Paleoindians of Texas: An Update on the Texas Clovis Fluted Point Survey

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ABSTRACT

Since the initial report of a statewide survey of 205 Texas Clovis fluted points (Meltzer 1986, 1987), an additional 201 Clovis points have been recorded. These additional records come from 33 counties not previously represented in the survey; they enhance, but do not appreciably change, the spatial distributional patterns observed earlier with the smaller sample. The density of these points vary across the state and by region. Most of these Clovis points occur in surface scatters with archeological materials of later age; many are otherwise Clovis isolates; a relatively few occur in sites. These contextual patterns vary by region, and suggest differences in land use. The majority of the points are made of Edwards formation chert; the minority are fashioned of Alibates agatized dolomite and Tecovas jasper; rare specimens occur made of Dakota quartzite, and a few other materials. Raw material use varies by region as well. Texas Clovis fluted points vary in their morphology and along certain dimensions—notably length and width—but that variation is attributable to reworking and breakage. Other dimensions (basal width and fluting thickness) in contrast are tightly constrained, indicating considerable standardization in the manufacture of these points, perhaps to fit pre-existing hafts. These and other morphometric data shed some light on the technology of fluted point manufacture. Most of the Clovis points in the sample are whole, but over 100 show distinct breakage or reworking patterns, which cluster to a degree by region, and provide clues to point function and life histories. Data on Texas Clovis fluted points continue to yield insight into Clovis adaptations.

INTRODUCTION

Some 15 years ago, Story (1981:142) observed that our views of the Clovis occupation of Texas were based more on speculation than substance. It was partly in an effort to put our understanding of Clovis on firmer ground that Meltzer (1986, 1987, 1989a) subsequently undertook the Texas Clovis Fluted Point Survey (hereafter, TCFPS), a systematic survey aimed at determining the number, density, distribution, and variability of Clovis fluted points across the state.

That survey was not the first of its kind. In the 1960s Thomas Hester and in the early 1980s, Elton Prewitt, each initiated similar efforts; their examination of published and unpublished reports and collections netted information on some 50 Clovis points scattered in 31 counties (Meltzer 1987:34), but unfortunately neither study was published. However, both Hester and Prewitt graciously provided their results to Meltzer, and his TCFPS built on their foundation by updating records on all known and published Clovis fluted point occurrences, and then by actively seeking data from individuals and collections (public and private) across the state—much of which came as a result of a questionnaire sent to the membership of the Texas Archeological Society (Meltzer 1987:29).

The initial results of the TCFPS were considerable: 205 Clovis fluted points were recorded from 95 counties across the state. Those data provided a measure of the density and distribution of Clovis points across the state, insight into Clovis land use, fluted point technology and function, and some measure of Clovis subsistence, settlement, and adaptation.

After the initial results of the TCFPS were published (Meltzer 1986, 1987), more records of Texas Clovis fluted points accumulated. A very brief update was published a few years later (Meltzer 1989a), but nothing has appeared since then, despite the fact that the sample is nearly double what it was in 1986 (Table 1), thanks to the continued interest and cooperation of individuals across the

Table 1. Tally of Texas Clovis fluted points by county, original tally, points added, and current tally (TCFPS indicates the source of the data was the Texas Clovis Fluted Point Survey. Data from other sources is listed by reference).

County (Site[s])	Original tally	Points added	Current tally	Reference
Anderson	0	1	1	TCFPS
Andrews	2	1	3	TCFPS
Angelina	1	6	7	Brown 1994; TCFPS
Armstrong	1	0	1	TCFPS
Atascosa	1	7	8	Hester 1974:Figure 1j; TCFPS
Bailey	1	0	1	TCFPS
Bandera	1	0	1	TCFPS
Bee	1	0	1	Sellards 1940
Bell (Gault)	1	2	3	Collins et al. 1991, 1992; TCFPS
Bexar (41BX52)	2	1	3	Henderson and Goode 1991; TCFPS
Blanco	1	0	1	Orchard & Campbell 1954; TCFPS
Borden	1	0	1	TCFPS
Bosque	1	0	1	TCFPS
Bowie	0	1	1	Story 1990:Table 44:8
Brazos	1	1	2	TCFPS
Brazoria	0	1	1	Chandler and Rogers 1995
Brewster	2	1	3	Enlow & Campbell 1955; Hester n.d.; TCFPS
Briscoe	0	8	8	TCFPS
Brown	4	1	5	TCFPS
Burnet	0	1	1	TCFPS
Calhoun	2	1	3	Suhm and Jelks 1962:Plate 89A, G; Hester 1988
Callahan	1	0	1	TCFPS
Cameron	1	0	1	Hester n.d.
Camp	1	0	1	TCFPS
Cass	0	1	1	TCFPS
Cherokee	1	0	1	Hester n.d.; TCFPS
Coke	2	2	4	TCFPS
Comal	0	1	1	TCFPS
Comanche	2	5	7	TCFPS
Concho	1	0	1	EHA 1981
Cooke	1	0	1	Jensen 1968
Coryell	0	4	4	TCFPS
Crosby	12	0	12	TCFPS
Dallam	3	0	3	TCFPS
Dallas	3	3	6	Crook & Harris 1955; Suhm and Jelks 1962:Plate 89C; TCFPS
Dawson	0	6	6	TCFPS
Deaf Smith	1	0	1	Suhm and Jelks 1962:Plate 89C
Denton (Lewisville, Aubrey)	1	3	4	Crook and Harris 1957; Ferring 1990; TCFPS
DeWitt	1	0	1	Prewitt unpublished
Dimmit	6	0	6	Hester n.d., 1974:Figure 1a, c, f, g
Donley	0	1	1	TCFPS

Table 1 (Continued)

County (Site[s])	Original tally	Points added	Current tally	Reference
Duval	1	0	1	Hester n.d., 1974:Figure 1b
Ellis	2	1	3	TCFPS
El Paso	0	1	1	TCFPS
Erath	3	2	5	TCFPS
Falls	0	2	2	TCFPS
Fayette	3	0	3	Meier and Hester 1972, 1976; Wilson 1979
Floyd	1	0	1	TCFPS
Foard	1	0	1	Etchieson et al. 1979
Gaines	16	7	23	TCFPS
Galveston	0	1	1	TCFPS
Garza	1	0	1	TCFPS
Gonzales	1	0	1	Hester n.d.
Gray	2	0	2	TCFPS
Grayson	1	0	1	TCFPS
Hall	0	1	1	TCFPS
Hamilton	1	2	3	TCFPS
Harris	2	4	6	TCFPS; Hester 1980; Patterson 1986; Patterson et al. 1992a, 1992b; Suhm & Jelks 1962:Plate 89B; Wheat 1953
Harrison	5	1	6	Hayner 1955, Hester n.d.; TCFPS
Hartley	0	1	1	TCFPS
Hays	4	1	5	Hester n.d.; Takac 1991; TCFPS
Henderson	1	3	4	Story 1990:Table 44:29; TCFPS
Hill	2	4	6	TCFPS
Hockley (Poverty Hill)	1	1	2	Walter 1990; TCFPS
Hood	1	0	1	Skinner and Rash 1969
Howard	3	1	4	TCFPS
Hunt	0	1	1	TCFPS
Jasper	2	0	2	TCFPS
Jefferson	10	60	70	Long 1977; Turner and Tanner 1994; TCFPS
Johnson	2	0	2	TCFPS
Jones	1	0	1	TCFPS
Kaufman	0	1	1	TCFPS
Kendall	1	2	3	Chandler 1983; TCFPS
Kerr	1	1	2	TCFPS; Saner 1995
Kimble	0	1	1	TCFPS
Lamar	2	2	4	TCFPS
Lampasas	0	1	1	TCFPS
Live Oak	0	1	1	House 1974
Lubbock (Lubbock Lake)	1	1	2	Johnson 1983; TCFPS
Marion	4	0	4	Hayner 1955; Story 1990:Table 44:20; TCFPS
Martin	2	0	2	TCFPS
McLennan	3	0	3	TCFPS
McMullen	2	1	3	Cooper 1974; Kelly 1983; TCFPS
Medina	1	2	3	TCFPS
Midland	5	0	5	TCFPS
Milam	0	1	1	TCFPS
Mills	0	1	1	TCFPS

Table 1 (Continued)

County (Site[s])	Original tally	Points added	Current tally	Reference
Montague	1	0	1	TCFPS
Montgomery	0	4	4	Chandler and Rogers 1995
Moore	6	0	6	TCFPS
Navarro	1	2	3	Story 1990:Table 44:33; TCFPS
Nolan	2	0	2	TCFPS
Oldham	2	0	2	TCFPS
Panola	1	0	1	Scurlock and Davis 1962
Parker	1	0	1	TCFPS
Pecos	1	0	1	Hester n.d.
Polk	0	1	1	TCFPS
Potter	0	3	3	TCFPS
Red River	0	1	1	Skinner and Rash 1969
Roberts (Miami)	3	0	3	Sellards 1952; Holliday et al. 1994
Robertson	1	0	1	TCFPS
Runnels	2	1	3	EHA 1981; TCFPS
San Augustine	1	1	2	Brown 1994; TCFPS
San Patricio	2	0	2	Chandler 1982; Hester 1980
San Saba	0	1	1	TCFPS
Schleicher	2	0	2	TCFPS
Shackleford	1	0	1	TCFPS
Starr	1	0	1	Weir 1956
Swisher	1	0	1	TCFPS
Taylor (McLean, Yellow Hawk)	5	1	6	Mallouf 1989; Ray 1930; Sellards 1952; TCFPS
Terry	0	4	4	TCFPS
Titus	1	1	2	Story 1990:Table 44:33; TCFPS
Tom Green	0	1	1	TCFPS
Travis	4	0	4	Alexander 1963; Hester n.d.
Tyler	1	0	1	Suhm and Jelks 1962:Plate 89E
Uvalde (Kincaid)	1	6	7	Hester n.d.; Collins et al. 1989
Val Verde	1	0	1	Greer 1968
Van Zandt	2	0	2	Johnson 1961
Victoria	1	0	1	Hester 1974:Figure 1i
Ward	3	0	3	TCFPS
Webb	0	1	1	Mitchell and Winsch 1974
Williamson (Wilson-Leonard)	2	0	2	Collins et al. 1993; Hays 1982; TCFPS
Wilson	0	1	1	TCFPS
Winkler	2	0	2	TCFPS
Wise	0	1	1	TCFPS
Wood	0	2	2	Story 1990:Table 44:19
Yoakum	1	1	2	TCFPS
Zavala	2	0	2	Hester 1974:Figure 1d, e
Unknown	1	0	1	TCFPS
Totals	205	201	406	

Note: The designation of a site does not indicate all points in that county were found at that site.

state. Now, as nearly a decade has passed since the initial report was published, it is time to present a detailed update of the TCFPS.

As before, this discussion will cover several areas: the spatial distribution of Texas Clovis fluted points; patterns in raw material use; their technology, form, and function; and what these data reveal of Clovis adaptations and land use patterns. In addition, now that a survey of Texas Folsom points has appeared (Largent et al. 1991; Largent 1995), we will take the opportunity to examine to what degree, if any, the distribution and patterning of Clovis and Folsom differed, and what changes that might reveal in Paleoindian adaptive strategies.

PARAMETERS OF THE TCFPS DATA

Boundaries, sources, and analytical units

We open with the caveat—the reminder, really—that there is an element of arbitrariness in examining the distribution of fluted points within the *state* of Texas. The state's borders are not entirely "natural." And even those portions that are (the Red River on the north, the Sabine River on the east, and the Rio Grande on the south) were unlikely to have been significant barriers to Clovis hunter-gatherers, wide-ranging and mobile as they were.

