A New Try at Dating and Characterizing Holocene Climates, as Well as Archeological Periods, on the Eastern Edwards Plateau[1]

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ABSTRACT

This paper helps redefine the Holocene climate of the eastern Edwards Plateau and dates its changes with radiocarbon assays only of charcoal. Age determinations are largely from the Jonas Terrace site (41ME29) of Medina County and stream deposits from the Fort Hood Military Reservation. No Hypsithermal climate obviously affected the Edwards Plateau, although a dry, Late Holocene Edwards Interval peaked forcefully around 1900 B.C. (all dates calibrated). Three principal Archaic archeological periods are redefined as to cultural content, and also in terms of major climatic events. The Early and Middle Archaic periods are set backward in time, the former beginning about 6500 B.C. and the latter around 3600 B.C. The Late Archaic period, which commences with the onset of the Edwards climatic interval, began at 2300 B.C. and was arid in its earliest days. It may have seen a spread of xerophytic plants in the Plateau's uplands and did witness the creation of many burned-rock middens largely from baking those and other plants in stone-lined pits and basins. The creation of rock middens is surely unconnected with the cooking or leaching of acorns, in spite of claims. Foreign influences are mentioned, in different periods, that come ultimately from the Plains and Eastern Woodlands.

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CLIMATES AND ARCHEOLOGICAL REMAINS

In most syntheses of regions, it is customary to see natural and archeological materials treated as quite separate topics. Those expositions are seldom meshed and melded to present a single picture based on local flora, paleoclimates, and so forth. Here, at least I try to do just that, and sketch out a unitary history of the eastern Edwards Plateau to which assorted disciplines offer information in one way or another. Findings made at the Jonas Terrace site (41ME29) contribute to that general history, and even make timely its rewriting and restructuring.

This paper does two tolerably specific things: it refines the definition of Holocene climates for the Edwards Plateau east of 99° 30' West longitude and sanitizes their dating, and also refines and re-periodizes the regional Archaic and Post-Archaic cultures. The idea behind choosing the indicated meridian is to separate (somewhat arbitrarily) the western and drier part of the Plateau from the moister eastern section (Figure 1), so that the latter can be considered separately. On the Edwards Plateau, Holocene climates of different periods furnished occasionally dissimilar environmental stages upon which aboriginal populations performed their social and economic dramas. Because aboriginal culture is molded to climate at least in part, the two are worth summarizing together. Although all the information which follows applies to the Plateau in one way or another, some of it is from the adjacent Blackland Prairie or Coastal Plain south of the Plateau's escarpment, while other useful data come from more distant places. The possible seasonal movement of some aboriginal groups between the Plateau and its attached lowlands makes the latter important.

Central Texas, particularly the eastern Edwards Plateau, is a transitional region of subtropical, subhumid climate that can easily swing to dry extremes. Average annual precipitation on the eastern half of the Plateau, for 1951-1980, ranged from 32 inches in the east to 26 inches in the west; and average annual temperatures varied from 67° F in the south of the eastern Plateau to 65° F in the north (Larkin and Bomar 1983:2, 18, 50). Also, the region is a biological transition zone, not a biotic province, and is made up of juniper and live oak savannas lying west of the Eastern Woodlands (though sundered from them by the narrow Blackland Prairie) and east of grasslands or desert scrublands.

Furthermore, the Plateau lies just south and southeast of the American Great Plains. It is striking and significant that two-thirds of the terrestrial vertebrates of central Texas are at the edge of their range (Gehlbach 1991). Given the transitional nature of the eastern Edwards Plateau, one would predict certain vegetational and faunal changes in the region throughout the Holocene, as climate varied somewhat from one subperiod to another. Nonetheless, the Post-Glacial climatic norm, once established, has been (and is) mesic and subhumid, with only occasional major lapses into drier conditions. Past shifts in the Plateau's climate and natural environment, whether gradual or sudden, must not be overstated.

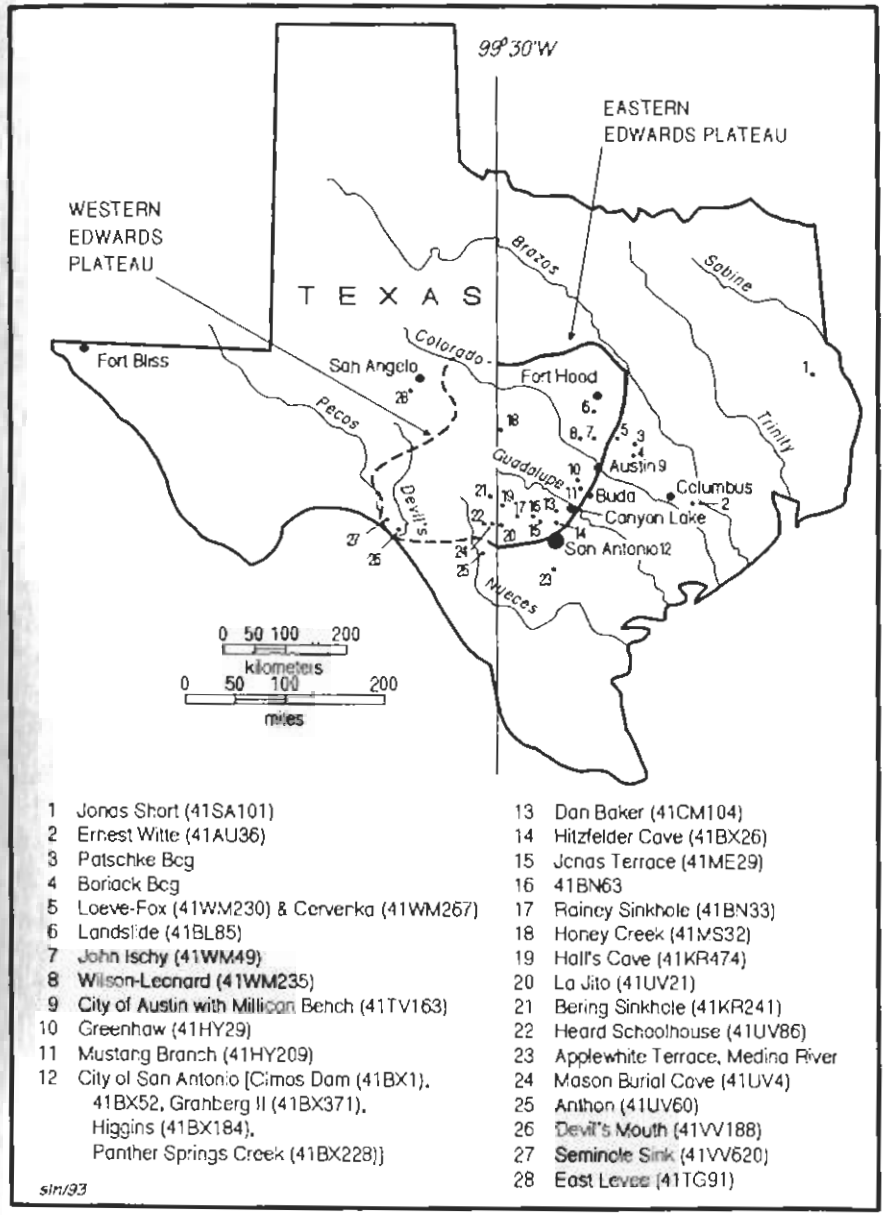

Figure 1. Map of Texas showing the eastern Edwards Plateau (bounded by heavy lines) as well as major archeological sites and other localities mentioned in the text.

On the left-hand side of Figure 2 is a graph that represents the Holocene climate for the central part of Texas, which has the Plateau at its center, from 7000 B.C.[2] onwards. The chart mainly shows a very slow and slight increase in temperature and associated dryness, although the Holocene is punctuated by a few major long-term weather changes.[3] On the chart, the nature of temperature and moisture changes is fixed more securely than previously, because of what has been learned in the last decade or so from so-termed geomorphological studies (e.g., Cowhouse Creek at Fort Hood [Nordt 1992, 1993]), as well as from a consideration of vertebrate fossils (e.g., from Hall's Cave [Toomey 1993]) and fossil pollen (e.g., from Patschke Bog [Camper 1991]).

Compared to what was accomplished before, it is now possible to make considerable improvements in dating climatic events. This has largely been done by selecting for use nearly 50 wood-charcoal radiocarbon assays mostly from joint archeological and "geomorphic" contexts, and by calibrating those dates using tree-ring corrections (Tables 1 and 2). The principal assays are for material collected from the terrace of San Geronimo Creek (at site 41ME29),[4] northwest of San Antonio, and from the streams of Fort Hood;[5] depositional and erosional events in the two areas can be correlated.

Regrettably, no other suitably precise and long series of geomorphic charcoal dates exists for the area of study. A quite long sequence has been reported by Blum (1992) for the Colorado River, but its radiocarbon ages fail to date contacts between sedimentary members at all well. I have mainly, but not exclusively, consulted age results from charcoal found in place in aboriginal hearths or middens, on or within terraces; solitary fragments of wood charcoal occurring loose in sediments are less reliable for dating stratigraphic members, since their origin can be ambiguous. This is not to say that humate dates should be employed in their stead when one has a choice between radiocarbon assays for the two materials.

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[2] All dates used here are true calendric ages, so far as they can be estimated from radiocarbon assays or calculated by counting ice varves—including dates that originally appeared in other publications. Ages produced by the radiocarbon dating technique have been calibrated via Stuiver and Reimer (1993).

[3] This progressive change toward aridity is not reflected in the new temperature chart for the Summit ice core of Greenland (Dansgaard et al. 1993:Figure 1) or in the Vostok ice column from eastern Antarctica (Dansgaard et al. 1993:note 5); both indicate an opposite but minor cooling trend over the last ten millennia that should generalize to large parts of the planet.

[4] Twelve charcoal assays, with tree-ring calibrations, come from the present Jonas Terrace site, and helped date the present climatic and archeological chart (Table 1).

[5] Nordt (1992:Appendix J) describes, among others, 34 radiocarbon ages corrected for $\delta^{13}C$ that are used to date the present chart; he provides their provenience and sedimentary context. The results of Nordt's assays have here been calibrated with tree-ring data in Table 2.

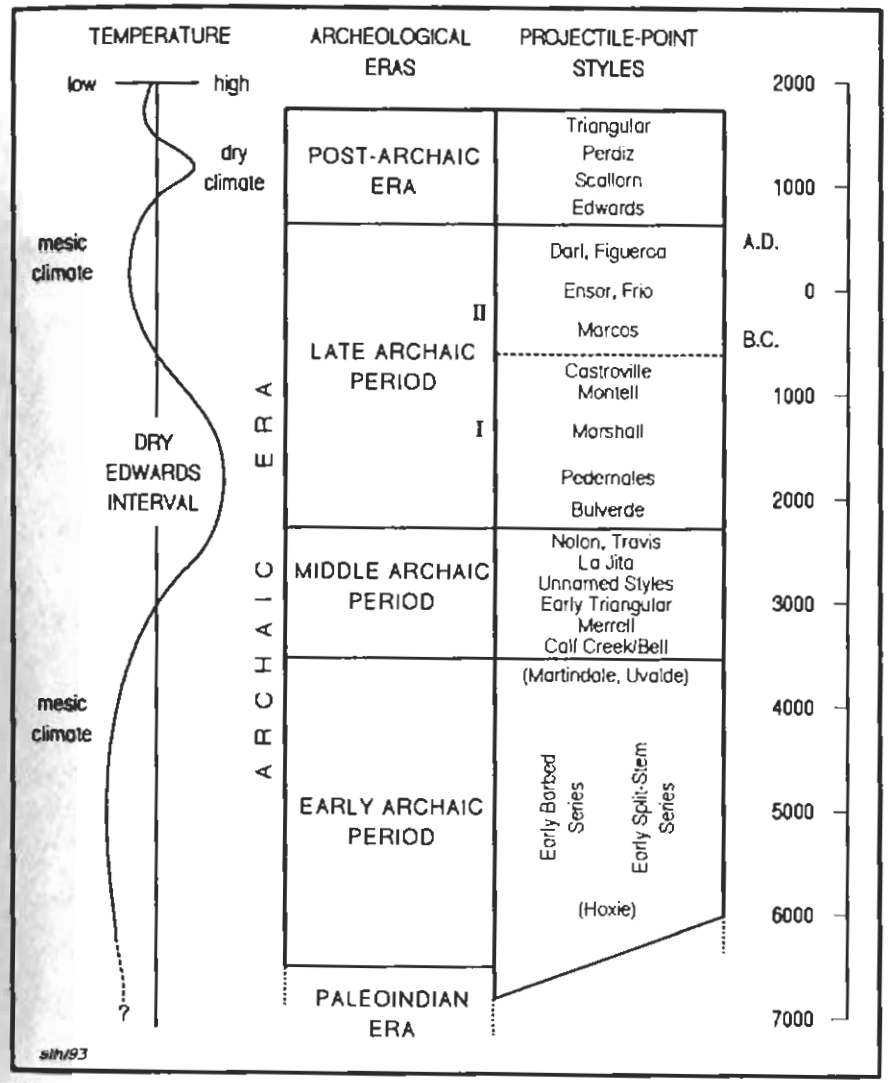

Figure 2. Chart of Holocene temperature fluctuations, archeological eras and periods, and marker projectile point styles. Calendric dates from calibrated radiocarbon assays of charcoal.

