From: ***The Prehistory of Texas***, 2004, edited by Timothy K. Perttula, Texas A&M University Press

3

Archeology in Central Texas

Michael B. Collins

This chapter reviews the archeological record of Native Americans in the central Texas archeological region and considers selected aspects of the nature of the evidence and how archeologists have studied that evidence. Previous reviews have covered these same topics comprehensively (see D. Suhm 1960; D. Suhm et al. 1954) or selectively (e.g., Black 1989b; M. Collins 1995; Creel 1991a; G. Ellis 1994; M. Howard 1991; L. Johnson 1967; L. Johnson and Goode 1994; Lintz 1993; W. McKinney 1981; Prewitt 1981, 1985; Weir 1976). "An Introductory Handbook of Texas Archeology" by Suhm et al. (1954) established a formal structure of archeological inquiry for the entire state, and the diverse data gathered over the first half of the twentieth century were organized and synthesized.

Although successive metamorphoses have rendered the particulars of the 1954 handbook virtually unrecognizable in current practice, each revision was built on what had gone before, so that much of what we know today rests on sturdy foundations laid a half century prior to this writing. Typologies of ceramics and projectile points published in the handbook have remained more intact than the other cultural constructs. In his introduction to the handbook, Alex D. Krieger (D. Suhm et al. 1954, 2–10) also established a number of the tenets of typology that continue to underlie some artifact classifications in the state.

The review published by Dee Ann Suhm in 1960 is the first metamorphosis, beginning by offering a smaller and less rigidly bounded delineation of "central Texas" (D. Suhm 1960, fig. 1). Among the lasting contributions of the review are good visual (D. Suhm 1960, figs. 2 and 3) and descriptive (D. Suhm 1960, 89–103) images of the nature of the central Texas archeological data base, particularly its key sites. Historic Indian groups in central Texas received greater treatment, and Suhm's review also reflects the beginnings of the preoccupation with prehistoric chronology building that overwhelmed the research effort over the next twenty-five years and dominated subsequent reviews and syntheses. At the time Suhm actually wrote her review (in 1958), only one radiocarbon date was available for a central Texas site (D. Suhm 1960, 88), and analyses of stratified site excavations were too few to use as a basis for establishing a chronology.

Since 1960, the several reviews that have been written focused on topical, temporal, or theoretical issues of central Texas archeology. Some of these have been more influential than others, but as this chapter will show, none has adequately considered the nature of the region's archeological record. The vast data base that now exists for central Texas cannot be adequately synthesized and presented in the space available. This essay attempts instead to

- critique aspects of the practice of archeology in central Texas,
- offer a brief summation of what we currently know, and
- consider some ways by which we might know significantly more (and have greater confidence in that knowledge) by the time the next review is written.

It is necessary to critique the manner of our work because archeology rarely answers questions that have not been asked and because the questions asked and the ways they are addressed in any archeological paradigm largely dictate the nature of the substantive findings. Over most of the second half of the twentieth century, archeological efforts in central Texas have excessively emphasized questions of chronology, have failed to identify and sustain a focus on but a few other issues of substance, and have not yielded adequate explanations for the nature of the archeological record.

Inexplicably, the preoccupation with chronology prevailed without the development of a very effective methodology for its pursuit. Specifically, although the *sondage* technique was adopted, the greatest effort has been expended on precisely the kinds of sites with the least potential

for yielding good chronological information, while sites having that potential languished with comparatively little attention. There have been many data generated but not much synthesis of those data.

It is encouraging to note that during the 1990s, four trends emerged that lead me to believe that the prospect is good for significantly improved research in the archeology of the region (see G. Ellis 1994). First, we have begun to better recognize the nature of the archeological record and how it was formed, as well as the greater need for data *quality* over data *quantity*. Second, preoccupation with chronological issues has begun to give way to a sustained concern with several questions of human adaptation. Third, research now reflects an awareness of great data potential that had long been overlooked, and the relevance of data to the questions asked is being scrutinized. Finally, archeologists working in central Texas are noticeably less provincial than has long been the case (Perttula 1995c). Thus, "The future of archaeological research in the Edwards Plateau and adjacent areas will be considerably less gloomy if the region can get the attention it deserves, and if its synthesis is addressed to a national or international audience that will be critical of any local misadventures" (L. Johnson 1991, 21–22).

Do not take what has just been said to mean that I do not consider chronology to be the backbone of archeological inquiry. Archeology is a historical science, and constantly improving chronological control of the past must remain a primary objective, *but only as the framework for ordering more substantive inquiries and findings.* In this vein, much has been said about the validity and meaning of various temporal frameworks offered for central Texas prehistory. In spite of the use of terms such as *phase,* and the discussion of phases in ways suggesting they have ethnic meaning, the foremost purpose of such constructs has been temporal ordering of archeological material culture. These constructs are based largely on morphological (supposedly stylistic) trends in artifact forms and, as such, are *archeological style periods,* not unlike style periods (e.g., Victorian, Greek Revival, or Tudor) used by architects. Eileen Johnson (1987c, 1991) has suggested that some of our archeological style periods be called *patterns,* and I (M. Collins et al. 1990) have proposed the label *intervals.* Either of these is better suited than *phase,* to which we both object, but I continue to prefer *interval,* first because it emphasizes the main thrust—time—and, second, because *pattern* implies that we know more about the material cultural composition of some of the time slices than I believe we do. Whatever we call the segments of our temporal framework, their function is to order cultural change, which is the essential basis for understanding cultural processes.

Central Texas as an Archeological Area

Culture areas (Kroeber 1939) and their archeological counterparts (e.g., as used in G. Willey 1966) have long served to focus attention on regions of shared cultural traits. At any single moment in time, culture area boundaries often can be drawn relatively easily. Some boundaries persist for centuries or millennia, but others shift and blur over time. The longer the time period under consideration, the more arbitrary boundaries become. Much of North America might be considered a single culture area during Clovis times, but by A.D. 1000 scores of areas would be needed, with each embracing the same degree of material culture sameness seen in all of Clovisdom.

Any delineation of the central Texas archeological area is highly arbitrary. Conversely, to draw boundaries based on careful considerations of material cultural sameness would result in a sequence of perhaps a dozen central Texas areas of quite different sizes and shapes—an unmanageable array for the purposes of this essay. So, for the present discussion, Prewitt's delineation (1981, 71, fig. 2) of the central Texas archeological area (Fig. 3.1) has been used as a descriptive framework, but its boundaries have not been adhered to rigidly as regards certain archeological and geological data that inform on key issues in the local record. Also, this delineation is selected with the proviso that, like any such arbitrary construct, it is more satisfactory for some parts of the prehistoric record than for others.

More importantly, as Clive Gamble

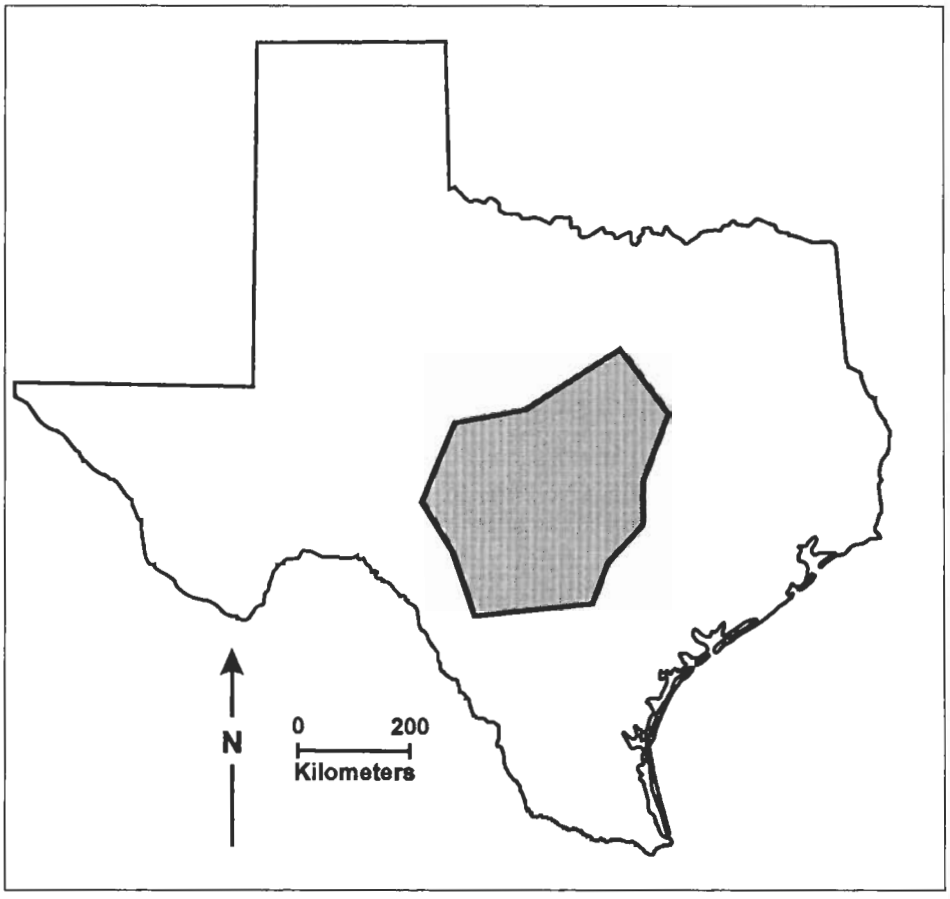

Fig. 3.1. The central Texas archeological area (after Prewitt 1981).

(1986), Ian Hodder (1978), David Clarke (1977), James Ebert (1992), and others have noted in general, and G. Lain Ellis (1994, 54–56) has discussed specifically for the central Texas culture area (see also L. W. Ellis et al. 1995), our spatial concepts can seriously impair our efforts to interpret past human adaptations. In the past eleven thousand years, there probably has never been any cultural group whose key resources, geographic range, or political sphere conformed even approximately to what archeologists designate as "central Texas." The concerns raised by these writers refer primarily to *investigating* the prehistory of central Texas; it is still convenient to use the cultural area rubric when *describing* its archeological record.

The central Texas archeological area is roughly 84,300 km^2, or 12 percent of the area of the state. As of January, 1995, recorded archeological sites for central Texas numbered 11,355, which could be as low as 10 to 20 percent of the actual number, judging from site densities in a few thoroughly surveyed areas. Documented sites are in open areas on various topographic features, along blufflines, in rockshelters, and in caves; site characteristics differ greatly, but they afford clues as to the function or functions of any given site, or to a component within a site (Table 3.1).

In central Texas, the most common kind of site recognized is an accumulation of debris (burned rock, stone chipping residue, pottery sherds) and diverse utilitarian objects (grinding stones, hammerstones, unifaces, and bifaces), sometimes in great quantities. Although various more specific interpretations ("base camps," "extractive sites," and so forth) have been offered, it is probably safest to say that the vast majority of these represent the residue from one or more periods of habitation; in simplified terms, these are camp sites where people stayed for a time, regardless of their more specific purposes for being at that location. Camps are found in all settings (see Table 3.1 and Fig. 3.2): in the open, along bluffs, in rockshelters, and even a few in caves such as Scorpion and Halls (Table 3.2). Features found at camps include just about all kinds: hearths (Fig. 3.2a), knapping areas, graves, caches, pits, houses, and many others. Some of the more conspicuous and, therefore, most commonly noted features in central Texas are massive, mounded accumulations of burned rocks or "burned rock middens" (Fig. 3.3a–c). Because they have played such a large role in the archeology of central Texas (see G. Ellis 1994), burned rock middens are discussed separately, below.

Table 3.1. Simplified Characterization of Site Types and Settings in Central Texas

	Site Settings			
	Open	*Bluffline*	*Rockshelter*	*Cave*
Camp	x	x	x	x
Caches	x	x	x	
Isolated artifacts	x	x	x	
Interments	x	x		x
Cemeteries	x	x	x	
Kill/butchery	x	x		
Quarry/workshop	x	x		
Lithic scatters	x			
Rock art		x	x	

The elements (artifacts and features) that make up or accompany camp sites sometimes occur apart from camps. These include caches, isolated artifacts, burials, bedrock mortars, and rock art (see Fig. 3.3d), all of which are known to occur in various settings (see Table 3.1).

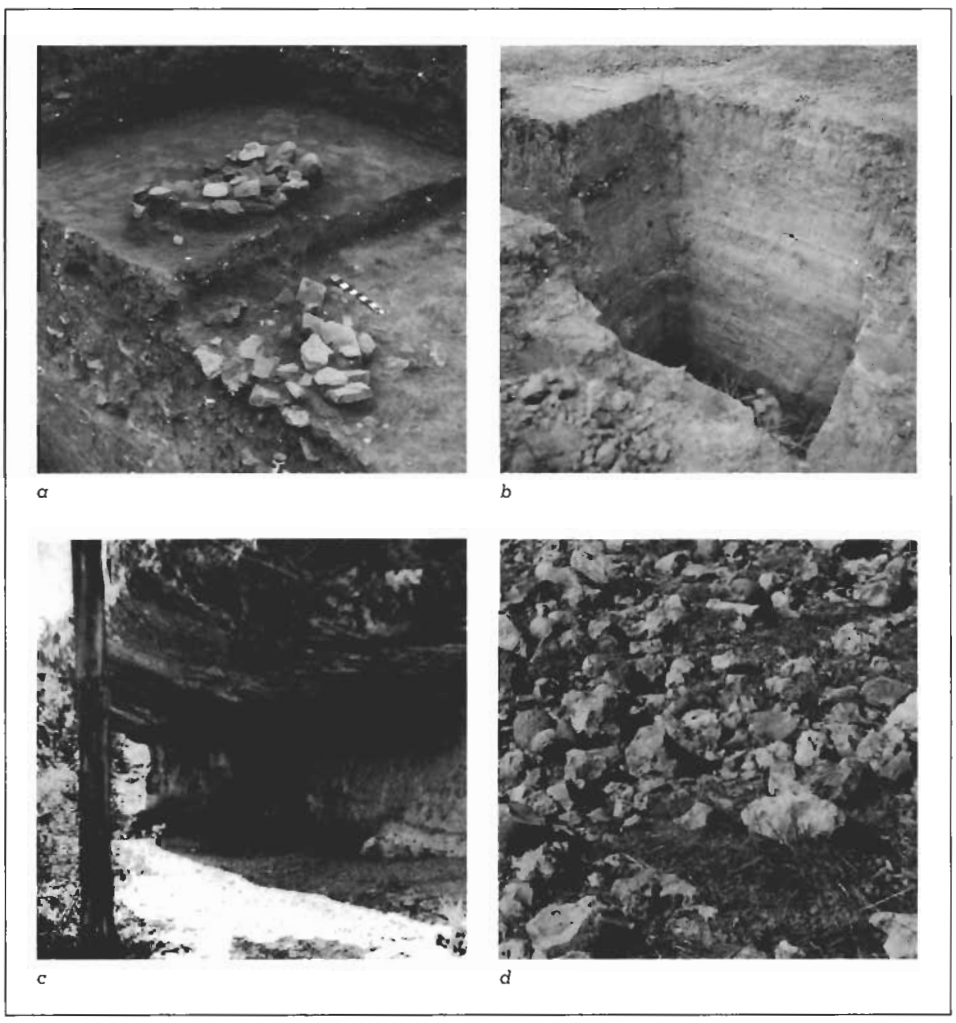

Fig. 3.2. Examples of common kinds of archeological sites in central Texas: a, open camp site; b, stratified open camp site; c, rockshelter; d, lithic quarry and workshop.

Table 3.2. Alphabetical Listing of Selected Central Texas Sites and Environmental Data Sets with Bibliographic References

Sites	*References*	*Sites*	*References*
Anthon	Goode n.d.	Smith	D. Suhm 1957
Barton	Ricklis and Collins 1994	Turkey Bend Ranch	Treece et al. 1993b
Bull Pen	Ensor and Mueller-Wille 1988	Vara Daniel	M. Collins et al. 1990; Ricklis et al. 1991; Takac et al. 1992
Buzzard	Stephenson 1970		
Camp Pearl Wheat	M. Collins et al. 1991	Waco Mammoth	J. Fox et al. 1992
Clark	Watt 1965	Wiley Williams	TARL Files
Crockett Gardens	McCormick 1982	Wilson-Leonard	M. Collins 1998c; M. Collins et al. 1993; Masson and Collins 1995
Currie	Treece et al. 1993		
Evoe Terrace	Sorrow et al. 1967	Wounded Eye	Luke 1980
Finis Frost	L. Green and Hester 1973	Wunderlich	L. Johnson et al. 1962
Footbridge	L. Johnson et al. 1962	Youngsport	Shafer 1963
Friesenhahn Cave	Krieger 1964	Zatopec	Garber 1987
Frisch Auf!	Hester and Collins 1969	Unnamed site (Bandera County)	Beasley 1978
Gault	M. Collins et al. 1991; M. Collins et al. 1992		
Gibson	Ray 1940	41BC50	TARL Files
Hall's Cave	Toomey 1993; Toomey et al. 1993	41CC1	Kirkland and Newcomb 1967
Higgins	Black et al. 1993	41GL160	Kelly 1987
Hitzfelder Cave	Givens 1968a, 1968b	41ME19	Hester and Kelly 1976
Horn Shelter No. 2	Redder 1985	41ML64	M. Collins and Holliday 1985
Jetta Court	Wesolowsky et al. 1976	41SU43	TARL Files
John Ischy	Sorrow 1969	41TG91	Creel 1990
Kincaid	M. Collins 1990b; M. Collins et al. 1989b	41TV29	TARL Files
Kyle	Jelks 1962		
Landslide	Sorrow et al. 1967	**Environmental Data Sets**	
Levi Rockshelter	Alexander 1963, 1982	Bison Abundance	Dillehay 1974
Lindner	C. Brown 1985	Bog Pollen	Bousman 1994; M. Collins et al. 1993
Loeve	Prewitt 1982	Sabinal River	Mear 1995
Loeve-Fox	Prewitt 1974	Pedernales River	Blum and Valastro 1989
Mason Burial Cave	Benfer and Benfer 1981	Fort Hood	Nordt 1992
Merrell	Campbell 1948	Colorado River at Bastrop	Blum 1992
Mustang Branch	Ricklis and Collins 1994		
Oblate	L. Johnson et al. 1962	Colorado/Concho River confluence	Blum and Valastro 1992
Pavo Real	Henderson and Goode 1991		
Richard Beene	Thoms and Mandel 1992	Brazos River at South Bend	Mandel 1992
Rob Roy	A. Jackson 1939		
Rocky Branch	Treece et al. 1993a	Brushy Creek	M. Collins et al. 1993; Masson and Collins 1995; M. Collins 1998c
Rush	Quigg and Peck 1995		
Scorpion Cave	Highley et al. 1978	Medina River at Applewhite	Thoms and Mandel 1992
Slab	Patterson 1987		
Sleeper	L. Johnson 1991	Southern Plains	Hall 1986

Cemeteries, in and away from camps, are known in the prehistoric record of central Texas and have been found in rockshelters (Watt 1936), open localities (Loeve-Fox, Frisch Auf!), and in vertical shaft caves (Hitzfelder, Mason Burial Cave).

