readily perceivable by the naked eye). Using recently developed analytical technologies a single, unassuming flake can tell the chipping habits of its makers, what it was used on, when it was made, where it came from, and why it was discarded. Add a pinch of nearby soil and its relationship to camp facilities can be determined. Add its brother (or sister) flakes and its relationship to other similar and different tasks can be surmised. Properly treated, out of this welter of information the form (if not the face) of ancient man emerges.

This and the following section summarize the numerical gymnastics that were necessary before reliable interpretations of what was found at Eagle Hill could be made. We used some, but certainly not even a small portion of the recently developed scientific technology to attempt a discovery of man's passage on Peason Ridge. This discovery is not an easy task and requires both forethought and effort. It should be made clear from the first that we are in search of the processes and patterns of prehistory, not its finite detail. In the time available to us we were able to intensively collect and analyze data from five occupation planes measuring 5 x 6 m. Approximately 100,000 observations were made on this 150 m^3 space. We probably excavated one-third of the discernible occupation planes with the greatest of care and about one-half of the site, which had not been destroyed. Thus 600,000 observations would be required to examine the whole site as thoroughly. How large the site was at various times we cannot know. It was certainly large, and most of it has probably been destroyed by natural and human agents. Because of these missing data points, even our best efforts can show only a part of the total reality of Eagle Hill. However, there is no direct relationship between reliable interpretation of cultural process and the size of a site. Reliable interpretation is relative to the space required to execute the activities common at the site. It only requires a window to culture to observe process. A full reconstruction is not a practical or even desirable objective.

The immediate problem of this and the next section is a concept for managing 100,000 data points in a way that will provide a reliable window to cultural processes. We have two basic kinds of data. The first is observations on one-meter squares: the number of flakes, the amount of charcoal, etc. The second is observations which are located to the centimeter: tools, platformed flakes, sherds, etc. To make maximum use of both kinds of information an idea was needed that would comfortably knit the two types of data into a single picture.

Providing reliable interpretations is a matter of properly fitting the resolution of recovery to the scale of activities. The unit of analysis for this study is the occupation floor or, more specifically, the occupation plane as it was defined in the section on excavation methods. The occupation plane (OP) is a window, hopefully positioned and sized, to avail a good view of culture process. The preliminary field excursion, control column analysis, etc., were all executed to assist in the proper positioning of the window. Once properly positioned, we can expect to see that people had room to go about their daily camp activities. The rush of the summer's excavation was intended to assure this. Naturally we have to justify our reasons for excavation of a room size unit rather than a city block. We assume we are dealing with a particular segment of a particular mode of life. The segment is camp activities, and the mode of life is hunting and/or collecting. As a consequence, we suspect that a culturally meaningful area will be rather small. Within that small area, however, artifacts need to be recovered with some care. Duties performed in camp afford insight into field activities. A broken arrowhead on a floor, for instance, tells us that rehafting was done at camp at day's end rather than in the field.

In general, we depend on the one-meter resolution data to delimit the features, which structure the camp: fireplaces, rubbish heaps and, certainly not least important, barren places where people sat. A one-meter square is about the amount of space a static human body rests and works in, so it is a good basic subunit for an occupation plane. A 6 x 5 m occupation plane is a reasonable amount of space for some portion of a camp.

The one-centimeter data defines locations of activities within and between background units. We would, for instance, want the discarded base of a projectile point located to the centimeter. As is illustrated in Figure 74, when the one-centimeter and one-meter data are analyzed together, they provide the backdrop or "background" and the detail or "foregound" necessary to provide a clear indication of cultural activities. "Cultural" is emphasized because the likelihood of following prehistoric movements of an individual are slim in most sites. It has been done under special conditions; however, in slow depositional situations the odds are that we are watching a lineage of fathers and sons, who hunted the same range, built fires in well-remembered places, and upon each return performed duties, which were indicated by their cultural heritage.

The Background-Foregound concept is a means of managing data resolution so that the analyst is not overwhelmed by detail or the analysis so superficial as to miss important patterns. Some analysis of one-meter resolution data was performed in the previous section along with the discussion of formal tools. The following articles complete analysis of specific artifacts at one-meter resolution and provide a general analysis of all one-meter data.

B. ANALYSIS OF BACKGROUND DATA

The next several subsections of this report examine the one-meter resolution data set from several perspectives. All the variables in the one-meter resolution data set are listed in Table 44. Each of the following subsections provides an analysis of some portion of that data. Also provided is an analysis of all the variables in the one-meter resolution data set together. The larger data set is resident on an SPSS (Statistical Package for the Social Sciences) file. When a subset is desired for a project it is extracted onto a smaller file or analyzed directly from the main file depending upon considerations of convenience and economy. The variables listed in Table 44 are defined in subsequent subsections.

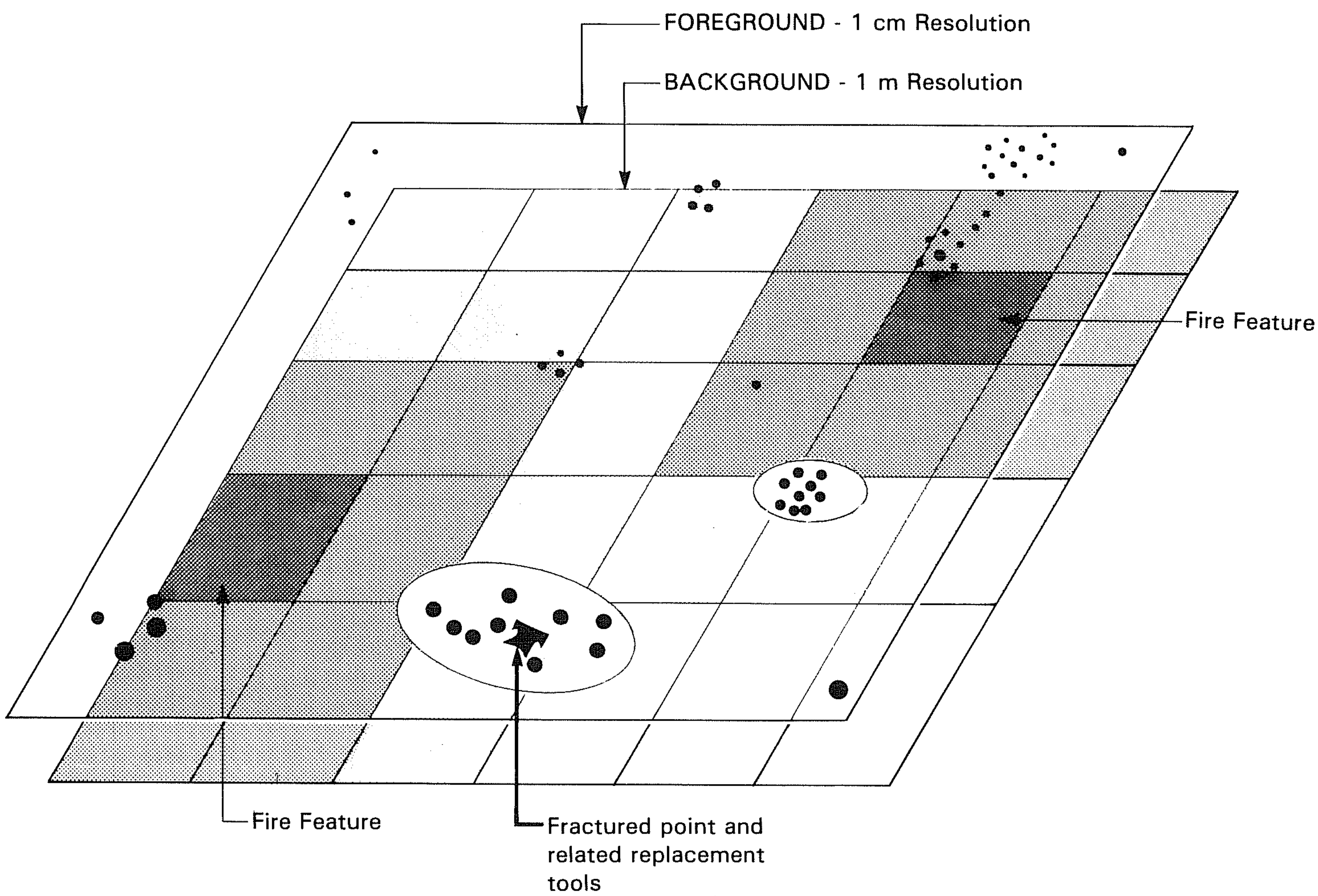

Figure 74. *Background-Foreground Site Evaluation Strategy.*

TABLE 44. ONE-METER RESOLUTION DATA SET

1. Physical Units (Subfile Name = EHOCPU, see Excavation Methods)

System Variable #	Format Variable #	Column #s	Pneumonic	Variable Name
1	1	1- 2	FM	Format Number (02)
2	2	3- 7	FN	Field Number
3	3	8-11	SS	Substratum (3 decimal)
4	4	12-17	EA	East Coordinate (2 decimal)
5	5	18-23	NO	North Coordinate (2 decimal)
-	6	24-26	-	Unit Size (cm)
6	7	27-28	LTHK	Level Thickness
-	8	29	-	Level Type
7	9	30-35	TDP	Transit Depth
8	10	36-38	HU	Hue (number)
9	11	39	HU	Hue (Alpha; 1=y, 2=yr, 3=r)
10	12	40-41	VAL	Value
11	13	42-43	CHR	Chroma
12	14	44	CV	Constant Volume (1=no, 2=yes)
13	15	45-46	TX	Texture
14	16	47	CON	Consolidation
15	17	48	CHAR	Charcoal Flecks
16	18	49	SAQ	Shells, Aquatic
17	19	50	SLND	Shells, Land
18	20	51	CHP	Chipped Stone
19	21	52	EXT	Extent of Excavation
20	22	53-54	REC	Recorder
21	23	55	MAP	Mapped
-	24	56	-	Tagged
22	25	57	DEP	Depth to Top
23	26	58-59	IN	Inspector #
24	27	60-61	DA	Day
25	28	62-63	MO	Month
26	29	64-65	YR	Year

2. One-Meter Resolution (Subfile Name = EHOCIM, see Laboratory Methods

System Variable #	Format Variable #	Column #s	Pneumonic	Variable Name
-	1	1- 2	FM	Format Number (05)
-	2	3- 7	FN	Field Number
-	3	8-10	SS	Substratum/Occupation Plane
-	4	11-14	EA	East Coordinate (meters)
-	5	15-18	NO	North Coordinate (meters)
27	6	19-20	EXC	Excavator #
28	7	21-23	CLCT	Clay Ball Count
29	8	24-25	SHCT	Sherd Count
30	9	26-28	PFCT	Platformed Flake Count
31	10	29-30	PFFC	Platformed Flake Fired Count
32	11	31-32	NFFC	Nonplatformed Flake Fired Count
33	12	33-34	FNCT	Field Number Count
34	13	35-38	CWT	Clay Ball Weight
35	14	39-41	SHWT	Sherd Weight
36	15	42-44	PFPW	Platformed Flake Plotted Weight
37	16	45-47	PFSW	Platformed Flake Screens Weight
38	17	48-51	NFPW	Nonplatformed Flake Plotted Weight
39	18	52-55	NFSW	Nonplatformed Flake Screens Weight
40	19	56-59	PBLW	Pebble/Granule Weight
41	20	60-63	LMTW	Limonite/Hematite Weight
42	21	64-67	C14WT	Carbon/Charcoal Weight
43	22	68-70	RESWT	Resin Weight

3. One-Meter Wear Analysis (Subfile Name = EHOCWR, see Wear Analysis)

System Variable #	Format Variable #	Column #s	Pneumonic	Variable Name
-	1	1- 2	FM	Format (06)
-	2	3- 7	FN	Field Number
-	3	8-10	SS	Substratum/Occupation Plane
-	4	11-14	EA	East Coordinate (meters)
-	5	15-18	NO	North Coordinate (meters)
44	6	19	SS	Soft Scraping
45	7	20	SC	Soft Cutting
46	8	21	SB	Soft Boring

Table 44. (cont.)

47	9	22	SP	Soft Perforation
48	10	23	SM	Soft Multiple Use (Scraping/Cutting)
49	11	24	SI	Soft Indeterminate
50	12	25	HS	Hard Scraping
51	13	26	HC	Hard Cutting
52	14	27	HB	Hard Boring
53	15	28	HP	Hard Perforating
54	16	29	HM	Hard Multiple Use (Scraping/Cutting)
55	17	30	HI	Hard Indeterminate
56	18	31-34	SUWD	Sum of Widths (mm)
57	19	35-36	NF	Number of Pieces

4. X-Ray Fluorescence Analysis (Subfile Name = EHOCXL, see XRF Data)

-	1	1- 2	FM	Format Number (08)
-	2	3- 7	FN	Field Number
-	3	8-10	SS	Substratum/Occupation Plane
58	4	11-13	FE	Iron
59	5	14-16	AL	Aluminum
60	6	17-19	SI	Silicon
61	7	20-22	TI	Titanium
62	8	23-25	K	Potassium
63	9	26-28	CA	Calcium
64	10	29-31	MG	Magnesium
65	11	32-34	MN	Manganese
66	12	35-37	GE	Germanium
67	13	38-40	RB	Rubidium
68	14	41-43	SR	Strontium
69	15	44-46	W	Wolfram
70	16	47-49	P	Phosphorus
71	17	50-52	CR	Chromium
72	18	53-55	NI	Nickel
73	19	56-58	ZR	Zirconium
74	20	59-61	CU	Copper
75	21	62-64	PB	Lead
76	22	65-67	ZN	Zinc
77	23	68-70	NA	Sodium
78	24	71-73	BA	Barium
79	25	74-76	GA	Gallium
80	26	77-79	SE	Selenium

5. Lithic Material Types (Subfile Name = EHOCIM, see Lithic Materials)

-	1	1- 2	FM	Format Number (11)
-	2	3- 7	FN	Field Number (FN)
-	3	8-10	SS	Substratum/Occupation Plane
81	4	11-12	DT	Dark Tan
82	5	13-14	DTM	Dark Tan Mottled
83	6	15-16	LTN	Light Tan
84	7	17-18	LTM	Light Tan Mottled
85	8	19-20	LTO	Light Tan Opaque
86	9	21-22	WO	White Opaque
87	10	23-24	BO	Brown Opaque
88	11	25-26	GO	Gray Opaque
89	12	27-28	CH	Chalcedony
90	13	29-30	BL	Black
91	14	31-32	BLM	Black Mottled
92	15	33-34	PW	Petrified Wood
93	16	35-36	BFG	Black Fine Grained
94	17	37-38	RY	Red Yellow
95	18	39-40	CO	Caramel Opaque
96	19	41-42	WQ	White Quartzite
97	20	43-44	YQ	Yellow Quartzite
98	21	45-46	PQ	Purple Quartzite
99	22	47-48	RO	Red Opaque
100	23	49-50	COR	Cortex
101	24	51-52	LIM	Limestone
102	25	53-54	POT	Potlidding
103	26	55-56	HC	Heat Crazed
104	27	57-58	HS	Heat Sheen
105	28	59-60	TRC	Translucent
106	29	61-62	OTH	Other

Baked Clay Balls (Sherwood)

One of the unusual artifacts recovered during the excavation of the Eagle Hill site was the large number of baked clay balls that appeared throughout the site in all levels. It was thought that distribution patterns might emerge to indicate the presence of hearths (their very presence implied some kind of firing), so the balls were plotted on unit maps. It was also thought that the clay balls were related to pottery making. A description of the clay balls, their location in relation to other artifacts (particularly charcoal), and their possible origin will be discussed in this section.

The soil at Eagle Hill consists of sandy loam in the surface and upper layers. Sediment composition becomes finer toward the bottom of excavation because of translocated pedogenic clays. The deepest level examined is a culturally sterile Miocene lake bed with high clay content. Clay balls were recovered from all levels of the site, regardless of the proportion of clay to sand in the soil (Fig. 75) except, of course, the Miocene lake bed. All balls showed evidence of baking. Colors varied from light brown and reddish yellow to bright red (7.5 YR 6/4, 7.5 YR 6/8, and 2.4 R 5/8; respectively on the Munsell Color scale). Many showed signs of blackening on one side, while some of the smaller lumps were completely black. In a few cases, balls were found that were black on one side and red on the other. These variations in color can be explained by the conditions under which the clay was fired. Clay that is exposed to oxygen during firing will assume a yellow color and, where the fire is hotter or upon repeated firing, will turn red. However, if clay is fired under conditions where oxygen does not come in contact with the clay, the clay will turn gray or black due to atmospheric reduction of carbon.

Table 45 shows the amount of clay balls by weight and number recovered from the excavated occupation planes. Frequencies of clay ball recovery may have been affected by different methods of screening used as the excavation progressed. During excavation of OP 1.13, artifacts were washed through 1/8-inch screen by pouring buckets of water over the matrix. Some clay may have dissolved in this process. In later screening, material was dry screened, which probably increased the recovery rate of the clay. As excavation continued into lower levels, it became increasingly difficult to dry screen material, because of the growing clay content of the soil.

TABLE 45. TABULATION OF CLAY BALLS, WEIGHT, AVERAGE SIZE, AND PERCENTAGES OF TOTAL

Substratum	Number	Percentage of Total No.	Total Weight (grams)	Average Weight (grams)	Percentage of Total Weight
1.13	165	8.9	75.6	0.46	4.9
2.13	1105	59.9	781.2	0.71	50.7
3.11	538	29.1	633.5	1.18	41.2
4.12	20	1.1	42.5	2.13	2.8
4.15, 4.16	17	1.0	5.9	0.35	0.4
TOTAL	1845	100.0	1538.7	0.83	100.0

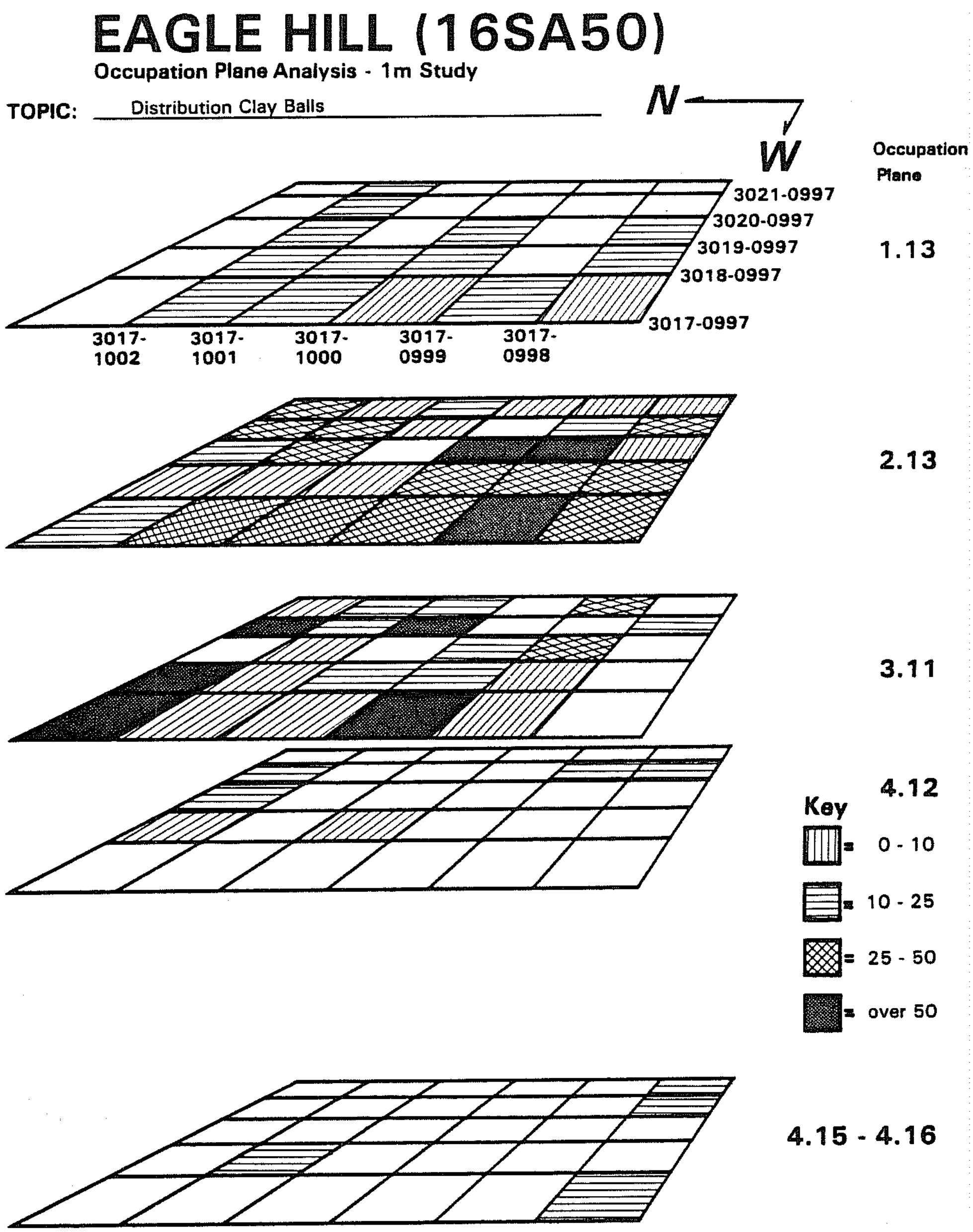

Figure 75. *Clay Ball Distribution.*

In the lower levels (OP 4.12-4.17), it was necessary to soak excavated material in ammonium hydroxide so that it would pass through the screens, or screen it under high water pressure. This process may have dissolved less coherent clay balls. To test this, clay balls were soaked in ammonium hydroxide overnight. The less solid clay balls did dissolve.

Water screening technique probably contributed to some unknown reduction in clay ball recovery. Excavator experience may also have been a factor early, although the crew had previously completed two levels (OP 1.11 and OP 1.12) before excavating OP 1.13. The effect of ammonium hydroxide, as determined by the above experiment, would have reduced the frequency of recovery in OP 4.12 and below.

None of the clay balls recovered shows any signs of hand molding. They are irregular in shape and range in size from four millimeters to three centimeters. In many cases, the size of the larger balls seems to be the result of two or three balls compacted together. This conclusion is drawn from what appear to be seam-lines on the surface of the balls (Fig. 76,c). In addition, where balls are cut in two, layers of different colored clays are revealed (Fig. 76,b) At least two balls have a thin layer of sand trapped between two layers of clay (Fig. 76,f), and several have what appear to be charcoal particles imbedded in them. One shows stratification of different colored clays interspersed with thin layers of black material (Fig. 76,e). The cross section of one ball shows a bright red interior with a lateral fissure across the interior and another short fissure perpendicular from the top partway into the interior. The area around the lateral fissure is yellow and is pierced with a series of small holes (Fig. 76,g).

The fact that two or more lumps of clay may have been pressed together to form a larger lump suggests that some animal, or perhaps man, may have stepped on them when they were on the surface, thus forming one large ball.

There are two additional balls that exhibited unusual features and deserve mention. One, upon opening, showed a small circle of dark clay in a yellow clay setting, taking up 1/4 of the surface area. There is another small dark spot at the lower end of the cut surface (Fig. 76,a). The other and most unusual clay ball has a small flint chip buried in it. The outside of the ball is grayish yellow in color. The top half of its interior is yellow with the bottom half shaded from gray to black. The chip is positioned at an angle 45° from the bottom of the ball, which is flattened and smooth. Microscopic examination shows evidence that the bottom may have been abraded (Fig. 76,d). D. R. Lewis (personal communication) found a cache of clay balls in a site on Lake Houston, which contained small flints and colored stones. No determination of the use or meaning of these objects has yet been made, if indeed they are handmade and not a natural deposition of clay around an object.

Fourteen balls recovered from OP 3.11 and weighing a total of 10.3 grams were composed partly of clay and partly of charcoal. The cores are charcoal with a clay coating. It is possible that the clay was accidently stuck to the wood with which it came in contact. Later, when the wood burned, the clay hardened and continued to adhere to the charcoal (Fig. 77).

