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Prehistory of the Jornada Mogollon and Eastern Trans-Pecos Regions of West Texas

Myles R. Miller and Nancy A. Kenmotsu

The Trans-Pecos region of Texas extends from El Paso on the west to the Pecos River on the east, with the Rio Grande defining its southern boundary and New Mexico its northern. Included within this region are El Paso, Hudspeth, Culberson, Brewster, Presidio, Jeff Davis, Terrell, Pecos, and Reeves Counties (Fig. 7.1). Part of the greater Southwest, part of the Southern Plains, yet mostly in and of itself, the Trans-Pecos region represents an important transitional point between several geographic and cultural regions. Archeological sites ranging in age from Paleoindian to Historic are well represented, and among these are site types ranging from lithic scatters and isolated hearths to rockshelters, pueblos, and Spanish missions. In this chapter, we offer an outline of prehistoric human adaptation to this vast and highly variable region.

For much of the twentieth century archeological research in the Trans-Pecos lagged behind that of many other regions of Texas and the Southwest. Due to the region's remoteness and the prevalence of nonarchitectural hunter-gatherer sites, its prehistory was viewed as peripheral to developments in better known and more archeologically visible culture areas. Despite this past neglect, the Trans-Pecos is proving to be an extremely fertile region for archeological inquiry, and its archeological resources offer an important and accessible data base for several topics of current archeological relevance. These topics include, to list but a few of the major ones, (a) the nature of hunter-gatherer mobility and organization in a semiarid environment characterized by spatially and temporally variable plant and animal resources, (b) the ecological and social aspects underlying a high degree of settlement mobility among horticultural and agricultural groups in the region, and (c) causal factors leading to the adoption of agriculture in the Southwest. Archeologists working in the region have also made several fundamental contributions to studies of prehistoric landscape use and landscape (or "nonsite") archeology (Burgett 1994; Camilli and Ebert 1992; Camilli et al. 1988; Doleman et al. 1992; Mauldin 1995; O'Leary 1987) and how artifact and site distributions are conditioned by geomorphological factors in active eolian environments (Anschuetz et al. 1990; Doleman et al. 1991; Mauldin et al. 1998; M. Miller 1988; Schutt 1992; Seaman et al. 1988).

As the effects of scale on archeological interpretation achieve wider recognition, the prehistory of the Trans-Pecos has great importance in explicating relationships between long-term change in adaptive systems and panregional social and economic systems. As archeologists gain a broader appreciation of the synchrony of developments across the southern Southwest and adjoining regions, it has become increasingly evident that events in Casas Grandes, the Mogollon, Chupadera Mesa, or southeast New Mexico and the Texas Panhandle cannot be completely understood without reference to contemporary developments in adjacent regions, including the Trans-Pecos (see Boyd et al. 1997; Creel 2000; Kenmotsu 1994; Mallouf 1990; M. Miller et al. 1997; Rautman 1993; Spielmann 1983, 1991a, 1991b; Wiseman 1988). Moreover, such processes may be examined over an extended time frame in the Trans-Pecos because of the presence of numerous Spanish Colonial period Native American and European settlements, several of which were continuously occupied from late prehistoric through historic times.

Archeological investigations have been conducted throughout the Trans-Pecos since the early part of the twentieth century, and several syntheses and overviews of regional prehistory have been produced since the middle of the twentieth century. In 1948, Donald Lehmer reported the results of several archeological investigations in south-central New Mexico and the western Trans-Pecos that ultimately led to his seminal definition of the Jornada Branch of the Mogollon. Meanwhile, J. Charles Kelley, in collaboration with Lehmer and T. N. Campbell, undertook the first professional and systematic investigations in the eastern Trans-Pecos, the results of which established a cultural historical sequence and descriptions of material culture for this region (J. C. Kel-