Few animal kill sites have been documented in central Texas. The Late Prehistoric bison skeleton (Feature 66) at Loeve-Fox is one possible example (Prewitt 1982, 73–79). Another is inferred from fossilized bison bones and Folsom points dislodged by treasure hunters from the floor of Kincaid Rockshelter, where it seems a bison died after it was wounded but was not retrieved by Folsom hunters (M. Collins 1990b).

Chert has been the most important kind of toolstone throughout the prehistory of central Texas, and the area is rich in the quantity and quality of this raw material (Banks 1990). This wealth is reflected in numerous sites where chert was acquired (quarries), acquired and knapped (quarry/workshops [see Fig. 3.2d]), or just knapped (lithic scatters).

Each of these kinds of sites has its own characteristic parameters. The diverse kinds of sites are not equally visible to the archeologist; their interpretive potential varies greatly; they were never equally numerous; and they have survived the vagaries of nature at different rates. Efforts to interpret and compare patterns of land use over time, or to estimate such things as relative population sizes, are heavily burdened with these sampling issues.

As a natural area, central Texas is diverse. Its single most significant feature is a prominent fault scarp, the Balcones Escarpment, that arcs from northeast to

southwest around the center of central Texas and breaks the area into two contrasting subareas (Fig. 3.4a). The larger subarea is north and west of the scarp, on its upside. Most of this is dissected plateau land of resistant limestone and thin upland soils, but deeply eroded crystalline rocks—the Central Texas Mineral Region—are present as well. The prevailing vegetation is oak and juniper savanna. Of roughly half the size of the larger subarea is the smaller subarea, south and east of the scarp, on its downside. This is part of the coastal plain, a region of relatively soft bedrock and deep soils. Most of this subarea is prairie with deep clayey soils, but a narrow strip along its eastern margin is post oak forest standing on deep sandy soils.

Along the escarpment lies a great ecotone (see Fig. 3.4a) where natural conditions are transitional between the plateau to the west and north and the prairies to the east and south. More importantly, it is beneficial for humans to occupy an ecotone whence they can readily access contrasting resources in the adjacent biomes and capitalize on the resource diversity of the transitional zone.

Annual precipitation decreases from east to west across central Texas from near 100 cm to 55 cm. The primary water resources for pre-industrial peoples are streams and springs. Two river systems, the Brazos and the Colorado, drain approximately 75 percent of the central Texas area (see Fig. 3.4b); the remaining 25 percent is roughly equally divided into the catchments of the Nueces, San Antonio, and Guadalupe Rivers (see Fig. 3.4b). Generally, drainage is toward the southeast. Of the 281 springs documented for Texas, 139 (49 percent) are in the area, including both of the state's very large springs (>100 cubic feet per second), and 12 of the state's 17 large (10 to 100 cubic feet per second) springs (Brune 1975).

Change, as it is everywhere, is and always has been unrelenting across the land of central Texas. Wind, water, and gravity move earth material from place to place; lakes, streams, and springs flourish and fail; caves and rockshelters form, enlarge, degrade, and collapse. The delicate balances between soils, climates, plants, and animals are ceaselessly being adjusted. Terra firma is but an illusion.

Fig. 3.3. Examples of the very common burned rock middens and the uncommon rock art panels of central Texas: a (upper left), a pristine burned rock midden in Blanco County; b, burned rock midden and hearth in the stratified Wiley Williams site, Travis County; c, typical structure of a burned rock midden (Sutton County); d (lower right), pictographs at Paint Rock in Concho County.

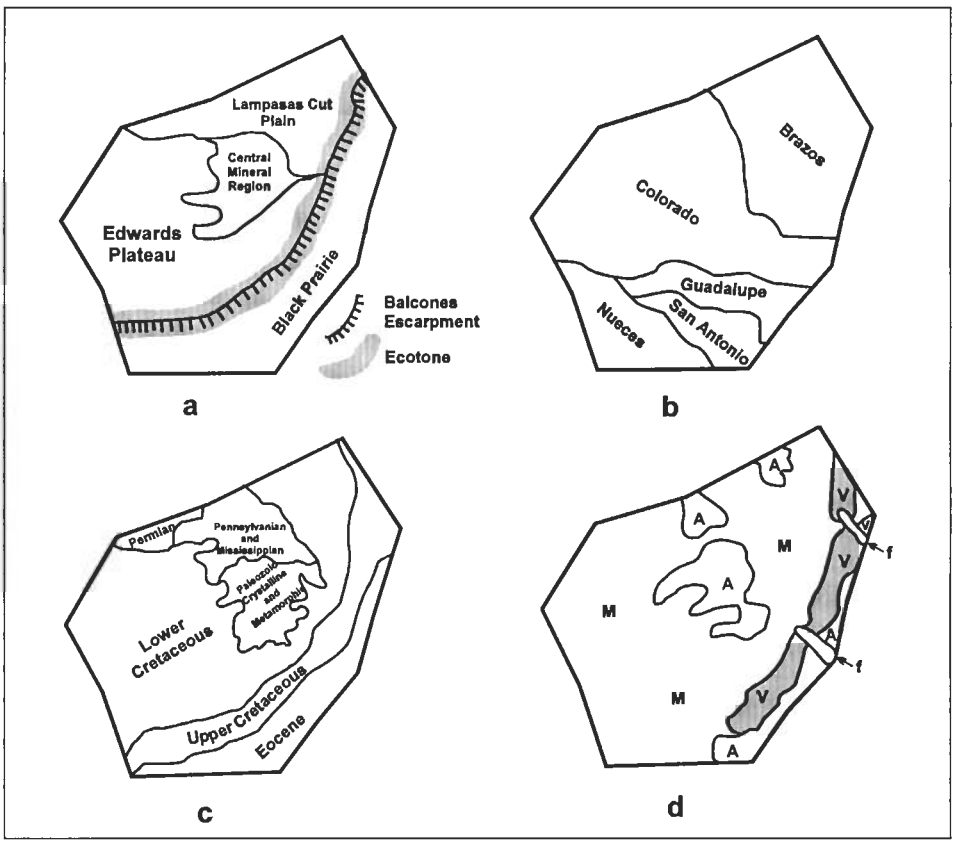

Fig. 3.4. Geographic aspects of central Texas: a, physiography; b, major river basins; c, geology; d, soils (A = alfisols; M = mollisols; V = vertisols; f = fluvial valley fills, various soils).

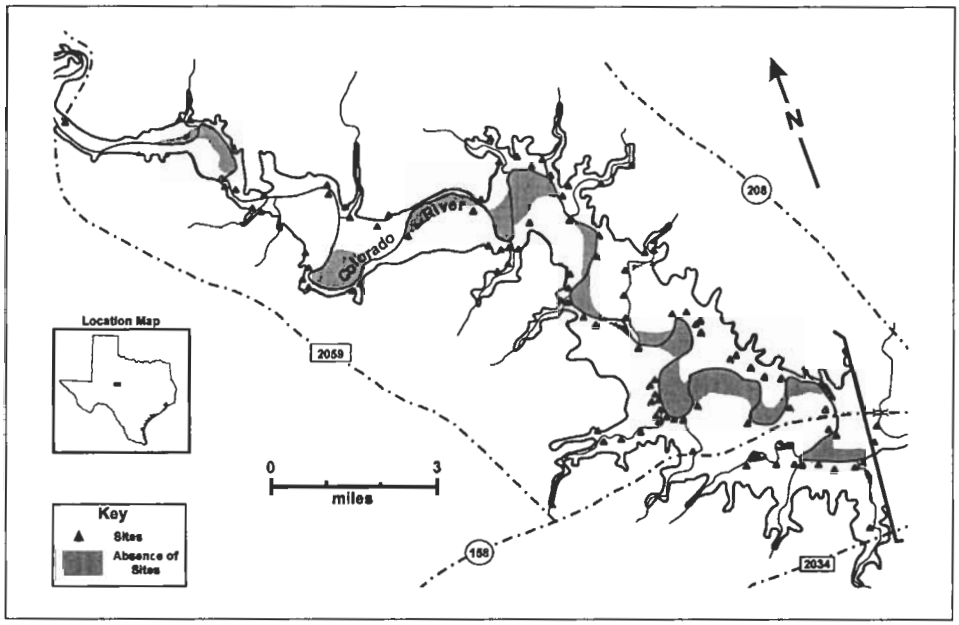

Fig. 3.5. Site distributions in the basin of Robert Lee Reservoir; note paucity of sites on the inside of river bends (from Shafer 1967).

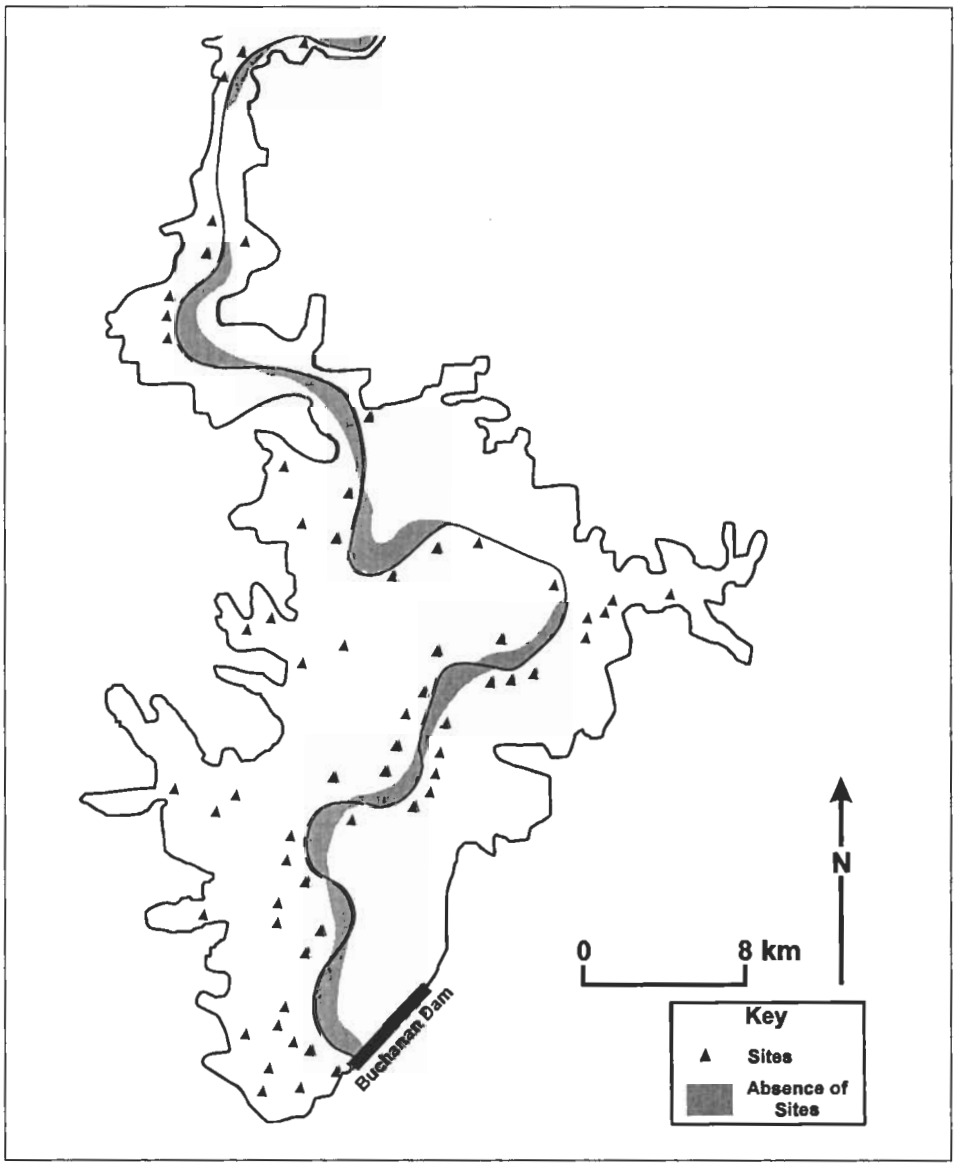

Fig. 3.6. Site distributions in Buchanan Lake basin; note paucity of sites on the inside of river bends (from Jackson and Woolsey 1938).

Landscape Evolution from Earthquakes to Earthworms

Foremost among deficiencies in the methodology by which most of the central Texas archeological record has been built is an inadequate recognition of the dynamic nature of the physical environment. Landscape evolution has profound implications for archeological inquiry. Issues of long-term changes in climate (Bryant 1977; Bryant and Shafer 1977; Bryant and Holloway 1985) and biotic communities (e.g., Dillehay 1974) have received considerable attention from archeologists, but these issues are like words without music when played against a static terrain. A few examples will illustrate the importance of integrating archeological inquiry with an understanding of landscape change—whether one is studying a region or a single sit

Most archeological surveys, until recent years, were conducted without the explicit objective of discovering buried sites (e.g., Shafer et al. 1964). Even though awareness of the need for subsurface reconnaissance has increased (e.g., J. W. Saunders et al. 1992), much of our archeological data base was generated without this awareness and is significantly biased as a result. Corollary to discovering buried sites is the recognition that in some areas landscape change has been sufficient to obliterate sites. The important point here is that geologic and pedogenic processes have *nonrandomly* altered, buried, and destroyed sites (e.g., Abbott 1995). Examples from different areas of central Texas are instructive.

Fluvial Systems

Simplified depictions of site distributions from archeological surveys in three reservoirs along the Colorado River clearly illustrate one aspect of this bias. In two of the three project areas (Figs. 3.5 and 3.6), virtually no sites were recorded on the inside of bends in the river (Jackson and Woolsey 1938; Shafer 1967). In the third area (Fig. 3.7), only a few sites, "ephemeral and not worthy of excavation" (M. Collins 1995, 368) were noted on the inside of bends (Texas Archeological Research Laboratory [TARL] files). Are we to infer that people almost never chose to live on the inside of river bends? No, I suggest we are to infer instead that the surveys failed to discover sites buried

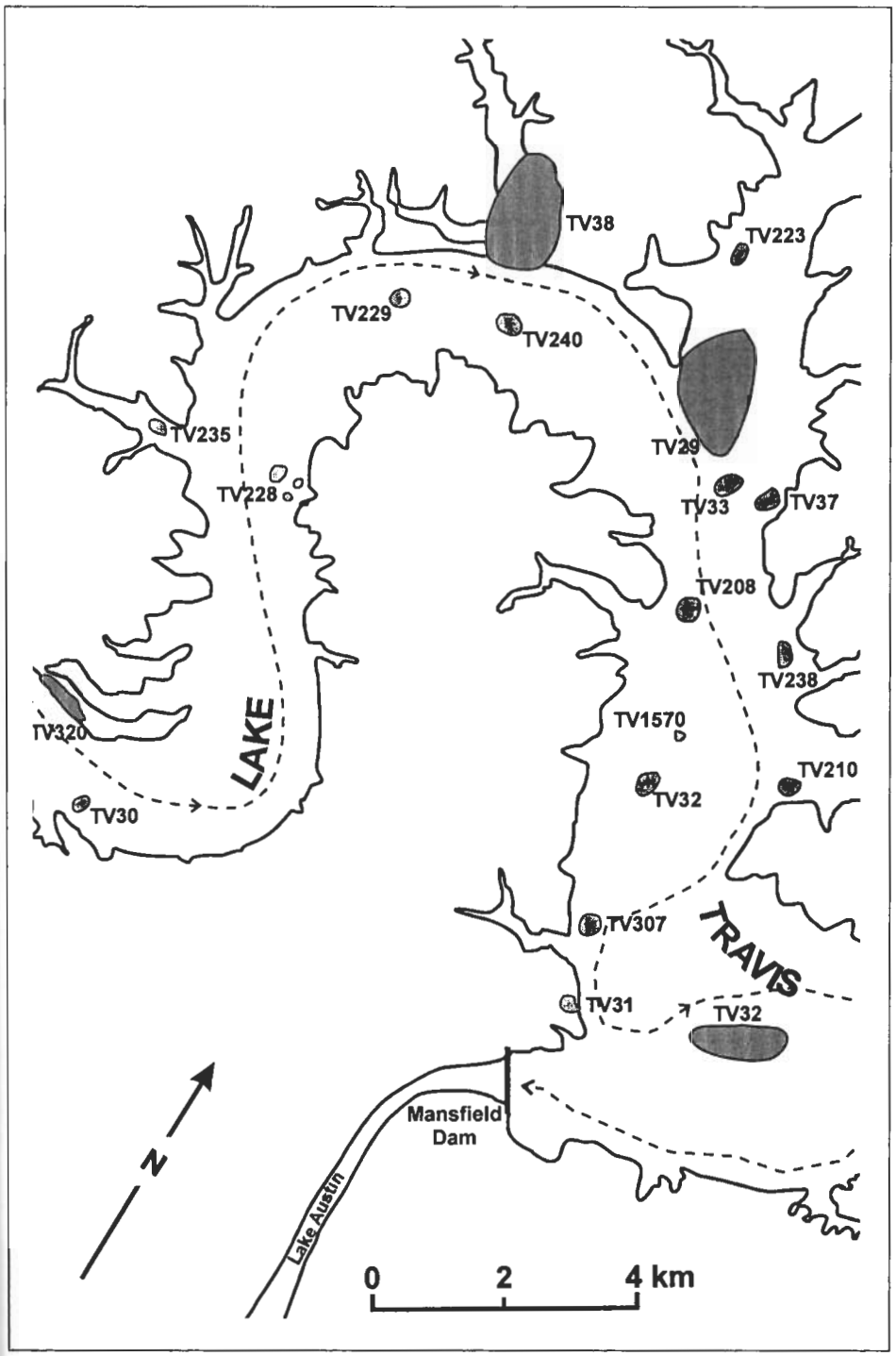

Fig. 3.7. Site distributions in the lower reaches of Marshall Ford (Lake Travis) basin; note that relatively few sites were mapped on the inside of river bends; sites 41TV208, 229, 240, 307, and 320 were tabulated in survey report as "ephemeral and not worthy of excavation" (M. Collins 1995).

on the interior of the river bends. Since streams almost invariably cut on the outside of their bends and deposit on the inside, a sequence of prograding deposits forms on the interior of bends. These are referred to as "point bars" and are often the ideal depositional environment for the formation of stratified sites. Such sites, however, are commonly invisible or decidedly meager in appearance at the surface, exactly the pattern seen in the three surveys.

Another aspect of site distributional data in the valleys of major streams is that even along a single stream, different histories of deposition often occurred in different areas. Almost no Early Holocene fill is exposed in the larger stream valleys in the central Edwards Plateau, and almost no Late Holocene fill occurs in the upper reaches of small streams (Blum and Valastro 1989; M. Collins et al. 1990). S. Alan Skinner (1974) found larger sites typically occurring along the main trunk of the Guadalupe River, with small sites being more characteristic of the tributaries. He interpreted this situation to reflect an Archaic settlement pattern with base camps on the large river linked to extractive sites in the smaller valleys. However, this conclusion cannot be valid because the archeological record formed differently along the main trunk and its tributaries. Exposed Early Archaic sites are extremely infrequent in the main Guadalupe valley, probably because most of them are deeply buried in Late Holocene alluvium, whereas in the upper reaches of tributaries, where little deposition has occurred since the Early Holocene, components dating throughout the Archaic are present, often mixed together in multicomponent sites on long-stable surfaces (M. Collins et al. 1990, 13–15).

