Creek) is less than 100 m distant.

Elevation: 1300'

Environment: The soil is a dark loam of indeterminate depth. Vegetation is primarily clumps of juniper and live oak interspersed with grassy areas.

Description: The site consists of scattered burned rock and chipped stone. Artifacts include a point, cores, biface fragments, scrapers and flakes. The site area is over 100 x 100 m. The site depth is indeterminate.

Investigation: The site was recorded but no collection was made.

Occupation Period: Unknown.

41 BX 373

Location: Terrace site with small river cobbles of medium fine chert; nearest permanent water, Cibolo Creek, is less than 100 m away.

Elevation: 1210'

Environment: Vegetation consists of live oak, hackberry, juniper and elm woods. The soil is reddish and clayey, containing some chert gravels. The soil depth is undetermined.

Description: The site is marked by a moderate density lithic scatter containing a point, bifaces, cores and flakes. The site depth is unknown; its area is ca. 40 x 30 m.

Investigation: The site was mapped according to standard procedure.

Occupation Period: Late Paleo-Indian.

41 BX 374

Location: Flood plain site; nearest water source less than one km distant (Cibolo Creek). No chert in immediate area.

Elevation: 1270'

Environment: Vegetation is composed of juniper and live oak brakes interspersed among grassy fields. The soil is dark and laomy with some depth. The site is located in a plowed field.

Description: The site consists of a lithic scatter including bifaces, preforms, biface fragments, a chopper and flakes. The site depth is unknown; dimensions are approximately 45 x 30 m.

Investigation: A surface collection of worked chert was made. The locations of the artifacts were mapped.

Occupation Period: Unknown.

41 BX 375

Location: Flood plain site; permanent water source less than one km away (Cibolo Creek). The site is on a bluff overlooking Cibolo Creek and approximately 50 m from an intermittent stream. Medium fine chert available in small river cobbles.

Elevation: 1190'

Environment: Vegetation includes sparse grasses with dense juniper clumps. The soil ranges from black clay-loam to reddish clay with chert gravels. The depth is indeterminate but probably fairly shallow.

Description: The site is a lithic scatter with points, bifaces, unifaces, blanks, cores and flakes present. The site area is ca. 100 x 50 m; the site depth is undetermined.

Investigation: A 3 m^2 unit was completely collected, and other diagnostic artifacts were collected and mapped.

Occupation Period: Pre-Archaic, Late Archaic.

41 BX 376

Location: Upland margin site; ca. 150 m to nearest seasonal water source (a ravine) and one km from Cibolo Creek, a permanent water supply.

Elevation: 1250'

Environment: Vegetation consists of grassy fields with clumps of juniper and live oak. The soil is very thin with bedrock outcrops. Moderately fine chert is available 800 m northwest at 41 BX 375.

Description: The site is a lithic scatter covering a large (320 x 250 m) area. Artifacts consist of points, bifaces, cores, a *Guadalupe* tool and flakes. Burned rock is scattered over the site.

Investigation: The site area was sketched and diagnostic artifacts were collected.

Occupation Period: Late Paleo-Indian, Pre-Archaic.

41 BX 377

Location: The site is buried in a colluvial terrace within 30 m of Cibolo Creek, which has a deep waterhole at this point. No chert in immediate area. Photograph on cover.

Elevation: 1200'

Environment: The present day vegetation includes juniper and live oak mixed with hackberry and persimmon. Disturbed areas have a heavy grass cover. The terrace soil is a deep reddish sandy silt, alluvially deposited.

Description: The site is buried in the terrace, indicating that Cibolo Creek was much higher during the time of occupation. Probably the area was an outside edge of a meander of Cibolo Creek and received flood-carried material (C. M. Woodruff, personal communication).

The prehistoric occupation is represented by a series of partially superimposed hearths within a 30 x 30 m area. Associated with these hearths are numerous chipped stone artifacts and land snail shells, often occurring in pockets. It is likely, given the nature of the probable soil deposition processes and the hearth stratigraphy, that the site was repeatedly occupied during non-flood seasons or years.

The low bone frequency may be due to poor preservation conditions (see III.A.12) or an original lack of bone. Only a few mussel shell fragments were recovered.

Table 11 presents data on the volume of burned rock present per level. The higher concentrations indicated hearths, often constructed with slab limestone and forming a discrete horizontal layer (Fig. 36,a). These hearths often contained pockets of unburned *Rabdotus sp.* land snail shells. Several contained charcoal and ash-stained soil. Artifact proveniences are presented in Table 11.

No clear chronological separation between Late Archaic and Late Prehistoric components was discernible.

Investigation: A roadcut through the site enabled initial recognition of several hearths (Fig. 37). A large number of artifacts had washed into the roadcut; a selective collection was made of these, but the locations were not mapped. Subsequently, eight 1 m^2 units were excavated, most of them in 5 cm levels and using 1/8-inch mesh screen. These are arranged in Fig. 38 according to surface topography.

Occupation Period: Pre-Archaic, Late Archaic, Late Prehistoric.

41 BX 378

Location: Terrace site with no chert in immediate area. A seasonal water supply is available within 100 m, as well as Cibolo Creek, which has permanent waterholes (Fig. 39).

Elevation: 1190'

Environment: Vegetation is primarily juniper and thorny brush, with light grass cover. The soil is very thin with bedrock visible.

Description: The site is a lithic concentration in a small area (5 x 5 m). A point, scrapers and flakes were present. The site has no depth.

Investigation: Diagnostic artifacts were collected.

Occupation Period: Unknown.

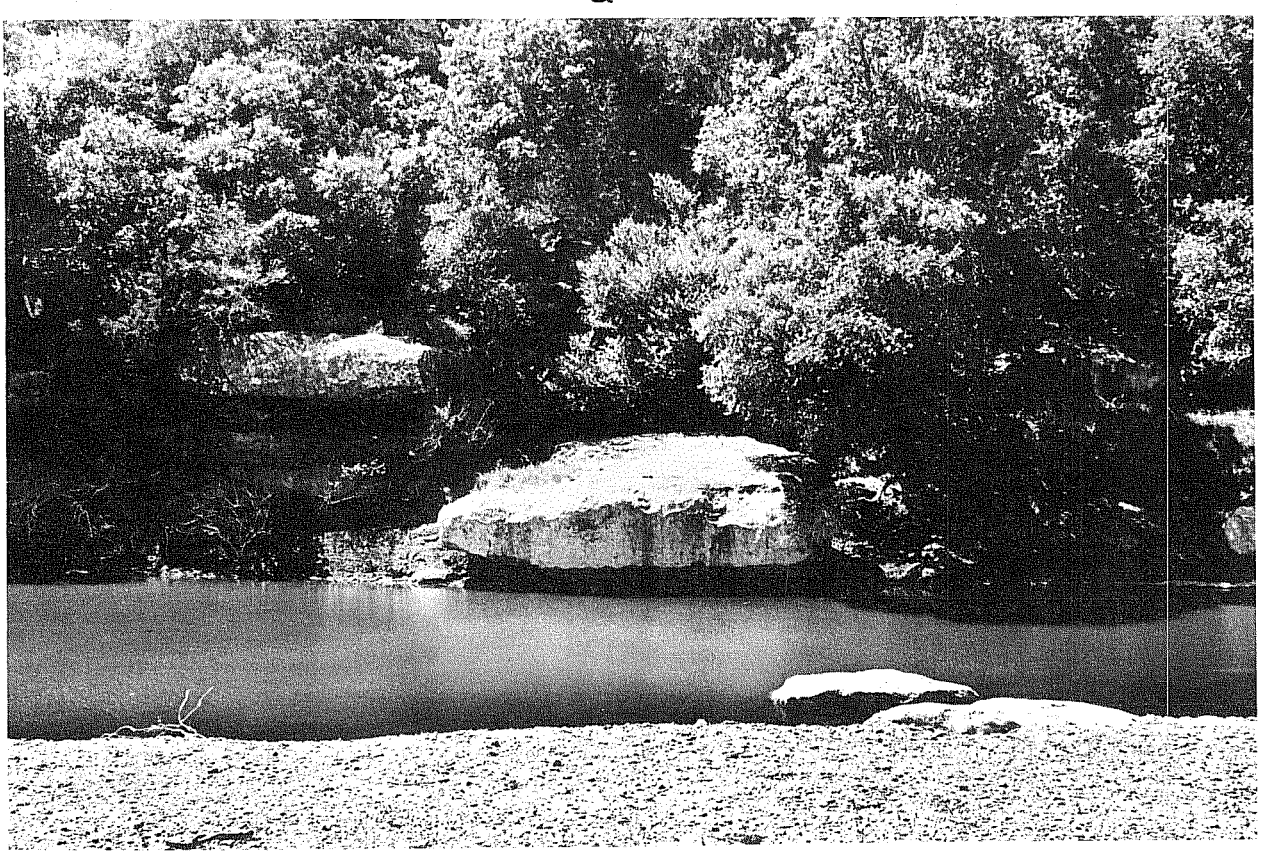
41 BX 379

Location: Terrace site located on a bluff above a waterhole in Cibolo Creek, within 100 m.

Elevation: 1190'

Environment: Vegetation is composed of dense juniper and thorny brush, with sparse grasses. The soil is a dark clayey loam, never more than 5 cm deep.

a



b

Figure 36. *Views of Prehistoric Sites, Camp Bullis.* a, hearths at site 41 BX 377; b, Cibolo Creek below site 41 BX 383.

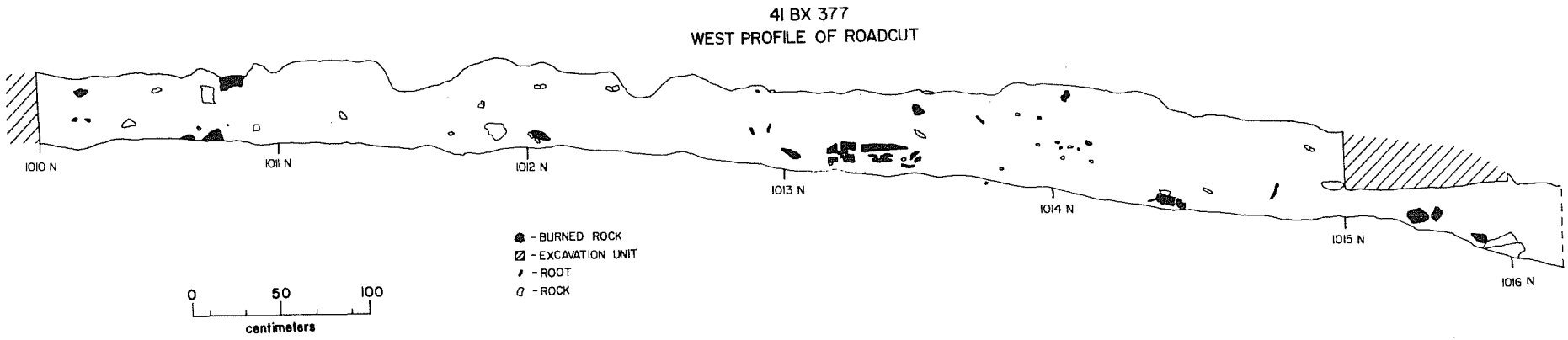


Figure 37. *Site 41 BX 377, Camp Bullis: West Profile.* The west profile along the roadcut at site 41 BX 377 is shown. See Fig. 38 for location of this profile within the site.

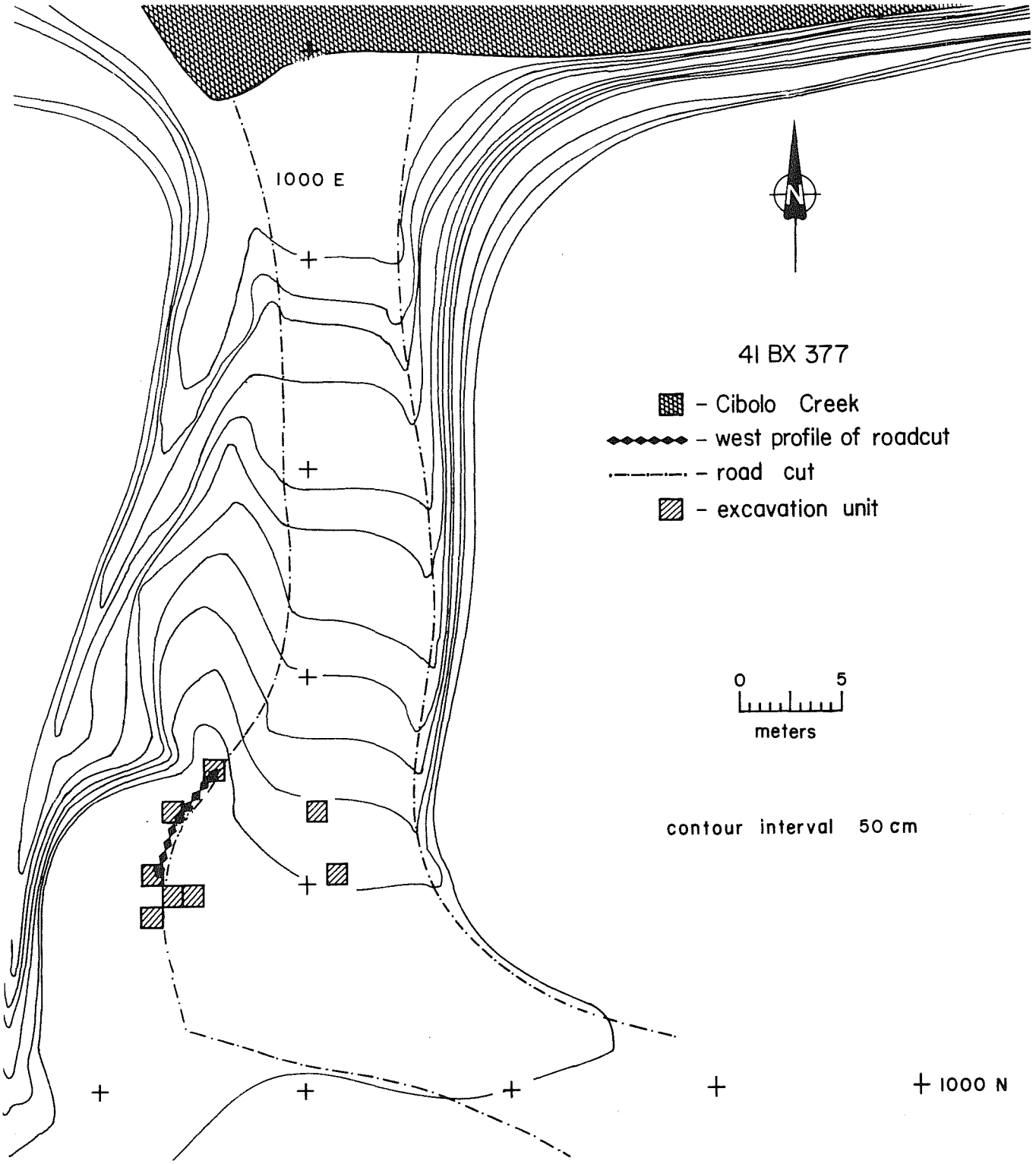


Figure 38. *Site 41 BX 377, Camp Bullis.*

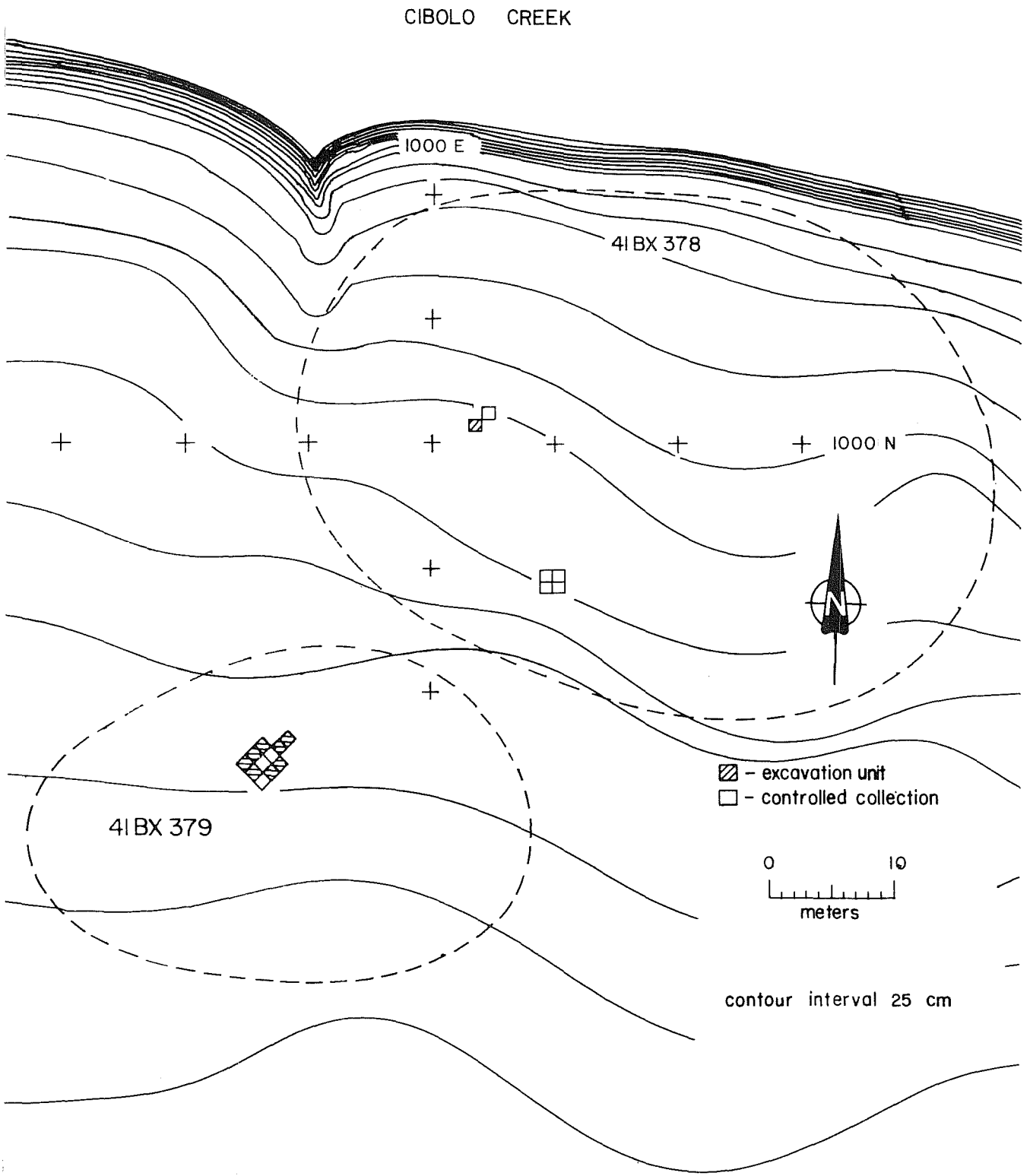


Figure 39. *Sites 41 BX 378 and 41 BX 379, Camp Bullis.*

TABLE 11. ARTIFACT PROVENIENCE AT 41 BX 377

Unit	Depth below Datum	Level (cm)	Screen Size	Vol. of Burned Rock*	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
1 (E1000, N1013)	125 cm	0-5	1/8"	618	0	11	50	Unknown arrow point
		5-10	"	412	0	0	17	-
2 (E1001, N1010)	95 cm	0-5	"	4738	7	22	179	Point fragment, *Edwards* (2)
		5-10	"	2678	3	27	112	*Edwards*, *Edgewood*
		10-15	"	618	1	3	15	-
3 (E992, N1008)	0 cm	0-5	"	4738	0	14	38	-
		5-10	"	1648	0	36	150	Point fragment (3), Biface fragment, *Scallorn*
		10-15	"	6180	6	23	103	Biface fragment, Retouched flake
		15-20	"	7210	3	15	87	-
		20-25	"	1648	3	11	26	-
		25-30	"	1442	1	8	59	-
		30-35	"	2266	3	20	68	Core fragment (2)
		35-40	"	4326	5	4	41	Preform fragment
		40-45	"	3090	1	5	20	Core
		45-50	"	1648	4	4	16	Quarry blank fragment
		50-55	"	1648	0	6	15	Preform fragment
		55-60	"	1442	1	3	57	*Ensor-Frio*
		60-65	"	6180	0	2	27	*Frio*
4 (E994, N1009)	13 cm	0-5	"	1442	6	5	43	-
		5-10	"	4120	3	11	48	-
		10-15	"	6180	1	4	32	Ground stone
		15-20	"	6180	1	10	63	Point fragment, Side scraper
		20-25	"	1030	6	13	101	Thinned biface fragment
		25-30	"	1030	2	12	81	-
		30-35	"	618	2	4	36	-
		35-40	"	1030	2	8	31	-
		40-45	"	412	1	4	20	-
		45-50	"	618	0	1	2	-
		50-60	1/4"	618	0	1	6	-
		60-70	"	412	0	0	1	-

TABLE 11. (continued)

Unit	Depth below Datum	Level (cm)	Screen Size	Vol. of Burned Rock*	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
5 (E992, N1010)	0 cm	0-5	1/8"	1030	7	4	31	*Edwards*
		5-10	"	1648	9	26	79	*Scallorn*, Side scraper
		10-15	"	1648	10	23	105	Quarry blank, Preform, Retouched flake
		15-20	"	2060	5	32	135	*Marcos*
		20-25	"	1648	5	19	65	Quarry blank fragment
		25-30	"	2678	4	18	159	Quarry blank fragment
		30-35	"	5678	0	13	31	Ground stone, *Scallorn*
		35-40	"	10,300	1	11	4	Core fragment
		40-45		8240	2	10	36	Pecked stone, *Ensor-Frio*
		45-50	"	6798	2	14	36	*Ensor* (2)
		50-55	"	8240	2	18	23	Mussel fragment
		55-60	"	2060	4	14	30	Quarry blank, Preform, Point fragment, Side scraper
		60-65	"	2678	1	6	13	Thinned biface fragment, Ochre, *Ensor-Frio*, *Ensor*
		65-70	"	2060	1	14	86	Core fragment, Ground stone
		70-75	"	618	2	8	43	-
		75-80	"	1030	1	4	43	Unknown point
		80-85	"	206	1	3	32	Point fragment
6 (E993, N1009)	0 cm	0-5	"	6180	1	6	11	*Edwards*, Point fragment
		5-10	"	3708	6	12	65	Unknown points (2)
		10-15	"	1648	1	7	42	Quarry blank, Point fragment
		15-20	"	4738	Unknown		Unknown	
		20-25	"	5150	1	19	87	-
		25-30	"	11,330	2	16	98	Mussel fragment
		30-35	"	13,390	0	11	75	-
		35-40	"	8240	10	13	102	*Martindale*, Preform
		40-45	"	1030	3	13	82	-
		45-50	"	8240	3	14	165	Ochre
7 (E995, N1015)	38 cm	0-10	1/4"	3090	4	13	32	Quarry blank
		10-20	"	618	5	12	21	Unknown arrow point
		20-30	"	618	4	10	48	Core fragment
		30-40	"	1648	1	7	34	-

TABLE 11. (continued)

Unit	Depth below Datum	Level (cm)	Screen Size	Vol. of Burned Rock*	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
7 (con't.)		40-50	1/4"	1648	1	10	31	-
		50-60	"	2678	0	2	16	-
		60-70	"	24,720	1	3	18	-
		70-80	"	1648	1	2	8	-
8 (E994, N1013)	13 cm	0-10	"	4532	3	16	62	Point fragment, Mussel fragment
		10-20	"	4738	2	4	56	Point fragment, Ground stone
		20-30	"	4120	3	6	41	Ground stone (2), Core scraper, *Ensor*
		30-40	"	25,750	2	18	28	Point fragment
		40-60	"	15,450	2	5	36	Preform, Ground stone, Unknown point
		60-70	"	?	0	2	18	-
		70-80	"	?	3	12	25	*Montell*
		80-90	"	4120	1	1	5	-
		90-100	"	1030	0	0	0	Preform
		100-120	"	0.0	0	0	0	-

*Cubic centimeters.
‡One specimen unless otherwise indicated.
1°, primary flake; 2°, secondary flake; Int., interior flake.

Description: The site is a concentration of chipped stone covering an area approximately 1 x 4 m. Artifacts include points, worked chert and flakes.

Investigation: The initial investigation consisted of complete collection of three 1 m^2 units. Subsequent excavations were carried out in eight 1 m^2 units (Fig. 39, Table 12). No hearths or other features were observed.

Occupation Period: Late Archaic, Late Prehistoric.

41 BX 380

Location: Terrace site; permanent water source within .25 km (Cibolo Creek). No chert in vicinity.

Elevation: 1220'

Environment: The soil is a dark clay-loam with some depth. Vegetation includes sparse grasses and dense juniper and live oak forest.

Description: The site measures approximately 30 x 30 m. Chipped stone artifacts include points and flakes with a few bifaces and rare core fragments. Cultural deposits are shallow.

Investigation: Diagnostic artifacts were collected and a 2 m^2 unit was completely collected.

Occupation Period: Late Prehistoric.

41 BX 381

Location: Terrace site; water available within one km (Cibolo Creek). No chert available.

Elevation: 1200'

Environment: Vegetation consists of dense juniper and sparse grasses. The soil is very thin; bedrock is predominant on the surface.

Description: The site is a low density lithic scatter covering an area approximately 150 x 20 m. Artifacts include points, cores, uniface and biface fragments and flakes.

Investigation: In addition to collecting the points, a 3 m^2 unit was completely collected.

Occupation Period: Late Paleo-Indian.

TABLE 12. ARTIFACT PROVENIENCE AT 41 BX 379

	Unit A Surface Collection	Unit B Surface Collection	Unit C Surface Collection	Other Surface Collection	A (E1000, N1000) Water Screened 0-3 cm	D (E1001, N1000) 1/4" Screen 0-2 cm	F (E1001, N1002) 1/4" Screen 0-4 cm	G (E999, ME N1000) MN 1/4" Screen 0-3 cm	H (E999, N1001) 1/4" 0-3 cm	J (E1000, N1003) 1/16" Water Screened 0-4 cm	K (E1000, N1004) 1/4" Screen 0-3 cm
Primary Flakes	7	10	5		18	10	15	9	9	24	5
Secondary Flakes	32	20	27		44	23	56	24	42	88	2
Interior Flakes	92	67	66		279	51	135	54	79	347	43
Biface Fragments	1	1	1		3		4		2		
Retouched Flakes		3	5		1		3	3	2	1	
Scrapers: Side	1										
Side/end			1								
Other		1									
Projectile Points:											
Fragment		4	5			1	2		1		
Frio				1							
Edwards	1			1			2	2		1	1
Scallorn	1	1									
Unfinished				1					1		
Unknown		1		1							
Preform	2		2				2			1	
Core	1		1			1		1			1
Chert Chunks	5	6	14		62	17	50	11	27	60	2
Crude Biface	1										
Chopper							1				

41 BX 382

Location: Upland margin site; a seasonal water supply is available within .25 km; the Cibolo Creek is ca. 0.3 km distant.

Elevation: 1240'

Environment: Vegetation is primarily grassy fields with clumps of live oak and juniper. The soil is very thin, with bedrock predominant.

Description: The site is a lithic scatter encompassing an area ca. 85 x 75 m. Artifacts include points, bifaces, unifaces, core fragments and flakes.

Investigation: All diagnostic artifacts were collected, and a 3 m^2 unit was completely collected. This was placed in a high density section near the center of the site.

Occupation Period: Late Archaic.

41 BX 383

Location: Flood plain site, ca. 50 m south of a water hole in Cibolo Creek (Fig. 36,b). No chert source in area.

Elevation: 1160'

Environment: Vegetation consists of dense but patchy juniper growth, with moderate grass cover. The soil is dark brown clay, approximately 20 to 30 cm deep, with some chert gravel. This is an erosional surface (strath plain).

Description: The site is a large lithic scatter with minimum dimensions of 200 m x 50 m. Chipped stone occurs in several concentrations connected by lower densities of material. Scattered burned rock is visible on the surface.

Investigation: Complete surface collection of 105 m^2 units forming a T-shape was accomplished in hopes of defining activity areas and/or separating different occupations (see Fig. 40). This was not successful, probably because of the partial erosion in the collection area, located between dense juniper stands.

Three units were excavated to determine the depth of cultural deposition. Unit 1 (E991, N1003) was excavated in a single level to a depth of 15 cm. A hearth was located, consisting of a concentration of fire-reddened and fractured limestone. A charcoal sample was recovered, as well as three pieces of chipped stone.

Unit 2 (E998, N1005), excavated to a depth of 35 cm, yielded a fair number of artifacts but no features. Only the upper 10 cm were screened. In spite of this, over a dozen flakes and a biface were recovered from the 30-35 cm level alone.

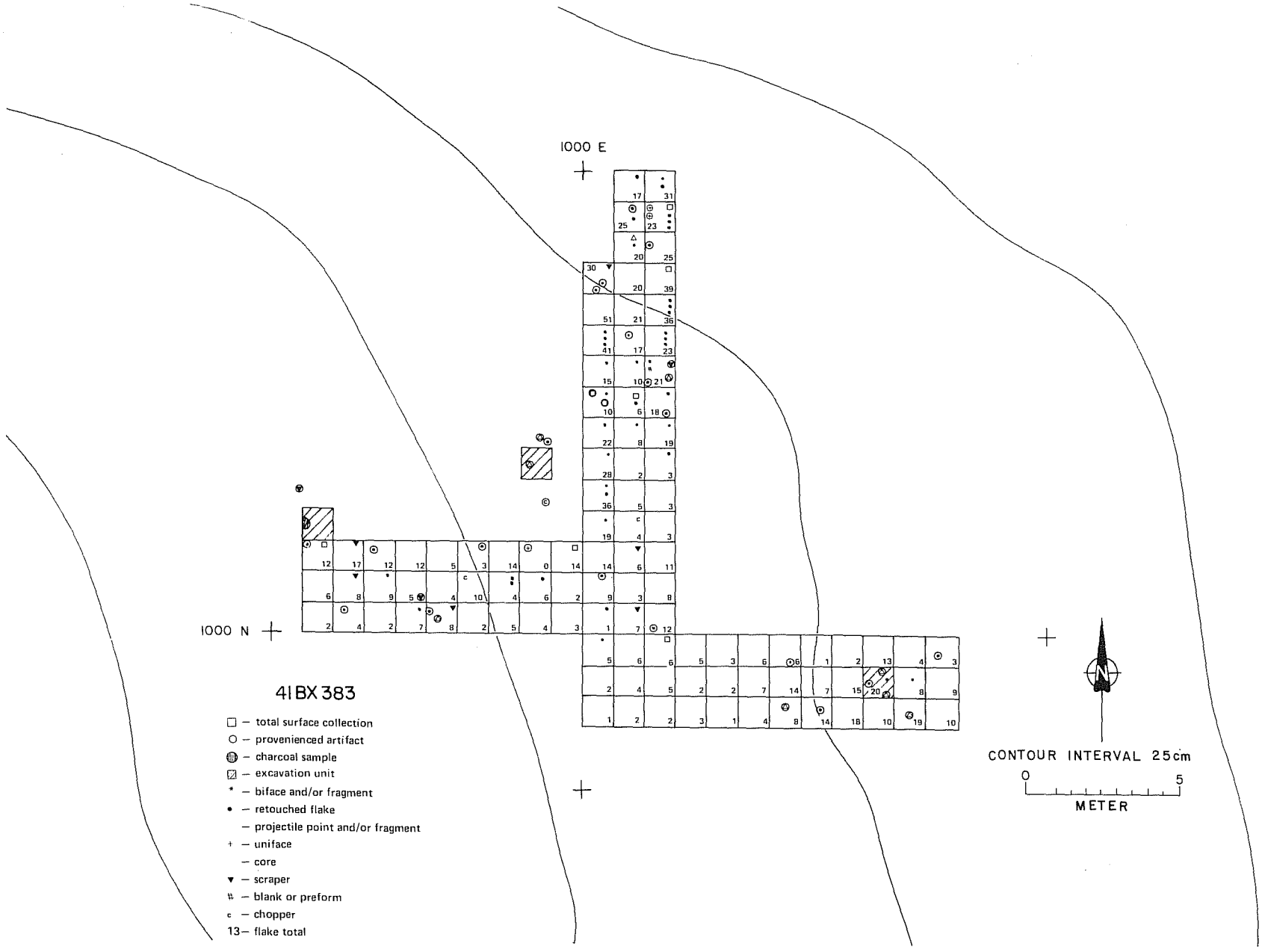


Figure 40. *Controlled Surface Collection Units at Site 41 BX 383, Camp Bullis.*

Unit 3 (E1009, N998) was excavated in two levels to a depth of 10 cm and screened with 1/4-inch mesh screen. The upper level yielded one biface fragment, one retouched flake and 35 flakes. The second level contained five flakes.