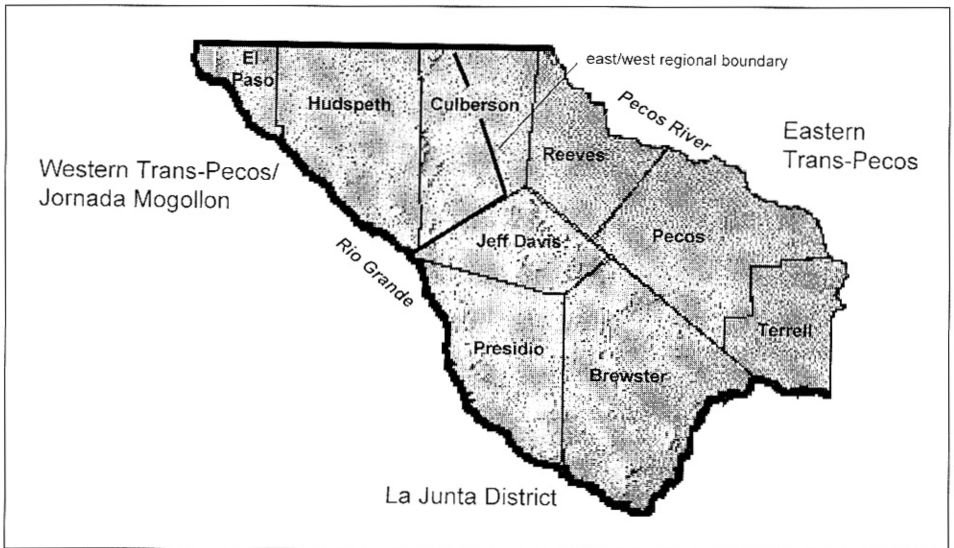

Fig. 7.1. Counties of the Texas Trans-Pecos region.

ley 1939, 1949; J. C. Kelley et al. 1940). After this brief period of activity, interest in this part of the southern Southwest faded as archeologists devoted their attention to the more visually appealing Mogollon, Hohokam, and Casas Grandes Culture areas. Lehmer reviewed the status of Trans-Pecos archeology in a 1958 article in the *Bulletin of the Texas Archeological Society,* as did Alexander J. Lindsay, Jr., in a brief 1969 current research contribution to *American Antiquity.* However, aside from Kelley's work in the La Junta de los Ríos area the Trans-Pecos received little attention from professional archeologists. In their place, the majority of excavations were performed by devoted and capable avocational groups such as the El Paso Archaeological Society, and much of the information on prehistoric pueblos in the Jornada Mogollon region is known through their efforts.

It was not until the 1970s and the advent of cultural resources management (CRM) programs that the Trans-Pecos again became the focus of professional investigations. The majority of archeological work in the 1970s and early 1980s consisted of small- and large-scale inventory surveys, most of which were conducted on the Fort Bliss Military Reservation (Beckes et al. 1977; Carmichael 1983; Skelton et al. 1981; Whalen 1977, 1978). This pattern continued through the 1980s, and while numerous sites were investigated to determine their research potential, intensive excavation projects were surprisingly few in number. The lack of excavation data was one of the major obstacles to acquiring a scholarly understanding of regional developments and changing adaptive trends, and even fundamental issues of chronology, artifact sequences, subsistence, architectural developments, and settlement patterns remained the subject of uncertainty and debate through the 1980s.

Fortunately, since the late 1980s this situation has changed, and it would not be unreasonable to state that during the 1990s the accumulation of archeological data progressed at an exponential rate for much of the Trans-Pecos. This change is perhaps best exemplified by the fact that 75 percent of the 827 radiocarbon dates from the Jornada Mogollon region of El Paso, Hudspeth, and Culberson Counties have been reported since 1988, and more than 50 percent of the dates are from just 1995–2000. Similarly, two-thirds of the dates from the eastern Trans-Pecos have been reported since 1985. In the far western portion of the region, numerous archeological testing and mitigation projects have been undertaken as part of well-funded CRM programs at Fort Bliss Military Reservation and because of the constant encroachment of urban developments on archeological sites resulting from the rapid growth of El Paso. As a result, our understanding of the timing and nature of prehistoric adaptations has undergone several important revisions and refinements. In addition, archeological investigations sponsored by the Texas Water Development Board in advance of several water delivery projects throughout the Rio Grande Valley southeast of El Paso have contributed an impressive amount of information on Historic period sites and material culture. In the eastern Trans-Pecos, a revitalized program of archeological investigations initiated by the Center for Big Bend Studies in Alpine has contributed additional survey and excavation data for several poorly known areas.