Finally, recent mapping and dating of allostratigraphic units in the valley of the Colorado River downstream from the Balcones Escarpment (Blum 1992) has shown that major changes have taken place in a much shorter time frame than previously inferred (e.g., Baker and Penteado-Orellana 1978).[1] During the culturally relevant past (ca. 12,000 B.P. to the present), four periods of Colorado River valley geomorphic history can be recognized, based on Blum's findings (1992), as relevant to the formation of the archeological record in the eastern part of central Texas.

At approximately twelve thousand years ago, the river had downcut in its older valley fill and was cutting into bedrock. High surfaces of the older fill (the Eagle Lake Alloformation that had built up during the period between 18,000 and 15,000 B.P.) were exposed as terraces along the river as possible localities for any very early sites to form. Significant portions of this landform were subsequently cut away, but scores of square kilometers are still present in the central Texas stretch of the lower Colorado River valley. From then until about thirty-five hundred years ago, the valley floor aggraded, forming a unit mapped as Member 1 of the Columbus Bend Alloformation. This unit dates from about eleven thousand to thirty-three hundred years ago and often exceeds 10 m in

thickness. Deeply stratified sites containing Paleoindian to Late Archaic period components, such as the Vara Daniel site in Austin's Zilker Park (Ricklis et al. 1991), formed in this unit. This unit was then partly cut by the river. Member 2 of the same alloformation then aggraded against, and partly over, Member 1 between about sixteen hundred and a thousand years ago. Member 2 often exceeds 12 m in thickness and contains Late Archaic to early Late Prehistoric sites; these, too, were present at the Vara Daniel site (Takac et al. 1992). There are a few hundred square kilometers of Members 1 and 2 of the Columbus Bend Alloformation in central Texas, concealing an untold number of buried archeological components.

The river downcut again, approximately a thousand years ago, before depositing its most recent unit, Member 3 of the Columbus Bend Alloformation, which is inset against the older Members 2 and 1. Blum (1992, 193) noted modern artifacts (e.g., barbed wire) in this member, but radiocarbon ages back to ca. 500 B.P. (Blum 1992, table 6.4) indicate that some buried Late Prehistoric components could be present. Accelerated deposition in the last one hundred years (Blum 1992, 193) is probably attributable to disruption of the natural vegetation by grazing and farming, and this activity may have buried most late sites.

For the archeologist, the horizontal extent of fluvial deposits may be as important as their temporal coverage. Deposits of any particular age might occur only in extremely limited areas favorable for deposition, might be massive and extensive, or might be moderately widespread. Knowledge of these conditions is essential to discovering sites and to interpreting their frequencies relative to other sites and by time periods.

"Eocene" Sand Sheet and the Big Brushy Formation

Along the eastern margin of the central Texas archeological area is a narrow strip of deep sandy land (see Fig. 3.4c), generally mapped as Eocene age on geologic maps (Barnes 1981). As in much of eastern Texas, prehistoric sites found in this setting commonly are either buried or exposed by some kind of land disturbance (see K. Brown 1986; A. Taylor 1987). Just outside the central Texas area, but in the same sand belt, recent geoarcheological work has defined a Holocene unit (the Big Brushy formation), a widespread sand mantle of variable thickness that in places contains buried archeological remains (see Bianchi 1984; Bousman and Fields 1988; Perttula et al. 1986). This work sheds light on the kinds of formation processes that might be expected in the central Texas part of the sand belt. Basically, in the words of C. Britt Bousman and Ross C. Fields regarding the Big Brushy formation, "Sand thickness is viewed as having a direct bearing on the preservation and interpretability of the archeological record, with thick sands having the potential to contain intact, stratified cultural deposits and thin sands having a greater likelihood of containing eroded, displaced cultural materials" (Bousman and Fields 1988, 195). Furthermore, since the Big Brushy formation is thought to have eolian and colluvial facies, it has the potential of reflecting changes in environmental conditions over time.

Blackland Prairie

That band of the coastal plain just east of the Balcones Escarpment known as the Black Prairie or Blackland Prairie is an area of deep soils ultrarich in clay, called ultraclay soils. Sites formed in these soils are subject to extreme disruption through soil processes (pedoturbation). Soil textbooks (e.g., Boul et al. 1989) even use Houston Black Clay, the prevalent soil series in the Blackland Prairie, as representative of the adverse properties of ultraclay soils (see Fig. 3.4d). Extreme plasticity when wet, deep vertical cracking when dry (Duffield 1970a), and a propensity to roll like a slowly boiling thick liquid (producing soil features called *gilgai*) are the factors that threaten site integrity. Gilgai movement in soil is like that in dough as it is kneaded. In deep Houston Black Clay, the rolling motion typically extends downward about 1.5 to 2 m and produces distinctive shear features, called slickensides, between masses of soil that move past each other. I have seen pieces of modern metal and glass dragged to the bottom of gilgai (a downward distance of more than 1.5 m) by this process, showing that the rolling time of gilgai is on the order of decades. If excavations encounter large slickensides (often observable in irregular planes 25 to 50 cm or more across) in a site, that site, in all likelihood, is badly disturbed.

Bluffs and Colluvial Slopes

Much of central Texas is dissected limestone plateau land, and there are also areas where hills of granite, sandstone, and other rock types occur. Hillsides and valley walls in all of these are subject to degradation in the form of slope movement, or colluviation. At least one site (41ML64 in McLennan County) has been documented as partially disrupted by a landslide (M. Collins and Holliday 1985). Where overhangs (rockshelters) occur, these, too, degrade and collapse over time (M. Collins 1991b). Sites on, or at the toe of, slopes are subject to movement or burial by colluviation. As rockshelters degrade and collapse, sites within them are buried in detritus. All of these factors profoundly shape the archeological record.

Ubiquitous Processes

Minor surface deformation events, as well as earthquakes with magnitudes up to 5 on the Richter scale, occur in the area (Davis et al. 1989; Osmond 1963). The consequences of seismic and tectonic activity during the Late Quaternary (see E. Collins 1982; E. Collins et al. 1980) may have influenced human history or the archeological record of that history in central Texas. Known consequences of earthquakes include degradation of rockshelters and blufflines (M. Collins 1991b), soil liquefaction or ejection events, and the alteration of stream courses (Rapp 1986; Schumm 1977; Talwani and Cox 1985).

Pedoturbation occurs to some extent in all soils. Common forms include the action of tree roots, brush, and herbaceous vegetation; the burrowing of animals; and the constant action of earthworms. Dens of the social insects, particularly ants, can also cause extensive damage to sites.

As the landscape aggrades, soil formation and the disruptive forces that accompany it are lessened proportionally to the rate of aggradation. Conversely, cessation of aggradation intensifies disturbance in the soil zone. It also invites the mixing of archeological evidence from multiple

periods of occupation, called *palimpsests* (see Ferring 1986b). It is important to recognize that any surface upon which archeological materials rest was stable, at least briefly. If that surface is buried, aggradation resumed after a time of stability. Not all buried surfaces are equal, since the time of stability can vary from days to millennia before deposition resumes.

Archeologists do not always discern the differences among buried archeological surfaces, placing too much emphasis on the fact of burial and not enough on the nature of the interval of stability (lacuna or hiatus) that preceded burial. Palimpsest sites can become buried and be just as mixed as their counterparts at the present surface.

A particular pitfall is that of *penecontemporaneity,* or burial at the same time. At any moment, the land surface will be composed of surfaces that have been exposed for different lengths of time. If widespread deposition abruptly covers part of that land surface, the preceding interval of stability will have been of greater duration in some areas than in others, but the overlying sediments will all be of the same age. Any attempt by archeologists to use the age of a depositional unit to estimate anything other than the minimum age of underlying archeological materials is at risk.

Chronology and Other Accomplishments

It has become fashionable to criticize efforts to build an archeological chronology for central Texas. Wilson W. McKinney (1981); Duane Peter et al. (1982); LeRoy Johnson (1987, 1991; L. Johnson and Goode 1994); Stephen L. Black (1989b); Michael Collins (1994a; M. Collins et al. 1991); and G. Lain Ellis (1994), among others, have all found fault with the leading chronological schemes proposed by Frank Weir (1976) and by Elton Prewitt (1981, 1985). There are significant flaws in both, but these are also two remarkable and significant contributions to the archeology of the region, not so much as chronologies but as attempts to integrate and synthesize large amounts of archeological data. It is also important to remember that Weir and Prewitt did not lack for prototypes (notably those of L. Johnson et al. 1962 and of Sorrow et al. 1967).

LeRoy Johnson et al. (1962) and Sorrow et al. (1967) proposed local archeological chronologies, each on the basis of a few sites. The data from the Footbridge, Oblate, and Wunderlich sites were not robust chronologically, but an effort was made to bring central Texas chronological thought into closer agreement with that being used in the eastern United States (L. Johnson et al. 1962; L. Johnson and Goode 1994). The Evoe Terrace and Landslide sites (Sorrow et al. 1967) afforded better chronological evidence, especially with the benefit of earlier findings at the nearby Youngsport site (Shafer 1963). Sequencing of diagnostic chipped stone tools, especially projectile points, was emphasized in these efforts.

Weir (1976) and Prewitt (1981, 1985) proceeded beyond chronologizing projectile point types; sought to find temporal patterning in site types, features within sites, and assemblages of artifacts; and offered suggestions to explain some of the patterns they discerned. G. Lain Ellis (1994) presents an insightful critique of Weir's and Prewitt's efforts.

It is a credit to Weir's and Prewitt's skills in the *art* of archeological analysis that such comprehensive schema could be developed when many of the data they used were from sites with (a) mixed components, (b) poor stratification, (c) unclear associations among artifacts and between artifacts and features, and (d) weak associations between samples dated by radiocarbon and the target archeological manifestations. Weir (1976) relied on only 46 radiocarbon dates, the vast majority of which were from sites outside of central Texas; Prewitt (1985) had 147 radiocarbon dates.

Considerable use has been made of Weir's and especially of Prewitt's chronological schemes, and revisions have been proposed (e.g., M. Collins et al. 1991; L. Johnson and Goode 1994; Ricklis and Collins 1994). The work of verifying and improving the regional archeological chronology will always remain unfinished. Recent efforts, especially the more rigorous use of absolute dating (see L. Johnson and Goode 1994), show promise for substantial improvements. Importantly, the caveat posted by LeRoy Johnson (1987) regarding Prewitt's chronology must continue to be heeded.

Many sites in central Texas are deficient or totally lacking in suitable organic materials for conventional radiocarbon dating. Use of AMS (accelerator mass spectrometry) in radiocarbon dating has enhanced the capability of the technique and brings more sites within the scope of radiocarbon dating.

Alternatives to radiocarbon dating and application of radiocarbon techniques to a wider array of materials are also important developments. Archeomagnetic (Eighmy 1993), optically stimulated luminescent (Stokes 1992), thermoluminescent (M. Collins 1994c, 499–501), and in rare cases even obsidian hydration (Stevenson 1992) procedures may hold promise for dating certain recalcitrant sites in the area. Dating of organic constituents of bone, soil, sediments, snail shells, travertines, and other carbonate rocks using radiocarbon techniques are becoming more useful as the chemistry of each becomes better known and the problems associated with assaying these materials become less serious.

Burned rock middens, because they are numerous and conspicuous in central Texas, have long received a large share of archeologists' attention. After decades of limited success in understanding what these sites represent in human behavioral terms, recent efforts employing more thoughtful research strategies and improved techniques for gathering and analyzing data have begun to extract information that promises to answer some questions and frame others more clearly. Perhaps the single most fundamental conceptual advance in burned rock midden research is recognition that burned rock middens likely formed in several different ways. The recovery of detailed data on the structure, composition, content, and context of middens in order to have data on explicitly defined material expressions of different aspects of human behavior is the approach that has long been lacking in burned rock midden research (Black et al. 1997; M. Collins 1991a, 1994b; Creel 1991a; Goode 1991; Hester 1991b; M. Howard 1991; Prewitt 1991; Potter and Black 1995; Potter et al. 1995).

Archeology in central Texas has also seen the development of sophisticated research into the technology of stone tool manufacture and use. A trend that began in the late 1960s (e.g., Sorrow 1969) and has become almost routine (e.g., Ensor

and Mueller-Wille 1988) is the inclusion of technological findings in lithic artifact descriptions. This practice has included efforts at sourcing cherts (e.g., Quigg and Peck 1995) and obsidians (e.g., Hester et al. 1985) along with sustained considerations of how people acquired stone and worked it, as well as how they used, maintained, and recycled the resultant objects. What has not occurred is any regional synthesis of the diverse descriptive data that have been amassed. Debitage analysis, properly done on assemblages of high contextual quality, contributes otherwise unknowable information about prehistoric knapping behavior (see M. Collins 1994a; Ensor and Mueller-Wille 1988; Quigg and Peck 1995; Ricklis 1994b).

Although ceramics are far less common than lithic artifacts in central Texas, concern with ceramic technology and the cultural implications of pottery-making behavior has recently emerged (e.g., L. Johnson 1994; Perttula et al. 1995b; Reese-Taylor et al. 1994). This development is an important one that, if sustained, will produce valuable results concerning the prehistoric central Texas archeological record.

Archeologists in central Texas have increasingly considered the processes of site formation and incorporated the findings into their interpretations (e.g., Potter and Black 1995). This is not a research goal in its own right, but it is an essential element in sound archeological inquiry, and it should become a routine part of any site investigation. An outstanding early example of the site-formation-process perspective is that of Kelley and Campbell (1942), which considered the relationship between rates of alluviation and the formation of burned rock middens. Unfortunately, this perspective did not prevail in the region, and only recently has it become very common.

Butzer (1982) notes that the archeological record can be viewed on three contrasting scales—micro, meso, and macro. Research at each scale has its own set of strengths and weaknesses. Archeological inquiry in central Texas has heavily emphasized the mesoscale, which usually encompasses a single site and its immediate setting. Unfortunately, archeological patterns are more vulnerable to disruption at the mesoscale than at either the microscale or the macroscale (M. Collins et al. 1991a). A few studies at the macroscale, where archeological data patterns covering wide areas are sought, have been concluded, and they incorporate data from central Texas (Creel 1991a; Howard 1991; Largent and Waters 1990; Meltzer 1987, 1989; Meltzer and Bever 1995), but considerable gain could be expected from more such studies.

Historically, archeological excavations in central Texas have emphasized the vertical dimension, a direct outgrowth of the emphasis placed on the building of an archeological chronology. Growing interest in recovering evidence of human behavior has led to increasing use of wide-area excavations on "living surfaces" (e.g., at the Slab, Loeve-Fox, Higgins, Camp Pearl Wheat, Mustang Branch, Turkey Bend Ranch, Sleeper, and Rush sites, to name a few). These shifts in emphasis constitute one of the most positive developments in the regional paradigm, but much is yet to be done to bring this approach to full fruition. Principally, the first requirement is that any archeological array thought to be a "living surface" be assessed for length of exposure. The primary aim in excavations of this sort is to find horizontal patterning within a single component of short duration. Ideally, that is a surface lived upon by only one cultural group, who left material clues of the spatial organization of their activities where those patterns have not been sullied by subsequent occupations of the same surface (see Ferring 1986b; L. Johnson 1987). Rapid burial of such surfaces is the surest process by which such conditions are produced, and comprehensive geologic evidence is the best indicator that burial was swift and sure. Good examples of these conditions having been met are for Late Prehistoric components at the Rush (Quigg and Peck 1995) and Mustang Branch (Ricklis 1994a, 1994b) sites. Obviously, "living surfaces" can be reused, as at the Slab site, where multiple components are clearly indicated at the same level in the site (Patterson 1987). Difficulty arises when it is unclear how long a surface remained exposed and how many episodes of use may be represented by the archeological materials on that surface (M. Collins 1994a).

A great advantage of horizontal exposures in archeological sites is the opportunity to fully investigate entire features in their horizontal contexts. Thoughtful i quiry into the form, function, and con tent of burned rock features, and the b haviors responsible for their creation (s Thoms 1989) is burgeoning in central Texas (M. Collins 1991a; M. Collins e 1990; L. Johnson 1991; Potter et al. 1995). Explicit criteria for recognizing ovens, open hearths, rock disposal hea and other behaviorally significant kind of burned rock features are emerging, a though consensus on these interpretati does not yet exist. The use of geomagne evidence to determine whether or not a given burned rock has been moved sinc it was last heated and cooled is one tec nique that holds promise in this area o inquiry (Gose 1994). The greater use o comparative ethnology and ethnograph analogy (Thoms 1989) has also been a major benefit to this line of inquiry. It too early to know what the potential of investigations in this vein might be.

Wide area excavations have also brought about more interest in the natu of prehistoric structures in central Texa (L. Johnson 1997; Lintz et al. 1995). F examples, at the Lion Creek, Slab, Turk Bend Ranch, Mustang Branch, Currie, Rocky Branch, and Zatopec sites, possi evidence of structures has emerged. Th structures suggest the presence of domi ciles or other architecture from Early A chaic to Late Prehistoric times. The na ture and functions of domestic structur have been among the more neglected to ics in central Texas archeology, but thes recent developments should bring abou increased awareness and interest in the subject. New findings will then follow i due course.

Faunal remains and, less often, floral remains have long been identified and r ported when recovered from archeologi cal sites in central Texas (Jelks 1962; M Donald 1974; Sorrow et al. 1967; Wei 1979). In the last few years, investigator have emphasized closer scrutiny of faun taphonomy and have made more con certed efforts to recover and interpret ec nomically important floral remains, in cluding pollen and phytoliths as well as macrofloral specimens (Black and Mc Graw 1985; Hester 1973; Holloway 1988; M. Howard 1991; Jelks 1962). Bone breakage is no longer lamented as interfering with taxonomic classificatio but is seen as an eloquent expression of

the cultural and natural forces that have operated on the assemblage (Masson and Holderby 1994). These views are essential to understanding the human behaviors and adaptations behind the regional archeological record, and thus they integrate closely with the investigation of living surfaces and burned rock features.

Archeologists in central Texas have been mindful of the need to understand the relationship between cultural history and past climatic conditions (Bryant and Holloway 1985; Bryant and Shafer 1977; Gunn and Mahula 1977). Integration of the two lines of evidence (see Bryant and Shafer 1977) has not been particularly successful, however, in part because the better environmental records have not been found in archeological sites (Blum 1992) and because neither record has been consistent and precise.