It appears that the greatest depth of the cultural material is to the north and west of the collection area. However, the hearth located to the west indicates the possibility of a living area to the west. It must be kept in mind that the collection area represents only a small portion of the site and that more extensive excavations over a larger area may reveal patterns that surface disturbance has destroyed.

Occupation Period: Intensive Late Prehistoric, with a minor Middle and Late Archaic manifestation on the east end of the site.

41 BX 384

Location: Flood plain site with large river cobbles of medium fine chert; water available within one km (Cibolo Creek).

Elevation: 1240'

Environment: Vegetation consists of open grassy fields with clumps of juniper and live oak. The soil is dark and loamy, of undetermined depth. Large chert gravels are present in the soil.

Description: The site is contained within an area measuring ca. 100 x 60 m. Artifacts include quarry blanks, preforms, core and core fragments and flakes.

Investigation: Six 1 m^2 units were completely collected, in addition to other diagnostic artifacts.

Occupation Period: Unknown, but the size of cores and debitage indicates Archaic or earlier production of large quarry blanks and preforms.

41 BX 385

Location: Terrace site; permanent water is available within 100 m (Cibolo Creek). No chert in immediate area.

Elevation: 1190'

Environment: Only very shallow soil is present; the site is mostly on bedrock. Vegetation is mixed juniper and grasslands.

Description: The site contains scattered burned rock and chipped stone. Artifacts include points, bifaces, cores and flakes. The site area is ca. 5 x 2 m; the site has no depth.

Investigation: All diagnostic artifacts were collected as well as a series of five 1 m^2 units.

Occupation Period: Late Prehistoric (Austin phase component).

41 BX 386

Location: Terrace site; seasonal water available within 50 m and a permanent water supply (Cibolo Creek) within 200 m. Medium fine chert cobbles in area.

Elevation: 1210'

Environment: The soil is very thin, overlying bedrock. Vegetation is open grassy fields with dense live oak and juniper clumps.

Description: The site is a lithic scatter measuring approximately 50 x 50 m. Artifacts include an unidentifiable arrow point fragment, bifaces, cores and flakes. The point and tools are concentrated toward one edge of the site.

Investigation: In addition to collecting the diagnostic artifacts, an area measuring 3 x 2 m was completely collected near the site center.

Occupation Period: Late Prehistoric.

41 BX 387

Location: Terrace site; Cibolo Creek affords a permanent water supply within 100 m. No chert resources.

Elevation: 1210'

Environment: Vegetation is the typical terrace covered by juniper and live oak clumps. The soil is a reddish clay with chert nodules present. The soil depth is undetermined.

Description: The site is a lithic scatter covering an area ca. 30 x 6 m. Artifacts include point fragments, bifaces, unifaces, cores and flakes.

Investigation: A 3 m^2 unit was completely collected and all diagnostic artifacts were collected and mapped.

Occupation Period: Late Prehistoric.

41 BX 388

Location: Terrace site; water available within 100 m from two intermittent streams and from the Cibolo Creek, ca. one km distant.

Elevation: 1270'

Environment: The soil is of the reddish clay type with chert gravels present. Vegetation consists of open grassy fields with clumps of juniper and live oak.

Description: This site is a small (15 x 6 m) lithic scatter containing a point, biface fragments, a scraper and flakes. No chert resources.

Investigation: A 3 m^2 unit was completely collected.

Occupation Period: Early Archaic.

41 BX 390

Location: Upland margin site; nearest water source more than one km distant. No chert resources.

Elevation: 1250'

Environment: The area is predominantly limestone bedrock with very thin soil cover. Vegetation consists of woods of live oak, hackberry, huisache, juniper and elm.

Description: The site is a moderate density small lithic scatter with scattered burned rock on the surface. It measures approximately 12 x 17 m, and contains an unidentifiable dart point, biface and core fragments, a preform and flakes.

Investigation: Diagnostic artifacts were collected and mapped. In addition, a 3 m^2 area was completely collected.

Occupation Period: Archaic.

41 BX 391

Location: Terrace site; seasonal water source is available within 100 m (Muesebach Creek).

Elevation: 1175'

Environment: Dark loamy soil of some depth and dense juniper and thorny brush vegetation characterize the area of the site.

Description: The site consists of a large lithic scatter with dimensions of approximately 140 x 90 m. Artifacts include points, cores and core fragments, biface fragments, scrapers, preforms and flakes. Depth of deposits is indeterminate.

Investigation: Artifacts were collected and mapped. A 2 m^2 area was also completely collected.

Occupation Period: Late Paleo-Indian, Early Archaic.

41 BX 392

Location: Upland margin site; nearest seasonal water supply ca. 200 m away, and a permanent source (Cibolo Creek) within one km.

Elevation: 1305'

Environment: Bedrock surface with only very thin soil cover underlies the site. Vegetation is characterized by grassy fields with juniper and live oak brakes.

Description: The site is a small lithic concentration about 5 x 2 m in measurement. Artifacts include a point, unifaces, quarry blanks, biface fragments and flakes.

Investigation: In addition to collecting diagnostic artifacts and special tools, an area measuring 1.5 x 2.5 m was completely collected.

Occupation Period: Late Prehistoric.

41 BX 393

Location: Upland margin site; water source within 100 m.

Elevation: 1320'

Environment: The soil is thin with bedrock predominant. Vegetation consists of grassy fields with juniper and live oak clumps.

Description: The site contains only chipped stone in an area approximately 50 x 50 m. Artifacts include points, biface fragments, scrapers, cores and flakes.

Investigation: A 3 m^2 area was completely collected as well as additional artifacts (Fig. 41,a).

Occupation Period: Unknown.

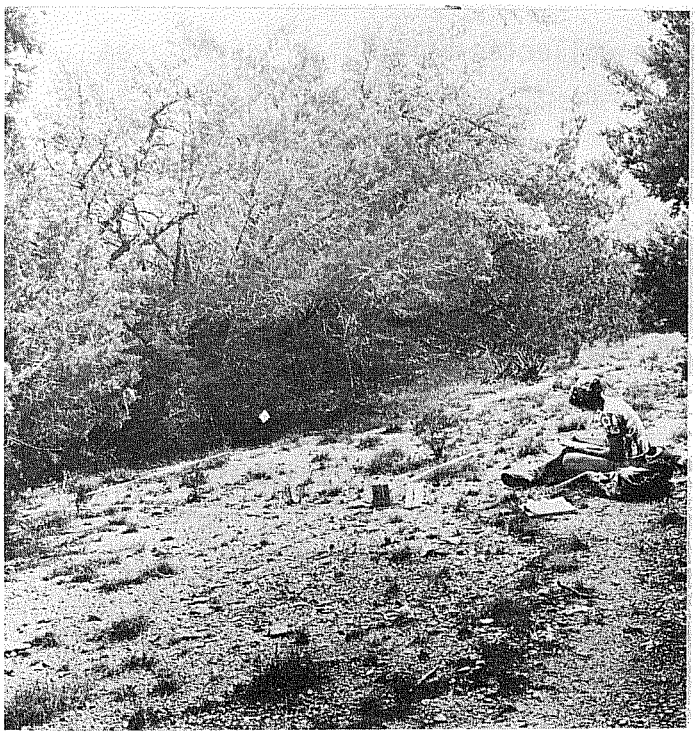
41 BX 395

Location: Upland margin site located along a seasonal stream. The Salado Creek, currently only seasonal, is within one km. Bedded lime chert resources.

Elevation: 1140'

Environment: Bedrock with very thin soil cover is characteristic. Vegetation includes grassy fields with juniper and live oak brakes.

Description: The site is a lithic scatter with dimensions of ca. 40 x 20 m. Chert nodules, cores, preforms and flakes are present.



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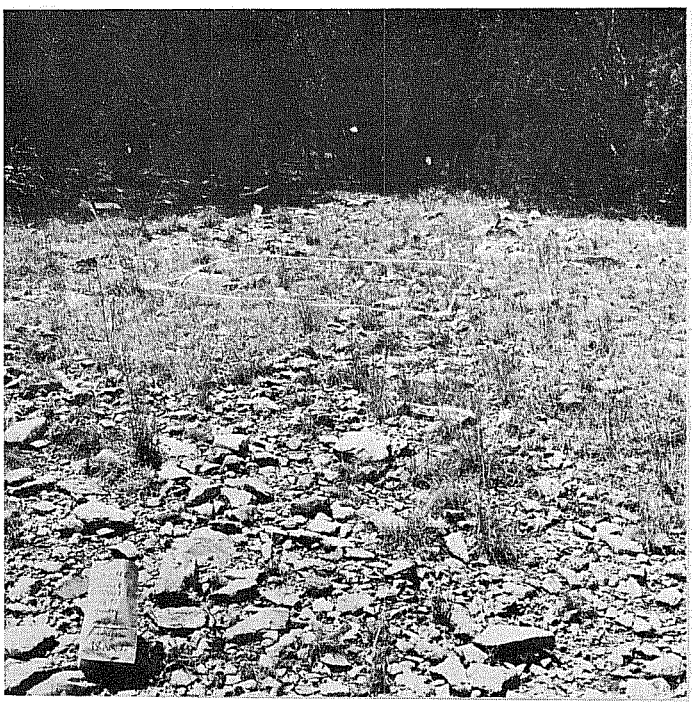

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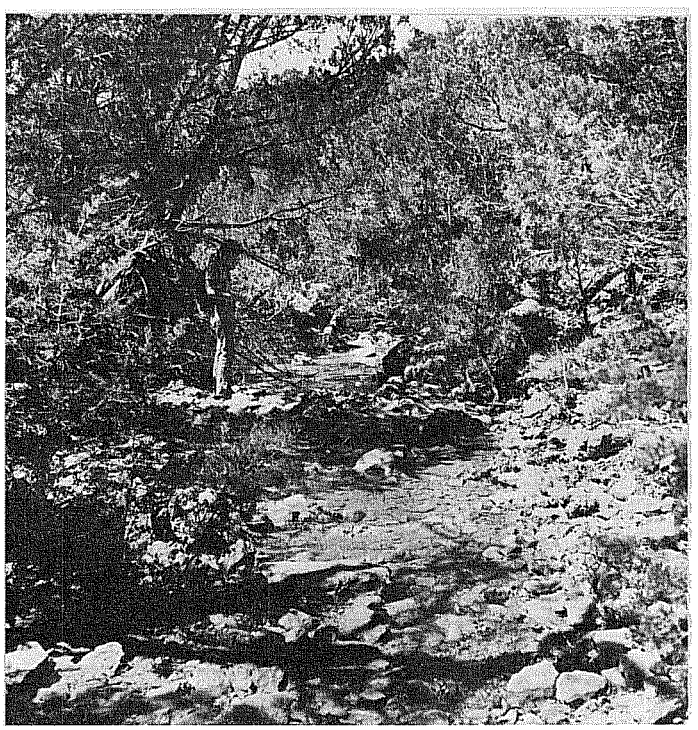

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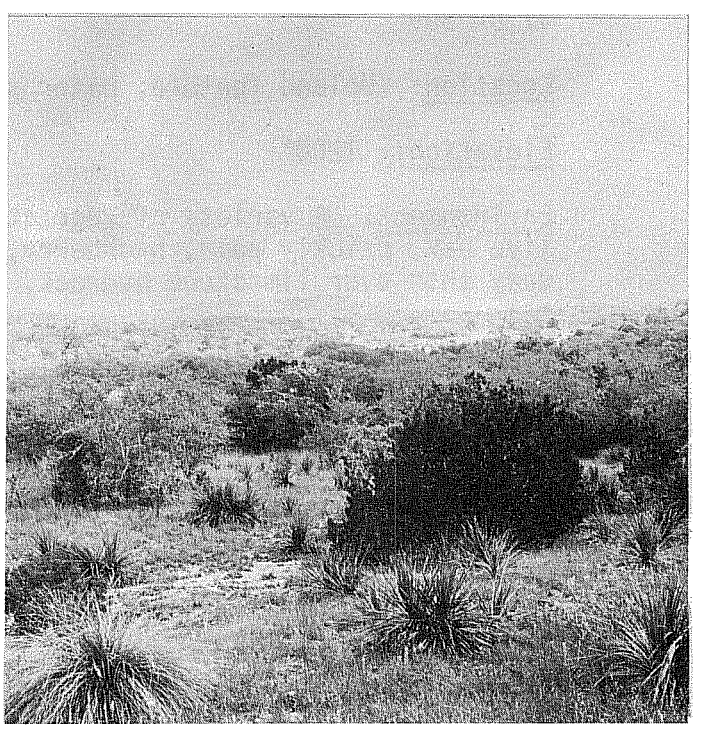

d

Figure 41. *Views of Prehistoric Sites, Camp Bullis.* a, 41 BX 393, view of controlled collection unit; b, 41 BX 395, view of controlled collection unit; c, 41 BX 408, view looking south along Lewis Creek; d, view of area near 41 BX 431.

Investigation: Worked chert artifacts were collected as well as a 2 m^2 area (Fig. 41,b).

Occupation Period: Unknown.

41 BX 396

Location: The site is located on a terrace above a presently seasonal drainage within 100 m of the site. No chert resources.

Elevation: 1140'

Environment: Juniper and live oak brakes are interspersed with grassy areas and prickly pear patches. The soil is a dark loam of considerable depth.

Description: The site is divided into two parts. The northern part has scattered burned rock and chipped stone including points, scrapers, biface fragments, flakes and a possible mano fragment. The southern portion has only chipped stone artifacts including biface fragments, preforms, cores and flakes.

Investigation: Artifacts were collected and mapped from both parts of the site. In the south part, a 50 cm square test pit was excavated to a depth of five cm. The cultural deposits were no deeper than four cm, where the dark loam became reddish clay. In addition a 3 m^2 area was completely surface collected.

Occupation Period: Late Prehistoric.

41 BX 399

Location: Upland feature; water source, Salado Creek, within one km.

Elevation: 1200'

Environment: A variety of vegetation is present, including grasses, juniper, live oak, prickly pear, hackberry, huisache and beargrass. The soil cover is very thin over limestone bedrock, containing abundant chert.

Description: The site is a very low density lithic scatter covering an area approximately 500 x 500 m. Artifacts include unidentifiable dart point fragments, bifaces, scrapers, cores and flakes. Bedded chert provides a lithic resources procurement area.

Investigation: Selected worked chert artifacts were collected in addition to a 2 m^2 area on the south slope of Bush Hill.

Occupation Period: Archaic.

41 BX 400

Location: Terrace site, 100 m south of the south fork of Muesebach Creek, an ephemeral stream.

Elevation: 1260'

Environment: Vegetation consists of juniper and live oak clumps and fields of moderately heavy grass cover. The soil is a rocky dark brown clay.

Description: The site is a lithic scatter measuring approximately 10 x 10 m. Artifacts include points, bifaces, scrapers and flakes.

Investigation: Initial investigation involved complete surface collection of a 3 m^2 area and excavation of a 1 m^2 unit to a depth of five cm. Further activities include horizontal excavations consisting of a block of four 1 m^2 units and a second block of five 1 m^2 units (Fig. 42, Table 13). No hearths or other features were observed. The density of land snails was very high and almost exclusively *Rabdotus sp.* Their significance is unknown.

Occupation Period: Early Archaic, Late Archaic, Late Prehistoric.

41 BX 402

Location: Upland margin site; water is available seasonally from Salado Creek, within one km.

Elevation: 1205'

Environment: Vegetation includes woods of live oak, hackberry, huisache, juniper and elm. Red clay soil with chert gravel is present.

Description: The site covers an area approximately 40 x 30 m and has a high density of chipped stone, one mano and scattered burned rock. Chipped stone artifacts include points, bifaces, scrapers, cores and flakes.

Investigation: All worked chert was collected and mapped. A 3 m^2 area was completely collected.

Occupation Period: Pre-Archaic, Late Archaic.

41 BX 403

Location: Valley slope site; seasonal drainage near the site. The Salado Creek is within one km.

Elevation: 1140'

Environment: Very thin soil overlying bedrock supports a vegetation cover consisting of grassy fields with clumps of live oak and juniper.

Description: The site is a chipped stone scatter with dimensions of ca. 60 x 40 m. Artifacts include points, bifaces, a perforator and flakes. Scattered burned rock is present.

Investigation: Worked chert was collected and mapped.

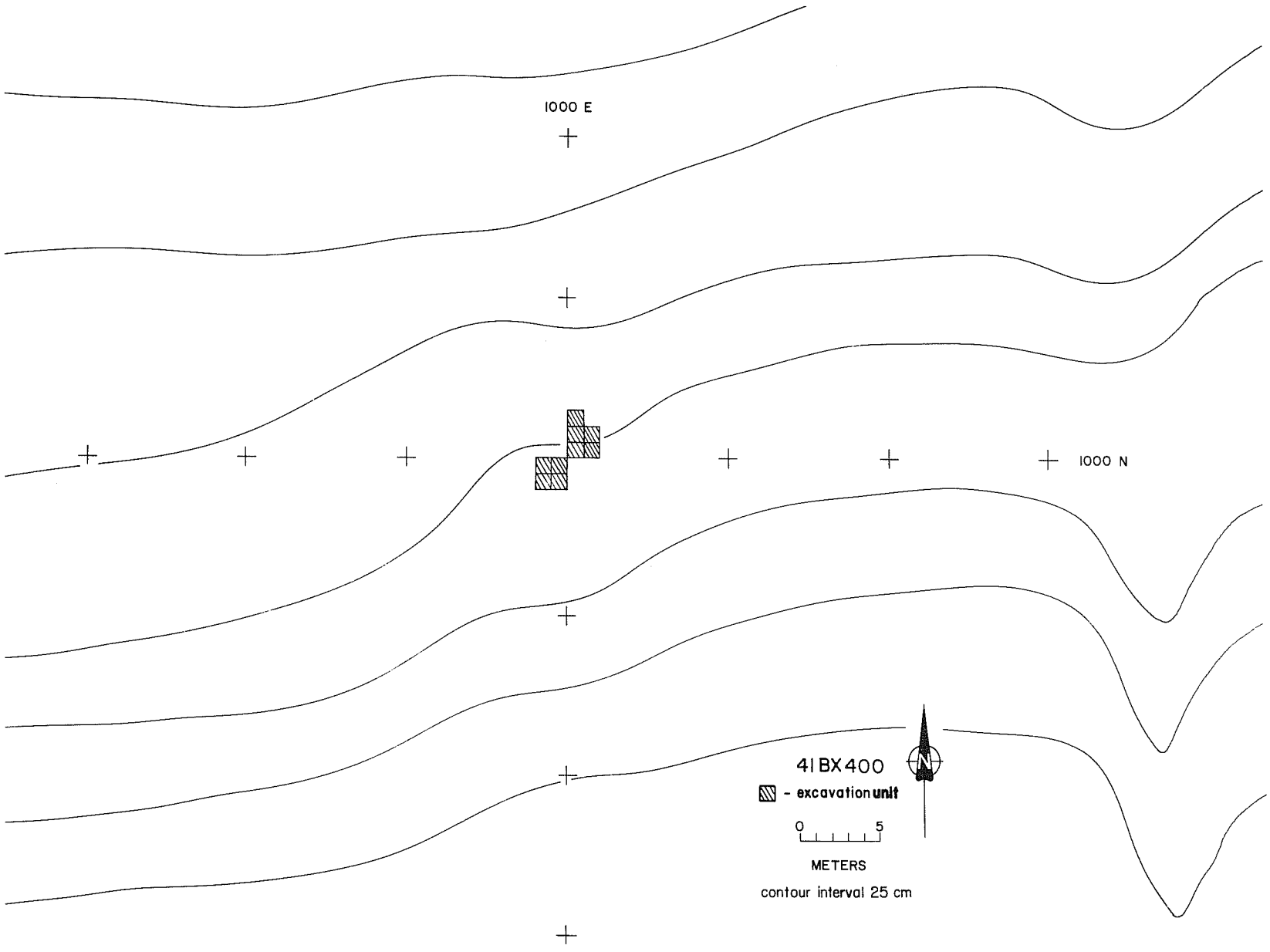

Figure 42. *Site 41 BX 400, Camp Bullis*

TABLE 13. ARTIFACT PROVENIENCE AT 41 BX 400

	3x3 M Surface Collection	1x1 M Unscreened Test: 0.5 cm	1 (E1000, N1000) 1/8" Screen 0-5cm	1 (E1000, N1000) 1/8" Screen 5-10cm	2 (E1000, N1001) 1/4" Screen 0-5 cm	3 (E1001, N1000) 1/4" Screen 0-5 cm	4 (E1001, N1001) 1/4" Screen 0-5cm	4 (E1001, N1001) 1/4" Screen 5-10cm	5 (E998, N999) 1/4" Screen 0-5 cm	6 (E998, N999) 1/4" Screen 0-5 cm	7 (E999, N998) 1/4" Screen 0-5 cm	8 (E998, N998) 1/8" Screen 0-5 cm	9 (E1000, N1002) 1/8" Screen 0-5 cm
Primary Flakes	3												
Secondary Flakes	12	5	12	6	18	24	14	5	16	9	7	1	6
Interior Flakes	20	7	65	21	36	30	35	19	61	39	35		42
Biface Fragment			1		1		2		1	1			
Retouched Flakes						1							
Scrapers: Side	8												
End/side	1												
End	2												
Concave	1												
Points: *Travis*	1												
Scallorn													1
Ensor	1												
Edwards			1									1	
Unknown	1												
Preforms	5								1				
Core								1					
Manos								1					
Chert Chunks	3												
Metal											1		

Occupation Period: Late Paleo-Indian, Pre-Archaic, Early Archaic, Middle Archaic.

41 BX 404

Location: Upland site between two seasonal tributaries of Salado Creek. Salado Creek is within one km of the site.

Elevation: 1140'

Environment: Grassy fields and clumps of juniper and live oak are supported by very thin soil cover overlying bedrock.

Description: The site is a lithic scatter with dimensions of approximately 600 x 100 m. Artifacts include bifaces, choppers, quarry blanks, cores and flakes. A concentration of quarry blanks and flakes were noted. Chert nodules are eroding from Edwards Limestone.

Investigation: A 2 m^2 area in the approximate site center was completely collected as well as a 1 m^2 area from the subconcentration.

Occupation Period: Unknown.

41 BX 405

Location: Upland margin site; seasonal tributary of Salado Creek ca. 30 m from the site.

Elevation: 1100'

Environment: Vegetation is composed of grassy fields with clumps of live oak and juniper. Prickly pear and yucca/sotol are also present. The soil is reddish clay with chert gravels.

Description: The site is a small lithic scatter covering an area ca. 25 x 20 m. Artifacts include cores, core fragments and flakes. No tools were observed.

Investigation: No collection was made.

Occupation Period: Unknown.

41 BX 406

Location: Valley slope site; seasonal water supply available within one km.

Elevation: 1070'

Environment: Vegetation consists of grassy fields with juniper and live oak clumps. Bedrock is predominant with very thin soil cover.

Description: The site is a moderate density lithic scatter covering an area ca. 200 x 350 m. Cores, core fragments and flakes are common. One bifacial scraper and retouched flakes were also found.

Investigation: No collection was made.

Occupation Period: Unknown.

41 BX 407

Location: Upland margin site; seasonal water supply approximately 400 m away.

Elevation: 1190'

Environment: Vegetation includes grasses and juniper and live oak stands plus prickly pear and yucca/sotol. Soil cover is very thin.

Description: The site is a moderate density lithic concentration covering an area approximately 50 x 25 m. Points, bifaces, quarry blanks, gravers, cores and flakes are present.

Investigation: A 3 m^2 area was completely collected.

Occupation Period: Pre-Archaic, Late Archaic.

41 BX 408

Location: Terrace site; water source (Lewis Creek) within 100 m (Fig. 41,c). No chert resources.

Elevation: 1210'

Environment: Ground cover consists of juniper and grasses. Reddish clay soil is present.

Description: The site is a moderate density lithic scatter with dimensions of ca. 20 x 15 m. Points, bifaces, preforms, scrapers and flakes are present.

Investigation: A 3 m^2 area was completely collected.

Occupation Period: Late Paleo-Indian, Middle Archaic.

41 BX 409

Location: Terrace site; water available within one km.

Elevation: 1070'

Environment: Vegetation consists of juniper and grassland. Bedrock is predominant with very thin soil cover.

Description: The site is small (30 x 18 m) and contains scattered chipped stone and burned rock. Points, bifaces, preforms, quarry blanks, scrapers, cores and core fragments, a *Guadalupe* tool and flakes are present.

Investigation: A 3 m^2 area was completely collected in addition to other tools and diagnostics.

Occupation Period: Pre-Archaic, Late Archaic.

41 BX 410

Location: Terrace site; Panther Springs Creek ca. 220 m distant.

Elevation: 1060'

Environment: Juniper and grassland vegetation is supported by dark clay-loam soil of indeterminate depth.

Description: The site is a lithic concentration measuring ca. 30 x 15 m. Artifacts include bifaces, unifaces, preforms, quarry blanks, core fragments and flakes.

Investigation: Worked chert was collected and mapped as well as a 5 m^2 area.

Occupation Period: Unknown.

41 BX 411

Location: Terrace site; seasonal water supply from Panther Springs Creek and a tributary stream, ca. 350 to 500 m distant.

Elevation: 1040'

Environment: The soil is very thin; bedrock outcrops are common. Vegetation is primarily juniper and grassland.

Description: The site is a lithic concentration covering an area of approximately 80 x 80 m. Artifacts include bifaces, quarry blanks, core and core fragments and flakes.

Investigation: A 1 m^2 area was completely collected.

Occupation Period: Unknown.

41 BX 412

Location: Terrace site; approximately 270 m from Panther Springs Creek, a seasonal water supply.

Elevation: 1060'

Environment: The area is predominantly bedrock, with a very thin and patchy soil cover. Vegetation consists of juniper and grassland.

Description: The site is a lithic scatter covering an area approximately 35 x 20 m. Artifacts include bifaces, quarry blanks, scrapers, core fragments and flakes.

Investigation: A 3 m^2 area was completely collected in addition to other worked chert and diagnostic artifacts.

Occupation Period: Unknown.

41 BX 412

Location: Terrace site; water available within one km.

Elevation: 1070'

Environment: Clumps of juniper and live oak interspersed with grassy fields are the characteristic vegetation. The soil is a dark loam of indeterminate depth.

Description: The site is a lithic concentration within an area of ca. 30 x 15 m. Artifacts include bifaces, scrapers and flakes.

Investigation: Worked chert artifacts were collected and mapped. A 3 m^2 area was completely collected.

Occupation Period: Unknown.

41 BX 414

Location: Upland margin site; seasonal water supply within 100 m and the Salado Creek approximately one km away.

Elevation: 1150'

Environment: Vegetation consists of grassy fields with clumps of juniper and live oak. Thin soil overlies limestone bedrock.

Description: The site is a lithic scatter covering an area approximately 200 x 100 m. Artifacts include cores, core fragments and flakes.

Investigation: Two adjacent 1 m^2 areas were completely collected.

Occupation Period: Unknown.

41 BX 415

Location: Terrace site, approximately 500 m from Panther Springs Creek.

Elevation: 1150'

Environment: Vegetation consists of open grassy fields with juniper and live oak clumps. The soil is dark and loamy.

Description: The site is a lithic scatter spread out over an area approximately 400 x 300 m. Artifacts include quarry blanks and flakes.

Investigation: A 3 m^2 area was completely collected.

Occupation Period: Unknown.

41 BX 416

Location: Terrace site; seasonal water supply within one km.

Elevation: 1130'

Environment: Juniper and live oak brakes are supported by reddish clay soil of indeterminate depth.

Description: The site is a lithic concentration scattered over a 20 x 15 m area. Artifacts include flakes and chert chunks.

Investigation: A 2 m^2 area was completely collected.

Occupation Period: Unknown.

41 BX 417

Location: Terrace site; nearest water source (seasonal) less than one km distant.

Elevation: 1100'

Environment: Vegetation consists of grassy fields with live oak and juniper clumps. Bedrock is predominant with very thin soil cover.

Description: The site is a lithic concentration with flakes and core fragments present. The site area is approximately 20 x 10 m.

Investigation: No collection was made.

Occupation Period: Unknown.

41 BX 418

Location: Terrace site; seasonal water source within 100 m.

Elevation: 1100'

Environment: Dark loamy soil with a vegetation cover of grassy fields and juniper and live oak brakes.

Description: The site covers an area approximately 40 x 40 m and contains chipped stone artifacts, including cores and flakes.

Investigation: Two adjacent 1 m^2 areas were completely collected.

Occupation Period: Unknown.

41 BX 419

Location: Upland margin lithic resources procurement site; seasonal tributary of Salado Creek ca. 200 m distant.

Elevation: 1140'

Environment: Vegetation includes grassy fields with juniper and live oak clumps. Bedrock is predominant with a very thin soil cover.

Description: The site is a lithic concentration covering an area ca. 60 x 50 m. Chipped stone includes bifaces, preforms, scrapers, cores and flakes.

Investigation: Worked chert artifacts were collected and mapped and a 2 m^2 area was completely collected.

Occupation Period: Unknown.

41 BX 421

Location: Upland site; seasonal water supply available 300 to 400 m distant and the Salado Creek approximately 1.25 km away.

Elevation: 1150'

Environment: Vegetation is composed of grassland with juniper and live oak brakes. The soil is very thin, overlying bedrock.

Description: The site is a lithic concentration with an area of approximately 50 x 40 m. Artifacts include cores, core fragments, flakes, scrapers and bifaces.

Investigation: A 2 m^2 area was completely collected and other artifacts were collected and mapped.

Occupation Period: Unknown.

41 BX 423

Location: Upland site; water available more than one km distant.

Elevation: 1200'

Environment: Vegetation includes live oak, huisache, juniper, prickly pear and yucca/sotol. Bedrock predominates, with very thin soil cover.

Description: The site consists of chipped stone scattered over an area ca. 40 x 20 m. Artifacts include bifaces, cores and flakes.

Investigation: A 3 x 2 m area was completely collected along with other artifacts.

Occupation Period: Unknown.

41 BX 424

Location: Valley slope site; seasonal drainage near the site and Panther Springs Creek ca. 300 m distant.

Elevation: 1275'

Environment: Vegetation consists of live oak, huisache, juniper, prickly pear and yucca/sotol. The soil is very thin with bedrock outcrops.

Description: The site is a lithic scatter covering an area 40 x 40 m. Artifacts include points and flakes.

Investigation: In addition to a collection of diagnostic artifacts, a 2 m^2 area was completely collected.

Occupation Period: Late Paleo-Indian.

41 BX 425

Location: Terrace site located within 100 m of Cibolo Creek. A water hole provides a permanent supply currently. The creek was probably much higher at the time of site occupation (Fig. 43,a).

a

b

c

Figure 43. *Views of Prehistoric Sites, Camp Bullis.* a, 41 BX 425, meter stick lies at a profile cleared along roadcut through site; b, 41 BX 428, general view looking south; c, 41 BX 428, profile of east wall of Unit 2 at 110 cm.

Elevation: 1180'

Environment: The site is covered and surrounded by dense juniper growth and sparse grass cover. The soil is very thick, alluvially deposited reddish sandy silt.

Description: The site is recognizable in a jeep road cut through the terrace which has exposed the layer of burned rock making up the site. No artifacts are visible on the surface.

Investigation: Initial investigation consisted of a shovel test in the north-central part of the site, taken to a depth of 35 cm and unscreened. A flake, a *Pedernales* point and a broken mano were recovered, and some charcoal was noted.

Further testing involved the excavation of six 1 m^2 units placed in a row across the northwestern portion of the site (Fig. 44). The jeep road profile was cleaned and mapped (Fig. 45).

The excavations indicated that the burned rock layer was formed on a hill sloping to the east. The thickness of the burned rock varies from 20 to 30 cm. It is 10 cm deep in the western portion of the excavations, increasing to 80 cm deep in the eastern end. A hearth-like feature was uncovered in the western half, consisting of a concentration of smaller burned rock fragments in a pile. No definite outline or structure could be identified.

Table 14 presents the provenience of artifacts recovered as well as the volume of burned rock in each level.

Occupation Period: Early Archaic through Late Prehistoric.

41 BX 426

Location: Terrace site; water source (seasonal) within one km.

Elevation: 1210'

Environment: Reddish clay soil is present with a vegetation cover of woods of live oak, hackberry, huisache, juniper and elm.

Description: The site is a lithic concentration approximately 20 x 20 m. Artifacts include points, biface fragments, preforms, core fragments and flakes.

Investigation: Worked chert artifacts were collected as well as an area measuring 3 x 1 m.

Occupation Period: Early Archaic, Late Prehistoric.