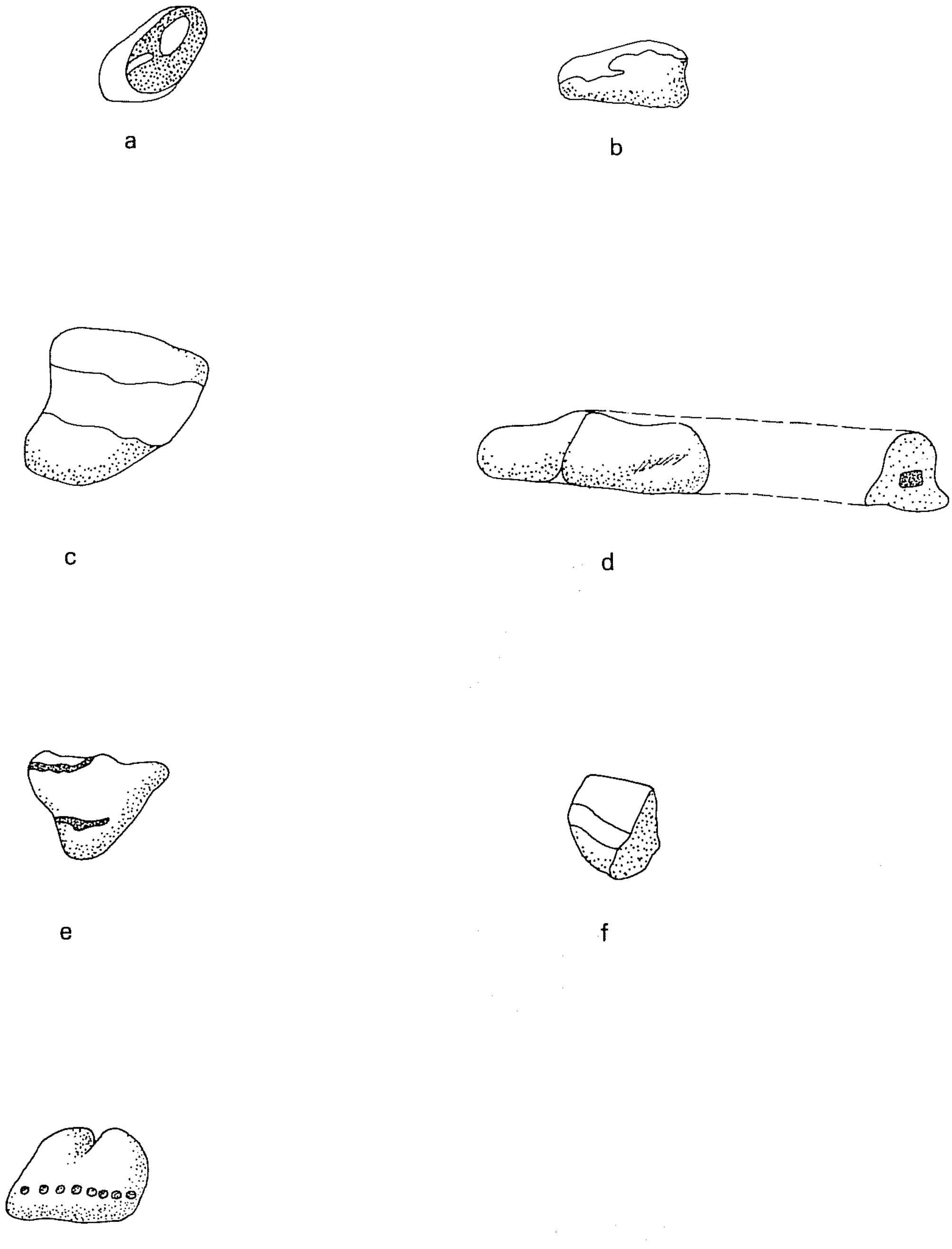

Figure 76. *Clay Balls Found at Eagle Hill.*

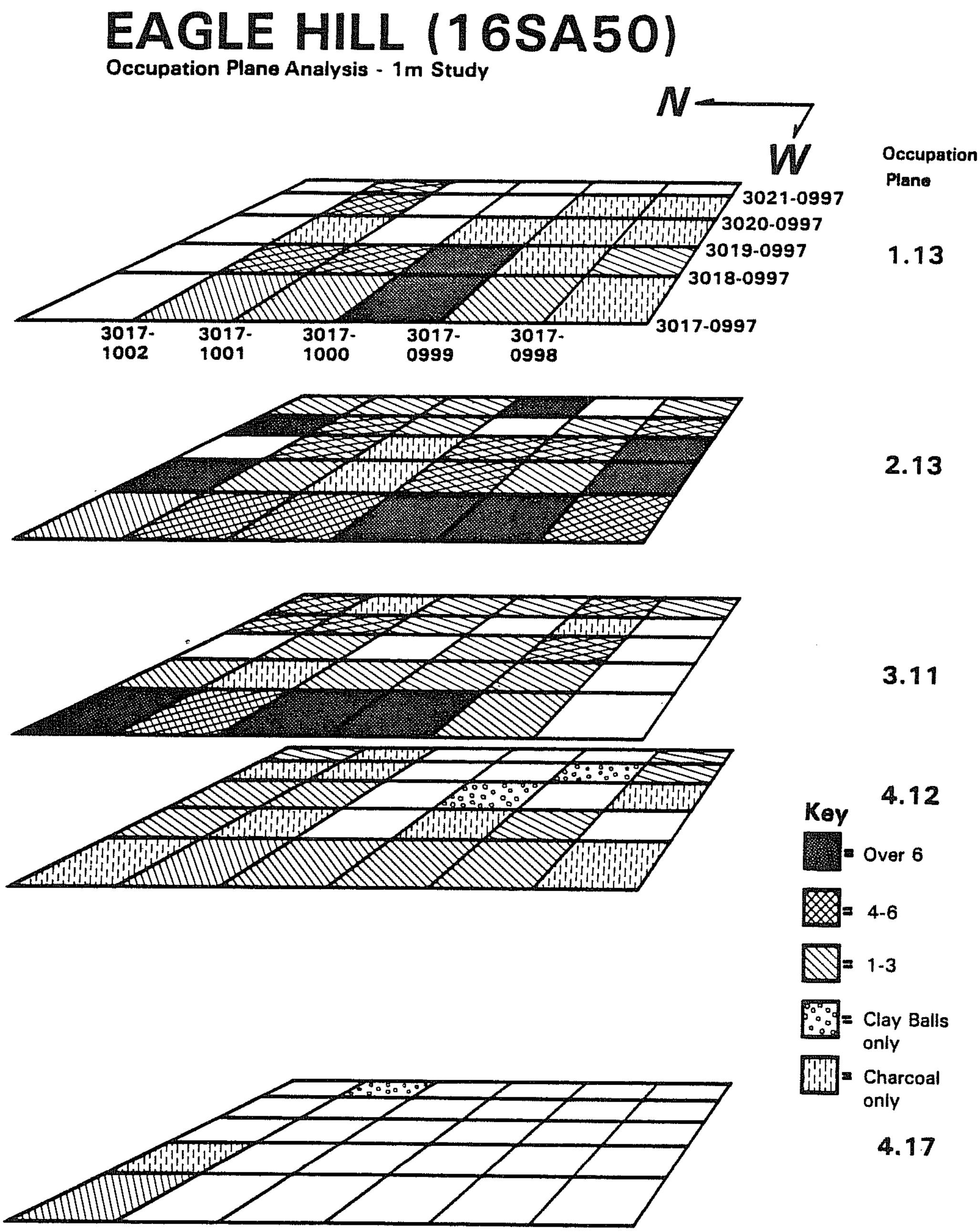

Figure 77. *Clay Ball Plots Found with Charcoal.*

With the aid of a magnifying glass, visual inspection of a random sample of clay balls from the different strata showed that the clay of these balls contained grains of foreign material. Grains are present at a ratio of 1% to 2% of the bulk of the clay with the majority in the 1% range. The estimates were made by use of the Comparison Chart for Estimating Percentage of Composition (Terry and Chilingar 1955:229-234). Exact composition of clay was determined by laboratory tests.

Clay balls have been found at many sites throughout the United States, usually in areas deficient in natural stone. Large quantities of clay balls or "Poverty Point" objects have been recovered from sites in Louisiana and along the Gulf Coast. They have been formed into cylindrical, spherical, and other shapes (Ford and Webb 1956:36-49). Similar clay balls have been recovered from sites in California (Heizer 1937:34-50); Charles Towne, South Carolina (South 1970:3-16); and along the Gulf coast from Florida to Louisiana (Gagliano 1977). Most of the objects (definitely hand molded) have been tentatively identified as cooking stones. Other clay balls, also man-made, but with a distinctive shape, known as "Kersey Clay Objects" have been recovered from sites in Missouri (Williams 1974:79-80). None of the clay balls recovered at Eagle Hill can be so identified, however, as they are small and do not show signs of hand molding or decoration.

There have been numerous reports of clay balls in Texas sites. Clay balls from Loyola Beach bear signs of human manufacture (Hester 1971:100-102). Hester hypothesizes that these clay balls may have been used as stone substitutes in hearths or may have been baked and used in containers as cooking stones. Another explanation for the formation of clay balls is offered by Corbin (1963:29) who suggests that they may be the result of open hearths built on the surface in areas where there is a large amount of clay in the soil. Black (1978:28-29) suggests that clay balls may also result from brush fires on top of clay surfaces. In Victoria and Goliad Counties, Texas (Fox, Black, and James 1979:56), concentrations of burned sandstone and clay were found that appear to be remnants of hearths, although no charcoal was found in direct association with these features.

None of these explain the presence of clay balls at Eagle Hill. Charcoal in association with clay balls in many areas of the excavation may account for the fact that the clay was baked, but it does not explain the origin of the clay since, as stated previously, the upper soil horizons are sandy.

We have also considered the possibility that the clay balls may have been the residue from pottery making. Potters may have discarded pieces of clay unsuitable for use or may have trimmed the pottery in the manufacturing process. Some sherds were found during excavation, but there is no other evidence (hearths) to indicate that pottery making was taking place in the area. Tests were performed to determine if the pottery sherds were made from clays at the site.

An explanation for the clay balls is suggested by the presence of crayfish on Peason Ridge. The depth of crayfish burrows varies from a few inches to as much as eight to ten feet depending upon the level of the water table. Crayfish must burrow down to the water level to keep their gills wet. The crayfish carries the mud from his burrow and deposits it at the entrance to the chimney. Chimneys may range in height from six to eighteen inches (Pennak 1953:456). Such chimneys were observed on the Eagle Hill site. Since the clay content of the soil increased with depth, particularly in the Miocene lake bed, it is probable that the clay found in the soil was carried to the surface by the crayfish activity over a long period of time and eventually deposited at different levels as the soil zones accumulated. This would account for the presence of the clay balls in the sandy soil. Probably the clay was baked as a result of successive ground fires, which swept the area over the years. Man-made fires may also have been responsible. The fact that clay balls and charcoal were found in the same areas supports this hypothesis.

Lithics (Jolly)

Excavations at Eagle Hill yielded a diverse assemblage of artifactual materials noteworthy for its scarcity of formalized tools. This lack of traditionally accepted temporal/cultural indicators necessitated more intensive analysis of some of the ancillary aspects of the cultural remains. In this study, the lithic raw materials as represented in the debitage assemblage are examined and presented in relation to a model for subsistence and lithic procurement.

The Method

An initial analysis of the debitage was conducted in conjunction with the edge wear analysis. Examination of approximately 1500 one-centimeter provenienced flakes provided a broad base of observations from which 21 material type categories were established (see Table 46). Delineation of these categories was judgmental and qualitative as defined by the following six attributes: (1) Color, (2) Fracture, (3) Cortex (Presence/Absence), (4) Grain, (5) Translucence, and (6) Mottling (Presence/Absence).

The final analysis consisted of raw counts of the material in each category for each one-meter unit from each occupation plane. The counts were made on all of the platform flakes of the units recovered by troweling. Counts of platformed flakes are thought to be an accurate representation of the amount of on-site flaking, the number of blows struck during lithic-related activities.

The total data set consisted of approximately 4600 flakes. Preliminary data analyses were directed toward establishing the integrity of the 21 lithic categories. In light of the fact that the categories were defined qualitatively, there was a question as to whether they were, in fact, discrete categories. Six material types (CT, DTM, LT, LTM, LTO, WO), due to conspicuous similarities, in particular, were targeted for a statistical analysis of their possible interrelation. A stepwise regression was performed on the frequencies of the six types by one-meter units as a means of isolating overlapping material type categories. It was assumed that material types originating from similar sources were likely to be found next to each other in the same squares and thus highly correlated. The simple correlations presented in Table 47 show that LTO and LTN exhibit the highest positive correlation (0.47), and LTN and WQ slightly lower (0.39). These relationships are examined more closely in the

TABLE 46. MATERIAL TYPE: DESCRIPTIONS

Dark Tan Chert (DT)	Brown to dark tan Irregular to smooth fracture Occasional cortex, Cortex inclusions Medium to fine grained Edge translucent No mottling Some large pieces, probably local
Dark Tan Mottled (DTM)	Brown to dark tan Smooth to irregular fracture Occasional cortex Medium to fine grained Edge translucent to opaque Tan to white mottling
Light Tan (LT)	Tan to light tan Smooth fracture Occasional cortex Medium to fine grained Translucent to edge translucent No mottling Largest category, probably local
Light Tan Mottled (LTM)	Tan to light tan Generally smooth fracture Occasional cortex Medium to fine grained Edge translucent to opaque Light tan to white mottling
Light Tan Opaque (LTO)	Tan to light tan Irregular to smooth fracture No cortex Medium to coarse grained Opaque
White Opaque (WO)	White Generally smooth No cortex Medium to coarse grained Opaque
Brown Opaque (BrO)	Brown Generally smooth No cortex Medium grained Opaque
Gray Opaque (GO)	Gray Smooth fracture No cortex Medium to very fine grained Opaque to edge translucent Possibly river cobble, exotic
Chalcedony (CH)	White Smooth fracture Occasional cortex Medium to very fine grained Opaque to translucent
Black (BL)	Black Irregular to smooth fracture Occasional cortex Medium to fine grained Opaque to edge translucent More of this burned than any other type, thermal alteration?

TABLE 46. (continued)

Black Mottled (BLM)	Black Smooth fracture No cortex Medium to fine grained Opaque to edge translucent White to gray mottling
Black Fine Grained (BFG)	Black Smooth fracture Very fine grained Edge translucent No cortex Two pieces in site, Flint, Arkansas or Oklahoma
Petrified Wood (PW)	Brown to light tan Generally smooth fracture No cortex Medium to coarse grained Edge translucent to opaque Very little in site despite local source
Red/Yellow (RY)	Yellow to red Smooth fracture No cortex Fine to very fine grained Edge translucent to translucent Might be thermally altered L.T.
Carmel Opaque (CO)	Carmel Smooth fracture Occasional cortex (river cobble) Fine to very fine grained Opaque Could be thermally altered Gray Opaque
White Quartzite (WQ)	White to gray Irregular fracture No cortex Coarse grained Edge translucent
Yellow Quartzite (YQ)	Yellow Irregular fracture No cortex Coarse grained Edge translucent
Purple Quartzite (PQ)	Purple Irregular fracture No cortex Coarse grained Edge translucent
Red Opaque (RO)	Red Smooth fracture No cortex Fine to very fine grained Opaque Tools from this material, not many flakes Exotic
Limestone (LI)	White to gray Irregular fracture No cortex Coarse grained Opaque
Translucent Cortex (TrC)	White Smooth fracture At least 50% cortex Fine grained (chert component) Translucent (chert component) Could be waste from chalcedony

regression analysis (Table 48) where LTO, with an R^2 value of 0.22, accounts for 22% of the variance in the category LTN, and WQ accounting for an additional 6%. The influence of the remaining categories is minimal, less than 1%. With the exception of these three categories, the relationships are below statistical significance and present no serious threat to the integrity of the categories. While the analysis suggests that categories LTO, LTN, and WO could be combined, their correlation could also be due simply to high frequency. While this needs to be kept in mind during the following analysis, the categories were kept separate in case the additional resolution should prove valuable in later analyses. This established, the data base was considered complete.

TABLE 47. CORRELATION BETWEEN SELECTED CHERT TYPES

	LTN	LTM	LTO	WQ	DT	DTM
LTN	1.00					
LTM	.06	1.00				
LTO	.47	.10	1.00			
WQ	.39	.11	.31	1.00		
DT	.25	.15	.40	.37	1.00	
DTM	.21	.13	.17	.22	.24	1.00

Note: By unit from all occupation planes, n=4600

TABLE 48. REGRESSION ANALYSIS

Dependent Variable LTN Summary Table

Variable	R Square	R Square Change	B	Beta
LTO	.23	.23	1.15	.39
WQ	.29	.07	1.09	.26
DTM	.30	.01	.52	.10
DT	.30	.001	-.72	-.03
LTM	.30	.0004	-.15	-.02
(Constant)				

Table 49 shows the raw counts of platformed flakes for each of the occupation planes by material type.

The Model

One of the basic problems in developing a meaningful analysis of the lithic raw materials at Eagle Hill has been the lack of information on lithic source areas, both local and exotic. In order to circumvent this problem and deal

TABLE 49. FREQUENCIES OF LITHIC MATERIAL CATEGORIES FOR EAGLE HILL OCCUPATION PLANES

	LITHIC CATEGORIES																			SPECIAL OBSERVATIONS						
	DT	DTM	LTN	LTM	LTO	WQ	BO	GO	CH	BL	BLM	PW	BFG	RY	CO	WQ	YQ	PQ	RO	COR	LIM	POT	HC	HS	TRC	OTHER
OP 1.13	24	20	193	14	37	34	9	16	69	12	8	1	0	28	6	0	0	0	0	1	1	0	0	2	17	2
OP 2.13	48	10	395	122	88	41	5	35	186	32	85	0	0	76	13	0	0	1	3	0	1	0	10	1	48	10
OP 3.11	42	24	308	222	80	41	0	22	152	16	21	15	2	63	19	1	1	1	1	11	10	0	5	4	41	11
OP 4.12	84	23	303	208	85	50	3	21	139	19	23	0	0	36	11	0	1	0	1	9	1	0	0	2	50	2
OP 4.17	90	25	178	103	72	31	7	9	75	10	2	0	0	16	4	0	0	0	0	11	1	0	2	1	35	0
Total	288	102	1377	669	362	197	24	103	621	89	139	16	2	219	53	1	2	2	5	32	14	0	17	10	191	25

Note: Refer to Table 44 for definitions to category abbreviations with the materials in a useful and direct manner, a model representing the relationship between subsistence and lithic procurement was developed.

The model itself is a meld of two concepts. The basic theoretical underpinnings can be traced to the German economist, Von Thünen, whose 1826 work (*Der Isolierte Staat*) presents the concept of 'diminishing returns with distance'. More recently, anthropologists have utilized this perspective in analyzing land use and subsistence. Chisom's (1968) study of rural German settlements, Lee's (1969) study of the !Kung and, most recently, Vita-Finzi and Higgs' (1970) 'site catchment' model, have shown the applicability of this concept as an analytical tool. The other half of our conceptualization of this model is drawn from Willey and Phillips (1958). In their analysis of a geography of culture, they present the concepts of locale, region, and area as cultural units. Application to this analysis of these terms is, as we shall see, slightly different.

The model (Fig. 78) divides theoretical space into "use spheres." Adapting Willey and Phillips' (1958) terminology, they are labeled the "locale," the "region," and the "area." Considering the model from the view of economics of 'diminishing returns with distance', note that the "use spheres" delineate points on a continuum sphere encompassing the site specific subsistence pattern, the "region" encompassing the annual/multiseasonal subsistence pattern, and the "area" encompassing the overall subsistence pattern, including trade networks. Also note that in theoretical space these use spheres are round and concentric, with all resources distributed, skewed toward the center (Fig. 78). Skewed means more frequent at the center and less frequent at the periphery. In practical (real) space, however, these spheres are distorted by topographic variablity and unequal resource distribution (Fig. 79).

Applying this model specifically to lithics, two concepts are implicit.

1. Lithic source areas are discrete.
2. Lithic materials, unlike food resources, are depleted through attrition rather than consumption.

From these assumptions we infer that resources relatively removed from the site will show a lower frequency of material than closer resources. By comparing the changes in frequencies of lithic resource utilization, changes from level to level, and possibly of general resource utilization, shifts in source areas, regions, and locales, etc., may be observed.

Application of the Model

Of primary interest in this study of lithic raw materials is the nature of the relationship between the debitage assemblage, the human subsistence patterns, and the procurement of lithics. The model can be drawn upon to develop a set of terms which define a presumed spatial grouping of chert resources. One must assume a seasonally occupied site with materials being carried into it. A non-seasonal occupation would call for a somewhat different formulation. That all materials are equally usable is also assumed.

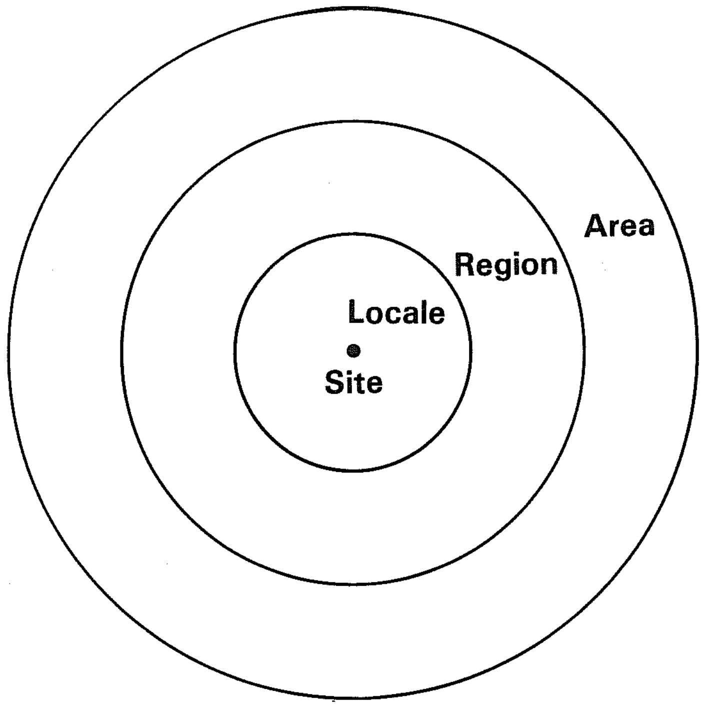

Figure 78. *In Theoretical Space, Use Spheres are Round and Concentric.*

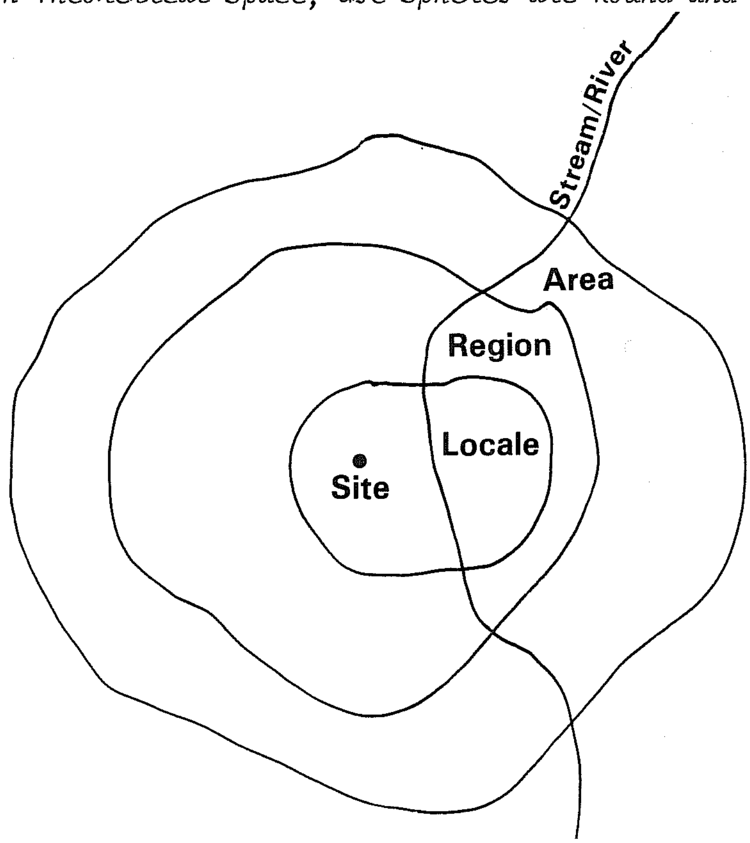

Figure 79. *In Practice, Use Spheres may be Distorted by Local Topography and Resource Distribution.*

1. Local — Resources within the general site specific resource pattern (collected). Represented by high relative frequencies.

2. Regional — Resources within the annual/multiseasonal general resource pattern (collected). Represented by lower relative frequencies.

3. Exotic — Resources outside the general resource pattern (traded). Represented by extremely low relative frequencies.

Certain changes should be evident with regard to these groups as assemblages change through time. Local resources should present a fairly stable frequency throughout time, while regional and exotic materials show greater change due to fluctuating cultural, environmental, and demographic conditions. This can be seen in Figure 80 where the hypothesized local materials show a fairly stable frequency compared to Figure 81 which shows relatively greater change in the regional materials. Figure 82 shows the presence of exotic materials which peak in Occupation Plane 3.11. The increased variation in the regional/exotic materials provides us with an insight into changing patterns of resource utilization, while materials in the margins of the use spheres provide a more sensitive indicator of change in subsistence emphasis than do the readily available local materials.