An almost complete vacuum exists between the prehistoric and ethnographic records of native peoples in central Texas. In the 1990s, considerable progress was made in explaining this gap and focusing attention on issues that are perhaps subject to meaningful investigation. No longer are the Jumanos (J. Kelley 1947) or the Tonkawas (D. Suhm 1960) considered to be possible descendants of the authors of Toyah prehistoric manifestations; no serious scholar still considers Cabeza de Vaca's path to have crossed central Texas (Campbell and Campbell 1981). The present territory of central Texas was not the long-term ancestral homeland of any indigenous group for whom an ethnographic account exists. The ethnographically well-known Comanche, Apache, Wichita, Kiowa, and even the Tonkawa arrived in central Texas just before or during the early European contact period (Campbell 1988; Newcomb 1961, 1993). Historic records document the *presence* of numerous other groups during the first decades of European contact but provide very little information about them. Concerted ethnohistoric work (see multiple listings by T. N. Campbell under Indian group names in Branda 1976; Campbell 1988; Campbell and Campbell 1985; Newcomb 1993) has gleaned valuable but incomplete information on these peoples who mostly vanish from historical view by the early eighteenth century. Thus, we have an early part of the Historic period, essentially a protohistoric period, consisting of historic glimpses of indigenous peoples, and a later Historic subperiod during which relocated, acculturated remnants of earlier groups as well as very recently arrived groups are known from more complete historical records and, in some cases, later ethnographic studies. These facts greatly reduce but do not eliminate the usefulness of any direct historical approach to the prehistory of central Texas (M. Collins and Ricklis 1994; Newcomb 1993).

The Gisement

Six features and 35 artifacts recovered in an excavation of the Camp Pearl Wheat site in Kerr County, Texas (M. Collins et al. 1990), tell us more about Archaic lifeways than the large burned rock midden and its 1,282 artifacts documented at the John Ischy site in Williamson County (Sorrow 1969). *The difference is in data quality.* At John Ischy, multiple components were hopelessly mixed as they accumulated in a midden on a long-stable land surface, whereas at Camp Pearl Wheat the land surface was stable for only a brief time, during which people occupied the site on one or a very few occasions and their leavings were buried before later cultural materials could be added. Sorrow could detect patterns in the distributions of certain artifact classes across the John Ischy site—for example, manos were more abundant just outside of the midden than within or farther away from it (Sorrow 1969, 50–51 and fig. 27)—but there was no way to know if this situation reflects behavior that continued throughout the thirty-two hundred or so years (my estimate) of the site's use or for only some portion of that time.

In contrast, all or part of a single, integrated, functional artifact assemblage is probably represented at the Camp Pearl Wheat site in an isolable component. This artifact assemblage contributes to an emerging regional pattern of site types and distributions that reflect subsistence behavior during the Early Archaic (see discussion below).

Localities where low-energy natural deposition is active during or between episodes of human occupation afford the optimum conditions for the isolation of discrete assemblages of material cultural remains. Such localities become stratified archeological sites with one or more isolable archeological components sealed between strata of natural deposits. When archeological methods of investigating such sites are integrated with those from the earth sciences, the results are superior to any that derive from archeology alone. Europeans studying the prehistory of the Old World, especially in France, have long recognized and practiced this integrated approach to site-specific as well as regional studies. (A good discussion as regards rockshelters appears in Laville et al. 1980, and A. G. Brown [1997] addresses the issue for fluvial site settings.)

A site with stratified archeological and geological layers is referred to in French as a *gisement* (plural, *gisements*) (both pronounced "GEEZE-mohn," with the "gee" as in "gee whiz"). Increasingly over the last forty years in Old World prehistory the methodology for excavating and interpreting gisements has emphasized the interdisciplinary approach, covering geology, soil science, paleontology, palynology, archeology, and whatever other fields are appropriate. Had archeologists in central Texas over the last forty years concentrated on the discovery and comprehensive analysis of gisements even a small fraction as much as have their counterparts in Europe, the record at hand today would be more complete, chronology would have been much more easily controlled, better constrained assemblages would exist for each time interval, and the regional archeological sequence would be integrated with a paleoenvironmental sequence. Data of this improved quality would have long ago fostered the kinds of substantive research just now beginning to emerge in the region.

Gisements can form in caves, rockshelters, dunes, or any area of natural, low-energy deposition. As a practical matter in central Texas, most gisements have formed in the alluvium of stream valleys.

Gisements and Central Texas Archeology

Contrary to an appearance that gisements might be scarce in central Texas or that none was known until recently, the problem has been that most archeologists have simply not appreciated the value of

the ones that have been found and have not rigorously sought others. Also, it is common for gisements in central Texas to have denser cultural deposits in the upper layers and sparser ones at depth (e.g., as at the Landslide and Wilson-Leonard sites). I have no doubt that countless times the excavators of such sites stopped digging either when artifact counts dropped off or when a sterile deposit was encountered (see the account of the previous testing of the Camp Pearl Wheat site [M. Collins et al. 1990]). In those cases, any deeper components went undetected.

Deep stratified sites, with one, several, or many isolable cultural components, have been documented since at least the 1930s (for example, the Merrell Site, excavated in 1934 and 1935 [Campbell 1948] and Rob Roy, dug in 1938 and 1939 [A. Jackson 1939]), and a few have been important in the development of the local record (notably Youngsport, Landslide, Kyle, Smith, Loeve-Fox, and Jetta Court). Nonetheless, in spite of archeological work begun at least by 1918 (Pearce 1932b, 48), only about thirty-one gisements with one or more securely isolated archeological components have been reported in central Texas (Figs. 3.8 and 3.9a and b).

I have characterized the components at these sites as having either very high or moderately high integrity on arbitrary and somewhat subjective criteria. Components with high integrity (depicted in solid shading in Fig 3.9a) show evidence of rapid burial, lack evidence for extensive postdepositional disturbance, and consist of a relatively homogeneous archeological assemblage (especially of diagnostic artifact forms). Components of moderately high integrity (lightly shaded in Fig. 3.9a) are either slightly deficient in one or more of these criteria, the sample is too small for a high-confidence assessment, or there is not enough information to assess integrity fully.

Several aspects of the information in Fig. 3.9a require comment. Three main periods, Paleoindian, Archaic, and Late Prehistoric, are used approximately in the conventional sense to depict what have long been inferred to be significant shifts in adaptations; these inferences may not be entirely sound, but the periods are, nonetheless, useful in organizing the archeological record. Subdivisions of these periods into subperiods are also based on adaptive shifts thought to reflect changes in subsistence strategies. In this presentation, the subdivisions of the Archaic follow the recent revisions proposed by L. Johnson and Goode (1994). Early and late subperiods of the Paleoindian and Late Prehistoric periods are used in this presentation to reflect distinctive archeological patterns.

The finer subdivisions (style intervals) are dependent primarily on diagnostic projectile point styles ("types") that change for reasons not really understood at our present level of knowledge. These subdivisions, too, follow approximately the scheme offered by L. Johnson and Goode (1994) and derive from the syntheses of Weir (1976) and Prewitt (1981, 1985). As already observed, some style intervals are better constrained than others—that called Toyah being probably the best, and that called Taylor, perhaps the poorest.

In Fig. 3.9b, absolute dating is portrayed in radiocarbon years before the

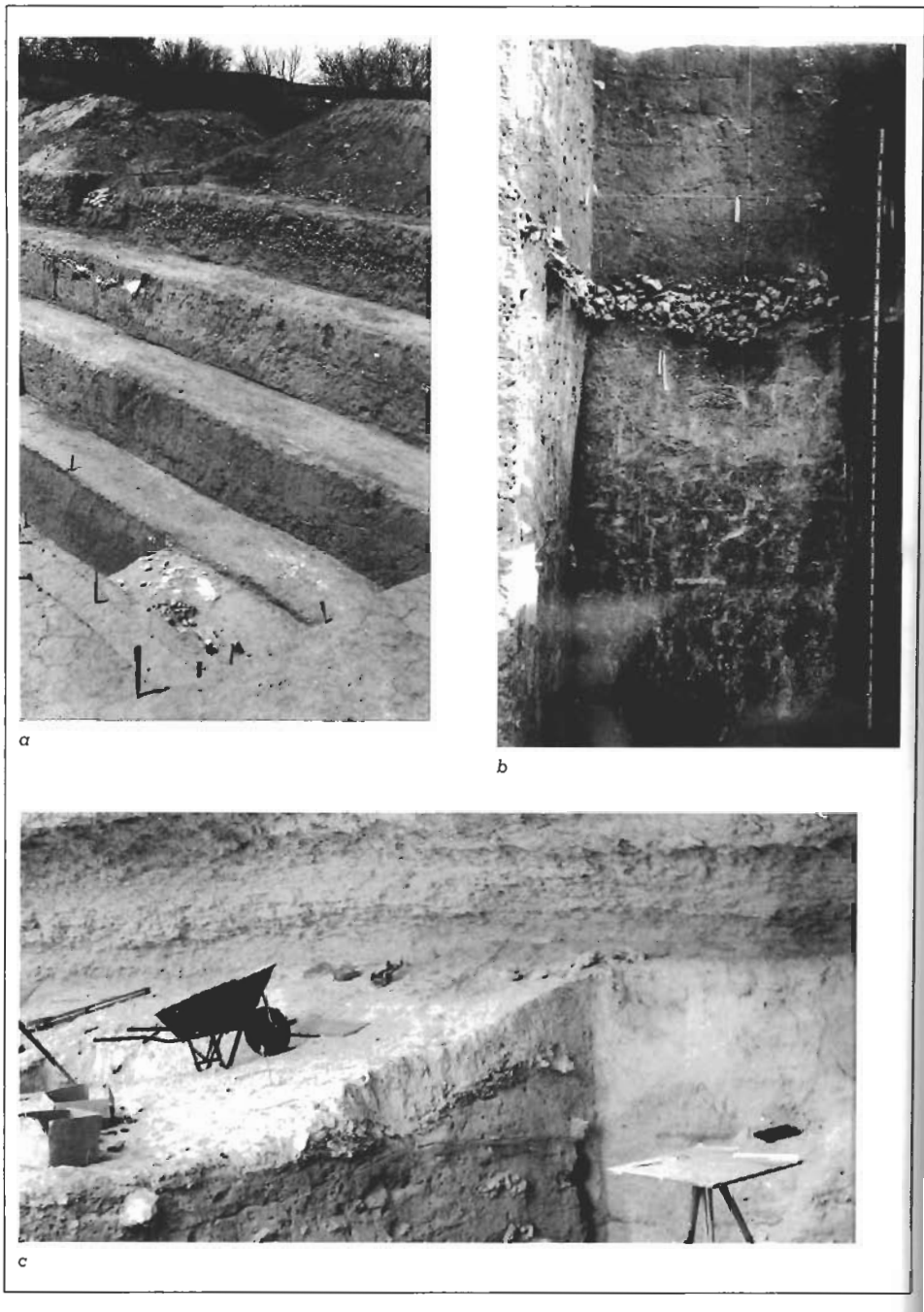

Fig. 3.8. Representative gisements (deeply stratified layers of cultural and natural deposits) in central Texas: a and b, open gisements in fluvial valley fill (Wiley Williams and Wilson-Leonard sites, respectively); c, rockshelter gisement in limestone detrital fill (Kyle site).

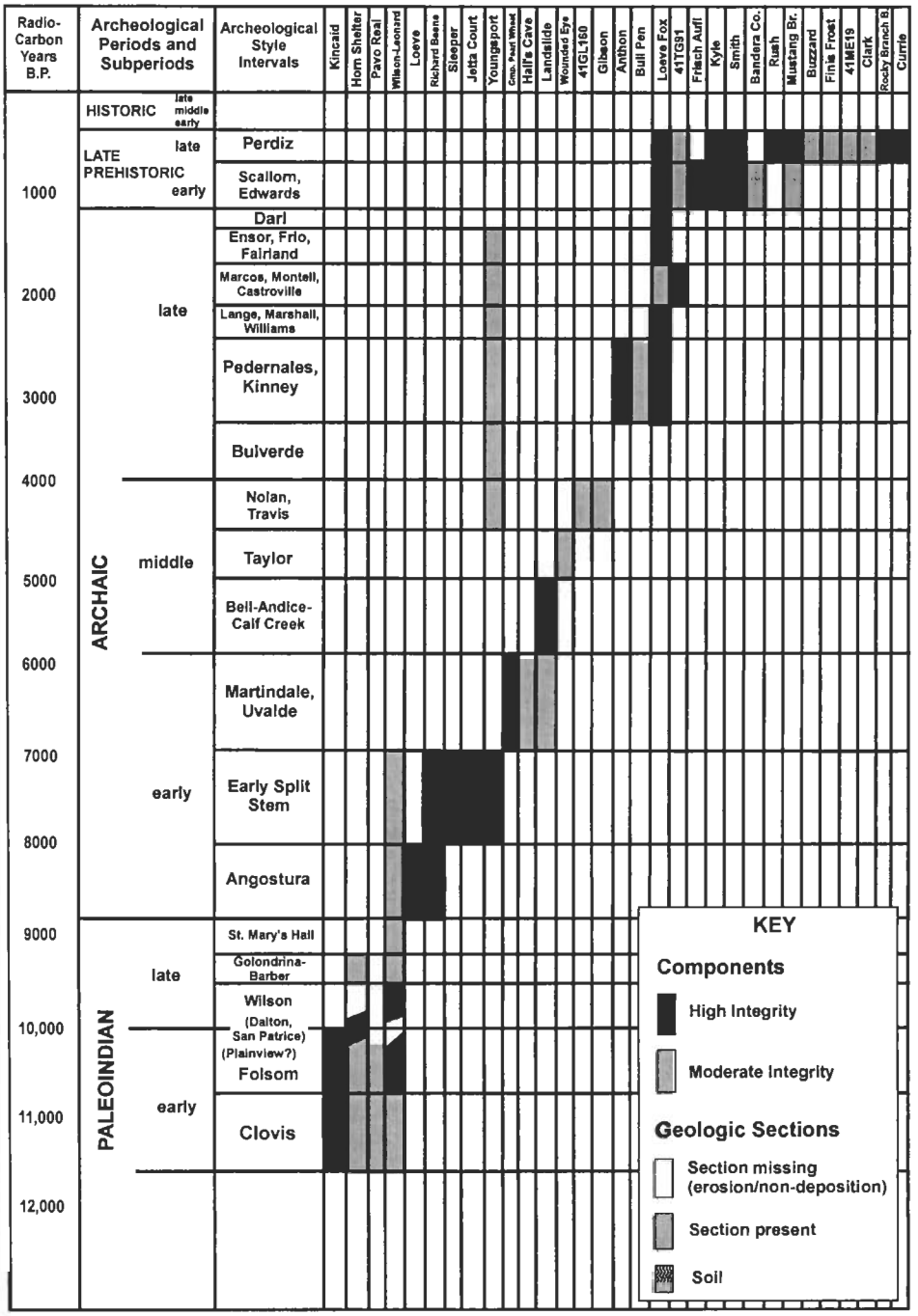

Fig. 3.9a. Central Texas archeological chronology, with key gisements (see Table 3.2 for references).

present, the convention generally followed by geoarcheologists. This convention facilitates use of uncalibrated dates from the literature of the geological sciences and from that of earlier archeological projects. It also allows any calibration to be applied. As a better, stratigraphically constrained archeological sequence emerges, higher-precision radiocarbon procedures along the lines advocated by L. Johnson and Goode (1994) will have greater efficacy.

Sixty-one components of moderately high to high stratigraphic integrity are reported for the thirty-one central Texas gisements presented in Fig. 3.9a. Additional components of lesser integrity occur at a number of these sites, but these are not included. As seen in a cumulative percentage graph of these components by subperiod (Fig. 3.10), the record is weighted toward the recent end with nineteen (31 percent) of the sixty-one components assigned to the Late Prehistoric period (the last one thousand years, or 8.7 percent of the local prehistory). The Late Paleoindian and Middle Archaic subperiods are represented by the fewest components (four and five, respectively); that means that 6.5 percent of the components are in the Late Paleoindian subperiod, comprising 10 percent of the sequence, and that 8.2 percent are in the Middle Archaic subperiod—16.5 percent of the sequence.

Twelve geological, palynological, or paleontological records (see Fig. 3.9b) in and near the central Texas archeological area reflect a consistent but generalized environmental sequence (see Table 3.2). Alternating intervals of comparatively mesic or xeric conditions have been inferred by Bousman in the pollen sequences from bogs in east-central Texas (M. Collins and Bousman 1993) and by Rickard S. Toomey from the vertebrate faunal record of Hall's Cave (Toomey 1993; Toomey et al. 1993). The bog-pollen sequence is not well controlled chronologically; however, the available dates indicate relatively constant rates of sedimentation, from which Bousman interpolated the depicted sequence. Bousman's interpretation of the reported pollen data from Weakly and Boriack bogs considered the relative frequency of grass to arboreal pollens. In doing this, a climatically sensitive aspect of the pollen record emerges from the complete spectrum that otherwise contains numerous taxa, of which the abundances are more likely reflective of localized conditions around the bogs.