As things have turned out, attempts by geographers studying landforms to use bulk humate assays of soil carbon in order to date periods of soil formation (and, by inference, resident but earlier depositional members and associated climates) are often wrong or ambiguous; the dates are too old. Generally speaking, soil dates should be more recent than the depositional age of the sediments in which they form, except in the case of slowly building deposits where soils

Table 1

Radiocarbon Assays of Charcoal from The Jonas Terrace Site, 41ME29

Date No.	Assay No. & Context	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
1	Beta-62340 (standard assay) Stratum 6	4480±80 (4490±80 uncorrected) $\delta^{13}C$ = -25.8‰	3330-3150 BC 3140-3040 BC	.65 .35
2	Beta-62343/ CAMS-6503 (AMS assay) Stratum 6	4370±90	3100-2890 BC	.94
3	Beta-62341/ CAMS-6501 (AMS assay) Stratum 6	4180±60	2820-2660 BC	.89
4	Beta-62347/ CAMS-6506 (AMS assay) Stratum 5	3870±60	2450-2280 BC	.95
5	Beta-62348/ CAMS-6507 (AMS assay) Stratum 4	3140±80	1510-1310 BC	1.00
6	Beta-62349/ CAMS-6508 (AMS assay) Stratum 4	2600±70	830-760 BC 640-550 BC	.51 .38
7	Beta-62338 (standard assay) Stratum 4	2570±60 (2580±60 uncorrected) $\delta^{13}C$ = -25.8‰	810-760 BC 680-550 BC	.37 .63

Table 1 (Continued)

Date No.	Assay No. & Context	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
8	Beta-62342/ CAMS-6502 (AMS assay) Stratum 4	2400±70	760-690 BC 540-390 BC	.26 .74
9	Beta-62346/ CAMS-6505 (AMS assay) Stratum 4	2420±60	750-690 BC 540-400 BC	.26 .74
10	Beta-62339/ ETH-10478 (AMS assay) Stratum 4	1295±55 [This assay comes from a late occupation atop the exposed surface of the burned rock mound (Stratum 4)]	AD 670-780	1.00
11	Beta-11250 (standard assay) Stratum 2	1830±110 (1860±110 uncorrected) avg. $\delta^{13}C$ =-26.7 ‰*	AD 80-340	1.00
12	Beta-26345/ CAMS-6504 (AMS assay) Stratum 2	1430±60	AD 590-670	.92

*Average of $\delta^{13}C$ values for 11 pieces of wood charcoal from the site (various proveniences).

develop during aggradation. Further, it is understood that humate dates for bulk soil samples in fact produce mean-residence ages, since both recent and more ancient *in situ* humates are mixed in soils. Archeologists sometimes try to correct mean-residence dates by correlating a number of them with the results of wood-charcoal assays, although the results are usually imprecise and hard to justify using.

Table 2

Radiocarbon Assays of Charcoal from Various Streams, Fort Hood (Nordt 1992:Appendix J)[a]

Date No.	Assay No. & Context[b]	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
1	GX-15762 (AMS assay) Str. Unit B Table Rock Creek hearth charcoal	8260±100	7420-7240 BC	.65
2	GX-15760 (AMS assay) Str. Unit C Leon River hearth charcoal	8616±92 [rejected as too old]	7700-7530 BC	.86
3	Beta-37618 (standard assay) Str. Unit C Cowhouse Creek dispersed charcoal	6850±90	5760-5600 BC	1.00
4	GX-15892 (AMS assay) Str. Unit C Cowhouse Creek midden charcoal	5740±300	4940-4320 BC	.97
5	Beta-37452 (standard assay) Str. Unit C Cowhouse Creek hearth charcoal	5210±230	4250-3790 BC	.95

Table 2 (Continued)

Date No.	Assay No. & Context[b]	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
6	Beta-38179 (standard assay) Str. Unit C Table Rock Creek hearth charcoal	4840±70	3700-3620 BC 3590-3530 BC	.60 .40
7	Tx-6696 (standard assay) Str. Unit C Table Rock Creek hearth charcoal (duplicate assay for No. 6)	4680±90	3530-3350 BC	.84
8	Tx-6705 (standard assay) Str. Unit D1 Cowhouse Creek dispersed charcoal	4170±100	2830-2620 BC	.84
9	Tx-6704 (standard assay) Str. Unit D1 Cowhouse Creek dispersed charcoal	3950±290	2780-2120 BC	.86

Table 2 (Continued)

Date No.	Assay No. & Context[b]	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
10	Tx-6703 (standard assay) Str. Unit D1 Cowhouse Creek hearth charcoal	3010±110	1390-1110 BC	.97
11	Beta-38173 (standard assay) Str. Unit D2 Cowhouse Creek dispersed charcoal	2860±50	1064-927 BC	.94
12	Beta-37451 (standard assay) Str. Unit D1 Cowhouse Creek hearth charcoal	2720±110	1010-790 BC	1.00
13	Tx-6702 (standard assay) Str. Unit D2 Cowhouse Creek dispersed charcoal	2380±150	760-620 BC 610-360 BC	.33 .63
14	GX-15794 (AMS assay) Str. Unit D2 Leon River hearth charcoal	1936±51	AD 20-130	1.00
15	Beta-37156 (standard assay) Str. Unit D2 Cowhouse Creek hearth charcoal	1820±80	AD 120-260	.77

Table 2 (Continued)

Date No.	Assay No. & Context[b]	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
16	Beta-37450 (standard assay) Str. Unit D2 Cowhouse Creek hearth charcoal	1690±90	AD 240-450	1.00
17	Beta-38174 (standard assay) Str. Unit D2 Cowhouse Creek dispersed charcoal	1500±60	AD 530-640	1.00
18	Beta-37011 (standard assay) Str. Unit D2 Henson Creek hearth charcoal	1300±80	AD 660-810	1.00
19	Tx-6698 (standard assay) Str. Unit D2 Table Rock Creek midden charcoal	1250±110	AD 680-890	1.00
20	GX-15761 (AMS assay) Str. Unit D2 Owl Creek hearth charcoal	890±51	AD 1050-1090 AD 1150-1220	.29 .56
21	Beta-37016 (standard assay) Str. Unit D2 Owl Creek dispersed charcoal	750±80	AD 1210-1310	.89

Table 2 (Continued)

Date No.	Assay No. & Context[b]	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
22	Beta-37021 (standard assay) Str. Unit D2 Reese Creek hearth charcoal	650±90	AD 1290-1400	1.00
23	Tx-6701 (standard assay) Str. Unit D2 Cowhouse Creek hearth charcoal	650±160	AD 1210-1450	1.00
24	Tx-6700 (standard assay) Str. Unit D2 Cowhouse Creek hearth charcoal	600±140	AD 1270-1460	1.00
25	Beta-37448 (standard assay) Str. Unit E Table Rock Creek dispersed charcoal	710±260	AD 1020-1460	1.00
26	Beta-38695 (standard assay) Str. Unit E Leon River midden charcoal	610±50	AD 1307-1360 AD 1379-1400	.72 .28

Table 2 (Continued)

Date No.	Assay No. & Context[b]	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
27	Beta-37023 (standard assay) Str. Unit E Table Rock Creek dispersed charcoal	480±80	AD 1390-1501	.91
28	Beta-37009 (standard assay) Str. Unit E Henson Creek dispersed charcoal	420±70	AD 1430-1520 AD 1580-1620	.73 .27
29	Beta-38177 (standard assay) Str. Unit E Cowhouse Creek wood	390±60	AD 1450-1520 AD 1570-1630	.56 .44
30	Tx-6699 (standard assay) Str. Unit E Cowhouse Creek dispersed charcoal	370±180	AD 1400-1680	.88
31	Beta-37449 (standard assay) Str. Unit E Owl Creek dispersed charcoal	330±80	AD 1490-1650	1.00

Table 2 (Continued)

Date No.	Assay No. & Context[b]	Corrected Age before 1950	Calibrated Age (20-yr. scale)	Area of 68% Range ≥.20
32	Tx-6697 (standard assay) Str. Unit E Cowhouse Creek dispersed charcoal	300±100	AD 1470-1670	.91
33	Beta-37008 (standard assay) Str. Unit E Cowhouse Creek hearth charcoal	190±90	AD 1650-1710 AD 1720-1820	.26 .47
34	Beta-37020 (standard assay) Str. Unit E Reese Creek dispersed charcoal	130±60	AD 1680-1750 AD 1810-1890	.41 .47

[a] GX=Geochron Laboratories; Beta=Beta Analytic, Inc; and Tx=University of Texas Radiocarbon Laboratory

[b] B=Georgetown Alluvium; C=Fort Hood Alluvium; D1=Lower West Range Alluvium; D2=Upper West Range Alluvium; and E=Ford Alluvium

The point to be made here, however, is that intrusive dead carbon can become incorporated in developing soils, and this carbon does not derive from locally decomposing organic matter which contributes to the true average residence age of humates. When ancient, dead carbon from upland areas or elsewhere is added to humates that developed in place, it causes the results of soil radiocarbon assays to be too old (Nordt 1992:9). Recent studies for Fort Hood (Nordt 1992) and Buda (Abbott 1993) compare humate and charcoal assays from similar contexts, proving that humate assays, especially on or near the Edwards

Plateau, produce ages that can be centuries or millennia too ancient for the soils they are supposed to date. It is also true that sediment dates from colloidal carbon attached mainly to clays can run older than the true age of deposition. Charcoal of known origin is the key to the successful dating of sediments, at least when one can reasonably infer that it is contemporaneous with the enclosing deposits.

A few words are in order concerning the correlation of strata or unconformities at the Jonas Terrace site, 41ME29, with similar stratigraphic members defined for the Fort Hood Military Reservation (Figure 3). This correlation is the underpinning of events depicted and dated in Figure 2. Alluvial Stratum 6 of 41ME29 correlates with Fort Hood's alluvial Member C quite nicely, and the beginnings of each may date to around 6000 or 5900 B.C. Both of these deep strata were truncated by erosion, according to the radiocarbon assays, between about 2700 and 2500 B.C., marking a very dry period when floodplain aggradation stopped everywhere for a shorter or longer period.

During this period of surface stability, man-made detritus and colluvium accumulated slowly to create Strata 5 and 4 at the Jonas Terrace site, during an interval of almost 1,700 years. At Ford Hood, certain streams likewise failed to build fluvial overbank deposits during the same period, whereas other streams recommenced floodplain aggradation quickly, maybe around 2600 or 2500 B.C. This created alluvial (or outwash-fan) Member D1 at Fort Hood, which correlates in time with Strata 5 and 4 of the Jonas Terrace site on San Geronimo Creek. The growth of Stratum 4 and Member D1 ceased about 600 or 500 B.C., according to the charcoal dates, and shortly thereafter floodplain/terrace aggradation commenced once more, creating alluvial Stratum 3 at Jonas Terrace and alluvial Member D2 at Fort Hood.

A correlation between Jonas Terrace Strata 2-3 (probably including Stratum 1 [not shown]) and alluvial Member D2 at Fort Hood is indicated, while the widespread aggradation responsible for D2 continued presumably until about A.D. 1200 or 1250. I deem the latest radiocarbon assay for D2 (Table 2, no. 24), which is a bit more modern than A.D. 1300, to be too recent since deposition of overlying alluvial Member E had apparently commenced by that date. Before that time, in any case, a long period of alluviation had created Member D2 at Fort Hood, as well as Stratum 3 (mainly lacking human debris) and then Stratum 2 (with hearths and aboriginal artifacts) at Jonas Terrace. The sedimentary record above Stratum 2 is unclear at Jonas Terrace, because overlying deposits were damaged by agriculture and road construction. Dating to A.D. 1200 or 1250, an unconformity at Fort Hood suggests a short period of considerable aridity.