In order to provide insight into these subsistence changes, one must return to the model for a moment. Lithic source areas are discrete and distributed in decreasing frequency away from the source or, in other words, a type of skewed distribution. The materials should be represented at the site in inverse proportion to their distance. The mean relative frequencies of local and regional materials (11.28% and 1.9%) have arbitrarily been assigned as cutoff points for local/regional/exotic materials (Table 50). That is, materials below the respective means are considered to have moved to the next use sphere outwards. Although the spatial relationship of sources to site is the same, the functional relationship of the material types rises and degrades with time (Fig. 83). Note, for instance, that Light Tan chert (LT) is a constant feature of local material through all the Eagle Hill occupation planes. Black chert (BL), however, changes in functional importance becoming more important in the economy with time. In Figure 83,a-e these distributions have been mapped onto the theoretical space. The following section discusses the implications of these distributions.

Interpretation and Integration

Examining the theoretical/empirical distributions for the different occupation planes yields some interesting patterns. In OP 4.17 (Fig. 83) there is a complete absence of exotic materials. Considering that this level is most probably Paleo-Indian, this is a rather unexpected conclusion. Paleo-Indian sites are generally notorious for the presence of exotic materials. Resolution of this problem falls within the realm of a re-examination of tool use and material selection, both of which are outside the scope of this report. From

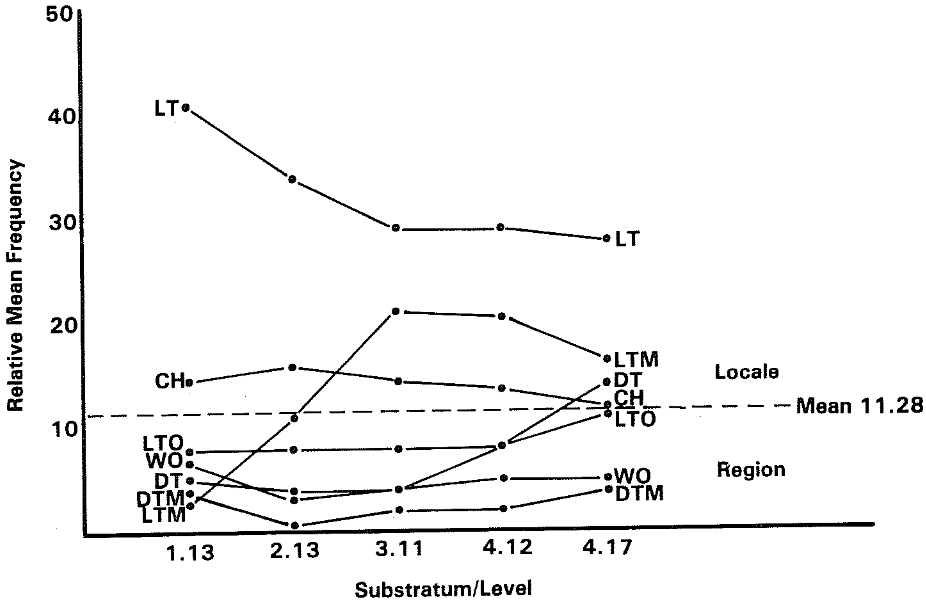

Figure 80. *Relative Mean Frequency of Hypothesized Local Materials.*

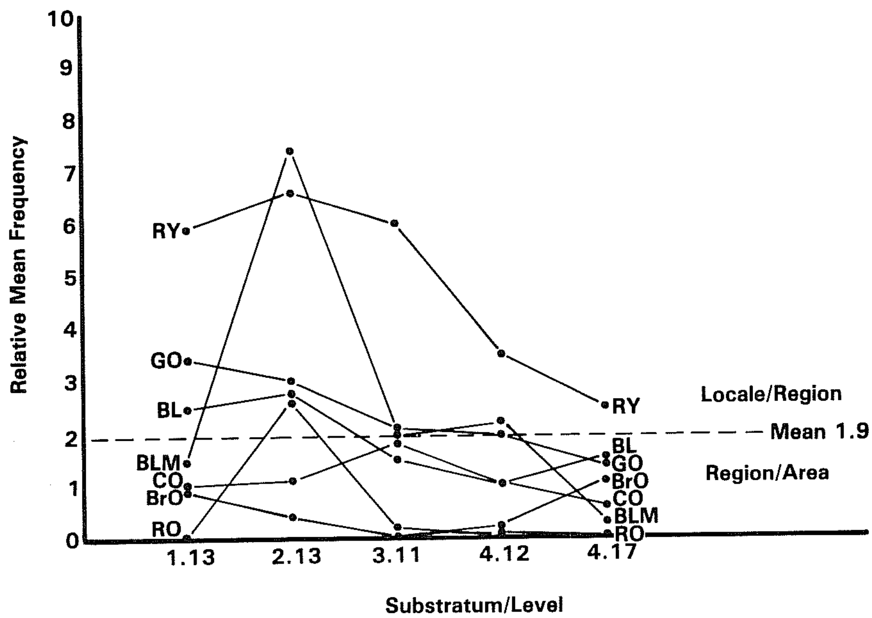

Figure 81. *Relative Mean Frequency of Hypothesized Local Materials.*

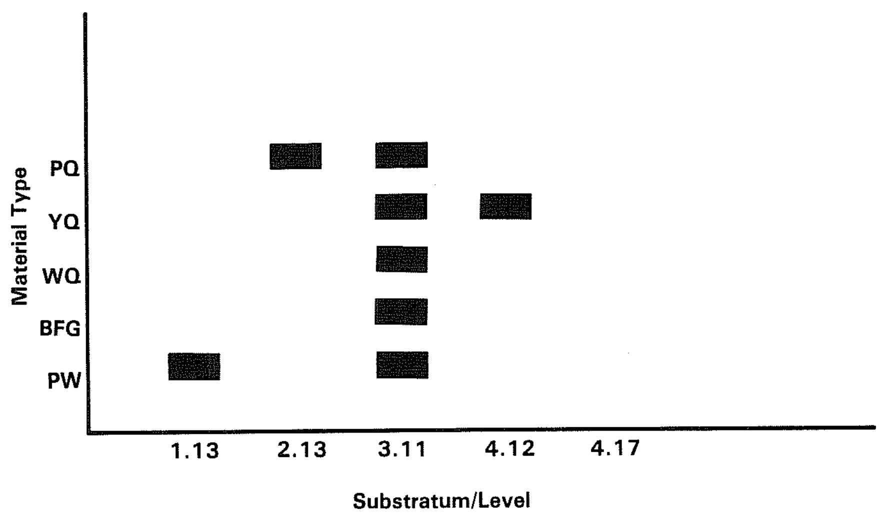

Figure 82. *Presence and/or Absence of Hypothesized Exotic Materials.*

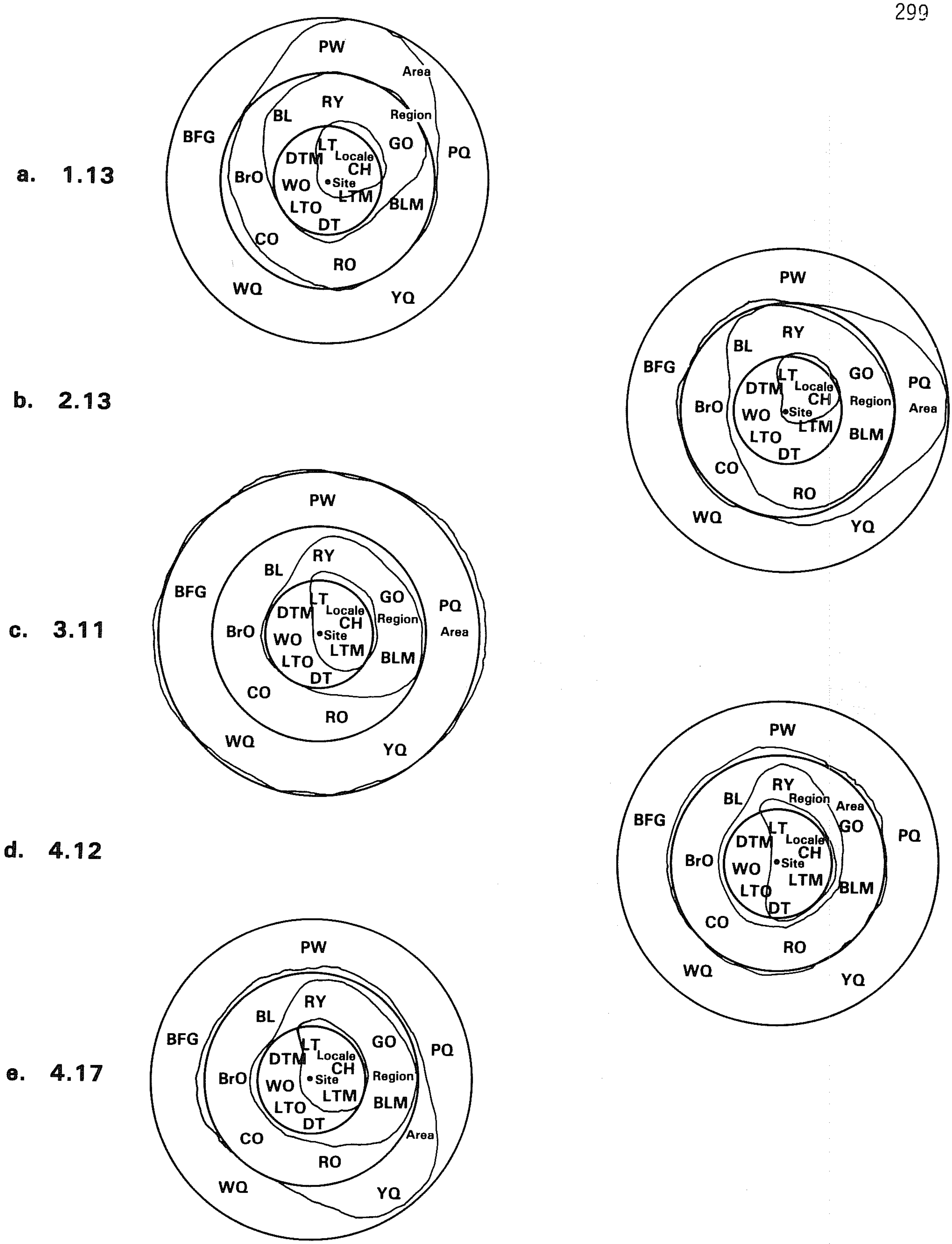

Figure 83. *Lithic Material Distributions on the Occupation Planes at Eagle Hill.*

the previous evidence it is noted that the occupation on this level was very localized and that late Paleo-Indian patterns are often thought to be drawn on more localized material sources.

Occupation Plane 3.11, in contrast, presents a totally different picture. The high predominance of exotics seems to indicate a broader based, more far-ranging subsistence pattern. If we posit this level as Archaic, the pattern is consistent with utilization of a variety of ecotones during drier periods. Evidence from pollen (Sheehan, page 161) seems to substantiate this as a relatively dry episode.

Occupation Planes 1.13 and 4.12 present essentially the same picture of a relatively balanced system. This similarity may be related to similar climatic episodes. Close examination of pollen may provide substantive evidence.

OP 2.11 shows a greater regional emphasis that may represent a transitional pattern from the far-ranging OP 3.11 to the balanced OP 1.13.

Conclusions

This analysis attempted to provide insights into the general nature of Eagle Hill and into the specific influence of the subsistence pattern on the lithic material assemblage. Although the constraints of time and money prevented a more exhaustive search for source materials, it is hoped that this theoretical approach has presented a perspective that is both practical and provocative.

TABLE 50. MATERIAL CATEGORIES BY SPATIAL MODEL

Substratum Level	Local	Local/Region	Region	Region/Area	Area
1.13	LT, CH	BL, GO, RY	LTO, WO, DT, DTM, LTM	BLM, CO, BrO	PW
2.13	LT, CH	BLM, GL, BL, RO, RY	LTO, WO, DT, DTM, LTM	CO, BrO	PQ
3.11	LT, CH, LTM	RY, CO, BLM	LTO, WO, DT, DTM	BL, CO, BrO, RO	PQ, YQ, WQ, BFG, PW
4.12	LT, CH, LTM	RY, GO, BLM	LTO, WO, DT, DTM	BL, CO, BrO, RO	YQ

Note: See Table 46 for category definitions

General Analysis of Occupation Plane Background Data

The analysis of background data proceeded in four steps. First, the variables appropriate for analysis were selected from the larger one-meter resolution data set. Second, the essential patterns of the selected data set were reduced by principal components. Component scores were calculated and plotted on maps of the occupation planes. Fourth, the scores were clustered, and the clusters interpreted in conjunction with the maps.

Data Selection

The general one-meter resolution data set consists of 106 observations on 134 squares from five occupation planes. We selected a set of variables which describe the cultural, sedimentological, and geochemical character of the entire occupation plane environment. The two major requirements of the data set are that it be as free of missing data as possible and that the variables be as nearly universally distributed as possible within the sample. Since rapid X-ray fluorescence tests were only made on 98 of the 134 units, this immediately limits the overall sample to 98 units. Nevertheless, the effects were not entirely undesirable since the loss of a few samples alleviated spatial auto-correlation to some degree. Some variables with blanket distributions, such as soil texture are not adversely affected by the sample-size reduction. Other variables which tend to occur in "hot spots," such as wear patterns on flakes are adversely affected.

Of the 106 observations on units, some are not interval scales and therefore not useful to the analysis. These include such observations as the date of excavation, unit size (always one meter), etc. Some variables occur only rarely and so were analyzed qualitatively. The selected data set consisted of 41 variables. These 41 variables describe six aspects of the site milieu: location, sediments, XRF elements, cultural indicators, lithic material types, and wear analysis (Table 51).

Location--In this analysis, occupation plane serves as an indicator of time. The east and north coordinates were included to pick up general directional trends in the data. Although there were no east-west trends, there was a north-south trend related to sediment color and preservation of clay materials. The nature of this phenomenon is discussed in Factor IV.

Sediments--The color and texture of the soil were observed in the southwest corner of each square at the time the constant volume sample was taken. This continuous grid of observations, the weight of pebbles and granules, and limonite-hematite weight from units serve to describe the weathering and textural character of the sedimentary environment of the site. In this study, including these variables is not so much to describe the sediments *per se*, but rather to control for any effects of postdepositional soil genesis. As we shall see, the effects are significant and need to be considered as part of the cultural interpretation. For instance, the north end of the excavation appears to have been much more oxidized than the south, and the oxidation affected the preservation of clay artifacts.

TABLE 51. VARIABLES USED IN THE BACKGROUND ANALYSIS

Location

SS	Occupation Plane
EA	East Coordinate
NO	North Coordinate

Sediments

HUE	Hue
VAL	Value
CHRO	Chroma
TX	Texture
PBLW	Pebble Weight
LMTW	Limonite/Hematite Weight

Cultural Indicators

PFCT	Platformed Flake Count
PFW	Platformed Flake Weight
NPFW	Nonplatformed Flake Weight
CWT	Clay Ball Weight
SHWT	Sherd Weight
C14WT	Carbon Weight
RESW	Resin Weight

Wear

SOFT	Soft Wear
HARD	Hard Wear
MNWD	Mean Width

Elements

FE	Iron
AL	Aluminum
SI	Silicon
TI	Titanium
K	Potassium
CA	Calcium
MN	Manganese
RB	Rubidium
SR	Strontium
W	Wolfram

Lithic Material Types

DT	Dark Tan
DTM	Dark Tan Mottled
LTN	Light Tan
LTM	Light Tan Mottled
LTO	Light Tan Opaque
WO	White Opaque
BO	Brown Opaque
GO	Gray Opaque
CH	Chalcedony
BL	Black
BLM	Black Mottled
RY	Red Yellow

Elements--More or less universally occurring elements determined by rapid X-ray fluorescence were included in the analysis. They describe the general geochemical composition of the sediments, translocation of elements downward through the soil zones and, hopefully, cultural concentration of elements. Correlated occurrences of elements presumably represent chemical compounds.

Cultural Indicators--Various indicators such as lithics, clay, and carbon materials were used as general indicators of human utilization of occupation planes. Resin was included as a separate variable in the belief that it might be more an indicator of the natural organic composition of the soil due to the burning of tree roots.

Lithic Material Types--The frequency of lithic types as observed on platformed flakes was analyzed in those cases where sample distributions were relatively universal. The types are discussed extensively in section III.

Wear--The frequency of wear on lithics of soft and hard material was summed for each square. Also, the mean width of worn flakes per square was analyzed.

Principal Components Analysis

Christenson and Read (1977) demonstrated that the use of principal components analysis in tandem with cluster analysis has several useful effects. The principal components analysis simplifies the data and opens up relationships to interpretation. Cluster analysis clarifies the groupings of cases in the data set and allows direct reference to tangible evidence, at least in the archaeological data used in this study. In this section, a principal components analysis of the data described above will be interpreted. A cluster analysis of the factor scores generated from the principal components analysis will also be presented.

A principal components analysis was performed on the 98 case/41 variable data matrix using the SPSS factor program (type = PA1, Nie *et al.* 1975). Five factors were judged to be important by making several runs and observing the loading sizes in the unrotated factor matrix. The five factors were rotated to varimax criteria, and factor scores calculated using SPSS procedures. Table 52 shows the variables loading on the five factors in order of their loading strength.

Interpretation

Factor I: CULTURE--Most of the loading for Factor I pertains to the cultural materials. Lithics (both frequencies and materials), sherds, and carbon are positively correlated with Factor I. The two noncultural elements loading on Factor I are iron and limonite-hematite concretions. Iron is negatively correlated with the component, while the iron-oxides are positive. This suggests the interesting possibility that human occupation catalyzes iron into iron-oxide concretions.

It is also interesting to note that the sherd weights load on the cultural component, but not the clay balls. During the whole project there has been a persistent question as to whether the clay balls were of natural, quasi-natural (crayfish and human activity), or human origin. The association of clay balls with noncultural phenomena suggest that they may be, at least in part, of natural origin. Clay artifacts are also differentially preserved depending upon their location in the site (see Factor IV).

Factor II: ELEMENTS--Virtually all of the variance provided by the geochemical analysis loads on the same factor. In part, this indicates that the measurements of elemental composition of the sediments are related to each other as an artifact of measurement technique. This is not uncommon and requires that the elements be pretreated as a data set in order to make full use of them. Such an analysis is performed in the section on XRF (page 156). Iron, in contrast to the extreme coherence between other elements, appears on several factors. Iron is extremely active in the soil-human system, while the other elements may be only part of the soil-sediment background. Manganese also shows some tendency to break off from the other elements and relate, logically enough, to the color of the soil.

TABLE 52. PRIMARY LOADINGS AND VARIABLES FOR PRINCIPAL COMPONENTS ANALYSIS OF EAGLE HILL BACKGROUND DATA

Factor I--CULTURE

.84	Platformed Flake Count
.82	Carbon Weight
.73	Chalcedony
.72	Resin
.72	Red Yellow
.66	Light Tan
.63	Limonite Weight
.55	Black
.48	Light Tan Mottled
.44	Light Tan Opaque
.38	Sherd Weight
-.38	Iron
.35	Black Mottled

Factor II--ELEMENTS

.96	Titanium
.95	Silicon
.94	Aluminum
.81	Calcium
.75	Rubidium
.74	Manganese
.69	Potassium
-.45	Iron
.43	Wolfram

Factor III--TIME

.81	Occupation Plane
.74	Nonplatformed Flake Weight
.72	Platformed Flake Weight
-.72	Soil Texture
.69	Iron
.60	Light Tan Mottled
.56	Dark Tan
.39	Limonite Weight
.38	Platformed Flake Count
.37	Strontium
.30	Chroma

Factor IV--CLAY

.85	Value
.83	Hue
.65	Chroma
-.47	Clay Ball Weight
-.46	Sherd Weight
-.45	North
.30	Manganese

Factor V--WEAR

.81	Hard Wear
.77	Soft Wear
.51	Mean Width
.41	Light Tan
.40	Brown Opaque
.39	Light Tan Opaque
.32	Dark Tan

Factor III: TIME--Occupation planes load on Factor III so it represents variables that age through time. Since the numbers assigned to the occupation planes are small at the top and become larger toward the bottom, positive association with the time factor indicates increasing frequency toward older sediments. For instance, platformed flake counts increase with time, or toward the bottom of the site. Several lithic material types are more frequent toward the bottom of the site. In other words, they were popular early and became less so later. There is also a general decrease in the total weight of flakes per unit with time.

Several of the sediment variables change with time as could reasonably be expected. Soil texture becomes fine toward the bottom, which is normal for an old soil. Finer particles leach toward the bottom leaving coarser material at the top. As was shown in the physical environments section (page 126), some of this may be due to large aeolian particles being deposited in the upper colluvium.

Iron increases toward the bottom of the section. There is either downward migration of iron, or older sediments are a richer source of iron. Strontium also increases toward the lower sediments.

Finally, the chroma of the soil increases with time. The lower sediments are more saturated or brilliant in color. Mottling and general reddening of the lower strata is caused by longer exposure to oxidation, which turns soils red.

Factor IV: CLAY--The north-south coordinate of the site grid is associated with Factor IV. Since the relationship is negative, as are clay ball weights and sherd weights, clay balls and sherds are more frequent in the north of the excavation. Color acts in the opposite direction. The soils become redder and darker to the south, yellower and lighter to the north. The colors are more saturated to the south. Since the relationships are opposite what would be expected if human habitation were the causal agent in soil coloration, the controlling factor must be natural. Since both clay balls and sherds are associated, one apparently natural and the other unnatural, the overall effect must be differential preservation of clay artifacts. Since the soils are redder to the south, the implication is that oxidation encourages the dissolution of sherds.

Manganese loads on the clay factor. It is probably the coloring agent that darkens the value to the south.

Factor V: WEAR--Both hard and soft wear load on Factor V. The most popular types of chert used also load for wear. There is probably an element of bias since all of the cherts are opaque and of darker color. Dark, opaque cherts facilitate the observation of wear patterns.

Factor Scores

The factors discussed above show the trend and communalities resident in the one-meter resolution data of the site as a whole. Naturally, our interests turn now to how those trends appear on a unit by unit basis. Factor scoring is a means of reducing the original 41 variables to five new variables represented by the factors just discussed. Factor scores were calculated for the data using SPSS procedures (Nie *et al.* 1975). A FORTRAN program written for this project was then used to map the results of this scoring onto a visual display (Fig. 84). Each row of squares represents an occupation plane, and each square is a map of the Area A excavation. Dashes (-) indicate missing data; an XRF sample was not run. Each number between zero and nine represents a one-meter unit. Fours and fives represent ½ standard deviation below and above the mean and so are nothing out of the ordinary. Zeros represent two or more standard deviations below the mean; nines indicate two or more standard deviations above the mean. Both are therefore extraordinarily low and high, respectively.