Complicating the picture further is the great diversity of environments across the state, not all of which are contained within the state (in effect, several ecological zones intersect, but are not isomorphic with, the boundaries of Texas). We now know not all Clovis was alike: it varied, and not just on a continental scale, but regionally as well (Meltzer 1993a). Moreover, because Clovis land use was likely tied to particular ecological niches (and not, obviously, to modern state lines), groups occupying those niches might on the face of it be expected to have very different adaptive strategies than those in other niches.

In effect, we must anticipate the possibility that not all Texas Clovis points in all regions of the state look alike or were alike. The Clovis record on, say, the High Plains of Texas almost surely had more in common with Clovis on the High Plains generally, than with Clovis in the East Texas forests. Such would be true of any state in North America, but seems especially true of one as large and varied as Texas. A pan-regional approach is clearly needed to truly understand the potential Clovis Paleoindian occupations of Texas, but so far comparable data are not readily available for the adjoining states and regions (they are starting to become available [Faught et al. 1994; Hofman and Wyckoff 1991]). So we start with Texas, but within the state also recognize, and use, the major geographical provinces of the state: the Plains/Panhandle, North Central, East, Coast, Southwest, Trans-Pecos, and Central Texas regions. This partitioning follows Suhm et al. (1954), with modifications from Arbingast et al. (1976) and Brown et al. (1982), and is in keeping with the divisions used in the original report and with other studies (e.g., Largent et al. 1991; Largent 1995). However, in order to incorporate site distributional data from Biesaart et al. (1985), their finer-scale regional divisions will also on occasion be used (as noted below).

The bulk of the data in the TCFPS comes from individual and institutional collections; the remainder is from published sources. In all instances, a form (Appendix A) was used to record information on fluted point size and shape and other attributes that might inform on point function, technology, and style (Figure 1). Data was also recorded on point location, the context in which it was found (and what kinds of archeological material of what ages was found with it), and the raw material of which it was made. As before, many of those forms were completed with the help and cooperation of scores of interested individuals (see Acknowledgments).

In some cases, particularly among the published sources, the morphological, metrical, and technological data sought for this analysis were not available, and hence it might have only been possible to record, for instance, that a fluted point was present in a particular county, and little beyond that. Still, even knowing fluted points were present in a county is very useful for helping fill in the statewide distribution map. It means, of course, we know of more fluted point occurrences than we have specific attribute data for those points.

The study of Clovis point distribution is based largely on the presence and/or number of points by county. The county serves as the basic mapping unit since it is almost always known and recorded; often, more precise location information is unavailable or unknown. Because the county is the most common spatial denominator used in recording Clovis finds, using it ensures that uneven details in available locational data do not unduly influence the analysis (Meltzer 1987:31). Counties also have the virtue of being easily mapped, clustered into

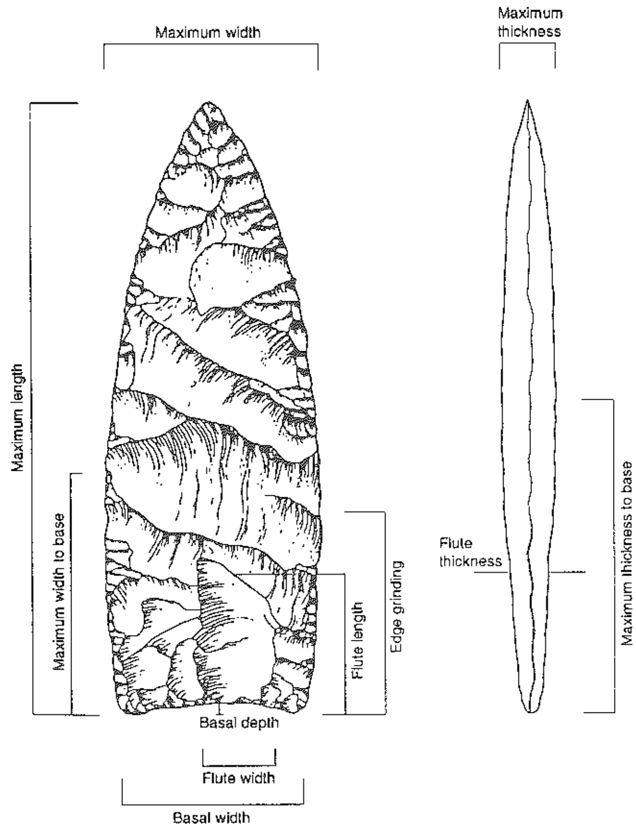

Figure 1. Schematic diagram showing attributes recorded on Texas Clovis fluted points.

larger geographic regions, and, given the statewide scale of this study, can be used without sacrificing much information. Obviously, were this a study of a smaller area (the distribution of fluted points along Blackwater Draw, say, or in the Pedernales River valley), knowing only that points were found in a particular county would not be as informative as knowing where within that county they occurred. But since we are interested in the distribution of fluted points across the state, the county is a useful spatial unit.

Potential biases

There are several potential biases regarding this data set (see also Meltzer 1987:29-31, 36-40). For one, to what degree do these data accurately reflect the range and variation of Texas Clovis points? In general, quite accurately. We infer this is so because, despite the near-doubling of the number of points in the TCFPS sample, the overall statistical patterns in size, shape, and other characteristics evident in the original TCFPS data remain largely unchanged (as we discuss in detail below). Such congruence would be unlikely were this sample unrepresentative of the underlying population of Texas Clovis points.

We would hasten to add, however, there is one obvious bias in the sample, in that it has disproportionately more complete points and point bases than point tips. This comes as little surprise: Clovis point tips, as well as medial blade fragments or other broken point sections lacking the diagnostic flute scars or the other distinctive Clovis attributes (Bradley 1993:253-254), will not always be recognized as having come from Clovis fluted points. While this bias may reduce the overall total of recorded Clovis points, and give a somewhat skewed picture of morphometric and breakage patterns in those points, it should not otherwise unduly influence the analysis. Except, perhaps, in one regard: if it appears that point attrition and breakage is more frequent in certain regions of the state, it may be that the tendency to collect and record whole points could underestimate the number of points from that region.

Another matter of potential bias is whether the spatial distribution of these points provides a reliable glimpse into Clovis land use, as opposed to revealing modern surveying and collecting patterns. In effect, were areas well represented by Clovis points intensively occupied by Clovis groups or have they just been more intensively surveyed by archeologists (and the reverse: does Clovis point scarcity indicate a scarcity of Clovis activity or a lack of archeological survey)? Certainly archeological visibility varies across the state, as does the degree of archeological scrutiny of the various regions (Meltzer 1987:30). Obviously, such matters will have to be considered (and will be considered below) in discussing specific regions, especially where Clovis points are rare or altogether absent.

Even so, it seems reasonable to suppose that, in general, the presence of Clovis points across the state is not simply a function of the distribution of collectors, either TAS members or the general populace. Previously, it was shown there was no statistically significant correlation between numbers of Clovis points and TAS members per county: there were counties with large numbers of fluted points but few TAS members and vice versa (Meltzer 1987:37-38). Since then, new Clovis finds and changes in TAS membership have produced different tallies of each category, but not enough to bring about a correlation between the two. Moreover, there is not a significant correlation between numbers of Clovis points and people per county.[1] Whatever the distribution of Clovis points may reflect, it is not merely an artifact of the present distribution of people in Texas. We will comment on other matters of potential bias below.

SPATIAL PATTERNS IN TEXAS CLOVIS FLUTED POINT DISTRIBUTIONS

Current Totals and Changes since 1986 by County and Region

We have now recorded 406 Clovis fluted points for the state of Texas (see Table 1), representing nearly a two-fold increase over the 205 points reported in the original TCFPS (Meltzer 1987:Table 1). The additional 201 Clovis points come from 70 counties, 33 of which were not represented in the original survey. Presently, Clovis points are known from 128 of Texas' 254 counties (Figure 2; previously, only 95 counties were represented).

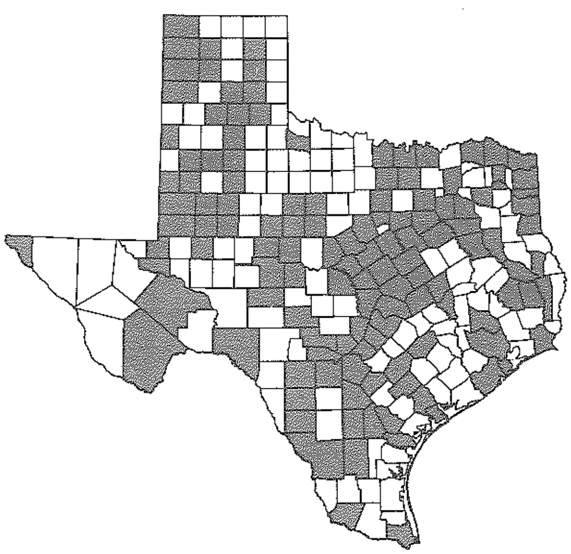

Figure 2. Occurrence of Texas Clovis fluted points by county.

Almost 30 percent (60/201) of the increase in the number of fluted points between 1986 and 1995 comes from the McFaddin Beach locality in Jefferson County on the central Gulf Coast. McFaddin Beach is a lengthy (ca. 35 km) stretch of the central Gulf Coast regularly littered by Clovis points and Pleistocene fossils that have washed ashore over decades from a source or sources apparently near the present coastline (but which during the Pleistocene were inland areas some 80 km from the coast [Long 1977; Turner and Tanner 1994:323]). This locality has lately been the subject of considerable interest and yield (Hester et al. 1992), and at present 70 Clovis points are known from it (Turner and Tanner 1994:324). This is a seven-fold increase over the previous total of 10 (Meltzer 1987:Table 1), and an increase far larger in relative and absolute terms than in any other county.

Atascosa, Briscoe, and Dawson counties had comparable relative increases, however. In fact, excluding the Jefferson County total, the average gain per county between 1986 and 1995 was 1.11; including Jefferson County, the average gain per county over that same period is 1.57.

In the current TCFPS sample, the average number of points per county is 3.16 (data from Table 1). For reasons just noted, and as was evident in the original TCFPS report (Meltzer 1987:36), using an average value is somewhat misleading, inflated as it is by the high numbers of points in just a few counties. As can be seen in Table 2, the modal distribution—the number of Clovis fluted points by county—is more meaningful, revealing as it does that the majority of Texas counties have just one or two Clovis points.

The changes in county tallies between the 1986 and 1995 TCFPS samples are mirrored in changes in point frequencies in the larger geographical regions (Table 3). All seven of those regions showed an increase in the number of Clovis points between 1986 and 1995. However, in most regions the increase, although substantial, generally resulted in no more than a doubling of the recorded occurrences of Clovis points.

Naturally, in the Coast region the increase from 1986 to 1995 was considerably greater (over three times larger than in any other region). Again, this spike is attributable to the singular contribution of

[1]The analysis used 1990 county population data provided in Kingston (1993:331-336). Because these data are on a ratio scale it was possible to derive a Pearson's correlation coefficient between the numbers of Clovis points and Log^{10} population, and the resulting value was .1648, with a significance of .051.

Table 2. Modal distribution of Clovis fluted points by county, 1995

(total number of counties with occurrences = 124)

	Number of occurrences of Clovis points								
	1	2	3	4	5	6	7	8	>10
Number of counties	59	21	18	10	4	8	3	2	3

McFaddin Beach, which makes it appear there was a more extensive Clovis record in this region than actually exists.