In Hall's Cave a deeply stratified, abundant, high-resolution sequence of small animal remains was found. Toomey excavated 3.7 m into the fill of Hall's Cave and recovered thousands of faunal specimens (more than twelve thousand had been cataloged in 1993, with many more remaining to be cataloged). Only the upper 2 m of the Hall's Cave sequence is considered here, and the climatic history depicted is based only on the relative proportions of the least shrew (*Cryptotis* sp. [which requires a relatively moist habitat]) to the desert shrew (*Notiosorex* sp. [found in more arid habitats]) following Toomey (1993) and Toomey et al. (1993). The Hall's Cave sequence I have used here is controlled by 41 radiocarbon dates on bone provided by Thomas Stafford (1995, 1997, personal communications; there are now almost 150 dates)

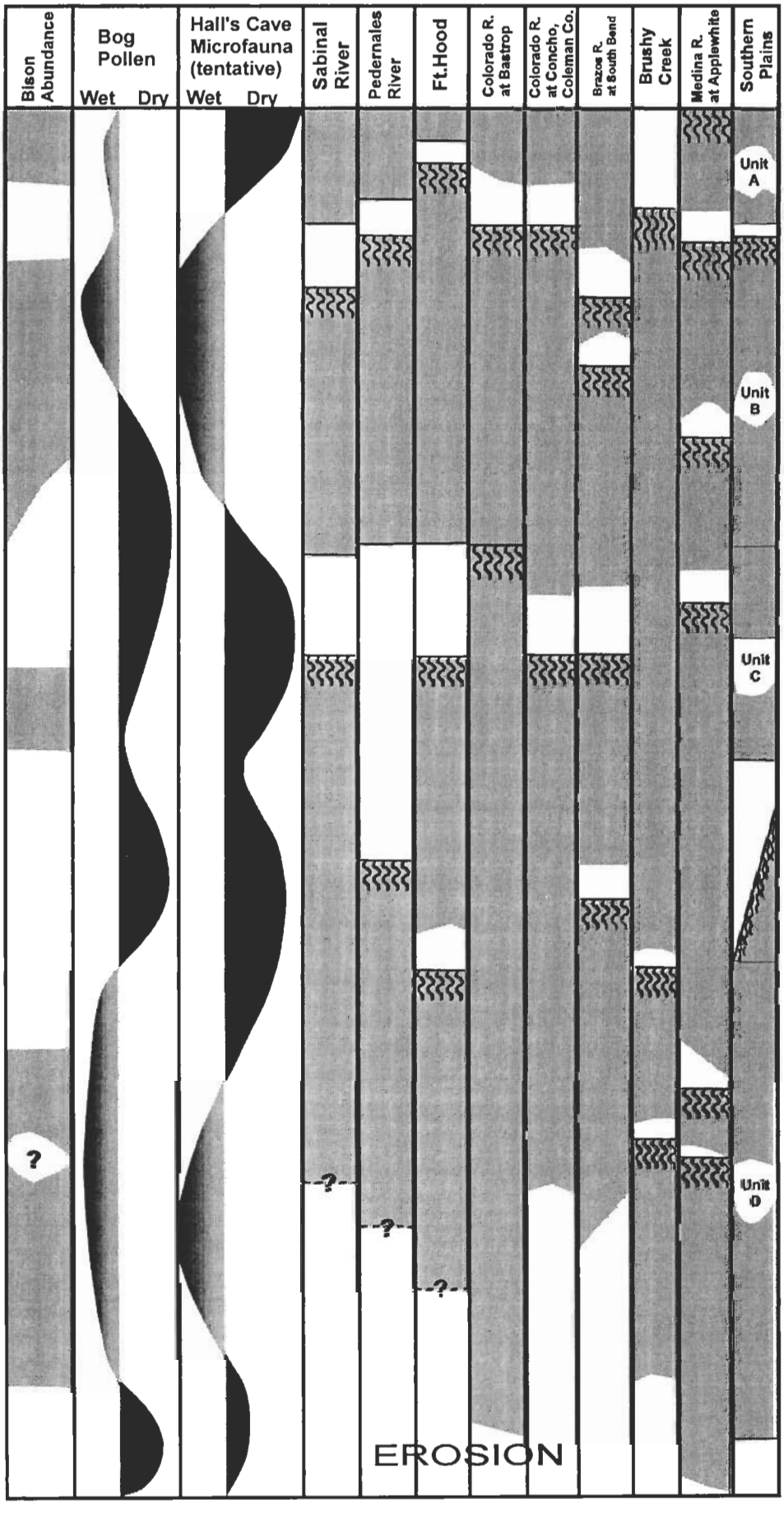

Fig. 3.9b. Central Texas archeological chronology, with paleoenvironmental records (see legend for geologic sections on Figure 3.9a and Table 3.2 for references).

and by three charcoal dates (Toomey 1993). Because of the large number of dates, the fact that the dates are almost perfectly stratigraphically consistent, and the generally high internal agreement between radiocarbon ages determined on different chemical fractions of the same bone, this sequence can be considered one of the best-dated and most environmentally sensitive records in North America. Concern expressed by L. Johnson and Goode (1994, 22) in regard to dates on the earthen fill of Hall's Cave is clearly dispelled by the bone-organic chronology. When it is fully reported, the Hall's Cave biostratigraphy will be a landmark contribution to Quaternary studies.

These pollen and faunal records both indicate an early xeric interval ending near 12,000 B.P. (closely correlating with the "Clovis Drought" noted in Haynes 1991) followed by a significant period of relatively mesic conditions. Each record then indicates a long Middle Holocene interval of relatively xeric conditions, which were slightly ameliorated at roughly its midpoint. That the two records are not synchronous probably results largely, if not entirely, from inaccuracy in the ages interpolated for the bog-pollen sequence. In general terms, the Middle Holocene xeric interval lasted approximately five thousand years—close to half of the local prehistory. The effects of Middle Holocene aridity are seen widely in central Texas, often in the form of stream incision, but precise dating is often difficult (see Abbott 1994).

Late Holocene conditions returned to being more mesic. The pollen and faunal indicators are inconsistent only in the latest Holocene, when a final swing toward xeric conditions appears in the Hall's Cave fauna. Other than relatively small samples of the species (and, therefore, possible sampling error) on which Toomey based his interpretations, the inconsistency is not readily understood. It is possible, of course, that contrasting conditions could exist because the pollen record is from the easternmost edge of the area and the faunal record is from more nearly the westernmost edge.

The relative abundance of bison in and near central Texas has been inferred from occurrences in archeological sites (Dillehay 1974; Prewitt 1981, 1985;

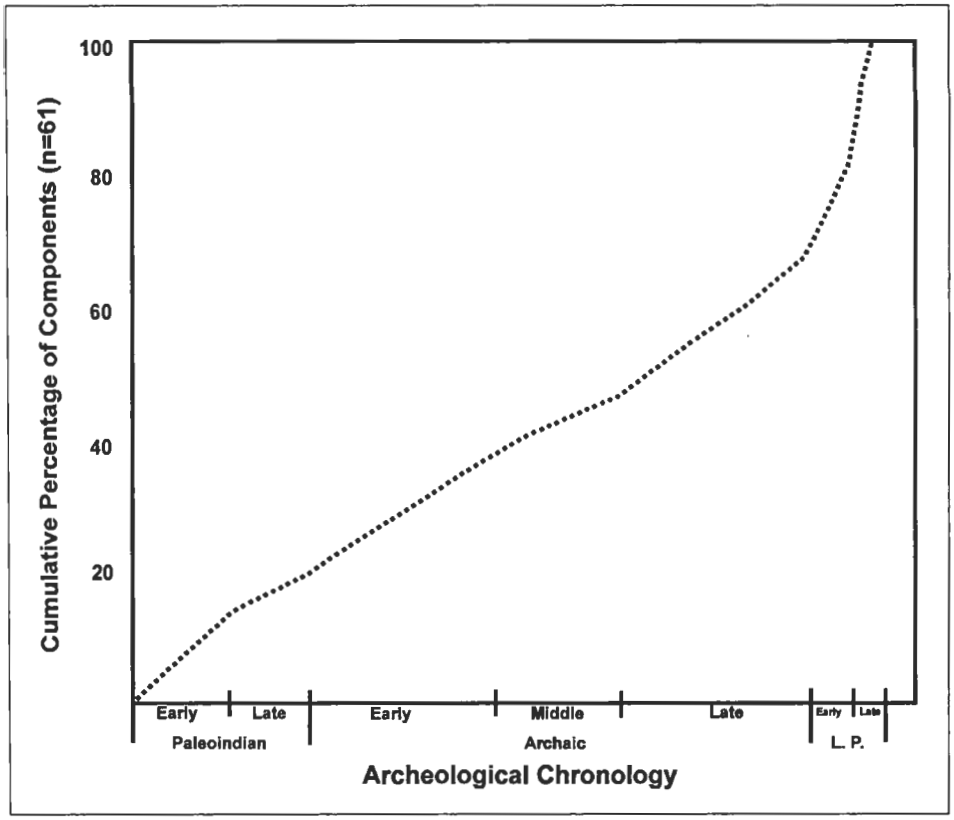

Fig. 3.10. Cumulative percentage graph of documented gisements by archeological time periods in central Texas.

M. Collins et al. 1990). There is a general correlation between bison occurrences and comparatively mesic portions of the bog-pollen and Hall's Cave faunal records.

The geologic records are based on fluvial sequences where episodes of valley filling alternate with periods of erosion and/or stability and soil formation. Geologic sequences portrayed in Fig. 3.9b are based on data of varying completeness and precision (particularly as regards dating). Geologists working with Quaternary-age sequences vary widely in their application of the concept of soils (some emphasizing soil formation and reporting every minor soil, others emphasizing sedimentary process and reporting only major soils). Local conditions in each fluvial system differ, and circumstances determining the amount of radiocarbon dating that can be applied are unequal. Furthermore, investigators allocate their radiocarbon resources differently, some targeting soils, others preferring to date sediments. For these reasons, the depictions in Fig. 3.9b must be viewed only as indicating the general trends and are not be taken to represent detailed, precisely dated alluvial sequences.

Consistently, the valleys of central Texas (and much of North America [Haynes 1991, 1992, and 1993]) were downcut and scoured of sediment in the Late Pleistocene, approximately fifteen thousand to twelve thousand years ago. Valley filling followed during the ensuing mesic interval, and it is in these sediments that a number of the important Early Paleoindian sites have been found.

Erosion and stability (with soil formation) are more characteristic of the Middle Holocene, during the long xeric interval. This interval was first recognized in North America on the basis of extensive evidence for erosion and arroyo cutting in the southwestern United States, and this interval has been called the Altithermal (Antevs 1955). Whether or not the interval was significantly warmer, it does seem to have been drier, and the paleoenvironmental record of central Texas was clearly influenced by dry conditions. It is yet to be determined exactly what the consequences of this xeric interval were in terms of human ecology. It is abundantly clear that the archeological record has been significantly and adversely affected by the Middle Holocene xeric conditions. Erosion undoubtedly destroyed many archeological sites, and many others, on stable surfaces, resulted in palimpsests of long duration. The approximately five thousand years of the Middle Holocene xeric interval—43 percent of the record—are represented by only about seventeen (22 percent) of the sixty-one components in Fig. 3.9a.

Downcutting of valleys occurred widely in the Middle Holocene, leaving former valley floors above the reach of most flooding and bringing deposition on these surfaces to a virtual halt. Major soils that formed on these long stable surfaces are documented over wide areas in the valleys of central Texas during the Middle Holocene, and many sites, especially burned rock middens, reside on those surfaces. It is from these numerous, highly visible, artifact-rich sites that much of the archeological record for the Middle Holocene has been derived.

Returning for a moment to the poorly defined Taylor-style interval, the question to be answered by future research is whether its archeological scarcity reflects a cultural reality or results from gaps in the archeological record brought about by erosion and reduced deposition during the Middle Holocene. This poorly represented interval is left on Fig. 3.9a to underscore this aspect of the record and to provide a tempting target for sound archeological dismissal or verification.

Fortunately, all central Texas streams did not respond in exactly identical fashion to the Middle Holocene xeric interval, and neither erosion nor nondeposition are absolute in any fluvial system—there is always deposition somewhere. Deposits of Middle Holocene age are present but less abundant and less conspicuous than those of the Early and Late Holocene ages. Corollary to this, there are undoubtedly sites of Middle Holocene age, in good geologic context, still waiting to be discovered. The search for them will need to be conducted using sampling designs based in geomorphology (see Blum and Lintz 1993, 313; Mandel 1992, 79–83; Nordt 1992, 68–80).

In the Late Holocene, valley filling prevailed, but one widespread episode of downcutting occurred ca. 1000 B.P. (S. Hall 1990). In part because the evidence is better preserved, the Late Holo-

cene record includes several less significant interruptions to deposition (see Fig. 3.9b).

Some years ago, Stephen A. Hall (1986) reviewed an entirely different set of geologic data and recognized essentially the same aspects of the Quaternary record as revealed by the data summarized here in Fig. 3.9. He presented an insightful synthesis of those data in an effort to inform archeologists on the nature of the data base with which they were working. The essence of the synoptic graph from that presentation (Stephen Hall 1995, personal communication) is reproduced here as the far right column of Fig. 3.9b. It is noteworthy that Hall perceived these patterns in valleys primarily north and northeast of central Texas, indicating the geographic extent of this general sequence.

A Brief Synthesis of the Prehistory of Central Texas

This section brings together several lines of evidence and offers a generalized cultural history of central Texas. Ideally, the empirical basis for this effort would come solely from the sixty-one isolable components arrayed in Fig. 3.9a, but two limitations stand in the way of that approach. First, there are comparatively few paleoenvironmental data from those components, and those that are available are neither consistent nor systematic. Second, archeological assemblages recovered from short-term components tend to be small, and sampling error is probably responsible for gaps in the data. There is a need for many more such components if we are to have a less rarefied record.

Pre-Clovis

Herbert Alexander (1982) is the only author to explicitly use the term "pre-Clovis" in reference to an archeological assemblage from a central Texas site (the Levi Rock Shelter). There is no question that humans made the purported pre-Clovis artifacts at Levi, but the assemblage is not coherent, was recovered from unclear stratigraphic context, and lacks several consistent radiocarbon dates. In addition, the associated fauna is a mix of extinct and extant species. A human presence of great antiquity has been proposed to account for selected fractured stones from Friesenhahn Cave (Krieger 1964), for the absence of caudal vertebrae among mammoth remains at the Waco Mammoth site (J. Fox et al. 1992), and for a "pre-sapiens" human form at Hitzfelder Cave (Givens 1968a, 1968b). None of these suggestions has been sustained with sufficient evidence for general acceptance. This is not to say that some future find might not prevail as a pre-Clovis site.

In addition to meeting the widely recognized criteria of stratigraphic integrity, unambiguous human evidence, and secure dating, two factors must be overcome in any search for sites earlier than Clovis. The first is geomorphological. Most valleys in much of North America were scoured to bedrock during the time immediately before Clovis, meaning that there is little chance of finding components stratigraphically beneath Clovis in fluvial contexts. Outside of alluvial valley settings, sites would either be on upland landforms or in rockshelters. Upland localities rarely produce good stratigraphic contexts, and rockshelters of pre-Clovis age may be highly degraded (M. Collins 1991b). The second is cultural. It is not known what might constitute the pre-Clovis material cultural assemblages, and, lacking these criteria for its recognition, the evidence will almost certainly have to come from the unlikely context of strata underlying a Clovis archeological component.

Paleoindian

Paleoindian sites and isolated artifacts are fairly common in central Texas. Concepts of Paleoindian lifeways in North America generally and in central Texas particularly are changing rapidly. The simple cultural sequence of big-game hunting "cultures"—Clovis, Folsom, Plainview, and Cody (Krieger 1947b; Sellards and Evans 1960; D. Suhm et al. 1954; Wormington 1957)—is no longer adequate to accommodate the diverse material cultural assemblages, projectile point styles, and indicated subsistence behaviors now documented during what has been traditionally recognized as the Paleoindian period, that is, earlier than ca. 8800 B.P.

It is necessary to draw upon some data from outside of central Texas to adequately portray these developments, but this is warranted because new results are emerging at a rapid tempo from Paleoindian research in the Americas, there is no cultural manifestation during Paleoindian times confined to central Texas alone, and, although sites in central Texas are contributing evidence to the broader developments, there are important ideas emerging elsewhere with implications for our understanding of the local Paleoindian evidence.

In this discussion, because the fundamental criteria for defining "Paleoindians" (best articulated in Wormington's proposed concept of a Paleoeastern Tradition [1957]) as nomadic big-game hunters are being challenged, the Paleoindian period is defined as a temporal span from ca. 11,500 to 8800 years B.P. This definition allows the issue of Paleoindian lifeways to be considered more objectively. As already noted, an Early and a Late subperiod of the Paleoindian period are proposed for central Texas (see Fig. 3.9a).

The Paleoindian period began as the Pleistocene waned, when now-extinct forms of large animals were among the prey taken by Early Paleoindian hunters. Projectile points in use during the Early Paleoindian subperiod were primarily, if not exclusively, of the lanceolate form and typically were fluted, Clovis and Folsom being the defined types.

Clovis is the earliest well-defined cultural horizon in central Texas. It is assumed on the basis of dating at sites elsewhere in North America that a Clovis culture existed in central Texas between approximately 11,200 and 10,900 B.P. (Haynes 1992). Kincaid Rockshelter, Wilson-Leonard, Gault, Horn Shelter No. 2, Pavo Real, and Crockett Gardens are where the principal Clovis components have been documented in the area, and surface finds of distinctive Clovis points are reported from a number of other localities (Meltzer 1987; Meltzer and Bever 1995). Generally in North America, Clovis manifestations are the most diverse in the Paleoindian period, with types of sites including kill, quarry/stone-working, cache, camp, ritual, and burial. The artifact inventory includes chipped stone artifacts produced using bifacial, flake, and prismatic-blade techniques (Fig. 3.11), always on high-quality and often on exotic stones (M. Collins 1990b). Engraved stones (M. Collins et al. 1991, 1992), bone and ivory points,

a bone shaft straightener, stone bolas, and ochre are reported from Clovis contexts (Collins n.d.).

Subsistence in Clovis times was based on diverse fauna (including large herbivores such as mammoth, bison, and horse as well as smaller animals such as water turtles, land tortoises, alligator, mice, badger, and raccoon). The diet presumably also included an array of plants (M. Collins et al. 1989b).

A paved floor at Kincaid Rockshelter reflects a greater investment of labor than nomadic hunters could afford on a fleeting habitation. (Enough stones, totaling more than two metric tons, were brought in from the nearby riverbed to cover 10 m^2 of the muddy shelter floor [M. Collins 1990b; M. Collins et al. 1989b].) Caches of Clovis artifacts (in Texas and elsewhere in North America [M. Collins n.d.]) are suggestive of hunting and gathering rounds that returned groups to the same places more reliably than is the case with nomadic hunters of big game.

Overall, the data indicate the Clovis lifeway to have been that of well-adapted, generalized hunter-gatherers with the technology to hunt big game but not to rely exclusively on it. Either their travels or their contacts with other groups enabled them to acquire exotic stone from great distances. Ironically, more is known of these earliest Paleoindians than of those who came later.

In contrast to Clovis lifeways, subsistence in Folsom times seems to have been more reliant upon specialized hunting of big game (bison). Sites with Folsom-age components in central Texas include Horn Shelter No. 2, Pavo Real, Wilson-Leonard, and Kincaid, the latter two of which show evidence of bison hunting. Camp, stone-working, and kill sites are all that have been documented, mostly in or near grassland habitats. These, along with a tool kit of Folsom points, end scrapers, and large ultrathin bifaces, are the trappings of hunters (Fig. 3.12a, b, d, e). Diagnostic artifacts in Folsom times are the large thin bifaces, fluted Folsom points, and thin unfluted (Midland) points.

Wilson-Leonard produced a thin, unfluted point (Fig. 3.12c) in association with bison bones and several bifaces flaked in the manner of Folsom bifaces. This point, and the Goshen assemblage of the Northern Plains (Frison et al. 1996), is part of a growing sample of point styles that do not adhere to the long-inferred sequence of Clovis-Folsom-Plainview.