As an interpretive example, note that the last column of squares is the WEAR factor (Factor V). The bottom square shows the distribution of wear on Occupation Plane 4.17. The lower left unit of that square is marked by a nine indicating that an unusually large number of worn flakes were found in that square. It is also the unit in which the Paleo-Indian lanceolate was found. The association of a Paleo-Indian point with utilized flakes is a matter of

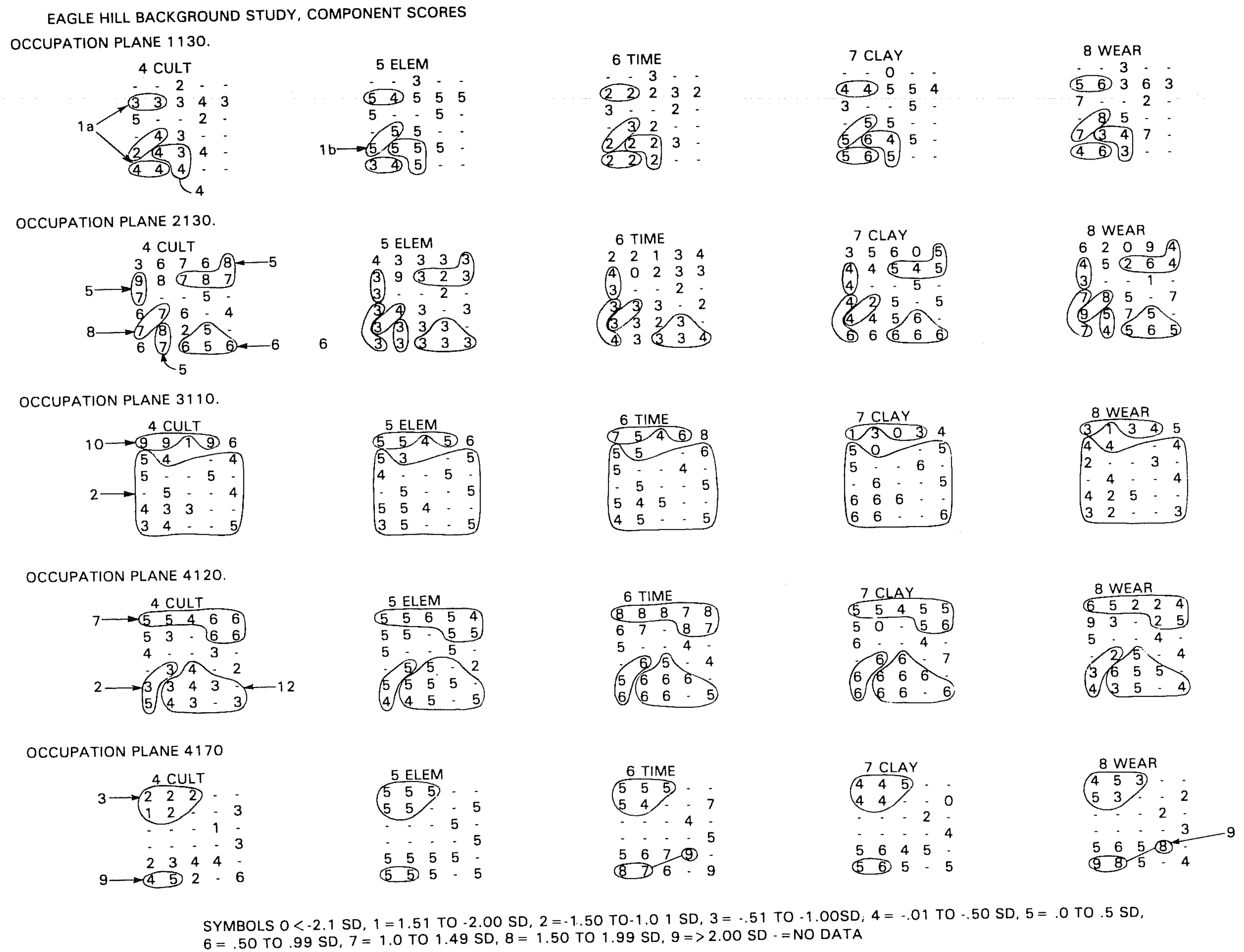

Figure 84. *Factor Scores for Five Components on Five Occupation Planes.* Each number represents a one-meter excavation unit. Numbers with arrows are clusters.

some interest and suggests that perhaps a tool kit was left in that and the adjacent squares rather than just an isolated point. The work flakes may have been used in conjunction with the point or perhaps in a rehafting effort. Toward the opposite side of the excavation, the relative frequency of work lithics falls far below normal, as is marked by the twos.

Casual inspection of Figure 84 highlights several "hot spots," as related to the various factors. A full and systematic analysis of the distributions, however, requires that we turn to cluster analysis to make sense of a large number of values.

Cluster Analysis

To assist in the interpretation of patterns on the occupation floors, a cluster analysis (BMDP2M) was performed on the 98 sets of factor scores. Twelve clusters resulted along with the seven apparently deviant squares (marked with "D"s). Each cluster and subcluster were assigned a numerical and letter designation and plotted on the perspective map of the site (Fig. 85). The clusters are also outlined and marked on the factor score map (Fig. 84).

OP 1.13

Cluster 1a: Humic Zone--Clusters 1a and 1b are located almost exclusively in OP 1.13. Cluster 1a consists of six scattered squares. Culturally they are low in the more general cultural indicators, but high in use and wear. Clearly the most characteristic aspect of Cluster 1a is the fact that it rates very low on the TIME component. This implies that it is low in lithics, popular early in the long history of the site, low in unit flake weights, low in the downward migrating elements (iron and strontium), and low in iron-oxides.

Cluster 1b: Use Spot--Cluster 1b differs little from Cluster 1a, except it is very high in use-wear as compared to any location in the site. This use-wear "hot spot" is congruent with a similar feature in the occupation plane below, OP 2.13. It is difficult to determine if the feature is a pile of occupation debris on OP 2.13 or a pit dug from OP 1.13. No differentiation of the soil was observed in the field. The fact that Cluster 8, the manifestation of the feature in OP 2.13, is isolated, while Cluster 1b appears to be a part of both Cluster 1a and OP 1.13, suggests that it is a pit dug from the apparent Caddoan level. As we shall see, conflicting evidence appears on OP 2.13.

Cluster 4: Seating--Cluster 4 resembles Clusters 1a and 1b, except that it lacks the wear "hot spots" observed in the other two clusters. Cluster 4 squares interdigitate between the units with wear and contain a normal amount of inorganic soil elements. In all, it is a picture of seating, rather than a discard pile or fireplace.

Cluster 8: Debris--Cluster 8 is the cultural debris and wear "hot spot" in the upper soil horizon. It is located in OP 2.13 under the similar Cluster 1b as in OP 1.13. It seems to be a part of a wider spread pattern of cultural accumulation and work tools in the southwest corner of OP 2.13. One must

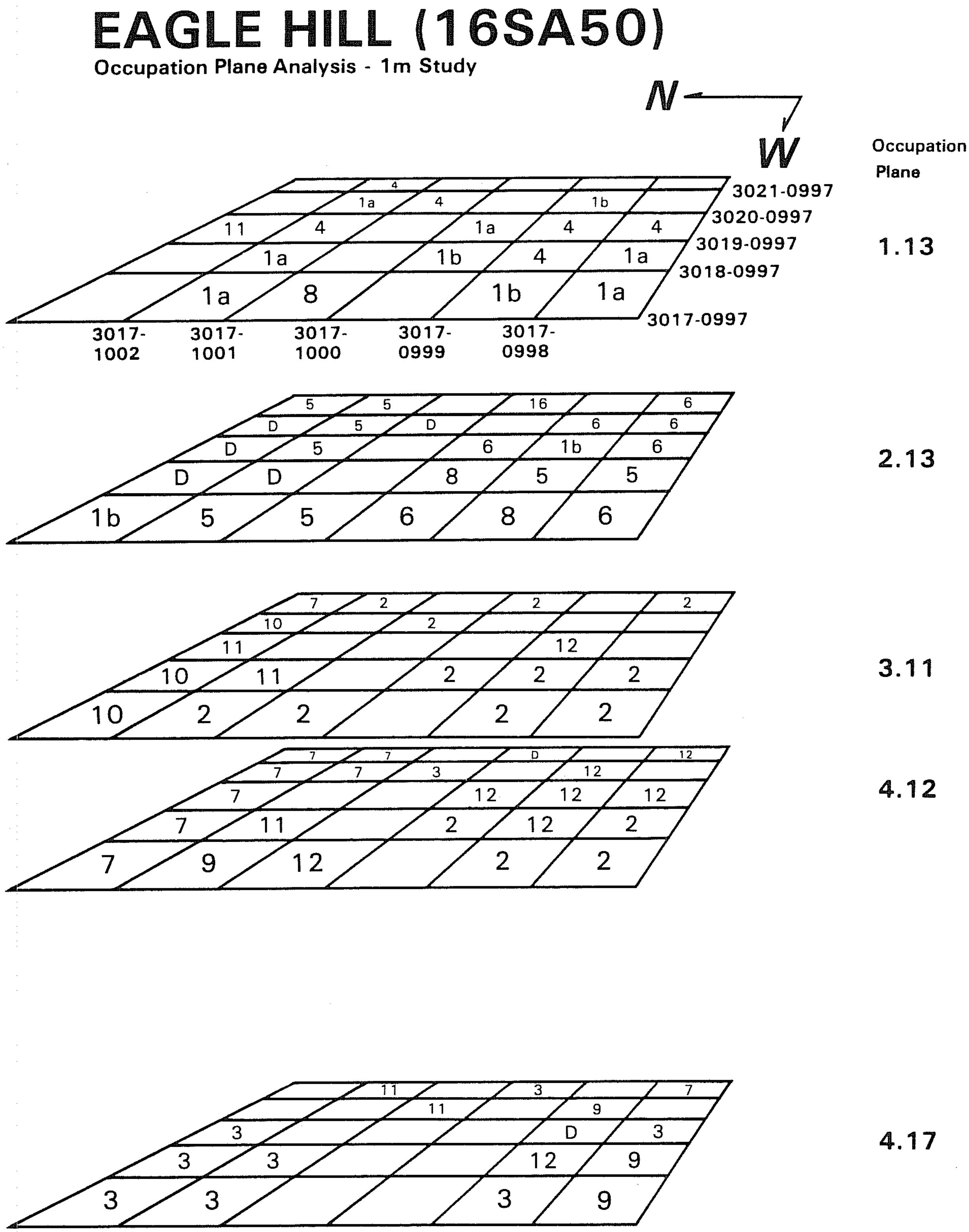

Figure 85. *Clusters 1-12 and Deviant (D) Units.*

assume that the material similarly discovered in OP 1.13 is the top of a pile that either protruded or mixed upward into OP 1.13. In addition to high cultural ratings, Cluster 8 is low in inorganic soil constituents. This is probably due to human activity turning the soil more organic. It is also low in clay items, a curiosity in a rich ceramic horizon. The overall picture is of a "trash dump."

Cluster 5: Clay--Cluster 5 is like Cluster 8 except that it contains clay objects. As will be seen in later analyses, carbon plays a major role. It is also above average in clay item content. Since the clay balls and carbon indicate probable fire activity, Cluster 5 is a likely prospect for hearths. This supposition is supported by low inorganic soil constituency on the ELEMENT factor.

Cluster 6: Wear--Cluster 6 resembles Clusters 8 and 5, except that the overall cultural indicators decrease, notably carbon. There is more wear and a notable increase in clay items. The indications are of a rather open work surface toward the southeast corner of the occupation plane.

OP 2.13

Aside from the three clusters just described, OP 2.13 is notable for all of the deviant squares except one. There are four contiguous deviant squares in the north central part of the floor, all marked by extreme values of one type or another. One has the highest ELEMENT values and the lowest TIME values of any square in the site. Something peculiar was going on in the north side of OP 2.13, which deserves detailed qualitative analysis later.

OP 3.11

For the most part, OP 3.11 is comprised of two clusters. Cluster 2 can be projected over the southern five-sixths of the floor with only occasional exceptions. It is the largest contiguous area encompassed by any cluster. Cluster 10 follows the north edge of the excavation.

Cluster 2: CLAY--The inorganic composition of the soil increases, which reflects the position of OP 3.11 in Soil Horizon B. Cluster 2 at the south end is marked by a general low cultural item yield and an abundance of clay balls. Use-wear is generally low. TIME related variables climb past the mean for the first time indicating translocation of soil constituents and the first appearance of the "old" cultural ways, those important in the earlier period of the site.

Cluster 10: CULTURE--The northern tier of squares shows the beginnings of the translocated materials, which will culminate in the next level down. The northern edge of the unit is marked by a massive concentration of cultural materials very much in contrast to the southern sector. The focus of occupation appears to be to the north in OP 3.11; the excavation caught the southern edge of the main activity area. In spite of all the cultural activity, there is a marked absence of use-wear on lithics.

The overall picture for OP 3.11 is that of the southern margin of an intensively utilized activity area.

OP 4.12

OP 4.12 is the first targeted floor in the lower colluvium (soil Zone II). It is perhaps most interesting sedimentologically for the massive concentration of translocatable elements, especially along the north edge. Apparently the influx of movable elements from the upper colluvium deposited in the last 1000 years is just arriving at the contact between the two soil horizons. Use-wear on lithics is more frequent than in the plane above, but the artifact yield is more varied and generally low. The floor seems to be structured in a manner similar to OP 3.11 with open work surfaces to the south and artifact concentrations to the north. The focus of activity appears to be more to the east.

Cluster 12: CLAY--Cluster 12 comprises the southeast quadrant of the OP 4.12 excavation and is not unlike the same area in the two levels above. Wear tapers off to the east and west, but is relatively prominent in the center. Clay balls are frequent, but other artifacts are rare. The TIME component affected factors of the soils, and cultural systems are now clearly in the "old" sector, well above mean values for old types of cherts, etc.

Cluster 2: CLAY--The units of the western tier resemble the units above enough to cluster with them. The main distinction from Cluster 12 is a drop in the frequency of use-wear.

Cluster 7: CULTURE--The units along the northern edge of the excavation have a higher artifact yield, less clay balls and some wear. They are most similar, however, in their very high relationship to the TIME factor. The units were particularly notable for large, edge-altered flakes constructed from the Dark Tan Mottled materials type. Dark Tan Mottled materials is an important contributor to the TIME component since it was popular earlier.

OP 4.17

Occupation Plane 4.17 is notable for concentrations of wear especially where important artifacts were found in the west margin of the excavated area. The topographic situation during this time period would have been quite different from the one imposed during the upper occupation levels. The site was probably a mound during most of its history. During the earliest occupation, however, the whole ridge appears to have been a flat to gently sloping surface. In other words, there would have been less incentive to concentrate camps on the site to avoid wet spots. It is not surprising, therefore, to find that the artifact yield is consistently low. If there is a locus of activity it is to the west. There may have been a bump in the recently eroded Pleistocene soil to the west of the excavation. This apparent erosional remnant includes the west one-meter tier of the site.

Cluster 9: PALEO-INDIAN POINT--There are two important clusters. Cluster 9 is in the southwest corner. It is very high in worn tools and is associated with the Paleo-Indian lanceolate. Cluster 9 and the south edge of the excavation seem to have caught the translocation of downward bound elements in the south side. For some reason, the IB/IIB interface was more permeable to the south.

Cluster 3: PALEO-INDIAN TOOLS--This area in the northwest corner of the excavation was associated with an end scraper on a blade and other formal tools. It is fairly high in WEAR, but very low in general artifact yield.

Conclusions

Perhaps as much can be told about changes in the topography of the site from the changing occupation patterns as from any other line of evidence. During the Paleo-Indian period, residence seems to have been encouraged by an erosional remnant hardly more than 10 cm high, a remnant of the well-developed B zone of the Pleistocene soil to the west of the excavation. After this, the locus of activity seems to have shifted to the north. Perhaps the topographic high, which brought people to the exact location of Eagle Hill again and again, was located slightly to the north. It has probably been eroded since it is on the uphill side of the site. The upper levels seem to show a southward shift toward the present location where the final occupation locus indicates that the top of the mound was virtually where it is now.

While the evidence for occupation activity areas outlined above cannot be considered conclusive in itself, it is the first in a series of contributions to an overall understanding of natural and human activity at the site. In the next section the artifact classes, which contributed to this analysis, will be examined in detail.

V. FOREGROUND: ANALYSIS OF OCCUPATION PLANES AT ONE-CENTIMETER RESOLUTION

A. USE-WEAR ANALYSIS (Gibson, Gunn)

Introduction

Determining stone tool function is a complex process, which must account for characteristics of raw material, its modification, how the tool was used, and what it was used on. Lithic artifacts from Eagle Hill II (16 SA 50) belong to an industry that incorporates varying degrees of raw material modification and use ranging from minimal, such as use of flakes, to extensive, e.g., use of formal tools. Our lithic analysis methodology involved several approaches. We were able to distinguish between different raw materials, artifact forms, and functions by characterizing the raw material types, the attributes of artifact morphology, and the degree, kind, and distribution of edge damage. By this approach we sought to determine whether or not the artifact was utilized, the mode of use, and if it was a fragment of a tool. If it was a fragment, the tool form was inferred. The material(s) the tool was used on (wood, bone, hide, etc.,) was also inferred. Our objective was to identify the artifacts within each of these wear categories and their intrasite distributions. Resources were too limited to implement an experimental program in tool replication and use. Keeley (1980) has shown that such a program is essential to a full understanding of use-wear. Our results can only therefore be considered as a preliminary step toward a thorough elucidation of tool function at Eagle Hill.

Determining function is a complicated process that must account for characteristics of raw material and modification of that material whether it be intentional or fortuitous. "Modification" is considered here to encompass alterations of the raw material that result from intentional technological efforts and the effects of use-wear. In addition to intentional modifications by humans, we must also consider possible alterations resulting from natural processes such as bioturbation. The identification of wear traces produced by specific materials or ranges of materials was the key to understanding the function of the lithic artifact assemblage. The selection of desirable raw materials for alteration into usable tools is the first step toward a functioning tool. As has been pointed out by other authors (Binford 1978; Goodyear 1982), selection of appropriate materials by prehistoric hunter-gatherers may have been an important logistical problem, particularly for highly mobile groups. Given the nature of the Eagle Hill occupation we have every reason to suspect high mobility. The selection of materials is thought to have been carried out at two levels. The first level is the selection of specific raw materials for the hunting tool kit (bifaces, projectile points, scrapers). In general these were hafted tools that were maintained through retouching, and/or reshaping. In a far-ranging nomadic subsistence-settlement system these raw materials were often not locally available. The second level of selection occurred locally. Lower quality raw material in proximity to sites were collected for nonspecific tasks and for immediate use and discarded.

The hypothesis we proposed to test was that the individuals who utilized the Eagle Hill site programatically selected certain types of rock from the local and regional environments in order to manufacture, maintain, and use them for specified kinds of tools. For the hafted tools, which were not manufactured and rarely discarded at the site, retouching, resharpening, and edge-damaged flakes (resulting from use) made of nonlocally available flint should be present. For the expedient, disposable tools made from locally available flint, the whole gamut of manufacturing, maintenance, and use flakes as well as the discarded tools themselves should be present on the site. The Null hypothesis is that there was a random distribution of stone tool forms manufactured from both nonlocally and locally available raw materials in the site area. The hypothesis was tested by statistically comparing the frequency and distribution of the material types, correlated with such lithic artifact categories as utilized flakes and flakes that were produced from manufacturing, maintenance, and use.

Given that the excavated portion of the site of Eagle Hill contained both (presumably) locally available and nonlocal flints (see lithic material section, page 180), and that there was a difference in the flake forms that resulted from different activities (e.g., manufacturing, maintenance, and use), it was necessary to construct an analytical methodology, which allowed us to distinguish between different raw materials and flake uses. The lithic raw materials were characterized as occurring in one of five categories, which are shown in Table 53.

Technological and wear attributes for each of the 1519 closely provenienced flakes and tools were observed and coded according to the attributes listed in Table 53. Our intention was to determine through these attributes if certain technologies were used to produce flakes slated for use. The observations determine which edge of the specimen was used, its shape, the edge angle, the aspect of use, and the specific edge damage. Properly done this task requires a stereomicroscope, similar in magnification, program, and equipment to that suggested by Lawrence (1979). Since we lacked the equipment at the time (it has since been acquired) our analysis has to be thought of as a preliminary screening of the use-wear problem at Eagle Hill. Table 54 shows the states of the attributes.

TABLE 53. VARIABLES OBSERVED ON EAGLE HILL LITHICS

Material
1. Coarseness
2. Color-Material
3. Opaqueness
4. Texture

Production Technology
5. Formal Tool Type
6. Technotype
7. Fragmentation
8. Platform Shape
9. Platform Exterior
10. Outline
11. Edge Thickness
12. Feathered Termination
13. Hinge Termination
14. Step Termination
15. Snap Termination
16. Asymmetrical Orientation
17. Axis of Force

Modification
18. Overlapping Flake Scars
19. Nibble Scars
20. Edge Damage
21. Crushed Edge

Wear
22. Probably Soft Use
23. Probably Hard Use
24. Polish
25. Aspects of Use
26. Initiation of Force
27. Wear Analysis Potential

Observation Mode
28. Microscope
29. Magnification

TABLE 54. ATTRIBUTES OF VARIABLES IN TABLE 53

Coarseness
1. fine
2. medium
3. coarse

Color-Material
1. dark tan
2. light tan
3. light tan opaque
4. black
5. petrified wood
6. white chalcedony
7. red-yellow
8. miscellaneous

Opaqueness
1. translucent
2. edge-translucent
3. opaque

Texture
1. normal
2. patina
3. weathered
4. heat sheen
5. potlidded
6. cortex

Formal Tool Type
0. indeterminate
1. edge-altered flake
2. biface tool
3. biface fragment
4. uniface fragment
5. waste
6. maintenance flake
7. other-projectile pt.

Technotype
1. flake
2. blade
3. chunk
4. indeterminate
5. nonartifact

Fragmentation
1. whole
2. platform end
3. medial
4. terminal end
5. nearly whole
6. indeterminate

Platform Shape
0. missing
1. flat
2. curved
3. triangular
4. irregular

Platform Exterior
0. missing
1. untrimmed
2. slightly trimmed
3. moderately trimmed
4. heavily trimmed

Outline
1. contracting
2. parallel
3. expanding
4. irregular

Edge Thickness
1. thick
2. thin
3. extremely thin

Feather Termination
0. absent
1. present
2. indeterminate

Hinge Termination
0. absent
1. present
2. indeterminate

Step Termination
0. absent
1. present
2. indeterminate

Snap Termination
0. absent
1. present
2. indeterminate

Asymmetrical Orientation
0. absent
1. present
2. indeterminate

Axis of Force
000. indeterminate
999. multiple

Overlapping Flake Scars
0. absent
1. present
2. indeterminate

Nibble Scars
0. absent
1. present
2. indeterminate

Edge Damage
0. absent
1. present on terminal end
2. present on lateral edge
3. on platform
4. on lateral and terminal end
5. on lateral edge and platform
6. indeterminate

Crushed Edge
0. absent
1. present
2. indeterminate

Probably soft use
0. absent
1. scraping
2. cutting
3. boring
4. perforating
5. multiple use
6. indeterminate

Probably hard use
0. absent
1. scraping
2. cutting
3. boring
4. perforating
5. multiple use
6. indeterminate

Polish
0. absent
1. present
2. indeterminate

Aspects of Use
0. absent
1. one side
2. two sides
3. three sides
4. four sides
5. all sides
6. indeterminate

Initiation of Force
0. absent
1. point
2. bending
3. indeterminate

Wear Analysis Potential
0. none
1. good
2. very good
3. excellent

Microscope
1. stereomicroscope
2. ILM
3. SEM

Magnification
1. 10X
2 15X
3. 20X
4. 25X
5. 30X
6. 35X
7. 50X
8. 100X
9. 200X
10. 400X

Approaches to Use-Wear Analysis

Regardless of which method of use-wear analysis one chooses, all of the methods involve judgement, interpretation of artifacts, and familiarity with the uses of stone tools. The analyst must first determine what level of accuracy is needed for functional interpretations. High magnification microwear analysis provides very precise information. Of course if one has specimens from a site like Hinds Cave where macro-organic residue is preserved on tool edges, the methods and techniques of Shafer and Holloway (1977:103-106) are much more precise. However, for the other 99% of archaeological sites, where such preservation does not exist, high magnification microwear analysis provides the most precise information.

In the past ten years there have been two major approaches to use-wear analysis that link method with technique and equipment with procedure. Edge damage has been emphasized in some lithic studies. Edge damage may be considered as an attribute (or attributes) of an artifact wherein flakes have been removed from stone tools through use and other processes. The technique of analyzing edge damage has been to use low magnification with a stereomicroscope. Ruth Tringham *et al.* (1974), George Odell (1975), and Lawrence (1979) have conducted some of the best edge damage studies. Researchers concentrated on edge damage with a stereomicroscope, because one observes a basically 3-D image. The depth of field is high relative to the specimen size. The problem with stereomicroscopes is magnifications above 100X are necessary for identifying specific microwear polishes (i.e., plants, hide, bone, wood). It is difficult to obtain a sufficient depth of field above 80X on a stereomicroscope. Microwear polishes can be detected with stereomicroscopes, but they cannot be confidently identified (see Keeley 1980).

In our analyses of the Eagle Hill material we were limited to edge damage analysis at low magnification with a stereomicroscope and, therefore, could only determine if the tool had been used on a hard or soft substance as opposed to identifying hard substances such as wood or hide. Using an incident light, high magnification microscope could have solved this problem, but none was available.

Following the program and attribute definitions described by Lawrence (1979), which are presented above, analysis proceeded in the following manner. We initially replicated Lawrence's experiments in use-wear, although we did not use the Instrom Machine; we found his results to be nearly identical with ours, and decided to adhere to his attribute terminology. The archaeological specimens were examined under low magnification with the stereomicroscope then the presence or absence of the edge and use-wear attributes was recorded (see Lawrence 1979:119). After recording these attributes, we examined them as a group or constellation of resultant characteristics and in most cases were able to identify the specific mode of use and whether or not it was used on a hard or soft material. Sometimes we were able to infer that a specimen was used, but its specific mode of use was ambiguous, because of a lack of certain attributes. These specimens were recorded as indeterminate in the relevant attribute categories.