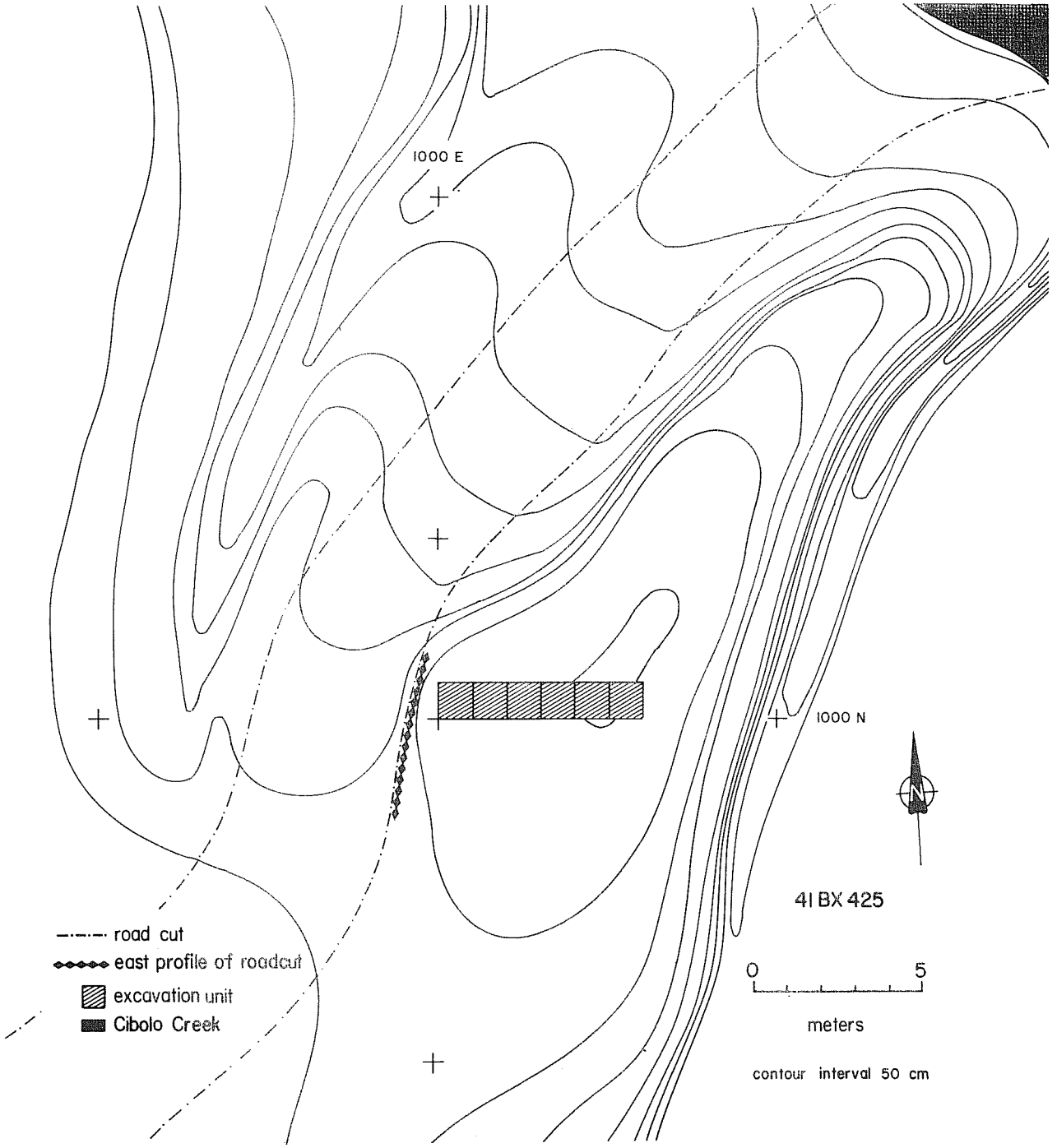

Figure 44. *Site 41 BX 425, Camp Bullis.*

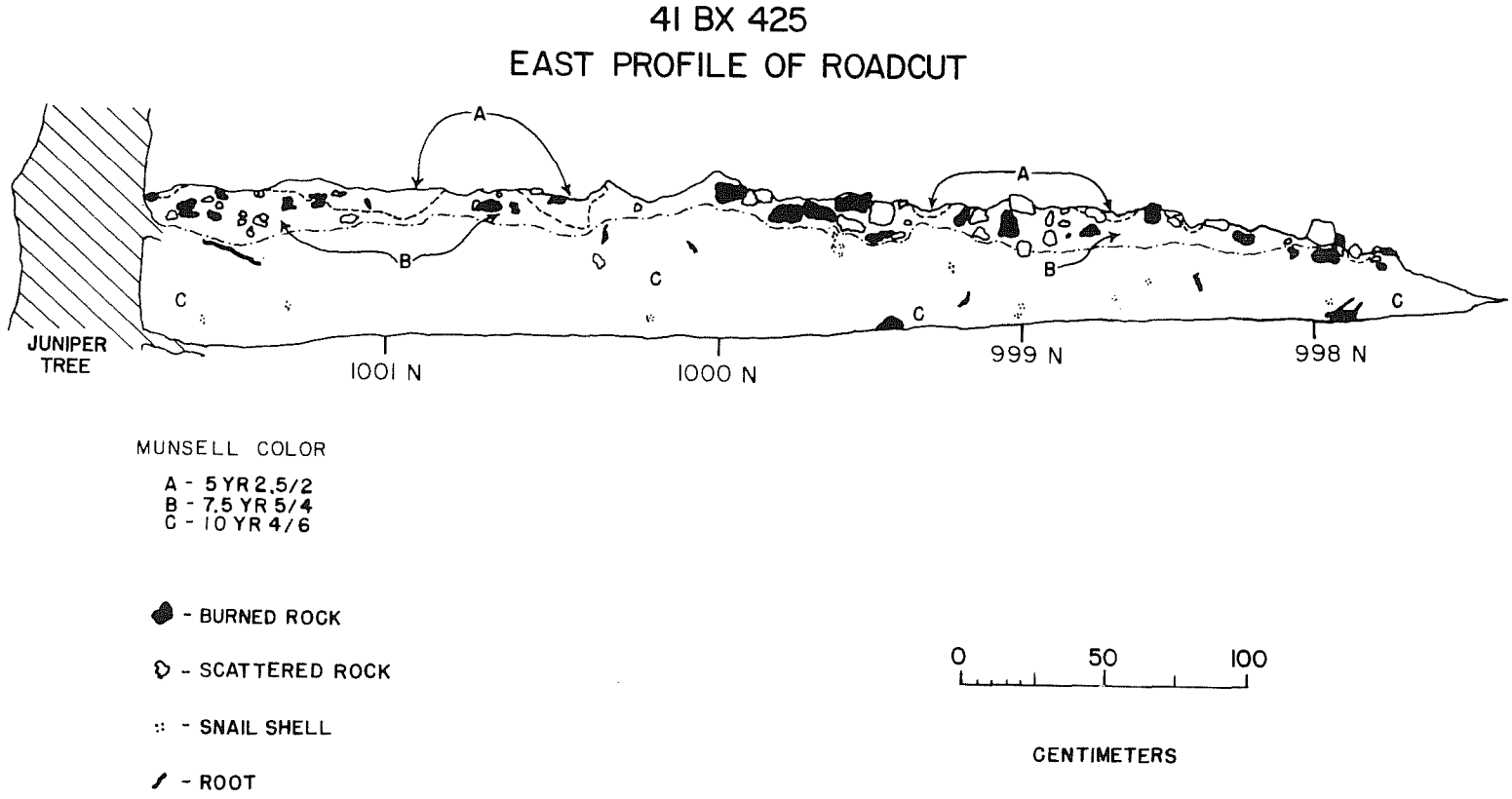

Figure 45. *Site 41 BX 425, Camp Bullis: East Profile.* The east profile along the road cut at site 41 BX 425 is shown. See Fig. 44 for location of this profile within the site.

TABLE 14. ARTIFACT PROVENIENCE AT 41 BX 425

Unit	Depth below Datum	Level (cm)	Screen Size	Vol. of Burned Rock*	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
A (E1000, N1000)	41 cm	0-5	1/4"	4120	5	7	40	-
		5-10	1/8"	8858	0	0	15	-
		10-15	?	?	0	2	10	-
B (E1001, N1000)	33 cm	0-10	1/4"	1030	1	5	21	-
		10-20	"	2678	2	3	14	-
		20-25	1/8"	8858	0	1	8	-
		25-30	"	8240	2	0	9	-
		30-35	"	10,300	0	0	5	Quarry blank
		35-40	"	6798	0	0	7	Mussel fragment
		40-45	"	4120	0	1	0	-
C (E1002, N1000)	24 cm	0-10	1/4"	15,450	0	7	11	*Nolan*
		10-20	"	20,600	1	2	21	-
		20-30	"	20,600	0	3	7	Quarry blank
D (E1003, N1000)	11 cm	0-10	"	206	0	1	1	-
		10-20	"	5768	1	5	52	Ground stone
		20-30	"	7210	0	17	103	Thinned biface, *Marcos*
		30-40	"	22,660	0	10	39	Thinned biface
		40-50	"	6180	0	1	39	-
E (E1004, N1000)	4 cm	0-10	"	?	0	1	5	-
		10-20	"	1030	7	15	69	-
		20-30	"	618	3	13	73	*Perdiz* (2), Unknown point
		30-40	"	1648	0	3	21	-
		40-50	"	2060	0	6	34	Quarry blank
		50-60	"	16,480	2	6	23	Thinned biface, Point fragment, Unknown point
		60-70	"	16,480	0	0	13	-
		70-80	"	3090	0	0	12	-
		80-90	"	2060	0	0	12	-
F (E1005, N1000)	0 cm	0-10	"	?	0	0	0	-
		10-20	"	?	3	16	57	Biface core

*Cubic centimeters.
‡One specimen unless otherwise indicated.

1°, primary flake; 2°, secondary flake; Int., interior flake.

41 BX 428

Location: Terrace site; spring located 50 m south of the site (presently seasonal flow).

Elevation: 1105'

Environment: Dense vegetation surrounds the site, including live oak, hackberry, huisache, pecan, elm and juniper. Sotol is present in the neighboring hills (Fig. 43,b). The soil is dark and deep clay-loam.

Description: The site is a burned rock accumulation with a slight depression in the center. The diameter of the mound is ca. 15 m; its elevation above the ground surface is approximately 1.5 m. Few artifacts were located on or around the accumulation.

Investigation: Initial investigation involved survey, mapping and excavation of a 1 m^2 area near the eastern edge of the mound. A *Castroville* projectile point was found on the surface.

Subsequent testing included a series of eight shovel tests around the site to determine its boundaries, and the excavation of four 1 m^2 units, two in the burned rock accumulation and two to the north of it (Fig. 46). A profile of Unit 2 is illustrated in Fig. 43,c.

To the north of this mound, a hearth was uncovered at 40 cm below the ground surface. This cluster of burned rock was associated with a higher frequency of chipped stone than above or around it.

The two test units to the north of the burned rock accumulation yielded altogether a larger quantity of flakes and tools than the fill from the mound. Very likely, this was the living area, with the burned rock pile possibly representing food processing activities or a refuse heap (Fig. 46).

Table 15 provides artifact and provenience data as well as the volume of burned rock.

Occupation Period: Early Archiac, Late Archaic.

41 BX 429

Location: Terrace site; nearest water source more than one km distant.

Elevation: 1125'

Environment: Reddish clay soil is present, with a ground cover consisting of grassy fields and juniper and live oak clumps.

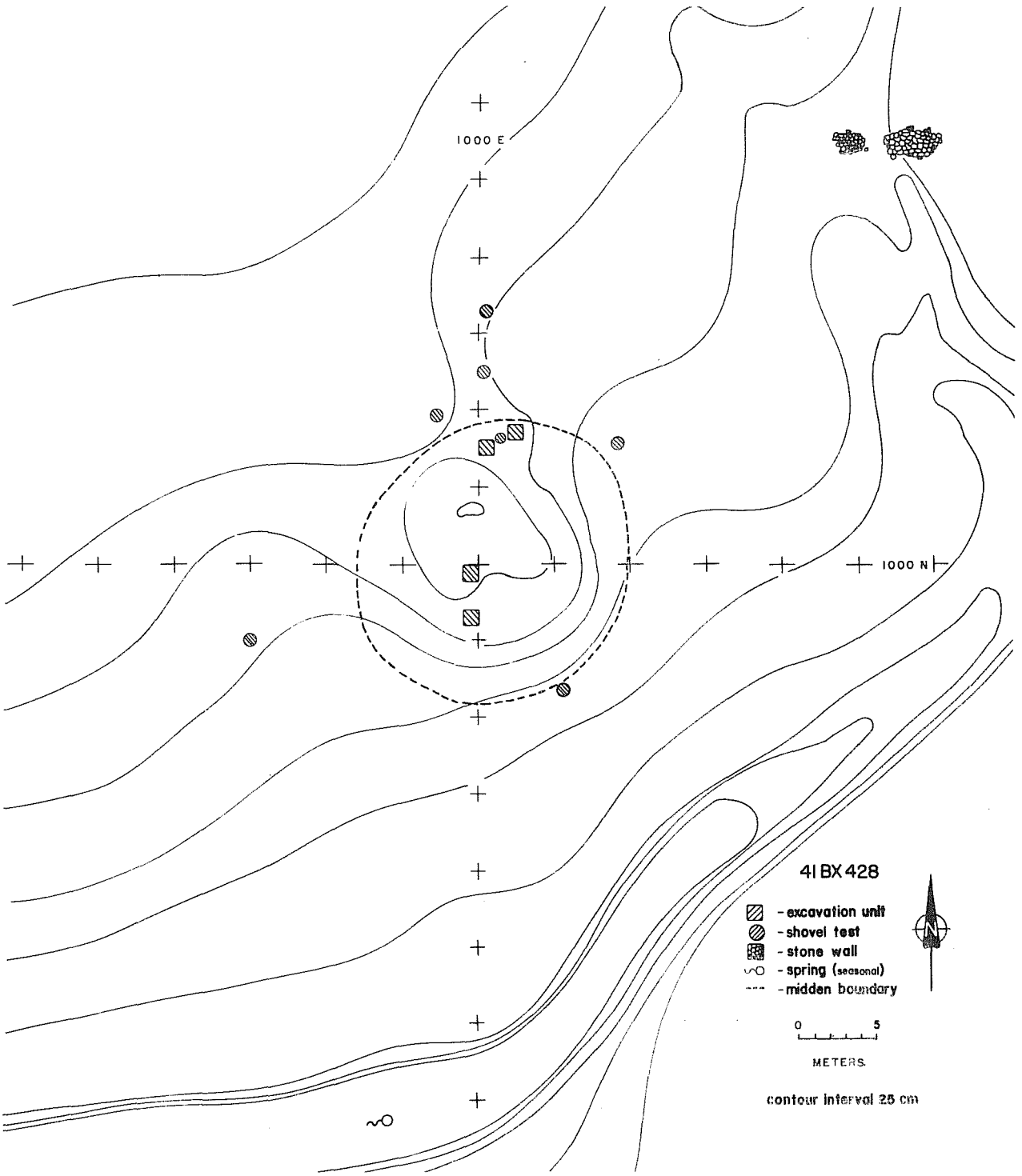

Figure 46. *Site 41 BX 428, Camp Bullis.*

TABLE 15. ARTIFACT PROVENIENCE AT 41 BX 428*

Unit	Depth below Datum	Level (cm)	Volume of Burned Rock**	Flakes 1°	Flakes 2°	Flakes Int.	Other Lithics‡
1 (E999, N996)	17 cm	0-10	82,400	0	1	1	Retouched flake
		10-20	51,500	0	0	0	Biface fragment
		20-30	72,100	0	1	1	Ground stone
		30-40	79,310	0	0	1	-
2 (E999, N999)	0 cm	0-10	2060	1	0	13	-
		10-20	22,660	1	4	41	Point fragment, Biface fragment, Retouched flake, Chunk
		20-30	46,350	0	1	10	-
		30-40	82,400	0	4	5	*Travis*
		40-50	106,090	0	0	7	-
		50-60	41,200	0	1	8	-
		60-70	61,800	1	2	9	-
		70-80	80,340	0	0	7	-
		80-90	39,140	0	0	13	-
		90-100	20,600	0	0	4	-
		100-110	28,840	0	0	3	-
3 (E1000, N1007)	19 cm	0-10	618	2	8	144	*Wells*, Retouched flake, Biface preform, Biface fragment
	1	10-20	3090	1	8	81	Retouched flake, Biface fragment, Chunk (2)
		20-30	7210	2	10	99	Core (2), Biface fragment, *Nolan*
		30-40	1648	0	5	20	Retouched flake
		40-50(1/2)	4120	1	5	64	Retouched flake, Point fragment, Biface fragment
	feature	40-50	12,978	3	16	55	Core fragment, Retouched flake
4 (E1002, N1008)	37 cm	0-10	618	4	7	24	-
		10-20	1648	0	11	23	Ground stone
		20-30	15,450	2	6	33	Thinned biface, Retouched flake (4)
		30-40	15,450	15	67	193	Preform, End scraper, Retouched flake (2), Biface fragment (2)

*1/4" screen used on all units.
**Cubic centimeters.
‡One specimen unless otherwise indicated.
1°, primary flake; 2°, secondary flake; Int., interior flake.

Description: The site is a lithic scatter containing bifaces, preforms, choppers, core fragments and flakes. The area is approximately 500 x 40 m. Several areas of higher density lithics were observed.

Investigation: General surface collections were made and a 50 cm square area was completely collected within a subconcentration.

Occupation Period: Unknown.

41 BX 430

Location: Terrace site; water available within one km.

Elevation: 1180'

Environment: Dark loamy soil is present, with vegetation consisting of woods of live oak, hackberry, huisache, juniper and elm.

Description: The site is a burned rock midden ca. 25 m in diameter. Very few lithic artifacts were observed; these included a scraper.

Investigation: A shovel test (unscreened) was placed in the center of the mound to a depth of 30 cm. No chert was recovered.

Occupation Period: Unknown.

41 BX 431

Location: A terrace site; small spring located just north and west of the site (presently seasonal) forming a stream tributary of Panther Springs Creek. Permanent water source within one km (Fig. 41,d).

Elevation: 1135'

Environment: Vegetation includes grassy fields and juniper and live oak brakes. The soil cover is very thin.

Description: Chipped stone and burned rock are scattered over an area approximately 75 x 75 m.

Investigation: At the time of initial recording, a biased "grab" sample of artifacts was collected but not mapped. A single test pit was excavated in the western portion of the site to a depth of 10 cm, in two levels. The first level yielded a biface fragment, a retouched flake and 42 debitage flakes (all but six are interior flakes). The second level yielded 45 flakes, of which 37 are interior flakes.

Occupation Period: Unknown.

41 CM 70

Location: Flood plain site with river cobble chert nearby; permanent water source (Cibolo Creek) less than 100 m distant.

Elevation: 1235'

Environment: Dark loamy soil with chert gravels is present, with a vegetation cover of live oak, hackberry, huisache, juniper and elm woods.

Description: The site contains scattered lithic artifacts and burned rock. Artifacts include points and flakes.

Investigation: Diagnostic artifacts were collected and mapped. A 3 m^2 area was completely collected and a 50 cm^2 unit was excavated to 10 cm depth, where bedrock was encountered.

Occupation Period: Early Archaic, Middle Archaic, Late Archaic.

41 CM 94

Location: Terrace site; permanent water supply (Cibolo Creek) within one km.

Elevation: 1210'

Environment: Dark loamy soil is present, covered by woods of live oak, juniper, huisache, hackberry and elm.

Description: The site is a lithic concentration confined to an area ca. 20 x 20 m. Artifacts include points, biface fragments, unifaces, scrapers and flakes.

Investigation: Diagnostic artifacts were collected and mapped and an area measuring 5 x 3 m was completely collected.

Occupation Period: Archaic, Late Prehistoric.

41 CM 96

Location: Flood plain site; permanent water supply (Cibolo Creek) within 100 m.

Elevation: 1205'

Environment: Reddish clay soil with chert gravels is characteristic. Vegetation includes grassland and juniper.

Description: The site is a lithic concentration covering an area approximately 20 x 20 m. Scattered burned rock, bifaces and flakes are present. A single point was found (*Big Sandy*-like).

Investigation: Only the point was collected.

Occupation Period: Unknown.

41 CM 98

Location: Terrace site approximately 300 m from Cibolo Creek, a permanent water supply.

Elevation: 1220'

Environment: Ground cover consists of grassy fields and clumps of live oak and juniper. Prickly pear and yucca/sotol are also present. Reddish clay soil is of moderate depth.

Description: Scattered burned rock and a high density of chipped stone are confined to an area ca. 60 x 40 m. Artifacts include bifaces, unifaces, quarry blanks, cores and flakes.

Investigation: No collection was made.

Occupation Period: Unknown.

41 CM 99

Location: Terrace site; nearest water supply within one km of Cibolo Creek. A small side drainage (seasonal) is near the site.

Elevation: 1220'

Environment: Grassland and juniper growth are supported by reddish clay soil.

Description: The site contains scattered burned rock and chipped stone artifacts within an area approximately 50 x 35 m. Two concentrations are apparent: a well-defined Late Prehistoric area within a scattered Archaic occupation.

Investigation: Initial investigation included the complete collection of a 5 m^2 area in the Late Prehistoric concentration. A 15 cm^2 area was also shovel tested, although unscreened. This shovel test was located two m northeast of the collection area. Flakes were present in the upper 15 cm of the test; the excavations went down to 30 cm depth.

Subsequent testing was performed in the Late Prehistoric artifact concentration. This consisted of three 1 m^2 units, one of which was partially superimposed over another (Fig. 47). A hearth was excavated in the .5 m^2 area of overlap which extended into the diagonally adjacent square. The hearth consisted of a pile of burned rocks without any apparent structural pattern.

Table 16 presents the artifacts recovered from each level.

Occupation Period: Middle Archaic, Late Archaic, Late Prehistoric.

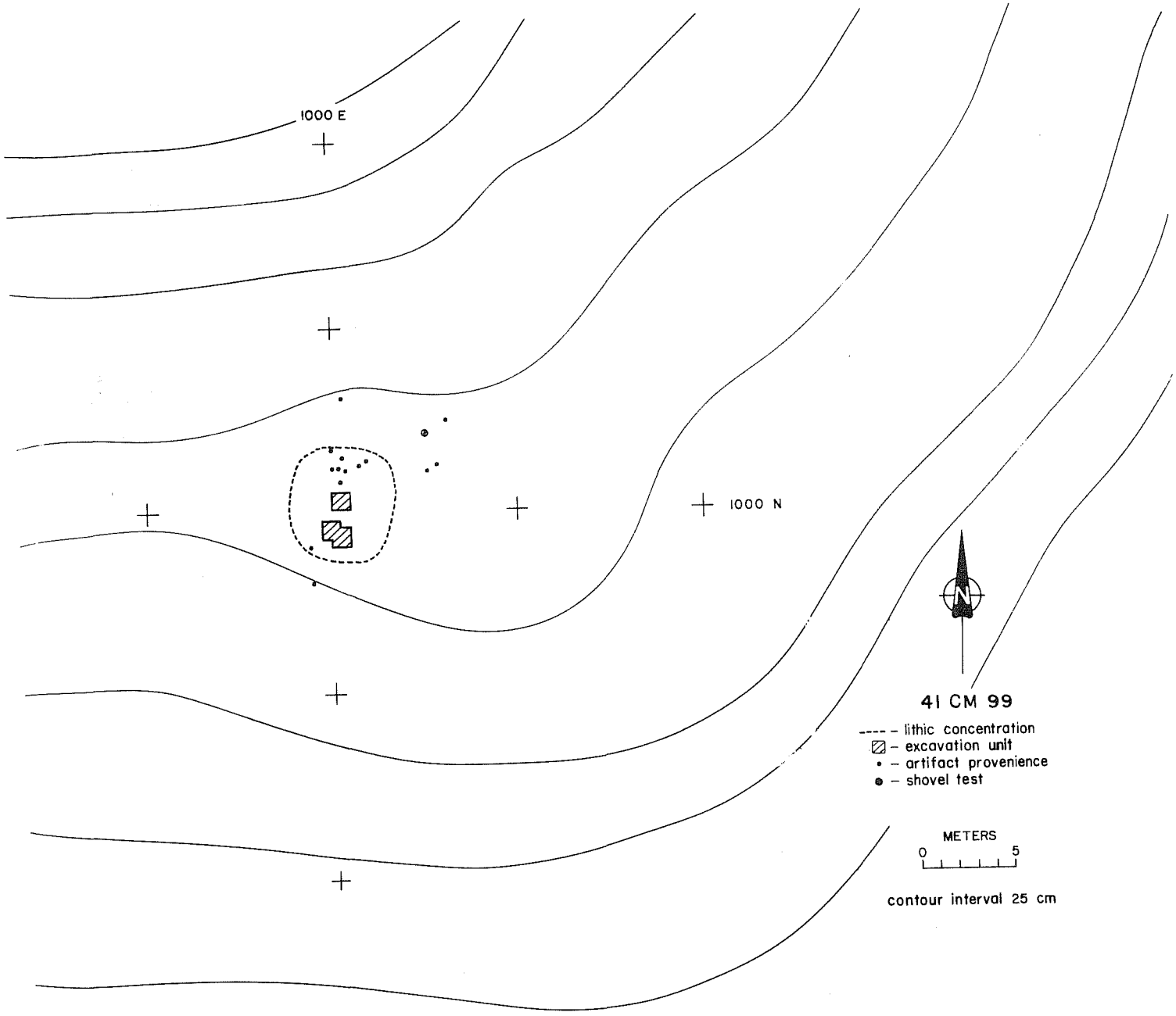

Figure 47. *Site 41 CM 99, Camp Bullis*

TABLE 16. ARTIFACT PROVENIENCE AT 41 CM 99

		Unit 1 (1000E 1000N) (1/4" screen)			Unit 2 (1000E 998N) (1/4" screen)		Unit 3 (999E 998N) (1/4" screen)	Hearth Feature	Shovel Test
	Surface Collection	0-5 cm	5-10 cm	10-15 cm	0-10 cm	10-20 cm	0-10 cm	0-10 cm	0-30 cm
Primary flakes		3	11	4	8	6	5	2	0
Secondary flakes		50	57	26	61	42	59	16	2
Interior flakes		132	137	80	144	96	147	48	7
Biface fragments	2								
Quarry blank (whole & frag.)	4					1			
Preform (whole & frag.)	5	2		1	1		2	1	
Core and frag.	2		1		1			1	
Retouched flake	1								
Points									
fragment	4	4		1	1	1	1		
Scallorn	2	1			2				
Edwards	3								
Perdiz	1								
Marshall	1								
Pedernales	2								
Castroville	1								
Ensor-Frio	1								
Side scraper	1				1				
Chopper					1				
Perforator							1		
Chunks		10							
Ground stone		1	2	1			1		

41 CM 100

Location: Terrace site; water supply (seasonal) within 100 m.

Elevation: 1200'

Environment: Vegetation consists of grassy fields with juniper and live oak clumps and prickly pear and yucca/sotol patches. Very thin soil cover overlying bedrock is present.

Description: The site is a lithic scatter covering an area approximately 65 x 20 m. Artifacts include points, biface fragments, scrapers, cores and flakes.

Investigation: A general collection was made and four shovel tests were excavated.

Occupation Period: Middle Archaic.

41 CM 101

Location: Flood plain site; permanent water supply (Cibolo Creek) within one km.

Elevation: 1195'

Environment: Reddish clay soil is present with a cover of grassy fields, juniper and live oak clumps, prickly pear and yucca/sotol.

Description: The site is a lithic concentration containing cores, bifaces, preforms and flakes. Site area is ca. 30 x 15 m.

Investigation: Chert artifacts were collected and mapped.

Occupation Period: Unknown.

41 CM 102

Location: Flood plain site within one km of Cibolo Creek, a permanent water supply.

Elevation: 1150'

Environment: Vegetation includes grassy areas and clumps of juniper and live oak. Reddish clay soil is present.

Description: The site is a lithic concentration covering an area approximately 25 x 25 m. Artifacts include points, scrapers, bifaces and flakes.

Investigation: Artifacts were collected and mapped.

Occupation Period: Late Archaic

TABLE 17. (continued)

East	West	Elevation	Artifact Type
541700	3283900	1200	Retouched flake
541800	3883500	1300	Biface fragment
544665	3289900	1185	*Bulverde*-like point fragment
544665	3289900	1185	Biface fragment
544600	3289640	1240	Biface fragment
545825	3290260	1220	Biface fragment
545725	3289260	1220	Flake
545500	3288400	1220	Biface fragment
544300	3287950	1260	Biface fragment
546800	3287700	1150	Biface fragment
546800	3287700	1150	Biface fragment
543125	3286800	1360	Side/end scraper
545800	3285460	1320	Side scraper
545800	3285460	1320	Concave scraper
544625	3285425	1360	*Pedernales*
544030	3285500	1425	Biface fragment
540500	3280000	1080	Biface fragment
541250	3282700	1170	Biface fragment
541250	3282700	1170	Secondary flake
540700	3277550	1210	Primary flake
540700	3277550	1210	Secondary flake
540700	3277550	1210	Interior flake
541100	3277000	1150	Retouched flake
541100	3277000	1150	Biface fragment
541800	3277500	1110	Preform
541600	3277800	1095	Core
541600	3277800	1095	Secondary flake
541600	3277800	1095	Interior flake
540600	3278200	1130	Retouched flake
540600	3278200	1130	Primary flake
539600	3278550	1200	Biface fragment
539200	3279300	1190	*Angostura*
539200	3279300	1190	Biface fragment
538200	3280250	1390	Biface fragment
546075	3279550	1150	Retouched flake
541780	3286150	1290	End/side scraper
541780	3286150	1290	Point fragment, unclassified
541440	3283075	1170	Retouched flake
541440	3283075	1170	Ovate scraper
541440	3283075	1170	Side/end scraper
545780	3279600	1040	Preform
545750	3278700	1100	Biface fragment
538070	3290180	1240	*Guadalupe* tool
544550	3280125	1240	Secondary flake (4)
544550	3280125	1240	Interior flake
544550	3280125	1240	Interior flake (5)

Scattered Artifacts

The scattered artifacts are presented here in tabular form with their UTM coordinates and elevation. The distribution of scattered artifacts is discussed in III.A.9.

TABLE 17. DISTRIBUTION OF SCATTERED ARTIFACTS

UTM Coordinates			
East	West	Elevation	Artifact Type
540600	3288400	1300	Biface fragment
538200	3289500	1290	*Martindale* point fragment
538150	3290060	1230	Biface
538025	3290125	1230	Circular scraper
537500	3389600	1280	Worked glass
537500	3389600	1280	Circular scraper
544400	3289600	1200	Biface fragment
544400	3289600	1200	Biface
542450	3289100	1370	Point, unclassified
542450	3289100	1370	Biface fragment
542475	3289325	1400	Biface fragment
542475	3289325	1400	Point, unclassified
543010	3291500	1210	*Edwards* point
543010	3291500	1210	Biface fragment
543250	3291000	1260	Core fragment
543250	3291000	1260	Primary flake
543250	3291000	1260	Secondary flake
544000	3291900	1210	Concave scraper
544000	3291900	1210	Point, unclassified
544000	3290000	1250	Core fragment
544725	3290700	1140	Biface fragment
544800	3291400	1140	Uniface retouched flake
539250	3287150	1410	Biface fragment
539400	3286100	1270	Biface fragment
539400	3286100	1270	Retouched flake
539100	3284000	1280	Side/end scraper
541100	3284000	1270	Biface fragment
539500	3283600	1350	Biface fragment
539500	3283600	1350	Interior flake
541300	3283900	1200	Side/end scraper
541300	3283900	1200	*Montell* point
541300	3283900	1200	*Angostura* point
541700	3283900	1200	Biface fragment
541700	3283900	1200	Biface fragment

TABLE 17, (continued)

East	West	Elevation	Artifact Type
544950	3282700	1215	Biface
544700	3283500	1210	Biface
546300	3281550	1130	Preform
543450	3281800	1250	Preform
545800	3281500	1230	Biface
545800	3281500	1230	Interior flake
545800	3281500	1230	*Edwards*
542425	3291060	1190	*Travis*
542425	3291060	1190	Point, unclassified arrow
542425	3291060	1190	Preform
542350	3281400	1370	Biface fragment

III. A.8

SITE TYPES

Andrea Gerstle and James E. Ivey

The analysis of site types (functions) and settlement patterns does not consist of separate, unrelated procedures; it is logically necessary to consider the two aspects in conjunction with each other, and the process of identifying one of these aspects requires consideration of the other. The function of the site is the totality of activities carried out at the site (as seen in the artifact assemblage); this is in part related to the environmental setting, available resources, and the exploitative orientation of the inhabitants. The combination of site types, their location and their distribution, is the settlement pattern. The analytical process involves observing the complete configuration in order to identify site functions and settlement patterns. The division of the two into separate chapters is purely an organizational advantage.