The Regional Density of Clovis Points

Just how extensive that effect is can be seen more clearly in the density of points in this and the other regions. The overall density of Clovis fluted points across the state is just over 15 per 10,000 square miles (Table 4). In four of the separate regions of the state, the Plains/Panhandle, East Texas, Southwest Texas, and Central Texas, density values are roughly comparable, ranging from 12-17 points per 10,000 mi^2 (Table 4). In two regions—North Central Texas and the Trans-Pecos—the densities of Clovis materials are considerably lower, while in the Texas Coast densities are considerably higher (39 points per 10,000 mi^2), for reasons already detailed.

To assess whether Clovis points are distributed evenly among the regions, we can calculate the degree of difference between the actual number of points in a given region and the number of points expected in that region were that number proportional to the region's area (that is, test the proposition that larger regions have more points, and smaller regions, fewer points [see Largent et al. 1991:Table 4]). Expected frequencies are derived by multiplying each region's percentage of the state's total area with the total number of points. Thus, as the Plains/Panhandle represents 25 percent of the total area of the state of Texas, it is expected to have 25 percent of the total number of the state's Clovis fluted points (in this case, roughly 100 points [0.25 x 406 points]).

Table 3. Tally of Texas Clovis fluted points by region, 1986 and 1995

Region		Number of Clovis points		Percent increase 1986 to 1995
		Original (1986) tally	Current (1995) tally	
1	Plains/Panhandle	73	109	49.3%
2	North Central	12	21	75.0%
3	East	22	47	113.6%
4	Coast	19	86	352.6%
5	Southwest	13	27	107.7%
6	Trans-Pecos	4	6	50.0%
7	Central	61	109	78.6%
	Unknown	1	1	-0-
		205	406	98.0%

Table 4. Distribution and density of Clovis fluted points by region against model of expected point frequency by area (data on area from Arbingast et al. 1976:78-79)

Region	No. of points	Area in mi^2	Density 10,000mi^2	% total area	Expected no. points[1]	Standard residuals
1 Plains/Panhandle	109	65,388	16.67	.249	100.84	1.054
2 North Central	21	24,719	8.49	.094	38.07	-2.662
3 East	47	26,765	17.56	.102	41.31	0.105
4 Coast	86	21,527	39.94	.082	33.21	9.052
5 Southwest	27	21,683	12.45	.083	33.62	-0.991
6 Trans-Pecos	6	34,797	1.72	.133	53.87	-6.412
7 Central	109	67,235	16.21	.256	103.68	0.564
Total	405	262,114	15.45	.999	404.60	

Chi square = 132.5665, df = 6, significant at 0.0000

[1] Obtained by multiplying the regional percent of the total area by the total number of points (405) from all the known regions

The calculated chi-square[2] statistic in Table 4 indicates the expected and observed values are significantly different, showing that indeed fluted point densities across the state are not uniform. The standardized residuals provide a measure of just how far the observed and expected values diverge from each other. In some regions of the state, most especially the Coast, the density of fluted points is far higher than expected for a region of that size.

Statewide Frequency Distribution of Clovis Fluted Points

Not surprisingly, then, the statewide map of the frequency of Clovis fluted points by county (Figure 3) is rather uneven: just as it was in 1986 (compare Figure 3 here with Figure 2 in Meltzer [1987]). The 1986 and 1995 maps are also somewhat alike, largely because, as noted, Clovis points added to the TCFPS since 1986 were distributed across the state roughly proportional to their abundance in the original sample (with the exceptions noted). Given this, it is appropriate to frame our discussion in terms of the six broad spatial patterns noted previously (Meltzer 1987:41-42), to assess whether and how those have changed, remained the same, or been enhanced by the additional data.

(1) **There is an apparent concentration of Clovis points in the Plains/Panhandle region, and specifically in the High Plains region** (Meltzer 1987:41). In the current TCFPS map, there is still a high frequency of Clovis points on the High Plains. Indeed, eight of the High Plains counties that did not previously have records of Clovis points have them now. Overall, adjusting for the McFaddin Beach Effect, the Plains has the greatest density of Clovis material of any area of

[2] The chi-square statistic measures the degree of difference between an observed and an expected value. In the case of this 1 x 7 cell table, the expected values are derived from data beyond that contained in the table itself (as noted in the text). More typically, and this is true of the 2 x 2 and larger (r x c) tables below, expected values are derived by multiplying row and column totals, then dividing the product by the overall total. This provides a probabilistic "best estimate" of the number that ought to be in that particular cell, based on the data within the table. The chi-square statistic then measures the magnitude of the difference between the observed and expected values, and whether that difference is more than would be expected by chance (Everitt 1977:7).

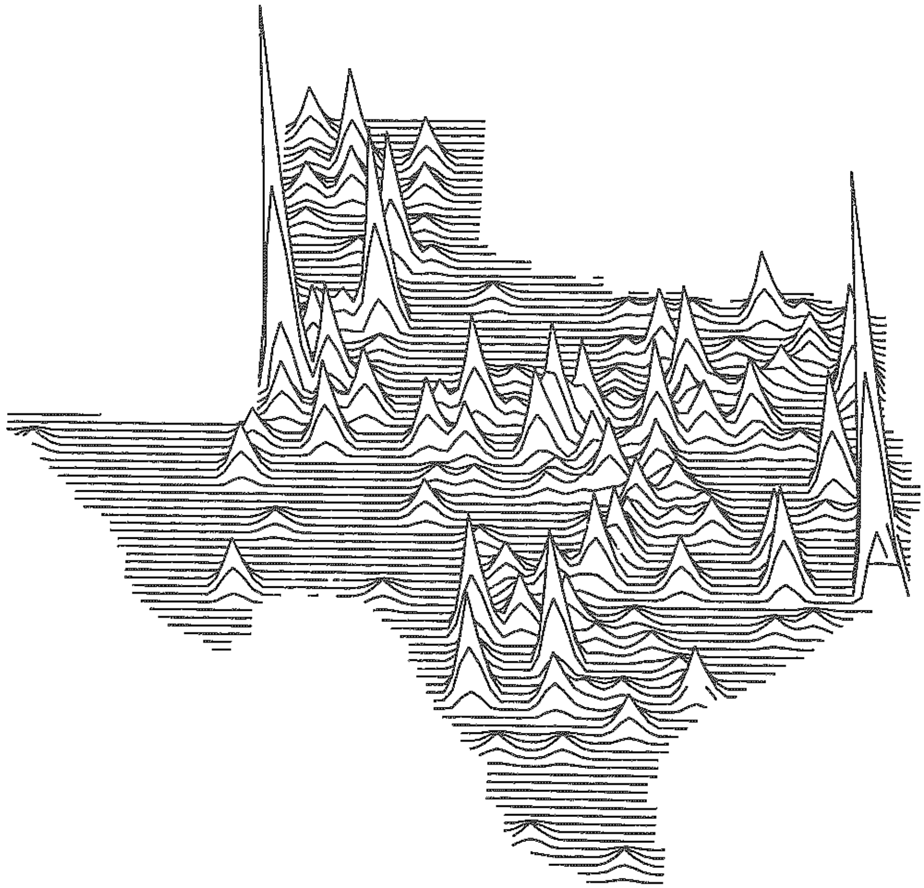

Figure 3. Frequency map of Texas Clovis fluted points by county. The spikes on the map represent the number of points recorded per county, except in the case of Jefferson County (the high spike on the Texas Gulf Coast). Were the 70 Clovis points from Jefferson County plotted, the resulting peak would proportionately reduce all the other county peaks, thus making the statewide patterns difficult to discern. For this figure, then, the Jefferson County total was arbitrarily set at 25. All other values represent the actual recorded totals.

the state (see Table 4).

The high frequency of Clovis material on the Plains was earlier attributed to brisk archeological attention (owing to the early recognition of several important Clovis sites on this landscape), and to the high surface visibility of archeological remains (owing to this being a largely treeless landscape where current land use practices regularly expose subsurface archeological material). It seems just as likely, however, that the abundance of Clovis age material here is no sampling fluke: this area was intensely occupied by Clovis groups. The Plains in Late Pleistocene times overall was wetter and cooler than today (effective precipitation was higher, whether because of increased precipitation, decreased evaporation, changes in seasonality or some combination thereof is unknown), and mantled by grasses, composites, chenopods, as well as some artemisia (sage) and *Ephedra* (Mormon tea) in the uplands, and open forest or wooded parkland in low-lying and wetter areas (Bryant and Holloway 1985). Antelope and bison grazed the landscape alongside the occasional mammoth. The abundant freshwater lakes that dotted the landscape (Sabin and Holliday 1995), and the spring-fed ponds (like the Clovis type site and Lubbock Lake), would have been a prime attraction to human foragers, and many Clovis points are found alongside these now dry features (Meltzer, unpublished). Haynes (1991) raises the possibility these features may also have been dry in Clovis times—that there was a Clovis-age drought. However, Holliday's extensive sediment coring and stratigraphic study on the High Plains of West Texas and eastern New Mexico has not found evidence to support the hypothesis of a Clovis drought (Holliday 1995). Regardless, the conclusion that Clovis groups more intensely occupied this area, as opposed to other regions of the state, must remain tentative until such time as those other regions have been as thoroughly searched for Clovis remains.

2) **There is a relative absence of Clovis points on the Lower or Rolling Plains (Brown et al. 1982), with Clovis points scarce in a 60 mile wide and nearly 400 mile long north-south swath just to the east and down off of the Llano Estacado or High Plains** (Meltzer 1987:41). Despite the large increase in the TCFPS sample since the original survey, the Rolling Plains remains an archeological "empty corridor," at least in regard to Clovis remains (for that matter, Folsom points occur in relatively fewer numbers in this region as well [Largent et al. 1991:324]). There may be several reasons for this. As earlier suggested (Meltzer 1987:43), aeolian and fluvial deposition off the High Plains deeply buried, and thus rendered invisible, any Late Pleistocene surfaces and associated archeological records in this region, though further work was needed on surface ages and the amount of deposition in this region. Several papers have since appeared that corroborate this suggestion (Blum et al. 1992; Blum and Valastro 1992; Ferring 1995a). A particularly striking illustration of the phenomenon is Baumgardner's report of a surface just 2000 years old buried beneath seven meters of sediment on the Rolling Plains (Baumgardner 1986:20). Any Paleoindian-age occupational surfaces below such thick deposits will not be readily visible archeologically (Meltzer 1987:43), assuming, that is, Paleoindian occupations preserve. The uplands and drainages of the Rolling Plains have also been subject (especially in certain settings) to high erosion and geomorphic removal (Blum et al. 1992:362), which, with the deep burial of preserved Clovis age surfaces, conspire to obscure if not destroy the archeological record (Ferring 1995a; Holliday, 1995 personal communication).

But the scarcity of Paleoindian material in this region may not be wholly attributable to natural formation processes preventing our access to the archeological record. As Gustavson has observed, the water in this region is only marginally potable: the rivers that traverse the area carry large amounts of salt (dissolved from Permian halite beds), and have since long before Clovis groups arrived (Gustavson et al. 1980:3-9, 33-35). The extremely poor quality of the water may have influenced, if not discouraged Clovis occupation in so far as good water, and animals, may have been more accessible elsewhere.

Still, current land use practices in the Rolling Plains (large and relatively inaccessible ranches covered with plains and mesquite savanna) do not provide good exposures of Late Pleistocene surfaces or opportunities for survey. Hence, it would be premature to conclude Clovis groups did *not* occupy this area. Until such time as deep testing shows the deeply buried Pleistocene surfaces lack Clovis remains, it is better to conclude on the side of cautzion that this empty corridor in the Clovis record results from inadequate exposures or insufficient samples of surfaces of the proper age.