Throughout our use-wear studies the analyst had information only on the vertical position of the artifacts. The horizontal placement of the specimens was unknown to avoid inadvertent biasing of the results. Examples and explanations regarding the meaning of hard and soft use-wear will be discussed in the following section.

B. INTERPRETATION OF OCCUPATION PLANE PATTERNS (Gunn)

Introduction

The analysis of relationships between artifacts and features recovered from excavated occupation floors is not new to North American archaeology, although the art is hardly more than a decade old. Examples in the Mid South and adjacent regions include Goodyear's (1974) examination of the Brand site remains from eastern Arkansas, Gunn and Mahula (1977) at the Hop Hill site, and Brose and Scarry (1976) at the Boston Ledges shelter. The European literature contains several exemplary efforts such as those of Leroi-Gourhan (1966) at Pincevent and of de Lumley (1969) at Lazaret Cave and, more recently, Cahen, Kelley, and Van Note (1979). There is also a body of writing on the problem of statistical analysis of horizontal distributions (Whallon 1973, 1974; Gunn and White 1977; Hanson and Goodyear 1976). Virtually all of these analyses were predicated on the recognition of formal tool types such as points and scrapers, features such as fire hearths and huts, and associated materials such as animal claws, mollusks, etc. There are two basic types of information derived from occupation floor analyses. One is the re-creation of camp habits, a sort of momentary snapshot from ancient man's life. The other is the locational association of tools, an attempt to interpret functional association of formal tools. When properly interpreted, both types of data provide substance from which social and cultural inferences of past lifeways can be made.

The analysis of the Eagle Hill assemblage was particularly challenging for a number of reasons. In the first instance, there were so few formal tools that little pertaining to behavior could be derived from them except as regards their manufacture. Small frequencies thwarted statistical analysis. Also, there was an absence of soil stains and alteration of soil color, which usually mark fire hearths. An examination of the distributions of charcoal fragments and small clay balls thought to be the result of building fires on crayfish castles may suggest the general locations of prehistoric fires. As we shall see, a logical examination of these surrogate features seems to bear out the inference of fires in at least some locations.

To produce an analysis of chert implements, which would suggest functional work areas on the floors, was a more involved process. While there were few formal tools, there was certainly no lack of chipped stone in the form of flakes. From the five occupation planes selected for intensive study, 5535 lithic items were recovered. These included 1519 pieces that were provenienced to the centimeter, and 4016 items that were provenienced to the meter. Given the proliferation of flakes, most of which were not primary reduction specimens, it seemed likely that, although we found few tools, the inhabitants of Eagle Hill brought tools to the site and reshaped and resharpened them there, always being careful to take them away rather than leave them. Workable cryptocrystalline rocks are unevenly distributed on the coastal plain and such a practice is more expectable than surprising. It, therefore, seemed reasonable that any evidence of the function of stone tools and of the site would have to be found among the flakes. To this end, the 1519 flakes, which were provenienced to within one centimeter on occupation planes, were examined for evidence of use and wear (see section IV).

The equipment available at the time of the study only allowed us to examine the flakes under low power with a binocular microscope, usually about 30X. Keeley (1980) found that detailed examination of stone tools under much higher magnification coupled with replicative experimentation is necessary to define the exact material on which tools were used. Gibson was, therefore, only able to identify use in a general sort of way, whether lithics were used on hard materials such as wood and bone or soft materials such as hide, meat, and softer plants. From Occupation Planes 1.13, 2.13, 3.11, 4.12, and 4.16, 270 flakes were found to bear evidence of alteration from use.

Occupation Floor Logic

Every archaeologist has had the experience of optimistically laboring over a map for hours plotting points and finally facing a bewildering array of "x's" and "o's" that resist any reasonable interpretation. As was explained in detail (page 14), Eagle Hill was dug in a way that we thought would give us a reasonable chance of recovering the remains of relatively brief intervals of human occupation. In assuring brief intervals, we thought we might capture some of those fleeting insights into personal life, which ancient persons occasionally leave within the arrangements of fire hearths and stone tools. Unfortunately, however, even the most carefully excavated occupation floor is not likely to leave a completely unambiguous record of events. As with virtually all data, interpretation requires a set of logical principles, which can be used to decipher associated arrangements of artifacts.

The logic of our interpretation of occupation floors can be stated briefly. We are interested in activities resulting from repeated, culturally defined events or episodes of activity. A single flake used to slice plant fibers and dropped on an occupation floor is a culturally defined event, marked by the discarded flake. However, it is of little use to us, because we have no particular means of logically assuring ourselves that the flake and its evidence are a part of a systematic set of acts.

On the other hand, several flakes used to scrape a shaft and then discarded within a few centimeters of each other represent an activity <u>episode</u>. The same wear pattern appearing on several flakes close together, in contrast to other similar associations with different wear, gives us some confidence that we are dealing with a coherent episode. This confidence is bolstered if that episode is in logical relationship to other evidences of camp activity. For instance, it would be logical for the flakes to be beside a fire hearth rather than in it. If illogical associations occur (such as flakes in fireplaces), then we must assume that we are dealing with more than one camp located in the same position and be duly wary of overinterpretation.

Beyond the episode is the more usual unit of analysis, the <u>concentration</u>. Concentrations are sets of episodes usually in a logical relationship to a fire feature. They are also found isolated within and without fire features. Definition of a concentration depends upon spatial discreteness. Definition of an episode, on the other hand, depends on functional discreteness. Together episodes and concentrations comprise a relatively powerful logic for defining spatio-functional activity sets.

A final element of logical inference relates to the location of fireplaces. Apparently, the stains and structure common to fireplaces has leached away at Eagle Hill. Most such stains and colors relate to carbon and iron-oxides in the soil. We have seen that both are mobile in the Eagle Hill sediments (see section IVB). However, we were able to locate isolated bits of charcoal. Those over one centimeter in their longest dimension are plotted on Figures 86-90. We also found burned pieces of flint, both potlidded and firecrazed, and we assume they are indicative of fire.

Finally, the assumption is made that the clay balls, which appear on every floor, were a product of humans building fires on the remains of crayfish castles. This process hardened the clay thus resisting severe leaching. Also, some of the clay is hardened and red on one side and black on the other. There may well have been clay-lined fire pits on occasion at Eagle Hill. It is highly likely that natural fires swept through the Eagle Hill site. Whether they would have provided the more than 700°F necessary to harden clay is a matter that requires study. For now we will assume not.

Statistical Analysis

In addition to the logic of spatial relationships, there is a battery of statistical-numerical analysis techniques, which can assist in the characterization of occupation floor patterns. The method used in this analysis centers on the concept of "adjacencies," which is calculated in a manner similar to "nearest neighbor" analysis. That is, the Euclidean distance between each pair of artifacts is determined from coordinates observed in the field to one-centimeter resolution. Distance between items, however, is managed according to a cross-cultural theory of work space (Gunn and White 1977).

The population of tool types is segregated into two cells, one within and one without a criterion distance. The criterion distance is arbitrarily set based on an idea of how far apart tools are likely to be discarded if they are utilized at the same task. The criterion value for this study was set at 1.6 m. Naturally, there are problems with any criterion distance, and whatever is used must be justified in terms of purpose. Consider for instance, two different tasks: rehafting a foreshaft with a broken point and dressing a deerskin. If the individual who is doing the rehafting is sitting and does not move during the operation, most of the tools used and discarded should be found one meter or so apart. On the other hand, tools used in dressing a large deerskin would be discarded at the periphery of the stretched skin. Some of them will be more than a meter apart. If adjacencies are determined on the one meter criterion, all of the tools associated with the rehafting episode will be correctly determined to be adjacent and, therefore, utilized in the same tasks. Adjacencies for the skinning episode will be somewhat deflated by the fact that the task area was larger than the criterion value.

For this study, the distance was set at 1.6 m because it seemed likely that most of the activities would be confined to tasks involving small, individual-sized spaces. This distance is approximately the range of a comfortable arm's reach in either direction. It is probably better to set the criterion too small and miss a few real adjacencies than to set it too large and falsely inflate the adjacency index.

Alternative settings of the criterion follow alternative research objectives and assumptions. For instance, a research project might be directed toward the behavior of family-sized units. Yellen's (1977) study suggests that a criterion distance of five to six meters would be sufficient to discover such associations. The criterion distance could be similarly adjusted for village-sized units, etc. The cross-cultural and ethnographic background studies for the adjacency technique are described in Gunn and White (1977).

An adjacency analysis was calculated for each occupation plane (Tables 55-59). The tables contain an adjacency transition matrix. Each row of the matrix contains an "A" and a "B" vector for each tool-wear type. A row is calculated for all types in the analysis. The "A" vector contains all of the adjacencies between types which fall within the criterion distance. The "B" vector holds the frequency of items which fall outside that distance. At the bottom of each table, an adjacency probability matrix is provided. The adjacency probabilities are calculated as: $P = A/(A + B)\ (1 - [1/A])\ (1 - [1/B])$. Multiplication by the reciprocals weights "P" in favor of larger sample sizes. If one cell is empty, the cell in which adjacencies occur is simply weighted for sample size. This is the second stage in developing the adjacency technique. The first was presented in Gunn and White (1977).

The advantage of the adjacency concept is the ability to externally and internally examine concentrations of tool types. Hanson and Goodyear (1976) developed a technique for determining tool associations. Concentrations of tools, which can be spatially defined, are associated with the same task, the "shared tool" technique. However, it is probable that spatially defined concentrations are likely to contain the product of more than one task. Of course, one is committed to determine the criterion distance. This is not wholly disadvantageous since it forces an explicit theoretical position to be defined to justify the criterion.

There are certain interpretive aids to understanding the adjacency probability matrix. The diagonal probabilities are the adjacencies between tool types and other tools of the same type. The off-diagonal statistics are between differing tool types. If the adjacencies on the diagonal are high, it suggests that the assemblage is homogeneous, a large number of the same tools being used in the same places.

Homogeneity of tool adjacencies is caused by one of two conditions. Lengthy tasks are being performed that consume large numbers of tools. Alternatively, it may be that generalized tools are being used for many different tasks, which explains the homogeneity. Which condition is effective in a given instance can be determined by the frequency structure of the assemblage, i.e., frequency of tools compared with number of tool types. A table will be given with each occupation plane with this information as well.

TABLE 55. EAGLE HILL TOOL-WEAR PATTERN DISTRIBUTIONS

1.13=OCCUPATION PLANE
6=NUMBER OF TYPES
1.60=CRITERION DISTANCE
28=NUMBER OF ARTIFACTS
756=NUMBER OF TESTS
288=NUMBER OF A-VECTOR ADJACENCIES

ADJACENCY MATRIX(VECTORS ARE MARKOV TRANSITIONAL & REFLEXIVE)

Type		1	2	3	4	5	6	Total
EDGE ALTERED FLAKES 1	A	6.	0.	6.	6.	12.	17.	3=TOTAL
	B	0.	0.	3.	0.	24.	7.	
SOFT SCRAPING 2	A	0.	0.	0.	0.	0.	0.	0=TOTAL
	B	0.	0.	0.	0.	0.	0.	
SOFT CUTTING 3	A	6.	0.	2.	4.	11.	11.	3=TOTAL
	B	3.	0.	4.	2.	25.	13.	
HARD SCRAPING 4	A	6.	0.	4.	2.	7.	10.	2=TOTAL
	B	0.	0.	2.	0.	17.	6.	
HARD CUTTING 5	A	12.	0.	11.	7.	28.	28.	12=TOTAL
	B	24.	0.	25.	17.	104.	68.	
HARD CUTTING & SCRAPING 6	A	17.	0.	11.	10.	28.	26.	8=TOTAL
	B	7.	0.	13.	6.	68.	30.	

ADJACENCY PROBABILITY MATRIX(LOWER TRIANGLE)
****=NOT CALCULABLE MIN=2

NO.	N	VARIABLE NAME	1	2	3	4	5	6
1	3	EDGE ALTERED FLAKES	0.67					
2	0	SOFT SCRAPING	****	****				
3	3	SOFT CUTTING	0.67	****	0.00			
4	2	HARD SCRAPING	0.67	****	0.50	****		
5	12	HARD CUTTING	0.26	****	0.23	0.18	0.19	
6	8	HARD CUTTING & SCRAPING	0.45	****	0.32	0.34	0.26	0.40

TABLE 56. EAGLE HILL TOOL-WEAR PATTERN DISTRIBUTIONS

2.13=OCCUPATION PLANE
6=NUMBER OF TYPES
1.60=CRITERION DISTANCE
91=NUMBER OF ARTIFACTS
8190=NUMBER OF TESTS
1616=NUMBER OF A-VECTOR ADJACENCIES

ADJACENCY MATRIX(VECTORS ARE MARKOV TRANSITIONAL & REFLEXIVE)

Type		1	2	3	4	5	6	Total
EDGE ALTERED FLAKES 1	A	0.	0.	5.	1.	5.	6.	2=TOTAL
	B	2.	16.	43.	11.	41.	50.	
SOFT SCRAPING 2	A	0.	9.	35.	13.	31.	56.	8=TOTAL
	B	16.	48.	157.	35.	153.	168.	
SOFT CUTTING 3	A	5.	35.	100.	31.	59.	135.	24=TOTAL
	B	43.	157.	452.	113.	454.	537.	
HARD SCRAPING 4	A	1.	13.	31.	8.	32.	38.	6=TOTAL
	B	11.	35.	113.	22.	106.	133.	
HARD CUTTING 5	A	5.	31.	98.	32.	100.	119.	23=TOTAL
	B	41.	153.	454.	106.	406.	525.	
HARD CUTTING & SCRAPING 6	A	6.	56.	135.	34.	119.	190.	28=TOTAL
	B	50.	148.	537.	130.	525.	566.	

ADJACENCY PROBABILITY MATRIX(LOWER TRIANGLE)
****=NOT CALCULABLE MIN=2

NO.	N	VARIABLE NAME	1	2	3	4	5	6
1	2	EDGE ALTERED FLAKES	****					
2	8	SOFT SCRAPING	0.00	0.10				
3	24	SOFT CUTTING	0.06	0.17	0.18			
4	6	HARD SCRAPING	0.00	0.22	0.20	0.19		
5	23	HARD CUTTING	0.06	0.16	0.17	0.21	0.19	
6	28	HARD CUTTING & SCRAPING	0.07	0.24	0.20	0.21	0.18	0.25

TABLE 57. EAGLE HILL TOOL-WEAR PATTERN DISTRIBUTIONS

3.11=OCCUPATION PLANE
6=NUMBER OF TYPES
1.60=CRITERION DISTANCE
49=NUMBER OF ARTIFACTS
2352=NUMBER OF TESTS
528=NUMBER OF A-VECTOR ADJACENCIES

ADJACENCY MATRIX(VECTORS ARE MARKOV TRANSITIONAL & REFLEXIVE)

Type		1	2	3	4	5	6	Total
EDGE ALTERED FLAKES 1	A	78.	0.	8.	9.	72.	39.	18=TOTAL
	B	228.	0.	28.	27.	144.	231.	
SOFT SCRAPING 2	A	0.	0.	0.	0.	0.	0.	0=TOTAL
	B	0.	0.	0.	0.	0.	0.	
SOFT CUTTING 3	A	8.	0.	0.	1.	7.	4.	2=TOTAL
	B	29.	0.	2.	3.	17.	26.	
HARD SCRAPING 4	A	9.	0.	1.	0.	5.	0.	2=TOTAL
	B	27.	0.	3.	2.	19.	30.	
HARD CUTTING 5	A	72.	0.	7.	5.	42.	35.	12=TOTAL
	B	144.	0.	17.	19.	90.	145.	
HARD CUTTING & SCRAPING 6	A	39.	0.	4.	0.	35.	48.	15=TOTAL
	B	231.	0.	26.	[illegible]	135.	162.	

ADJACENCY PROBABILITY MATRIX(LOWER TRIANGLE)
****=NOT CALCULABLE MIN=2

NO.	N	VARIABLE NAME	1	2	3	4	5	6
1	18	EDGE ALTERED FLAKES	0.25					
2	0	SOFT SCRAPING	****	****				
3	2	SOFT CUTTING	0.16	****	****			
4	2	HARD SCRAPING	0.13	****	****	****		
5	12	HARD CUTTING	0.32	****	0.14	0.11	0.33	
6	15	HARD CUTTING & SCRAPING	0.14	****	0.06	0.00	0.18	0.22

TABLE 58. EAGLE HILL TOOL-WEAR PATTERN DISTRIBUTIONS.

4.12=OCCUPATION PLANE
6=NUMBER OF TYPES
1.60=CRITERION DISTANCE
53=NUMBER OF ARTIFACTS
2756=NUMBER OF TESTS
644=NUMBER OF A-VECTOR ADJACENCIES

ADJACENCY MATRIX(VECTORS ARE MARKOV TRANSITIONAL & REFLEXIVE)

Type		1	2	3	4	5	6	Total
EDGE ALTERED FLAKES 1	A	29.	0.	7.	2.	63.	44.	11=TOTAL
	B	82.	0.	37.	9.	146.	154.	
SOFT SCRAPING 2	A	0.	0.	0.	0.	0.	0.	0=TOTAL
	B	0.	0.	0.	0.	0.	0.	
SOFT CUTTING 3	A	7.	0.	2.	0.	15.	13.	4=TOTAL
	B	37.	0.	10.	4.	61.	59.	
HARD SCRAPING 4	A	2.	0.	0.	0.	6.	5.	1=TOTAL
	B	9.	0.	4.	0.	13.	13.	
HARD CUTTING 5	A	63.	0.	15.	6.	84.	76.	19=TOTAL
	B	146.	0.	61.	13.	258.	266.	
HARD CUTTING & SCRAPING 6	A	44.	0.	13.	5.	76.	68.	18=TOTAL
	B	154.	0.	59.	13.	266.	238.	

ADJACENCY PROBABILITY MATRIX(LOWER TRIANGLE)
****=NOT CALCULABLE MIN=2

NO.	N	VARIABLE NAME	1	2	3	4	5	6
1	11	EDGE ALTERED FLAKES	0.23					
2	0	SOFT SCRAPING	****	****				
3	4	SOFT CUTTING	0.11	****	0.00			
4	1	HARD SCRAPINC	0.00	****	0.00	****		
5	19	HARD CUTTING	0.29	****	0.17	0.18	0.24	
6	18	HARD CUTTING & SCRAPING	0.21	****	0.15	0.14	0.21	0.21

TABLE 59. EAGLE HILL TOOL-WEAR PATTERN DISTRIBUTIONS

4.17=OCCUPATION PLANE
6=NUMBER OF TYPES
1.60=CRITERION DISTANCE
54=NUMBER OF ARTIFACTS
2862=NUMBER OF TESTS
736=NUMBER OF A-VECTOR ADJACENCIES

ADJACENCY MATRIX(VECTORS ARE MARKOV TRANSITIONAL & REFLEXIVE)

Type		1	2	3	4	5	6	Total
EDGE ALTERED FLAKES 1	A	20.	0.	12.	11.	53.	46.	11=TOTAL
	B	90.	0.	65.	33.	125.	130.	
SOFT SCRAPING 2	A	0.	0.	0.	0.	0.	0.	0=TOTAL
	B	0.	0.	0.	0.	0.	0.	
SOFT CUTTING 3	A	12.	0.	12.	3.	20.	25.	7=TOTAL
	B	65.	0.	30.	25.	92.	87.	
HARD SCRAPING 4	A	11.	0.	3.	2.	19.	17.	4=TOTAL
	B	33.	0.	25.	10.	44.	47.	
HARD CUTTING 5	A	50.	0.	20.	18.	64.	81.	16=TOTAL
	B	126.	0.	92.	46.	176.	175.	
HARD CUTTING & SCRAPING 6	A	46.	0.	25.	17.	61.	72.	16=TOTAL
	B	139.	0.	87.	47.	175.	168.	

ADJACENCY PROBABILITY MATRIX(LOWER TRIANGLE)
****=NOT CALCULABLE MIN=2

NO.	N	VARIABLE NAME	1	2	3	4	5	6
1	11	EDGE ALTERED FLAKES	0.16					
2	0	SOFT SCRAPING	****	****				
3	7	SOFT CUTTING	0.13	****	0.22			
4	4	HARD SCRAPING	0.19	****	0.00	0.00		
5	16	HARD CUTTING	0.27	****	0.16	0.24	0.26	
6	16	HARD CUTTING & SCRAPING	0.25	****	0.20	0.22	0.31	0.29

If the larger values are off the diagonal, then the tool assemblage must be specialized and diverse. This should be reflected in moderate frequencies of a wide range of tool categories.

The tool categories consist of edge-altered flakes, soft and hard scraping, soft and hard cutting, hard scraping and cutting, and indeterminate. That indeterminate is a valid wear category is suggested by the fact that indeterminant patterns sometimes cluster together and appear more frequently on some floors than others. Whatever causes the indeterminate observation was systematic in nature.

Tool Typology

The formal tool types were not numerically analyzed as part of the adjacency analysis. However, they are plotted on the wear pattern maps. In many cases, they appeared with wear patterns in apparently meaningful relationships and contributed materially to deciphering the use episodes and tool concentrations. The tool types and their symbols are listed in Table 60.

TABLE 60. FORMAL TOOL TYPES FOUND AT EAGLE HILL AND SYMBOLS USED IN MAPS

Type	Map Symbol
1 Point	P
2 End Scraper	SE
3 Side Scraper	SS
4 Denticulate	D
5 Notch	N
6 Graver	G
7 Beak	BK
8 Burin/burin spall	BR
9 Retouched flake	R
10 Biface fragment	BF
11 Edge-altered flake	E
12 Blade/Bladelet	B
13 Flake core	CF
14 Microblade core	CM
15 Bipolar core	CB

Vertical Perspective

Before attempting to examine the maps of the occupation planes, it was necessary to define the range of variations and frequencies in 251 worn items. Table 61,a shows the states the variables, hard and soft, can take and the frequencies in which they appear on the same and/or different tools. Any one flake can have both hard and soft wear and, thanks to the direction of the wear relative to the edge on which it appears, it is possible to determine if it was hard and/or soft. The hard and soft wear patterns can resemble scraping (2), cutting (3), or boring

(5). Slightly more complicated is the matter of absence of wear (1) or indeterminate wear (6). Note that most of the pieces that showed hard wear were also found to have associated indeterminate soft wear, 197 (78.5%, see total, indeterminant soft wear) in all. This is to be expected since any act involving hard wear will also produce marginal soft wear or may be associated with limited soft wear tasks. Consider, for instance, the carpenter who trims a delicate edge in the midst of hard planing a flat surface.

As a whole the population of worn flakes is dominated by hard use. Only 17 items (6.8%) show a total absence of hard use. It is quite possible that soft use is under-represented in the sample, because it is more likely to be missed under low magnification. Note that soft use is usually associated with indeterminate hard wear (19.8%) rather than soft wear alone (7.8%). Conversely, virtually all hard worn pieces have some sort of soft wear (98.2%).

TABLE 61. USE-WEAR AT EAGLE HILL

a. Contingency table for all hard and soft wear at Eagle Hill

	SOFT WEAR				
	1 Absent	2 Scraping	3 Cutting	6 Indeterminate	Total
HARD WEAR					
1 Absent	-	6(2.8%)	10(4.6%)	1(0.4%)	17(6.8%)
2 Scraping	2(0.8%)	0	1(0.4%)	12(4.8%)	15(6.0%)
3 Cutting	1(0.4%)	0	0	81(32.3%)	82(32.7%)
4 Cutting and Scraping	0	0	1(0.5%)	84(33.9%)	85(33.9%)
5 Boring	1(0.4%)	0	0	3(1.2%)	4(1.6%)
6 Indeterminate	0	2(0.8%)	30(12.6%)	16(6.4%)	48(19.1%)
TOTAL	4(1.6%)	8(3.2%)	42(16.7%)	197(78.5%)	251(100.0%)

b. Frequencies of wear on Occupation Planes

OP	SS	SC	HS	HC	HM	HB	II	Contigency Coefficients	V	P
1.13	0	3	2	12	8	0	0	.71	1.00	<.001
2.13	8	25	6	23	28	1	6	.73	.61	<.001
3.11	0	2	2	12	15	0	4	.48	.54	.017
4.12	0	4	1	19	18	2	0	.77	.86	<.001
4.17	0	8	4	16	16	1	6	.54	.46	.008

For purposes of analysis it is desirable to reduce the number of types of wear as much as possible. Examination of Table 61 shows that some of the cells are empty and can be disregarded. Some of them can be combined since their meanings are ultimately the same. For instance, soft wear with hard wear absent, and soft wear with indeterminate hard wear are, for practical purposes, the same. Table 62 shows the combinations of hard and soft codes from Table 61.