CLUSTER ANALYSIS

The sites were classified into groups using the BMDP (Biomedical Computer Programs) program 2M: Cluster analysis on cases (Dixon 1975:323-337). For the purposes of this project, the sites are considered cases and the locational attributes of each site comprise the variables. The mathematical procedure used by the cluster analysis is briefly explained.

The program begins by taking the original data for each site and standardizing it. The values of each variable used in the analysis are added together, and the average or mean value of each variable is found. The values of each variable are then subtracted from this mean, and this difference is divided by the standard deviation of that variable from the mean value. In mathematical notation, the mean is computed as follows:

$$\bar{x} = \frac{\sum_{1}^{N} x}{N}$$

where: $\bar{x}$ = the mean of the variable,
N = the number of cases,
x = the value of the variable, and

$\sum_{1}^{N}$ = the sum of the values of the variables for all cases.

The standard deviation is:

$$S.D. = \sqrt{\frac{\sum_1^N (x-\bar{x})^2}{N-1}}$$

or the square root of the sum of the squares of the differences between the variable describing each case and the mean value of that variable for all cases used in the analysis. This is a single numerical value for each variable.

The standardized value of each variable, then, is expressed as:

$$x_s = \frac{(x_0-\bar{x})}{\sqrt{\frac{\sum_1^N (x_0-x)^2}{N-1}}}$$

where: x_s = standardized value of the variable, and
x_0 = original value of the variable.

Once each case has been standardized, the "distance" from each case to all other cases used in the analysis is computed. This is a quite complicated procedure, and there are four possible methods permitted by the BMDP program. The one employed here uses the square root of the sums of the squares of the differences between the cases.

Since in this analysis we are using seven measurements, each case is described by a unique point in a seven-dimensional space, the seven dimensions being the seven variables. Each point in this space, representing one site, can be connected to any other point by a straight line. This line has a specific length, determined by the distances between the two points in the seven dimensions. To find this length in a space of two dimensions (horizontal and vertical, for example), one finds the horizontal and vertical differences between their positions. These differences would be squared, added together, and the square root of that sum found. This is the familiar method of finding the hypotenuse of a triangle. If a third dimension is added, the procedure would be the same with the difference in the third dimension included, and so on.

Once the distances between cases are found, the cases are grouped, or "amalgamated," according to closeness; those two cases which are most similar or closest are amalgamated into a cluster. This cluster is then described by the mean values of the variables describing each of the two cases within it. As

far as the program is concerned, the two individual cases cease to exist, and a single case, the cluster, replaces them. The amalgamation step is then repeated. After a series of these steps, there are usually several clusters, each formed of two or more cases, and a number of individual cases, still too different from each other to have been placed into any cluster.

When, in the later stages of the amalgamation process, individual cases are added to already formed clusters, the values describing the cluster change by smaller and smaller amounts depending on the number of cases already in the cluster. The averaging procedure is "weighted" so that the cases already in the cluster have more influence on the description than does the less similar newcomer. The logical extreme of this clustering process is the formation of a single large cluster including all cases input into the program.

The smallest clusters, those consisting of pairs of very similar cases, are of little use to us in this analysis; the final cluster, consisting of everything in the analysis, is also of little use. It is necessary to compare the encoded values describing each site cluster, and select that stage of clustering which most meaningfully amalgamates our sites into easily comprehended and described groups.

This analytical tool has revealed intersite relationships which it is unlikely we would have been able to see otherwise and has many potential uses.

CLUSTERS

First, all of the locational attributes from each of the 24 sites located on the transects were input in the clustering program. The cluster analysis grouped the sites on the basis of topographic setting, distance to water and type of surrounding resources (lithic outcrops, soil*), mean diameter of site, the amount of chipped stone on the site and the absence or configuration of burned rock on the surface. Eight clusters resulted containing two or more sites, two sites were sufficiently unique so that they did not group with any others, and two sites formed an extended group too loose to be considered a cluster (Fig. 48). These clusters are assumed to be unbiased, i.e., representative of the major variation in all sites on Camp Bullis, as they are based on the statistically valid 15% survey samples. These "true" clusters are the baseline for determining site types and settlement patterns.

The second step was to conduct an identical cluster analysis using all of the sites located, including those found on the 15% transect sample as well as others, a total of 63 sites. The purpose of this is twofold: (1) to see if any major differences are present in the unsystematically located sites, i.e., if "intuitive" site location techniques result in a biased representation of site types, and (2) to include the non-transect-located sites in clusters along with transect-located sites, thus maintaining the "objectivity" of mathematical (statistical) analysis.

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*Note that the values assigned to lithic outcrops and soils have little relationship to each set of characteristics assigned a value; that is, soils coded as 3 do not have any specific increase in some characteristics over soils coded 2, but are simply different. This had little effect on the clusters, but such systems of coding should be avoided when using cluster analysis on future projects.

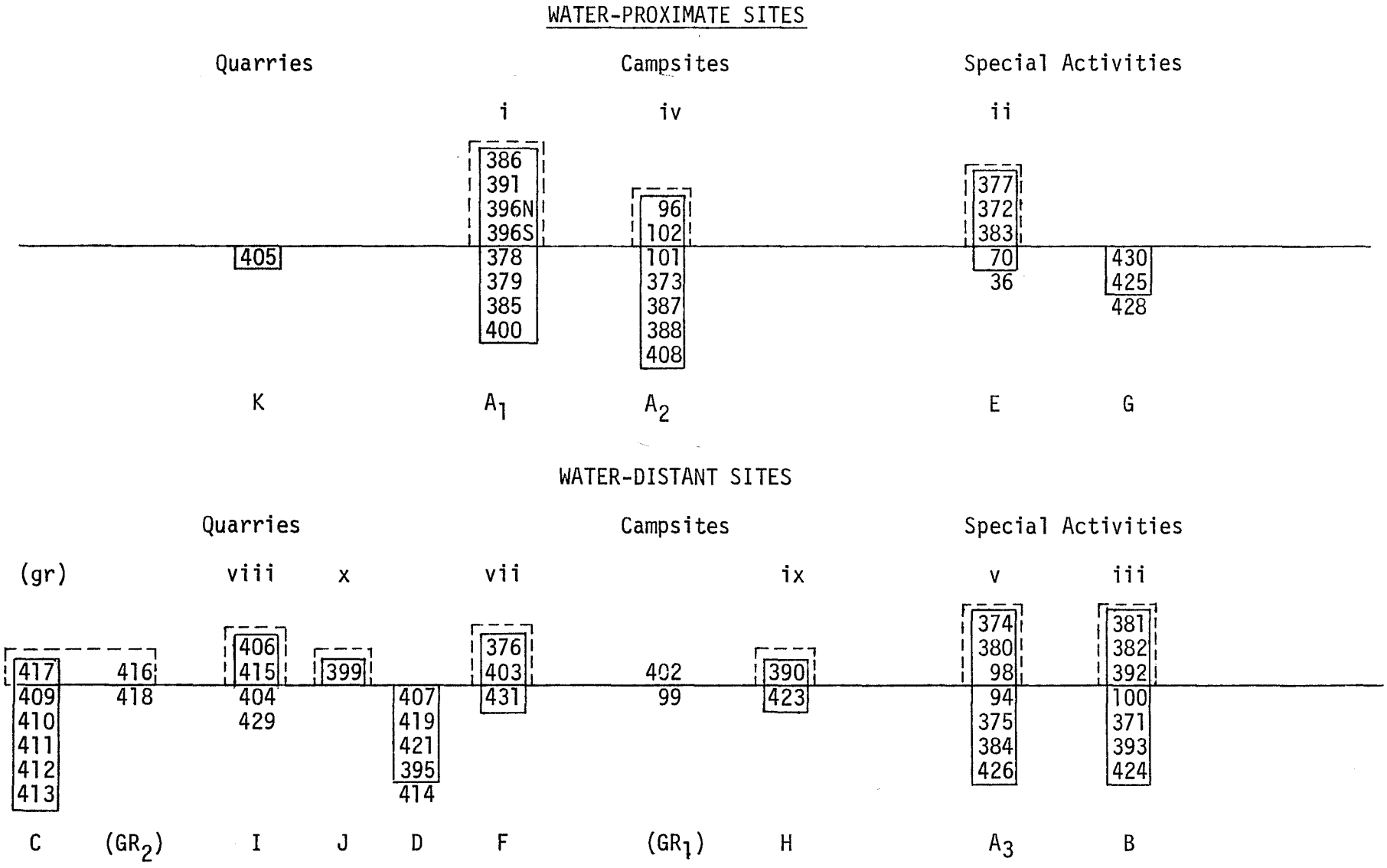


Figure 48. *Site Clusters*

The cluster analysis of all sites yielded a total of 13 clusters, of which 11 have two or more sites, and two consist of a single site (Fig. 48). Five sites are associated with, but not included in, these clusters. They are not unique but are not "similar enough" to the sites in the clusters to warrant their inclusion. Four other sites form two extended groups, one of these unassociated with any single cluster.

Examination of Fig. 48 shows us the similarities and differences between the clusters produced by the two analyses. More clusters are defined by using a larger sample of sites. This is to be expected; more sites result in more variation in the attribute combinations. This is seen in the sites which are associated with, but not included in, clusters. It is also logical that certain attribute combinations would occur more often, resulting in more and more well-defined clusters of sites.

Comparison of the clusters of sites produced by the two analyses are also instructive with regard to identifying the biases introduced by unsystematic survey. In the Camp Bullis survey, it is apparent that the Clusters ii, iii, vii, viii, ix and x, defined from the representative sample of 24 sites, are substantiated by clusters E, B, F, I, H and J from the combined 63-site sample. Clusters D, G and K are found only in the combined sample. Clusters i, iv and v correspond to subdivisions of cluster A: A_1=i, A_2=iv, A_3=v. Cluster A of the all-sites analysis was formed from three subclusters, all of very similar characteristics. This cluster was formed at the threshold of similarity selected to be the level at which the detailed examination of the cluster would be carried out. Since A included 22 sites, or about 32% of the total number of sites, it was decided to use the three subclusters A_1, A_2 and A_3 for the analysis, because they were representative of three clusters from the on-transect analysis, and a more detailed picture of site typology would result. Cluster C of the all-sites analysis is similar to the two-site grouping of the on-transect sites.

The clusters are presented graphically in Fig. 48. In this figure, sites which are members of a cluster are enclosed in a rectangle. Sites associated with a given cluster, but not part of it, are listed outside the appropriate rectangle. In the on-transect clusters the two-site unassociated grouping is indicated by the symbol (gr); in the all-sites clusters the groupings are marked by the symbols (GR_1) and (GR_2).

Close examination of the attributes of the sites forming each cluster provides the means of identifying site functions and settlement patterns.

CLUSTER INTERPRETATION

The clusters illustrated in Fig. 48 are defined on the basis of locational information plus amount of chipped stone and configuration of burned rock. When combined with artifact types, including tools and manufacturing debris, the result is a composite picture of site functions and settlement patterns.

The configuration of locational attributes is most readily divided into groupings of clusters by the "distance-to-water" attribute. Clusters were sorted

according to whether they were "water-proximate" (less than 100 m from a permanent or intermittent water supply) or "water-distant" (more than 100 m from a permanent or intermittent water supply). The other attributes, and the tool assemblages, were then taken into account for a more specific description of each site type represented by a cluster.

The tool assemblages are evaluated according to the presence or absence of the different artifact types. Chipping debris consists of cores, core fragments, chunks, quarry blanks, preforms, and primary, secondary and interior flakes. The presence of cores, core fragments, chunks, quarry blanks, and primary and secondary flakes is taken to indicate initial core reduction activities. The presence of quarry blanks, preforms and interior flakes would result from secondary reduction and final tool manufacturing activities, especially in conjunction with finished tools.

The presence of finished tools is taken to mean that they were used as well. Although probably not all tool use occurred on the site itself, the variety occurring is assumed to be representative of the activities which took place in and around the site. Projectile points are hunting implements; scrapers, thinned bifaces (knives), perforators, choppers and retouched flakes were probably used for plant food collecting and plant and animal processing. Ground stone manos were used for plant processing (including seeds). The two specimens of pitted stones were possibly "nutting stones." *Guadalupe* and *Clear Fork* tools are assumed to be special purpose scraping tools (cf. Hester, Gilbow and Albee 1973). Hammerstones are likely knapping implements.

In many cases, the artifacts classed as knapping debris, especially cores, blanks and preforms, were probably utilized as tools as well as being tool "sources." No use wear analysis was performed on the artifacts, hence possible multiple functions are not recognized. For those artifacts believed to be tools, the functions are inferred from the form and manufacture of the specimen. This approach is fraught with dangerous assumptions. Foremost among these is the assumption that tools of similar function will have similar morphology. For this reason, the tool types used here are not specific as to the exact morphology of the part of the tool that presumably was utilized.

The clusters are arranged here in two major groups (Fig. 48): "water-distant" (far from water) and "water-proximate" (close to water) sites. Within these two, the major functions of the sites are designated: quarry sites, campsites and special activity sites. The individual clusters are indicated within the major functional classes. These are described in the text according to their specific characteristics: the environmental features and artifact assemblages.

Small Water-distant Quarry Sites (Cluster C/gr and GR_2)(Fig. 49)

Including sites 41 BX 409, 41 BX 410, 41 BX 411, 41 BX 412, 41 BX 413, 41 BX 417 and associated sites 41 BX 416, 41 BX 418.

Locational Attributes

All sites in this cluster are located in a small group in the extreme southeast corner of Camp Bullis, on a high terrace of Panther Springs Creek. Soil

varies from very shallow to moderately deep red clay or dark clayey loam. Chert sources are near all of the sites. The mean diameter of the sites varies from 15.0 m to 80.0 m. The frequency of chipped stone is generally high, from 50 to more than 100, except for two sites with an estimated 10 to 50 pieces. Burned rock is present at only one of the sites.

Artifact Assemblage

The artifacts on these sites consist primarily of knapping debris but are variable between sites. All of the sites contain secondary flakes, and all but one contain chunks. All but two have primary flakes, and all but one have interior flakes. Five of these also have core fragments. All but two have quarry blanks. Five sites have cores and three have preforms.

Evidence of tool use is scanty on these sites. Scrapers are present on three sites, one of which also has a chopper. Four sites have retouched flakes and two have bifaces. One of these sites also has a *Guadalupe* tool.

The small size of the sites, the quarry/knapping nature of the artifact assemblages, and the lack of burned rock, all indicate very short-term occupation of the sites for the purpose of quarrying and initially reducing the local chert for later use elsewhere. Site 41 BX 409, which is the only site in this cluster having identifiable points and a *Guadalupe* tool, is considered a quarry/campsite rather than strictly a quarry.

Water-distant Quarry Sites (Cluster D)(Fig. 49)

Including sites 41 BX 395, 41 BX 407, 41 BX 419, 41 BX 421, with related site 41 BX 414.

Locational Attributes

The sites comprising this cluster form a small group in the extreme south central part of Camp Bullis, with the exception of 41 BX 395, located in the southwestern corner of the camp. They are upland or upland margin sites, with the closest water supply usually less than one km away. All are on very shallow soil or bedrock, and all are on or near an upland (water-distant) chert source. The mean diameter of these sites ranges from a minimum of 30.0 m to a maximum of 150.0 m. Estimated chipped stone frequency is greater than 100. None contains burned rock.

Artifact Assemblage

The artifact assemblages in these sites are very much alike, supporting the notion that sites of similar function will be similarly located.

Tool manufacturing debris is predominant. All of the sites contain cores and core fragments. All of the sites have primary, secondary and interior flakes. Three sites have quarry blanks present; two have preforms.

The variety of tools occurring at sites in this cluster is limited and inconsistent. Four sites have scrapers; of these, three have retouched flakes, and one of those has a projectile point and a perforator graver. This site is 41 BX 407, which is apparently a quarry/camp similar to 41 BX 409.

It is apparent, then, that these upland (water-distant) sites are primarily quarry and initial core reduction sites, with only minor and varied tool-using activities occurring. The general lack of burned rock, either scattered or in a hearth configuration, indicates that, for the most part, these were not habitation sites. This is confirmed by the lack of extensive tool use.

The supplementary activities indicated by the tools evidently involved either projectile points (hunting) or scraping tools (processing).

Large Water-distant Quarry Sites (Cluster I/viii)(Fig. 49)

Including 41 BX 406, 41 BX 415 and related sites 41 BX 404, 41 BX 429.

Locational Attributes

This group of sites is rather variable according to location. The sites are scattered throughout the southern portion of Camp Bullis and are terrace, valley slope and upland sites with water available at more than 100 m. All of the sites are located near or on lithic outcrops and are very extensive. Mean diameter ranges from 270 m to 350 m. Soil is generally very thin (two sites) or moderately deep red clay or dark clay/loam (two sites). Frequency of chipped stone is always greater than 100, and no burned rock is present.

Artifact Assemblage

The artifacts comprising these sites are almost exclusively core reduction debris. All sites have cores, chunks, primary and secondary flakes. Three sites have core fragments, interior flakes and quarry blanks, and two sites have preforms. The areal extent of these sites, the chipping debris within them, and their location near or on chert sources argues strongly for their primary function as quarrying and initial core reduction sites.

The lack of many and varied tools corroborates this. No sites contain projectile points, perforators or gravers. Two sites have scrapers, one site has only a thinned biface, one site has a chopper, and three sites have retouched flakes. The meager finished tool assemblage suggests that only occasional minor food procurement occurred on these sites. They may be characterized, then, as large upland quarry sites with essentially no other activity taking place.

Water-distant Quarry Area (Cluster J/x)(Fig. 49)

Including site 41 BX 399.

Locational Attributes

This enormous site covers the tops and northeast sides of two large adjacent hills, Laurin Hill and Bush Hill, which contain extensive chert outcrops, but very shallow soil deposits. Water is available within one km. The exact boundaries of the site are indeterminate. No burned rock was observed on the site, which contained well over 100 pieces of chipped stone.

Artifact Assemblage

The vast majority of artifacts in this site consists of cores, core fragments, chunks, quarry blanks and large primary, secondary and interior flakes. It is apparent that the area served as a chert quarry, with some crude initial core reduction occurring as well. The density of the artifacts varies with the amount of surface chert, but no discrete concentrations are present.

Finished tools are present, but scarce. Three unidentifiable dart points were found on the eastern extension of Bush Hill, and some scrapers and thinned bifaces were recovered from the north end of Laurin Hill. These artifacts indicated very limited hunting and plant collecting activities.

The site is perhaps best described as an upland quarry area, with probable continued exploitation through time.

Large Water-distant Campsites (Cluster F/vii) (Fig. 49)

Including sites 41 BX 376, 41 BX 403 and 41 BX 431.

Locational Attributes

The three sites in this cluster include terrace, valley slope and upland margin. Water is over 100 m away. The soil is very shallow, and no chert sources are nearby. Mean site diameter ranges from 52.5 m to 162.5 m, and the chipped stone frequency in all cases is above 100. Scattered burned rock occurs on all of the sites as well.

Artifact Assemblage

Evidence of initial and secondary core reduction is weak on all sites. The predominant manufacturing debris consists of cores, quarry blanks and preforms. One site has primary flakes, a second has secondary flakes, and the third has interior flakes. It appears that little lithic processing was carried out at these sites.

In addition to the knapping function of the site, a variety of tools are also present. All of the sites have projectile points, and two have retouched flakes, two have thinned bifaces (knives), two have scrapers, one has a perforator, and one has a chopper. One site also has a *Guadalupe* tool--a very distinctive tool form with a presumably specialized function.

Small Water-distant Campsites (Cluster H/ix) (Fig. 49)

Including sites 41 BX 390 and 41 BX 423.

Locational Attributes

Both sites contained in Cluster H are upland sites with water available within one km or more. The soil is very thin, but no chert source is located near the sites. The mean diameters of the sites are 30.0 and 6.5 m. Both contain approximately 10 to 100 pieces of chipped stone, and one site has scattered burned rock.

Artifact Assemblage

The chipped stone assemblages in these two sites are very similar. Manufacturing debris at both sites consists of cores and chunks, as well as secondary and primary flakes. The other has quarry blanks. This combination suggests that secondary core reduction and tool manufacturing were carried out at these sites.

The tools present at 41 BX 390 include projectile points, scrapers, thinned bifaces (knives) and retouched flakes. Site 41 BX 423 contained only thinned bifaces and retouched flakes. These varied tool types indicate numerous food-procurement and processing activities. This, plus the secondary core reduction activity and the presence of burned rock, indicates use of the sites as temporary upland knapping and camping locales. The presence of burned rock indicates at least temporary occupation of one of these sites.

Water-distant Knapping Campsites (Group GR_1) (Fig. 49)

Including sites 41 CM 99 and 41 BX 402.

Locational Attributes

These two sites form a group not closely associated enough to form a cluster, but still more like each other than any of the clusters. One is a terrace site, while the other is on the upland margin. Both are more than 100 m from water; in fact, one is more than one km from a water source. Neither is located near a chert source; both have reddish clay soils of some depth. Mean diameters are quite similar: 35.0 m and 42.5 m. Chipped stone counts exceed 100 at both sites, and both have scattered burned rock.

Artifact Assemblage

Both sites show strong evidence of initial and secondary core reduction activities, having cores, core fragments, chunks, secondary flakes and interior flakes. Both have quarry blanks, one has preforms, and the other has primary flakes. It is evident, then, that much, if not all, of the core reduction and tool manufacturing sequence occurred at these sites.

Tools at both sites include projectile points and retouched flakes. One site also has scrapers and thinned bifaces. The other has a perforator/graver.

These two sites are probably best described as short-term knapping campsites.

Water-distant Special Activity Sites (Cluster A_3/v) (Fig. 49)

Including 41 BX 374, 41 BX 375, 41 BX 380, 41 BX 384, 41 BX 426, 41 CM 94 and 41 CM 98.

Locational Attributes

The sites composing this cluster are flood plain and terrace sites. Distance to water is consistently less than one km. Soil is either moderately deep dark loam or moderately deep reddish clay. Chert cobble deposits are present near two of these sites. The mean diameter ranges from 20 m to 80 m. The majority of the sites (five) have a mean diameter of 20 m to 50 m. All have a moderate to large amount of chipped stone on the surface, from 50 to over 100 pieces. One site has burned rock visible on the surface.

Artifact Assemblage

The artifacts contained in these sites emphasize tool manufacturing activities.

Manufacturing debris on all sites includes cores, quarry blanks, and secondary and interior flakes. All except one site have core fragments and all but one have primary flakes. All but two have preforms. Four sites have "chunks." The implication of this type of manufacturing assemblage is that primary and secondary core, quarry blank and preform reduction was being carried out. It is likely that raw cores, chert and quarry blanks were brought into the site, and the consistent presence of quarry blanks, preforms, and primary, secondary and interior flakes are the products of the reduction processes.

The tool types found on sites in this cluster include projectile points (three sites), scrapers (four sites), thinned bifaces (four sites), choppers (one site) and retouched flakes (three sites). No pattern of association of the different tool types is evident, indicating that no specific resource, but rather a variety of resources, was being collected or processed.

The lack of burned rock in these sites is an indication of their likely short occupation span. These sites are primarily tool manufacturing locations, with some food collecting activities.

Sites 41 BX 375 and 41 BX 384 were located on chert sources and have artifact assemblages characteristic of quarrying sites. They were probably used primarily as quarry sites.

Water-distant Special Activity Sites (Cluster B/iii) (Fig. 49)

Including 41 BX 371, 41 BX 381, 41 BX 382, 41 BX 392, 41 BX 393, 41 BX 424 and 41 CM 100.

Locational Attributes

Two sites in this cluster are on terraces, one on a valley slope, and the rest on upland margin sites; all have a water source generally available within one km (in one case, the distance is less than 100 m). No chert source is available near these sites, and the soil is generally thin. The sites range from 3.5 to 85 m in mean diameter. The sites are characterized by a fairly low frequency of chipped stone, an estimated 10 to 100 pieces. Scattered burned rock is present on one site.

Artifact Assemblage

All of the sites contain some manufacturing debris, including secondary and interior flakes (all sites), cores (four sites), chunks (three sites), core fragments (four sites) and primary flakes (two sites). Four sites have quarry blanks and three have preforms present. This combination of artifacts indicates that secondary core reduction and tool manufacturing activities were carried out.

All seven sites have projectile points, five have scrapers, five have thinned bifaces, two have choppers, and two have retouched flakes. Of the seven sites, two (41 BX 371, 41 BX 393) have all these tools. Of these two, 41 BX 371 is the only site with burned rock in the cluster and probably was occupied somewhat longer than the others.

In general, these sites likely functioned as secondary reduction sites and specialized resource procurement sites. The lack of burned rock and low chipped stone density again imply very short-term occupation of the site.

Water-proximate Quarry Sites (Cluster K) (Fig. 49)

Including 41 BX 405.

Locational Attributes

Site 41 BX 405 is located on the upland margin but is within 100 m of a water source. A chert outcrop is present on the site, and the soil is red clay with some depth. The mean site diameter is 22.5 m. The chipped stone count is quite low for a quarry site, from 10 to 50 pieces. No burned rock was found on the site.

Artifact Assemblage

Lithic debris found at the site consisted of cores, core fragments, chunks, and primary, secondary and interior flakes. No finished tools were found. Other than its relative proximity to a water source, this site is much like the sites in cluster C, small water-distant quarries.

Water-proximate Campsites (Cluster A_1/i) (Fig. 49)

Including sites 41 BX 378, 41 BX 379, 41 BX 385, 41 BX 386, 41 BX 391, 41 BX 396N, 41 BX 396S and 41 BX 400.

Locational Attributes

The sites in this cluster are less variable than those in the previous clusters with regard to locational attributes. These sites are situated on terraces. Distance to water is less than 100 m. The soil type is either very shallow soil or deep, dark soil.

Average site diameter varies from a minimum 1.0 m to a maximum of 115 m. (The second largest site is 50 m in diameter.) The amount of chipped stone is consistently greater than 50 pieces, and scattered burned rock appears on two of the eight sites.

Artifact Assemblage

Most of the eight sites contained cores (seven sites), primary flakes (seven sites), secondary flakes (eight sites) and interior flakes (eight sites). Seven sites had preforms. Four sites had core fragments, four had chunks, and only two had quarry blanks. These numbers indicate an emphasis on secondary reduction and tool manufacture.

Projectile points were recovered from all sites, and scrapers from six sites. Thinned bifaces (knives) and retouched flakes were located on six of the eight sites.

The presence of a wide range of tools and similar tool types on every site may indicate similar resource extractive activities. Those presumably included hunting and plant collecting/processing. They were likely temporary campsites at which a variety of activities took place. Site 41 BX 386, located on a chert cobble source, was probably a quarry-camp.

Water-proximate Campsites (Cluster A_2/iv) (Fig. 49)

Including 41 BX 373, 41 BX 387, 41 BX 388, 41 BX 408, 41 CM 96, 41 CM 101 and 41 CM 102.

Locational Attributes

These sites are found on flood plains or terraces with water generally available within 100 m. Chert is present as a raw material source at only one site. The soil is a moderately deep reddish clay. Mean site diameter varies from 10.5 to 35.0 m, and the chipped stone frequency is moderate, ranging from 10 to 100 specimens. Hearths are present at two sites.

Artifact Assemblage

The general pattern of artifacts present at the sites of this cluster shows somewhat less emphasis on manufacturing debris than in cluster A. All sites have interior flakes, and five of the seven sites have primary and secondary flakes. Four sites have preforms. Three sites have cores, two have chunks, two have quarry blanks and one has core fragments.

The tool assemblages present on these sites include projectile points (six sites), scrapers (five sites) and thinned bifaces (all sites). Two sites contain retouched flakes. These varied tool types reflect a diversity of activities.

The sites in this cluster are similar in function to the previously described lowland (water-proximate) campsites (Cluster A_1). Site 41 BX 373 was located on a chert cobble source and was probably primarily a quarry-camp.

Water-proximate Special Activity Sites (Cluster G) (Fig. 49)

Including sites 41 BX 425 and 41 BX 430 and related site 41 BX 428.

Locational Attributes

Sites which are grouped into Cluster G are all located on low terraces with deep dark clay/loam soil. The distance to a water source ranges from on the site to one km. No chert sources are found in the vicinity of these sites. Chipped stone frequency on the surfaces of these sites is very low, from one to 10 pieces or none at all. They are recognizable by the extensive quantity of burned rock in a small area, often called burned rock middens. The mean diameter of these middens varies from 7.5 m to 25 m.

Artifact Assemblage

Although the frequency of chipped stone is very low, a large variety of artifact types was recovered from test excavations at two of the sites. Observations on the assemblages are necessarily limited to the two tested sites.

Manufacturing debris consists of cores, core fragments, chunks, quarry blanks, preforms, and primary, secondary and interior flakes. Evidently a wide range of activities took place at or near the midden. The fragmentary nature of most of the artifacts in the burned rock accumulations suggests that these may be disposal areas.

Tools recovered from the two sites include projectile points, scrapers and thinned bifaces. One site also contained retouched flakes. Ground stone fragments were recovered from both sites. The majority of these tools are fragmentary; however, those from 41 BX 425 were mixed in with the burned rock, while those from 41 BX 428 were recovered primarily from test pits placed adjacent to the burned rock concentration.

The function of these sites is unclear, but it is evident that a variety of knapping and tool-using activities occurred. The burned rock concentrations suggest long-term or repeated occupation, yet the low total artifact frequency does not substantiate this. The possible function of burned rock accumulations such as these is discussed elsewhere (see III.A.9).

Water-proximate Special Activity Sites (Cluster E/ii) (Fig. 49)

Including sites 41 BX 372, 41 BX 377, 41 BX 383, 41 CM 70 and associated site 41 BX 36.

Locational Attributes

All the sites in this cluster are located on flood plains or low terraces. All are within 100 m of a water source, and all but one have no on-site chert sources. Soils are moderately deep black loam or reddish clay. The mean diameter ranges from 30 m to 130 m, with three of the five sites having mean diameters larger than 100 m.

Artifact Assemblage

All sites had primary, secondary and interior flakes. Most had cores, core fragments, quarry blanks and preforms. Three of the five had chunks.

All sites had projectile points and thinned bifaces. Most had scrapers and retouched flakes. Three sites had perforator/gravers and two had choppers.

Both the size and depth of the burned rock accumulation, and the nature and quantity of chipped stone and bone tools and debris, indicate long-term intensive use of the sites as habitation areas. The major differences between these and other campsites, however, cause them to be placed in the category of lowland special activity sites. Most were probably used as long-term occupation sites, as well as knapping sites.

SUMMARY

A total of 13 clusters of similar sites were defined on the basis of locational attributes and artifact assemblages. These form six larger types of sites, based on their general location and primary activities: upland or lowland, and quarry, camp, or special activity. Each major grouping contained one or more

site clusters with a greater or lesser range of specific functions. These functions relate to the site locations, artifact assemblages and site features. Briefly, they include four types of upland (water-distant) quarry sites: small, moderate, large and extensive; upland camps with extensive tool manufacture; upland hunting camps; and upland special activity sites of two types: general food procurement including hunting and plant collecting along with moderate knapping activity, and specialized food procurement (either hunting or plant collecting) with minor knapping activity. Water-proximate site types include one quarry site, campsites, general food procurement sites with minor knapping activity and two types of burned rock accumulations, small and extensive.

Certain general patterns are visible in these divisions. For example, excluding cluster K, consisting of site 41 BX 405 (which is virtually the same type of site as those of cluster C), there are no clusters of water-proximate quarry sites. All sites which could have qualified as such a type were clustered with campsites. At the same time, all sites which are strictly quarry sites are in the southern half of the survey area.

Burned rock accumulation clusters are all near water. The only other clusters with a consistent burned rock attribute are F, H and GR_1, the water-distant campsites.

In general, the impression is that sites associated with a nearby, dependable water supply tend to have been used for a wider range of activities or for longer time spans than water-distant sites.