3) **The Trans-Pecos region has the lowest abundance and density of Clovis points in the state** (Meltzer 1987:42). That was true in 1986, and it remains so today. Indeed, as evident in Table 4, the density of fluted points in the Trans-Pecos is far lower than would be expected for a region that size. Again, the question of sampling adequacy arises: will the region appear to have been peopled by Clovis groups, once it has been thoroughly peopled by archeologists? That's a reasonable possibility, in part because the Big Bend National Park and the large size of ranches in the area have tended to restrict access to the area.

Even so, there was an extensive surface survey of a 3500 km^2 area of the Trans-Pecos around Van Horn by Hedrick, which included an examination of several private projectile point collections, and the only Paleoindian material recorded was a single Folsom point (Hedrick 1989:149). No Clovis remains were noted (see also Collins 1976; Mallouf 1981, 1985); later Paleoindian occupations are also only "scattered thinly" throughout the region (Mallouf 1985:100). For that matter, Clovis remains are equally rare in the Mexican states of Chihuahua and Coahuila south of the international border (MacNeish and Nelken-Terner 1983). Thus, it may be the scarcity of Clovis remains in the Trans-Pecos is real, possibly a result of harsh environmental circumstances (Mallouf 1985; Meltzer 1987:44). In this regard, it would be useful to know whether there is evidence in this region for Haynes' posited Clovis-age drought (Haynes 1991).

4) **Clovis points occur with some frequency and are rather evenly distributed in a slightly elliptical trend of contiguous counties through Central Texas, beginning in Uvalde County in the southwest, and extending up to Bell county in Central Texas** (Meltzer 1987:42). This distributional pattern remains largely unchanged with the presently available data. If anything, the arc now extends farther to the north. For most of its length, that elliptical distribution conforms to the eastern edge of the Edwards Plateau (the Balcones Fault line), along which were freshwater springs and extensive outcrops of Cretaceous age, chert-bearing, limestone of the Fredericksburg (Edwards) Group. These resources were likely a prime attraction to Clovis groups and, as important, the exploitation of the chert sources resulted in a dense and well-marked archeological record (Meltzer 1987:44).

5) **Clovis points appear, at first glance, to be relatively scarce in the Coastal region; however, there are concentrations of this material, and some apparent areas of high versus low densities of point materials** (Meltzer 1987:42). That observation is corroborated statistically: analysis of residuals in a plot of Clovis points by Paleoindian sites indicates there are significantly more isolates in this region than would be expected.

The Clovis points from Southeast Texas nearly all occur as surface finds along the Gulf Coast shoreline (but mostly on McFaddin Beach). At the time of the Clovis occupation, sea levels were still lower than at present (although by then, post-Pleistocene sea level rise had begun), the coast was under what is now Gulf waters, and McFaddin Beach was well inland. The materials that wash ashore on McFaddin Beach today are from now-submerged source(s) on the continental shelf, which in Clovis times were coastal plain or downstream river drainages (Meltzer 1987:35; Hester et al. 1992; Turner and Tanner 1994). Since McFaddin Beach is a secondary deposit of material washing ashore, and not the primary source of the material, its point tally may underrepresent the offshore record, in so far as some of the Clovis points from the offshore source(s) almost certainly have failed to make it to shore.

It may be the extraordinarily high numbers of Clovis points from McFaddin Beach derive from no more than a single, rich Clovis site or cache offshore. On the face of it, however, several sources would seem more likely, given the variation evident in the morphology of these points; perhaps some of the apparent clusters of a few, highly similar points found close to one another (Turner and Tanner 1994:324) represent a single source. As to the nature of the source, whether a camp site, kill site, or cache, little can be said. It is perhaps worth noting that the few known Clovis caches tend to comprise not just finished points, but a wide technological range of forms from large preforms down to points (e.g., Frison 1991). Ultimately, determining the extent and nature of the McFaddin Beach source will have to wait more extensive work, possibly including underwater survey (geophysical sounding techniques might prove useful here). McFaddin Beach aside, Patterson (1993:262) notes that Clovis materials are relatively rare in this region.

6) **There is an apparent abundance of Clovis points recorded from East Texas** (Meltzer 1987:42). In the earlier TCFPS, the abundance of Clovis points from East and Northeast Texas was referred to as "apparent" in light of the fact that two-thirds of the recorded points had only minimal documentation, and there seemed reason to doubt that all the forms said to be Clovis were Clovis (Meltzer 1987:46). It was suggested then the data ought to be used with caution, until such time as further work in the region corroborated the apparently high numbers of Clovis points.

That has now happened: several reports (Brown 1994; Perttula 1989; Story 1990) document in detail the presence and distribution of Clovis groups in the region. That distribution is concentrated along and near the Red River and in the Upper Trinity drainage, as well as the North and South Sulphur drainages (Perttula 1989:20; Story 1990:Figure 26). The distribution may in part be attributable to the active collecting of avocational groups (Perttula 1989:19; Story 1990:178), and to deep incision of (and exposure of Pleistocene age deposits in) the Sulphur River channel since the 1930s (Ferring, personal communication, 1995). Because Clovis-age surfaces in these large river valleys are now deeply buried or removed by erosion, the Clovis material tends to occur as isolates (rather than sites) in upland and tributary settings (Perttula 1989:20; Story 1990:182).

Both Story (1990:182) and Perttula (1989:21) see Clovis groups in this region as having a broad-based diet, and foraging widely over this forested area. There is tantalizing, but unfortunately not well documented, evidence that the Clovis point from the multi-component Murphey site (Marion County, Texas) was associated with mastodon bones (Story 1990:185). If that was the case, it would make this locality one of the few in all of North America in which Clovis was associated with mastodon (as opposed to mammoth).

Moving slightly west into North Central Texas, the Aubrey Clovis site (Ferring 1989, 1990; Humphrey and Ferring 1994)—along with the Lewisville site (Crook and Harris 1957, 1958; Stanford et al. 1995)—are now filling in vital gaps in the Clovis occupation of an area, an occupation that is otherwise not well represented in the TCFPS. The scarcity of Clovis age material in this area, as in others, may be attributable to geologic processes obscuring the archeological record, rather than an absence of Clovis occupations.

Distribution of Clovis and Folsom in Texas

Clovis, Folsom, and later Paleoindian occupations were traditionally thought to be similarly adapted, and represented a continuous tradition of big-game hunting that began with a focus on the Pleistocene megafauna (mammoth and mastodon) in Clovis times, and shifted to bison in Folsom and later periods. In recent years, however, it has become clear the adaptive picture is far more complex, and that Clovis adaptations not only varied across their range, but perhaps differed from those of the Paleoindians who followed (Meltzer 1993a, 1993b).

Moreover, there is ample reason to doubt Clovis groups were big-game hunters (of mastodon *or* mammoth). More likely, they were generalized hunter-gatherers who occasionally pursued big-game, but more often exploited smaller, less risky prey. Like turtles. Turtle remains (and other small game) appear with surprising regularity and abundance in Clovis sites (Meltzer 1993b), including several in Texas such as Lewisville (Crook and Harris 1958; Stanford et al. 1995) and Aubrey (Ferring 1990, 1995b). Our romantic image of specialized Clovis hunters moving in for the kill on a trumpeting, rearing mammoth, may have to be replaced by one of Clovis foragers roasting turtles on the half-shell, after a more leisurely and far less dangerous hunt.

In contrast to Clovis, Folsom and later Paleoindians (especially those on the Plains), were more specialized hunter-gatherers, focusing on bison, although theirs was not wholly a bison-diet (see Hofman 1996). Given that contrast in adaptation and the differences in land use that ought to follow from that contrast, we would not expect a strong correlation in the distribution of Clovis and later Paleoindian localities. By and large, that proves to be the case. Table 5 shows the correlation between the numbers of Clovis and Folsom occurrences, all Paleoindian sites, and all archeological sites (data on Folsom occurrences are from Largent et al. [1991:Table 1]; data on Paleoindian and all sites are from Biesaart et al. [1985]).

These results indicate that the distribution by county of Clovis points is unrelated to the distribution of later Paleoindian sites: there is no correlation between the two (Spearman's rho, $r_s = .1508$, significance = .074, and even less between Clovis points and all archeological sites). However, there was a strong correlation between the number of Paleoindian sites and the total number of sites by county ($r_s = .6621$, significance = .000). Granting biases in the collection and reporting of Clovis points versus Paleoindian sites, one might attribute the lack of correlation between the two to differential intensity of land use on the part of Clovis groups (Meltzer 1987:36).

Yet, it is important to note this lack of correlation is partly an artifact of scale. Reanalysis of the data using fewer and larger spatial units, namely the environmental and geographic regions defined by Biesaart et al. (1985:9, and Figure 15), shows there is a significant correlation between the number of Clovis isolates and Paleoindian sites by such regions ($r_s = .6999$, significance = .008). This means, in effect, that at a coarser spatial scale the Paleoindian archeological record (and this includes Clovis) is more generally homogeneous, as perhaps might be expected given regions are larger and more archeologically meaningful units than counties. From this one might speculate that intra-state, inter-regional Paleoindian land use patterns were similar.

Taking the analysis a step further, what of the relationship between Clovis and Folsom? After examining the correlation of Folsom localities with several variables (including county population, area, number of TAS members, and number of available publications), Largent et al. (1991:330) conclude the "best way to predict Folsom localities is to

Table 5. Spearman (r_s) rank order correlations of Clovis and later Paleoindian materials, by county and region.

a) **By county**	Clovis points	Folsom points	Paleoindian sites
Folsom points	-.0445 sig = .600	-	-
Paleoindian sites	.1508 sig = .074	.2870 sig = .001	-
All sites	.1219 sig = .150	.0214 sig = .801	.6621 sig = .000

b) **By region**[1]	Clovis points	Folsom points	Paleoindian sites
Folsom points	.3269 sig = .276	-	-
Paleoindian sites	.6999 sig = .008	.6138 sig = .026	-
All sites	.4972 sig = .084	.1515 sig = .621	.5447 sig = .054

[1] Region designations follow Biesaart et al. 1985

know the number of Clovis points in a county." Relative to the other measures they included in their analysis, this may be so.

Yet, analyzing the correlation between Clovis and Folsom points, using the updated TCFPS data, reveals the relationship is, at best, a very weak one (r_s = -.0445, significance = .622; the correlation measured by Kendall's Tau-B [to allow comparison with Largent et al.'s 1991 results] is -.0375, significance = .593). In fact, unlike the Clovis distribution, the Folsom data do correlate, albeit weakly, with the number of Paleoindian sites per county (Table 5). Our analysis differs somewhat from that of Largent et al. (1991), in so far as we examined the correlation between the number of Clovis and Folsom points per county, not the number of localities per county (as was apparently done by Largent et al. 1991). Still, since there is a very strong correlation between Folsom points and Folsom localities by county (r_s = .9648, significance = .000), the difference between our approaches may be more apparent than real (cf. Largent et al. 1991:328). It seems, then, the Clovis and Folsom records are not significantly alike, at least in their frequency and spatial patterning.