TABLE 62. TYPES OF WEAR SUGGESTED BY HARD AND SOFT STATES

Wear Pattern	Map Symbols	Combination of Hard (1st) and Soft (2nd) Codes	Possible Uses
1 Soft Scraping	SS	1-2, 6-2	Hide working
2 Soft Cutting	SC	0-3, 6-3	Meat, hide, plants
3 Hard Scraping	HS	2-0, 2-3, 2-6	Bone, wood
4 Hard Cutting	HC	3-0, 3-6	Bone, wood
5 Hard Cutting and Scraping	HM	4-3, 4-6	Bone, wood
6 Hard Boring	HB	5-1, 5-6	Bone, wood
7 Indeterminate, hard and soft	II	6-6	Unknown

Table 63 shows the frequency and percentages of determinate hard and soft scraping in the various occupation planes. Most show about the same ratio of hard to soft wear. The exception is OP 2.13, which contains a much higher incidence of soft wear. Every indicator of occupation activity suggests that OP 2.13 is peculiar, an interval of much-increased occupation activity at Eagle Hill. The incidence of charcoal and pottery fragments is very high in OP 2.13 as well as sizable numbers of lithics. Casual inspection of the following maps affirms the aberrant nature of OP 2.13. This complex of artifacts along with more soft wear suggests that Eagle Hill assumed more of a base camp status during OP 2.13 times than it knew before or after. Hard use is probably a product of manufacture and refurbishment of weapons, perhaps during idle hours while waiting for game. Soft use from preparation of meat and hides or plants during the OP 2.13 occupation seems a likely indication of a well-rounded complement of activities by both sexes (White, Burton, Brudner, and Gunn 1975).

TABLE 63. HARD AND SOFT USE THROUGH THE OCCUPATION PLANES

Occupation Plane	Hard	Soft	Total
1.13	22(88%)	3(12%)	25
2.13	57(63%)	33(37%)	90
3.11	29(94%)	2(6%)	31
4.12	38	4(10%)	42
4.17	36(82%)	8(18%)	44
TOTAL	182(76%)	50(24%)	232

Table 61,b shows the frequencies of all categories of utilization by occupation planes.

Overall Occupation Control

As was indicated in the background study, topography of the immediate area of the site seems to have encouraged occupation. The focus of Paleo-Indian occupation to the west was controlled by the advantage offered by a slight rise in the ground. Later the slope downhill and southeast of this rise formed a basin in the impervious, Pleistocene-weathered clay which acted as an aquifer for overlying vegetation. This fostered a more or less consistent topographic high in the vicinity of the site and promoted occupation during the Holocene.

In addition to the moderate relief, there is evidence that large trees with tap roots a half-meter in diameter grew in the site. Skimpy pollen evidence (page 161), inference from the general southeastern vegetational succession (page 104), and local history indicate that the trees present during the late Holocene were longleaf pines. One tree was located at the western edge of the Servello test pit in unit E3017-3018 N1000. The other is along the northeast edge of the excavation in unit E3021 N1001. Since these are the only places in the 30-m excavation with tap roots, the locations of trees must have been constant or limited to one generation. Human intervention may have acted to prevent the growth of additional trees past the first generation.

The two trees in the excavation were apparently dead and burned by the time logging began early in this century, or stumping would have destroyed what was left of the site. The tree northeast of the excavation contained decayed wood, while the one on the west contained only charcoal. Occupation during the historic Caddo period seems to have focused around the western tree; it may have been alive as late as A.D. 1700-1800. A massive stump hole centering three meters west of the excavation marks the location of the 20th-century tree. In hindsight, it might have been interesting to date the trees. When we were selecting carbon for dating we went to the utmost effort to avoid burned trees.

Occupation Plane 1.13

Occupation Plane 1.13 (Fig. 86) is dated to the last millennium and possibly to historic Caddoan as indicated by a small point base fragment. It encompasses three artifact concentrations with 34 items (tool forms and wear patterns).

Logical Analysis

Two areas seem to bear the marks of fireplaces. Concentration 1 is located south of what was probably a large, longleaf pine judging by the tap root extending down through the levels. Also, there are burned pieces of flint among the charcoal and clay balls. This suggests multiple occupation events. Their placement was guided by the presence of the western tree. Perhaps it was used

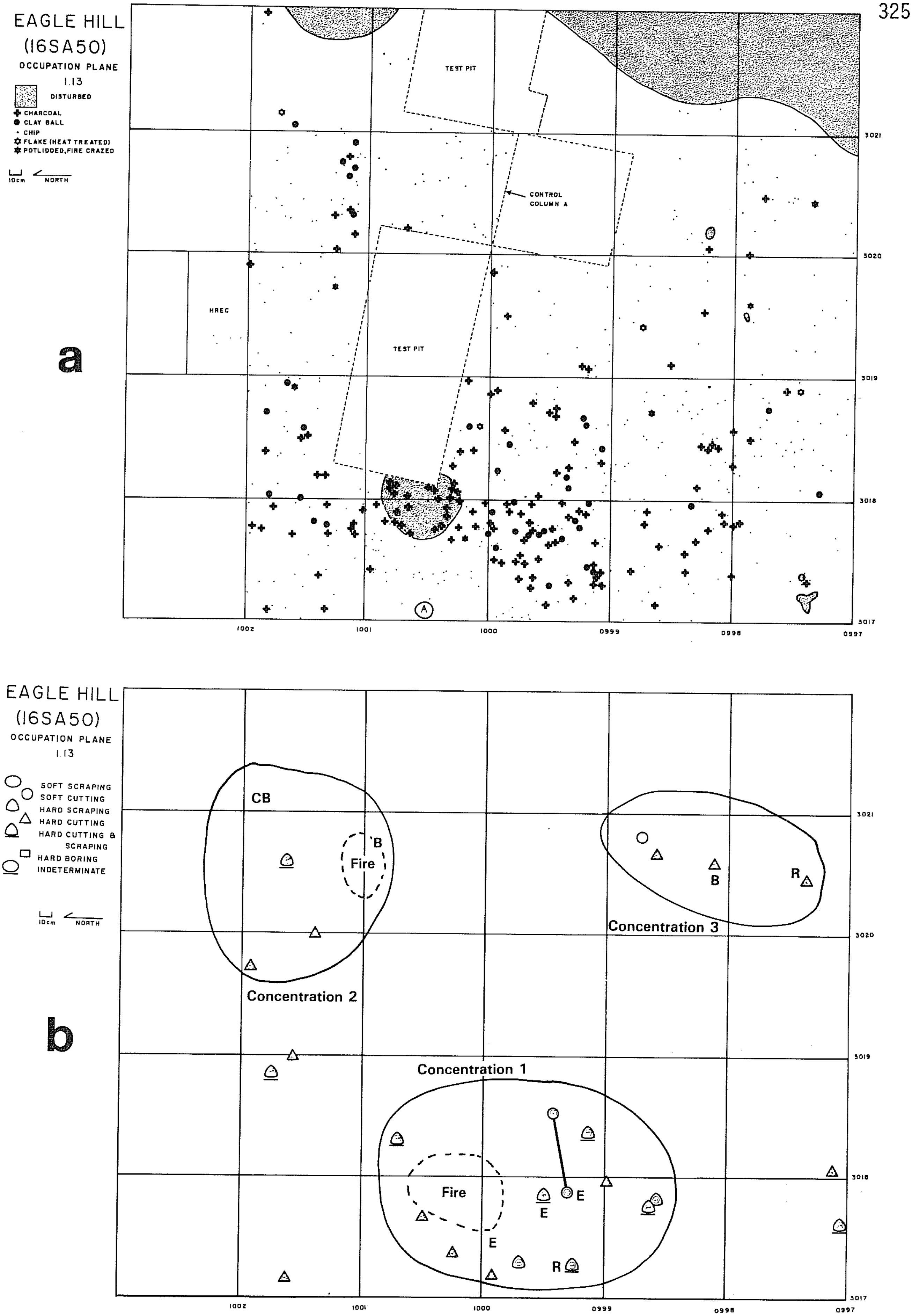

Figure 86. *Map of Occupation Plane 1.13.* a, fire-related artifacts and chips from Occupation Plane 1.13 (see Table 60 and 62); b, wear patterns and formal tools (see Table 60).

to shield the fire from a northerly wind, an indication of cool season occupation. Most of the wear is hard cutting. All of the soft cutting on the floor is located east of the fire, which suggests a single incident within the scope of the excavation.

Less can be said about Concentration 2. Charcoal and clay balls mark the location of a fireplace. An episode of hard cutting is recorded east of the fire. Concentration 3 is a hard cutting episode, although there is one soft cutting implement. A single burned chip and charcoal fragment to the south mark a possible fire. The concentration may have been truncated by the roadcut to the east.

Concentration Content

The concentrations are spatially discrete and easily analyzable because of the small number of artifacts. However, in following floors, the problem becomes more difficult due to increasing numbers of items. It is necessary to tabulate artifacts to discover patterns of association. Table 64 provides data on frequencies within the concentrations.

TABLE 64. FREQUENCIES OF WEAR CATEGORIES IN OP 1.13 BY CONCENTRATION

	Concentration		
Wear type	1	2	3
SS	0	0	0
SC	2	0	1
HS	2	0	0
HC	4	2	3
HS and C	5	1	0
II	0	0	0
Boring	0	0	0
TOTAL	13	3	4

Adjacencies

Adjacencies on OP 1.13 are interesting because of the floors simplicity. There is only one concentration with a complex assortment of tools. The other two are dominated by hard cutting. The adjacency probability matrix (Table 55) shows that there are substantial variations in the degree of association between tool-wear categories. The edge-altered pieces are all in the main concentration, and the strength of the adjacency between edge-altered pieces and other categories are all appropriately high.

The relatively low adjacency index between mutual occurrences of hard cutting on the same flakes sounds a note of interpretive caution. Hard cutting is present in all three clusters (many pieces are within the criterion distance). The low 0.19 adjacency index reflects the effect of differential frequencies between concentrations. Ideally, categories should be evenly distributed throughout all concentrations. This methodological liability would disappear if distances between concentrations were discounted. This is the next logical step in developing the adjacency methodology.

An element of interpretive logic that was utilized to define use episodes was that, if tools of a single use pattern (scraping or cutting) were mixed with items of mixed wear such as scraping and cutting, the mixed items were considered as the pure form. On OP 1.13 hard scraping and cutting are associated more often with hard scraping.

Occupation Plane 2.13

Op 2.13 (Fig. 87) is dated to A.D. 935 ± 80 years (UGa-3703). Contemporary ceramics indicate a late Coles Creek occupation. Artifacts are so frequent on the floor that selecting concentrations is problematical. However, there appear to be six concentrations with 106 items (tool forms and wear patterns).

Logical Analysis

It is apparent from several indicators that OP 2.13 was a heavily occupied floor. The complexity of the occupation pattern is practically an order of magnitude greater than any other judging by the number of logically discernible features. This is not to mention the general jumble of artifacts, which do not lend themselves to interpretation within the scope of the logic we are using to make interpretations. The clutter is probably too great to allow any sure interpretations without the assistance of numerical analysis. However, a few suggestions may ultimately help to unravel the confusion. As was mentioned before, there is a marked increase in soft wear in OP 2.13 suggesting that a broader range of activities accompanied the increased frequency of activity.

Concentration 1a contains practically every variety of material: clay balls, charcoal, all types of wear, and burned flint. There is no apparent pattern to it although there is an unusual frequency of soft cutting. It may well be an accumulation of trash (see section IV for related problem, page 307). Concentration 1b may be associated with Concentration 1a or it could be an independent episode of soft cutting. Concentration 1c is a large area relatively free of charcoal and clay balls. The complement of used flakes is 71% (18) hard use in contrast to the usual high incidence of soft use on the floor. The incidence of soft cutting and scraping next to the fire counterpoised by hard utilization away from fire is congruent with standard, cross-cultural division of labor schemes (White, Burton, Brudner, and Gunn 1975).

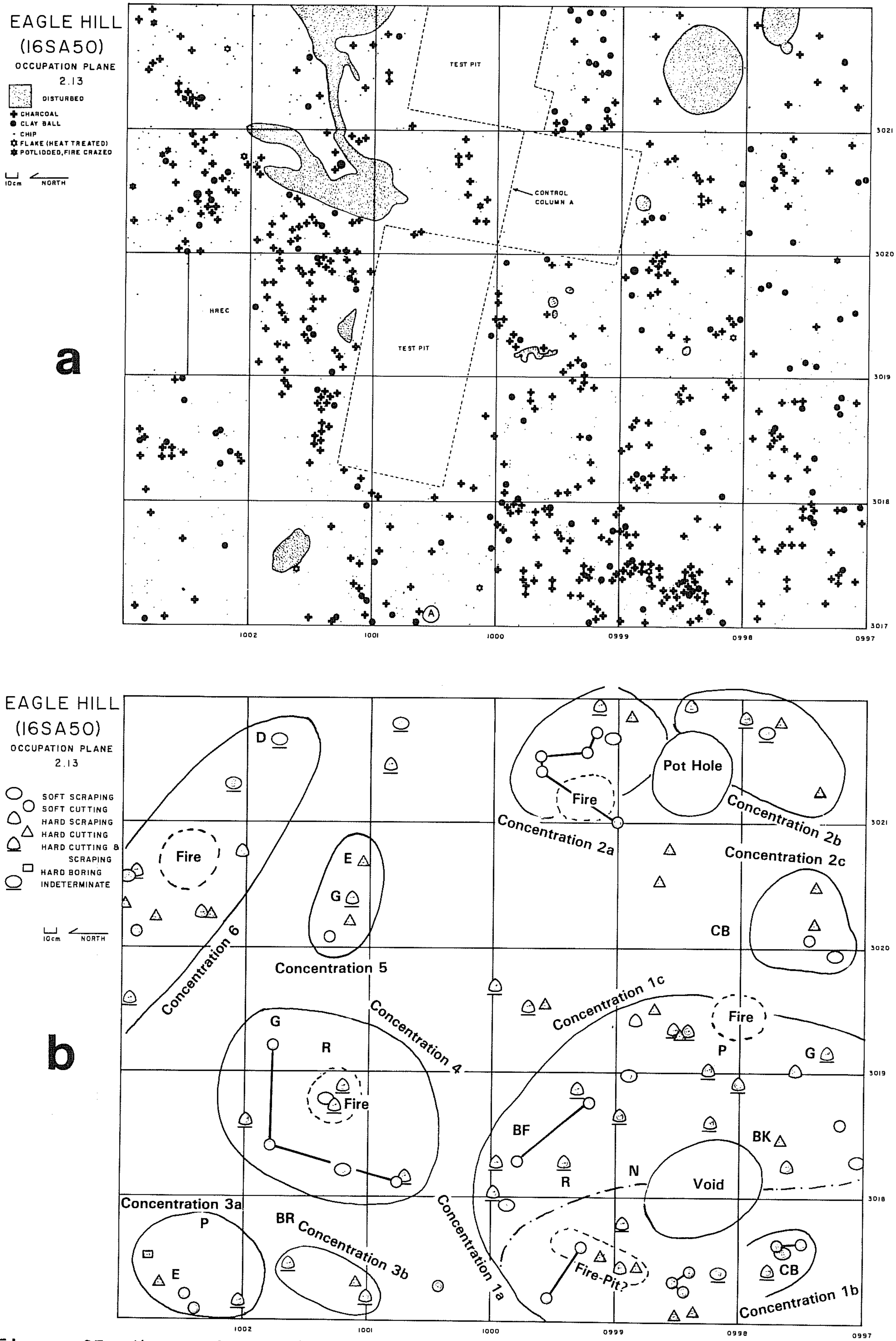

Figure 87. *Map of Occupation Plane 2.13.* a, fire-related artifacts and chips from Occupation Plane 2.13 (see Tables 60 and 62); b, wear patterns and formal tools (see Table 60).

Concentration 2a is a charcoal and clay ball feature with a locus of soft cutting on its northeast side. Concentration 2b is an episode of hard cutting without an associated fire feature. The distributional pattern is not like the Concentration 1a-1c complex, but the wear composition is similar. Concentration 2b and 5 are composed of hard cutting implements. It would be interesting to know if they represent work on the same material. If so, their location may result from a tendency for certain activities to be barred from the campfire. One can envision someone wielding a long shaft while rehafting the point being politely called away from the fire. Concentration 2c is a mixed hard and soft utilization cluster.

Concentration 3a is a charcoal and clay ball feature with an associated, varied tool kit. Wear is dominated by soft cutting. A boring wear pattern is noted next to a projectile point. Concentration 3b is composed of hard use. Note that the burin spall is associated with the hard cutting pieces.

Concentration 5 is an episode of hard cutting. Charcoal and clay balls are so frequent that a single fireplace cannot be reasonably outlined.

Concentration 6 is a charcoal and clay ball feature associated with cutting. A great majority of it is hard cutting and more like the hard cutting episodes above and below rather than on the rest of OP 2.13.

Concentration Content

It appears that three out of six concentrations are composed of contrasting sets of hard and soft wear with soft wear more closely associated with the fire. This is a logical set of associations whether women were present or not. However, the marked contrast to the rest of the occupation planes in terms of wear and distributional patterns assuredly indicates a change in site status, possibly involving visits by nuclear families rather than specialized task groups.

This inference is further supported by the fact that soft scraping appears only on OP 2.13. It probably implies hide scraping and provides another indication of lengthier camps at the site. Soft scraping is distributed rather uniformly among the concentrations containing larger and more varied numbers of tools.

The concentration of charcoal and clay balls in the northeastern sector of the floor is so scattered that specific campfires cannot be located. However, Concentrations 4 and 6 may be another dyadic pair of subconcentrations. Inspection of Table 65 clearly shows the rhythm of alternation between hard and soft use-wear patterns.

The number of artifacts in the concentrations are larger than in any other occupation plane. Yellen (1977) found that larger numbers of implements scattered over a greater area is a direct indicator of length of occupation. We might surmise that the length of stay during the OP 2.13 period was two to three times longer than during periods before and after. This estimate would roughly agree with the artifact frequencies.

TABLE 65. FREQUENCIES OF WEAR CATEGORIES IN OP 2.13 BY CONCENTRATION

Wear type	Concentration 1a	1b	1c	2a	2b	2c	3a	3b	4	5	6
SS	1	1	2	1	0	1	0	0	2	0	0
SC	6	2	2	4	0	1	2	0	3	1	1
HS	1	0	3	0	1	0	0	0	0	0	1
HC	4	0	3	1	2	2	1	1	0	2	3
HS and C	4	1	9	1	1	0	1	2	4	1	3
II	1	0	0	0	1	0	0	0	0	0	3
B	0	0	0	0	0	0	1	0	0	0	0
TOTAL	17	4	19	7	5	4	5	3	9	4	11

In addition to the large number of flakes with observable wear patterns, there are a large number of formal tools compared with the other late Holocene levels. OP 2.13 shares, in two instances, a bipolar core trait with OP 3.11. Since bipolar cores are unique to these two floors, they may indicate cultural continuity over the 100 or more year period of occupation.

Occupation Plane 3.11

OP 3.11 (Fig. 88) is dated to A.D. 820 ± 70 years by radiocarbon (UGa-3704) and is associated with *Coles Creek* ceramics. There are three concentrations containing 71 items (tool forms and wear patterns). OP 3.11 is particularly notable for a high frequency of edge-altered flakes. In fact, "E-pairs" (edge-altered flakes with another tool associated) occur all over the floor.

Logical Analysis

Concentration 1 is a charcoal and clay feature surrounded by tools and wear patterns. The wear patterns are predominantly hard cutting. Two such objects are located in the fire feature suggesting multiple occupation. It is on the southwest side of the western tree. Tools are consistently paired with edge-altered flakes.

Concentration 2 contains three episodes. Concentration 2a is very peculiar. All of the wear patterns are of the double indeterminate variety. This subconcentration suggests that there is more to the "II" observation than just an inability to assign the use to soft or hard. Some task was being performed which generated an obscure wear pattern. There appears to be no immediate fire feature. Concentration 2b is clearly a hard cutting subconcentration. It is associated with one or two fires indicating an episode or episodes in a frequented spot. Concentration 2c is also against a fire and is purely hard scraping and cutting. Concentration 3, like Concentration 2c, is completely devoted to hard multiple use, perhaps associated with a fire.

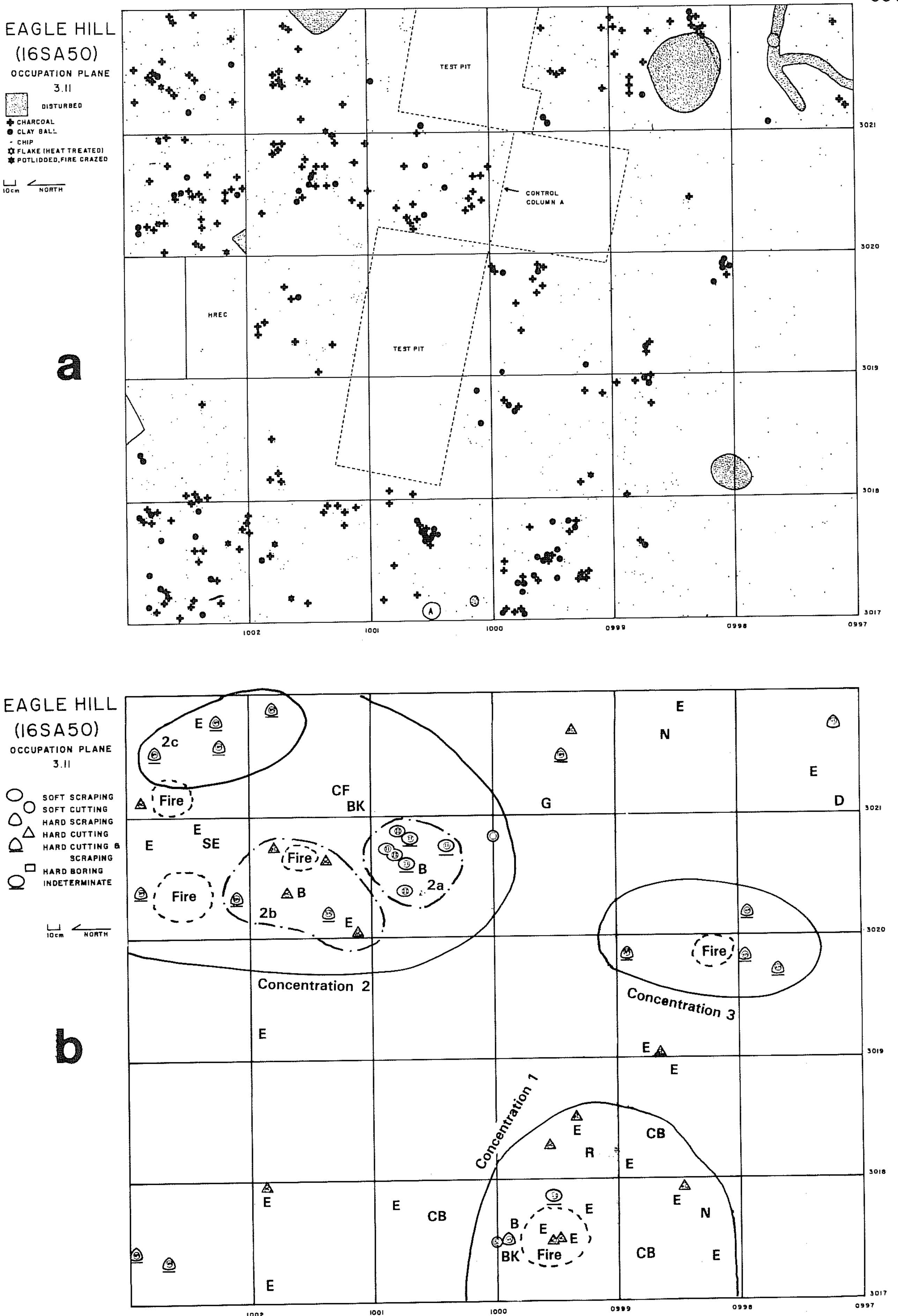

Figure 88. *Map of Occupation Plane 3.11.* a, fire-related artifacts and chips from Occupation Plane 3.11 (see Tables 60 and 62); b, wear patterns and formal tools (see Table 60).

Concentration Content

OP 3.11 is like OP 1.13 in its sparse occupation and high frequency of edge-altered flakes. It is more like OP 2.13 in its high frequency of formal tools and particularly the two bipolar cores located in Concentration 1. Unlike OP 2.13, there are no dyadic spatial relationships between soft and hard use patterns.