Cluster	Site Number	Physiographic Transect	Distance to Water	Lithic Outcrop	Soil Type	Site Mean Diameter (m)	Chipped Stone Frequency	Burned Rock Configuration	Projectile Point	Scraper	Thinned Biface (Knife)	Perforator/Graver	Chopper	Retouched Flake	Core	Core Fragment	Chunk	Blank	Preform	Primary Flake	Secondary Flake	Interior Flake	Hammerstone	Ground Stone	Gouge	Biface Fragment	Uniface Fragment
	41 BX 409	*2	3	5	1	24.0	4	1	X	X	X			X	X	X		X	X	X	X	X			X		
	41 BX 417	2	3	5	1	15.0	4	0							X	X	X			X	X	X					
C	41 BX 411	2	3	5	1	80.0	4	0			X				X	X	X	X		X	X	X					
	41 BX 412	2	3	5	1	27.5	2	0		X			X	X			X	X	X	X	X	X					
	41 BX 413	2	3	4	2	22.5	2	0		X				X			X	X			X						
	41 BX 410	2	3	5	2	22.5	3	0						X		X	X	X		X	X	X					
GR2	41 BX 418	2	2	6	2	40.0	4	0							X	X	X		X	X	X	X					
	41 BX 416	2	3	6	3	17.5	4	0							X		X	X			X	X					
	41 BX 429	2	4	5	3	270.0	4	0						X	X			X	X	X	X	X					
I	41 BX 406	3	3	5	1	275.0	4	0		X				X	X	X	X			X	X	X					
	41 BX 415	2	3	6	2	350.0	4	0			X				X	X	X	X		X	X	X					
	41 BX 404	5	3	6	1	350.0	4	0		X			X	X	X	X	X	X	X	X	X	X					X
J	41 BX 399	6	3	8	1	500.0+	4	0	X	X	X			X	X	X	X	X		X	X	X					
	41 BX 414	4	2	6	1	150.0	4	0		X				X	X	X	X			X	X	X					
	41 BX 407	4	3	5	1	37.5	4	0	X	X		X		X	X	X		X	X	X	X	X					
D	41 BX 419	4	3	6	1	55.0	4	0		X					X	X	X	X		X	X	X					
	41 BX 421	5	3	6	1	45.0	4	0			X			X	X	X		X	X	X	X	X					
	41 BX 395	4	3	9	1	30.0	4	0							X	X	X			X	X	X					
	41 BX 403	3	3	0	1	52.5	4	1	X	X	X	X		X		X		X	X	X							
F	41 BX 431	2	3	0	1	75.0	4	1	X	X				X	X			X	X			X	X					
	41 BX 376	4	3	0	1	162.5	4	1	X		X		X		X			X		X	X	X			X		
GR1	41 CM 99	2	4	0	3	42.5	4	1	X			X		X	X	X	X	X		X	X	X					
	41 BX 402	4	3	0	3	35.0	4	1	X	X	X			X	X	X	X	X	X		X	X			X		X
H	41 BX 423	5	4	0	1	30.0	2	0			X			X	X		X	X			X	X					
	41 BX 390	4	4	0	1	6.5	3	1	X	X	X			X	X	X	X		X	X	X	X					

Figure 49. *Site Attributes: Locational and Artifact Assemblages.*

Cluster	Site Number	Physiographic Transect	Distance to Water	Lithic Outcrop	Soil Type	Site Mean Diameter (m)	Chipped Stone Frequency	Burned Rock Configuration	Projectile Point	Scraper	Thinned Biface (Knife)	Perforator/Graver	Chopper	Retouched Flake	Core	Core Fragment	Chunk	Blank	Preform	Primary Flake	Secondary Flake	Interior Flake	Hammerstone	Ground Stone	Gouge	Biface Fragment	Uniface Fragment
K	41 BX 405	4	2	6	3	22.5	2	0							X	X	X			X	X	X					
A1	41 BX 378	2	2	0	1	1.0	3	0	X	X				X	X		X		X	X	X	X					
	41 BX 386	2	2	2	1	50.0	3	0	X						X	X			X	X	X	X					
	41 BX 391	2	2	0	2	115.0	4	0	X	X	X				X	X			X		X	X					
	41 BX 396[Φ]	2	2	0	2	22.5	4	1	X	X	X			X	X		X		X	X	X	X				X	
	41 BX 400	2	2	0	2	10.0	3	0	X	X	X			X		X		X	X	X	X	X		X		X	
	41 BX 396[†]	2	2	0	2	45.0	4	0	X		X			X	X		X		X	X	X	X					
	41 BX 379	2	2	0	2	2.5	4	0	X	X	X			X	X	X	X		X	X	X	X				X	
	41 BX 385	2	2	0	1	3.5	4	1	X	X	X			X	X			X		X	X	X				X	
A2	41 CM 96	1	2	0	3	35.0	2	1	X		X										X	X					
	41 CM 102	1	2	0	3	25.0	2	1	X	X	X							X	X			X	X				
	41 BX 387	2	2	0	3	18.0	3	0	X	X	X			X	X					X	X	X				X	
	41 BX 408	2	2	0	3	17.5	3	0	X	X	X								X	X	X	X					
	41 BX 388	2	2	0	3	10.5	2	0	X	X	X			X			X		X	X	X	X				X	
	41 BX 373	2	2	2	3	35.0	2	0	X	X	X				X	X	X		X	X	X	X				X	X
	41 CM 101	1	3	0	3	22.5	2	0			X				X			X		X	X	X					
E	41 CM 70	1	2	2	3	130.0	4	1	X		X	X		X				X	X	X	X	X					
	41 BX 377	2	2	0	3	30.0	4	2	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	
	41 BX 383	1	2	0	3	125.0	4	2	X	X	X			X	X	X	X		X	X	X	X					
	41 BX 372	1	2	0	2	100.0	4	2	X	X	X				X	X		X		X	X	X					
	41 BX 36	2	2	0	2	49.0	4	3	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X	X
G	41 BX 428	2	1	0	2	15.0	0	3	X	X	X			X	X	X	X	X	X	X	X	X		X			
	41 BX 430	2	3	0	2	25.0	1	3		X																X	
	41 BX 425	2	2	0	2	7.5	1	3	X	X	X				X	X	X	X		X	X	X		X			

Cluster	Site Number	Physiographic Transect Distance to Water Lithic Outcrop Soil Type	Site Mean Diameter (m)	Chipped Stone Frequency Burned Rock Configuration	Projectile Point	Scraper	Thinned Biface (Knife)	Perforator/Graver	Chopper	Retouched Flake	Core	Core Fragment	Chunk	Blank	Preform	Primary Flake	Secondary Flake	Interior Flake	Hammerstone	Ground Stone	Gouge	Biface Fragment	Uniface Fragment
	41 CM 98	2 3 0 3	50.0	4 1			X				X	X	X	X		X	X	X			X		
	41 BX 426	2 3 0 3	20.0	4 0	X		X				X	X	X	X	X	X	X	X				X	
	41 BX 384	1 3 2 2	80.0	4 0						X	X	X	X	X	X	X	X	X					
A3	41 BX 375	1 3 2 3	75.0	4 0	X	X					X			X	X	X	X	X				X	
	41 BX 374	1 3 0 2	37.5	3 0		X			X	X	X	X	X	X		X	X	X					
	41 BX 380	2 3 0 2	20.0	3 0	X	X	X				X	X		X	X		X	X					
	41 CM 94	2 3 0 2	20.0	3 0		X	X			X	X	X		X	X	X	X	X					
	41 CM 100	2 3 0 1	42.5	2 0	X	X	X				X						X	X				X	
	41 BX 381	2 3 0 1	85.0	2 0	X	X					X	X		X	X		X	X				X	X
	41 BX 424	3 3 0 1	40.0	2 0	X					X			X	X	X		X	X			X	X	
B	41 BX 392	4 3 0 1	3.5	2 0	X								X	X		X	X	X				X	X
	41 BX 382	4 3 0 1	77.5	3 0	X		X			X		X			X		X	X					X
	41 BX 371	4 3 0 1	62.5	3 1	X	X	X		X	X	X	X	X				X	X					X
	41 BX 393	4 2 0 1	50.0	3 0			X		X	X	X	X		X	X	X	X	X					

*The code presented here is from the Computer Coded Field Survey Form (see Fig. 5 for explanation). It is presented as a visual aid in gauging the similarity of sites in the cluster. These attributes were used in the cluster analysis.

$^{\Phi}$41 BX 396N

†41 BX 396S

Figure 49. (continued)

III. A.9

SETTLEMENT PATTERNS

Andrea Gerstle

The spatial configuration of the site types presents some indication of the relationships between the different sites. A glance at the map shows that distribution of sites is not uniform over the survey area. This is not only the result of the off-transect survey focus being along Cibolo Creek, but is also evident in the 15% systematic transect sample (see Fig. 34). Most of the sites are located along Cibolo Creek, with a second concentration in the south and southeast sections of Camp Bullis, i.e., the area south of the Balcones Fault Zone where chert resources are available. The extensive area between these two site concentrations contains only a few sites.

The explanation for this distribution lies partly in the function of the site and partly in the resources available or absent. For the purposes of discussion, Camp Bullis is divided into three archaeological sections: (1) the southern quarter, (2) the middle half and (3) the northern quarter (measured along the north-south dimension of the reservation). The divisions are approximate areas, not actual boundaries.

SOUTH SECTION

The southern section contains a concentration of sites, most of which are located in the eastern portion. The majority (19 out of 28) of these are quarry sites. Since chert outcrops are abundant here, it is logical that the primary purpose of the sites is directed toward the exploitation of that resource.

Six sites (41 BX 396N, 41 BX 396S, 41 BX 402, 41 BX 403, 41 BX 423 and 41 BX 431) appear to have functioned as campsites. Four of the six have scatters of burned rock; all show evidence that lithic reduction activities were carried out on the site.

The occurrence of three of the eight burned rock accumulations in this section is somewhat problematical. Two of the sites (41 BX 428 and 41 BX 430) are without extensive chipped stone present. The third (41 BX 36) is large and with abundant artifactual remains. It is probable that these three sites functioned as habitations. The location of these three sites near permanent or intermittent water sources and distant from chert sources (in direct contrast to the quarry sites) supports this possibility. It may well be that the small campsites in this area are satellite camps to the sites with burned rock accumulations. Small groups may have made forays for a short time for the purpose of collecting chert to bring back to the main camp. The chert was tested and reduced to the quarry blank stage before returning to the home base.

The sites in this southern area fall naturally, by type and physical location, into five groups:

(1) Sites 41 BX 36, 41 BX 428 and 41 BX 430 are stream valley sites with burned rock accumulations.

(2) Sites 41 BX 396N, 41 BX 396S, 41 BX 402, 41 BX 403, 41 BX 423 and 41 BX 431 are campsites, most with burned rock scatter, and in general are well up out of the major stream valleys.

(3) South of the chert line (Fig. 34), where chert is available at the surface, quarry sites of clusters I and J (see III.A.8) are large lithic procurement areas scattered through the area.

(4) Quarry sites of cluster C/gr form a group of five small sites close together on low hills in the Panther Springs Creek valley with a sixth member at a little distance to the north, and the two sites 41 BX 416 and 41 BX 418 (Grouping GR_2, associated with cluster C/gr) immediately north of that. Of this group of eight sites, one (41 BX 409) is an anomalous site with a scatter of burned rock and a wide range of tool types found on site, the kind of site being called a quarry-camp here. Quarry site 41 BX 405 is much like the sites in cluster C/gr and GR_2, but is located within 100 m of a water source; thus, it formed the single member of cluster K.

(5) Quarry sites of cluster D form a group of four moderate-sized quarry sites on the upper ridges and crests of Scott Hill and its neighbors to the immediate west. A fifth member of cluster D is 41 BX 395, about 1-1/2 miles away to the west across the Salado Creek valley. Of the close group, one site (41 BX 407) has an artifact collection quite similar to that seen at 41 BX 409, but no burned rock is reported. 41 BX 407 can be tentatively considered as a quarry-camp. Sites 41 BX 409 in Group 4 above and 41 BX 407 in this group are the only quarry sites in their respective clusters to which dates can be assigned. Both are dated to the Pre-Archaic and Late Archaic.

The configuration of site types and locations in the southern portion of Camp Bullis is a good application of Central Place Theory. Several major centers (the burned rock accumulation sites) are surrounded by minor centers (the short-term campsites). Both of these are in turn surrounded by resource-producing locations. The resource, in this case primarily chert, is funnelled either into the major centers directly or by way of the minor centers. The symmetry of the hexagonal Central Place Model is slightly distorted in this example due to the non-uniform distribution of the chert (it is restricted to the south) and the limits of the available transportion services (on foot).

The location of the main camps to the north of the chert source has interesting implications with regard to population movement. It is possible that the peoples exploiting the chert sources came from the north just for that purpose. However, this suggestion must remain tentative until surveys outside of the Camp Bullis boundary have determined the presence and types of sites occurring to the south.

Another possibility is the presence of abundant and varied plant resources to the north. The heaviest present-day concentration of sotol is to the north of 41 BX 428 and 41 BX 430. These burned rock accumulations may have been sotol-processing operations with concurrent camping activities. If this is true,

then 41 BX 36, a larger burned rock accumulation with abundant tools and bone, may have been a base camp of a higher level. The sotol-processing sites 41 BX 428 and 41 BX 430 would have been satellites of 41 BX 36 while serving as centers to the satellite quarry sites.

CENTRAL SECTION

The central section of Camp Bullis, half of the area of the reservation, contains a total of six sites, or 9.5% of the total number of sites recorded. This astonishingly low proportion may be due to several factors. First, one must consider the survey techniques employed, and second, the nature of the sites and the environment of the area.

One of the primary reasons why so few sites were located is because only minimal off-transect searching was conducted (in contrast to the northern section, where liberal time was spent in additional survey). The entire area was covered by the 15% systematic transect sample, but only parts of the western Muesebach Creek drainage were surveyed intensively. It may be assumed that these sites actually represent 15% of the total number and variability of sites in this area.

The second factor to be considered is the nature of the sites and the environment. Of the six sites in this section, three are campsites and three are special activity sites. The campsites are located in the stream valleys, while the special activity sites are well up into the hills. This situation suggests that the area was used only occasionally and for special purposes.

The relative scarcity of campsites and their satellites in this area may result from several factors. Although small springs and streams are scattered throughout the region, they are all unreliable water sources. Related to this water scarcity is the limited number and non-uniform distribution of plant species (at least currently, and probably in the past; C. M. Woodruff, personal communication). It may be that sufficient and varied food resources were not available, making the area less desirable for intensive prehistoric habitation.

Another possible cause for the scanty occupation may be related to the social organization of the prehistoric peoples. Ethnohistoric records document the existence of a band-level society with territorial limits (see Part I). In all likelihood, the arrangement also extended into prehistoric times. The central section of Camp Bullis may represent a territorial boundary zone which was exploited less intensively than either the southern section or the northern section, each of which would belong to different band territories. Unfortunately, this hypothesis cannot be tested at present, as the contemporaneity of whole site groupings, especially in the southern section, is as yet indeterminate.

NORTH SECTION

When considering the distribution of sites in the northern section, survey techniques must be taken into account once again. Although the entire area was covered with the 15% systematic transect sample, this section was also

the focus of much additional intensive survey. A total of 29 prehistoric sites was recorded for the northern section. Of these, 13 (45%) were located on the transects comprising the 15% sample. Based on these figures, at least 30% of the sites in this area were located (in the judgment of the survey crews, probably more nearly 75%). Table 18 presents the frequencies of sites located by transect survey and off-transect survey for each major site type in this section. Examination of this table indicates the direction of bias introduced by non-systematic survey techniques. Sites far from water tend to be slighted while water-proximate sites are emphasized.

The distribution of campsites, which in the central and southern sections forms the central focus of a series of special activity sites, is rather scattered in the northern section. In the transect sample, two water-distant campsites were located (from west to east: 41 BX 376 and 41 BX 390).

TABLE 18. FREQUENCIES OF SITES LOCATED ON AND OFF TRANSECTS

Site Type	On-Transect	Off-Transect
Water-distant Quarry Sites	0	0
Water-distant Campsites	2	1
Water-distant Special Activity Sites	5	6
Water-proximate Quarry Sites	0	0
Water-proximate Campsites	3	7
Water-proximate Special Activity Sites	3	2
	13	16

Three water-proximate camps were also located on transects (41 BX 386, 41 CM 102 and 41 CM 96). These are all situated within 100 m of Cibolo Creek, and one was on a chert source (remnant chert gravels on erosional surfaces, or strath plains; C. M. Woodruff, personal communication). This strategic location enables combining chert quarrying and tool manufacturing activities at the same place and time as other necessary living activities.

The fairly uniform distribution of campsites along Cibolo Creek suggests that it was a major deciding factor in the choice of campsite locations. It is a relatively reliable water source (deep water holes provide a year-round supply) and is definitely attractive because of its varied food and chert resources.

Five water-distant special activity sites were also located on the transects. They are all food procurement and secondary knapping areas. One (41 BX 381) is located in the uplands; the others (41 CM 98, 41 BX 380, 41 BX 374 and 41 BX 382) are in the flood plain of the Cibolo, or on its terraces. Three water-proximate special activity sites, situated on flood plains or low terraces, were located on the transects. They are all large burned rock accumulations, including sites 41 BX 372, 41 BX 377 and 41 BX 383.

A review of the types and distribution of systematically (transect) located sites from the north section indicates a different pattern of associations than in the south and central sections of Camp Bullis. The major difference lies in the lack of specific quarrying activity sites on the Cibolo Creek. However, many of the campsites served as quarry and resource procurement sites as well as camps, thus combining activities which in other areas occurred in separate locales. The environment along Cibolo Creek apparently was favorable enough to allow this consolidation of tasks in a single area.

The high site density along Cibolo Creek suggests that the area may have supported a relatively large population, but without better chronological definitions as to the times of site use, this prospect must remain speculative. The permanent water supply, varied food resources and availability of chert apparently were major criteria for defining a favorable occupation area.

SCATTERED ARTIFACTS

A total of 57 artifact scatters yielding 105 specimens was documented on Camp Bullis. These are divided into 10 types: projectile points, thinned bifaces and biface fragments, scrapers, cores and core fragments, flakes, retouched flakes, preforms, *Guadalupe* tool, chunks and worked glass. Table 19 presents the frequencies for each. It is apparent that thinned bifaces and fragments are the most common, followed by flakes, points and scrapers, and retouched flakes. It is very likely that many of the thinned biface fragments are actually projectile point fragments. Their shape is usually that of finely flaked distal tips or midsections with contracting, straight lateral sides. Most of these artifacts probably result from hunting activities. The high frequency of scattered scrapers and retouched flakes suggests plant collection away from campsites.

TABLE 19. FREQUENCIES OF SCATTERED ARTIFACT TYPES

Projectile points	14
Bifaces and fragments	34
Scrapers	12
Retouched flakes	8
Guadalupe tool	1
Cores and fragments	3
Preforms	5
Flakes	25
Worked glass	1
Chunks	2
Total	105

In comparing the distribution of the scattered artifacts with known sites, we see some interesting patterns. For example, a series of bifaces, retouched flakes and scrapers surround 41 BX 408, in the upper reaches of Lewis Creek.

Of the 12 artifacts, only three, and possibly five, are near the main watercourse. An additional three are along a small tributary which joins Lewis Creek near the site. Four artifacts were found in the upland (water-distant) margin, three of which are bifaces or biface fragments, as well as a retouched flake. Of the artifacts occurring along the drainages (water-proximate), two are bifaces, three are scrapers, two are retouched flakes and one is an unretouched flake. This distribution suggests that bifaces (possibly projectile point fragments) are used mostly in the uplands (water-distant) and scrapers and retouched flakes are predominant in the lowlands (water-proximate).

The same pattern is also true for the north section of Camp Bullis. Points and biface fragments are scattered throughout the uplands south of Cibolo Creek up to a distance of approximately three km. Scrapers and retouched flakes are much less common, but are for the most part within one km of Cibolo Creek, and generally much closer.

On the basis of these characteristics, it is suggested that biface fragments and projectile points, distributed throughout the uplands as well as the lowlands, are evidence of wide-ranging hunting activities. The scrapers and retouched flakes, on the other hand, are found most frequently in lowland (water-proximate) areas bordering streams, suggesting that their primary function was the gathering of lowland plant resources.

In the south section of Camp Bullis, containing predominantly quarry sites, projectile points, bifaces, scrapers and retouched flakes are less frequent and generally not associated with particular sites. The lack of major water sources or altitudinal differences precludes a correlation with resource or topographic zones. However, the majority of scattered preforms, cores and flakes occur in this area, indicating additional minor quarrying and core reduction activities. This would be expected, given the nature of the sites and the presence of chert.

CHANGE THROUGH TIME

Change in site types and settlement patterns through time is rather difficult to assess, as almost half of the prehistoric sites (29, or 46%) contained no chronologically diagnostic artifacts (i.e., identifiable projectile points). This decreased sample of dated sites includes both systematically (transect) located sites and off-transect sites. Any trends suggested by the data must remain tentative for the present.

Table 20 presents a tabulation of site components of a given time period, sorted according to site function and distance from water. A component is an occupation of a site in a particular period as shown. The percentage column refers to the proportion of water-distant and water-proximate sites of a particular type in each time period. A review of the totals by time period (the column on the far right) shows that the heaviest occupation was during the Late Archaic and Late Prehistoric, with slightly less than half the total number of sites in these two most recent periods. Although the bias introduced by the limited sample of dated sites cannot be accounted for, these figures would tentatively suggest a higher population density during the Late Archaic and Late Prehistoric periods. Most of this late population was

TABLE 20. CONTINGENCY TABLE OF SITE COMPONENTS BY TYPE AND TIME PERIOD

	Water-distant Quarry Site	Water-proximate Quarry Site	Water-distant Campsite	Water-proximate Campsite	Water-distant Special Activity Sites	Water-proximate Special Activity Sites	Frequency Total
Late-Paleo Indian		1(100)	2(50)	2(50)	2(67)	1(33)	8
Pre-Archaic	3(100)		3(100)		1(50)	1(50)	8
Early Archaic		1(100)	3(75)	1(25)	1(25)	3(75)	9
Middle Archaic		1(100)	2(67)	1(33)	1(25)	3(75)	8
Late Archaic	3(75)	1(25)	2(33)	4(67)	1(16)	5(84)	16
Late Pre-historic		1(100)	1(14)	6(86)	4(50)	4(50)	16
Frequency Total	6	5	13	14	10	17	65

Frequencies and the percentage of components of the sites are recorded.

First number = Frequency Second number ( ) = Percentage

concentrated along Cibolo Creek. Whether this is a function of the distribution of projectile points or actual population concentration is currently unknown.

The fact that most of the sites in the south section of Camp Bullis are quarry sites and have no finished, datable points makes it difficult to estimate when the sites were used and whether the utilization was varied in extent and intensity through time. Only 41 BX 407 and 41 BX 409, the two quarry-camps associated with clusters D and C/gr respectively, and 41 BX 399, with general Archaic lithic material, have datable points. These suggest dates of Pre-Archaic and Late Archaic utilization for both sites. The presence of these dated sites in the two groups could be taken to imply that the groups themselves were used only during those periods, but this is only a very tentative suggestion. It has yet to be proven that similarity of characteristics and physical association of sites indicate similarity of date, and such an assumption is necessary before the dating of sites without identifiable points can be possible. The figures presented in Table 20 make use only of the sites with dated components.

Examination of each of the site types and the frequency of dated occupations in each yield information suggestive of changing trends in land use through time. The differential utilization through time of different types of sites and areas is perhaps best seen in a comparison of the percentages in Table 20. Five sites located along the Cibolo Creek valley, which are located on chert cobble sources and show artifact assemblages appropriate to those of a quarry, were counted as quarry sites rather than as camps or special activity sites for the purposes of this table. These were 41 BX 386, 41 BX 373, 41 CM 70, 41 BX 375 and 41 BX 384.

In the Pre-Archaic and Late Archaic, quarry sites are largely water-distant, but in the remaining periods they are entirely water-proximate (see Table 20). Campsites are 50% water-proximate in the Late Paleo-Indian period but are entirely water-distant in the Pre-Archaic. Thereafter, the trend toward water-proximate campsites gradually increases, with 86% of such sites being water-proximate in the Late Prehistoric. Special activity sites also evidence an increase in water-proximate location through time, from 33% in the Late Paleo-Indian period to 84% in the Late Archaic; however, the trend is slightly reversed in the subsequent Late Prehistoric period, where special activity sites are divided equally between water-distant and water-proximate locations.

The great majority of quarry sites are undated, but are water-distant and would push the distribution curve for quarries well into the "water-distant" region for any period they were in use. In other words, the curves are probably reasonably representative for campsites, special activity sites and water-proximate quarries, but not trustworthy as an indicator for the usage of most water-distant quarry sites.

The preceding statements, of course, are not to be taken as conclusive. The small sample of sites per period and the potential bias introduced by non-systematic site locating techniques are not considered here. Hence, the changes in settlement patterns delineated are only tentative indications and must be further substantiated by similar studies in the area.

Another important bias which is unaccounted for here is the high frequency of multiple occupations. All of the site types were partly defined on the basis of the tool assemblages. If two or more occupations are indicated by projectile point types, then the remainder of the chipped stone must have been divided between the groups. In other words, what may have functioned as a hunting camp during one occupation might have been a secondary core reduction locale during another occupation. The combined assemblage would fall into the knapping campsite type category, but obviously this was not the function of the site during either occupation. Although detailed studies of chert-working technology and non-projectile point tool types may allow for the division of the entire artifact assemblage into its separate components, this was not attempted with the Camp Bullis data.

The following model (Fig. 50) for change through time is proposed as an aid for comparing Camp Bullis settlement patterns with those of other areas.

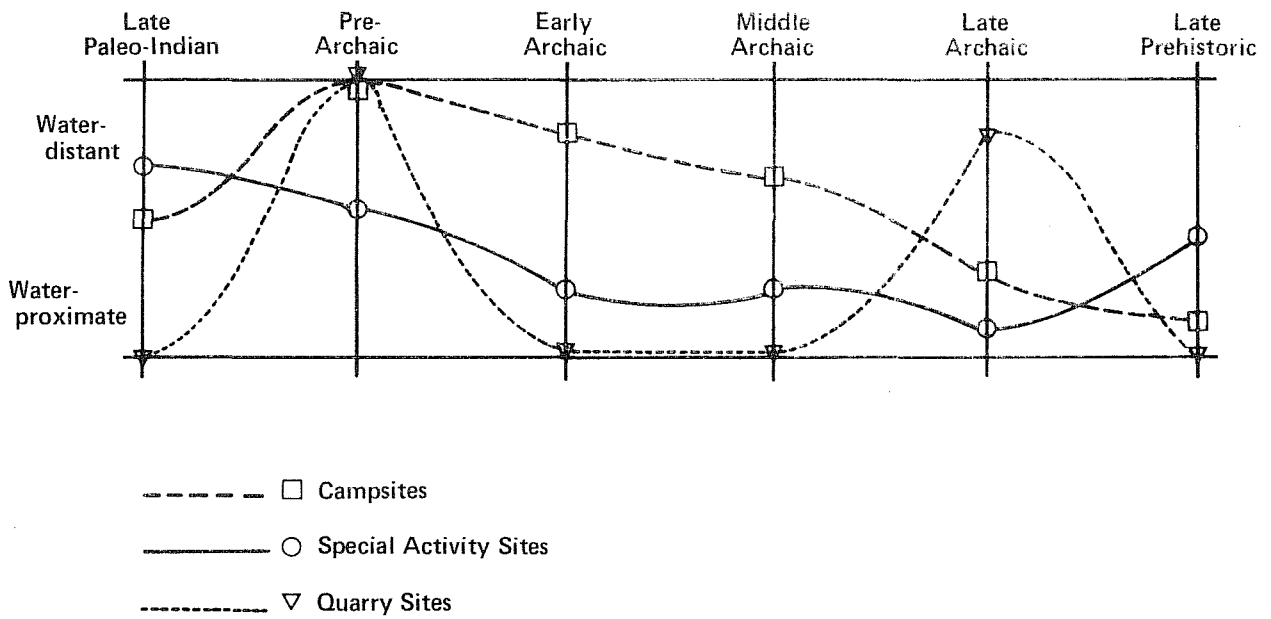


Figure 50. *Model of Changes in Settlement Patterns on Camp Bullis.* Campsites exhibit a gradual trend toward water-proximate locations from the Pre-Archaic to the Late Prehistoric. Special activity sites are generally water-proximate in the Archaic, with varied locations in the other periods. Quarry sites are largely water-distant in the Pre-Archaic and Late Archaic, but are entirely water-proximate in the remaining periods.

COMPARATIVE MODELS

The pattern delineated for the Camp Bullis data is compared here to settlement patterns of prehistoric hunter-gatherer groups in several different areas in Texas. Such comparisons may indicate the presence or absence of relationships with neighboring areas. These relationships may be due to cultural affinities in the sense of "genetically" related groups, i.e., actual contact and exchange of cultural traditions, or may be the result of similar culture-ecological adaptations to similar environments, while separation between groups is maintained.

The method of comparison to be used here is that of model testing. The settlement patterns characteristic of other areas are presented as models against which the Camp Bullis data can be tested for similarities and differences. Each model consists of three data subsets: (1) site types, (2) site locations and (3) change through time. When these are not available from a certain project or area, the subsistence interpretations presented are used in lieu of specific details. The reader should keep in mind that "water-proximate" is roughly locationally equivalent to river valley floors, flood plains and low terraces, while "water-distant" is equivalent to valley rims, bluffs and uplands.

Central and North Central Texas

Archaeological investigations in central and north central Texas consist largely of small area and reservoir surveys (cf. Hester 1975a). As mentioned previously, these emphasize the flood basin areas rather than yielding even coverage of all topographic features. In spite of this, two models are presented, the first based primarily on data derived from Skinner (1971), the second from Briggs (1971a), Kelly and Hester (1975a,b), Kelly and Hester (1976) and Patterson and Adams (1977).

Model I

At Cordova Bend Reservoir, Skinner has identified three types of sites. There are base camps, hunting and gathering camps and chipping stations, essentially the same as Hester's (1970a, 1976b) site types at Chaparrosa Ranch and Shafer and Baxter's (1975) multiple function, limited function and resource procurement sites, with some slight overlap of the latter two types. Skinner's (1971: 158) base camps are considered long term, repeated occupations of large size and depth. The hunting and gathering camps are presumably seasonal, rather limited activity sites occupied by smaller groups (*ibid.*:158, 259). The chipping station definition is self-explanatory.

The distribution of these types of sites is decidedly not uniform. Base camps are located on the alluvial terraces of the major watercourses. Seasonal hunting and gathering camps are along the tributary stream banks, and chipping stations are present on the high limestone bluffs (Fig. 51). The types of sites are correlated highly with the various micro-environments (*ibid.*:160).

MODEL I

	Early	Late
Bluff	o	o
Tributary	Δ	Δ
Alluvial Terrace	*	*

* Base Camp Δ Hunting/Gathering Camp o Chipping Station

Figure 51. *Model of Settlement Pattern in North Central Texas.*

Skinner hypothesizes about the social organization of the prehistoric reservoir inhabitants. The proposed "central-based wanderer" model is characterized by ". . . two different size living sites, the larger one being the central base which was inhabited by many families and the smaller ones having been occupied by nuclear or extended families on a seasonal or activity specific basis. All these sites would be within an area recognized as their own by the peoples" (*ibid.*:285).

Skinner (1971:259) observes no change in settlement patterns through time. It is apparently similar during the entire time span covered by the Archaic and Late Prehistoric periods.

Model II

Briggs (1971a) found a basically similar pattern of settlement present in the Ingram Reservoir area. The main period of occupation was during the Archaic. He has identified two major site types: camps and quarry sites. The camps are subdivided into two groups: those with burned rock middens and open campsites without burned rock middens. The majority of sites were camps with burned rock middens. These and the open campsites are almost without exception located on the first terrace above the river or near other flowing or intermittent water sources. Briggs surmises that ". . . the main emphasis in utilization of streams may have been as a water source, with additional emphasis placed on the hunting of game in the higher reaches of the hills and terraces" (*ibid.*:30). Briggs' open campsites are comparable to Skinner's hunting and gathering camps, and Briggs' burned rock midden sites can be equated with Skinner's base camps.

The same sort of pattern is duplicated in other survey areas. On Walker Ranch in northern Bexar County, all but nine of 43 sites located are on the lower terraces adjoining the main creek. Of the nine other sites, one is a campsite located on a bluff, and one is a specialized quarry site. The others ". . . show little evidence of occupation . . ." (Hudson *et al.* 1974:15).

Investigations at Lake Whitney, Texas, show the same distribution of site type and a similar continuity through time (Skinner and Gallagher 1974). In this area, rockshelters show seasonal habitation beginning in the Late Prehistoric, although excavations at other rockshelters in central Texas have yielded Archaic occupation levels (cf. Johnson, Suhm and Tunnell 1962; Fawcett 1972).

Patterson and Adams (1977:7-9), in a survey of a ranch in Kendall County, explored the relationship between types of quarry sites and change through time. They have identified two types of quarry sites: (1) campsite-quarry sites with a full lithic tool kit and (2) quarry-workshop sites which are limited to core reduction and tool manufacture. Type 1 sites, the campsite-quarry sites, are Paleo-Indian and Pre-Archaic in age and are located on hilltop chert sources. The quarry-workshop sites of Type 2 are Early to Middle Archaic in age (*ibid.*: 12) and located on lower terraces overlooking creeks (Patterson and Adams 1977:9; cf. Hester, Bass and Kelly 1975; Kelly and Hester 1975a,b).