THE ARCHEOLOGICAL CONTEXT OF TEXAS CLOVIS FLUTED POINTS

Clovis fluted points recorded by the TCFPS were found in several contexts (Table 6): as isolated surface occurrences (*isolates*); in well defined (and perhaps sealed) Clovis *site* contexts; and, in the clear majority of those where the context was known, in *surface scatters* amidst archeological material of many different types and ages, including Clovis, other Paleoindian, Archaic, Late Prehistoric, and even Historic material. Note that Table 6 shows the number of individual points as well as number of localities within which those points occur (the latter is included to offset the statistical effects of a single locality having an inordinate number of points, and will always be equal to or less than the number of points). For nearly a third of the points, the context was unknown, or at least insufficient information was provided to make a secure judgment, and we always preferred to err on the side of caution, perhaps unduly so: TCFPS respondents generally noted if other material was present with a fluted point; the absence of such a note provides some warrant to speculate that many "unknown" points are, therefore, isolates. We did not assume so in our analysis, however.

There are a number of observations that might be made of these data. For one, they highlight the fact that discrete and well-defined Clovis sites are rare, a point noted previously (Meltzer 1987:27-28), and also observed in later Paleoindian occupations elsewhere (e.g., Hofman 1996). Even counting the surprising number of sites discovered or reported since the initial TCFPS, notably Aubrey (Ferring 1989, 1990; Humphrey and Ferring 1994), Pavo Real (Henderson and Goode 1991), Gault (Collins et al. 1991, 1992), Poverty Hill (Meltzer, unpublished; Parker 1983; Walter 1990), and Yellow Hawk (Mallouf 1988, 1989), as well as the Clovis sites already known—some of which were recently subject to reinvestigation (e.g., Miami [Holliday et al. 1994] and Wilson-Leonard [Collins et al. 1993])—the essential fact that Texas Clovis sites are rare remains unchanged. Which itself reaffirms the importance of examining the distribution of individual Clovis fluted points (and not just sites) across the state.

But is that scarcity of sites itself meaningful, perhaps suggestive of Clovis settlement activities (Meltzer 1987:27-28), or is it simply an artifact of an archeological record that has somehow made it difficult to see once-intact Clovis sites? The latter possibility might seem supported by the large number of Clovis points that occur within surface scatters, if one assumes those scatters also include the debitage and tools from Clovis assemblages that, unlike fluted points, are difficult to recognize as Clovis.

However, the occurrence of Clovis points within those larger surface scatters could result from one of several causes, but precisely which causes can be difficult to determine, especially from a distance. For example, the occurrence of a Clovis fluted point in a large surface scatter might indicate, as above, that a larger Clovis component was once present at the locality, but by virtue of a heavy artifact rain of later occupations and only light sedimentation, just the fluted point (and not the tools and debitage that were part of the same assemblage and are still present at the site) is recognized as Clovis (while the occurrence ought to be tallied as a site). Alternatively, that Clovis point might be no

Table 6. Context in which Texas Clovis fluted points are found, by region[1]

	Number by region[2]							
Context	1	2	3	4	5	6	7	Totals
Clovis site	6/3	2/2	0	0	0	0	14/6	22/11
Surface scatter	29/25	3/3	18/17	75/6	7/7	1/1	57/52	190/111
Isolate	15/15	5/5	6/6	0	5/5	1/1	8/8	40/40
Unknown	59	11	23	11	15	4	30	154
Totals	109/43	21/10	47/23	86/6	27/12	6/2	109/66	406/162

[1] Region designations follow Table 3

[2] Figures are Numbers of points / Numbers of sites or localities in which points are found

more than a single isolate left at that locality by earlier Clovis groups (and should be counted as an isolate, and not as a site). Finally, the Clovis point might have been picked up elsewhere by later groups and brought into the site by them for their use (its present context therefore providing few clues as to whether its original context was as an isolate or in a site).

These several possibilities, especially the first two, are likely in areas where key resources, freshwater or stone, for instance, long attracted human occupation, while the third would be likely (but not necessarily restricted) to stone-poor areas. And unless the Clovis point was re-fashioned into a later style (notched, say), its post-Clovis life history might not be easily traced. Examples of Clovis points apparently recycled by later groups would include the fluted points at Ryan's site (Hartwell et al. 1989), Crockett Gardens (Hays 1982), the Doering site (Wheat 1953), 41SP69 (Chandler 1982), the Fred Yarbrough site (Johnson 1961), La Perdida (Weir 1956), the Meier site (Meier and Hester 1972, 1976), and the Obshner site (Crook and Harris 1955).

Sorting these and other possibilities (the ones listed are just the few that come readily to mind) is mostly a methodological problem: how can we differentiate Clovis versus later debitage, for example? Resolving that problem will also require detailed information on the archeological, geological, hydrological, and paleoenvironmental context of the occurrence, information that unfortunately rarely accompanies the points in the TCFPS. Thus, while "surface scatter" is presently the most common context in which Clovis points occur, we cannot conclude that they represent scattered Clovis components or, for that matter, Clovis isolates.

A related matter bears mention: as seems evident elsewhere in Clovis times, and particularly in comparison to later, post-Paleoindian occupations, Clovis groups did not always participate in the highly structured spatial behavior that produces sites. As highly mobile hunter-gatherers, whose movements were virtually unrestricted across the very thinly inhabited and relatively rich Late Pleistocene landscape, Clovis groups were not forced to use the same localities repeatedly, and hence would not necessarily build up a visible archeological record at any one. Indeed, most of the known Texas Clovis sites represent single, very short-term events (the Aubrey site [Ferring 1989, 1990, 1995b] being a particularly well-documented example).

The exception to this pattern would be those areas in which key resources were relatively rare and spatially restricted (so-called point resources): like the freshwater springs and ponds on the High Plains. Such point resources would lend themselves to repeated and perhaps cyclical Clovis exploitation and use, which in turn would lead to the build-up of spatially concentrated debris (sites). Given that many of the springs and ponds on the High Plains dried in the Early Holocene (Holliday 1989, 1995), these localities would not necessarily be targets of later groups, and hence would not become palimpsests of different occupations (surface scatters).

Conversely, where the point resources were unaffected by changing climates or environments (high-quality stone outcrops, for example), use by Clovis and later groups would ultimately result in large surface scatters. Again, however, unless there was active sedimentation on site, discrete Clovis components may not be separable. The intensive use of the Edwards chert outcrops along the Balcones Escarpment provides a good illustration of this. It is appropriate to add that the resultant concentration of Clovis material need not arise, as Shiner (1983) suggested, from sedentary Clovis occupations, but simply from the build-up of assemblages over repeated visits (Meltzer 1987:44).

To a degree, these inferences are supported by the analysis in Table 7, which provides the chi-square and adjusted residuals[3] values for the *locality* data in Table 6 (which of course excludes tallies on the Clovis points for which the context was "unknown"). The significant chi-square result indicates that site context and region are not independent: there are regions in which points occur in certain contexts more often than would be expected by chance. The adjusted residuals help pinpoint which of the cells (region by context) contributed most to the chi square.

In Central Texas, as inferred, surface scatters occur significantly more often than would be expected by chance, while isolates are significantly

[3] Adjusted residuals help identify which cells are responsible for a significant chi-square value (Everitt 1977:46-47). Adjusted residuals are read as standard normal deviates; values greater than 1.96 (or -1.96) mark cells in which the observed values are significant—hence, have observed values greater (or lesser) than would expected (and thus drive the chi-square value).

Table 7. Chi square and adjusted residuals analysis of the context in which Texas Clovis fluted points are found, by region (data are from Table 4, excluding the "unknown" row).

	Adjusted residuals by region[1]						
Context	1	2	3	4	5	6	7
Clovis site	.06	1.71	-1.40	- .67	-.97	-.38	.97
Surface scatter	-1.71	-2.71	.60	1.69	-.79	-.57	2.33
Isolate	1.81	1.92	.17	-1.43	1.42	.84	-3.08

Chi square = 23.156, df = 12, significant at 0.026

[1] Region designations follow Table 3

under-represented (adjusted residuals values of 2.33 and -3.08, respectively). A similar pattern seems to characterize the Coast region. For lack of other information, McFaddin Beach is currently designated as a surface scatter, given that it has also yielded other Paleoindian points, as well as those of Archaic and Late Prehistoric age (Turner and Tanner 1994:324). Were the McFaddin Beach materials derived from one or more discrete site contexts, the results would almost certainly change. In the Plains/Panhandle and in North Central Texas, the pattern is just the reverse: Clovis points found as isolates are more common, surface scatters less so.

These results open a window into Clovis settlement strategies, suggesting as they do that such strategies differ across the state. Perhaps, following the earlier line of argument, resource exploitation in Central Texas entailed the kind of highly structured spatial behavior that produces sites: camping at springs and refurbishing tool kits from locally abundant supplies of chert, for example. We might speculate, therefore, that Clovis points occurring within surface scatters at localities with such key, point resources might represent palimpsests of sites, more so than a record of isolates (after all, if the locality attracted repeated use throughout prehistory, then it may equally have attracted repeated occupations by Clovis groups).

In contrast, in North Central Texas and on the Plains/Panhandle it would appear more non-point resources were utilized. On the Plains, point resources that were visited repeatedly, such as the freshwater springs and lakes around which many of the isolates were found, were not otherwise used in ways that produced a significant archeological record. Such speculations, however, are limited by the lack of more fine-grained data in the TCFPS on the precise contexts of Clovis points.

VARIATION AND PATTERN IN TEXAS CLOVIS FLUTED POINTS

There is additional information to be gleaned from the points themselves which sheds light on this and other aspects of Clovis adaptations. To explore these issues, we sought through the TCFPS data on the kinds of lithic raw material used in the manufacture of the points (which may reveal something of Clovis settlement strategies), patterns in fluted point size and shape (which might bear on technology, function, and possibly style), and information on fluted point life-histories.

Raw material sources and usage

The analysis of lithic raw materials used in the production of Texas fluted points was limited by the fact that correspondents were generally able to identify the stone to type (chert as opposed to quartzite, say), but less often to specific outcrops or even sources; this is a difficulty hardly limited to TCFPS correspondents, given the well-known complexity of raw material sourcing (Banks 1990:6-7; Hofman et al. 1991). Even so, enough raw material types were identified to make some statements about the sources of raw material used by Clovis groups in the manufacture of their points or, short of that, at least the general rock type used (Table 8).

Not surprisingly, the majority of the 137 Clovis points across the state identifiable to raw material type were manufactured of Edwards Formation (Cretaceous) cherts, which crop out over a large area of Central Texas (Banks 1990:Figure 3.1; Frederick and Ringstaff 1994:Figures 6.3-6.5). Based on those data, and the descriptions that accompany many of the reports, we would speculate that a majority of the 269 "unknowns" in Table 8 are also made of Edwards chert. In those instances where uncertainty existed, however, we tallied the stone type as unknown.

Far fewer Clovis points statewide are manufactured of Alibates agatized dolomite and Tecovas jasper, which crop out in relatively smaller areas of the Plains/Panhandle and escarpment (Banks 1990:91-92). Less common still are points made of quartzite (those that were fashioned of Morrison or Dakota quartzite, which crops out discontinuously across the High Plains [Banks 1990:90]). Individual Clovis specimens were also fashioned of petrified wood (source locality unknown), Manning fused glass (Brown 1976,1994; this material outcrops in eastern Texas [Banks 1990:53]), and obsidian.

An interesting pattern emerges in the data on Edwards, Alibates, and Tecovas materials that comprise the bulk of the identified sources. If one collapses the data in Table 8 to show only the number of Clovis points fashioned of Edwards chert by region, arrayed against the number of Clovis points fashioned of either Alibates or Tecovas by region (combining the Alibates and Tecovas stone sources on the rationale that together they represent a "High Plains" source), as in Table 9, it becomes clear there is a distinct asymmetry in Clovis stone usage.