DEFINING ARCHEOLOGICAL PERIODS

On the right-hand side of Figure 2 there appears a tentative revision of the Archaic Era into periods named Early, Middle, and Late; the Paleoindian and Post-Archaic eras are also shown. My desire is to redefine the three Archaic

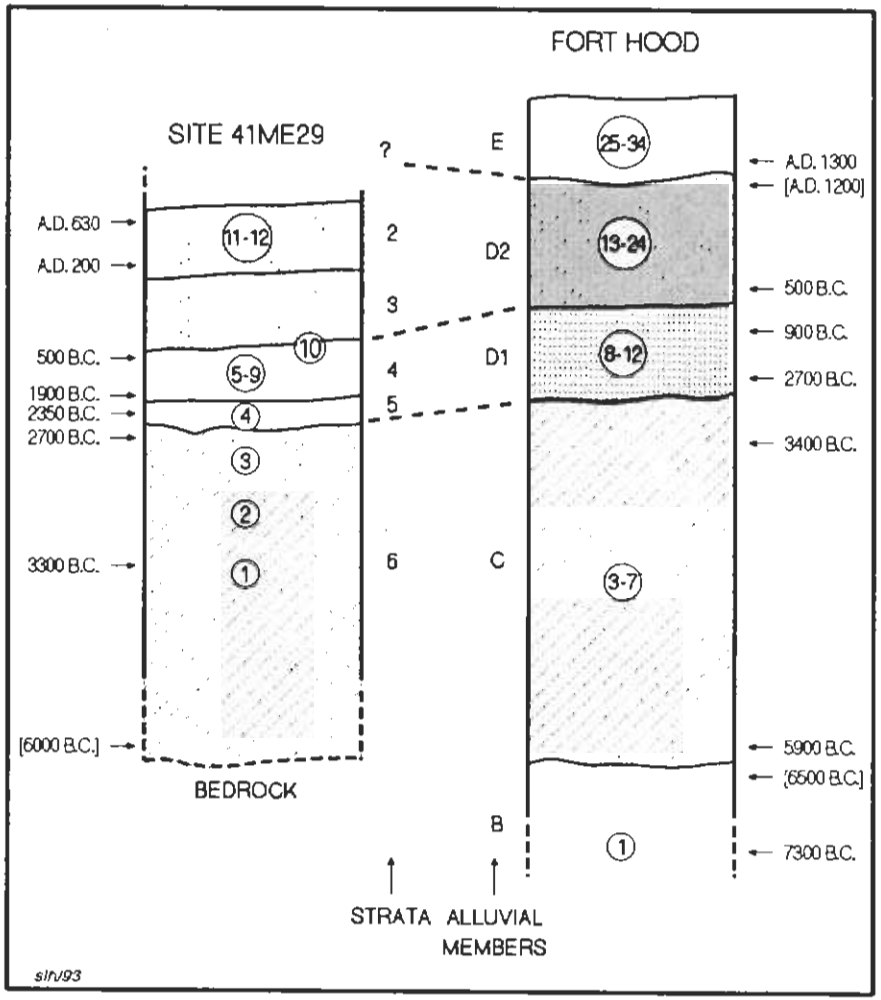

Figure 3. Idealized stratigraphic columns for site 41ME29 (left) and Fort Hood stream deposits (right). Circled numbers are radiocarbon dates identified in Table 1 (41ME29) and Table 2 (Fort Hood). Inferred dates for specific parts of stratigraphic units appear in square brackets. Columns not to scale.

periods in terms of what they reflect about gross patterns of human behavior and their changes. Everyone will surely agree that periods should correspond to the major perceived events of the past, and that periods will serve little purpose if they carve up history in an arbitrary way.

To be useful, periods should segregate time spans whose archeological content is fairly uniform. Furthermore, they ought ideally to commence with some combination of the following: the appearance in a region of new artifact

complexes, new dart-point styles, or new people; a change in economic and other behavior; a shift in the size of a region's human population; or a major climatic and vegetational change capable of affecting human life. And for major periods of the type defined below, the perceived events need to represent trends of some duration, although a period's content can vary a bit through the years.

In 1962, Dee Ann Suhm counseled a division of the Archaic Era of Canyon Lake into periods (Johnson et al. 1962), with the idea in mind of imitating temporal units defined for the Eastern Woodlands. At that time, it seemed that a few developmental parallels could be seen with the Archaic cultures of the eastern United States, where a three-part division was first proposed and used. In the Canyon Lake study, however, a fourth or Transitional period was added to the three primary Archaic divisions, since some scholars seemingly think four to be a magical number, although the extra period was never used by all scholars working in central Texas.

Then, in 1964, Lee Johnson published a three-part division of the Archaic Era for the Lower Pecos/Devil's River region, and the composition and dating of the previous periods for Canyon Lake had to be modified to bring them in line with new information about the age of Archaic materials. It was also necessary to allow for inclusion in the Archaic Era of stone tools from the Devil's Mouth site (41VV188) that preceded the misidentified and hence mislabeled "Early Archaic" (here, upper Middle Archaic) of the eastern Edwards Plateau. The curious reader may wonder why the 1962 attempt to define Archaic periods at Canyon Lake was inadequate for certain stretches of time. I can only say that it is a wonder that the results were as useful as they turned out to be, since before excavations were done at Canyon Lake not much was known about the relative ages of major dart-point styles on the Plateau, much less about their true ages. Furthermore, the writers of the Canyon Lake study were burdened by false notions about the evolution of dart point styles, and mistakenly thought that Nolan and Travis dart points, which they placed in an Early Archaic period, derived directly from Paleoindian ancestors such as Angostura points.

Before long, the 1964 revision was applied by various archeologists to eastern parts of the Edwards Plateau, since it is relatively easy to correlate the archeology of that region with the prehistory of the Lower Pecos. The first general and quite successful application was made by Sorrow et al. (1967) for Stillhouse Hollow Lake on the Lampasas River. Although several period changes and additions have been suggested (though not accepted universally) for the Archaic Era since 1964, the three major Archaic periods and their artifact content have been left largely unaltered until now. Of course, a number of tool styles have been assigned to the various Archaic periods since 1964. As said, Johnson et al. (1962:Figure 45) originally proposed a Transitional Archaic period at the end of the Archaic Era. This time unit, corresponding to the latest part of the present Late Archaic II subperiod (with small "dart" points), proved of little interest, although a number of later writers have used that period label.

Additionally, Sollberger and Hester (1972:326-327) proposed adding a transitional Pre-Archaic period following the Paleoindian Era, although the concept did not take hold. Not long afterwards, E. Mott Davis (Prewitt and Nance 1980:3-4; Prewitt 1981:68) suggested *Neoarchaic* as a period label for the Archaic-like cultures of central Texas that existed after the bow was adopted, yet lacked horticulture. However, Prewitt's (n.d.) *Post-Archaic* appellation encompasses the same cultural phenomena that characterize the variously termed Neo-American, Neoindian, Neoarchaic, or Late Prehistoric period. As a simple designation free of perhaps unwanted interpretive baggage, Post-Archaic is here preferred over the other labels.

The reader interested in general archeological syntheses of the eastern Edwards Plateau and adjacent areas is referred to papers by Dee Ann Story (1985) and Stephen L. Black (1989). Among a number of other things, their reviews treat the melancholy history of archeological research in the region and summarize a number of profusely speculative published statements by regional archeologists about aboriginal settlement patterning, prehistoric social organization, group mobility, and the establishment of group territories. The present work tries to avoid that kind of speculation, which nevertheless involves fascinating mental calisthenics.

At this point, it is appropriate to mention the publication of a number of named, supposedly sociocultural, phases for central Texas archeology by Frank Weir (1976) and Elton Prewitt (1981). Although the "phase" label was used for them, the San Geronimo, Clear Fork, Round Rock, and other phases were actually defined to function as periods within the Archaic or Post-Archaic eras (Prewitt 1981:71-74). Of course, when a named regional period is given a specific artifact content, it cannot help but function as a quasi-cultural entity.

As true phases the published units have not proven useful (Johnson 1987), since the items that are said to make them up have rarely been shown to be properly associated. And as minor periods often of uncertain content and age the named "phases" are not of outstanding utility. Johnson (1987:Tables 1 and 2) demonstrated explicitly that, all too routinely, the dated charcoal used to set the span of a particular phase (Prewitt 1985:Table 1) was not in proper association with diagnostic phase artifacts. In fact, the advice that Weir's and Prewitt's phase names be employed as appellations for regional periods (e.g., Collins et al. 1990:92) has been one source of the recent confusion in dating and characterizing the archeology of the Edwards Plateau.

Such confusion can be seen in Bement's (1991) study of Bering Sinkhole (41KR241), where phases were sometimes identified strictly on the basis of the known or suspected age of deposits, with none of the diagnostic artifacts of the phases being present. It may well be that a series of valid Archaic and Post-Archaic phases of the sociocultural sort will someday be defined for the Edwards Plateau, but that day lies beyond the horizon.

The present revision of a threefold division of the Archaic Era can provide all that is needed in the way of broadly conceived periods useful for culture-

historical descriptions and reconstructions. In any case, it is unquestionably time to reconstitute the periods of the Archaic Era for the Plateau, and overhaul their age boundaries and content. In 1964, Lee Johnson explained that his proposed Archaic periods were tentative constructs, and anticipated changes. And, for some time now, the periodization of the Archaic Era has needed reworking because events and cultural trends have been perceived that were not suspected in the 1960s.

The historical sketch outlined below partakes of general Holocene climatic and human-behavioral shifts in large parts of North America, such as population growth and the development of proficient economies, which became noticeable after mid-Holocene times. In some instances, however, the sketch recounts particular Archaic or Woodland period events in the East which have affected the Plateau, albeit weakly. In other cases, influences from the Great Plains can be detected on the Plateau, whereas in yet others the major events of the eastern Edwards Plateau are purely regional developments, as far as is known. Certainly some of the climatic episodes on the Plateau that affected aboriginal people may be regional phenomena linked to water temperature and air currents of the Gulf of Mexico, or even of the Pacific Ocean.

Sometimes it is possible to see that projectile point styles, which help characterize the Archaic periods, appeared fairly suddenly on the Edwards Plateau—particularly when new styles lack eastern Plateau antecedents either in shape or manufacturing methods. It is more difficult, however, to decide whether new styles were carried in by immigrants or merely borrowed (usually with modification) by Plateau folk from people living outside the region. Of course, it is also conceivable that certain styles may have been developed locally on the Plateau, itself, and occasionally one can choose among the three explanations. However, if innovations in dart-head style or manufacturing were made very quickly, whether by borrowing or by local invention, the chance is poor of capturing the actual developmental steps in our always gross archeological record.

The existing Early Archaic and Middle Archaic periods (as well as the versions offered here) fall much later in time than similarly named units of the Midwest and the eastern United States. For example, the Early Archaic of North Carolina (Phelps 1983:Figure 1.2), with Kirk dart points, began around 8000 or 7500 B.C., whereas the Early Archaic on the Edwards Plateau commences some 1500 years later. Thus a large part of the difference for the Plateau mirrors reality, because Archaic-type cultures developed much earlier near the eastern seaboard than in areas adjacent to the Great Plains such as the Edwards Plateau. On the Plains and some quite nearby areas, Paleoindian cultures lasted longer than in the East, and Archaic-type societies appeared mainly at the time Paleoindian culture died out. Archaic tools—numerous small bifacial knives, chipped axes and adzes, multi-purpose scrapers, abundant plant-milling implements, and barbed dart points—reflect an emphasis on a more sedentary, collecting way of life (usually with deer hunting) than do Paleoindian unifacial tools and lance-shaped dart heads (Johnson 1989b:52).