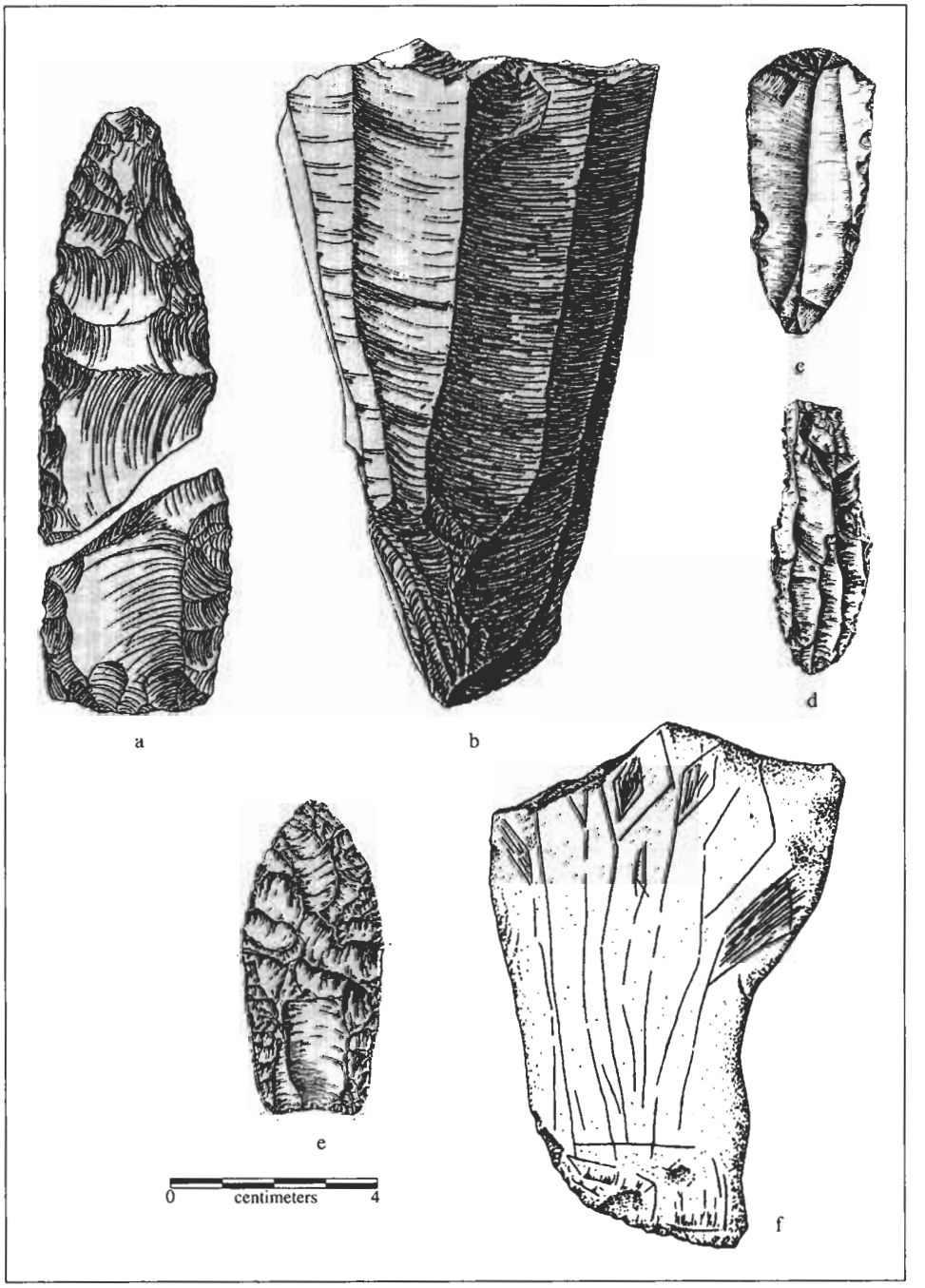

Fig. 3.11. Representative Clovis artifacts: a, Clovis point preform broken during manufacture (Kincaid site); b, prismatic blade core (Comanche Hill site); c, end scraper on prismatic blade (Pavo Real site); d, proximal fragment of prismatic blade (Gault site); e, unbroken but depleted and discarded resharpened Clovis point (Yellow Hawk site); f, engraved stone (Gault site).

An urgent problem in and beyond central Texas regards what constitutes "Plainview" and where that manifestation fits chronologically. Much that has been called Plainview—a plethora of unfluted, lanceolate dart point forms—fails to match the type-site points in thinness and flaking technology (see, e.g., Chandler 1994; Hester 1990b; Redder 1985). A serious revisiting of existing typological and contextual evidence bearing on this problem is needed as are new and better data. I am beginning to suspect that true Plainviews (as at the Plainview site and some of the artifacts from Bone Bed 2 at Bonfire Shelter) are equally as old as Folsom (i.e., greater than 10,200 B.P. [see Haynes 1993]) and are absent from or extremely rare in central Texas. "Plainview" points at Horn Shelter No. 2 are thicker and

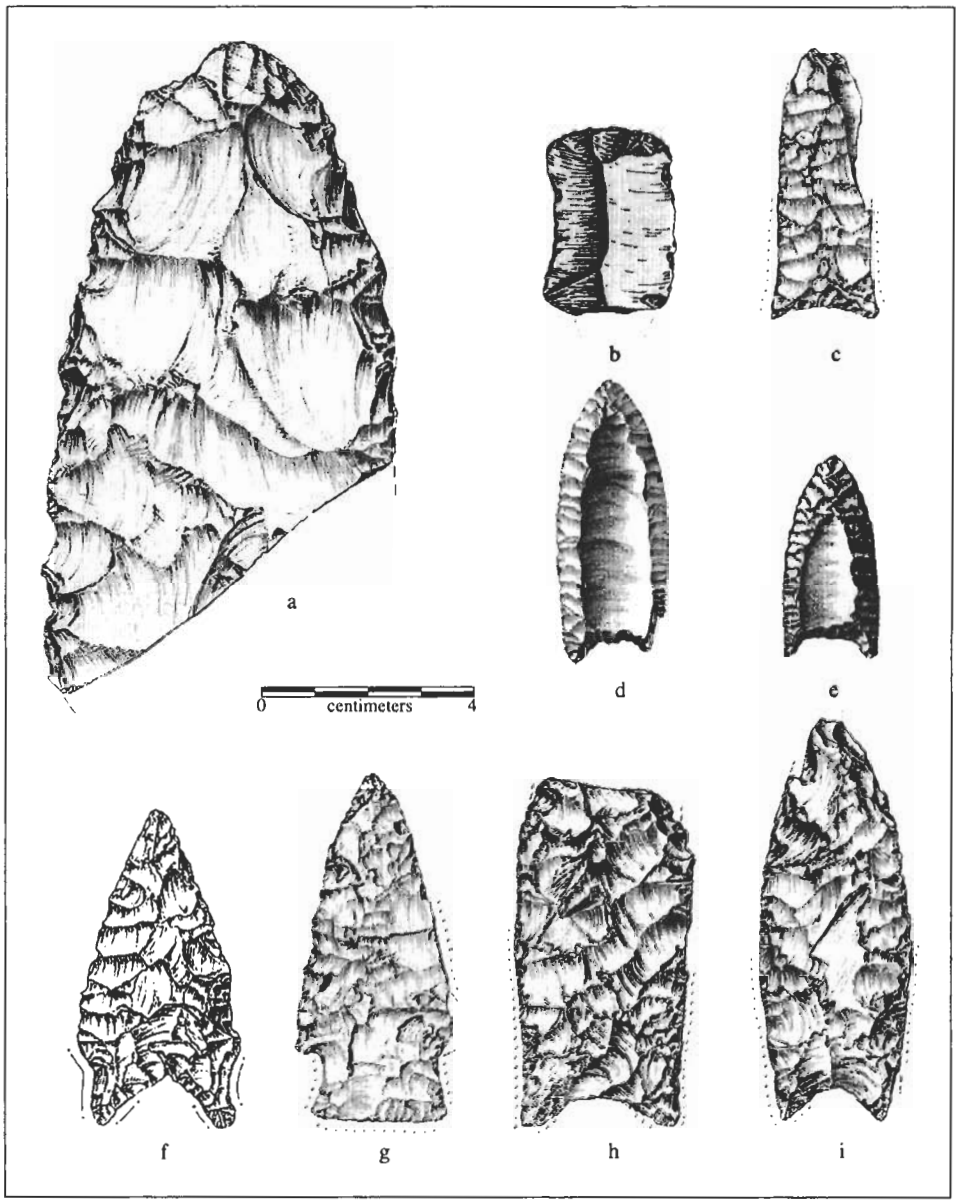

Fig. 3.12. Representative Paleoindian artifacts: a, ultrathin biface of Folsom style (Wilson-Leonard site); b, end scraper (Pavo Real site); c, thin, unfluted point from ca. 11,000-year-old deposits at Wilson-Leonard site; d and e, Folsom points from Kincaid Rockshelter; f, dart point form variously referred to as San Patrice, Rodgers Side-Hollowed, and Brazos Fishtailed (Kincaid Rockshelter); g, Wilson dart point (Wilson-Leonard site); h, Golondrina dart point (Wilson-Leonard site); i, Barber dart point (Wilson-Leonard site).

have more deeply concave bases than those at the Plainview site and come from zones dated ca. 8400 B.P. (Redder 1985). At Wilson-Leonard, the unfluted lanceolate points previously identified as Plainview (Weir 1985) are morphologically distinct from points at the Plainview type site and date to the interval between 9500 and 8000 B.P. These points from Wilson-Leonard are placed in the late Paleoindian subperiod and referred to as Golondrina (Fig. 3.12h), Barber (Fig. 3.12i), and St. Mary's Hall (Fig. 3.13a) (M. Collins 1998c; Masson and Collins 1995).

Also murky in central Texas and elsewhere are the temporal position and cultural significance of the few Dalton and not-so-few San Patrice–like points (variously called San Patrice, Brazos Fishtailed, and Rodgers Side-Hollowed) (see Fig. 3.12f). The San Patrice–like points occur at Wilson-Leonard and at Kincaid, and both they and Daltons occur at Horn Shelter No. 2 in central Texas. Daltons are dated in the middle Mississippi valley at ca. 10,500 to 9500 B.P. (Morse and Morse 1983) and are close to that age at Horn Shelter No. 2 (ca. 9980–9500 B.P. [Redder 1985]). San Patrice–like Rex Rodgers points are associated with a Clovis point and an unfluted lanceolate point in what appears to be a single-event bison kill site in the Texas Panhandle (Willey et al. 1978b). They occur in a deposit dated between 9980 and 9500 B.P. at Horn Shelter No. 2 (Redder 1985) but remain undated at Kincaid (M. Collins 1990b). Everything about the fauna, associated artifacts, and features (including a double burial) found with San Patrice (Brazos Fishtailed) and Dalton points at Horn Shelter No. 2 suggests an Archaic-like, hunter-gatherer cultural manifestation (Redder 1985). For Fig. 3.9a I have tentatively regarded this material as transitional, between Early and Late Paleoindian; future work or new finds will help clarify the picture.

Three style intervals—Wilson, Golondrina-Barber, and St. Mary's Hall—are here proposed for the late subperiod of the Paleoindian period (see Fig. 3.9a). These style intervals are moderately well defined at the Wilson-Leonard site (M. Collins 1998c; Masson and Collins 1995). The Wilson component is the better represented and is characterized as having corner-notched, Archaic-like Wilson dart points (see Fig 3.12g) (Masson and Collins 1995; Weir 1985) in association with features, a burial, artifacts, and faunal remains more Archaic than Paleoindian in appearance. Dates for this component are ca. 10,000 to 9650 B.P. (Masson and Collins 1995).

The Archaic-like character continues for the Golondrina-Barber and St. Mary's Hall components, dated between 9500 and 8000 B.P. All three of these components (Wilson, Golondrina-Barber, and St. Mary's Hall) have burned rock features, but the size of the features and the amounts of rock present are decidedly less than that in Archaic features of younger ages. The subperiod here called Late Paleoindian is in many ways archeologically intermediate (or "transitional") between Early Paleoindian and the Archaic; the question to be answered is how accurately this material culture–based impression reflects their respective human adaptations. One suggestive indication of the transitional nature of this cultural interval is the continuity of the Angostura dart point (see Fig. 3.13b) and similar forms (see Fig. 3.13c, d) from the Late Paleoindian into the Early Archaic periods.

Two burials between ninety-five hun-

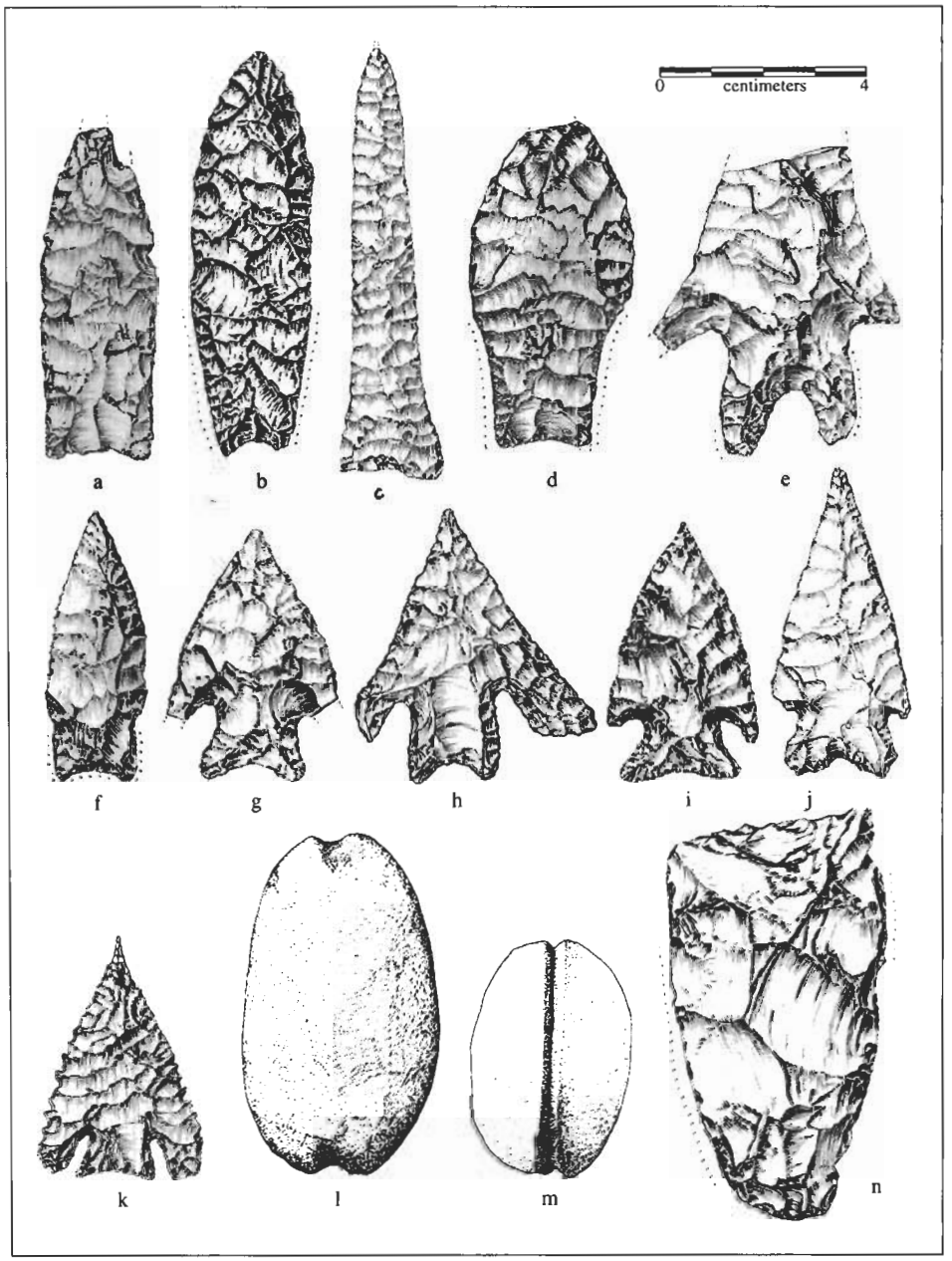

Fig. 3.13. Selected Late Paleoindian (a–c) and Early Archaic (d–n) artifact forms (all from Wilson-Leonard): a, St. Mary's Hall dart point; b, Angostura dart point; c, perforator (?); d, Thrall dart point; e, f, early split-stem dart points; g, h, untyped bifurcate stemmed dart points; i, j, Martindale dart points; k, Bandy dart point; l, "Waco sinker" or notched stone; m, grooved stone; n, Clear Fork tool.

dred and ten thousand years old, one at Wilson-Leonard and one at Horn Shelter No. 2, have produced three of the better-preserved early human skeletons of North America (Steele 1998; Steele and Powell 1994). Both of these contained objects of a utilitarian as well as an ornamental nature.

Archaic

Two-thirds of the prehistory of central Texas is "Archaic" in character. Archeologists have viewed the Archaic as a time when the hunting and gathering of local resources was intensified relative to that in Late Paleoindian times. The material culture shows greater diversity, especially in the application of groundstone technology. A hallmark of the Archaic in central Texas is extensive use of heated rocks, present archeologically as various forms of hearths, ovens, middens, scatters, and other features. Multiple tons of heat-altered rocks occur at many Archaic sites in the region. The full gamut of uses for these rocks can only be guessed at from available evidence, but thoughtful inquiry into this problem is increasingly common.

For more than seventy-five hundred years the basic Archaic mode of life prevailed in central Texas. There are distinctive changes to be seen within the Archaic archeological record, but it is not clear how significant these changes really were at the times they occurred. It is clear, however, that in the broadest sense this long span represents a basic adaptation that was successful. A priority in the investigation of the Archaic record is to better understand the fundamentals of that adaptation and to determine the significance of the variations seen over time and across space. In briefly reviewing the Archaic of central Texas, the cultural chronological framework proposed by L. Johnson and Goode (1994) is adopted with minor adjustments.

The early part of the Archaic, from ca. 8800 to 6000 B.P., is here subdivided into the three projectile point style intervals: Angostura (see Fig. 3.13b), early split-stem (see Fig. 3.13e, f), and Martindale-Uvalde (see Fig. 3.13g–k) (see also Fig. 3.9a). Open camp sites (including Loeve, Wilson-Leonard, Richard Beene, Sleeper, Jetta Court, Youngsport, Camp Pearl Wheat, and Landslide) as well as a cave (Hall's Cave) occupied at the far reach of daylight contain noteworthy components of the Early Archaic. Numerous dart points and Guadalupe tools attributable to the Early Archaic also are present in Kincaid Rockshelter, but in mixed contexts.

It is unclear if the distributional data are representative, but a number of authors have noted a concentration of Early Archaic components near the eastern and southern margins of the Edwards Plateau (Black 1989b; G. Ellis 1994; L. Johnson 1991; L. Johnson and Goode 1994; W. McKinney 1981). Large and varied burned rock features (at the Sleeper, Camp Pearl Wheat, Wilson-Leonard, Richard Beene sites), domestic structures (Turkey Bend Ranch), and caches (Lindner) are known from the Early Archaic. Grooved or notched stones variously interpreted as net sinkers or bola stones (Boyd and Shafer 1997) appear in the Early Archaic (see Fig. 3.13l, m). Grinding and hammering stones, Clear Fork (see Fig. 3.13n) and Guadalupe bifaces (Fig. 3.14a) (both inferred to be specialized tools, probably for woodworking), along with a variety of unifacial and

bifacial chipped stone implements, are also reported from Early Archaic components. Subsistence data are sparse for the subperiod, but hunting of deer, exploitation of various small animals, including fish, and the cooking of bulbs in earth ovens are indicated.

If the currently known site distributional data reflect land use in the Early Archaic, then this was a time when people were living in the better-watered parts of the live-oak savanna habitats on the Edwards Plateau. Acorns, deer, and turkey are conspicuous among live-oak savanna resources, but geophytes (e.g., onions, prairie turnip), other nuts (e.g., pecan, walnut), berries (e.g., agarita and hawthorn), fruits (e.g., grapes, plums, persimmons), and grass seeds, along with a host of small terrestrial, amphibious, and aquatic animals, round out a diverse and reliable subsistence base.