The distinction between these two quarry site types corresponds with change through time; ". . . there could be a change in site locations . . . from the early 'lookout sites' to later Archaic period sites with a lower riverine adaptation" (Patterson and Adams 1977:12). Surveys by Patterson (*ibid.*:12-14) in Bandera, Medina and Real Counties suggest that this shift in site locations ". . . is not an isolated phenomenon, but rather may be a generalized pattern for the hill country of South-Central Texas." This survey has produced indications of settlement changes through time, namely that of sites moving closer to major waterways as time progresses.

The phenomenon of burned rock middens is restricted to the Edwards Plateau and Trans-Pecos regions (Kelley and Campbell 1942; Suhm 1960:68). They generally appear during the Middle Archaic and continue to be constructed in the Late Archaic. By the Late Prehistoric period, although occupation is often on or near the burned rock midden, they were not added to. Although form varies (cf. Weir 1976; Greer 1967), they are often interpreted as a special type of base camp feature ". . . not purposefully constructed" (Kelley and Campbell 1942:322). They are possibly the remains of broken-up hearths which are consistently cleared and dumped on a convenient pile (Hester 1970b, 1971:125), or they may be a series of superimposed hearths (Kelley and Campbell 1942; Suhm 1959, 1960:68) accumulated through time. The burned rock midden sites are typically located on low terraces fronting a good water source, or near a permanent or now intermittent spring or stream (Hester 1970b, 1971; Johnson, Suhm and Tunnell 1962:10; Fawcett 1972).

Open campsites without burned rock middens are also numerous during the Archaic, but their distribution seems to have a slightly broader range, extending farther up tributaries and often associated with less reliable water sources.

The Late Prehistoric campsites are often located directly on or adjacent to Archaic burned rock middens. This indicates a similar site location pattern, but the occupations themselves are invariably without the burned rock accumulations characteristic of the earlier Archaic occupations.

Model II, based on the research summarized above, consists of the following attributes (Fig. 52). Paleo-Indian sites are usually campsite-quarry sites located on upland chert sources. Archaic site types are of three major types: base camps, of which two types are noted, one with burned rock middens, one without; hunting and gathering camps; and quarry workshops or chipping stations. Both base camp types are located mainly on major river or stream terraces, as are chipping stations. Hunting and gathering camps are located along tributaries of the larger water courses. Late Prehistoric sites also consist of base camps, hunting and gathering camps, and chipping stations with a similar

distribution. However, no burned rock middens are formed during this period. Rockshelters are occupied throughout the Archaic and Late Prehistoric, with perhaps a greater emphasis on the Late Prehistoric (Shafer 1971:2).

A depopulation from the Archaic to the Late Prehistoric is tentatively suggested for Bexar County by Fawcett (1972:33) and for the Austin area and much of central Texas in general by Shafer (1971:5). Fawcett also notes a possible change in the location of hunting and gathering camps from high bluffs overlooking major streams in the Archaic to locations at the junction of tributaries with major creeks in the Transitional Archaic, but moving back up to blufftops during the Late Prehistoric.

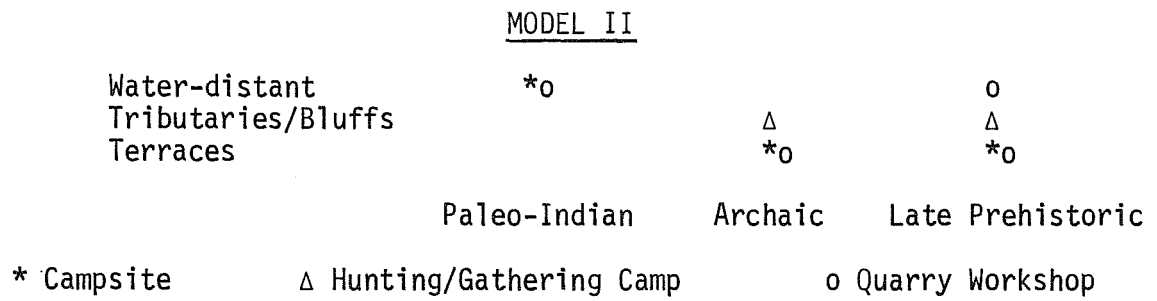


Figure 52. *Model of Edwards Plateau Settlement Pattern.*

South Texas

Studies in south and south central Texas, i.e., on the coastal plain south and southeast of the Balcones Escarpment, have yielded substantial data on settlement patterns. Foremost among these studies are surveys carried out on Chaparrosa Ranch (Hester 1970a, 1976b), the Lignite Project in Atascosa and McMullen Counties (Shafer and Baxter 1975), Palmetto Bend Reservoir (Mallouf, Fox and Briggs 1973), Cuero I Reservoir (Fox *et al.* 1974), and Cibolo Reservoir (Hsu and Ralph 1968), in addition to other smaller scale surveys. These surveys have revealed a considerable amount of variability in settlement patterns, and as a result, a single model is insufficient. Two models are presented here. Model III is based on Hester's work at Chaparrosa Ranch. Model IV is derived from Shafer and Baxter's report on the Lignite Project. Both of these models are based on surveys which covered the entire range of topographic variability, from stream bottom to hilltop, rather than selected topographic areas such as reservoir basins. The reservoir survey data, however, provides supplementary details, especially on site types and changes through time.

Model III

Hester's settlement pattern model for south Texas is presented in brief form below (Fig. 53). Three basic site types are identified: base camps, temporary hunting/foraging camps and lithic workshops. Base camps are extensive linear accumulations of artifactual material, often with some depth,

paralleling the stream channels. They are situated on the flood plain, low terraces or natural levees. Short-term hunting and foraging sites are shallow, small sites with scattered debitage and hearth stones, located in the uplands, on high gravel terraces and on the flood plain margins. Chipping stations, or lithic workshops, are located in the uplands near gravel outcrops (Hester 1970a:12-13; Hester 1976b:85).

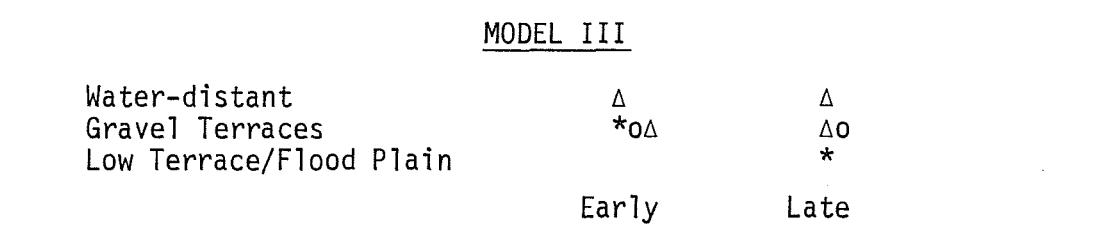


Figure 53. *South Texas Settlement Pattern* (A).

Hester (1970a:13) refers to the short-term hunting and gathering camps and lithic workshops as "subsidiary sites," implying that they are satellites to the base camps where the majority of the population lived and most of the everyday campsite tasks were accomplished.

A distinct change in settlement locations through time is noted on Chaparrosa Ranch.

> "Paleo-Indian and Pre-Archaic sites are found on high terraces rimming the stream valley; later sites, particularly Late Archaic and Late Prehistoric, are found near the present channels . . . often positioned in ecotone situations" (Hester 1976b:95).

The three types of sites are apparently present during the entire cultural-historical sequence.

Model IV

The second model proposed for south Texas is based on the Lignite Project survey in Atascosa and McMullen Counties (Shafer and Baxter 1975), somewhat closer to Camp Bullis than the Chaparrosa Ranch area.

In a manner similar to Hester's, several site types have been identified, based on the type and number of activities indicated by the material remains. These are called Multiple Function Sites, Limited Function Sites and Resource Procurement Sites. The definitions of the sites are as follows (*ibid.*:72).

Multiple Function Sites are represented by a wide range of activities (Hester's base camps). Limited Function Sites are considered short-term or seasonal; ". . . although a wide range of activities were actually conducted there, the

occupations were not extensive enough that most activities were represented by lithic refuse" (Shafer and Baxter 1975:72). Resource Procurement Sites are represented by only one or very few specific activities. Often these are lithic procurement sites, or chipping stations.

The distribution of these site types between the physiographic areas is apparently more uniform than on Chaparrosa Ranch (Fig. 54). Multiple Function Sites occur in every location from the stream bottoms to the upland (water-distant) margins and upland ridges between drainages. Limited Function and Resource Procurement Sites are similarly distributed as shown by an insignificant Chi-square value (X^2 = 5.66, df - 6) calculated on the cross-tabulation of site types with physiographic locations (upland, upland margin and stream valley) (*ibid.*:74; Table 4:8).

Shafer and Baxter (1975) propose several possible reasons why the site types do not correlate with physiographic zones. These include the lack of natural and biotic resource diversity, the common utilization by all bands of the resources (*ibid.*:15), and the fact that "There is ample water in the upland drainages during wetter seasons . . . (and) that the Archaic populations would venture into the uplands and establish encampments during wetter seasons or years" (Shafer and Baxter 1975:74). Due to the seasonality of upland water availability, however, "the better watered areas . . . over time . . . would see the most intensive utilization" (*ibid.*:75).

A chronology of sites located in the Lignite Project study area was impossible to establish, due to the scarcity of projectile points (Shafer and Baxter 1975: 70). It is likely that the majority of the sites are Archaic in age, and therefore the model presented is considered typical of that period. Change in settlement patterns through time is impossible to assess using data from this survey.

MODEL IV

Water-distant	o
Water-distant Margin	*Δ
Stream Bottom	*

Archaic

* Multiple Function Site (base camp)
o Resource Procurement Site (primarily lithic)
Δ Limited Function Site

Figure 54. *South Texas Settlement Pattern (B).*

Other South Texas Surveys

The data from other surveys in south Texas conforms in part with one or the other of the two models presented above. The data is of limited utility in formulating models of entire settlement systems because it is restricted to the flood basins of proposed reservoirs. In addition, the types of sites are

not so clearly defined or described; hence, comparability with the areas under consideration is limited. However, some interesting data on site locations and change through time is presented.

The Cuero I Reservoir survey (Fox *et al.* 1974) presents some information on changing settlement locations through time. Paleo-Indian, Early and Middle Archaic tool forms are not found on the modern flood plains or colluvial gravel deposits, but are present on the older fossil flood plain and upland sandstone terraces. It is suggested for the Early and Middle Archaic that, although the river is the focus of settlement, the subsistence base included the upland terraces and prairie outside the river basin. Late Archaic and Late Prehistoric occupations are concentrated in the modern flood plain, with Late Prehistoric covering a slightly wider range of locations. This indicates a reliance on riverine resources. These changes in settlement and subsistence may be associated with climatic changes, from xeric during the Early and Middle Archaic, to mesic during the Late Archaic, although this has not been conclusively demonstrated (*ibid.*:205,213-215).

It appears that the upland orientation of Early and Middle Archaic settlement at Cuero I may correspond with the upland Archaic occupation in the Lignite Project area. It is possible, however, that settlement in the Lignite Project area was as dynamic as in the Cuero I Reservoir area. It seems that settlement trends through time are similar for both Chaparrosa Ranch and other areas in south Texas, i.e., the later populations moved closer to the major water sources.

Fawcett's (1972:23-24) summary of Bexar County archaeology is based on two settlement pattern models, one for the Edwards Plateau region, and one for the southern portion of the county, corresponding to the Rio Grande Plain. The latter model, based primarily on Hester's (1970a, 1971) work, is examined here.

Fawcett defines three site types, primarily on the basis of site size and artifact content. These are base camps, hunting and gathering camps, and chipping stations.

The base camps are large, thick alluvial sites situated on major watercourses. Hunting and gathering camps are located on valley rims and in the uplands. Chipping stations are present on the gravel terraces on the rims of large valleys. This model, similar to Model III presented above, is examined for change through time.

Most of the Paleo-Indian materials are mixed with later Archaic occupations. This may tentatively indicate a similar settlement pattern as in the later Archaic; however, no isolated Paleo-Indian components are known. The distribution of point types at the time of the review (1972) appeared to be nonrandom; *Angostura* points are predominant in the northern part of the county, and *Plainview* and other types appear mostly in the southern part. This remains to be conclusively demonstrated.

During the Archaic period, base camps are large, thick terrace sites with evidence of plant and mussel collecting as major food sources. Archaic hunting camps are unknown from south Bexar County, and the only Archaic chipping

station known is on the upper edge of the Cibolo Creek valley on a natural chert gravel concentration. Except for the lack of known gathering camps, Archaic settlement conforms with the general model. The Archaic pattern is continuous with the Transitional Archaic. However, there is evidence of a rapid depopulation combined with a possible northward migration (Fawcett 1972:33).

The Late Prehistoric period in south Bexar County is characterized by a scarcity of sites. All of the ones as yet located are base camps where Late Prehistoric and Archaic materials are mixed. The sites are located on alluvial terraces.

The distribution of Late Prehistoric point types is apparently significant. *Edwards* points are commonly found in the northern zone; *Scallorn* and *Perdiz* points are concentrated along the easternmost edge of the Edwards Plateau (*ibid.*:35).

It appears, on the basis of the limited amount of data available from south Bexar County, that settlement patterns did not change through time. However, there seems to be a decrease in population density from the Archaic to the Late Prehistoric, corresponding with a northward movement. This settlement pattern and population decrease is also observed in the results of a survey of the Cibolo Reservoir, Wilson County (Hsu and Ralph 1968:52-53).

Some of the surveys mentioned above indicate a change from upland to stream bottom site locations through time. Similarly, evidence of depopulation is present in some areas. These are combined in a model of change through time (Fig. 55).

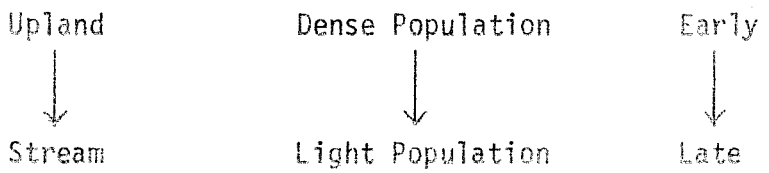


Figure 55. *Model of Changes in Settlement Patterns in Bexar County.*

COMPARATIVE ANALYSIS

The settlement patterns suggested by the Camp Bullis data (Fig. 50) and the models presented for neighboring areas in Texas may be compared for similarities and differences. A review of the trends through time is instructive.

One striking similarity is seen in the changing locations of base camps. It is apparent in all the models that either base camps were moved into the lowlands (water-proximate) as time progressed or, as in north central Texas, the main camping locations were always the lowlands. This is seen in Camp Bullis where the Late Prehistoric campsites are predominantly in the lowlands. Within the Archaic period, however, campsites gradually migrated from upland

(water-distant) to lowland (water-proximate) locations. There is some difference, however, in the lowland (water-proximate) location of 50% of the campsites on Camp Bullis with Late Paleo-Indian components. This appears to contradict Models II and III for the surrounding areas, where Late Paleo-Indian campsites were water-distant; however, this contrast may not be real, but rather an artifact of the possible misidentification of site functions for these components on Camp Bullis (see discussion, page 203).

The variations within the Archaic period (including Early, Middle and Late Archaic) settlement patterns in Camp Bullis are only roughly comparable with the less specific models presented for other regions. Again, the variation may be due to differing views on site-functional classifications, but given the long time span covered by the Archaic period, some differences are to be expected.

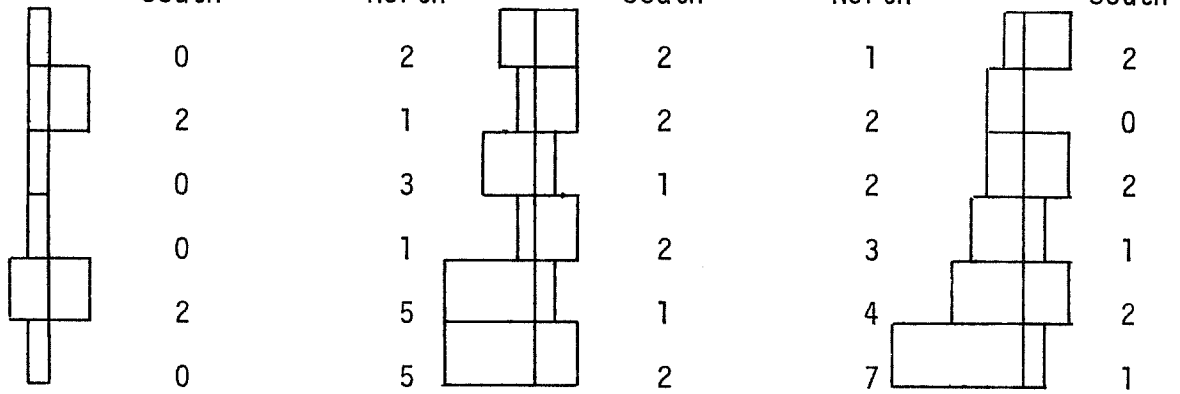
Comparison of Camp Bullis with other regional models in terms of quarry sites is complicated by the large number of undated, upland (water-distant) quarry sites located in the Bullis survey (see page 202). Quarry sites generally occupied upland (water-distant) locations in the four regional models, although Model II notes lowland (water-proximate) quarries in the Archaic and Late Prehistoric.

It is interesting to note the similarities between Fawcett's model south of Bexar County and the counts of site components from Camp Bullis. In Table 20, these counts are presented showing the actual number of site components of each type in each location, according to their distance from water. Table 21 is a count with the division according to whether the sites are in the north portion of Camp Bullis, largely Cibolo Creek and its associated terraces and valley rims, or in the south portion, the lower hills and small stream valleys of the edge of the Edwards Plateau. Both tables show a distinct trend of increase through time, but the north/south histograms reveal that this increase is largely in the north. The south shows little change through time. It is tempting to suppose that Fawcett's apparent northward movement is being reflected here, with his population moving into such areas as the Cibolo Valley.

Obviously, it is very difficult to compare the changing Camp Bullis settlement pattern to those of other areas. This is primarily due to the lack of specific and suitable data from these other regions; either the studies did not focus on settlement patterns, or the dating possibilities were restricted by the lack of chronologically diagnostic tool types. This latter factor is probably the major one, caused either by different adaption of the prehistoric inhabitants or, more likely, by the selective collecting of projectile points by modern inhabitants. The Camp Bullis military reservation has long been accessible only to military personnel, which probably accounts for the large number and variety of projectile points recovered during the survey of Camp Bullis, thus enabling more detailed, if still tentative, trends in settlement patterns through time to be identified. The model presented remains to be tested with and compared to other detailed studies of this type.

TABLE 21. CONTINGENCY TABLE OF SITE COMPONENTS BY NORTH, SOUTH DISTRIBUTION

	Quarry Sites		Campsites		Special Activity Sites		Total
	North	South	North	South	North	South	
Late Paleo-Indian	1	0	2	2	1	2	8
Pre-Archaic	1	2	1	2	2	0	8
Early Archaic	1	0	3	1	2	2	9
Middle Archaic	1	0	1	2	3	1	8
Late Archaic	2	2	5	1	4	2	16
Late Prehistoric	1	0	5	2	7	1	16
Total	7	4	17	10	19	8	65



Number = Frequency of Sites

III. A.10

CONSTANT VOLUME ANALYSIS

Cristi Assad

INTRODUCTION

Three sites were chosen for analysis of constant volume samples (hereafter referred to as CVS). The sites 41 BX 36, 41 BX 377 and 41 BX 428 were chosen for a variety of reasons: (1) each was in a different area of the base, (2) each was excavated to a depth of 80 cm or more, and (3) this depth provided ample vertical sample for a variety of studies including soil analysis, microfaunal analysis, pollen analysis and micro-snail analysis.

FLOTATION ANALYSIS

The CVS provide information which the normal excavation procedures do not allow. Flotation analysis, consisting of a light and heavy fraction (see III.A.4), provides control data which is normally unobserved during excavation (Tables 22 and 23; see discussion of laboratory procedures on pages 55 and 61).

The heavy fraction was sorted for six samples from two units (1, 23) from 41 BX 36; nine samples from Unit 5 of 41 BX 377; and nine samples from the two units (2, 4) from 41 BX 428. The material obtained from this sorting includes: a variety of lithics, seeds (burned and unburned), numerous snails (many very small), faunal material (burned and unburned) and a few miscellaneous items. Separate soil and pollen analyses were also carried out on soil from these samples.

Site 41 BX 36 is a major mulit-occupation site. Two units were samples from this site: Unit 1 (E997, N1007), excavated to 110 cm where limestone bedrock was encountered; and Unit 23 (E1-07, N1005), excavated to 50 cm where limestone bedrock was encountered. Both were excavated in 10 cm levels; a sample was processed for every alternate level. Site 41 BX 36 produced numerous lithics, bone, snails and a variety of other material.

Site 41 BX 377 is a Late Prehistoric/Pre- and Late Archaic site located in alluvial deposits along Cibolo Creek. One excavation unit, Unit 5 (E992, N1010). was sampled. This unit was excavated in 5 cm levels and was sampled at every 10 cm. Unit 5 was excavated to 85 cm and bedrock was never reached. The site produced a moderate amount of lithics, many snails and very little faunal material.

Site 41 BX 428 is a possible special activity and occupation site. Two units were sampled from this site, one in the burned rock accumulation (Unit 2) and one in the adjacent occupation area (Unit 4). Unit 2 (E999, N999) was excavated to a depth of 110 cm and bedrock was never reached. The soil from Unit 2 was very black but consisted primarily of burned limestone. The CVS yielded very little in the way of cultural material. Unit 4 (E1002, N1008),

TABLE 22. HEAVY FRACTION FROM CONSTANT VOLUME SAMPLES*

Site	Unit	Level (cm)	Artifacts or Retouched Flakes	Flakes†	Misc. Chert Debris	Seeds	Seeds (Burned)	Identifiable Bone	Identifiable Bone (Burned)	Unidentifiable Bone	Unidentifiable Bone (Burned)
41 BX 36	1	30-40		76	7	10	1	3		32	21
	1	50-60		138	6	15		1		21	7
	1	70-80		44	2	11				12	11
	1	90-100		30	2	13				9	3
	23	10-20	1	328	11	17	13	14		136	74
	23	30-40	2	205	6	31	21	9	1	172	34
41 BX 377	5	0-5		12		10	3			1	
	5	10-15		30	2	2				3	1
	5	20-25		22	1	1					
	5	30-35		20		2	1			2	3
	5	40-45		13						7	1
	5	50-55		17						4	
	5	60-65		8		1				2	
	5	70-75		4							
	5	80-85		7							
41 BX 428	2	0-10		13	3	16				1	2
	2	20-30		32	3					1	2
	2	40-50		10		1	7				
	2	**									
	2	70-80		9		3	1			1	
	2	90-100		5		3				4	
	2	100-110		6	1	9	4				
	4	0-10		31	1	2					1
	4	20-30		57						2	8
	4	30-40		141	5	1				7	13

* - The information for the snails is in Table 23, and the soils analysis results are in Table 24.
** - The CVS between 50 and 70 cm were not available for processing.
† - Includes primary, secondary and interior. The majority of flakes were interior.

TABLE 23. SNAILS FROM CONSTANT VOLUME SAMPLES

Site	Unit	Level (cm)	*Rabdotus sp.**	*Polygyridae*†*	*Helicina orbiculata tropica**	*Pupoides modicus*	*Succinea grosvenori*	*Vertigo oscariana*	Burned Snail Fragments
41 BX 36	1	30-40	142	21	59		1		82
	1	50-60	72	21	54				21
	1	70-80	79	20	32		3		61
	1	90-100	71	26	14		7	1	27
	23	10-20	228	33	56			3	277
	23	30-40	142	45	101			2	299
Total			734	166	316		11	6	742
41 BX 377	5	0-5		1	2				2
	5	10-15	6	4	19				9
	5	20-25	2	1	2				2
	5	30-35	18	3	2				28
	5	40-45	26		1				
	5	50-55	22	6	2	1			27
	5	60-65	2	1	3	2			11
	5	70-75	4	3		1			12
	5	80-85		2	1	2			2
Total			56	21	32	6			63
41 BX 428	2	0-10	14	10	19	3			46
	2	20-30	64	9	10	1	2		35
	2	40-50	43	9	15				13
	2	70-80	25	7	10				4
	2	90-100	33	12	1				1
	2	100-110	41	16	6				4
	4	0-10	10	7	10				
	4	20-30	53	2	6				35
	4	30-40	116	9	16				212
Total			399	81	93	4	2		318

* - All juveniles and adults counted together.
† - Snail family covers all *Polygyra sp.* and one *Mesodon sp.*

however, with dark brown humic soil, produced many snails and lithics. It was only excavated to 40 cm and did not completely penetrate the cultural deposits.

Time did not allow for the sorting of the light fraction which would have required a microscope. Nor was there time for a horizontal sample to complement the present vertical sampling.

SOIL ANALYSIS

Twenty-four soil samples were tested in conjunction with the constant volume samples. The Agricultural Extension Service of Texas A & M University, College Station, processed the soil. The tests gave readings for pH, calcium, magnesium, nitrates, phosphorus, potassium and organic matter. Table 24 lists the provenience of the samples and the test results. In dealing with these various chemical elements, some general statements can be made before applying them in an archaeological context:

1. Soil reaction, or pH values, are usually high (alkaline) when the sediments involved develop in calcareous environments (Shackley 1975). A high acid pH in soils causes decomposition of bone and plant material (Shackley 1975).

2. Both calcium and magnesium are supplied from lime or lime-related sources (in this case the limestone bedrock) (Buckman and Brady 1969).

3. Nitrates are derived mainly from plant matter and are added to soil by decomposition of proteins (Cornwall 1958). Nitrogen, organic phosphorus and potassium are supplied to soil from fecal material or organic matter (Buckman and Brady 1969). Both organic matter and nitrogen are easily lost through oxidation and leaching (*ibid.*).

4. Organic phosphorus, as stated above, is produced in soils by decomposition of bone and fecal material (Buckman and Brady 1969, Shackley 1975). A pH value of 5.6 or less (more acidic) will allow for the leaching-out of phosphates.

5. Potassium is usually added to soils the same way as phosphorus and nitrates. However, potassium, in contrast to phosphorus, is usually plentiful except in sandy soils (Buckman and Brady 1969).

6. Organic matter is deposited by dead and decomposing organisms and is directly related to many of the above chemicals.

Each of the three sites tested will be discussed separately with regard to its soil composition. The results of the soil analysis of these sites are inconclusive; comparative horizontal data would probably prove very informative.

TABLE 24. RESULTS OF SOILS ANALYSIS*

Site	Unit	Level**	pH	Nitrate†	Phosphorus†	Potassium†	Organic Matter (%)
41 BX 36	1	30-40	8.1	4	>640	>1200	1.3
	1	50-60	8.2	1	553	>1200	1.1
	1	70-80	8.6	<1	475	>1200	.6
	1	90-100	8.3	1	194	>1200	.4
41 BX 36	23	10-20	8.4	1	>640	>1200	2.8
	23	30-40	8.2	1	>640	>1200	1.6
41 BX 377	5	0-5	8.2	4	34	750	3.3
	5	10-15	8.2	1	16	460	1.5
	5	20-25	8.5	1	22	410	.8
	5	30-35	8.3	10	27	390	.4
	5	40-45	8.6	4	22	440	.4
	5	50-55	8.4	4	16	480	.4
	5	60-65	8.6	2	18	440	.3
	5††	70-75	8.2	2	13	570	.3
	5	80-85	8.6	2	5	550	.3
41 BX 428	2	0-10	7.8	12	553	>1200	4.2
	2	20-30	8.2	4	103	>1200	4.2
	2	40-50	8.0	5	78	730	4.0
	2	70-80	8.1	1	13	620	3.7
	2	90-100	8.2	1	132	460	2.8
	2	100-110	8.3	4	132	410	2.0
	4	0-10	8.1	10	201	>1200	>4.2
	4	20-30	8.1	8	42	>1200	2.4
	4	30-40	8.2	4	38	1140	1.7

* - Calcium and magnesium readings are omitted; all were above maximum instrument sensitivity.
** - Number of cm below ground surface.
† - Pounds per acre.
†† - Possible error in this level.

THE SITES

Both the calcium and magnesium values were well over the scale of the instruments they were tested on for all three sites. Their source is the limestone bedrock of the Camp Bullis area. The nitrate level fluctuates for all the sites tested and, due to its easy leaching qualities, has been disregarded.

The data for 41 BX 36 are presented briefly. The pH level increases in alkalinity from top to bottom (Unit 1, 40 cm to 100 cm, and Unit 23, 10 cm to 40 cm) as the levels get nearer to the limestone bedrock. The organic matter decreases correspondingly from the upper levels to the lower levels. The potassium readings for this site are all above the instrument levels and cannot be used. The phosphorus readings are extremely high (over the instrument scales) in the upper levels of both units (Unit 23, 10-20 cm and 30-40 cm, and Unit 1, 30-40 cm). In Unit 1 the phosphorus values drop steadily along with the bone count (see Table 24) but are still high. These phosphorus readings may be partially the result of former human occupation, although the specific organic phosphates which would indicate this are not recognized. Cornwall (1958:196) states that ". . . the presence of a concentration of phosphate at any level in an archaeological (site) may be taken to represent a surface occupied by man or animal." Specialized phosphate testing would likely prove profitable.

The results for 41 BX 377 can only be considered negative evidence (Philip Dering, personal communication).* The site was formed during the deposition of alluvial silt. Repeated inundations through time result in alternate leaching and deposition of organic materials. The pH and the organic matter readings are similar at 41 BX 377 and 41 BX 36, but there are no other similarities. The phosphorus readings are very low, indicating probable leaching caused by the flooding of Cibolo Creek.

The two excavation units on 41 BX 428 represent two different activity areas. Unit 4 is in a living area with numerous lithics and burned rock, while Unit 2 is in a burned rock accumulation, a possible special food processing area. Unit 4 was only excavated to a depth of 40 cm and was not culturally sterile at that level. The information for Unit 4 is incomplete and, for this reason, provides an incomplete comparison with Unit 2, excavated to a depth of 110 cm.

The pH readings increase in alkalinity as the levels get closer to the limestone bedrock, while the organic matter decreases with greater depth. The phosphate readings are low and erratic when compared to those for 41 BX 36. There may be some cultural cause for the correlation between the potassium levels and the phosphorus levels, but at this point, no data has been found in the published archaeological literature to allow any conclusions.

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*Mr. Philip Dering is with the Department of Anthropology, Texas A&M University, College Station, and consulted for the present project on many occasions in June and August, 1977.

SNAIL ANALYSIS

A total of 1921 snails were analyzed for the present project. These were obtained from the constant volume samples, thus providing comparable information.

Seven different genera of snails were identified, six to the species level, from CVS. Table 23 lists the provenience and quantities of these snails. Mr. John Clark, Jr., Archeologist, Texas Historical Commission, Austin, identified many of the smaller snails and provided useful information. The types of snails recovered from excavations are listed below, along with habitat information.

Rabdotus (Bulimulus) cf. dealbatus. Inhabits semi-arid to arid areas in grassy fields with low brush (Clark 1969).

Polygyra cf. texasiana. Open fields and woodlands; a hardy species (Allen and Cheatum 1961).

Helicina orbiculata tropica. Drought-resistant; inhabits open fields and more often woodlands; has arboreal habits (*ibid.*).

Pupoides modicus (Gould). A hardy species which inhabits wooded as well as arid areas (Allen and Cheatum 1961).

Succinea grosvenori. Inhabits moist wooded areas with woodland floor cover (Clark 1969).

Vertigo oscariana (Sterki). Found in moist areas under stones and ground debris (Allen and Cheatum 1961).

Mesodon sp. Occurs in heavily wooded areas (*ibid.*).

Three types of snails, *Rabdotus sp.*, the family *Polygyridae* and *Helicina orbiculata tropica*, were found at each of the three sites. *Succinea grosvenori* and *Vertigo oscariana* were found in small quantities at 41 BX 36. *Pupoides modicus* was the only other snail found at 41 BX 377 and only in the lower levels (55-85 cm). Both *Pupoides modicus* and *Succinea grosvenori* were found in the upper levels of Unit 2 at 41 BX 428 but only in very limited quantities. The snails in the samples are all usually found in an upland habitat, and no major environmental conclusions can be drawn from the data.

Many archaeologists have used snails for dating and attempting to determine changes in environmental conditions. References have also been made to the use of snails as a food item. Clark (1969) briefly mentions previous works involving the analysis and interpretation of the use of snails in archaeological contexts.

No conclusive statements can be made at this writing about the snails found in the constant volume samples. Future statistical analysis may prove fruitful in correlating relative quantities of snails to other culture data.