Carving up the Archaic Era

The Early Archaic Period

The Early Archaic period of the Plateau, in some places beginning around 6500 B.C. or earlier, as at the Wilson-Leonard site (41WM235), represents almost three millennia when bison were supposedly absent from the region (cf. Dillehay 1974). Unfortunately, the Early Holocene climate of the period is not yet well understood and work remains to be done in characterizing it. However, although the climate near the beginning of Holocene times was obviously warmer and drier than previously, the pollen cores from peat bogs of east-central Texas (especially Boriack [Bryant 1977; Bryant and Holloway 1985] and Patschke [Camper 1991] bogs] do not reveal vegetation noticeably more xeric than the flora of Middle Archaic days. So whatever the climate was like in the Early Archaic period, it is apparent that no long-lasting, dry Hypsithermal climate affected the eastern Edwards Plateau and the lowlands to its east (cf. Bryant and Holloway 1985:61-62), although a warm-moist Hypsithermal climate is at least possible. Evidence for a "standard" Hypsithermal Interval would require a climatic regimen drier than what went both before and *after* it. Perhaps the absence of a dry Hypsithermal is due, partly, to effects of the nearby Gulf of Mexico and its idiosyncratic temperature patterns and wind currents, or of Pacific Ocean air currents that cross Mexico to reach the Edwards Plateau.

However, the Hypsithermal-Atlantic climatic maximum correlates in time with the Early Archaic period and the first part of the Middle Archaic period of the Edwards Plateau, and in many parts of North America this warm interval was dry. In the lower U.S. Midwest and elsewhere east of the Great Plains, the Hypsithermal peak has been dated at around 5600-5000 B.C. (calibrated), and the total span of the interval stretched from about 6700 B.C. to 3300 B.C., although it is dated variously (e.g., Brown and Vierra 1983:167). However, the Summit ice core from Greenland shows little patterned temperature change within the Holocene, except for a widespread, persistent cool period around 6200 B.C.—before the peak of the North American Hypsithermal. Arctic and Antarctic air and water temperatures, as well as precipitation patterns, are important because they are often capable of mirroring planet-wide climatic trends.

Some evidence from central Texas suggests a fairly brief interval of droughts with episodes of violent flooding at the very beginning of the Early Archaic or just before that period. The question of interest is whether these should be thought of as Hypsithermal events, since they appear to be a bit too early for such a characterization.

A period of erosion and cessation of alluviation is indicated by the unconformity separating the Pleistocene Georgetown Alluvium (Member B) from the Early Holocene Fort Hood Member (C), in Bell and Coryell counties, Texas (Nordt 1992). The Georgetown Member may have stopped its growth at around 6500 B.C. or earlier (my estimate), but in any case the date is not well

fixed (see Figure 3). At the Jonas Terrace site, medium-sized gravel dating by inference to around 6000 or 5900 B.C. rests upon limestone scored by flooding perhaps some centuries earlier.[6] These data betoken large-scale but brief climate shifts during the earliest Holocene, which appear in the geologic record in a number of other areas in and near the central part of Texas.

Lee Nordt (1992:Figure 31) assumes that terrace aggradation at Fort Hood corresponding to the long Early Archaic period, as well as the first part of the Middle Archaic, may represent the "Altithermal" climatic maximum. *Altithermal* is a rather loosely used appellation in the American West for what is termed the Hypsithermal Interval elsewhere in North America; the term has been applied, however, to a number of Holocene dry periods that may be unconnected. At any rate, Nordt suspects depletion of upland vegetation at Fort Hood, but may be guilty of error or overstatement. A long period with some amount of overbank flooding and floodplain growth, often producing fine-grained sediments, indicates a fairly moist climatic regimen more often than not. A dry period, typically with periodic torrential rains but dry summers, would surely cause downcutting and erosion. Nevertheless, it is clear that some drying occurred at least in latest Early Archaic times.

Importantly, the bone study of Hall's Cave (41KR474) of Kerr County appears to support the idea of gradual drying from Late Glacial times forward (Toomey 1993:474-475; Toomey et al. 1993), and to my eyes indicates no recognizable Hypsithermal Interval capable of being separated out from the remainder of the Holocene's climatic record. However, the age of Hall's Cave is poorly known, since many of the site's eleven radiocarbon assays listed by Toomey (1993) are from unsuitable materials such as travertine and bone apatite. For that reason I decided upon a (tentative) re-dating, using only the cave's few charcoal assays and the stratigraphic position of certain Early Archaic dart heads of known age.

Whatever the case, my interpretation of Hall's Cave is as follows (Figure 4). The indicated maximum for the woodland least shrew of a mesic disposition, at a depth of 1.45 m, falls already in the earliest Holocene, since Pleistocene buffalo bones are found in the column below a depth of 1.55 m. The Holocene shift largely winnowed out a number of moisture-loving creatures: mainly the pipistrelle bat, eastern mole, woodland vole, and northern prairie vole. Then there was a period of yet-increasing dryness until 3500 B.C. that falls at the end

[6] The Chappice Lake sediments from southeastern Alberta are interesting because they indicate wild fluctuations in water levels between 6100 B.C. and 5300 B.C. (Vance and Clague 1992). At Chappice Lake, a Holocene climatic disruption, perhaps equal to that seen at Fort Hood and Jonas Terrace before 6000 B.C., was clearly followed by a long period of weather that was much warmer and drier than anything that came later. Nothing like this long Hypsithermal period at Chappice Lake is indicated on the eastern Edwards Plateau, lending support to the idea that a dry Hypsithermal climate did not affect central (and coastal) Texas.

of the Early Archaic period. The indicated calendar date is reasonably appropriate for the three terminal Early Archaic dart points, discovered between the 1.00- and 1.10-m depths (see Figure 4), of the Martindale and Uvalde styles.

It is hard to know what the desert shrew maximum at a depth of 0.80 m means, since an earlier *Notiosorex* spike correlates with the mesic least shrew maximum at 1.45 m. That ambiguity is unfortunate, since the 0.80 m depth probably falls in the climatically poorly differentiated Middle Archaic period. Because the smooth-toothed pocket gopher was still around in those days, but fell out of the stratigraphic column soon afterwards, I surmise that a drying trend merely continued during the Middle Archaic; I see no evidence for a massive Hypsithermal/Altithermal climate shift. However, at the 0.50 m depth (1500 B.C.) the indicated conditions were indeed considerably drier, for this was in the middle of the Edwards Interval recognizable at Fort Hood, the Jonas Terrace site, and elsewhere. (In no way is the Edwards Interval to be thought of as an Altithermal/Hypsithermal dry period, for it is much too recent.) The smooth-toothed pocked gopher, as well as both the woodland least shrew and the dry-environment desert shrew, were gone for the most part. It would be dimwitted to use these data to argue for a mesic Late Archaic I subperiod.

These are the trends and dates important for archeologists. But let the prehistorian beware, for in late 1993 Thomas Stafford of the University of Colorado secured scores of new (but as yet unpublished) radiocarbon assays for the Hall's Cave stratigraphic column. Series of assays were run separately for bone collagen, various kinds of soil humic matter, etc., and mainly produced much earlier dates for the site's strata (Stafford, 1993 personal communication and public lecture) than Toomey proposed or I reckoned (in my case, using three available charcoal assays and the known ages of Archaic projectile point styles). I fear that dead carbon has become incorporated in some of Stafford's dated soils, to produce ages for Hall's Cave *Archaic* strata that may be too old.

Whatever the Plateau's climate and vegetation were like in Early Archaic times, the people did their stone knapping in an Archaic as opposed to a Paleoindian mode. Their dart points largely represent two broad styles, the Early Barbed and the Early Split-Stem traditions (Prikryl 1990:51; Johnson 1991:105ff), which did not obviously develop from the region's Paleoindian points.[7] Early Barbed dart points (many of which have been called Early Corner-Notched [Hester 1971:71-73]) tend to have wide blades, as well as short and narrow stems (produced by deep basal or corner notching) and longish down-

[7] At the bottom of the Early Archaic section of Figure 2, the Hoxie point type appears in parentheses. Elton Prewitt (1994 personal communication) believes Hoxie to be an intrusive style related to Pryor Stemmed of the High Plains, which dates to the seventh millennium B.C. (Frison 1978:24, 26). Hoxie is not related to either of the two main projectile-point traditions of the Early Archaic: Early Barbed (Corner-Notched) and Early Split Stem.

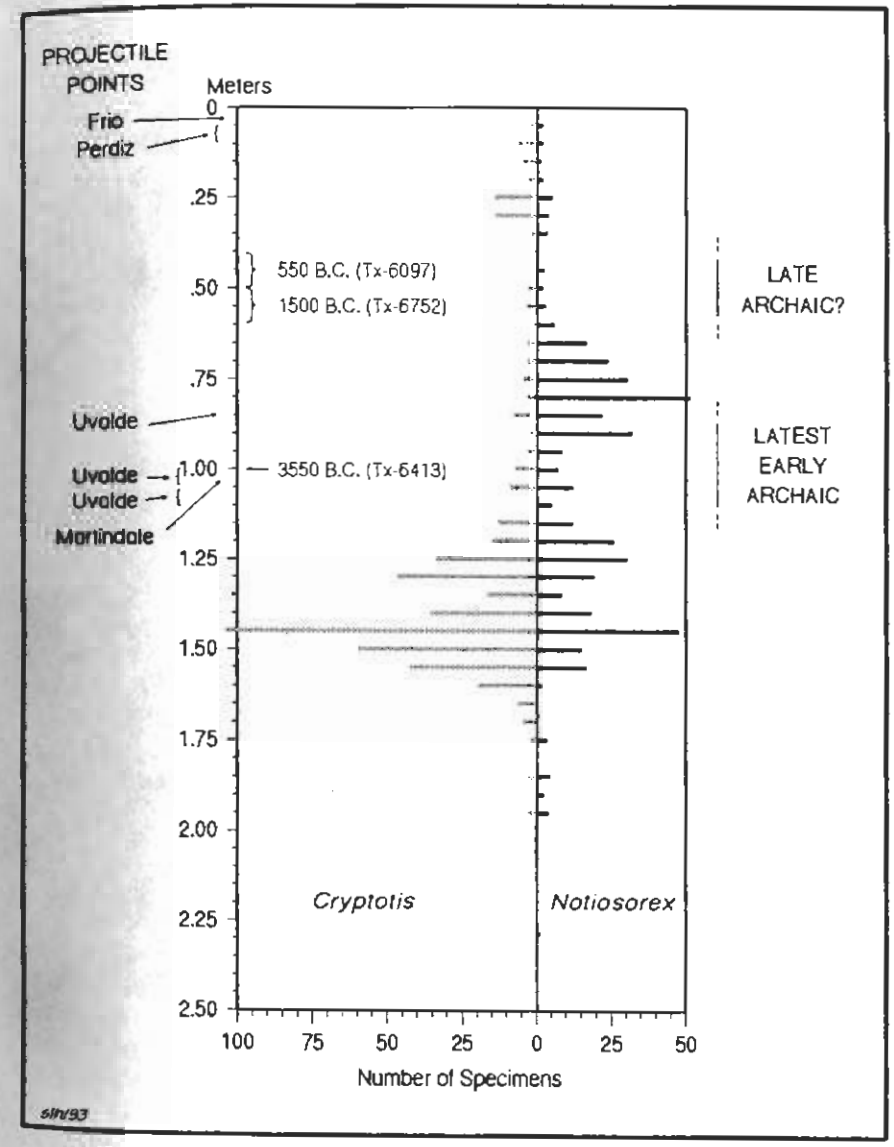

Figure 4. Graph of Composite Pit 1 of Hall's Cave, with number of specimens for the woodland least shrew (*Cryptotis*) and desert shrew (*Notiosorex*) by depth (m) (adapted from Toomey 1993:Figure 38). To the chart have been added the locations of radiocarbon dates on charcoal, as well as the locations of four early dart points and two later projectile heads. A tentative correlation of the cave's sediments with periods of the Archaic Era appears at the far right.

hanging barbs (e.g., Sorrow 1968:Figure 3m-r). Early Split-Stem dart points have a clear-cut stem with bifurcated base with a central notch or concavity, and usually exhibit very short barbs or else barbless shoulders (e.g., Johnson 1991:Figures 42-44). This almost continental style was spread far beyond the bounds of the Edwards Plateau, as in Alabama, West Virginia, and New York (Fiedel 1992:91-92) during the seventh and sixth millennia B.C. Related dart points, such as the Pinto type, were also well established in the American West (Fiedel 1992:126-129) at least by 5000 B.C.

The last Early Archaic dart points of the Edwards Plateau were arguably the Uvalde and Martindale[8] styles, as well as unnamed wide-stemmed dart heads otherwise shaped very much like Martindale points, and found at the Dan Baker site (41CM104) on the Guadalupe River of the Plateau, lying just above Early Split-Stem dart points of various sorts (Shirley Van der Veer, 1993 personal communication).