The peculiar pattern of pairs of tools, at least one of which is an edge-altered flake, appears frequently across the floor. The pairs appear both within and without the concentrations. The variety of tools in the "E-pairs" is diverse. However, one of them, in many cases, is a scraping implement. It could be that the cultural norm and a function peculiar to the time dictates that a tool kit should consist of a scraping implement and an edge-altered flake for cutting. Concentration 2 appears to be highly internally structured, but all three sub-clusters are related to hard materials. I assume that the "II" wear category involves hard, destructive usage. This requires further investigation for confirmation.

Consistent with other concentrations, the only soft cutting implement on the floor is located near a fire in Concentration 1. Table 66 shows the wear composition of the concentrations.

TABLE 66. FREQUENCIES OF WEAR CATEGORIES IN OP 3.11 BY CONCENTRATION

	Concentration				
Wear type	1	2a	2b	2c	3
SS	0	0	0	0	0
SC	1	0	0	0	0
HS	1	0	0	0	0
HC	5	0	4	0	0
HS and C	0	0	2	4	4
II	0	7	0	0	0
B	0	0	0	0	0
TOTAL	7	7	6	4	4

Adjacencies

Hard cutting provides the highest adjacency probabilities, both with itself and edge-altered flakes. Note that the wear patterns are frequently identified from a formal tool both of which are in the adjacency analysis if the tool happens to be an edge-altered piece. In those cases, the adjacency analysis is also acting to associate wear patterns with a tool type. Edge-altered flakes are also frequently located next to each other. Contrary to previous experience, pure hard cutting is not so strongly juxtaposed with hard scraping and cutting. Examination of the concentrations confirms that hard cutting and hard multiple use are located in separate areas.

It is difficult to escape the conclusion that OP 3.11 pertains to highly specialized activities being approached through a highly specialized technology. Higher resolution analysis of the wear patterns to determine exactly what the tools were being used on would be necessary to find the particular aspect of the environment with which the technology was interfacing.

Occupation Plane 4.12

OP 4.12 (Fig. 89) dates to the late early Holocene based on the upland sedimentation-erosion cycle delineated in the section on climatic change in the Southeast (page 104). It is composed of six concentrations and 53 items (tool forms and wear patterns). It is notable for the virtual absence of formal tools.

Logical Analysis

Concentration 1 is a single episode judging by the absence of chert in the charcoal and clay ball feature. A line of hard scraping and cutting flakes flanks the fire feature. Outside this is another circle composed exclusively of hard cutting. Concentration 2 is a hard cutting episode. There may have been a fire feature in its southeast corner. Concentration 3 is a cluster of hard cutting and scraping wear patterns. Charcoal and clay balls suggest a fire hearth to the north or northeast. Concentration 4 is a fragment of a possible activity area in the southeast corner of the excavation. It is a concentration composed of a fire feature with hard cutting around it. Concentration 5 is a fire feature indicated by a burned flake and a clay ball surrounded by implements of hard scraping and cutting. Concentration 6 is a concentration of hard cutting and scraping wear patterns with a fire at the southwestern end.

Concentration Content

There is little to argue that OP 4.12 is not a hard cutting floor with occasional variations toward hard scraping and cutting. Soft cutting implements are distributed more or less uniformly over the floor and two of the four boring patterns recovered appear at this level. Formal tools are not absent but are remarkably infrequent. Table 67 summarizes the wear pattern frequencies.

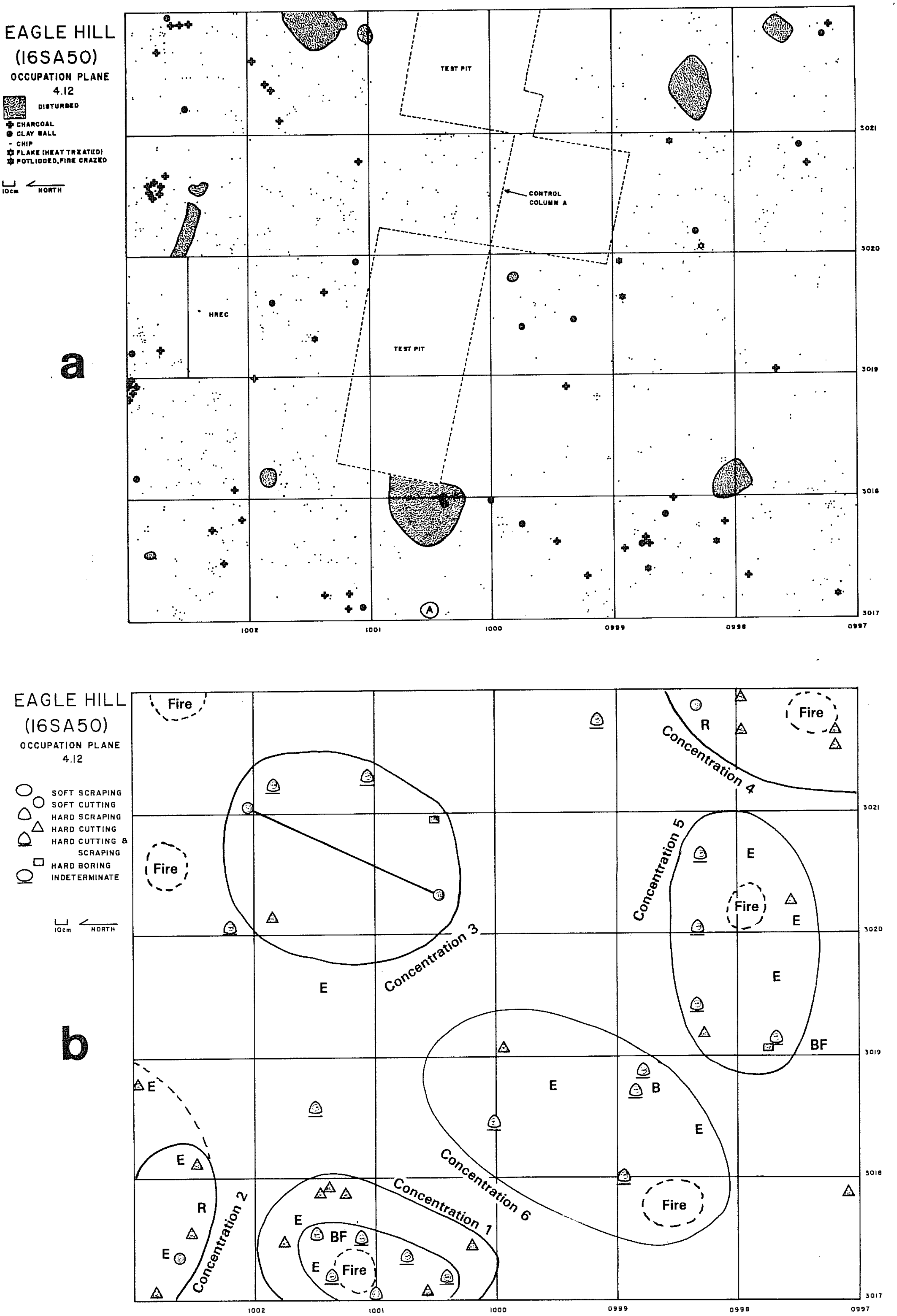

Figure 89. *Map of Occupation Plane 4.12*. a, fire-related artifacts and chips from Occupation Plane 4.12 (see Tables 60 and 62); b, wear patterns and formal tools (see Table 60).

TABLE 67. FREQUENCIES OF WEAR CATEGORIES BY CONCENTRATIONS ON OP 4.12

Wear type	Concentration 1	2	3	4	5	6
SS	0	0	0	0	0	0
SC	0	1	2	1	0	0
HS	1	0	0	0	0	0
HC	6	3	1	4	2	1
HS and C	5	0	3	0	4	4
II	0	0	0	0	0	0
B	0	0	1	0	1	0
TOTAL	12	4	7	5	7	5

As is shown in Table 68, the tendency for soft scraping to occur in pairs is very high, so high in fact that it is hard to resist the temptation to draw lines between the pairs and see what results. I yielded to the temptation and connected pairs and higher sets by line. The distances between pairs of implements fall into two distinct categories. One is between 500-1000 mm. The other is between 100-200 mm. All of the close sets fall on OP 2.13, while the wide sets occur on all floors except OP 3.11 (Table 69). OP 3.11 has only one soft cutting implement.

TABLE 68. OCCURRENCE OF SOFT CUTTING IN SETS

Substratum	Singles	Pairs	Triples	Quadruples/ Quintuples
1.13	1	1	0	0
2.13	4	4(B*)	2	1
3.11	1	0	0	0
4.12	2	1(B)	0	0
4.17	2	1	1(B)	0
TOTALS	10	7	3	1

B = Borer
* = Borer without Soft Cutting

TABLE 69. DISTANCES BETWEEN SETS OF SOFT CUTTING IMPLEMENTS

Close sets	D	$\bar{x}$	s
2.13	143	181	35
2.13	143		
2.13	171		
2.13	200		
2.13	200		
2.13	229		

Far Sets	D	$\bar{x}$	s
1.13	686	686	0
2.13	543	852	195
2.13	1058		
2.13	771		
2.13	771		
2.13	771		
2.13	1029		
2.13	942*		
4.12	1714	1714	0
4.17	942	666	243
4.17	571		
4.17	486		

NOTE: all measurements in mm, D=distance
* = distance between two close sets

Since there are so few examples to work with it would be dangerous to draw far-ranging conclusions from the soft cutting sets. However, a few suggestions can be made. First, the close sets fall within the span of a hand and are probably "piles" of discarded tools used in similar or the same task. This could be checked by high resolution microwear analysis. The fact that the "piles" occur on OP 2.13 and not other floors indicate longer sittings, perhaps by a specialist rather than the single use episodes represented on the other floors. This is consistent with the general, specialized character of OP 2.13.

The far sets all fall within a range larger than 400-500 mm and less than 1500 mm. These distances I take to be wider than a sitting person's body, but within comfortable arm's reach. Mean distances fall exactly within the range one would expect tools to fall if they were being placed on either side of a sitting person with minimal outward movement of the arms, between 600-700 mm. The distance between pairs on OP 4.12 is outside the usual distance, but still within a comfortable arm's reach.

Naturally, to know the mechanisms, which caused the paired sets of soft cutting implements, would be very interesting. About half the soft cutting implements appear as singles and half of sets. It is possible that a task was being performed, which commonly, but not always, required the expenditure of more than one flake because of the dulling of the edge. I would further suggest that this task involved cutting first with the right hand and then with the left. With an equal number of cuts per hand the statistical changes are, over time, that discarded tools would appear as pairs placed on opposite sides of the artisan's sitting position. Adovasio (personal communication) knows of net making techniques that might require such movements.

Once we are informed of the artisan's body orientation by a soft cutting set, other relationships can be contemplated. Bores, for instance, appear to the front and right indicating a tool used exclusively in the right hand, perhaps set forward and in view, because of intermittent re-use rather than discard. The majority of the hard use tools appear to the front and right of the presumed, seated user. The analysis could be carried much further, but not without more intimate knowledge of their specific uses.

Other intriguing potentials present themselves. For instance, from the larger mean distances between pairs, Coles Creek people were of a larger body size than Paleo-Indians. This is counter to the findings of a recent article (Frayer 1981) on the different body styles of bowmen and spearmen, which indicates that spearmen would be larger and more linear. However, pygmies are elephant hunters and have specialized techniques to overcome the handicap of body size and turn it to advantage. It is also counter to dogma on hunter and horticultural nutritional affects on stature. With such a small sample we can at best ask questions of future data.

The absence of the soft cutting complex on OP 3.11 is a novelty. It may be that the "E-pairs" are a complementary trait that replaced them.

Adjacencies

The OP 4.12 concentrations are rather consistent in composition. Edge-altered pieces are associated with hard usage (Table 58), especially with hard cutting. The various types of hard usage cluster together. Soft cutting tends not to be associated with one or the other types of hard usage.

Occupational Plane 4.17

OP 4.17 (Fig. 90), is dated to the late Pleistocene based on the typological character of the assemblage including a *Folsom*-like point and by thermoluminescence dating. It is composed of seven concentrations composed of 54 items (tool forms and wear patterns). It is notable for the presence of formal tool types in addition to the usual array of wear patterns. Burned flint provides the only indication of fires.

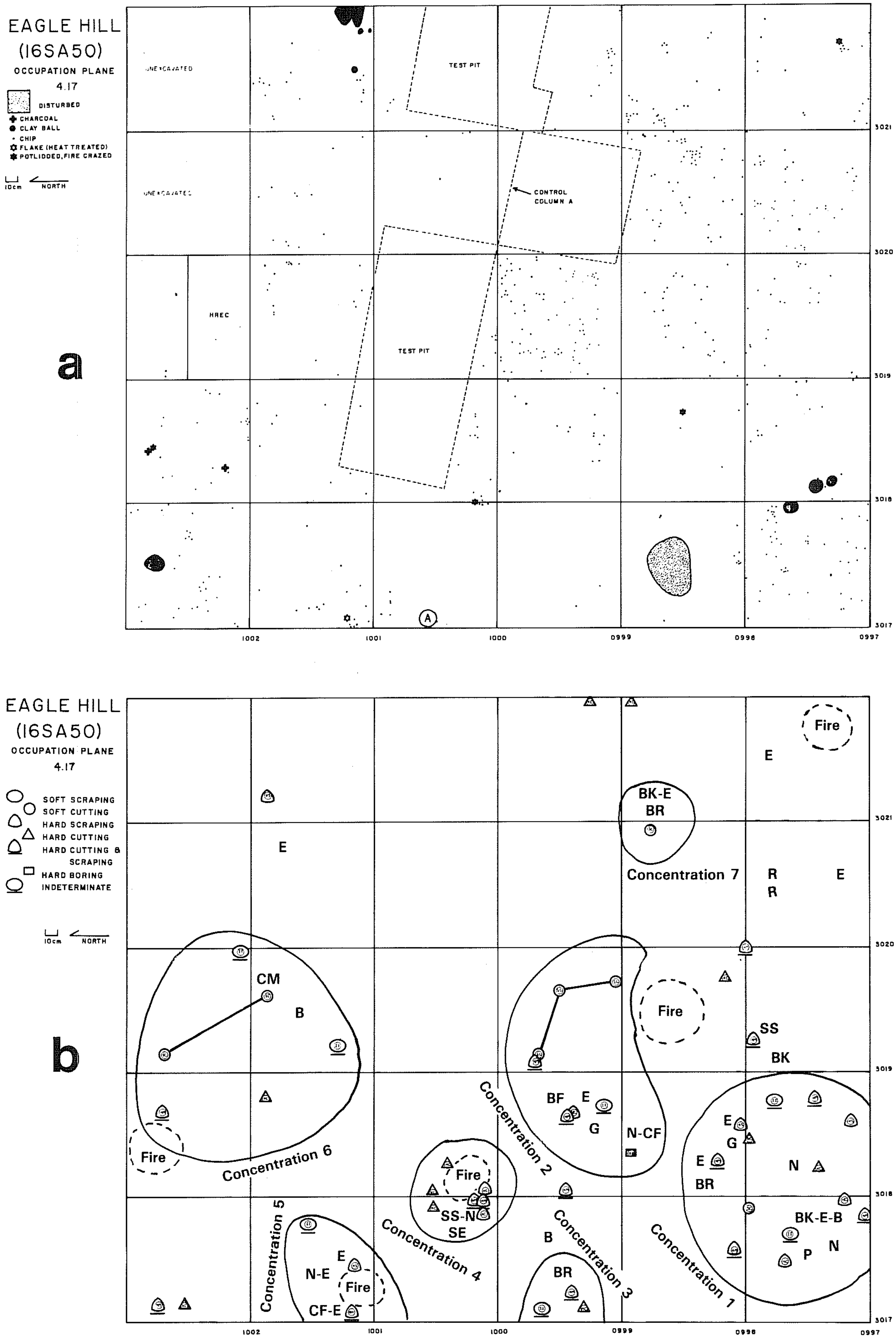

Figure 90. *Map of Occupation Plane 4.17.* a, fire-related artifacts and chips from Occupation Plane 4.17 (see Tables 60 and 62); b, wear patterns and formal tools (see Table 60).

Logical Analysis

Concentration 1 is circular and is composed of a complement of hard use and a diverse, formal tool kit including the Paleo-Indian point, beak, notch, burin, and graver. The combination suggests a complete, abandoned tool kit. Wear is confined, for the most part, to hard cutting and scraping. Concentration 2 is composed of diverse wear patterns reminiscent of Concentration 1, but with a soft cutting element. It also contains a biface fragment. It appears to be associated with a fire. Concentration 3 is a hard scraping and cutting episode accompanied by a burin. Concentration 4 is a decidedly hard use episode associated with an end scraper and side scraper. If a burned flake in the middle is interpreted as indicating a fire, the tools cluster very closely on it. Perhaps fire was used in whatever craft was being practiced. Concentration 5 is another closely packed, fire-indicated concentration. Concentration 6 includes more soft cutting and more distance from the fire. Concentration 7 is a beak, burin, and soft cutting cluster (Table 70).

It is worth noting that square E3018 N0998 is void of chips and tools except for the burned fragment, while the surrounding squares are rich in artifacts and wear patterns. Its not unlikely that there was a fire in unit E3018 N0998, and Concentrations 1, 2, and 7 were the individual work areas around it.

Concentration Content

As with the other levels excepting OP 2.13 the emphasis in the Paleo-Indian period technology is clearly on the working of hard materials. Most of the soft cutting examples appear in sets as described in the OP 4.12 section. For the first time concentrations can be defined almost as much on the basis of formal tools as wear pattern.

TABLE 70. FREQUENCIES OF WEAR CATEGORIES BY CONCENTRATIONS ON OP 4.17

Wear type	1	2	3	4	5	6	7
SS	0	0	0	0	0	0	0
SC	1	3	0	0	0	2	1
HS	2	0	0	0	1	0	0
HC	4	1	1	5	0	1	0
HS and C	4	2	1	2	1	1	0
II	2	1	1	0	0	2	0
Boring	0	1	0	0	0	0	0
TOTALS	13	8	3	7	2	6	1

Concentration 1 contains almost every variety of standard Paleolithic tool aside from the normally missing soft scraping; it also contains a full range of wear categories. Concentrations 2 and 6 resemble Concentration 1 except that Concentration 6 lacks the formal tools. Concentrations 2 and 6 show the soft cutting complex and thus mark the beginning of its long history. Concentrations 3, 4, and 5 appear to be specialized hard cutting and scraping loci. All of them contain formal tools. Concentration 4 has the notable presence of a well-made end scraper on a blade and a side scraper. Both Concentrations 4 and 5 have a peculiarly close proximity between fire and tools. Perhaps wood or bone was being charred and scraped.

Adjacencies

The adjacencies (Table 59) show that hard cutting tends to be proximate to edge-altered pieces, while hard cutting and hard scraping form a separate group. Soft scraping clusters with itself and nothing else. This is due to the fact that the soft cutting pieces are located at the periphery of the area of a dense implement concentration.

Conclusions

The adjacencies on inspection indicate the structure of the assemblages change through time. During the Paleo-Indian period there was a cleavage between the soft cutting component of the assemblage and the harder elements. As was pointed out earlier, this was a product of the soft cutting operation being located peripheral to the rest of the activity area. During the following two occupations studied, there seems to be little proclivity to separate functions, at least so far as appears from the methods used in this analysis show.

With OP 2.13, specializations return with hard and soft scraping gravitating away from hard or soft cutting. After OP 2.13, emphasis again returns to a less specialized tool kit with a definite bent toward the use of edge-altered flakes. The interest in edge-altered flakes before and after OP 2.13, along with other continuities, indicates that the upper occupation planes were occupied by the same or similar peoples. The lower archaeological zone appears to have seen a great deal of technological change from bottom to top.

An investigation of the locus of concentrations through time shows that the occupation was prone to move from southwest to northeast or generally north. This movement appears to correspond with changes in location of the high point of the mound.

Early in this presentation it was suggested that the various types of wear might be associated with categories of plant and animal tissue processing. On a somewhat more adventurous note, when the categories of application hypothesized in Table 62 are applied to the map, some interesting observations appear. For instance, the softer plant/animal tissue processing is peripheral to the rest of the activities in the Paleo-Indian camp. The next two occupations are given over almost completely to wood and bone. However, there is a hint of soft tissue processing in OP 3.11 next to the main fire. In OP 2.13 this characteristic changes radically with wood and bone being forced to the periphery and soft tissue processing dominating the center of the camp. After OP 2.13, the situation returns to that of the one before with soft tissue related activities limited to a spot by the fire and wood and/or bone work all around.

While it would be inappropriate to draw far reaching conclusions from so small a sample of activity areas, it would be equally inappropriate to not point out that this pattern of change could be the basis of future research in the west-central Louisiana and east Texas activity area analysis. The events in the upper, late Holocene levels are easy enough explained. In an analysis of the division of labor in 185 primitive societies, White, Burton, Brudner, and Gunn (1975) showed that there is an overwhelming tendency cross-culturally for males to work with hard materials in the early stages of the processing trajectory. Females on the other hand tend to work with soft materials and manufacturing processes toward the end of the production trajectory. OP 4.12 interpreted from the point of view of this model, indicates a progressive increase in female influence at the site until the final level. If we assume that the female-accompanied visits are a product of increasing population pressure in the alluvial floodplains, the progression fits the general accepted scheme for demographic change in the Southeast.

The Paleo-Indian camp presents a substantially different picture from the others. There seem to be a wide range of activities, which sometimes dictate soft tissue processing near the fire, sometimes away. Each concentration suggests a radically different task. Some appear to be rather domestic activities while others indicate the proximate use of tools and fire. Further study of this very interesting circumstance would yield a wealth of information on obscure Paleo-Indian lifeways.

The Net Hypothesis

The idea that nets were being manufactured and/or repaired at Eagle Hill was not an anticipated discovery. However, there are potentially interesting explanations for such an activity, which interface comfortably with what we know of the environment of the site. The first possible explanation is that the nets were being constructed as carrying devices for nuts and other plant products. Since we suppose that the site was actively utilized only as a substation when alluvial valley populations were so large as to force exploitation of the uplands, the necessity of transporting collected foodstuffs back to the alluvial base camps is apparent.

The second possible explanation is the nets were being used to capture migratory birds. During rainy springs and falls, the flat surface of Peason Ridge takes on a swampy character if the precipitation rate is faster than the infiltration rate. During periods when climate sponsored such conditions consistently from year to year, the swamps might well become acceptable habitats for migratory birds. Spring rains would be necessary to foster the vegetation necessary to hold site deposits so such a hunting and sedimentation relationship would be completely consistent with what is known of the site sedimentological history. This includes the gleying of clays in the lower soil horizon.

Except for OP 3.11, the soft cutting complex is present on all floors. The OP 2.13 floor, however, is qualitatively different in its expression of the soft cutting complex. OP 2.13 suggests long sittings in which a substantial amount of cutting was done. The other floors show evidence for only brief sittings.

VI. CONCLUSIONS (Gunn)

A. CONTEXT

Macroenvironmentally the Eagle Hill II (16 SA 50) site is located on the northern margin of the Kisache Wold. Geomorphic forms in the immediate one kilometer or so area of the site are dominated by hilltop sands and colluvium off the hill crests. Within five kilometers the alluvial component of the landscape rises to about 20%.

The site is located on the lower margin of the colluvium next to exposed Miocene clays. Water collected and stored by the sands and colluvial surfaces at the site provide a rich upland environment. The site is located midway along a colluvium-clay interface between, for humans, two nutritionally unproductive sand bodies, which provide the most efficient access to the colluvium-clay ecotone.

Studies of the colluvium indicate erosion and deposition activity during the late Quaternary. A very old soil was eroded to the B zone during the late Pleistocene. Subsequent, similar erosional episodes indicate that the erosion of the Pleistocene soil may have been associated with a warm Two Creeks interstadial. The presence of a Folsom-aged cultural industry at the end of the erosional period supports the Two Creeks erosional hypothesis.

Following the Two Creeks interstadial erosion, there was a period of colluvial deposition which appears to span the Valders substage, Preboreal interstadial, and Cochburn-Cochrane stadial intervals. Since we have no evidence of a break in deposition during the Preboreal, we must assume that conditions were moist enough, particularly in the spring, to maintain vegetation necessary to hold the sediments in place.

Following the early Holocene deposition is a long period of little or no deposition and perhaps erosion. The materials deflated onto this erosion surface appear to be of early late Holocene (after 4500 B.P., Subboreal) vintage as judged by the archaeological diagnostics. Apparently springs were dry enough during the Roman Empire Climatic Optimum (500 B.C.-A.D. 500) to cause a net erosional balance. Deposition was resumed at the beginning of the Little Ice Age (*senso lato*; after 1400 B.P. or A.D. 600) and continued to the present century.