III. A.11

POLLEN ANALYSIS OF SOIL SAMPLES FROM 41 BX 36, 41 BX 377 AND 41 BX 428

Philip Dering

INTRODUCTION

Pollen analysis was performed on soil from the CVS subjected to flotation and chemical analysis (see III.A.10). Central Texas is notorious for having a poor environment for pollen preservation. This prompted the use of a new process for pollen recovery. Unfortunately, pollen was still not recovered in frequencies large enough to allow inferences about the prehistoric ecology of the area. This report will examine the pollen extraction method and possible factors which may have contributed to the destruction of pollen.

METHODS

Removal of pollen from soil involves basic steps: (1) separation of the pollen from the soil matrix and (2) concentration of the fossil pollen. Because the soil matrix at the sites in the Camp Bullis area had a relatively high clay content, an extraction method utilizing the Nitex nylon screen was employed. Nylon screens with 15-20 μ mesh which allows clay to pass but stops pollen grains were used instead of the chemical methods of clay removal. In this manner chemical damage to the pollen was minimized. After treatment with 10% HCl to remove carbonates, the zinc chloride-density separation method was used to remove silicates. The laboratory techniques for removing fossil pollen from Camp Bullis sediments are outlined below.

1. A 25 ml portion of the sample was screened through a 250 μ screen to remove larger particles.*

2. The sample was poured into a small sieve fitted with a 20 μ mesh Nitex screen until the sieve was one-half full. Then the sieve was filled to near the brim with trisodium phosphate (Na_3PO_4). The bottom of the sieve was tapped rapidly with the tips of the fingers until all the liquid portion of the sample passed through the screen.

   Note: Step 2 was repeated until the filtrate was clear, which meant that most of the clay had been removed.

3. The residue on the screen was washed into a beaker with distilled water and the beaker was filled with water and stirred. Heavy

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*Five milliliter portions were originally used, but the poor pollen preservation in the samples forced us to use larger samples.

sand sediments were removed by quickly decanting the beaker, discarding the heavy sediments which remained on the bottom. The decanting process was repeated until most of the heavy sediments were removed.

4. The mixture remaining in the beaker was concentrated into a 90 ml centritube by pouring it into the centritube, and spinning the tube at 2000 rpm for 10 seconds to pull the pollen to the bottom. The liquid fraction was decanted, leaving the residue in the bottom. This process was repeated until the beaker was emptied, and all the pollen-containing sediments were concentrated into the tube.

5. The tube was filled with 10% HCl and vibrated on a Vortex mixer to remove carbonates. The 10% HCl was added until all bubbling stopped, indicating that no carbonates remained.

6. The tubes were centrifuged at 2000 rpm for 10 seconds and decanted, leaving the residue at the bottom.

7. Each tube was filled one-half full with 1.90 zinc chloride ($ZnCl_2$) and centrifuged at 2000 rpm for 30 minutes.

8. The centritubes were then removed and examined for a thin black line at the top of the solution. The liquid portion of the sample was poured into a beaker, taking care to leave the unwanted sediment in the bottom of the centritube. The bottom sediment was examined for pollen loss and then discarded.

9. The $ZnCl_2$ solution was then diluted 5X with distilled filtered water. The resulting solution was centrifuged as in step #4.

10. Once the solution was concentrated into a centritube it was washed with distilled water twice, centrifuging in between washings as in step #4.

11. The remaining residue was examined for pollen content.

RESULTS

Pollen from the Camp Bullis sites was not found in sufficient numbers to justify counting the slides. The few pollen grains observed were highly degraded and often difficult to identify as result of pollen distribution. Five pollen grain types appeared repeatedly in the samples: *Pinus sp.*, *Gramineae*, high spine *Compositae*, *Juniperus sp.*, and *Quercus sp.* The results are given in Table 25.

TABLE 25. POLLEN ANALYSIS FROM 41 BX 36, 41 BX 377 AND 41 BX 428

Site	Unit	Level (cm)*	Pollen	Spores
41 BX 36	1	0-10	none	few
	1	10-20	rare	none
	1	20	rare	several
	1	20-30	rare	several
	1	30-40	rare	few
	1	40	rare	none
	1	40-50	rare	few
	1	50-60	rare	few
	1	60	rare	few
	1	60-70	rare	few
	1	70-80	rare	none
	1	80	rare	several
	1	80-90	rare	several
	1	90-100	rare	few
	1	100	rare	few
	1	100-110	rare	few
	23	0-10	rare	several
	23	10-20	rare	few
		20-30	rare	none
		30-40	rare	none
		40-50	rare	none
41 BX 377	5	10	rare	none
	5	10-15	rare	few
	5	20	none	few
	5	20-25	none	several
	5	30	rare	several
	5	30-35	none	several
	5	40	none	several
	5	40-45	rare	several
	5	50	none	none
	5	50-55	none	none
	5	60	none	few
	5	60-65	none	none
	5	70-75	none	none
	5	80-85	none	none
41 BX 428	2	0-10	rare	several
	2	10-20	none	few
	2	20-30	rare	several
	2	30-40	rare	several
	2	40-50	rare	few
	2	50-60	rare	few
	2	60-70	†	
	2	70-80	none	none
	2	80-90	none	none
	2	90-100	rare	none
	2	100-110	none	none
	4	0-10	rare	several
	4	10-20	rare	none
	4	20-30	none	none
	4	30-40	none	none

*Exact depth samples were collected by Dering; others were obtained from CVS.

†Level not available for processing.

Despite the improved extracting ability of Nitex, we were unable to recover pollen in adequate numbers to justify more palynological research of fossil pollen in the soils of the area, at least until another new means of processing and quantifying low concentrations of pollen in the soil is developed.

DISCUSSION

Pollen preservation was the primary obstacle encountered in this project. The amount of pollen preserved in soils often depends upon many factors in addition to how much pollen the regional vegetation produces. Studies of depositional environments have revealed that the susceptibility of pollen grain destruction varies greatly from pollen type to pollen type (Sangster and Dale 1961, 1964). In general, alkaline environments, leaf moulds and riverine clays are considered to be the most destructive environments of deposition (Havinga 1971).

Within the environment of deposition, at least three major processes acting alone or in combination can lead to the eventual destruction of some or all of the pollen found in soils. These are: (1) physical or mechanical processes, (2) chemical processes and (3) biological processes.

Mechanical destruction of pollen grains can begin any time after the pollen is released into the air. Since many airborne pollen types have thin walls and lack excessive ornamentation, they are among the most susceptible to mechanical destruction. Destruction of pollen grains may result from airborne collisions with any other objects during transport, and from abrading action while on the surface of soils or during the post-depositional period.

The chemistry of the depositional environment can also determine the probability of preservation. The oxidation-reduction potential (Eh) affects the rate of pollen attrition. Sediments with a low Eh indicate a reducing environment which is favorable for pollen preservation (Tshudy 1969).

The pH of soils has been shown to be a factor in pollen preservation (Dimbelby 1957). Dimbelby noted that fossil pollen was best preserved in soils with a low pH, and that pollen probably could not be recovered in soils with a pH higher than 6.5. Since Dimbelby's study, Martin (1963) and Bryant (1969) have been able to recover pollen from deposits with a pH as high as 8.9 in the arid southwestern states. However, in those cases where the pH was higher than 6.5, the condition of recovered pollen was extremely poor. Analysis of soil samples from Camp Bullis conducted by the Texas Agricultural Extension Service Soil Test Laboratory indicated that all except one sample were very alkaline, with pH readings higher than 8.0.

Certain biological agents such as fungi and bacteria play a role in the degradation of pollen grains. Species of fungi in the Phycomycetes were investigated by Goldstein (1960) and were found to prey upon certain pollen types. Elsik (1971) recorded the destruction of pollen grains by bacteria. He found that bacteria in the Actinomycetes degrade pollen walls of both

fresh and fossil pollen. As the results columns in Table 25 indicate, fungal spores were observed in several samples from Camp Bullis. Although these spores were not identified, the high fungal spore count suggests the possibility that biological degradation was one of the destruction agents in the Camp Bullis area.

CONCLUSIONS

Any combination of the above mentioned factors could have caused the destruction of pollen at the Camp Bullis sites. The most likely causes are fungal activity and a high soil pH. Because of the high attrition rate of pollen in the soils of Camp Bullis, no further testing for pollen presence is recommended until new methods for the extraction and quantification of pollen from low-yield soils are devised.

III. A.12

FAUNAL ANALYSIS OF SITE 41 BX 36, WITH DATA PRESENTED FOR 41 BX 377 AND 41 BX 428

Jerry Henderson

INTRODUCTION

Analysis of the faunal materials from sites 41 BX 36, 41 BX 377 and 41 BX 428 was undertaken in an attempt to assess the role of the vertebrate fauna in the subsistence strategies of the aboriginal occupants of the sites. The small amounts of bone recovered from sites 41 BX 377 and 41 BX 428 prevented any detailed cultural inferences. The recovery from 41 BX 36 was conducive to a study of prehistoric faunal exploitation including detection of the subsistence base and the major sources of meat protein, a survey of the habitats represented by each species in order to determine aboriginal exploitation patterns, determination of butchering practices, explanations of other signs of cultural modifications such as burning and secondary usage, and determination of the season(s) of occupation at the site.

METHODOLOGY

The vertebrate collections housed at the Texas Archeological Research Lab and The University of Texas Vertebrate Paleontology Lab at Balcones Research Center, Austin, Texas, were used to identify the specimens. Species identifications were recorded for each level of each excavation unit, and any additional observations such as age at death of the animal, burning, butchering marks or secondary usage were also noted. Spatial distribution of the faunal remains was determined from this procedure. In addition, minimum numbers of individuals within each species were calculated for the entire site, according to procedures recommended by Chaplin (1971) which involve, briefly, the counting of specific elements with consideration given to symmetry of the element (right versus left) and maturity of the animal at death. This methodology produced statistical data from which cultural inferences were drawn.

41 BX 36

Statistical Data

Four classes of fauna (amphibians, reptiles, birds and mammals) were identified from 41 BX 36. Table 26 lists the identified species along with the total number of individuals represented by this count.

Species identifications were virtually impossible on the reptile and amphibian remains due to the lack of species-diagnostic elements and the fragmentary nature of the remains. In the case of the snake remains, only isolated vertebrae were present which are difficult, if not impossible, to identify even at the genus level. The turtles were represented only by pieces of carapace

TABLE 26. FAUNAL INVENTORY

Species	Number of Fragments	Minimum Number of Individuals
AMPHIBIANS		
Frog (*Rana sp.*)	1	1
REPTILES		
Unidentifiable turtle	22	?
Unidentifiable snake	8	?
Fence lizard (cf. *Sceloporus sp.*)	3	3
BIRDS		
Bob-white quail (*Colinus virginianus*)	4	1
Mourning dove (*Zenaidura macroura*)	1	1
Boat-tailed grackle (*Cassidix mexicanus*)	1	1
Turkey vulture (*Cathartes aura*)	1	1
Caracara (*Polyborus audoboni*)	1	1
MAMMALS		
Pronghorn antelope (*Antilocapra americana*)	3	1
White-tailed deer (*Odocoileus virginianus*)	117	4
Bison (*Bison bison*)	11	2
Cow (*Bos sp.*)	12	1
*Javelina (*Pecari tejacu*)	1	1
Domestic pig (*Sus scrofa*)	1	1
Coyote/Dog (*Canis sp.*)	4	1
Raccoon (*Procyon lotor*)	1	1
Eastern cottontail rabbit (*Sylvilagus floridanus*)	31	3
Jackrabbit (*Lepus californicus*)	1	1
Plains pocket gopher (*Geomys bursarius*)	8	2
*Pocket gopher (*Thomomus sp.*)	1	1
Fox squirrel (*Sciurus niger*)	1	1
Mexican ground squirrel (*Citellus mexicanus*)	1	1
Cotton rat (*Sigmodon hispidus*)	11	3
Woodrat (*Neotoma sp.*)	6	1
White-footed mouse (*Peromyscus sp.*)	1	1
Pocket mouse (*Perognathus sp.*)	1	1
Vole (*Microtus sp.*)	2	1

*Invader species

which were too fragmentary for further identification. The one amphibian element (a frog tibio-fibula) and the lizard remains (three mandible fragments) are similar among many different species and thus could not be identified specifically. However, the lizard remains were tentatively identified, based on similarities to species in the comparative collections and present-day geographic ranges of these species.

It is extremely difficult to distinguish antelope from deer remains unless skull parts (especially teeth) or metapodials are present; hence, the only definite antelope identifications were based on these diagnostic elements. It is therefore probable that other non-diagnostic skeletal parts identified as deer were actually antelope. The non-diagnostic elements were identified as deer because the location of the site is well within the goegraphic range of white-tailed deer while somewhat outside the known range of antelope (cf. Hester and Hill 1975; Hester 1975b).

A similar problem exists with distinguishing coyote from dog. Since none of these remains have distinctive characters, they were simply called *Canis sp.*

It is also difficult to distinguish *Bison* from *Bos* species except with certain diagnostic elements. Since none of these remains were species-diagnostic, it was considered here that they represented *Bos* when recovered from a historically disturbed deposit and *Bison* when recovered from an undisturbed deposit. The bovid remains referred to as *Bos* were probably *Bison* even though they were associated with historic debris. They were also associated with many aboriginal artifacts and lithic debris. The distinction in no way attempts to identify the elements at the species level but rather assumes the possibility that such species were present.

A similar situation arose over javelina versus domestic pig remains. However, since the earliest known javelina remains date to the early 1700s in northeastern Mexico (Guerrero missions), they are assumed to be a recent introduction (T. R. Hester, personal communication).

Most of the small rodents were not identified at the species level because of the similarity of like elements among species; therefore, these were identified at the genus level only. However, in cases where positive identification of specific diagnostic traits was possible, identifications were taken to the species level.

Table 27 presents the spatial distribution of all identified and unidentifiable fragments within the site. Horizontally, highest bone concentrations occurred in Excavation Units 1 and 2, and 4 through 7 in the central northwestern portion of the site. Smaller concentrations occurred in the central northeastern portion of the site in Excavation Units 18 and 23, and at the southeastern edge of the site in Excavation Unit 22. This pattern of horizontal distribution remained consistent vertically. No attempt was made to separate the fauna into vertical levels or zones of occupation because of the highly disturbed nature of the deposits and the recovery techniques (i.e., some units were excavated in 5-cm increments, some in 10-cm increments and, rarely, in 15-cm increments).

TABLE 27. DISTRIBUTION OF BONE FROM 41 BX 36

Unit	Level (cm)	Unidentifiable		Modified	Identifiable		
		Unburned	Burned		Number	Species	Element
TP 1	0-10	33	-	-	-	-	-
	10-20	47	12	-	2	Bovid	Left lunate, tooth
					1	Bob-white quail	Right femur
					3	Cotton rat	Mandible, 2 upper incisor
					1	Plains pocket gopher	Lower incisor
	20-30	7	-	-	-	-	-
TP 2	0-10	14	2	-	3	White-tailed deer	Humerus, 2 antler tips*
	10-20	52	18	-	1	White-tailed deer	Right mandible
					1	Pocket gopher	Tibia
					1	Bob-white quail	Left humerus
	20-30	-	2	-	1	Boat-tailed grackle	Left coracoid
	30-40	-	1	-	-	-	-
	40-bedrock	-	-	-	-	-	-
TP 3	0-10	15	4	-	-	-	-
	10-20	122	-	-	1	Pronghorn antelope	Tooth
					1	White-tailed deer	Humerus*
					1	Bison	Carpal*
	20-30	10	-	-	-	-	-
	30-45	3	-	-	-	-	-
	45-55	-	-	-	1	White-tailed deer	Left pelvis
	55-65	2	-	-	-	-	-
	Unknown	-	-	-	1	White-tailed deer	Tooth
1	0-10	143	-	1	2	White-tailed deer	Right metapodial, vertebr
					1	Cotton rat	Left mandible
					5	Turtle	Five carapace fragments
	10-20	213	26	2	8	White-tailed deer	Upper left P3, 2 right 2nd phalanges, lumbar vertebra, naviculo-cuboid lower left P3, left 1st phalanx, right magnum
					1	Pronghorn antelope	Right metacarpal
					4	Cottontail rabbit	Right humerus, calcaneus, right radius, metatarsal

TABLE 27. (continued)

Unit	Level (cm)	Unidentifiable Unburned	Unidentifiable Burned	Modified	Identifiable Number	Identifiable Species	Identifiable Element
1 (cont.)	10-20				1	Cotton rat	Right mandible
					1	Woodrat	Right mandible
					1	White-footed mouse	Right mandible
					1	Plains pocket gopher	Right femur
					5	Turtle	Five carapace fragments
	20-30	68	7	-	1	Turtle	Carapace fragment
					2	White-tailed deer	Two metapodials
					1	Cottontail rabbit	Metapodial
	30-40	20	1	-	1	Eastern fox squirrel	Lower right molar*
	40-50	11	1	-	-	-	-
	50-60	-	-	-	-	-	-
	60-70	4	-	-	-	-	-
	70-80	7	2	-	-	-	-
	80-90	2	-	-	-	-	-
	90-100	-	2	-	-	-	-
	100-110	-	1	-	-	-	-
2	0-10	-	-	-	3	White-tailed deer	Left radius*, right metatarsal, right tibia
					1	Bovid	Right cuneiform
					1	Canine	Tooth
	10-20	-	61	-	5	White-tailed deer	Lower right P4, rib, mandible, metatarsal*, right scaphoid
	20-30	28	4	-	-	-	-
	30-40	17	2	-	-	-	-
	40-50	7	-	-	-	-	-
	50-60	24	2	-	2	White-tailed deer	Left metatarsal, right lunate
3	0-5	14	-	-	2	White-tailed deer	Tooth, femur*
	5-10	65	8	-	1	White-tailed deer	Right lunate
	10-20	45	7	-	1	White-tailed deer	Lower first or second molar
	20-30	18	-	-	-	-	-
	30-40	6	-	-	-	-	-
	Clean-up	-	-	-	1	White-tailed deer	Right second phalanx

TABLE 27. (continued)

Unit	Level (cm)	Unidentifiable		Modified	Identifiable		
		Unburned	Burned		Number	Species	Element
4	0-5	3	2	1	-	-	-
	5-10	37	5	-	2	White-tailed deer	Left radius, skull fragment
	10-15	133	25	1	5	White-tailed deer	Right radius, rib, right patella, left first phalanx*, antler tip*
					3	Cottontail rabbit	Left maxilla, left scapula, first phalanx*
	15-20	72	32	-	4	White-tailed deer	Third phalanx, first phalanx, left astragulus, left calcaneus
					1	Bison	Second phalanx
	20-25	-	3	-	1	Cottontail rabbit	Left mandible
					1	Turkey vulture	Left tibiotarsus
	25-30	29	5	-	2	White-tailed deer	First phalanx*, vertebra
	30-35	1	1	-	-	-	-
	35-40	2	-	-	-	-	-
	40-45	8	1	-	-	-	-
	45-50	1	-	-	-	-	-
	50-55	3	1	-	-	-	-
	55-60	-	-	-	-	-	-
5	0-10	127	35	1	3	White-tailed deer	Antler tip*, left second phalanx, left lunate
					1	Bovid	Carpal
					1	Cotton rat	Right femur
					1	Mexican ground squirrel	Pelvis
	10-20	138	60	1	6	White-tailed deer	Left 1st phalanx, 2 right naviculo-cuboids, left radius, lower left 1st or 2nd molar, upper 1st or 2nd molar
					4	Bison	Right tibia, 2 left astraguli, upper left P3, right femur
					1	Woodrat	Right femur
					3	Cottontail rabbit	Metacarpal, calcaneus*, left radius

TABLE 27. (continued)

Unit	Level (cm)	Unidentifiable Unburned	Unidentifiable Burned	Modified	Identifiable Number	Identifiable Species	Identifiable Element
5 (cont.)	10-20				1	Snake	Vertebra
					3	Turtle	Three carapace fragments
	20-30	21	9	-	-	-	-
	30-40	11	1	-	1	White-tailed deer	First phalanx
	40-50	2	-	-	-	-	-
	50-60	3	-	-	-	-	-
6	0-10	78	-	-	3	White-tailed deer	Lower right M2, upper M1 or M2, upper right P4
					1	Bison	Upper left P2
					2	Coyote/dog	Naviculo-cuboid, upper right P4
					1	Cottontail rabbit	Left mandible
					2	Turtle	Two carapace fragments
	10-20	127	41	-	4	White-tailed deer	Right first phalanx*, cuneiform, right radius, right first phalanx
					2	Bison	First and third phalanx
					2	Cottontail rabbit	Right mandible and pelvis
	20-30	46	18	-	-	-	-
	30-40	16	-	-	1	White-tailed deer	Antler*
	40-50	14	-	-	-	-	-
	50-60	14	1	-	2	White-tailed deer	Metapodial, lateral first phalanx ("dew claw")
					1	Bison	Left lunate
7	0-10	64	32	-	1	White-tailed deer	Left calcaneus
					4	Bovid	Upper M1 or M2, 2nd phalanx (Art.H), upper right M3, lower left incisor (Art.A)
					1	Domestic pig	Left second phalanx
					1	Cottontail rabbit	Left calcaneus
					1	Mourning dove	Left humerus
	10-20	136	39	-	4	White-tailed deer	Left mandible, left second phalanx, 2 right humeri
					3	Cottontail rabbit	Left and right maxilla, right femur

TABLE 27. (continued)

Unit	Level (cm)	Unidentifiable Unburned	Unidentifiable Burned	Modified	Identifiable Number	Identifiable Species	Identifiable Element
7 (cont.)	10-20				1	Cotton rat	Left femur
					1	Turtle	Carapace*
	20-30	54	30	-	2	White-tailed deer	Right naviculo-cuboid, left petrosal
					1	Turtle	Carapace fragment
	30-40	25	4	-	1	White-tailed deer	Left scapula
	40-50	29	4	-	1	White-tailed deer	Rib
	50-60	6	-	-	1	White-tailed deer	Right ulna
8	0-10	26	14	-	-	-	-
	10-15	51	19	-	3	White-tailed deer	Right mandible, 2 phalanges
	15-20	55	8	-	1	White-tailed deer	Left first phalanx
					1	Cottontail rabbit	Right femur
					1	Snake	Vertebra
	20-25	109	6	-	1	Turtle	Carapace fragment*
	25-30	42	13	-	-	-	-
9	0-10	90	26	-	1	White-tailed deer	Right metacarpal
					1	Cottontail rabbit	Maxilla
	10-20	94	24	-	6	White-tailed deer	Left humerus, upper left M1 or M2, incisor, right astragulus, metapodial, right naviculo-cuboid
					2	Cottontail rabbit	Left and right mandible
	20-30	98	25	-	2	Bovid	Humerus, tooth
					1	Cottontail rabbit	Left calcaneus
	30-40	31	11	-	1	Pronghorn antelope	Metatarsal
					1	Javelina/pig	Third phalanx
	40-50	12	7	-	2	White-tailed deer	Metapodial, right humerus
					1	Turtle	Carapace fragment
	50-60	5	-	-	-	-	-
	60-70	4	-	-	-	-	-
	70-80	-	-	-	-	-	-
	80-90	-	-	-	-	-	-

TABLE 27. (continued)

Unit	Level (cm)	Unidentifiable		Modified	Identifiable		
		Unburned	Burned		Number	Species	Element
10	0-10	20	4	-	-	-	-
	10-20	100	10	-	4	White-tailed deer	Left mandible, left 2nd phalanx, 2 right humeri
					3	Cottontail rabbit	Left and right maxilla, right femur
					1	Cotton rat	Left femur
					1	Turtle	Carapace fragment*
11	0-10	62	9	-	2	White-tailed deer	Left calcaneus, vertebra
					1	Cottontail rabbit	Right humerus
	10-20	12	-	-	2	White-tailed deer	Right calcaneus, lower left M1 or M2
					1	Bison	Left naviculo-cuboid
					1	Bob-white quail	Left tarsometatarsus
12	0-5	15	2	-	1	Bovid	Upper right P4
					1	Woodrat	Femur
	5-10	72	3	-	4	Plains pocket gopher	Left mandible, left femur, left tibia, left humerus
	10-15	30	5	-	1	White-tailed deer	Upper M1 or M2
	15-20	-	-	-	1	Frog	Right tibio-fibula
13	0-10	-	-	-	-	-	-
	10-20	-	-	-	3	White-tailed deer	Right calcaneus, left metacarpal, right radius*
					1	Turtle	Carapace fragment*
14	0-15	49	11	-	1	Bison	Tooth*
	15-25	11	1	-	-	-	-
	25-35	22	1	-	-	-	-
	35-45	-	-	-	-	-	-
	45-55	5	1	-	-	-	-
15	0-10	54	21	-	1	Plains pocket gopher	Left humerus
	10-20	20	5	-	1	Jackrabbit	First phalanx
					1	Snake	Vertebra
	20-30	6	-	-	-	-	-
	30-40	5	1	-	-	-	-

TABLE 27. (continued)

Unit	Level (cm)	Unidentifiable Unburned	Unidentifiable Burned	Modified	Identifiable Number	Identifiable Species	Identifiable Element
16	0-10	1	-	-	-	-	-
	10-20	-	-	-	1	Bison	Tooth
	20-30	-	-	-	-	-	-
17	0-10	34	6	-	1	White-tailed deer	Lower left M3
					1	Cottontail rabbit	Right radius
	10-20	5	3	-	-	-	-
	20-30	18	3	-	2	White-tailed deer	Tooth, left astragulus
18	0-10	46	-	1	3	White-tailed deer	Rib, left radius, right third phalanx*
					1	Coyote/dog	Left ulna
					1	Cottontail rabbit	Left scapula*
					1	Caracara	Left humerus
	10-20	26	9	-	1	White-tailed deer	Left scapula
					1	Raccoon	Right mandible
	20-30	19	5	1	2	White-tailed deer	Left astragulus, right ulna
19	0-10	34	17	-	-	-	-
	10-20	8	2	-	-	-	-
20	0-10	4	-	-	-	-	-
	10-20	-	-	-	-	-	-
	20-30	44	4	-	-	-	-
21	0-10	5	1	-	-	-	-
	10-20	12	1	-	-	-	-
22	0-10	11	6	-	1	Woodrat	Left tibia
	10-20	27	6	-	1	Woodrat	Left maxilla
					2	Cotton rat	Two right femurs
	20-30	53	11	-	1	White-tailed deer	Phalanx
					1	Cotton rat	Left femur
					1	Bob-white quail	Left coracoid
					1	Mourning dove	Left coracoid
					1	Turtle	Carapace fragment
					1	Snake	Vertebra

TABLE 27. (continued)

Unit	Level (cm)	Unidentifiable		Modified	Identifiable		
		Unburned	Burned		Number	Species	Element
22 (cont.)	30-40	11	6	-	1	White-tailed deer	Right first phalanx
	40-50	8	1	-	-	-	-
	50-60	-	4	-	-	-	-
	60-70	9	1	-	1	Cottontail rabbit	Right mandible
	70-80	2	-	-	-	-	-
23	0-10	72	-	1	2	White-tailed deer	First phalanx, lateral first phalanx ("dew claw")
					2	Cottontail rabbit	Left tibia, right tibia*
	10-20	37	6	-	1	White-tailed deer	Left metacarpal
					1	Fence lizard	Right mandible†
					1	Vole	Tooth†
					1	Reptile	Vertebra†
					2	Snake	Vertebrae†
	20-30	15	4	-	-	-	-
	30-40	8	2	-	2	Fence lizard	Two right mandibles†
					1	Cotton rat	Molar†
					1	Pocket mouse	Calcaneus†
					1	Vole	Molar†
					2	Cottontail rabbit	Pelvis, upper left incisor†
					2	Snake	Vertebrae†
	40-50	21	4	-	-	-	-
Pit G	0-10	20	9	-	3	White-tailed deer	Right metatarsal, right metacarpal, lower left P2
					1	Turtle	Carapace fragment*

*Burned.

†From constant volume samples (only Units 1 and 23 were processed).

Biotic Communities Represented

To understand more fully the aboriginal exploitation patterns occurring at site 41 BX 36, it was first necessary to establish the biotic community preferred by each species recovered from the site. Information on habitat, abundance, seasonality, behavior and any other factors directly relating to that species' relationship with the human component was compiled, so that inferences could be drawn regarding human exploitation patterns and subsistence activities. Following is a brief summary for each species. Omitted were those animals which could not be identified to the species level when a simple genus classification was too arbitrary to disclose specific habitat requirements (Table 28).

Reconstruction of Aboriginal Exploitation Strategies

From Table 28, it would appear that the aboriginal inhabitants of 41 BX 36 exploited at least two major biotic zones--an open grassland/prairie zone and a mixed scrub forest zone. The species recovered from the site representing a grassland prairie and mixed grassland situation include pronghorn antelope, bison, jackrabbit and Mexican ground squirrel. Those representing a mixed forest situation include the boat-tailed grackle, white-tailed deer, raccoon and fox squirrel. The remaining species can be found in either biotic zone--or perhaps more likely, in an ecotonal situation where there is an overlapping of both vegetation types.

The conspicuous absence in the archaeological assemblage of aquatic and riverine species such as fish, river fowl, beaver, mink and raccoon (only one was noted) indicates that these species either were not available to the prehistoric hunters or were not exploited by them. Since the species recovered represent a wide range of size and kind of animal, it is natural to assume that the aborigines would also have taken aquatic and riverine species had they been available. It is possible that Salado Creek, if it has only a seasonal flow, would not have supported aquatic and riverine species of fauna. However, the extensive flood plain suggests a permanent flow. Hester (1975b:109) suggests that ". . . overgrazing and the resultant watershed destruction . . ." was the cause of the loss of formerly available surface water, which was confirmed by historic accounts to have been present even as late as the 20th century.

The three species of antelope, bison and white-tailed deer probably represent the main sources of meat protein for the aboriginal diet in terms of the amount of edible meat furnished by each, relative to the other smaller animals recovered from the site. Therefore, it can be hypothesized that the aboriginal hunters were deliberately and actively hunting these larger game species, and taking the smaller animals when encountered as supplements to the diet.