Early Archaic burials from the eastern Edwards Plateau are uncommon, and most come from Bering Sinkhole (Bement 1991) of Kerr County, on the westernmost margin of the eastern half of the Plateau. At that site, three Early Barbed dart points, as well as radiocarbon assays, help date some of the scattered human skeletal material to Early Archaic times. Significantly, a low or moderate rate of tooth-enamel hypoplasia is indicated and the caaries rate is low relative to that of later burials. Those data indicate little weaning stress and a general diet fairly low in carbohydrates, lower than for the Early Archaic desert people found at Seminole Sink in the Lower Pecos area (Turpin 1985). Moreover, ratios for stable-carbon isotopes argue for a low reliance on C_3 plants and animals consuming such vegetation; both sotol (in Texas) and acorns are classed as C_3.

The Middle Archaic Period

The short Middle Archaic period of some 1300 years commences around 3600 B.C. and can best be taken as a transitional epoch. Prikryl (1990:Figure 4) likewise begins his newly defined Middle Archaic period for north-central Texas at about that date, just before the heyday of Calf Creek dart points. Turning again to the Plateau, the first dart-point style of the Middle Archaic was probably the

[8] At the Landslide site (41BL85), Martindale points tend to occur mainly in Stratum V, deeper in the site terrace than Calf Creek/Bell specimens (Sorrow et al. 1967:Figure 72; Johnson 1991:154). At the Panther Springs Creek site (41BX228), whose stratigraphic separation of point styles is admittedly imperfect, Martindale points (which are rare) occur in Area M with Early Barbed points and below a single Calf Creek/Bell specimen (Black and McGraw 1985:Table 48), but perhaps in mixed deposits. At the Camp Pearl Wheat site (41KR243) Martindale and Uvalde dart points were found in the same isolated stratum as a Calf Creek/Bell point (Collins et al. 1990:32-34), but the stratum in question represents many years.

intrusive Calf Creek/Bell dart head. It was during the early part of the Middle Archaic period that buffalo came briefly into the region, attracting hunters probably from the Eastern Woodland's margins who introduced Calf Creek dart heads of the Bell and Andice varieties.[9]

My interpretation is that most of the Middle Archaic period was moderately moist but drying, as can be seen from the steady deposition of overbank sediments on San Geronimo Creek (at the Jonas Terrace site) and from the aggradation of stream terraces (creating alluvial Member C) at Cowhouse Creek at Fort Hood, Texas. Furthermore, at the Jonas Terrace site of upland Medina County, Middle Archaic sediments typically contained large quantities of a snail (*Oligyra orbiculata*) preferring a wooded riparian or savanna environment, which may speak for mesic weather conditions. The moist-environment snail was largely replaced in the sedimentary column at 41ME29, around 2400 or 2300 B.C. or so, by a species of snail (*Rabdotus mooreanus*) much more tolerant of open spaces and drier conditions (Johnson 1994). The Middle Archaic record of vertebrate life, if present at Hall's Cave, cannot now be isolated stratigraphically by acceptable radiocarbon assays.

My idea of a relatively mesic Middle Archaic period is somewhat at variance with Lee Nordt's interpretations about Fort Hood vegetational changes, or at least his ideas as to their magnitude (Nordt 1993:57-71). He finds a shift in $\delta^{13}C$ values for soil organics roughly between 4900 and 3800 B.C. (calibrated years), producing readings for $\delta^{13}C$ of -14.6, -14.5, -14.0, and -15.4 per mil (Trench 19, Fort Hood Member C, approximately 0.32-1.53 m in depth). He thinks that a substantial increase in the contribution of C_4 plants to the biomass is indicated, which Nordt believes is due to a decrease in trees and forbs (C_3 plants) locally, because of reduced rainfall and higher temperatures equatable with the so-called Altithermal drought.

That interpretation is partially correct, since no mesic period is indicated by the above $\delta^{13}C$ values. An *increase* in rainfall would cause an expansion of trees (with associated C_3 grasses) on the creeks' floodplains and low terraces (Gehlbach, 1994 personal communication), changing stable-carbon isotope ratios to those indicating a dominance of C_3 plants. Of course, increased moisture would also foster lush upland grasses. The point I make, however, is that Nordt may overstate the severity of the change seen in Trench 19. According to my view of depositional and isotopic data from Fort Hood, the temporary shift in the direction of C_4 plants (surely grasses) sometime between 4900 and 3800 B.C.

[9] In addition to the fact that the Calf Creek point type occurs with buffalo bones in Oklahoma (Newsletter, Oklahoma Archeological Survey 1993), such an association exists in central Texas. Feature 2 of the Landslide site (41BL85) was a stone baking heap with several bison bones and a Calf Creek/Bell dart head directly atop its rocks (Sorrow et al. 1967:41). Additionally, Feature 26 of the Cervenka site (41WM267) was an early earthen fireplace with bison bones lying on it (Peter et al. 1982:8-260 to 8-261). It may be of the same age as Feature 2 from the Landslide site.

was not the result of a major change in climate or vegetation. No clear-cut Altithermal period is represented, either in Trench 19 or elsewhere in the eastern part of central Texas (Gehlbach, 1994 personal communication). Consequently, I conclude that the Plateau's Middle Archaic climate was still somewhat mesic but gradually drying, though around 4500 B.C. or so a fairly modest shift (in a geological sense) toward temporary aridity occurred.

A gradual drift away from mesic conditions, in the Middle Archaic period, is borne out by the development, mostly at the end of that time span, of a number of burned rock middens,[10] whose presence elsewhere indicates the baking largely (but not exclusively) of upland xerophytic plants that had increased their range. According to sedimentary and snail information from the Jonas Terrace site, mentioned above, the climate in late Middle Archaic times was not nearly so dry as during the first part of the succeeding Late Archaic I subperiod. However, a steady and modest shift toward aridity could have put semi-succulents on the road to becoming a significant food source in the latter half of the Middle Archaic period, though not to the degree seen in Late Archaic days. Nevertheless, the weather shift was moderate enough not to affect the growth by flooding of headwater terraces in upland areas, at least until aggradation stopped just before the Bulverde dart point style made its appearance on the eastern Edwards Plateau.

In the eastern Plateau, scattered stands of sotol and other xerophytic plants such as yucca and nopal persist even today under reasonably mesic conditions, particularly in loose soil on southwestern slopes, and these stands could easily expand if encouraged by drought to do so. The modern distribution of sotol plants, which in the north includes parts of Bell County, is summarized usefully by Goode (1991:87). The distribution of yucca is even greater, including as it does fairly tight soils. One factor that has restricted the range of sotol plants a bit, in recent times, is their past use as cattle feed by the region's ranchers, as Ernest Wilson (1930) documented for western parts of the Edwards Plateau. In some areas of the Plateau the sotol population has been eliminated by the hand of man and the tooth of ox.

As for regional prehistory, the Middle Archaic archeology of the eastern Edwards Plateau was varied, and in one sense witnessed a transition from "antique" Early Archaic material cultures to "advanced" plant-collecting and hunting cultures of the Late Archaic period. The evidence for fairly rapid change

[10] Calling these features "burned rock middens" may be something of a misnomer (cf. Kroesen and Schneider 1991:44, note 1), although that designation is retained here. In the sense that burned rock middens are made up of rock debris from baking pits and basins, they do not constitute "kitchen middens" of quotidian domestic detritus. However, the contents of hearths and other kinds of domestic debris have been added to burned rock middens at a number of sites, contributing sometimes extraordinary amounts of typical kitchen midden garbage to the piles of burned rocks.

consists of the appearance in the region of Early Triangular dart heads[11] and the brief emergence of Merrell points (conceivably, however, of Early rather than Middle Archaic age).[12] There is also a profusion of probably Middle Archaic dart-head styles, some of which have long and narrow rectangular stems, at the Wounded Eye (41KR107) and Shep (41KR109) sites (Luke 1980), as well as Cervenka (41WM267).[13] And later within the period, the La Jita[14] dart head appears, which Glenn T. Goode believes to be of the same age as Travis and Nolan dart heads, since it shares manufacturing features with them.

In the late part of the Middle Archaic, large and narrow Nolan-Travis dart points were dominant in much of the Plateau, though local styles such as La Jita seem partly to have taken their place at the southern edge of the Plateau and just south of there. It is consequential that thick Nolan-Travis dart points, and their long and narrow predecessors with rectangular tangs (as found at the Cervenka site), portray a major stylistic and technological change in point making. Calf Creek and Early Triangular specimens, made during the first part of the Middle Archaic period, are wide-bladed and thin, and their blade surfaces were flaked partly by pressure. The large, narrow, and thick dart heads which followed them in the region could be well made (as in the case of Nolan specimens), but were often knapped crudely (as in the case of many Travis dart points). In any case, they are distinct from Early Archaic and early Middle Archaic dart-point styles.

Elton Prewitt (1993 personal communication) believes that the general style of the first Nolan and Travis points appearing in central Texas may have been borrowed from the Lower Pecos region, since beveled-stemmed and roughly similar dart heads (mostly of Pandale type) may be more ancient there. For the Lower Pecos region, calibrated dates for charcoal possibly associated (at least stratigraphically) with Pandale points or their Nolan congeners cluster between 3800 B.C. and 3100 B.C. (Turpin 1991:Table 1.1). The best radiocarbon assays

[11] At the Landslide site (41BL85), Early Triangular points/knives appear from their stratigraphic position to be of approximately the same age as Calf Creek/Bell dart heads (Sorrow et al. 1967:Figure 72). Additionally, most Early Triangular artifacts from the John Ischy site (41WM49) were found below Nolan (upper Middle Archaic) points (Sorrow 1969:Table 4-6), although the artifact count is low and perhaps unreliable. It is reasonable to conclude, provisionally, that Early Triangular artifacts are of about the same age as Calf Creek points or else slightly more modern. In so doing, the data from the Landslide site are given great importance.

[12] Dart points of the so-termed Merrell type, and specimens rather like it, occur in a mixed Early and Middle Archaic context at the site of that name (41WM2; Campbell 1948:Plate 3A, No. 9). From what we presently know about this style, it could be either Early Archaic or early Middle Archaic in age, although my preference is for the latter.

[13] For illustrations of such miscellaneous styles that are particularly clear and useful, see Peter (1982:Figure 14.1-3e, 14.1-4b, j and 14.1-5b).

[14] The La Jita type was named by T.R. Hester (1971) for a Girl Scout camp and an archeological site (41UV21) of that name. The word *lajita* is Spanish for "flagstone."

for Pandale points, however, may be Tx-2747, Tx-773, and Tx-2742 (Turpin 1991:Table 1.7), which produced calendar dates falling between 3500 and 3200 B.C. Lacking conclusive evidence, I nonetheless believe that Nolan and Travis dart heads are no earlier than 3000 B.C. on the eastern Edwards Plateau, if that ancient.

It is possible to see a redefined Middle Archaic period, generally, as one in which considerable borrowing of alien artifact styles took place. Additionally, some outlanders with new tool styles may have intruded physically onto the Plateau. In contrast, there is evidence for general stylistic continuity from one century to another throughout large parts of the preceding Early Archaic period, as said, although archeologists who think only in terms of types (rather than broader stylistic traditions) can be blind to such trends.

It is apparent to all that mixed economies characterized the Middle Archaic period. Nevertheless, toward the end of Middle Archaic days one can see evidence for the gathering of sizeable quantities of single plant resources. For instance, a number of charred acorns were found in small man-made depressions at site 41BN63 (Hester 1985), although most came from a single hollow. The man-made holes were in the surface of a clay stratum, below a Late Archaic Pedernales-Montell burned rock midden, and radiocarbon dating discloses their terminal Middle Archaic age. Furthermore, the appearance of burned rock middens points to an economic emphasis on collecting plants at appropriate seasons, in quantities, and baking them in pit ovens. The people who made and used large Nolan and Travis dart points occasionally baked (xerophytic?) plants in stone-lined ovens, causing a certain quantity of burned rock middens to accumulate.[15]

Burial practices for the Middle Archaic period are most uncertain, at least for the Edwards Plateau, itself. However, near the margin of the Plateau in Uvalde County, on the western edge of the area of interest, is Mason Burial Cave (41UV4). That deep sinkhole contained the earthly remains of 25 to 50 people and a few Travis, Nolan, and triangular dart heads (Benfer and Benfer 1962). The projectile points date at least some of the Mason Cave burials to the upper Middle Archaic period.