Clovis points fashioned of Edwards chert were commonly found in Central Texas as well as on the High Plains (although as the adjusted residuals indicate, Edwards is still significantly under-represented on the High Plains). Yet, Clovis points made from the High Plains sources were common on the High Plains, but rarely were carried east into Central Texas (and given the cautions of Goode [cited in Banks 1990:61], there is a possibility the few that do occur in that region are not actually Alibates or Tecovas, but an anomalous local Edwards variety). The easternmost occurrence of a point manufactured of Alibates "flint" is from the McFaddin Beach locality (Long 1977:7), but as noted previously, it exhibits little of the attrition that often occurs on points so far from their source, and thus

Table 8. Raw material types identified in the TCFPS, by region

	Number by region[1]								
Source/type	1	2	3	4	5	6	7	Unk	Totals
Edwards chert	37	7	3	0	7	0	39	0	93
Tecovas jasper	6	1	0	0	0	0	0	0	7
Alibates dolomite	18	2	0	0	0	0	4	1	25
Alibates or Tecovas?	2	0	0	0	0	0	0	0	2
Quartzite	4	1	0	1	0	0	0	0	6
Petrified wood	0	0	2	0	0	0	0	0	2
Obsidian	0	0	0	1	0	0	1	0	2
Manning fused glass	0	0	1	0	0	0	0	0	1
Unknown	42	10	41	84	20	6	65	0	268

[1] Region designations follow Table 3

Table 9. Clovis fluted points made of Edwards versus Alibates & Tecovas, grouped by region

	Number by region[1]							
Source/type	1	2	3	4	5	6	7	Totals
Edwards chert	37	7	3	0	7	0	39	93
Adjusted residuals	-3.84	-.28	1.04	0	1.62	0	3.10	
Alibates & Tecovas	26	3	0	0	0	0	4	33
Adjusted residuals	3.84	.28	-1.04	0	-1.62	0	-3.10	
Totals	63	10	3	0	7	0	43	126

[1]Region designations follow Table 3

seems oddly out of place on the Texas Gulf coast (Meltzer 1987:45). Points made from Alibates and Tecovas, however, were often carried onto the High Plains far to the north and west of their source, as seen most notably in their occurrence in the Drake Cache in North Central Colorado, some 485 km from the Alibates outcrops (Stanford and Jodry 1988).

What this pattern of stone use might indicate is that the Clovis High Plains settlement system tracked predominantly to the north and west of that region (and then back), more so than to the south and east, although, of course, High Plains groups did utilize Edwards chert (Meltzer 1989b). Unless the Edwards chert on the High Plains marks Clovis groups from Central Texas moving onto the High Plains, it suggests as well that they cycled back to Central Texas without procuring or using to any significant degree the stone local to the High Plains. Such speculations, however, must be taken with the caveat that the raw material evidence is saying no more than that certain stone sources were being used, and is not directly tracking whether Clovis settlement systems did not extend in certain directions or in specific regions. Still, it does highlight the fact that in order to truly understand the movements of hunter-gatherers as wide-ranging as these Clovis groups clearly were, one must attack the problem on a very large scale, and (reinforcing the point made at the outset) pay no attention to modern political boundaries.

Perhaps shedding additional light on Clovis settlement systems is an intriguing bit of largely negative evidence, which naturally must be taken with great caution. No artifact-quality obsidian occurs in Texas (Hester 1988); hence, any obsidian in or near the state is exotic and was imported. For reasons outlined in Meltzer (1989b), it is suspected that where exotic stone comprises the bulk of a group's stone supply, then it most likely was obtained by the group directly at the distant outcrop. Cases where exotic stone is extremely rare open the possibility that either direct procurement or exchange might have been the mechanism by which the stone was moved from source to site. In general, most lithic raw material used in Clovis sites (and perhaps Folsom as well [Hofman 1992:198]), appears to have been directly procured. But obsidian—rare as it is and distant as its sources—may prove the exception to that rule.

One obsidian Clovis point occurs on the High Plains at Blackwater Locality No. 1 (the Clovis type site) in New Mexico, just across the Texas border. It was made of obsidian from the Valles Caldera in the central Rio Grande Valley of New Mexico, some 350 km west of the site (Johnson et al. 1985:52). No other obsidian Clovis points from this or any other central Rio Grande source have been found on the High Plains. This indicates that in Clovis times at least there was only infrequent traffic between the two regions, which may reveal something of the direction of Clovis settlement systems, backhanded support for the supposition that Plains Clovis groups were moving south to north, or perhaps some evidence of the scale of these systems.

In regard to the latter, one might observe that obsidian Clovis points tend to be infrequent in North America, occurring most often and in the greatest abundance in what we might term "Clovis-proximity" to major obsidian sources (e.g., the Dietz site in Oregon [Willig 1988]). "Clovis proximity" is about 300 km, the figure that turns up repeatedly in measures of the distances these groups are known to have traveled from their stone sources (Haynes 1982:392; Meltzer 1993a:305). It may well be that if groups cycling through the central Rio Grande were heading towards the Plains, they did not do so often or extend very far onto the Plains (it being beyond Clovis proximity), or interact with groups that were on the Plains. It would be most interesting, although well beyond the scope of the present paper, to determine the relative frequency of Clovis points made of Alibates or Tecovas in the central Rio Grande Valley, in order to see the degree to which the pattern evident in the use of obsidian in Texas was mirrored in the other direction by the use of Texas cherts Judge (1973:248) notes that 21 percent of a sample of 26 Clovis points from the central Rio Grande are made of "chert and obsidian," but does not specify the chert in question. Judge adds that 43 percent of the points are made of chalcedony, which appears at the Aubrey site (Ferring, personal communication, 1995) as well; it was not distinguished in the TCFPS analysis, but does occur in this sample.

Only two obsidian Clovis points have been found within Texas. One was reported by Hester (1988) from the Port Lavaca area of Calhoun County on the central Gulf Coast (41CL72), and had been heavily abraded by wave action. The precise source of the obsidian could not be determined by laboratory analysis: however, it did not match the known New Mexico sources, nor did it match sources known from old Mexico (each at least 1000 km to the west and south, respectively) (Hester 1988:28). In this instance, knowing the context of the discovery is crucial (notably, whether the point was picked up and moved by post-Clovis groups), for if that context is securely Clovis and its source can be located it may be possible to infer something of the scale and direction of Clovis movements across the landscape or Clovis exchange.

In that regard, the obsidian Clovis point from Kincaid Shelter is of some interest. This point, originally described by Hester et al. (1985:150-151) as an indeterminate (possibly Angostura-like) Paleoindian point, has subsequently been identified by Collins et al. (1989) on the basis of the point's morphology and context as Clovis. The point was fashioned of obsidian derived from a Valley of Mexico source (Queretaro) some 1000 km south of Kincaid. It is a heavily ground basal fragment, which Collins (personal communication, 1995), believes represents a re-tooling discard. Point manufacture was taking place at Kincaid, and not surprisingly the Clovis preforms from the site are made of locally available chert; the obsidian point was one of the very few exotics in the Kincaid Clovis assemblage. If this obsidian specimen was acquired directly at the source by highly mobile Clovis groups, as opposed to obtained via exchange, its presence in Central Texas would imply a considerable settlement range. Taking this evidence a step further, if Clovis groups were the first Americans and were generally trending southward through the hemisphere (in addition to their more "local" settlement moves), then this evidence would also indicate that the migratory process was not unidirectional, and that even after travelling some distance south of the Rio Grande, these groups cycled back north as well. This is in keeping with recent models of the peopling of the Americas, which anticipate "reverse migrations" in the long process of colonizing the continent (Meltzer 1995), but again it assumes that Clovis groups were the first Americans—which may or may not be the case.

Texas Clovis Morphometrics

Of the 201 points added to the data set since 1986, morphological and metric data are available on 132 of them (Table 10). Measurements on all variables were not always available for all specimens, however; hence, the different values for *n* in Table 10. Adding those data to the analysis is revealing in several ways, not the least of which is that despite substantially increasing the number of points from the original sample, the overall size and shape patterns remain largely unchanged (compare Table 10 with Meltzer 1987:Table 9). That there was so little change between the two samples demonstrates that the original data set was indeed a reasonably representative one in terms of point morphology. Were the original sample not representative, the additional data would have significantly changed the statistical patterning.

The data from the TCFPS indicate that the "average" Texas Clovis fluted point is just over 6 cm long, and 2.75 cm wide at its widest spot (generally, the base is narrower, only 2.36 cm wide). The widest spot occurs partly up the blade, 2.88 cm up from the base, just a few mm beyond where the haft ended. The haft area in Clovis points is marked by edge grinding, which on average extends upwards from the base 2.59 cm, and is present on virtually all of the points in the TCFPS. The *maximum thickness* of these points averages 7.3 mm, and generally the points are thickest on the blade portion well beyond the haft (3.5 cm from the base) and beyond the point of maximum width. In effect, these points are "front heavy." All of which means they have a slight taper, in both plan and longitudinal section. Flute scars generally do not extend beyond the haft area, are centered over the point axis, and are sufficiently narrow (on average, 1.29 cm wide) that they rarely extend to the lateral edges of the point.

Further, the points in this sample tend to scale by size in a relatively straightforward manner: longer points are generally thicker and wider (at both their maximum and at their base), and the spots in which they are widest and thickest are farther from the base (correlations of *length* with *maximum width to base* and *maximum thickness to base* are *rp* = .7090 and .8681, respectively, with both significant at the .000 level). Longer points also tend to have longer flute scars although their length does not correlate as strongly with overall length (*rp* = .3562, p = .000). As might be expected, the extent of the *edge grinding* does not correlate with length (*rp* = .0878, p = .149); the size of the haft was apparently relatively constant regardless of point size (see below, as well). To highlight the obvious: the length of *edge grinding* can also be more tightly controlled than flute scar length, which is also part of the haft. The number of flute scars does not correlate at all with point length (r_s = -.0432, significance = .475, and -.0754, significance = .215, for flute scars on the obverse and reverse faces, respectively).

At least those are the statistical averages and trends. Of course, it is highly unlikely that all (or even most) of the 406 points in the TCFPS conform precisely to the averages in Table 10. But these statistics do show that in certain attributes there is considerable conformance to the mean, while in others there is more variance about the mean (as measured by, for example, *kurtosis*, which indicates the shape of the distribution of cases about a mean: normal distributions have a kurtosis value of zero, positive kurtosis values result where most of the individual cases cluster tightly around the average value for all cases, while negative values occur where cases are scattered widely around the mean). While we obviously cannot describe each point individually, we can use such measures to help gain insight into how and in what attributes the "average" values are representative (or not), and from that perhaps draw some general inferences about Texas Clovis fluted point morphology, technology, and function.

As was true in the original survey, a measure that shows considerable variation is the *maximum length* of the fluted point, which in the original sample had a kurtosis value of -.28; the value is currently .05, indicating a very slight "tightening" of the distribution about the mean in this larger sample. The relative scatter of *length* values is easily understandable: *length* varied considerably over the life history of a Clovis fluted point as a result of use, breakage, and reworking (Meltzer 1987:56). Because the data in Table 10 come from all the cases in the TCFPS, including whole, reworked, and broken points, the values naturally vary. Accordingly, the subsample of only the whole and completely unbroken points in the TCFPS is longer and much less varied (mean = 7.81 cm; kurtosis = .81), than the subsample of only the reworked points (mean = 5.38 cm; kurtosis = .50). In fact, there is a statistically significant difference in the lengths of whole versus reworked points (t-value = 6.49, significant at .000 level) (see also Meltzer 1987:49).