Pollen and fluvial geologic evidence portrays an oscillation from mesic through extremely xeric and back to mildly xeric conditions during the Early Archaic (see Fig. 3.9b). Bison (and perhaps antelope) were evidently scarce or absent. What mix of other foods constituted the staple diet(s) during the Early Archaic is unknown at this time.

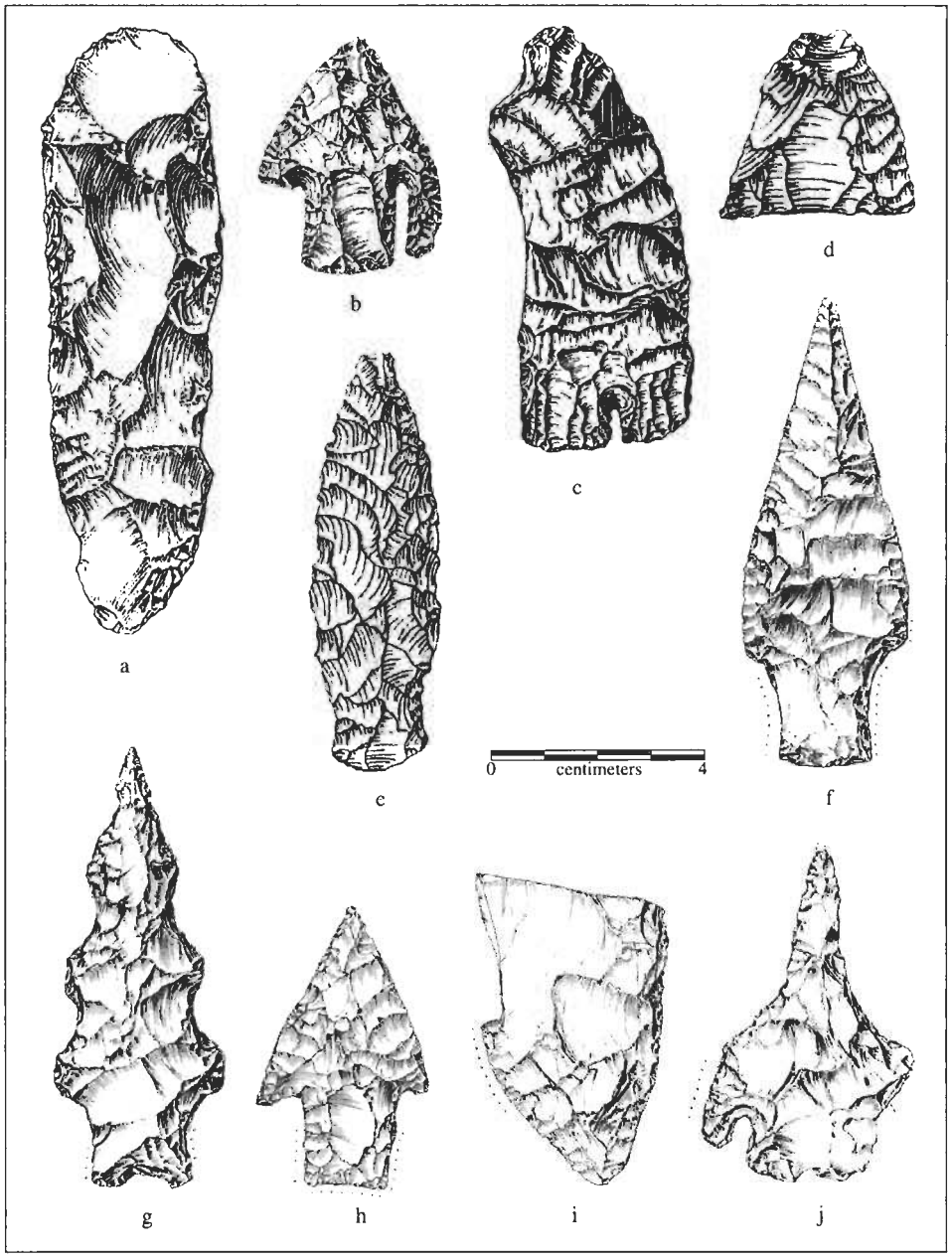

Fig. 3.14. Selected Early (a), Middle (b–g), and Late (h–j) Archaic artifact forms: a, Guadalupe Tool (Kincaid Rockshelter); b, c, Andice dart points (Gault site); d, Taylor or Early Triangular dart point (Higgins site); e, Travis dart point (Higgins site); f, g, Nolan dart points (Wilson-Leonard site); h, Bulverde dart point (Wilson-Leonard site); i, burin on a biface (Wilson-Leonard site); j, drill on a Montell dart point (Wilson-Leonard site).

The appearance during the early split-stem interval (as at Wilson-Leonard) of specialized cooking appliances that use quantities of stone as heating elements reflect a sophisticated technology for exploiting the oak-savanna resource base. These features almost certainly represent the technological antecedents of the larger burned rock middens that become a hallmark of later intervals in the Archaic of central Texas.

The middle subperiod of the Archaic, from ca. 6000 to 4000 B.P., too, is further subdivided into three style intervals: Bell-Andice-Calf Creek, Taylor, and Nolan-Travis (see Figs. 3.9a and 3.14b–g). The earlier two of these intervals reflect a shift in lithic technology from that which had prevailed earlier. Bell-Andice-Calf Creek and Taylor are thin, basically triangular bifaces with long thinning flakes emanating bifacially from the base; Taylor bifaces remain unnotched whereas Bell-Andice-Calf Creek bifaces are characterized by deep, narrow basal notches. All of these thin-bladed forms would serve equally well as knives or as tips of lances, spears, or darts. Impact fractures common on the Bell-Andice-Calf Creek forms attest to their use as weapon tips.

Climate during the earliest interval (Bell-Andice-Calf Creek) was somewhat mesic. It was a time when bison were hunted, leading L. Johnson and Goode (1994) to surmise, correctly, I think (M. Collins 1994a, 94), that these thin bifaces were part of a specialized bison-hunting weaponry, probably brought to the region by peoples moving southwesterly from the prairie, prairie margins, and woodlands west of the Ozarks (see Wyckoff 1995). A tantalizing hint of functionally different sites is seen in this interval, with a greater diversity of tool forms occurring at the Landslide site than at the Barton site's Bell-Andice component. Notable at Landslide are more wood- and bone-working kinds of tools and especially milling equipment, which is absent from the Barton site. It seems apparent that more diverse tasks were undertaken at Landslide than at Barton. Large burned rock features—hearths as well as rock ovens—are inferred for the interval, par-

ticularly at the Barton site. In a very subjective sense, components of this interval seem to me to show less intensive use than that indicated at earlier-interval components, particularly those of the early split-stem interval. Perhaps greater mobility associated with bison hunting is indicated.

By the later Middle Archaic Taylor and Nolan-Travis intervals, bison have disappeared from the record and more xeric climate conditions have returned. In fact, this transition culminates toward the end of the Nolan-Travis interval in what appears from the record to have been the onset of the most xeric conditions ever experienced by humans in central Texas. Interestingly, Taylor and Nolan-Travis components again have the appearance of either long-term or intensive use, or both. Burned rock middens debut (best seen at the Wounded Eye site in Kerr County, where Taylor bifaces dominate the assemblage recovered from a small burned rock midden). Another technological shift is seen in the production and morphology of Nolan and Travis projectile points, as they have comparatively thick and often narrow blades (especially on Travis points) with stems and shoulders; distinctive beveling of the stems is characteristic of Nolan points.

L. Johnson and Goode (1994, 26) suggest, as Prewitt (n.d.) had earlier suggested, that burned rock middens at this time were more frequently being used to cook xerophytes such as sotol, which may have thrived in central Texas as conditions became drier. This practice does not necessarily signal an end to extraction of the more typical oak-savanna floral and faunal resources; it could be merely a shift in emphasis with concomitant adjustments in subsistence technology, strategic planning, and scheduling (see Bousman 1993).

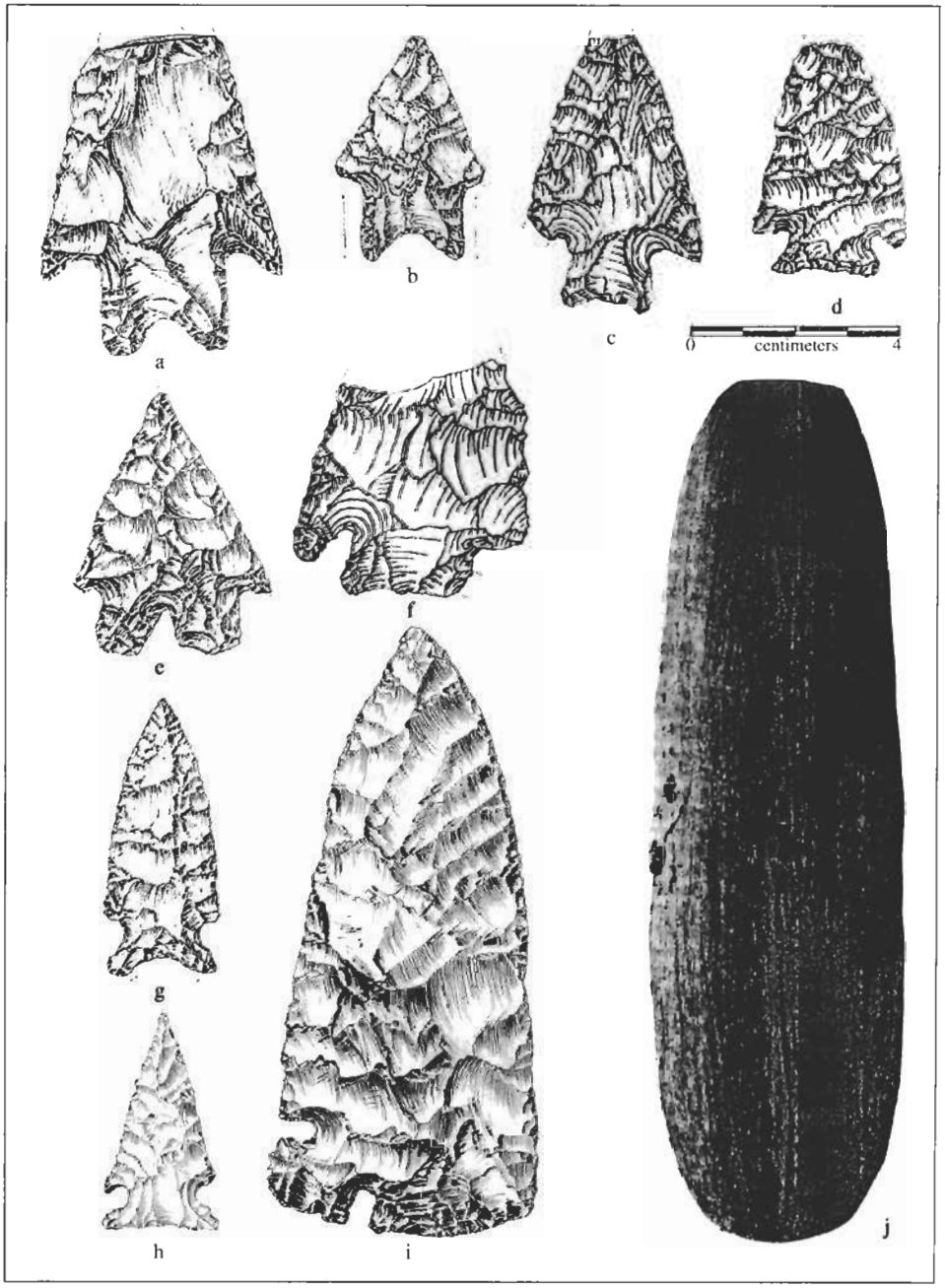

Fig. 3.15. Selected Late Archaic artifact forms: a, b, Pedernales dart points (Kincaid Rockshelter); c, Marshall dart point (Higgins site); d, Marcos dart point (Higgins site); e, Montell dart point (Kincaid Rockshelter); f, Castroville dart point (Higgins site); g, Frio dart point (Kincaid Rockshelter); h, Ensor dart point (Wilson-Leonard site); i, corner-tanged knife (Wilson-Leonard site); j, tubular stone pipe (Collins site).

The Late Archaic, ca. 4000 to 1300 or 1200 B.P., began as effective moisture was at its lowest in central Texas, but gradually the climate became substantially more mesic (see Fig. 3.9b). Six style intervals have been postulated for the Late Archaic (see Fig. 3.9a). The Late Archaic is well represented by investigated sites, including a number with components in good stratified contexts, although well-stratified components are almost completely unreported for the earliest Bulverde style (see Figure 3.14h) interval. Middle Archaic subsistence technology, and the burned rock middens resulting from a portion of it, continue well into the Late Archaic. In fact, during the second style interval (best known for its Pedernales points), the growth of burned rock middens was at its greatest, especially in the eastern parts of the area. It appears, however, that xeric vegetation and whatever reliance people placed upon it gradually disappeared from those parts of central Texas between 3500 and 2500 B.P., and burned rock midden growth slowed but did not cease. The xeric vegetation remained, and continues to remain, in the western reaches of the area where its exploitation involved the regular use of communal earth ovens into Late Prehistoric times (Black et al. 1997; Goode 1991).

Among distinctive material traits of the Late Archaic in central Texas are diverse dart point styles (Fig. 3.15a–h and Fig. 3.16a, b), "corner-tanged" knives (see Fig. 3.15i), and cylindrical stone pipes (see Fig. 3.15j). Marine shell orna-

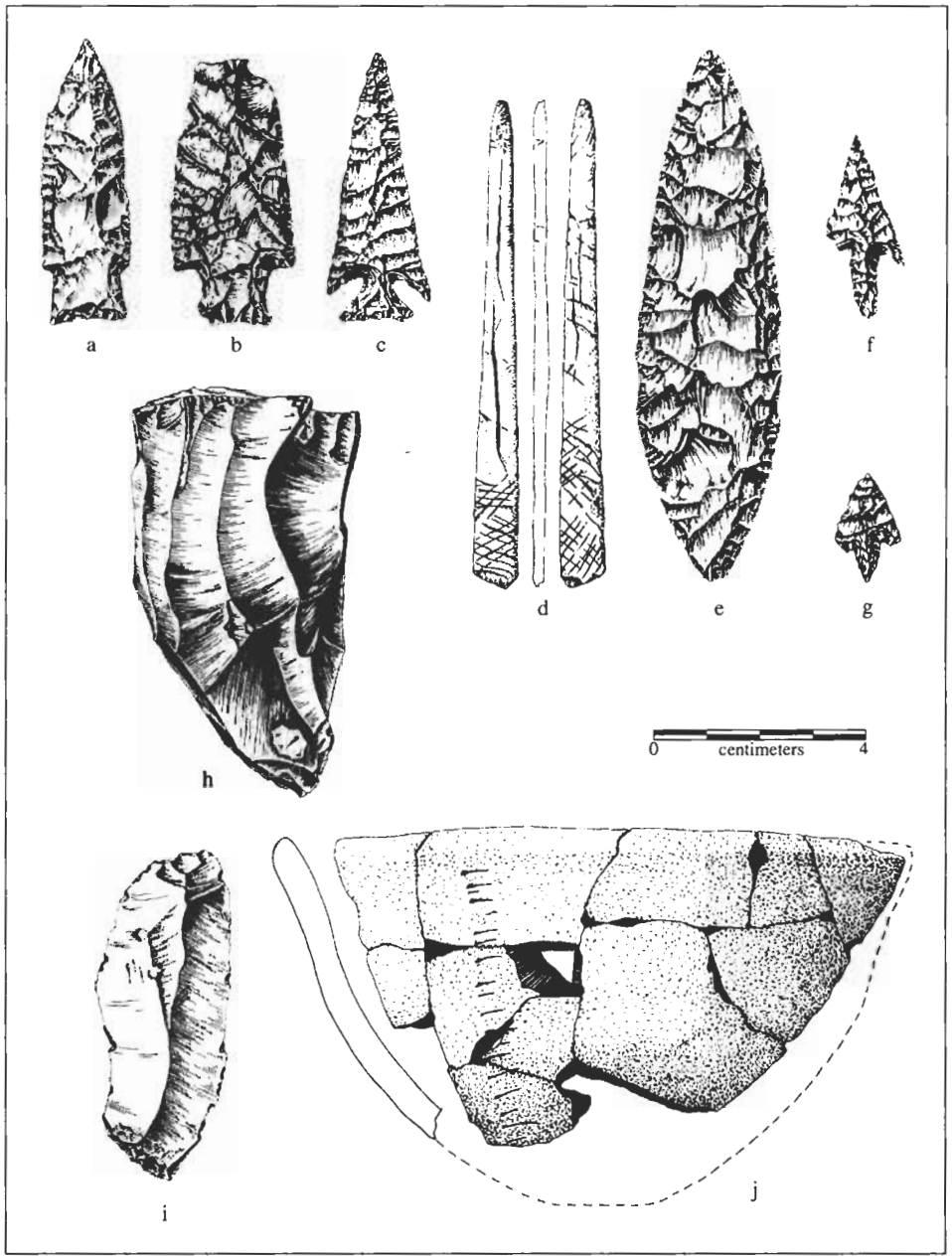

Fig. 3.16. Selected Latest Archaic (a, b) and Late Prehistoric (c–j) artifact forms: a, b, Darl dart points; c, Scallorn arrow point; d, Austin Interval decorated bone object; e, Toyah biface; f, g, Perdiz arrow points; h, Toyah prismatic blade core; i, Toyah prismatic blade; j, bone-tempered ceramic vessel of Toyah affiliation, resembling Leon Plain except for the decorative fingernail impressions. (All artifacts from the Mustang Branch site, except a [Wilson-Leonard site].)

ments occur, along with caches of large bifaces. Burned rock middens were in use throughout the Late Archaic.

L. Johnson and Goode (1994) have offered a succinct account of the main cultural aspects of the Late Archaic on the eastern Edwards Plateau. In so doing, they distinguished between early (Late Archaic I) and late (Late Archaic II) subperiods. Their provocative ideas need not be repeated here other than to mention some highlights. Diverse and comparatively complex archeological manifestations toward the end of the Late Archaic attest to the emergence of kinds of human conduct without precedent in the area. Among factors that have been cited as contributing to these developments are increasing population size (Prewitt 1981; Weir 1976) and stimuli from religious practices in the eastern part of the continent (L. Johnson and Goode 1994). Much remains to be learned about the hunter-gatherers of central Texas in Late Archaic times, and the questions prompted by the interpretations of L. Johnson and Goode (1994) will require thorough and comprehensive archeological investigations using data of the highest possible integrity.

Late Prehistoric

Archeologists working in central Texas have not been able to clearly interpret the extent and importance of the material cultural change that occurred in the region ca. 1200 B.P. This is the somewhat arbitrary break commonly made between the long Archaic period and its successor, the Late Prehistoric. Previously this was referred to as the "Neo-American Stage" (D. Suhm et al. 1954, 20) in the expectation that all three defining traits (pottery, bow and arrow, and agriculture) would eventually be recognized. It now appears that generally for central Texas, only the bow and arrow appeared initially, pottery was added later, and agriculture (or, at least, the possession of tropical cultigens) came last and was of quite minor importance.