[15] Burned rock middens with Nolan and/or Travis dart heads are known from several locales, although at most eastern Plateau sites with rock middens, Nolan and Travis dart points are found below rock accumulations of Pedernales or Montell age. According to G.T. Goode, Nolan or Travis specimens occurred in the Archaic burned rock midden found at the Wilson-Leonard site (41WM235); in an "upper" rock pile at the Millican Bench site (41TV163) on a tributary of the Colorado River's Bull Creek, at the very edge of the Plateau (Frank A. Weir, 1993 personal communication); and within middens B, C, and G at the Greenhaw site (41HY29) on a tributary of Onion Creek, near the eastern verge of the Edwards Plateau (Weir 1979).

The Late Archaic Period

The lengthy and important Late Archaic period is divided into subperiods I and II. The entire period, however, lasted nearly three millennia and can be said to have commenced around 2300 B.C. with people who used Bulverde dart points. That style appeared immediately after the regional climate had been distressed by a sharp decrease either in yearly rainfall or in seasonal precipitation, and by an inferred rise in temperature portending the longish Late Archaic I drought to follow. The classic Bulverde type, with its abrupt pressure flaking and thin, wedge-shaped rectangular stem, may be intrusive onto the eastern Edwards Plateau, perhaps coming from the prairies of northern or northeastern Texas—the general area where Calf Creek points throve a thousand years earlier. Bulverde points were soon followed by specimens of the almost omnipresent Pedernales type.

Of the changes proposed herein, I foresee resistance most of all to the reclassification of the Bulverde and Pedernales intervals as Late Archaic. Habits have a tenacious life of their own and those intervals have been thought of as Middle Archaic for nearly 30 years, in spite of the fact that the original period assignment in the 1960s was arbitrary. In any case, I petition the reader to ponder the reasons for extending the beginning date of the Late Archaic period back in time. First, in the eastern United States a large human population and an efficient economy have long distinguished a Late Archaic period dating earlier than the Texan period of that name, and similar developments will be inferred for the eastern Edwards Plateau perhaps during Bulverde times but certainly in the Pedernales period. Second, strong continuity exists between Pedernales material culture (and economics) and later Montell implements (and subsistence practices). The Montell interval has long been classed as Late Archaic.

The reader is referred to Johnson (1994), which documents the carry over of specific facets of Pedernales dart-point manufacture and styling (most noticeably, blade shape) to later Montell specimens. (One says "dart heads" by habit, although Pedernales and Montell specimens could have been used on thrusting spears, rather than atlatl-thrown darts!) Moreover, the same large and thin billet-made knives were created both in Pedernales and Montell times. So one should not let the new stem style of Montell dart points (a combination of Plains corner notching and Plateau bifurcating) overshadow technological and stylistic continuities that link Montell with earlier point types. And equally as important as the foregoing evidence is the continuance of Pedernales-period plant baking by subsequent Montell folk, in a big way, in burned rock piles. Montell plant bakers often worked in the selfsame middens that Pedernales folk had earlier accumulated with their oven- or pit-roasting activities. Reasonably, throughout the first part of the Late Archaic period (from Pedernales through Montell days), economic and culture-historical clues point to the existence, on the eastern Plateau, of *ein Volk*.

Daniel J. Prikryl (1990:Figure 24) initiates his Late Archaic period for northern Texas at 1500 B.C.—earlier than is traditionally done in the central part of the state, but not so early as proposed here. Interestingly, Pedernales projectile heads typical of much of the early part of the Late Archaic period on the Edwards Plateau do not occur in north-central Texas. It is possible that this type, which is based on a particular kind of thinned or fluted tang with concave base, was developed locally on the Edwards Plateau from the preceding Bulverde style. For instance, specimens of an intermediate shape are illustrated by Gearhart (1987:Figure 46d-e) for Williamson County. In any eventuality, Bulverde and especially Pedernales folk (surely the same society at two different periods) lived through the peak of the dry Edwards Interval. At this stage of understanding I do not claim that the climate of the Edwards Interval can be traced northward from the Plateau. However, the warm and dry climatic period in question corresponds to a rapid rise in the Gulf's sea level, which had taken place by 2200 B.C. or so, and with a recognizable Gulf highstand (Ricklis 1993:66ff).

This adjustment in sea level may mirror hemispherical or global temperature changes, although the question has not been settled. According to sedimentary and other information from the Jonas Terrace site, the dry and hot climatic shift, though seemingly presaged by incipient weather changes in that direction during the latter part of the Middle Archaic, nonetheless struck the uplands of the Edwards Plateau a considerable blow. Evidence for some such abruptness or suddenness is seen at the Jonas Terrace site, where floodplain aggradation indicative of a relatively moist climate suddenly ceased (Johnson 1994). In Bulverde times (not long before Pedernales points appeared), aggradation of upland floodplains stopped and xerophytic plants seem to have completed their extension over parts of the Plateau, where they must have thriven, as foretold by E. Prewitt (n.d.) some years ago.

At the Jonas Terrace site, the main snail living on the terrace (*Rabdotus mooreanus*) was of a type avoiding shady areas with trees, preferring open space. However, the claim that a mesic snail (*Glyphyalinia umbilicata*) at Bering Sinkhole in Kerr County was extirpated in Late Archaic I times, indicating a dry climatic regimen, is unconvincing.[16] The absence of this snail from the pertinent cave zones is apt to be a function of small sample size, since snails of all species become rare at the indicated depths and *Glyphyalinia umbilicata* is never abundant at any level.

The Late Archaic period at Hall's Cave is not particularly easy to identify, although a segment of deposits at least 0.25 m thick are of that age, at least according to the two relevant radiocarbon assays of charcoal (see Figure 4). Neither desert shrews nor mesic least shrews were present in any numbers in

[16] See Bement (1991:80, especially Table 6) for data on the occurrence of Bering Sinkhole snails; the reader is also referred to the radiocarbon dates for that site (Bement 1991:Table 1).

Late Archaic zones, nor were vertebrates who required a mesic environment. The climate during much of Late Archaic I times must have been very dry, since the least shrew returned to Hall's Cave only later, perhaps near the end of the Late Archaic period when conditions became wetter. The deposits of Patschke Bog of Lee County are better dated for the period in question; that peat bog is situated in Post Oak savanna (with some blackjack) east of the Blackland Prairie (Camper 1991). During Early and Middle Archaic times, a rise in percentages for oak and grass pollen surely indicates progressive regional drying. However, in the Late Archaic period that followed, grass pollen was both abundant and reasonably stable in its percentages, apparently bespeaking a long period of submesic (perhaps arid) climate, with elevated temperatures and less precipitation.[17]

The end of overbank flooding and floodplain/terrace aggradation mentioned for San Geronimo Creek (at 41ME29) and Fort Hood can be seen in other localities, which deserve mention. Not too far beyond the Plateau, and about 15 miles south of San Antonio, the Medina River's Applewhite Terrace preserves a buried alluvial member which ceased aggrading during the period of concern, probably at or near the beginning of the Edwards Interval. For the Medina, I would date this cessation of flooding, which is surely a dryness indicator, to sometime between 2700 B.C. and 2300 B.C., judging from the available radiocarbon assays (Thoms and Mandel 1992).

Closer to the Gulf coast, the Columbus Bend formation of the lower Colorado River is composed of several alluvial members of interest. According to sometimes ambiguous radiocarbon assays for West Point and Columbus, Member 1 appears to have stopped its growth and become stable sometime between 3200 B.C. and 2500 B.C. (Blum 1992:156, 175-178, 189). In actuality, the indicated dry period almost certainly corresponds to the Edwards Interval.

It may be that most (but not nearly all) of the manos and metates of the Plateau, such as those found along the middle Colorado River above Austin, are of Pedernales or Montell-point age and were used in milling unknown plant parts, although manos also occur in some Nolan-Travis burned rock middens and in numbers at the Early Archaic Sleeper site (Johnson 1991). This conclusion is suggested, for example, by the apparent stratigraphic association of many milling stones with Pedernales and/or Montell projectile heads at the shallow Toungate (41TV33) burned rock site on the Colorado (Clark n.d.). Of course, locales are known that have Pedernales points but no manos whatever, indicating that special economic chores were done at different kinds of sites.

[17] For Patschke Bog, a date of approximately 2550 B.C. (SI-5232) applies to the 1.10-1.20 m depth of Core 2, while an age of about 825 B.C. (SI-5231) comes from the 0.40-0.50 m depth of the same core (Camper 1991:Table 2). Those are calibrated ages, figured with an estimated $\delta^{13}C$ value of -25.0‰; the two age calculations are from depths corresponding to high grass and oak pollen percentages, and bracket most of the Late Archaic I subperiod.

Late Archaic burned rock middens grew in many places, and are made up of heat-broken limestone rocks left over from baking yucca, sotol, various bulbs, nopal tunas, etc., in rock-lined and sometimes rock-filled pits, sizeable hearths, and basins.[18] Sotol was certainly only one of a number of plants chosen for baking and consumption. However, some piles of heat-broken baking rocks came also to serve as garbage dumps and had spent hearth rocks and kitchen midden trash added to them from time to time. Glenn T. Goode (1991:78) believes he had good evidence for the dumping of discarded hearth stones and human debris on the edge of an oven midden at the Heard Schoolhouse site (41UV86). Dumped human residue is also found in other burned rock middens (see provenience data for tools and other detritus in Peter et al. 1982:8-107 to 8-129). For that reason, a number of burned rock middens of the eastern (and western) Edwards Plateau contain quantities of animal bones, broken stone tools, and flintknapping debris.

Recently, fragments of burned sotol leaves were identified for the burned rock middens of the Jonas Terrace site and the Heard Schoolhouse site (41UV86) on the Dry Frio River (P. Dering, 1993 personal communication), and it is important to point out that the Jonas Terrace burned rock midden is not principally a dumping place. Few flint flakes or artifact parts were found among its fire-broken stones, and for that reason one can be fairly certain that the burned sotol was produced by pit (oven) baking and not dumped there with hearth debris.

Mescalero Apaches and other aborigines did similar pit baking of xerophytic plants with heated rocks thousands of years later, and their behavior in that regard is documented very well. Also recorded is their practice of drying oven-cooked plants and then making bread from them. For fairly detailed and fascinating ethnographic descriptions of rock-oven baking, the reader is directed to Castetter and Opler (1936), as well as Baschart (1960) and Wilson (1930:62-63). Additionally, Tunnell and Madrid (1990) supply interesting portrayals of the present-day baking of sotol heads within rock-lined pits in Chihuahua, as a first step in manufacturing soothingly delicious sotol liquor.

As a significant aside, the reader should consult Black et al. (1993:24-31) for a reconstruction of the way burned rock middens grew through the repetitive baking of plants in single places. The compelling argument of those writers, is that the "domed middens" of central Texas (which lack visible surface pits) are mainly rock-oven sites, nonetheless. Additionally, Black et al. (1993:29) doubt that acorns were processed in burned-rock middens:

[18] Howard (1991:59 and Table 1) lists a number of burned rock middens with baking pits or basins, most of which she calls "hearths." In addition, such baking features appear in middens, some of which are of Late Archaic age: according to G.T. Goode, at the Mustang Branch site (41HY209); at site 41BX52; at the Higgins site (41BX184; Black et al. 1993:25); and at a number of newly excavated burned rock middens at Fort Hood (J.M. Quigg, 1993 personal communication).

> Acorns, to generalize from North American ethnographic analogy, are commonly parched, leached, simmered, and baked, but none of these steps would seem to require a massive oven that holds heat for days. Therefore, to us it seems unlikely that acorns represent the major resource associated with BRMs [burned rock middens].

It is entirely sensible to believe that the development of burned rock piles had nothing to do with a California-style addiction to cooking acorn mush with hot stones, or to leaching tannic acid from acorns with heated limestone.[19] Those notions are mostly based on a partial agreement in the occurrence of oak trees and some (but not all) burned rock middens in west-central Texas. The idea that burned rock middens had to do with acorn processing is best summarized by Creel (1991). Clearly, however, the explanation of large rock piles primarily as acorn-processing features needs to be set aside pending more reasonable evidence, for the arguments that have been made are unconvincing. The mere presence of a few charred acorns in occasional burned rock accumulations is not a conclusive clue that limestone was heated principally to process those nuts. (Howard [1991:Table 8] reports charred acorns in a few sites with burned-rock middens: the Indian Creek site [no trinomial], 41UV48, 41WM53, and 41WM56.) Acorns are properly leached by being ground and having water poured through the meal, by being soaked whole in water, or by being boiled with calcium in the water.