Thanks to its delicately balanced hydrology, Peason Ridge and the Eagle Hill II site in particular appear to be sensitive indicators of climatic change. This sensitivity is no doubt magnified by its location near the North American Prairie-Forest ecotone. From what is known about southeastern climatic change during the late Quaternary, it is interesting to note that the Two Creeks interstadial produced an erosional episode equivalent to the Hypsithermal and the Roman Empire Climatic Optimum. By contrast the Preboreal and Medieval Climatic Optimum (A.D. 900-1200) did not produce detectable erosional events.

Dry springs and summers with rushes of precipitation in the form of thunderstorms are most likely to produce erosion. However, whether the climatic genesis of all of the erosional episodes is due to the same combination of seasonal precipitation remains to be determined. In any event, the magnitude and timing of erosional events on Peason Ridge is important to the general scheme of southeastern paleoclimatology.

There are reasons to think that the character of the early Little Ice Age (A.D. 600-900) deposits is, in part, due to human intervention. The great frequency of charcoal and the high incidence of human artifacts suggest the possibility that humans contributed substantially to the rapid accumulation of deposits during that interval. Furthermore, the contributions may have come from several sources. We might add to the "dry feet phenomenon," the idea that the site was in part a desirable place to live, because it was slightly higher than the surrounding terrain and a refuge from inclement weather. The fact that the neutron activation shows the clay balls to be from the Miocene clays, but not those directly under the site, suggest the clay balls were of human origin, perhaps carried to the site unintentionally from nearby, exposed deposits to line fireplaces.

In summary, the Eagle Hill site presents a sedimentological record that bears logical relationships to what is known of global paleoclimatology, southeastern alluvial chronology, and upland erosion. It appears to be essentially intact, although as might be expected, there is a certain amount of mixing due to animal and human intervention in the depositional processes.

B. CULTURE HISTORY

The culture history of the site parallels the sedimentological history, except for the apparent deflated cultural manifestation that is associated with the early late Holocene. In the southeastern cultural chronology the period would have been associated with the Late Archaic.

Preserved human occupation of the site begins in the late Pleistocene with a Folsom-related culture. The industry is not only marked by a *Folsom*-like point, but it also has many other *Folsom* characteristics of the Texas region. Tools are predominantly unifacial and diminutive as in the Plains traditions and unlike the more robust and bifacial eastern variant in the Paleo-Indian. The assemblage does not contain any of the highly specialized scrapers characteristic of later Plains Paleo-Indian assemblages.

The geomorphic situation on Peason Ridge was different from the present in the late Pleistocene. There was no colluvium to act as an aquifer for nut-bearing trees as there was later. Certainly the impermeable clays were there. Judge (1973) has noted the tendency for Folsom sites to be located far from present day water sources in the Southwest. This probably indicates much wetter conditions than present. If it was wetter in western Louisiana, Peason Ridge may have been swampy.

The wear patterns found on the Folsom occupation floor are not unlike those determined for later periods, particularly as relates to the soft cutting sets. In the event that soft cutting was used in net making, and assuming that there were no nuts to be carried in nets, the idea that Folsom people may have been there to catch aquatic birds from swamps is not unappealing.

Neither, for that matter, is the possibility that they were hunting bison, deer, or other large animals that prefer open habitats. A great deal is contingent on the presence or absence of seasonal swamps.

The fact that Folsom visitors to the site left tools about is highly unusual with respect to later occupations. It is not unlikely that leaving tools reflects an expectation to return to a spot on a predictable basis. The contrast is most striking between the Folsom level and the Early Archaic occupation, where no tools are left. It is generally thought in the Midsouth that the Early Archaic sported the same tool kit as the Paleo-Indians, except the point styles changed. Apparently by the early stages of the Hypsithermal people were less sure of their intentions to return to Peason Ridge.

The Early Archaic component supports the same range of use-wear evidence as the Paleo-Indian level. Formal tools, however, are massively absent. The colluvial aquifer was in place by the early Holocene so occupants of the site may have visited the site for plant resources and hunting.

The Late Archaic seems to be deflated onto the interface between the early and late Holocene deposits. Since we were not interested in disturbed material, the interface was removed as an intermediate level at one meter resolution. There was, however, a Late Archaic point associated with the interface. Also, Servello (n.d.) reports that the debitage from the interface zone clusters with the late rather than early Holocene deposits.

A number of concurrent processes are evident in the late Holocene. Technologically, there is a shift from dart to arrow points, through a series of transformations that appear to be related to a rather lengthy period of adjustment to the new weapons system. There are few hunting weapons, however, and the bulk of the assemblage is comprised of simple cutting and scraping implements.

There is a clear trajectory of change in the frequencies of use-wear categories. The late Holocene begins with a sparsely cluttered camp that is dominated by hard wear. In about a century this pattern shifts to one in which soft cutting is strongly represented. As in other levels the soft cutting is organized in pairs separated by the width of a sitting person's body. However, rather than being single specimens there are triples. This is taken to mean that whatever was being done to produce the peculiar arrangements of soft cutting wear patterns was now done in sittings three times as long as in the smaller, more ephemeral camps. If the task was net making, three times more nets were being constructed or repaired. Since this period corresponds with maximum populations in the alluvial valleys in the Southeast, the increased activity was probably a product of overexploitation of the alluvial floodplains and consequent appeal to upland habitats for relief.

With the onset of the main stage of the Little Ice Age (A.D. 1250), populations declined in the Southeast and Eagle Hill returned to its former status as an occasionally visited, outlying camp.

Visual and neutron activation studies of ceramics and cherts found at the site indicate multiple sources of materials in both instances. These studies appear in a more detailed format in Brown (1981). Future research should be directed toward the prospect that Eagle Hill was part of the settlement patterns in the Sabine and/or Red Rivers during the various prehistoric periods.

C. RECOMMENDATIONS

Area B was determined to be a very low productivity archaeological deposit and geomorphically equivalent to the upper soil zone in Area A after thorough testing and augering. In my judgement, it would be fruitless to pursue any further work in Area B.

The Area A excavation removed about 90% of the available deposits in the uppermost levels. Remaining deposits are progressively larger toward the bottom of the site, because the road cut and stumping operation destroyed the upper levels. As nearly as we can determine, given that our estimates are handicapped by the low incidence of artifacts in the site, it seems likely that about 50-60% of the *in situ* sediments from the lower part of the site have been removed by the efforts of the project. It would add to our knowledge of the Paleo-Indian occupation to recover the remainder of the site. However, the risk of a return season being unproductive is so great due to the proximity of the stumping operation that I cannot recommend further work in Area A.

While there is no reason for National Register status for the site, it is customary to preserve portions of important sites for future reference. The long chronology and unique upland locale of Eagle Hill will make it an important reference point in the future of west-central Louisiana archaeology. While the essential archaeological value of the site has been recovered, both the site and the surrounding habitat are in danger of being destroyed by the erosive effects of the water directed into the saddle by the road coming from the airstrip. In the opinion of one of our geologists, the road is responsible for the erosion of the site. It is possibly clay-lined and certainly compacted to the point that it prevents downward percolation of surface water. Thus, sediments, which have withstood 10,000 years, are suddenly eroding away. It seems likely that both the site and the habitat could be saved by terraces perpendicular to the road, which would disperse the running water and let it soak into the sandy sediments to the side of the road as it has done for 10,000 years.

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APPENDIX A:

pH AND PHOSPHATE TESTING PROCEDURE

<u>pH Paper Test</u>

The first series of pH paper tests were performed on one soil sample from each core from the contact of the interface of sand and bedrock clay. The second series of tests were run on the samples in each core above and below the contact zone samples.

Lab procedure for both series consisted of taking one half gram of each soil sample crushed and placed in a test tube with 5 ml of distilled water. Two drops of a saturated solution of potassium chloride and distilled water were added and the samples stirred and allowed to settle. The potassium chloride solution aids in particle settling and acid release from clay particles. pH 4.0-7.0 paper was placed in the water and immediately removed and graded with the color chart provided with the paper. The results were recorded on previously formatted code sheets.

<u>pH Meter Test</u>

The second series of pH tests were performed on selected soil core columns using a Corning Model 20 pH meter calibrated to pH 7.0 at 26°C between each five sample tests. Each sample was prepared by crushing 5 g of soil and mixing this with 25 ml of distilled water in a 30-ml beaker. After sediment had settled, the pH level was measured with the meter and recorded on specially prepared code sheets. The meter probe was placed in the solution above the sediment and rinsed and dried between each test. Each sample was then buffered by mixing with two drops of the same saturated potassium chloride solution used in the paper test and allowed to settle. A second reading was taken with the meter and these pH levels recorded. Noted was a substantial increase of acid content after the potassium chloride solution was added and the pH level measured.

<u>Phosphate Spot Test</u>

The first series of phosphate spot tests were performed on several selected core columns using one gram of soil. The soil was placed on filter paper and two drops of reagent "A" added and allowed to react for 30 seconds. Two drops of reagent "B" were added. A judgmental evaluation of phosphate content was made at the end of a two-minute interval according to intensity of blue on the filter paper. Grading was done on a one to six scale on a comparative basis between all the samples tested. A second series of phosphate spot tests were run identical with the first, except that grading was limited to a value of one or two. The results of the first series of tests were made compatible with the second test by changing values between one and three to a value of one and values between four and six to a value of two. This regrading was done because tests in the first and second series were run on different days, and test results are not valid after five minutes due to phosphates in the air. The two series also had to be made statistically compatible.

Reagent "A" was prepared in a 100-ml beaker by dissolving 5.0 grams of ammonium molybdate in approximately 50 ml of distilled water and slowly adding 30 ml of 6N hydrochloride acid. The mixture was then poured into a graduated 100-ml cylinder and brought to 100 ml with distilled water. The solution was poured into a 250-ml bottle and stored when not in use.

Reagent "B" was prepared in a 100-ml beaker by dissolving 0.5 grams of granular ascorbic acid in 35 ml of gently swirled distilled water. The solution was poured into an unused graduated 100-ml cylinder and brought to 100 ml with distilled water. The solution was poured into a 250-ml bottle and kept capped when not in use. Solution reagent "B" must be remade daily as ascorbic acid neutralizes in 24 hours.

APPENDIX B:

SITE FORMS

EAGLE HILL (16 SA 50) PROJECT
Center for Archaeological Research-UTSA

PHYSICAL UNIT RECORD
Data Recovery and Prompting Device

1	1- 2	0 2	Record Number
2	3- 8	_ _ _ _ _ _	FN #
Before Excavation			
3	9-13	_ _ . _ _ _	Substratum (m)
4	14-19	_ _ _ _ . _ _	East (m) SW corner
5	20-25	_ _ _ _ . _ _	North (m) SW corner
6	26-28	_ _ _	Size of unit (cm)
7	29-30	_ _	Level thickness (cm) average
8	31	_	Level type (1=natural, 2=arbitrary, 3=cultural)
9	32-34	_ _ _	Slope (dip, degrees, 0=horizontal)
10	35-37	_ _ _	Direction of slope (strike, degrees)
11	38-40	_ _ . _	Hue (number)
12	41	_	Hue (alpha: 1=y, 2=yr, 3=r, 4=g, 5=n, 6=bg, 7=b)
13	42-43	_ . _	Value
14	44-45	_ _	Chroma
15	46	_	Constant Volume Sample (1=absent, 2=present)
16	47-48	_ _	Texture

1=clay	2=sandy clay	3=silty clay
4=sandy clay loam	5=clay loam	6=silty clay loam
7=sandy loam	8=loam	9=silt loam
10=loamy sandy	11=silt	12=sand

17	49	_	Consolidation (1=usual, 2=unusual)
After Excavation			
18	50	_	Charcoal flecks (1=absent, 2=present)
19	51	_	Aquatic shell frags (1=absent, 2=present)
20	52	_	Land snail frags (1=absent, 2=present)
21	53	_	Chipped stone (1=absent, 2=present)
22	54	_	Extent of excavation (0=no, 1=N, 2=E, 3=S, 4=W)
23	55-56	_ _	Recorder
24	57	_	Mapped (1=no, 2=yes)
25	58	_	Tagged (1=no, 2=yes)
26	59	_	Depth to Top on Transit Shot Format (1=no, 2=yes)
27	60-61	_ _	Inspected (Inspector #)
28	62-63	_ _	Day
29	64-65	_ _	Month
30	66-67	_ _	Year

________________ Excavator ________________ Photo #s

________________ Excavator ________________ Photo #s

________________ Excavator ________________ Photo #s

________________ Excavator ________________ Photo #s

Figure 91. *Physical Unit Record.*

EAGLE HILL (16 SA 50) PROJECT
Center for Archaeological Research-UTSA

CULTURE UNIT RECORD
Data Recovery and Prompting Device

1	1- 8	0 3 _ _ _ _ _ _	Record #-Site #
2	9-13	_ _ _ _ _	FN of cultural unit
3	14-18	_ _ _ _ _	FN of Substratum unit
4	19-24	_ _ _ _ . _ _	East (m) from SW corner
5	25-30	_ _ _ _ . _ _	North (m) from SW corner
6	31-36	_ _ _ . _ _ _	Depth (bottom center)
7	37-38	_ _	Datum
8	39-42	_ . _ _ _	E/W Length
9	43-46	_ . _ _ _	N/S Length
10	47-50	_ . _ _ _	Thickness
11	51-53	_ _ _	Direction, downhill, E of N
12	54-56	_ _ _	Slope (0=horizontal, 90=down)
13	57-61	_ _ . _ _ _	Occupation plane (rel. microstr.)
14	62-64	_ _ _	Cultural Type
15	65	_	Artifact labeled (1=NA,2=on artifact, 3=on bag,4=on artifact and bag)
16	66-67	_ _	Inspected (Inspector #)
17	68-69	_ _	Day
18	70-71	_ _	Month
19	72-73	_ _	Year

________________________________ Recorder

________________________________ Excavator

Cultural Types (May 80)

8 Charcoal	50 Blade	150 Denticulate
10 Fire Feature	51 Blade fragment	160 Gouge
11 Reddened Rock	52 Blade, retouched	170 Metate
12 Reddened Stone Conc.	53 Blade, edge altered	171 Metate fragment
13 Burned Limestone	60 Quarry blank	172 Mano
14 Burned Sandstone	61 Chopper	173 Mano fragment
15 Boiled Stone	62 Biface	180 Ceramics
20 Storage Feature	63 Biface fragment	190 Clay objects
30 Hammerstone	70 Point	200 Glass
31 Chip	90 Scraper	300 Rock
32 Chunk	91 Scraper, side	301 Sandstone
33 Core	92 Scraper, end	302 Limestone
34 Core fragment	93 Scraper, side and end	310 Nodule
35 Core, edge altered	94 Scraper, ovate	311 Nodule concentration
36 Flake, decortification	95 Scraper, circular	400 Shell, mussel
37 Flake	96 Scraper, thumbnail	401 Shell, snail
38 Flake, pressure	97 Scraper, misc.	500 Bone
39 Flake, retouched	110 Perforator	501 Post-skeletal
40 Flake, edge altered	120 Engraver	510 Skin
41 Flake, bif. thinning	130 Burin	520 Turtle Carapace
42 Flake concentration	131 Burin Spall	600 Metal
43 Heat spall	140 Notch	999 Other

Figure 92. *Culture Unit Record.*

EAGLE HILL (16 SA 50) PROJECT
Center for Archaeological Research-UTSA

UNIT MAPPING RECORD

1	1- 2	1 8	Record #
2	3- 8	_ _ _ _ _ _	FN
3	9-10	_ _	Number of Depth measurements
4	11-15	_ _ . _ _ _	Substratum
5	16-18	_ _ _	Plan photo number
6	19-20	_ _	Inspected (Inspector #)
7	21-23	_ _ _	Scale (5 mm = x)
8	24-25	_ _	Coder
9	26-27	_ _	Day
10	28-29	8 0	Year

□ = 5 mm^2 =

LEGEND

. =

o = flake

x = chip

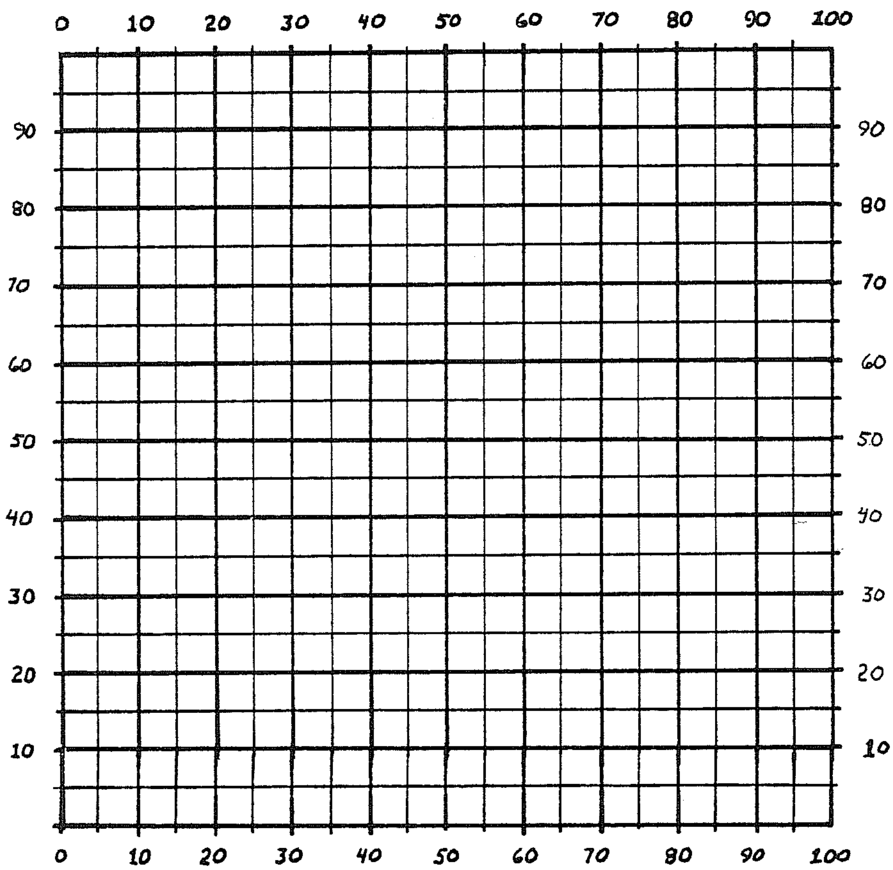
* = burned chip

= charcoal

=

=

North ↑



→ East

_ _ _ _ EAST
_ _ _ _ NORTH

______________ Measurer

______________ Recorder

Figure 93. *Unit Mapping Record.*

EAGLE HILL (16 SA 50) PROJECT
Center for Archaeological Research-UTSA

pH-PO4 Soil Chemistry Format

Format	Sample FN #	Sample Segment	pH/KCl Paper Test	pH Meter	pH Meter/KCl	PO4 Spot	PO4 Colorimeter	Day/Month/Yr
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0
1 0	_ _ _ _ _ _ _	_ _	_ _	_ _ _	_ _ _	_	_ _ _	_ _/_ _/8 0

Figure 94. *Soil Chemistry Record.*

EAGLE HILL (16 SA 50) PROJECT
Center for Archaeological Research-UTSA

TRANSIT SHOT FORMAT-01

_ _ _ _ _ _ FN#	_ _ _ _ _ _ FN#	_ _ _ _ _ _ FN#	_ _ _ _ _ _ FN#
_ _ _ _ . _ _ E	_ _ _ _ . _ _ E	_ _ _ _ . _ _ E	_ _ _ _ . _ _ E
_ _ _ _ . _ _ N	_ _ _ _ . _ _ N	_ _ _ _ . _ _ N	_ _ _ _ . _ _ N
_ _ . _ _ _ F.S.	_ _ . _ _ _ F.S.	_ _ . _ _ _ F.S.	_ _ . _ _ _ F.S.
_ _ _ . _ _ _ Elev	_ _ _ . _ _ _ Elev	_ _ _ . _ _ _ Elev	_ _ _ . _ _ _ Elev
_ _ . _ _ _ Bsite	_ _ . _ _ _ Bsite	_ _ . _ _ _ Bsite	_ _ . _ _ _ Bsite
_ Vdat	_ Vdat	_ Vdat	_ Vdat
_ _ _ _ . _ _ Dis	_ _ _ _ . _ _ Dis	_ _ _ _ . _ _ Dis	_ _ _ _ . _ _ Dis
_ Grid	_ Grid	_ Grid	_ Grid
_ _ _ . _ _ Azim	_ _ _ . _ _ Azim	_ _ _ . _ _ Azim	_ _ _ . _ _ Azim
_ _ Tstat	_ _ Tstat	_ _ Tstat	_ _ Tstat
_ _ Format	_ _ Format	_ _ Format	_ _ Format
_ _ Area	_ _ Area	_ _ Area	_ _ Area
_ _ Coder	_ _ Coder	_ _ Coder	_ _ Coder
Comments	Comments	Comments	Comments

Figure 95. *Transit Shot Record.*

EAGLE HILL (16 SA 50) PROJECT
Substratum Plan Map - Forward Perspective

FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX
FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX
FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX
FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX
FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX
FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX	FN N E DPT EX

Control Front Movement

Control Front Movement

N

E

LEGEND: *Area* ___ ⊙ *Datum* _ _

Figure 96. *Substratum Plan Map.*

EAGLE HILL (16 SA 50) PROJECT
Center for Archaeological Research-UTSA

FN ASSIGNMENT INVENTORY

FN Block	Category*	Area	Day/Month/Year	Coder
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _
_ _ _ _ _ _ _ - _ _ _ _ _ _ _	____________	_____	_ _ / _ _ / _ _	_ _

*core, physical, cultural

Figure 97. *FN Assignment Inventory.*

EAGLE HILL

THE UNIVERSITY OF TEXAS AT SAN ANTONIO

CENTER FOR ARCHAEOLOGICAL RESEARCH

FIELD NOTES

Date____/____/____

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Figure 98. *Field Notes.*

APPENDIX C:

FLAKE CONCENTRATIONS

by

Joan Sherwood

FLAKE CONCENTRATIONS

During excavation of the Eagle Hill site (16 SA 50), a total of 92 flake concentrations was identified in all occupation planes and levels (Table 71). A concentration is defined as a group of flakes, chips, pebbles, or other materials lying in close juxtaposition. Some concentrations also contained clay balls. The explanation for these features is not certain. Among the possibilities under consideration are human caches, rodent activity, and erosion.

TABLE 71. NUMBER OF CONCENTRATIONS BY OCCUPATION PLANE

Level	Number of concentrations
1.13	0
2.13	1
3.11	10
4.12	24
4.15	24
4.16	7
4.17	25
5.11 (Pleistocene soil)	1

Many of the lithics in the concentrations were found lying horizontally. This would seem to be the normal position for any casually discarded or dropped object--gravity would tend to force it into that position. However, a significant frequency of concentrations contained flakes that were vertical.

The fact that these concentrations occur in levels where there are often less chips and flakes in single context would seem to indicate that some action had taken place to gather them.

The possibility of rodent activity, perhaps of packrats collecting and piling objects in their burrows, may have been the cause of these concentrations, but there is no evidence of rodent disturbances in areas where concentrations were uncovered. Furthermore, it would seem that rodent activity would have been responsible for a more varied collection of lithic materials that comprised the concentrations.

Man-made concentration, either accidental or intentional, has also been considered, but ruled out for several reasons. In the first place, the results of tool making or retouching activities would have resulted in debitage spread over a wider area and would tend to consist of material of a more uniform nature than found in Eagle Hill concentrations. Tool making activities would have resulted in a large number of pressure flakes whereas these concentrations contained a mixture of different types: edge-altered flakes, blade fragments, chips, clay balls, and pebbles. All this material seemed to have been mingled indiscriminately. Likewise, any deliberate arrangement of lithics and other materials into piles seems improbable because the piles would not have remained in place, but would have been scattered by subsequent activity in the area.

The most likely explanation seems to be that of deposition by the action of natural forces such as the runoff from heavy rains. A strong stream of water could have moved these small pieces along until one piece was obstructed and more accumulated behind it. This action would also explain the many flakes and chips found standing upright since the force of the water would have turned them vertically. Other pieces lodged beside them would have kept them in that position. Dirt washed along by the same water flow would have covered them and protected them from later disturbance.

Occupation Planes 4.12 and 4.15 have the greatest frequency of concentrations, but these are not the levels where the largest number of flakes and chips were found. Below the substrata is where lithics were found in the greatest abundance. The water-action explanation seemed most reasonable with ultimate stabilization by sediments filling the gaps between flakes. For this reason, flake concentrations were eliminated from the systematic analysis of material.