Because basic hunting and gathering subsistence continued, what is here called the Late Prehistoric has also been labeled the "Neo-Archaic" (Prewitt 1981) or the "Post-Archaic" (L. Johnson and Goode 1994). Two subperiods, early and late (see Fig. 3.9), are here recognized in the Late Prehistoric (Jelks 1962); these correspond to the Austin and Toyah "phases" (I will continue to use the term "interval") of long-standing use in the systematics of the local prehistory (Prewitt 1981). More than projectile point style change distinguishes Austin from Toyah manifestations, and the subperiod level of designation is intended to reflect the importance of these differences. I agree with L. Johnson and Goode (1994, 39–40) when they note that an equally satisfactory solution would be to place the break between the Archaic and the Late Prehistoric at ca. 800 B.P., when Toyah replaces Austin as the prevailing archeological configuration. This distinction is, however, not as easily made for other regions of the state (see below).

The most apparent change seen at the beginning of the early Late Prehistoric (or Austin interval) is from a prevalence of dart points to that of arrow points and, inferentially, from use of the atlatl and dart to that of the bow and arrow (see Fig. 3.16c). Evidence is seen of widespread hostilities in the form of what are

thought to be numerous incidents of arrow-wound fatalities (Prewitt 1974). Otherwise, comparatively little change is noted from terminal Late Archaic patterns, particularly in subsistence behavior. Recent scrutiny has found evidence that in western central Texas burned rock middens continued to be produced in what may have been the cooking of sotol (Black et al. 1997; Goode 1991).

The late subperiod of the Late Prehistoric is expressed as a single style interval, designated on Fig. 3.9a by the Perdiz arrow point (see Fig. 3.16f, g). However, it has long been recognized that in central Texas the Toyah archeological manifestation consists of a constellation of material culture traits (see Fig. 3.16e–j). Notable among these traits are pottery (both local and imported from the Caddoan area), large thin bifaces, Perdiz arrow points, and end scrapers and prismatic blades; the stone tool assemblage is associated with the hunting of bison as well as deer and antelope.

The occurrence of these distinctive traits on about the same time line across a wide area of the state distinguishes the Toyah as an archeological "horizon." A question that arises is whether such a horizon is the spread of a people across the landscape or the spread of ideas and their adoption by different peoples. LeRoy Johnson (1994) and Robert A. Ricklis (1994b) have recently brought forth differing views on Toyah lifeways. In keeping with traditional interpretations, Johnson sees Toyah materials as the artifacts of particular folkways—the products of a single ethnic group. Ricklis, in contrast, observes that the cultural materials that define Toyah represent tools and technologies that can be spread among different groups rather easily—that is to say, Toyah is a technocomplex. The issue hinges on how similar lithic and ceramic objects and their technologies of production have to be to represent the work of a single ethnic group. In the absence of linguistic evidence (which is precluded by a pre-contact truncation of Toyah culture) or more robust archeological data, the issue will not be resolved since the answer to the question just posed is too subjective. No time in the prehistory of central Texas is represented by more gisements, and the prospects for discovering more and better Toyah components are good. The debate framed by Ricklis and Johnson is the kind of anthropological issue that is so rare in the history of central Texas archeology. Because it is both intriguing and substantive, such a debate can be expected to continue, grow, and be refined, and perhaps in the future even resolved to some degree with robust new data.

Historic Period

Historic archeology differs from prehistoric archeology in that past people, places, and events can be investigated from the vantages of written accounts as well as tangible archeological records. In the case of central Texas, the collision of multiple indigenous and European cultures produced complex and rapidly changing events that are chronicled spottily in the early documents and seen sparingly in the archeological record. With time, both the written and archeological records become fuller, but by the middle nineteenth century, little but the European-derived cultures remained.

I consider three subperiods in the Historic period of central Texas—early, middle, and late. In the first two, vestiges of both indigenous and European peoples and cultures are represented; in the third, the indigenous peoples have virtually disappeared.

The early Historic subperiod in central Texas begins in the late seventeenth century with the first documented arrival of Europeans (Berlandier 1969; Bolton 1915; Newcomb 1961). Although there are documentary glimpses of the indigenous groups in and near central Texas, political consequences of the arrival of Europeans were already in motion, most notably the southern advance of mounted Apaches. For the indigenous peoples, little more than group names, locations, and limited descriptions exist. Concerted ethnohistorical research (see multiple entries by T. N. Campbell under Indian group names in Branda 1976; Campbell 1988; Hester 1989a, 1989b; Newcomb 1961, 1993) has been used to piece together important yet incomplete accounts that reveal several distinctive features of native cultures in central Texas between ca. 1690 and 1720.

In these earliest historical accounts, numerous displaced groups are found in and near central Texas, some having gone northeastward to escape Spanish oppression, others having fled southeastward ahead of the Apache incursion. Their lifeways had been affected substantially by the political accommodations to this new propinquity and possibly by social disruption brought about by the mortality of European-introduced diseases. The French and the Spaniards vying for the territory that is now Texas often manipulated the indigenous groups for their own political purposes. Also, native patterns of mobility had been altered by the acquisition of horses. It is obvious that these accounts do not provide direct analogs to prehistoric patterns. Instead, they represent a time of drastic cultural change and political conflict to be investigated in its own right.

There may be some indigenous cultural patterns that prevail through this time and thus afford insights into prehistoric lifeways of the aboriginal inhabitants of central Texas (M. Collins and Ricklis 1994). Small band-sized residential camps are indicated, but so are large, diffuse encampments composed of peoples with mixed ethnic affiliations. It is not clear whether the large, diffuse camps or political amalgamations occurred prehistorically, but to judge from the apparent ease and frequency of these occurrences historically, it is possible that large camps shared by different ethnic groups had precedents in prehistory.

Hunting, particularly of bison but also of deer and antelope, is repeatedly noted in Spanish and French documents, as is the extensive use and exchange of bison products. Much of the mobility and hunting behavior of peoples was in response to the movements and densities of bison populations. Though the historically observed behavior was affected by the use of horses, the same was probably true to some extent of pedestrian peoples whenever bison were present in the area.

Of particular importance to Late Prehistoric archeology are the many accounts of Hasinai Caddo traveling into central Texas to hunt bison and at times camping with indigenous groups. The fairly common presence of Caddoan ceramics and of local pottery with Caddoan style decoration in Toyah interval sites of central Texas (see discussion in Perttula et al. 1995b) suggests that this was a long-standing pattern.

At a very general level, the early Historic subperiod informs prehistoric archeological inquiry on two topics. First, indigenous peoples clearly were more cosmopolitan than most archeologists seem to think. Second, large and dispersed encampments, exceeding the usual parameters of "a site," may have been fairly common.

The middle Historic subperiod, when much of the record on aboriginal peoples is in reference to remnants of native groups living in the Spanish missions, began in about 1730 and ended in about 1800 as the mission system was failing (Hester 1989a, 1989b). Central Texas lies mostly outside of the Spanish Colonial sphere, and the mission Indian subperiod is manifest primarily at the missions in Bexar County (Campbell and Campbell 1985). Interesting continuities from prehistoric times and new behaviors resulting from acculturation are reflected in the material culture of the mission Indians (D. Fox 1979).

Shoshonian-speaking Comanches, who had become consummate equestrians by 1800, began to spread into northwestern Texas from the High Plains toward the end of the middle Historic subperiod (Wallace and Hoebel 1952). Their presence in central Texas is documented mostly from the hostile view of Euro-American settlers.

The late Historic subperiod, extending into the twentieth century, encompasses minor numbers of mission Indians, far-flung nomadic native groups (primarily the Comanches) until the late nineteenth century, and a rich archeological record of the European-derived cultural presence (D. Fox 1983). As the Comanche presence in central Texas waned in the mid- to late nineteenth century, more than eleven millennia of Native American presence in the area came to an end.

Conclusions and Comments on Future Research

Central Texas was occupied by Native American hunter-gatherers more or less continuously for longer than eleven thousand years. During that time the net change in population was from zero to a pre-contact figure that may have been as high as 150,000 (based on a very approximate hemisphere-wide estimate of 2.1 persons per square kilometer [Dobyns 1966]). Whatever the actual ending figure, and however nonlinear the rate of increase, it is an absolute certainty that over time more and more people lived in and around central Texas. Without doubt, population growth increasingly constrained subsistence and mobility options and may have fostered political conflict, but it also led to a cosmopolitan condition where more knowledge, commodities, words, and mates could be exchanged.

Exchange in each of these domains of culture is likely to have comparatively low archeological visibility except when nonperishable commodities are exchanged or knowledge is transmitted that is reflected in durable items of material culture. The more exchange occurs, no matter its form, the more likely it is to have archeological visibility.

In the course of central Texas prehistory, archeological evidence for the exchange of ideas and exotic commodities becomes more visible in the later part of the Late Archaic and reaches its greatest expression in the Toyah interval (assuming that exotic lithics in Paleoindian times more often represent high mobility). When Late Archaic sites in central Texas contain exotic obsidian and marine shells, and when there are interments influenced by Hopewellian burial ceremonialism, the indigenous population is not living in isolation. Unseen behind these tangibles are undoubtedly culture brokers, travelers, multilingual interpreters, and diplomats—the prehistoric counterparts of the likes of Juan Sabeata, Sacagewea, and the Turk. To have reached sufficient levels for archeological expression in the Late Archaic, when did distant connections first develop? I doubt the natives of central Texas were ever isolated—a key element in my views of the local prehistory that follows.

Horticulture or agriculture had come to be practiced in all directions (Mesoamerica, the Southwest, Southeast, and Plains) during what in central Texas was still the Late Archaic. Early European settlers found central Texas optimal for farming (Fehrenbach 1968), and much of it is farmland today. A shift to horticulture or agriculture by natives of the region was not precluded by natural conditions of soil or climate. Nor was it precluded out of ignorance on the part of its inhabitants. These conclusions argue for the alternative interpretation that efficient technologies for hunting and gathering prevailed and that the resource base was both rich and diverse. Central Texas was one of those places in the world where the labors and limitations of food production could be looked upon with disdain. What then are the ingredients of that technology and the characteristics of that resource base? The axiom that specialization is the path to extinction seems to be borne out by its corollary, namely eleven thousand years of successful, generalized exploitation of a diverse resource base in central Texas. The adaptability of hunter-gatherer subsistence in central Texas is underscored by the swings in climate (see Fig. 3.9b) from relatively mesic (ca. 11,500 to 8800 or 8500 B.P.) to xeric (ca. 8800 or 8500 to 3000 or 2800 B.P.) with a brief amelioration (ca. 6800 to 5500 B.P.), and back to mesic again (ca. 2800 to 1000 B.P.), which was followed by a brief drying interval near 1000 B.P. Since ca. 1000 B.P., the climate seems to have been rather moderate compared with the more mesic and more xeric periods of earlier times.

From the earliest arrival of peoples into the area, which present evidence places near the middle of the twelfth millennium B.P., until ca. 8800 B.P., conditions were relatively mesic, and the archeological record reflects hunter-gatherers of moderately high mobility. Camp sites of these Paleoindians usually have simple fireplaces with little or no use of rock. During Folsom times, there may have been a substantial reliance on bison hunting, but otherwise Paleoindian subsistence seems to have been rather generalized. A small human population and reasonably abundant plant and animal resources would seem to best account for the evidence.

Beginning around eighty-eight hundred years ago, large fireplaces with quantities of burned rocks appear and signal important changes in adaptations, ushering in what we refer to as the Archaic (Black et al. 1997). It is in the Archaic that we see the development and perseverance of archeological patterns distinctive to central Texas; a conspicuous element in that distinctiveness is the extensive use of rock in a variety of fireplaces. It is apparent that these rocks were used primarily for their heat-storage ca-

pacity in most cases, and this practice is central to the long history of Archaic adaptations (Black et al. 1997).

There is a clear correlation between mesic climatic indicators and the archeological occurrence of bison remains. There is less clear but suggestive evidence that burned rock features (middens and complexes of earth ovens) grew at faster rates in the more xeric intervals. In general, large hot-rock cooking appliances are needed for plant foods requiring long periods of cooking, whether baking or steaming. The labor and fuel required for efforts of this kind are efficient only if a large volume of food is cooked. It follows that the existence of the large hot-rock cooking appliances is *prima facie* evidence of bulk processing of starchy plants, be they sotol bulbs, prairie turnip roots, cattail roots, acorns, or wild onion bulbs. But it is important to consider that once the effort is made to construct and fuel a hot-rock cooking appliance, it can be used to cook almost any kind of food—plant or animal—wherein lies the adaptability of these facilities.

As the abundance of various plant foods changes seasonally or in response to longer-term climatic shifts, rock ovens can be used to bake or steam, as appropriate, the most available bulk staple augmented with anything from river mussels or turtle meat to hawthorn or persimmon fruits. It would appear, in this vein, that at those (mesic) times when bison were more abundant, somewhat less reliance was placed on the bulk processing of plant foods. One of those times was when Calf Creek, Bell, and Andice bifaces were in vogue, and another was when Marcos, Montell, and Castroville points were common. L. Johnson and Goode (1994) offer the suggestion that makers of Calf Creek and related point forms migrated into the region as bison ranges spread. Relatively little use of hot-rock appliances is seen during the Bell-Andice-Calf Creek style interval, and possibly even during the interval identified by Marcos, Montell, and Castroville forms, but this use is far less evident.

Central Texas environments are and have been far from uniform, and the foregoing generalizations will not apply equally over the region, and not at all in some places. Certainly such potentially important resources as desert succulents, bison, acorns, and riverine plants and animals have varied greatly in number over time, and archeological understanding of their importance will emerge locally, not regionally.

During the late (Toyah) interval of the Late Prehistoric, when bison hunting and mobility were evidently at their highest levels since Folsom times, the ancient practice of using large hot-rock appliances came to an end. Once again, as in the Bell-Andice-Calf Creek interval, there is good evidence that the Toyah interval is the archeological expression of bison hunters who migrated into the area and neither depended very much on other local resources nor adopted the technology for their exploitation.

Such are a few general interpretations of the prehistory of central Texas. Should any of these be found worthy, they could guide future archeological investigations in a general sense, but as framed they are too general to be tested directly. Instead, archeological effort in the area needs to be directed toward more basic tasks that include accumulating specific evidence relevant to these generalizations.

First, a very small percentage of the archeological data base of central Texas derives from well-stratified contexts. To correct this deficiency, gisements need to be targeted as widely in space and as fully along the temporal vector as possible. Artifact assemblages and paleoenvironmental data of high resolution derived from such contexts can provide the evidence needed to address most of our currently recognized archeological issues.

As assemblages with greater integrity and higher data quality are investigated, more comprehensive data recovery and analytical techniques must be applied. First, the basics of archeological evidence must be better met, and second, the perspective of comparative ethnology should be used to structure inquiry.

The basics of archeological inquiry are relatively simple: obtaining well-documented, representative samples of archeological assemblages and controlling for the relative and absolute dating of those assemblages. An initial effort at this task has been made in central Texas.

I suggest that a comparative-ethnological perspective is needed because in central Texas we have learned relatively little about the human lifeways that came and went in the region for nearly twelve thousand years. We need to have an organizational framework for our investigations that defines objectives and directs effort toward those objectives in the greatest need of attention. An obvious framework is comparative ethnology. The elements of culture that ethnologists compare cannot all be known from extinct cultural systems, but a subset of those that realistically can be at least partially reconstructed out of archeological evidence is useful. A matrix table with cultural traits across the top and our archeological intervals arrayed up the left side would constantly remind us of our major data gaps. Within each cell of the matrix is a research objective that must be carefully considered in terms of what archeological evidence is needed and how that evidence would best be obtained. Traits from the general (e.g., subsistence, settlement pattern, or transhumance) to the specific (e.g., burial practices, ornaments, and woodworking tools) need to be included. Obviously, the evidence required to satisfy any specific objective will not be found just because it is listed in the matrix. What is important is that research will proceed with that objective in mind, the essential evidence needed to satisfy the objective will have been thought out, and in the long run our efforts will be more productive by being allocated more appropriately.

A significant element in our lack of progress to date is redundancy. We keep digging up the same kinds of evidence using the same techniques. Targeting other aspects of the archeological record and using a greater array of procedures are priorities. Another impediment is how we conceive evidence. We see deer bones and dart points and infer that game was taken with weaponry that employed darts. We rarely consider alternative or complementary paraphernalia or strategies, such as the use of nets, snares, or dogs. We seldom ask, much less try to answer, questions like, "What was made using those tools we infer to be adzes or gouges? Were people making canoes, shelter, wooden mortars? If so, what were they doing with them?"

Explicitly defined research objectives on the macro-, meso-, and microscales of investigation are starting points. Fuller use needs to be made of the more so-

phisticated techniques of dating and archeometry—techniques that usually are not warranted unless applied to data from superior contexts. These suggestions carry a price. The costs of doing archeology, even mediocre archeology, continue to rise, and unless substantive new information is gained on nearly every attempt, those costs are not justified. Only by eliminating redundant efforts and targeting quality data with explicit research objectives and well-conceived plans for data recovery and analysis can we expect to make those substantive contributions. Because archeologists working in central Texas have begun to evaluate site data for their integrity, to move beyond the single-minded pursuit of chronology building, to give thought to data and analytical requirements for other research objectives, and to recognize important kinds of evidence previously ignored, conditions are right for making real progress in understanding the local prehistory.

Acknowledgments

Tim Perttula encouraged me to write this chapter and its predecessor essay, which appeared in volume 66 of the *Bulletin of the Texas Archeological Society,* and his comments and editorial skills are greatly appreciated. The following individuals offered valuable and greatly appreciated information and counsel: Jan Guy Motrick, Susan W. Dial, C. Britt Bousman, Glenn T. Goode, Anne C. Kerr, Thomas R. Hester, Stephen L. Black, Marilyn A. Masson, Darrell Creel, Linda Wootan Ellis, and Charles Frederick. At the Texas Archeological Research Laboratory, Lauren Sullivan assisted with research in the site files, Pamela J. Headrick drafted the figures and drew all of the artifacts except for Fig. 3.11a (drawn by Ellen Atha), Fig. 3.12d and e (drawn by the late Hal Story), and Fig. 3.15j (drawn by the author). Elizabeth Andrews printed the photographs, and Robin Benson assisted in the preparation of the artifact plates. Rickard Toomey III and Tom Stafford graciously allowed me to use unpublished radiocarbon dates from Hall's Cave, and Glenn T. Goode shared his unpublished data on the Anthon site. C. E. (Gene) Mear and Paul Goldberg granted me access to unpublished geologic data.

To all of these I extend my appreciation without any burden of responsibility for my errors.

Note

1. An allostratigraphic unit is a sedimentary unit defined and mappable on the basis of its bounding discontinuities; such a unit itself does not have to be continuous (North American Commission on Stratigraphic Nomenclature 1983, 865–67).