That does not mean, however, that acorns were never dried at times on existing burned rock middens or never burned with the fuel used to heat the mound's oven; acorns make a very hot fire. At any rate, the existence of a few acorns in a burned rock midden can have a number of explanations that have nothing to do with acorn cooking or leaching, such as their use as fuel or their accidental inclusion in fire basins because of nearby, even overhanging, live oak trees. The discovery, however, of charred leaf fragments of sotol (as well as nopal seeds, plant bulbs, etc.) in a burned rock midden is a different matter. Charred parts of such fragile plant are apt to represent debris left over from baking, since other explanations of their presence would be farfetched.

Echoing the comments of Black and his fellow writers (above), I also state that the idea that the Plateau's aborigines would accumulate rock middens by somehow processing acorns with heated limestone is a fatuous notion. Acorns do not need to be baked in rock ovens or leached in them (assuming such to be

[19] Stone-boiling experiments conducted by S. Black, at the Texas Archeological Research Laboratory in 1993, produced fractured stones with saw-toothed sides (composed of jagged interlocking fractures) that are very distinctive. On the other hand, burned rock middens in central Texas contain fractured rock with squared-off faces, of a type consistently produced by the direct and repeated application of heat. Apparently, the limestone rock found in the middens of central Texas was not fractured by being dropped, hot, in water.

possible), although the parching of acorns on hot rocks might help preserve them for storage (by killing worms). A person familiar with acorn consumption in the Northwest or California knows that the drying, leaching, and cooking of acorns is a simple matter hardly warranting the kinds of efforts that would accumulate burned rock middens. Furthermore, the occurrence of burned rock middens largely in live oak groves along streams, in west-central Texas, may simply mean that both pit baking of xerophytic plants and the health of live oaks demand a good source of water. In the region in question, live oaks may prefer areas with a limestone bedrock capable of furnishing oven stones for baking desert plants.

However dry the climate of the Edwards Interval, Part I of the Late Archaic period (2300 B.C. to 600 B.C.) witnessed no hardships for the aborigines, who apparently came to thrive on upland semi-succulents. Nevertheless, some data (Bement 1991) indicate a less healthy diet for the period under consideration, with too much in the way of carbohydrates (or sugars; sotol leaves produce sugar when baked quite slowly). In any event, at certain seasons of the year people continued to enjoy the nuts and game of the wooded river valleys, which were not much affected by the inferred temperature rise. In fact, streams such as the San Gabriel and Nueces rivers are known to have continued aggrading during Late Archaic I times, at places not too far below the Plateau's escarpment.[20] Certain Fort Hood streams also built up alluvial deposits (Member D1) of Late Archaic I age (Nordt 1992:passim).

In conclusion, burned rock middens were *much more abundant* on the eastern Edwards Plateau in Late Archaic I times than in any other period.[21] Nevertheless, in western Texas as well as Mason, Kerr, and Uvalde counties (areas that continued to experience fairly xeric conditions long after this dry period), burned rock middens commonly accumulated also in Post-Archaic days. Thus some arrowhead-period burned rock middens are known from the western border of what is here called the eastern Edwards Plateau. But on the eastern Plateau proper, fewer burned rock middens built up in later times than during the Late Archaic I period, and became less common than in the west. A burned rock

[20] The Loeve-Fox site (41WM230), located within alluvial sediments of the San Gabriel River, shows floodplain aggradation both before and during Pedernales times (Prewitt 1982a:Figure 5). And at the Anthon site (41UV60) on the Nueces River, G.T. Goode reports that the river's floodplain continued to build upwards during the Pedernales period, after a pre-Pedernales pause. Both sites contain fine-grained sediments and are situated not too far below the escarpment of the Edwards Plateau. Nearer the Gulf coast, however, aggrading ceased on the Colorado River, presumably during the early part of the Late Archaic period; that stream's exposed floodplain consequently remained stable for centuries. Evidence for this event appears, for example, at the top of truncated Alluvial Member I at Columbus Bend, about 120 miles inland from the Gulf (Blum 1992:70, 156).

[21] See Weir's population estimates as graphed in Prewitt (1985:Figure 6A).

midden with central baking oven is known from the Mustang Branch site (41HY209) near the eastern edge of the Edwards Plateau (though the basin may be later than the body of the midden), and apparently dates to terminal Late Archaic or early Post-Archaic times. According to Goode, who took part in that site's excavations, Darl and Fairland dart heads, as well as a few arrow points, were found within the rock midden. Additionally, a few burned rock middens possibly of Late Archaic II and/or Post-Archaic age have been reported from Williamson County (Gearhart 1987:58, 78, 117-118).

Glenn T. Goode (1991) reviewed a few such Post-Archaic midden sites on the southwestern or western edge of the eastern Edwards Plateau, discussing their possible function in baking sotol heads. He conscientiously described the Honey Creek site (41MS32) in Mason County and the Heard Schoolhouse site (41UV86) in Uvalde County. It can be added that Scallorn arrowheads may have occurred in a burned rock midden outside Hall's Cave (see Figure 1). One can argue that most Post-Archaic middens are largely tied to the remnant sotol fields near, or west of, the far western edge of the present study region.

There is no evidence that the eastern Edwards Plateau, with its many springs and streams, served as a refuge area (as has been suggested) for parched and hungry outsiders during the dry Edwards Interval. Local Pedernales projectile points and associated knife forms prevailed uniformly during the supposed peak of the dry Edwards temperature maximum, and Plateau folk maintained a quite uniform material culture. Had outlanders arrived in any numbers, a variety of projectile point styles representing alien forms would surely occur on the Plateau at this time, and they do not.

Further into the Late Archaic I subperiod, after Pedernales projectile heads had given way to the related Marshall and (later) Montell styles,[22] buffalo seem to have appeared again in the eastern Edwards Plateau.[23] And although the effects of the dry climate of the Edwards Interval may have been lessening by that time, the people using Marshall and Montell projectile points continued the Pedernales-period baking of semi-succulent xerophytic plants, and accumulated or added to burned rock middens during the same period that they sometimes barbecued buffalo. Obviously, the climate and vegetation were still fairly xeric.

[22] The fact has gone largely unrecognized that broad-bladed Pedernales points, Marshall dart heads, and Montell points are all made in the same way, by expert billet thinning (Johnson 1994). Very thin and flat blades are produced which show large flake scars from such billet work. According to G. T. Goode, the differently shaped stem of Montell points can obscure the indicated continuity, which also appears among large and flat, oval knives that run through Pedernales, Marshall, and Montell times.

[23] On the Edwards Plateau, buffalo bones may be part of the Montell-period debris of the John Ischy site (41WM49; Sorrow 1969:62) and the Jonas Terrace site (Johnson 1994). In the Lower Pecos region, Montell dart points are definitely associated with bison bones at Bonfire Shelter (41VV218; Dibble and Lorrain 1968:42-55).

In bidding subperiod I *adieu* (though the Castroville style is formally transitional,[24] it can perhaps be put at the end of that subperiod), three additional observations can be made. The first is that the Late Archaic I period lasted for about 1700 years. The second is that the billet thinning of sizeable bifacial knives and projectile heads saw its artistic and technological flowering during that subperiod, making flint-knapping debris of the epoch easy to identify when it occurs abundantly. The third is that the human population appears to have increased during Late Archaic I times (see Weir's data in Prewitt 1985:Figure 6A; also, for the Lower pecos area, consult Turpin 1990).

In the Late Archaic II subperiod (largely corresponding to the Middle Woodland in eastern North America), which lasted from 600 B.C. to A.D. 600, fairly mesic conditions had returned to all but the western and southwestern parts of the Edwards Plateau, although some increase in moisture had already taken place during Montell days. Local aborigines lost most or part of their former supply of upland xerophytic plants. As said, plausibly towards the end of subperiod II the moisture-loving least shrew returned to Hall's Cave in Kerr County. Burned rock middens no longer accumulated in very large numbers as a consequence of pit baking, except in the far west and on the southwestern edge of the eastern Plateau, and evidence of buffalo hunting has not yet been found in the eastern Edwards Plateau for subperiod II. However, Marcos points of this epoch (at least one of them!) occur with bison bones near San Angelo (Creel 1990:220)—which is quite a distance from the eastern Plateau.

It behooves me to say, once again, that Lee Nordt's climatic notions do not always run parallel to mine. His study (Nordt 1993:68 and Figure 4) of changes in the biomass at Fort Hood during this period (specifically, around 200 B.C. [calibrated]) argues for a brief warming/drying trend, producing increases in the relative abundance of C_4 grasses. Those increases, relative to the abundance of trees and forbs, could well mirror mild drought conditions, although other interpretations are at least possible. For instance, short-term increases in rainfall could easily increase local C_4 grass cover and make it denser, at the expense of C_3 weedy plants. Strangely, perhaps, the earlier dry Edwards Interval does not readily reveal itself in the plant-biomass data from Fort Hood, which is perhaps sufficiently far north to experience Plains-like or "northern" long-term weather changes not felt in southern Central Texas—but I doubt it. Quite possibly, the interval in question merely saw little sedimentary deposition in the Fort Hood area.

[24] Statistical comparisons (Johnson 1994) demonstrate that the blades of Castroville dart points are thicker, on the average, than Montell specimens and resemble yet later styles in several respects. Castroville points also tend to have biconvex rather than flat lateral cross sections, and frequently lack the large billet-flake scars of Montell dart points. Additionally, evidence of pressure flaking appears on many Castroville blade surfaces, but not those of Montell points.

My rendition of Late Archaic II climate calls for somewhat moister conditions than previously, to explain the active aggradation of floodplains in many localities. And during the indicated time period, one of two things happened. Either foreigners from the Southern Plains showed up with new styles of projectile points and made themselves to home, or else Plateau residents borrowed certain tricks and techniques of projectile making from outsiders. Marcos dart heads came first to be made. In fact, Marcos dart heads are very much like dart points of the same age from the Southern Plains. And later in subperiod II, aborigines of the eastern Plateau used Frio and Ensor dart heads. Although some of the foregoing styles find parallels in the dart points of Southern Plains buffalo hunters (Hughes 1989), as said, evidence can also be identified in subperiod II (mainly in Ensor-point and Frio-point times) of social intercourse in an entirely different direction: with the eastern United States.

In subperiod II, evidence of spreading Eastern religious cults or ideas appeared on the Southern Plains, eastern Texas, the Gulf Coastal Plain, and in a small way even on the eastern Edwards Plateau. Some of the major markers are exotic burials, foreign copper, elaborate bone ornaments, Gulf whelk shells, and atlatl weights typically of exotic stone; most of these items were widely traded throughout the eastern half of North America. However, only the last two items are ordinarily reported for the Edwards Plateau[25] (though an engraved bone pin turned up nearby, in San Antonio), and the region's spear-thrower weights are often made of local rock. It is sometimes difficult to determine whether fancy Late Archaic grave goods are linked to developments in the eastern U.S., since elaborate Late Archaic I burial furniture apparently not so linked is known for the Texas Gulf Coastal Plain. For example, at Landa Park in New Braunfels, a large Archaic cemetery on the Locke farm (site 41CM25) produced a whelk gorget and a few other special artifacts in flexed burials (Texas Archeological Research Laboratory files). But one cannot know whether this "ceremonial" material has local Archaic roots or is connected to eastern U.S. religions and their spread.

Unfortunately, whelk shells and atlatl weights are hard to date on the Plateau, itself, since nearly all represent surface finds or goods excavated by collectors. However, a number of fancy bone and whelk-shell items have been found at San Antonio, directly below the Plateau's margin in Late Archaic II burials (Lukowski 1988). And, significantly, decorated whelk-shell pendants and

[25] See Patterson (1937a). As an example of other recorded occurrences of atlatl weights and whelk shells, there is the whelk columella from site 41HY51 (Texas Archeological Research Laboratory files). And a limestone atlatl weight was found with "Darl" points at the Smith Rockshelter (41TV42) (Suhm 1957:38 and Figure 8B). Additionally, artifact collectors report a large number of whelk pendants and spear-thrower weights from the Leon River, in Bell and Milam counties, seemingly associated with Ensor and Marcos dart points. G. T. Goode reports that most of the atlatl weights are of local stone, although a few (including a specimen made of purple quartzite) are of foreign material.

atlatl stones are definitely associated with Late Archaic dart heads on the Southern Plains,[26] occurring also in Late Archaic II cemeteries near the central Texas Gulf coast. The cemetery of greatest interest is Burial Group 2 at the Witte site (41AU36; Hall 1981:83-90). As an important aside, it is noteworthy that Edwards Plateau people of Late Archaic II days contributed a strictly local product to the distinctive trading networks of the time: large and thin corner-tanged knives worked bifacially from Edwards flint (Patterson 1936, 1937b; Hall 1981). Additionally, many caches of bifacial preforms of Edwards flint, perhaps of this age, have been found far and wide, often beyond the Edwards Plateau on the southern edge of the Llano Estacado and at the western border of the Eastern Woodlands (Miller 1993). The notion of trading networks is reviewed by Johnson (1982:206-209).