In general, it appears points were reworked while still mounted in their haft (Meltzer 1987:49), based on the "shouldering" just beyond the haft that occurs in many cases, and the fact that flute scars and edge grinding were rarely removed by subsequent flaking or retouch. Thus, reworking mostly affected the blade portion of the fluted point, and because reworking did not just make the points shorter, but narrower too (by moving the blade edges in), the *maximum width to base* measure is significantly reduced in reworked points as well (the mean for whole points is 3.33 cm, for reworked points it is 2.26 cm, producing a t-value of 4.97, significance = .000).

Table 10. Descriptive statistics for Texas Clove fluted points, 1986 and current samples (in centimeters)

Variable	n in sample	Mean	Minimum	Maximum	Standard Deviation	Kurtosis
1986 data only[1]						
Maximum length	155	5.75	1.10	13.04	2.69	-.28
Maximum width	155	2.73	1.71	4.80	0.49	1.46
Distance from maximum width to base	130	2.78	.00	6.50	1.28	-.01
Base width	144	2.34	1.38	4.50	0.46	2.43
Maximum thickness	137	0.72	.30	1.20	0.15	.36
Average flute length[2]	106	2.42	.95	5.20	.83	.41
Average flute width[3]	111	1.28	.65	2.30	.35	-.27
Basal depth	124	.21	.00	.80	.17	.24
Average length edge grinding[4]	87	2.51	1.07	4.88	.79	-.30
All data						
Maximum length	285	6.14	1.10	16.40	2.78	.05
Maximum width	287	2.75	1.71	4.89	0.49	1.60
Distance from maximum width to base	235	2.88	.00	8.13	1.39	1.03
Base Width	260	2.36	1.38	4.50	0.46	1.82
Maximum thickness	269	0.73	0.30	1.20	0.15	0.23
Distance from maximum thickness to base	17	3.50	1.50	5.63	1.20	-.39
Average flute length	138	2.42	.95	5.20	.81	.36
Average flute width	146	1.29	.65	2.30	.33	-.11
Flute thickness	18	.57	.42	.88	.11	2.21
Basal depth	177	.28	.00	.80	.17	.10
Average length edge grinding	140	2.59	.97	5.72	.78	1.18

[1] There were several discrepancies in the original published version of this table (Meltzer 1987:Table 9)—the most glaring of which was maximum fluted point thickness erroneously listed as 2.80 cm, far thicker than any fluted point in this or perhaps any other sample. We present the corrected data here. Certain measurements were not taken in the original survey, hence the difference in the variable list between the 1986 and current samples.

[2] These values are derived by first calculating the average flute length on an individual fluted point (by summing flute length on the obverse and reverse faces of the point, then dividing by two), then averaging those values for all points.

[3] The calculation for average flute width was done in the same manner as the calculation for average flute length.

[4] The calculation for average length of edge grinding was done in a similar manner as average flute length and width, only in this instance the length of the left and right edge grinding was averaged for each individual point.

If reworking also made the blade thinner, then there should be a difference in *maximum thickness to base* between whole and reworked points. However, if reworking was of the sort that characterized Dalton points, in which the blade was narrowed and its edges steepened, but the blade was not thinned. In that case, there would be no significant difference between whole and reworked points. Unfortunately, we have measurements of *maximum thickness to base* on only nine of the whole and reworked points in the TCFPS, so a test of that proposition would not be statistically meaningful at present.

But perhaps we can explore this issue another way: by looking at the values for *maximum thickness*. These were normally distributed about the mean, and showed approximately the same dispersion as maximum length values (see Table 10). That variability might result from reworking and/or use, or perhaps other factors. In a recent discussion, Tankersley (1994) argued that variation in fluted point thickness results from variation in the lithic raw material selected for use, and as a byproduct of the use of a percussion-based bifacial reduction strategy. He assumed that percussion flaking yields less precise and more variable thinning flakes than that resulting from the controlled pressure-flake fluting of Folsom times (Tankersley 1994:506). Unfortunately, Tankersley's paper proposes, but by no means demonstrates, that the relationship between thickness and raw material/technology occurs, and the proposition is weakened on several counts, not least that the site (Williamson) in Tankersley's sample with the most raw material variability is not the one with the greatest variation in point thickness (see Tankersley 1994:Tables 2 and 10). Still, the proposition makes intuitive sense, so it is appropriate to ask, is there such variation in the thickness of fluted points in the TCFPS sample, and can that variation be correlated with raw material types?

A histogram of the distribution of fluted point *maximum thickness* reveals a bimodality in the TCFPS sample: one mode centers around 0.63 cm, the other around 0.81 cm. Obviously, if Tankersley's supposition is correct, then that bimodality ought to represent two distinct lithic raw material subgroups within the sample. Our data do not support this, however. These two modes do not correspond with raw material types. Instead, the *maximum thickness* of points made of Edwards chert and Alibates agatized dolomite is quite similar (average thickness for Edwards points [n=86] is 0.742 cm; average thickness for Alibates points [n=22] is 0.756 cm), and statistically indistinguishable (t-value = -.35, significance = .727). While Tankersley's proposition is not supported by this particular data set, there is always the possibility that raw material differences might emerge in the use of other, more contrasting lithic raw materials than Edwards and Alibates: it would be useful, therefore, to compare points made of, say, Edwards, and those made of Dakota quartzite, but unfortunately, sample sizes of quartzite and other non-chert materials in the TCFPS are currently too small to make statistically meaningful comparisons. Thus, it remains to be demonstrated that fluted point thickness varies with raw material type (see also the comments in Amick 1995:34).

As to what does explain the observed variation and bimodality in fluted point thickness, we explored whether it might sort by region, reworking, and many other possibilities, ultimately concluding that point thickness appears to sort by *breakage* types. Specifically, whole points tend to be significantly thicker than points that have snapped in half: the average *thickness* for whole points (n=135) is 0.752 cm; the average *thickness* for laterally snapped point bases (n=42) is 0.654 cm; the two means are significantly different (t-value = 3.72, significance = .000). That, of course, brings us back to the observation earlier made that the spot of *maximum thickness* generally occurs on the blade beyond the haft. Since lateral snaps usually occur along the upper edge of the haft (also Meltzer 1987:49), that effectively removes the thickest portions of the point, and thus gives us the observed bimodality. In effect, then, it does not appear there is any significant variation in fluted point thickness, at least none that is not explained by the overall size of the points in the TCFPS sample.

The fact that reworking was generally done outside the haft helps explain the relatively higher kurtosis values for variables within the haft area, such as *flute thickness* and *basal width*, as well as why the averages for the latter changed less than 0.2 mm between the 1986 and current samples. It is worth noting, as well, that the average value of *basal width* in the TCFPS sample is within 0.2 and 0.6 mm of the averages for 305 Clovis points from the Midwest, and 57 Clovis points from Oklahoma (see Hofman and Wyckoff 1991:30; Tankersley 1994:Table 3).

In turn, these relatively high kurtosis values suggest that since the attributes most directly associated with the haft vary the least, there was a degree of "standardization" in point manufacture. Were these artifacts all intended for use as spear points, one might suggest the standardization reflects the critical size range necessary for maximum penetrating efficiency (e.g., Sollberger 1988:2, 11). However, that argument may not hold, as many of these points (by their wear and retouch patterns, lack of impact fractures, and distinctive breakage) were almost certainly also used as hafted knives (see Meltzer 1987:46-54).

Alternatively, the standardization may reflect hafting demands, and those required of maintaining composite (tool, haft, and foreshaft) artifacts (for a further discussion along these lines, see Bleed [1986]). Judge (1973), and others (e.g., Amick 1995; Keeley 1982; Meltzer 1987:56; Odell 1994:54-55; Shott 1986:43) have inferred that hafted tools were made to fit their hafts, and not vice versa, and that the hafts themselves were maintained and curated through the lifetimes of several points (hence, the standardization in attributes such as *basal width*). Perhaps this implies that the raw materials for hafting (bone, wood, or ivory) were scarcer or by some other measure (perhaps the labor involved in manufacture or the scarcity of suitable materials) more "costly" than the stone to make the points. Or perhaps it indicates that stone points simply had a much shorter use life than the non-stone hafts. In any case, making a new point was likely more efficient and less costly than making a new haft, and thus the point became the most readily expendable and interchangeable part in this artifact system.

This conclusion may seem somewhat counterintuitive, given the time involved in point production, and especially the potential for failure in the very last stages of point manufacture—the fluting itself (Bradley 1993; Sollberger 1988:13). Still, Clovis fluting may have been less prone to failure than fluting the thinner Folsom points (Bradley 1993:255), although it nonetheless always involved a degree of risk of errant flutes ending in reverse hinge or step fractures that broke the preforms (Sollberger 1988:9). But stone was, relatively speaking, a reasonably inexpensive commodity, and perhaps the risks of fluting were less than they appear some 11,000 years after the fact.

The specific technological process by which Clovis fluting was accomplished—whether direct or indirect percussion, pressure, or levered pressure—is still a matter of discussion and debate (e.g., Bradley 1993; Collins 1990, unpublished; Henderson and Goode 1991; Mallouf 1989; Sollberger 1988). There is little in the TCFPS data that will resolve that issue, since it is difficult to tease technological information from morphological data on a group of finished and primarily isolated fluted points. The TCFPS data do, however, shed some light on the fluting process, at least on a statewide scale.

For one, it was a remarkably exact process. The tight distribution of *flute thickness* is evidence of that, indicating as it does that there was a narrow range of thickness tolerances, perhaps driven by the requirements of the haft. The fluting process most often involved a single flute on each face, and only occasionally multiple flutes (flutes side by side and sometimes overlapping); roughly 30 percent of the 285 points for which data are available have two or more flutes. Multiple flutes were in some cases struck to provide guide ridges for a main flute.

Basal preparation in advance of fluting is not always obvious in the finished products, especially when the base was retouched afterwards. However, it is of interest to observe that the *basal concavity* in these points is on average rather shallow (less than 3 mm), much smaller than the average for Clovis points in other parts of North America, notably in the northeast U.S. and on the northern Plains (e.g., Colby points), and considerably smaller than the average in some forms that have basal concavities upwards of 8 mm deep (Gramly 1982:Table 2; Tankersley 1994:Table 3). The depth of the *basal concavity* may be a stylistic feature and/or a technological one, and in the case of the latter may represent one (or more) of several possibilities: a by-product of pre-flute platform preparation (whether bevelling or preparation of nipple platforms) and platform remodeling (e.g., Sollberger 1988:12); the result of fluting; or a consequence of post-fluting trimming and retouch (possibly by pressure flaking) (Collins 1990:74). One fact seems clear: the depth of the *basal concavity* is unrelated to *flute length* (rp = -.1306, p = .145), *flute width* (rp = -.0266, p = .763), and the number of flutes, so does not appear to be a direct correlate of the fluting process itself.

Flute length, as noted, seems to scale with overall point length, but only weakly, which suggests that beyond a certain minimum length the extent of the flute did not particularly matter. In fact, while the overall range of *flute length* extends up to a maximum of 5.2 cm, that maximum value is an anomaly, much longer than the next longest flute scar (4.5 cm). Plotting the distribution of average flute lengths reveals that in the large majority (77 percent) of the cases, *flute length* falls between 1.5 and 3 cm. There was clearly little effort, at least in this sample of Clovis points, to create flutes that ran much past the haft, let alone the full length of the point, as they do in Folsom points, and in some eastern fluted styles (e.g., Barnes, Cumberland). As an aside, the empirical observation that longer flutes occur on later point styles (Sollberger 1988:11) seems correct on a continental scale, but that does not mean the reverse is true: that is, shorter flutes are not necessarily earlier. In fact, some of the later eastern varieties, like Holcombe, have short flutes (for a useful discussion of stylistic change in eastern and some western fluted points, see Deller and Ellis [1992:125-133]). Nor is it yet clear that full-length fluting can be used as a chronological marker independent of radiocarbon dating, or that *flute length* increased over time as a result of technological improvements which yielded greater hunting efficiency (Sollberger 1988:3, 7).