An alternate hypothesis involves the distinct division of labor, according to age and sex, practiced by many prehistoric groups; hunting parties consisted of adult males, and the women and children remained at the site. It can be inferred that the adult males hunted the larger game species, while the women and children caught the smaller animals during the course of their daily

TABLE 28. BIOTIC COMMUNITIES REPRESENTED IN FAUNAL ASSEMBLAGE OF 41 BX 36

	Habitat	Behavior	Meat Yield
Pronghorn antelope	Plains and mixed grasslands, not necessarily near water	Diurnal browsing in small bands. Home range: three to six km [1]	Average weight: 68 kg. Edible meat: 36 kg [2]
White-tailed deer	Highest population densities in ecotonal areas with largest variety of vegetation [3]	Seasonal range of single deer ca. one mile. Acorns as winter food, stream-bottom grasses as spring food, woody glades and meadows provide summer food [4]	Average weight: 68 kg. Edible meat: 36.32 kg [4]
Bison	Tall and short grass plains and mixed grasslands. Extended prehistorically into central Texas [5]	Emigrated in summer. [6,7,8] Concentrated herds during summer mating season (July to September), otherwise smaller groups. Birthing in April. Animal healthiest in fall and winter [9]	Edible meat: 160 kg [3]
Javelina	Tropical and subtropical environments; primarily rooting animals	Travel in bands from a few to several hundred individuals	
Coyote/dog	Desert scrub through grassland and timbered areas [2]	Varying diet, depending on type available. Home range is several km; density ca. one per sq km	Average weight: 18.16 kg. Edible meat: 4.54 kg
Raccoon	Wide variety but especially river and lake margins, brushland, forested ridges, etc.	In winter and spring, timbered river bottoms favored; in summer and fall, dispersal into uplands. Arboreal dens ca. 120 m from water. [4] Average home range: 2.6 km; average density: 15 per sq km [3]	Average weight: 9.08 kg. Edible meat: 3.86 kg [3]

TABLE 28. (continued)

	Habitat	Behavior	Meat Yield
Eastern cottontail rabbit	Forest border habitat with brushy cover ideal, but highly adaptable [4]	Average home range: 0.54 ha, but expands during breeding season [4]	
Jackrabbit	Hot, dry desert scrubland and brushy habitats. Prefers sparse vegetation [2]	Maximum density: 154 per sq km. Diet includes herbs and grasses [2]	Average weight: 2.59 kg. Edible meat: 0.98
Plains pocket gopher	Prefers sandy soils at least 10 cm deep	Mostly remains underground, with a diet of roots and stems. Overland range limited, but underground range large. Average density: 332 per sq km	Average weight: 0.45 kg. Edible meat: 0.17 kg
Pocket gopher	Prefers moist and easily worked soil, although some found in rocky areas	Gopher species usually spatially separate, although with similar habitats. Home range ca. 1700 sq ft; solitary and territorial. Recent invader of Edwards Plateau [10]	
Eastern fox squirrel	Upland mixed hardwood and pine forests and open bottomlands. Rarely in dense climax forest	Diet of nuts, plants, insects, larvae, fruits. Home range of a few hundred meters. Average density: 124 per sq km [3]	Average weight: 2.27 kg. Edible meat: 0.68 kg
Mexican ground squirrel	Grassland, brush, mesquite, cactus vegetation preferred, with sandy or gravelly soil	Subsurface dens with burrows with maximum home range of 30 m. Some hibernate in winter [1]	Average weight: 0.15 kg. Edible meat: 0.06 kg
Cotton rat	Tall-grass prairies not subject to flooding [2]	Diet of grasses, sedges, herbs. Population correlates positively with rainfall. Average density: 20 per ha [2]	Average weight: 0.23 kg. Edible meat: 0.10 kg
Woodrat	In desert, plains and rocky areas	Nocturnal habits. Dens of sticks and rubbish [1]	Average weight: 0.03 kg. Edible meat: negligible

TABLE 28. (continued)

	Habitat	Behavior	Meat Yield
White-footed mouse	Woodland and bottomland habitat	Seed and nut diet. Dens in hollow trees above ground. Average range: 50 m	Average weight: 0.03 kg. Edible meat: negligible
Pocket mouse	Prefers friable or sandy soil with moderately dense vegetation	Lives in burrows; active all year. Herb diet [2]	Average weight: 0.03 kg. Edible meat: negligible [2]
Vole	Prefers good grass cover, occasionally rocky and wooded areas [1]		Edible meat: negligible [1]
Bob-white quail	Brushy habitats preferred [11]	Scratching birds with seed, fruit and insect diet. May be an introduced species [12]	
Mourning dove	Open fields preferred	Slow-moving ground feeders. Diet of seed and grain	
Boat-tailed grackle		Lives in flocks all year. Bulky nests of mud and grasses	
Turkey vulture	Temperate regions	Carrion eaters	Probably not a food source
Caracara	Prairie region of south Texas	Carrion eaters	Probably not a food source
Fence lizard	Varies from steaming tropical forest to sparse timberline growth [13]	Ground dwellers, often climbing rocks and stumps to bask in the sun [13]	

References: [1] Burt and Grossenheider 1964
[2] Davis 1974
[3] Charles Winkler, large game biologist, Texas Parks and Wildlife Department: personal communication
[4] Smith 1975
[5] Dillehay 1974
[6] Roe 1951
[7] Haines 1970
[8] Levy 1961
[9] Garretson 1934
[10] Lundelius 1967
[11] Peterson 1947
[12] Hester 1975b
[13] Stebbins 1966

activities. This hypothesis is somewhat supported by the presence of many small rodents at the site whose habitats correspond with edible wild plant sources (particularly the woodrat which nests in cactus and yucca plants). If this division of labor were practiced at 41 BX 36, the resulting faunal assemblage would be expected to reveal exactly what has been recovered--a combination of large game animals plus a variety of small animals and reptiles.

A survey of the age at death of the individual remains was undertaken in an attempt to ascertain whether the aboriginal hunters were practicing a "cropping" technique or had an age preference among the animal populations available to the site. Extent of epiphyseal fusion, amount of dental attrition and presence of antlers were used as criteria to estimate the maturity at death of the individual. Only crude age categories were established since many other variables such as sex, diet, geographic range and climate also affect maturity characteristics within species. Table 29 is a breakdown of all elements showing age characteristics.

A total of 30 white-tailed deer elements, four bison elements, one cotton rat element and one plains pocket gopher element displayed such age-indicators. The sample is too small in both the rodent cases (only one per species) to indicate any kind of patterning. Although the sample of bison elements (only four) is too small to be conclusive, it is interesting to note that all these elements represent adults.

Of the 30 white-tailed deer elements, the age categories were established in the following manner. The "Juvenile" category was based on lack of epiphyseal fusion of the long bones, little or no wear on permanent teeth and presence of deciduous teeth. This category would comprise individuals up to 1-1/2 years of age (Davis 1974). The "Young Adult" category was based on partial or incomplete fusion of epiphyses, mild dental attrition and presence of "yearling" or "spike" antlers. This category consists of individuals from 1-1/2 to 3 years old (Winkler, personal communication). The "Adult" category was based on complete epiphyseal union, moderate dental attrition and presence of fully developed antlers. Individuals in this category would have been three years or older at time of death (Winkler, personal communication). The "Very Old Adult" category was based only on extreme dental attrition since epiphyseal union is complete at, and antler development can not be age-diagnostic beyond, three years of age. Individuals in this category would have been five years or older at time of death.

All age categories were present among the white-tailed deer remains. Juveniles and young adults represent nine of the total of 30 specimens (or 30%), while adults represent 21 of 30 specimens (70%). This configuration is about what would be expected to occur in the live white-tailed deer populations; that is, there would normally be about one fawn or yearling for every two adults. From this data it can be inferred that the aboriginal hunters did not practice any form of "cropping" among the deer populations or did not have a preference as to the age of the animal taken. However, it must be remembered that the specimens used to arrive at these conclusions represent individual elements rather than individual animals and thus do not indicate a true ratio of juveniles to adults but merely a range of elements

TABLE 29. AGE OF DEATH OF ANIMALS REPRESENTED IN FAUNAL REMAINS

Species	Element	Juvenile	Young Adult	Adult	Very Old Adult
White-tailed deer	Metapodials	1	1	5	
	Phalanges	2		1	
	Teeth	1	4	6	1
	Radius			1	
	Humeri			2	
	Antlers			5	
		4	5	20	1
Bison	Teeth			3	1
Cotton rat	Femur	1			
Plains pocket gopher	Femur			1	

present. Nonetheless, it is obvious that all age categories were present, although the sample used may not be representative of the true situation.

Tools, Butchering Marks, Burning and Other Modifications

Only one distinctive bone tool was found at 41 BX 36. A white-tailed deer ulna flaking tool came from Unit 18 (Fig. 56,b) and is similar to ulna flaking tools from other archaeological sites (Jelks 1962, Hester 1971 and Suhm 1957). There are two unidentifiable burned and modified pieces. One is a rib section which is notched on one side (Fig. 56,a), and the other is a small fragment which is very highly polished on the outer surface.

Two bovid shaft fragments exhibit modification. One was possibly broken up for marrow extraction and discarded. It has a cut mark and has been burned at one end. The other appears to have been utilized or worked as chert would be. Both outer sides of the fragment have flake scars (Fig. 56,c).

Cut marks interpreted as butchering marks were observed on four white-tailed deer elements: an antler tip, a rib, a right humerus (distal end) and a left radius (distal end). The marks on the antler tip, which was also extensively burned and somewhat smoother, could possibly be the result of tool manufacture, since these parts were often used as flaking tools. Butchering at the locations of the marks on the two long bones would serve to sever the forelimbs. The cut marks on the rib occurred parallel to the long axis of the bone and could have resulted from severing and eating the meat as well as from butchering the carcass. Table 30 gives the provenience of the culturally modified bone.

The range of elements representing the large game species indicates that the entire carcass was returned to the site for butchering. In the case of white-tailed deer, most parts of the skeleton were present, although 88 of the 118 identified pieces were foot or skull parts. With bison, 20 of the 22 identi-elements were foot or skull parts; the remaining two elements (a humerus and a tibia) represent a forelimb and a hindlimb. This frequency of foot and skull parts is puzzling in that these elements represent the least desirable parts of the carcass as far as edible meat is concerned.

There are several possibilities to account for this preponderance. One possibility is that the site contained a butchering area in which the non-edible parts were discarded and the edible parts taken elsewhere for consumption. This theory is perhaps the least likely because of the presence, though scarce, of a few edible parts of the larger species as well as a number and variety of smaller animals. Another possibility is that the entire carcass was utilized at the site, but the long bones were further modified into tools or fractured beyond recognition for marrow extraction, and the more fragile bones of the torso (i.e., scapulae, vertebrae and ribs) were not recovered in quantity due to poor preservation.

The most likely explanation, based on the evidence at hand, for the high frequency of foot and skull parts is that they represent an intra-site locale (especially the area sampled by Units 1 through 7) utilized by the aboriginal occupants as a refuse area in which the least preferred parts were discarded.

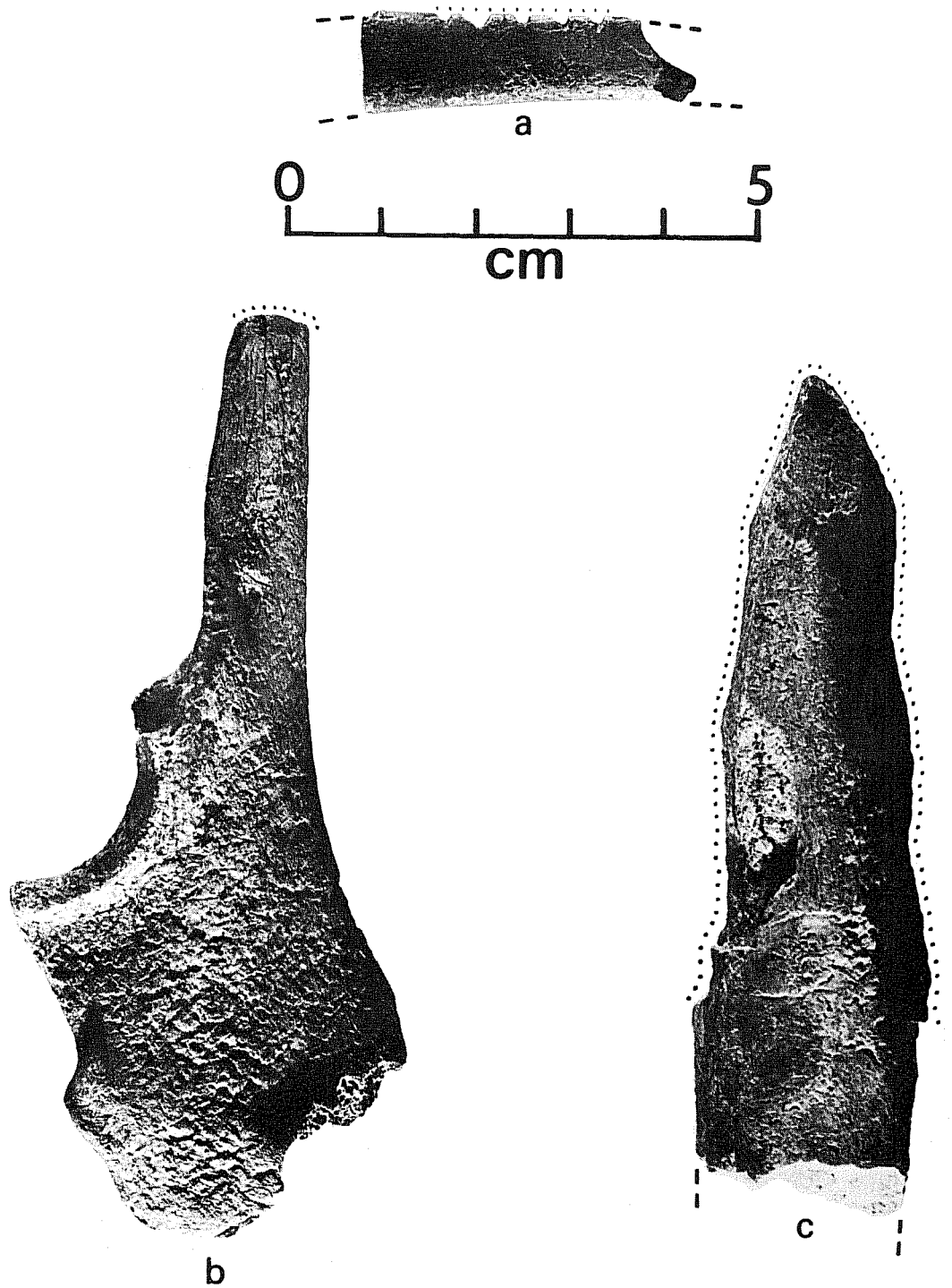

Figure 56. *Bone Artifacts from 41 BX 36.* a, burned and notched animal rib fragment; b, deer ulna flaking tool; c, probably worked and utilized fragment (dots indicate extent of modified edges).

TABLE 30. BONE TOOLS AND MISCELLANEOUS BONE MODIFICATIONS NOTED AMONG FAUNAL REMAINS

Excavation Unit	Level	Element	Modification	Function
1	0-10	Bovid	Utilized or worked bone fragment. Flake scars on both sides (Fig. 56,c).	Unknown
1	10-20	White-tailed deer first phalanx	Possible hole drilled through long axis at proximal end	Unknown
1	10-20	Bovid shaft	Burned on one end and cut marks present	Possible marrow extraction
4	0-5	Unknown	Small fragment which is very burned and highly polished on the outer surface	Unknown
4	10-15	White-tailed deer right radius	Non-natural sawtoothed fracture line at proximal end	Unknown
5	0-10	White-tailed deer antler tip	Burned and smoothed	Possible flaker or awl
5	10-20	White-tailed deer left radius	Proximal end fractured longitudinally	Possible marrow extraction or tool fragment
18	0-10	White-tailed deer left radius	Very smooth and straight but through longitudinal axis at distal end	Possibly the result of tool manufacture or a tool fragment
18	20-30	White-tailed deer left ulna	Heavy use wear at shortened distal end (Fig. 56,b).	Flaking tool
23	0-10	Unidentifiable rib section	Burned and notched on one side (Fig. 56,a).	Unknown

Support for this interpretation is the presence of different species of carrion eaters within the refuse area, the variety of small animals not considered here to have been the main or preferred meat source and of little value as secondary utilization (i.e., for tools, etc.), and the disposal of at least two individual bison in the same place in the same manner (one left astragulus recovered from Unit 5, 13 cm deep). A definitive statement regarding the temporal aspect of the refuse area cannot be made due to the highly disturbed nature of the cultural deposits. (A factor contributing to the disturbances could have been the carrion eaters themselves scavenging among the waste.) Sampling error could, of course, account for this skewed distribution of skeletal parts. Unexcavated portions of the site might yield a somewhat different faunal assemblage, the analysis of which might serve to support or dismiss the above hypotheses.

Table 27 lists the identified elements exhibiting burning. Burning in general increases the preservation qualities of bone by dehydrating and chemically altering its composition. Therefore, it can be assumed that burning might have caused the differential preservation of the recovered fauna. It was felt that the burned elements other than white-tailed deer occurred in frequencies too low to be conclusive. Regarding white-tailed deer, all the recovered antler fragments were burned; the post-cranial elements revealed no apparent pattern as to which parts of the body were burned or to the relationship of burned to unburned bone in general. The recovery of the antler tips may have been due to the fact that the burning enhanced their preservation since these elements, in their natural state, deteriorate rapidly once deposited in the ground.

Since the species are potential food sources, it can be assumed that the burning was primarily a result of cooking. However, especially in the instances of antlers and foot parts, other reasons for burning should be considered. It is possible that the burning was a result of general site maintenance (i.e., the burning of trash for hygienic reasons), tool manufacture (i.e., the preparation of the bone for modification into a tool), convenient disposal (i.e., the tossing of a bone back into a campfire rather than a remote trash area), and grass fires and other natural causes.

Seasonality of the Site

Seasonality of the site can only be indirectly inferred from the faunal remains. There were no migratory birds or winter hibernators identified. The antlered/antlerless condition of adult male deer skulls can be used to indicate seasonality; however, the only antler fragments recovered were four tips and one medial section, so that their shed/intact condition could not be ascertained. A general statement regarding the availability of bison herds during certain periods of the year can be made. Haines (1970) and Levy (1961) state that, although bison did not migrate regularly with any pattern, they generally vacated the southern extremes of their range in the summertime because of the heat. Hornaday (1887) says that during a three-month period (July through September) there were large portions of the range where bison could not be

located because of their propensity to aggregate toward the center of their range during mating season. From these data, it can be inferred that bison herds were probably absent during the summer months in Texas. Therefore, their presence at 41 BX 36 indicates an other-than-summer occupation.

This interpretation is supported by additional, though negative, observations involving the absence of riverine and aquatic species which might have been exploited had they been available in other seasons. Their absence suggests that the local water supply may have been seasonal, probably drying up during the hot summer months. Based on these data, it can be speculated, but not concluded, that the site was not occupied during the summer months.

41 BX 377

Table 31 is a list of the identified fauna from Site 41 BX 377. The sample is obviously too small to generate cultural inferences.

TABLE 31. FAUNAL INVENTORY FROM SITE 41 BX 377

Excavation Unit	Level (cm)	Species	Element
3	10-15	White-tailed deer	Right mandible, 2 teeth
3	15-20	White-tailed deer	Left calcaneus (adult)
Surface (from road cut)		Mule deer*	Right humerus (adult)

Odocoileus hemionus

41 BX 428

Table 32 is a list of the identified fauna from Site 41 BX 428. The sample is obviously too small to generate cultural inferences.

TABLE 32. FAUNAL INVENTORY FROM SITE 41 BX 428

Excavation Unit	Level (cm)	Species	Element
2	0-10	White-tailed deer	Third phalanx (looks very recent)

SUMMARY

Faunal data from 41 BX 36 were analyzed to determine the basic subsistence strategies operating within the prehistoric confines of the site. It was concluded that the major sources of meat protein were antelope, white-tailed deer and bison, with many smaller animals supplementing the diet. The fact that these three major species represent two distinct biotic zones indicates that the aboriginal hunters were exploiting at least two different environments: a mixed scrub forest zone and a grassland prairie zone. All stages of maturity of the individual at the time of death were evident from the white-tailed deer remains. The small sample of bison remains showing age characteristics was from mature adults. The range of elements present suggested that the entire carcass was returned to the site for butchering, but actual butchering marks were observed on only a very few bones. There was a very high frequency of foot and skull parts relative to other parts of the body among the white-tailed deer and bison remains. Several hypotheses were given for this configuration, as well as for the occurrence of burned bone within the collection. Other cultural modifications to the bones were described. The season(s) of occupation at the site were speculated to be other than summer, based on the presence of bison and the absence of riverine and aquatic species.

The conclusions generated from the faunal data perhaps best serve as indicators of prehistoric man's adaptations to the local environment and his relationship with his food sources. It is hoped that these data will lead to a fuller understanding and a more comprehensive interpretation of the site.

III. A.13

RADIOCARBON DATING

Thomas C. Kelly

Only three charcoal samples suitable for radiocarbon dating were recovered during excavations at Camp Bullis. In addition, a bone sample recovered from the same unit and level as one of the charcoal samples was radiocarbon dated for the purpose of comparison. The following dates were obtained from Radiocarbon Limited (RL designation), Lampasas, Texas, and from the Radiocarbon Laboratory (Tx), The University of Texas at Austin.

TABLE 33. RADIOCARBON DATES FROM CAMP BULLIS

Laboratory No.	Sample Location	B.P. Date	AD/BC Date	MASCA Calibration*
RL-816	41 BX 36, Unit 1 (20-30 cm)	900±100	A.D. 1050	A.D. 1090
RL-817	41 BX 36, Unit 5 (10-20 cm)	420±120	A.D. 1530	A.D. 1440
Tx-2815	41 BX 36, Unit 5 (10-20 cm) bone	300±120	A.D. 1650	A.D. 1610-1520
Tx-2771	41 BX 377, Unit 3 (10-15 cm)	890±70	A.D. 1060	A.D. 1100

*Ralph *et al.* 1973

RL-816 was obtained from a level containing a *Perdiz* arrow point, with *Edwards* points found in the level immediately below. The author submitted the sample to obtain information on temporal interface between *Edwards* points and the Toyah phase. The *Edwards* arrow point type was associated with dates of A.D. 930, 960 and 1040 at the La Jita site in Uvalde County (Hester 1971:114-115).

RL-817 was closely associated with *Perdiz* arrow points and considerable bovid bone; this seems to be a valid date for the *Perdiz* variety as defined for the Toyah phase of the Late Prehistoric period.

Tx-2815, the burned bone sample, was from the same unit and level as charcoal sample RL-817. The two dates are reasonably close.

Tx-2771 is from 41 BX 377, a colluvial terrace site on Cibolo Creek, and was closely associated with *Edwards* points. The date correlates closely with RL-816 and seems to be valid for the *Edwards* type (cf. Hester 1971).

Comments

The strongly alkaline soils of Camp Bullis are often non-conducive to the preservation of charcoal samples adequate for radiocarbon dating. Numerous hearths which would seem to be obvious charcoal sources were excavated, yet only the above samples were suitable for dating. The disappearance of charcoal in open sites in this area appears to be a function of the time the material is exposed to leaching by the soil. Dates from other open sites in the central Texas area suggest that radiocarbon dates earlier than 1500 B.C. may be difficult to obtain. The oldest dates obtained from several area sites are La Jita, A.D. 100 (Hester 1971); 41 KE 49, A.D. 830 (Kelly and Hester 1976); the Crumley site, 1500 B.C. (Kelly 1961); Oblate Rockshelter (a shallow shelter with an open occupation area), 1600 B.C. (Johnson *et al.* 1962); Loeve-Fox, 40 B.C.; and John James Park, A.D. 750 (Katz 1977).

The radiocarbon dates obtained from Camp Bullis are valuable for their corroboration of the age of the *Edwards* and *Perdiz* arrow point types.

PART III

THE CAMP BULLIS STUDY

SECTION B

HISTORICAL ARCHAEOLOGY AT CAMP BULLIS

III. B.1

INTRODUCTION

James E. Ivey

In addition to the extensive prehistoric cultural remains found in the Camp Bullis area, there are a number of sites dating from the period of the European occupation of this region. This section will describe and discuss the more notable of these sites (Fig. 57).

The sites mentioned here were found during the survey of Camp Bullis or were previously known from maps and specifically located as part of this study. In either case, a site description was filled out, a site number assigned and a set of photographs and a representative surface collection made. A measured sketch was then made of the more important structural remains. The artifacts collected were studied in the Center for Archaeological Research laboratory and their approximate dates of manufacture were estimated. Considering the collection from each site, a period of occupation was derived for that site. In some cases the nature of the artifacts permitted us to make some inferences about the sort of activities carried out at the site.

It must be recalled that only a very preliminary investigation has been made of these sites; the intent was to collect enough information to permit a reasonable estimation of the importance of each site as a cultural resource. A "representative" surface collection, one which collects a few examples of most of the varieties of artifacts found on-site, is not a controlled sampling, and the inferences about a site, based on such a collection, may be far from accurate. In most cases, however, such a "representative" collection has been found to give a fair approximation of the time period and major activities of a site, if only in the most general frame. Such a generalized first step should never be forced to say more than the quality of its evidence can permit.

The first tracts of land which eventually became Camp Bullis were purchased by the government in December 1906, and consisted of two large ranches totalling over 16,000 acres. These were the Conrad Schasse tract of 4,877 acres and the Oppenheimer tract of 11,840 acres (Fig. 57).

Other, much smaller tracts were added in 1907 and 1917, and Camp Bullis achieved its present outline in a final series of purchases in 1941. The majority of the historical sites found within the Camp Bullis reservation were in the tract added in this last series. A few, however, are located in the original tracts.

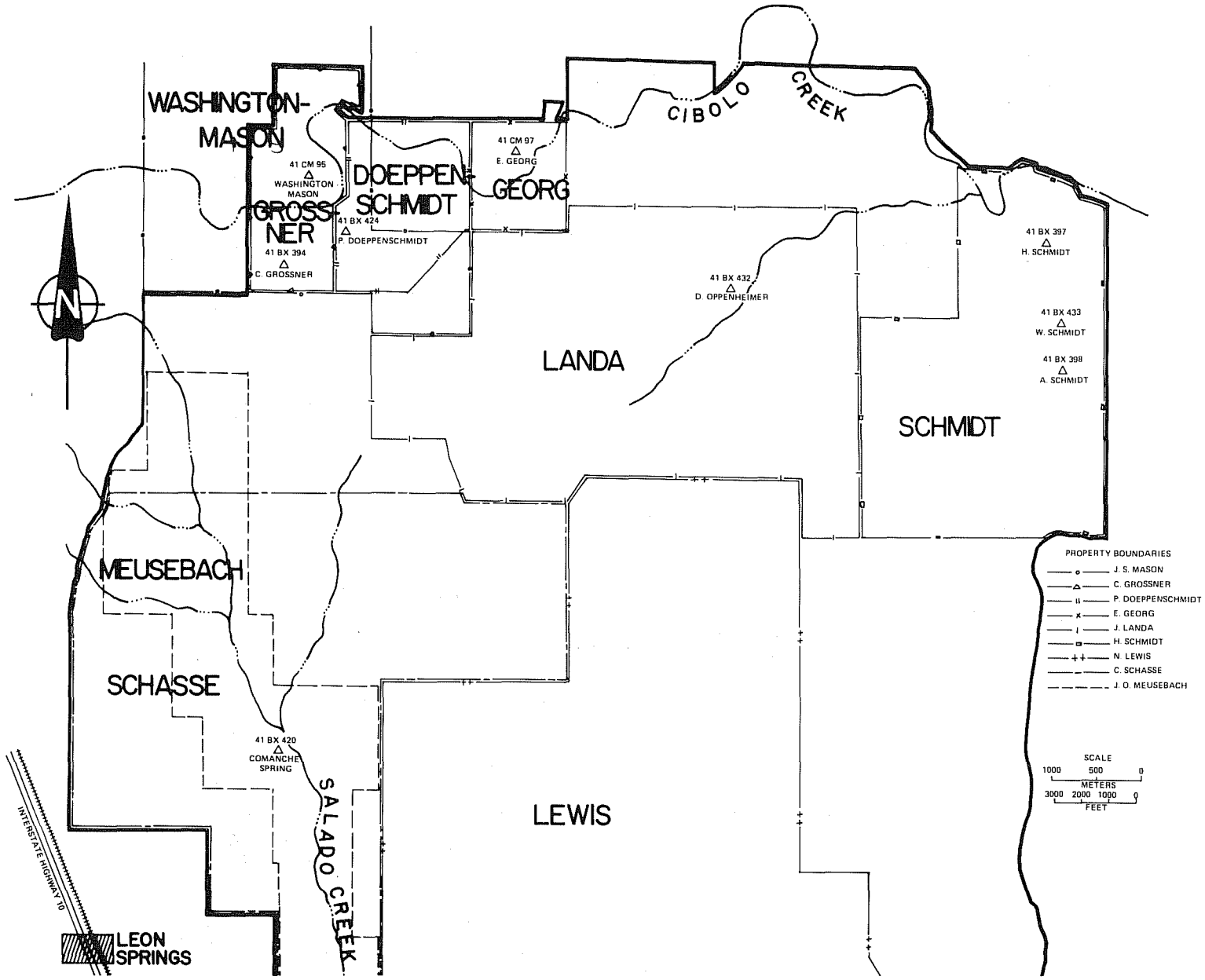

Figure 57. *Map Showing Early Property Boundaries, Camp Bullis.* The Landa and Lewis tracts were later combined to form the Oppenheimer property (see text).

III. B.2

SITE DESCRIPTIONS

James E. Ivey and Sara E. Kleine

In this section we will present a discussion of each site based on an assessment of the nature of the site, its artifacts and available historical records. In the following section we will consider the artifacts in more detail.

41 CM 95 (the "Washington-Mason house")

This site consists of the structural remains of a house about 10 x 13 m, with two apparent masonry chimney bases near the front (eastern) side of the structure (see Fig. 58). An area in the central part of the house appears to have been paved with flagstones. There is a flagstone walkway along the back edge of the house, extending in a northerly direction, which was probably associated with a back door or doors. The "front yard" of the house is a rectangular area along the eastern side of the remains, bordered by fieldstone placed edge-up in the ground. In some areas a further decorative edging of limestone chunks eroded into sponge-like masses is found along the inside face of the fieldstone edging. In the center of the eastern face of this rectangular area is a narrow avenue formed by a continuation of this edging.

Some alignment of brush along the south side of the structural traces indicates the presence of a fence line in the past, perhaps associated with the structure. To the south and slightly west is a large cistern, an estimated 3-4 m in diameter and 5-6 m deep, uncollapsed, and with perhaps 0.5 m of fill covering the interior floor. No indications of other structures have been found at the site.

The artifact collection implies an occupation period from about 1850 to earlier than 1940. In fact, a final date for occupation could predate 1900. The lack of any recognizable traces of other structures on the site implies that they were probably built of wood, if they were present.

The artifact collection is too limited to permit any activity descriptions other than that of general household operations. It should be noted, however, that the house is unique in several respects. Its artifacts are quite different from those of the other sites, this being the only place where glazed brick, Victorian majolica and blue flown ware are found. The cut square nail count is quite high, also; the total here is higher than the sum of all cut nails collected at other sites.

A component of the Comanche Spring site, 41 BX 420, is also dated by its artifacts to a mid-19th century origin, but its diagnostic 19th century earthenware is unlike the Washington house collection; it consists of blue shell-edged ware and banded slipware (mocha). The implication is that two quite different groups occupied the two sites in the 1850s--but whether the differences stem from the cultural backgrounds of the inhabitants, the purpose of the sites, or

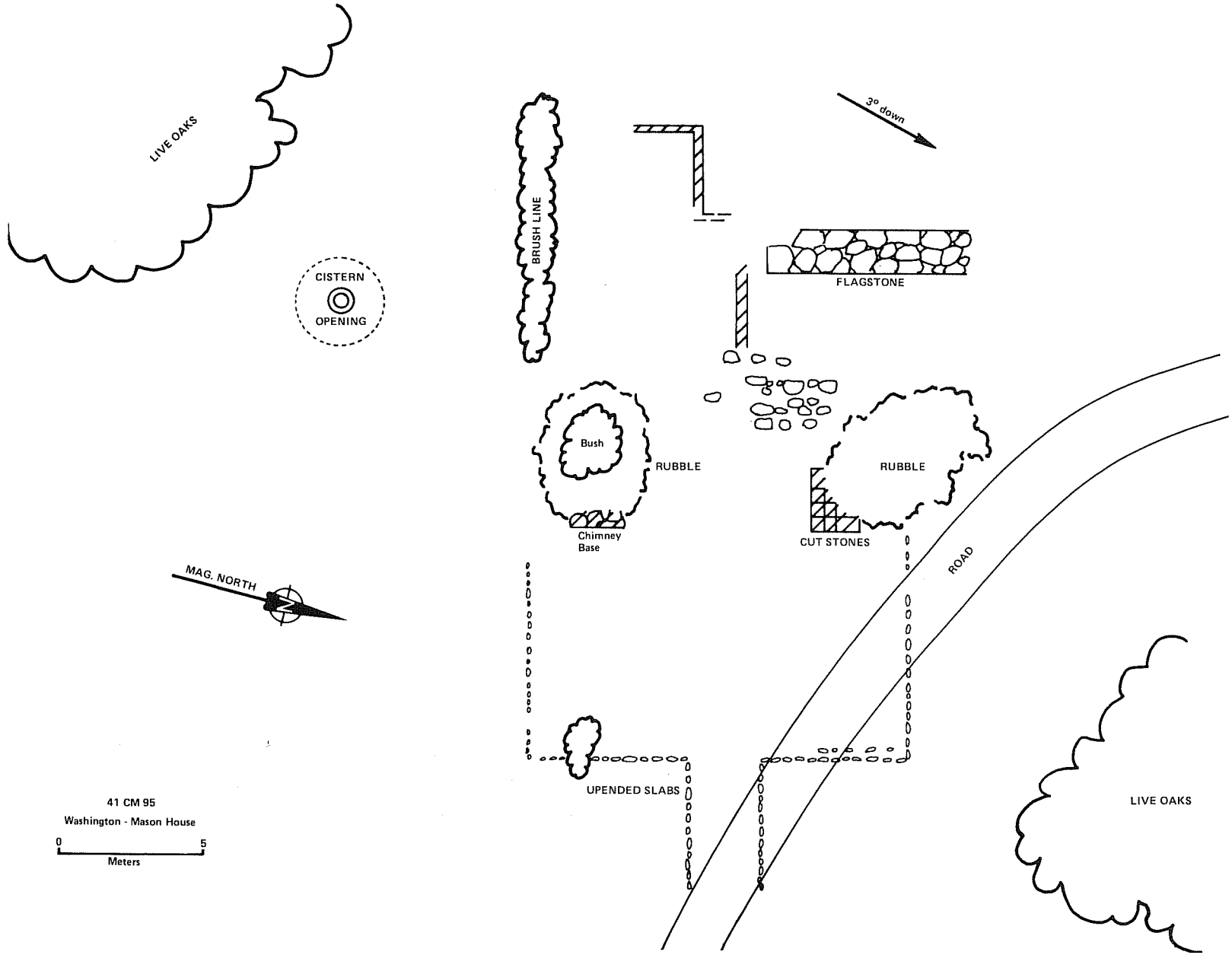

Figure 58. *Site 41 CM 95, Washington-Mason House, Camp Bullis.*