In the eastern U.S., religious movements linked to the use of many of the above items, and their long-range transport, are well dated to some part of the time range from 200 B.C. to A.D. 500, which represents a major slice of the Middle Woodland (Hopewell or Marksville) period of the East. In the eastern Plateau, Ensor, Frio, and perhaps other dart points date within this time frame. In eastern Texas, there is little doubt but that the Mossy Grove people who built the Jonas Short burial mound (41SA101) were influenced strongly by this movement. Additionally, the elaborate bone and shell artifacts, and occasional atlatl weights of Arkansas stone, found with people buried around the time of Christ at the Ernest Witte site (41AU36) in Austin County, Texas, may comprise a peculiar regional expression of widely spreading Middle Woodland religious beliefs.

The important point is that the religious and ceremonial materials mentioned above, however locally varied, appear basically on one temporal plane. In itself, that fact supports the notion of a related batch of interconnected religious ideas involving the possession of special cult items eventually included with the dead at burial. Of course, some items of whelk shell and other conceivably ceremonial and religious objects were known on the Texas coastal plain during earlier periods, and in the East both before and after Middle Woodland (Late Archaic II) times. Yet that fact is largely immaterial to the present argument, for the Texas material highlighted here is all approximately contemporaneous, and is tied together at least by Middle Woodland atlatl weights (often of Arkansas stone) perceived to have been religious paraphernalia.

To explain the appearance of elaborate ceremonial goods in Texas just in terms of local economic developments, the growth of farflung trading networks, an increase in human population, the development of a hierarchical social organization or power structure, or the rise of a sedentary life style (e.g., Hall 1981) is

[26] The best publications on the subject are those of Ray (1936), Parsons et al. (1979), and Redding and Parker (1991). The first article describes corner-notched dart heads, whelk pendants, and atlatl weights burned with a human corpse. The last reports a side-notched Late Archaic dart point found in a human cremation along with small shell beads and an elaborately worked atlatl weight of stone.

to misunderstand the issue. It may be true that a complex cult with a rich material expression only evolves within a complex social system like that of the Hopewell people; but it is also true that such a belief system can spread to almost any kind of society. Hence one finds whelk ornaments and atlatl weights of foreign stone in cremations of Southern Plains hunting people, and very occasionally in sites of the hunting-and-gathering aborigines of the Edwards Plateau.

Human skeletons probably dating to Late Archaic times have been found at three sites on or very near the eastern Edwards Plateau. The first is Bering Sinkhole (Bement 1991) at the western edge of the eastern part of the Plateau. The results of analyses done on human skeletal parts conceivably dating to subperiod I are engrossing. Teeth show a high rate of enamel hypoplasia, as well as a high caries rate. Stable-carbon isotope ratios argue for a much greater dietary reliance on C_3 plants than could be deduced for Early Archaic burials from the same sinkhole. Consequently there was considerable weaning stress for young children (the hypoplasia), as happens with large populations, and for most of the deceased a high carbohydrate or sugar diet is indicated which likely included either sotol/yucca/agave or acorns, in addition to animals eating C_3 plants.

Hitzfelder Cave (41BX26), with a sinkhole entrance, contained parts of 30 to 50 bodies, some of which must date to the Late Archaic I and II subperiods. A Pedernales projectile point and a Marshall point were among the few projectile heads that were observed (Givens 1968; Collins 1970), as were three Frio points of subperiod II. Considerably to the southeast of the Plateau, on the Gulf Coastal Plain, Late Archaic II cemeteries sometimes have burials with elaborate burial furniture that includes decorated whelk-shell pendants, incised bone wands and pins, and atlatl weights made of Arkansas stone (e.g., Hall 1981:29-92). Interestingly, the third Late Archaic burial site to be mentioned on or near the Plateau had burials resembling the elaborate Coastal Plain kind, although the limited excavations turned up the remains of only 12 or 13 bodies. The Olmos Dam site (41BX1; Lukowski 1988) is an open locale on a stream bank within the city of San Antonio, only a few miles south of the Plateau's escarpment. Most of the site's bodies had been placed in graves, resting on either side, in a flexed or semi-flexed position with head to the northeast or east. Importantly, the bodies of Burial Group 2 at the Witte site were oriented similarly, expressing a shared religious preference. Found with the Olmos Dam bodies, variously, were grinding slabs, whelk pendants and columellas, a mussel pendant, a bone awl or hairpin, and chert cobbles. Remarkably, piles of antlers rested over some bodies and covered all but the heads of adults. Burial goods and the well-associated radiocarbon dates indicate a Late Archaic II age for the cemetery, near the time of Christ.

The Post-Archaic Era

I provisionally stop the Late Archaic period around A.D. 600, just before arrowheads such as the Sabinal and Edwards styles arrived onto the eastern

Edwards Plateau or were developed there. If Edwards and similar points were indeed the first true arrowheads on the Plateau, the regional acceptance of the bow was only slightly tardy from a continental perspective. The date of the bow's advent in eastern North American is usually said to fall between A.D. 500 and A.D. 800 (Shott 1993:425), and Edwards points appeared around A.D. 700 or 800 at the Plateau's Rainey Sinkhole (41BN33; Henderson n.d.). Nevertheless, one should underscore the fact that some cultural and considerable economic continuity tied the end of the Late Archaic period with what came directly afterwards. In fact, of all the period boundaries set in the present paper, that for the ending of the Late Archaic II subperiod is the most subjective and bothersome. For one thing, human culture did not change *greatly* after the beginning of that interval down through the days when Scallorn arrowheads were in vogue. If the informed reader wishes to terminate the Late Archaic period at A.D. 1200, I will not argue. Or if the reader wants to stop the period at around A.D. 400 (or later), when very small "dart" points of the Darl and Figueroa sort appear in the region, that is another possibility. Those small points may actually represent the first arrowheads to materialize locally. The appearance of small dart points at this time is also documented for north-central Texas (Prikryl 1990:56) and other regions.

In any case, human life on and just below the eastern Edwards Plateau changed in small ways in the Edwards-Scallorn part of the Post-Archaic Era. First, my impression is that the population increased a bit, although I cannot prove it. If the human population grew, the cause may have been a quite mesic climate favorable for deer and mast. I doubt seriously that the acceptance of the bow, locally, had anything to do with it, although it is a clearly more efficient or effective hunting instrument than the atlatl and dart.[27] Some communities consequently came into competition and battled one another, so much so that the demise of quite a few people found in Scallorn-period cemeteries was due to a peppering of arrows. Prewitt (1982b:Table 4) lists a number of burials with bodies apparently pierced by arrows. Whatever else transpired, the material culture of the people who made and used Edwards and Scallorn arrowheads was not very different from that of Plateau people who lived during Late Archaic II days, although arrowhead-period knapping was a bit different from what went

[27] For strong but exaggerated warnings against accepting the idea of an increase in the efficiency of bow hunting over dart hunting, see Shott (1993). I suspect, however, that the bow was indeed much more efficient that the atlatl for hunting. But this added efficiency may well have expressed itself in increased accuracy and the need for a given hunter to spend much less time on the chase than otherwise. There is no compelling need to assume a necessary increase in the number of animals killed (just because it became easier to hunt them), or an increase in acquired calories. Prehistoric Texan aborigines were unacquainted with Marx's notions about economic production and had not heard of "maximum foraging efficiency."

before it. Bifacial flint knives (with convex or straight bases) of early Post-Archaic age are smaller than many of their Late Archaic counterparts.

The climate continued to be mesic until around A.D. 1200, when a drought affected at least parts of the Edwards Plateau. Buffalo came back onto the Plateau soon thereafter and stayed, even after climatic conditions may have reverted to the region's near-mesic norm between A.D. 1300 and 1400.[28] The Archaic-seeming life style of the Scallorn folk was replaced by buffalo hunting and foraging by smallish groups of Toyah-culture people. The latter made true flint blades by direct percussion, manufactured a bit of pottery of seeming Southwestern shape and finish, and used bevel-edged knives and sandstone shaft abraders typical of the Southwest's eastern margin and of the Plains Village region. No Archaic Era blade industries are yet known on the Edwards Plateau (Collins and Headrick 1992:27), nor have many pottery vessels been discovered that are older than Toyah ceramics. The best example is a thick-walled beaker (Black and McGraw 1985:188-189 and Figure 41), from the Panther Springs Creek site (41BX228), built up by plastering the inside and outside of very thick clay ropes in Tchefuncte style. The present historical narrative concludes at A.D. 1600, near the end of Toyah days when Perdiz arrowheads were in vogue.

I close by affirming that the eastern Edwards Plateau has been the proscenium and stage for a basically low-key Native American drama unfolding between 6500 B.C. and A.D. 1600. The Plateau is just beyond the margin of the horticultural Eastern Woodlands, and gardening did not develop locally during this lengthy epoch except ephemerally among Post-Archaic buffalo hunters of the Toyah culture, as well as later Apaches.[29] As a wide transitional zone composed both of arboreal and prairie elements, the well-watered eastern half of the Edwards Plateau ordinarily furnished ample plant and animal food for a moderately sized human population practicing Archaic hunting and gathering methods. The success of local hunting-and-collecting economies is surely one

[28] After a period of erosion perhaps in the twelfth or thirteenth century (inferred date), the Ford Alluvium (Member E) of Fort Hood was laid down during a moderately mesic period beginning sometime after A.D. 1300 (Nordt 1992:76-77). Nordt (1992:67) notes that ". . . radiocarbon ages from Fort Hood demonstrate that stream metamorphosis, and possible brief channel trenching, occurred shortly after 1000 B.P. and that channel and overbank filling has been proceeding since that time." This overbank filling indicates greater precipitation after A.D. 1300 (my dating).

[29] This statement is too strong. Apache-type ephemeral gardening could have been practiced here and there on the Eastern Plateau during Late Archaic times, without leaving many recognizable archeological clues. It is altogether too soon to disregard three pollen grains of *Zea mays* (Indian corn) recovered from water used to wash a Late Archaic milling stone from the Wild Turkey Midden (41MI8: Howard 1991:63). Holloway (1988:8) seems ready to do just that, but the occurrence of the grains on a grinding stone argues that they were original adherents.

reason why pottery was so tardily accepted by aborigines of the Plateau, and serious horticulture not at all.

Naturally, being a climatic and vegetational borderland, the Plateau was susceptible to changes caused by lengthy fluctuations in precipitation. More than at any other time, it was during the dry Edwards climatic interval, whose peak may have occurred around 1900 B.C., that aboriginal economics changed to a degree and an increasing population seemingly came to rely quite regularly on upland xerophytic and other plants as food staples—though they had sometimes been collected previously, as well. Few places, however, are ever insulated against all outside influence. During three periods and maybe more, bison came into the region, no doubt to the delight of aboriginal gourmands and talented (or cold) hide workers. And at another time Edwards Plateau people felt the touch of cultural and religious developments reaching them from the Coastal Plain below the Plateau and indirectly from the Eastern Woodlands. Additional regions such as the Great Plains also affected Plateau folk during (and maybe just after) periods of bison presence, and the stone tools of Plainsmen were occasionally imitated by Plateau artifact makers.

By temperately redefining the content and boundaries of local culture periods to accommodate recent knowledge, and by dating both the culture periods and the region's climatic episodes better than heretofore, human life and its history on the Plateau can be viewed in a clearer light. It is hoped that the stage is now set for increasing the candle power of that light with new research. Some day, acceptable and well-founded research will surely be done about prehistoric social and community organization on the eastern Edwards Plateau, although that day of fable lies (if anywhere) in a most uncertain future, somewhere over the rainbow.

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