There is in the TCFPS sample evidence for a *regional* difference in *flute length*: points from Central Texas tend to have longer flutes than those on the High Plains (the means are 2.68 and 2.28 cm respectively, producing a t-value of 2.61, significance =.01). But as points on the High Plains also show a higher incidence of reworking (see below), often obscuring the distal portion of the flute scars (a practice that, in general, was avoided by Clovis knappers [Bradley 1993:254]), these differences in *flute length* are likely not technological or stylistic. In fact, when only whole points are considered, *flute length* does not differ between the two areas.

Clovis Life-histories

As is evident, Clovis fluted points in the TCFPS vary considerably in their condition. The numbers of whole and broken points are tallied in Table 11. The tally is obviously biased toward whole points and points in which at least a portion of the base remains. The reason for that is twofold: first, whole points are more likely to be collected and reported; and, second, only points in which the flute is visible are likely to be recognized as Clovis. There are in the TCFPS sample some 55 fluted point bases (categories 2 and 5), most of which snapped off at the haft line. Just as many distal ends were once attached to those bases, and at least some of them ought to be present in the archeological record, but if they lack any evidence of a flute their Clovis affinities might not be obvious (and as flutes tend not to extend much beyond the haft, they were likely absent on many of those distal ends).

The frequency of whole points is actually higher than it appears in Table 11, for several of the other categories (4, 6 and 7) are points that are virtually intact, and have only minor breaks that likely took place *after* the points had been discarded or lost (it is common for points lying on a surface, for example, to lose a tip or corner). In fact, 169 of the points in Table 11 (the sum of categories 1, 4, 6, and 7) can be counted having been discarded or lost while still essentially intact. While that is a large number for the size of the sample, it is not unexpected, given the manner in which points are recognized and collected.

Of the remainder of the points in Table 11, breakage likely took place while the points were in use; perhaps this was the reason the points were discarded. As before (cf. Meltzer 1987:Table 6), lateral snaps are the most common break in the TCFPS sample (categories 2 and 5, n = 55). For a variety of reasons (Meltzer 1987:48-49), lateral snaps may indicate points broken while being levered in the haft. That action hints at the additional use of these points as knives, a suggestion corroborated in some instances by patterns of retouch and utilization.

Reworking (categories 3 and 10) is evident on 58 of the points, and is responsible for some of the morphometric patterns seen in the sample (as just noted). Furthermore, reworked points are not distributed evenly among the regions; rather, the incidence of reworking is significantly higher than would be expected in the Plains/Panhandle region (Table 12). Lithic raw material was, of course, relatively scarce there (above, see also Johnson and Holliday 1984:67; Meltzer 1987:43), which led Paleoindians (and, for that matter, later groups) to conserve their raw material through judicious reworking and reuse of points and tools (see also Amick 1995; Hofman 1992).

Table 11. Breakage patterns for Texas Clovis fluted points (breakage patterns are unknown for 99 specimens)

Source/type	Distribution by region								Totals
	1	2	3	4	5	6	7	Unk	
1 Whole points (no breaks)	31	5	14	21	8	1	34	0	114
2 Base only (lateral snap)	19	5	4	2	2	1	15	0	48
3 Reworked (distal end)	21	5	4	1	9	0	12	0	52
4 Distal tip broken	11	1	1	5	2	1	7	0	28
5 Base only (lateral snap) with broken corners	2	0	1	0	1	0	3	0	7
6 Broken corners	2	1	3	1	2	1	7	0	17
7 Distal tip broken, broken corners	2	0	0	1	1	0	5	1	10
8 Broken base	2	0	1	1	0	0	4	0	8
9 Distal tip broken, broken base	1	2	2	1	0	0	2	0	8
10 Reworked (distal end), impact fracture	5	0	0	0	0	0	1	0	6
11 Edge damage	0	0	0	2	0	0	1	0	3
12 Failed preform	0	0	0	0	0	0	6	0	6
Total	96	19	30	35	25	4	97	1	307

Overall, reworked points tend to be the same length regardless of region and regardless of raw material type, which indicates that there may have been a threshold size beyond which a point was no longer useful in that form, and reworking ceased. There is a further, interesting pattern bearing on reworking hinted at when these data are partitioned by the major raw material types: whole and reworked points made of Edwards chert tend be slightly longer (by 0.27 cm) in Central Texas (their source areas) than on the High Plains (where they had to be imported). The difference is not statistically significant. And yet whole and reworked points of Alibates and Tecovas also tend to be slightly longer (this time, by 1.32 cm) in Central Texas and not the Plains, where the raw material occurs. Again, the difference is not statistically significant, and the sample sizes make any conclusions premature (there are 16 points for which data are available). Still, these data raise the possibility that reworking of Alibates and Tecovas was more extensive on the High Plains where the distance (in time and space) to stone sources enhanced efforts to prolong point use-life through resharpening and reworking; reworking was less extensive in Central Texas where there was an ample supply of raw material to replace the points long before they reached the threshold beyond which they were unusable or exhausted.

Impact fractures (n = 6) remain extremely rare in Texas Clovis fluted points, and occur mostly (5/6) on points from the Plains/Panhandle. Whether that regional difference bespeaks different uses of the points is uncertain, especially given the small sample size, and the fact that reworking may have masked impact fractures that were once on other points. Reworked points, as noted earlier, are shorter and narrower than whole points, but whether some of those represent impact damaged-projectiles that

Table 12. Whole point (categories 1, 4, 6 and 7) versus reworked points (categories 3 and 10), by region.

	Number by region[1]							
Condition	1	2	3	4	5	6	7	Totals
Whole points	46	7	18	28	13	3	54	169
Adjusted residuals	-2.57	-1.34	.80	2.89	-1.78	1.01	1.56	
Reworked points	26	5	4	1	9	0	12	57
Adjusted residuals	2.57	1.34	-.80	-2.89	1.78	-1.01	-1.56	
Totals	72	12	22	29	22	3	66	226

[1] Region designations follow Table 3
Chi square = 19.73, df = 6, significant at .00309

were repaired, as opposed to points that were simply resharpened, is unknown. Taking this low figure at face value, however, does highlight the contrast between Clovis and later Paleoindian assemblages, especially those from Plains bison kills, in which impact features are common damage on points used to bring down large game. The low incidence of impact fractures in this large sample of Clovis points, including the one from the Murphey site apparently associated with mastodon remains (Story 1990:185), raises the question of whether these points were regularly used as the tips of spears (also Meltzer 1987:50-51).

Preforms (broken and whole) are equally rare in the TCFPS sample (n = 6), although this is partly a definitional matter: only later stage preforms in which the flute was present (and hence recognizable as Clovis) were recorded in the survey. Earlier stage preforms and reduction debris are present at a few sites in Texas, notably Aubrey (Ferring, personal communication, 1995), Kincaid Shelter (Collins et al. 1989), Spring Lake (Takac 1991), and Yellow Hawk (Mallouf 1989), and ultimately it is this evidence that will yield the most precise information on Clovis technology.

SUMMARY AND CONCLUSIONS

The salient facts that emerge from this update of the TCFPS are as follows: the sample (n = 406) is now nearly double what it was originally, and in most respects is a representative one. The sample is not biased by modern population density, and its statistical similarity to the original data set suggests it provides a valid profile of Texas Clovis material (with exceptions as noted).

In this updated sample, points were added to 33 counties where Clovis records had not previously been reported, raising the total number of Texas counties with Clovis points to 128. The vast majority of counties have less than two Clovis points, though a few (Crosby, Gaines, and Jefferson), have more than 10. The average density of Clovis points by region is 15 per 10,000 square miles, although some regions (such as the Trans-Pecos) have far lower densities, while in other regions (the Coast) the densities are much greater.

These patterns are also reflected in finer-grained statewide maps, which also show a considerable density of Clovis material on the High Plains and on a crescent-shaped arc through Central Texas, but lower densities in East Texas, and a near absence of Clovis material on the Lower Plains. In some areas (such as the Trans-Pecos, Central Texas, and the High Plains), those patterns may accurately represent the relative intensity of Clovis land use. In other areas, the patterns may be skewed by geological processes which either mask Clovis age surfaces and remains (the Lower Plains), or prevent us from understanding the context from which Clovis remains are derived (McFaddin Beach on the Coast).

One pattern does seem clear, which is that the Clovis distribution is not coincident with the distribution of later Paleoindian remains (including Folsom), except at a very coarse spatial scale. This contrast may imply differences in land use strategies, and is in keeping with independent evidence that the adaptations of Clovis groups may be quite different than those of the Paleoindians who followed.

A further expression of Clovis land use patterns is in the context in which Clovis materials occur. Most are found within surface scatters of material of later age; the remainder occur as true isolates; only a few occur in discrete Clovis sites. Such patterns, which to a degree vary by region, bespeak adaptations which did not always involve the redundant use of space, except perhaps in those instances where fixed, point resources occur, such as freshwater springs on the Plains or chert in Central Texas.

The majority of Texas Clovis fluted points are made of Edwards Group chert from Central Texas; a significant minority are fashioned of Alibates agatized dolomite and Tecovas jasper from the High Plains/Panhandle region; a few specimens are made of Dakota quartzite; individual points occur on a sprinkling of rare materials. There are regional differences in raw material use: Edwards cherts are common throughout the state, while the High Plains raw materials tend to drop off sharply in frequency moving east off the Plains, though stone from these same sources was routinely carried north on the Plains. Such patterns, and the extreme scarcity of material such as obsidian, reveal something of the scale and direction of Clovis settlement mobility.

Texas Clovis fluted points are generally 6 cm long, around 2.5 cm wide, are less than a cm thick, taper in both plan and longitudinal section, were fluted only once on each face, and generally were fluted only within the haft area (as defined by the extent of lateral grinding). As a group, however, they also vary in their morphology and along certain dimensions (notably *length* and *thickness*), but that variation is attributable to reworking and breakage, and not raw material differences or technological strategies. In contrast, other dimensions of the points, such as *basal width* and *fluting thickness*, are tightly constrained, indicating considerable standardization in the manufacture of these points. That standardization appears to be related to the demands of fitting the points to pre-existing hafts.

Reworking of these points generally took place while the points were still in the haft, and one of the most common breakage patterns (lateral snaps) also occurred while the points were in their hafts. Reworking and breakage patterns varied by region, with point attrition being especially pronounced on the Plains, where raw material was scarcest and where, perhaps not coincidentally, the few points with impact fractures were mostly recovered. Patterns in the use, reworking, and breakage of these points generally suggest they were multifunctional: not simply projectile points, but hafted knives as well.

In the end, much as there is to gain from this enhanced sample of 406 fluted points, we can only surmise that even more information will come as additional records of Texas Clovis are compiled. Certainly, more is still needed. We should continue to seek more (and more precise) data on Clovis occurrences; greater information on the paleoenvironmental stage which Clovis groups inhabited; data on raw material use and the context in which these points are found; and information on the technology, form, and function of these points.

We have little doubt that additional records will be forthcoming, since we believe that the current tally remains just a sample (of size yet unknown) of the Clovis fluted points of Texas. More will surely be recorded in collections yet undocumented, sites still uninvestigated, and regions now but lightly examined. As these new data emerge, they warrant careful investigation and documentation, for they continue to provide important insights into the adaptive strategies of the first hunter-gatherers of Texas.

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