The increasing pace of archeological work during the 1990s has produced a considerable amount of new information, much of which remains unpublished or has yet to be widely disseminated. Among the most profound contributions are several investigations of long- and short-term regional adaptive patterns based on compilations of data obtained during twenty years of CRM investigations and earlier professional or avocational work. Several recently reported studies have provided crucial insights into changing patterns in subsistence economies, landscape use, feature and artifact variation, and regional exchange patterns. These include analyses of macrobotanical samples (Hard et al. 1996; M. Miller 1997), groundstone (Calamia 1991; Hard et al. 1996; Mauldin 1995; Mauldin and Leach 1994), thermal features (Leach 1993; Mauldin 1994, 1995, 1996a; Mauldin et al. 1998), ceramics (M. Miller 1997), lithic raw materials and obsidian geochemical data (Church et al. 1996; M. Miller and Shackley 1998), and burials (M. Miller 1990; Mauldin 1995). Published databases available for study include more than four thousand chronometric dates (M. Miller 1996a) and descriptive information for more than one thousand habitation structures from the northern and southern Jornada Mogollon regions (Graves 1996).

We will present some of the insights recently gained from these studies and offer several new perspectives on the prehistory of the Trans-Pecos region. Numerous cultural historical summaries for the Jornada Mogollon region have appeared since the 1970s, although the majority are in introductory sections available in a multitude of CRM reports. Unfortunately, many of these summaries tend to be behind the curve in considering recent developments or at worst are simply "boilerplate" insertions. In either case, they often tend to maintain interpretations and data sources that may be out-dated by a decade or more. While it would be safe to assume that, at any given time, any geographic or culture region is ready for an overhaul of current interpretations, assumptions, and theoretical perspectives, the Trans-Pecos region is particularly suited for such an endeavor.

To accomplish such an overhaul in this chapter required a synthesis and summary of the accumulated archeological work of fifty years, an endeavor that presented several challenges. Perhaps most troublesome was the highly variable quantity and quality of data available across a region measuring more than thirty-one thousand square miles. This imbalance is particularly evident in the tone of the respective discussions for the eastern and western segments of the Trans-Pecos. Several counties and geographic zones in the eastern Trans-Pecos are archeologically among the least known regions of the state, and for these areas it is only possible to make general statements regarding changing aspects of material culture over broad time intervals.

We also take into account the intended audience of this volume on the prehistory of Texas: a group undoubtedly including academic and CRM archeologists, avocational archeologists, students, historians, and members of the public having an interest in the prehistory of the state. With these varied groups in mind, we debated whether to produce a technical and theoretically oriented review of long-term patterns and processes involving prehistoric adaptations in the Trans-Pecos region or a more conventional presentation that simply profiled sequential intervals in material culture, feature types, and general subsistence trends (i.e., a traditional culture-historical overview). We opted for a compromise approach. Accordingly, while the overview is largely structured within a conventional culture-historical framework involving sequential periods and phases, we emphasize specific trends within these periods. Trends examined within each time interval include settlement mobility and landscape use, changes in subsistence economies as reflected in dependence upon domesticated versus nondomesticated plants and animals, and how changes in technology, settlement structure, and social organization reflect the evolution of these settlement and subsistence systems. Our scale of inquiry tends to be regional in order to illustrate important adaptive trends as well as social relationships with adjacent regions. We do discuss individual sites, however, to provide examples of specific settlement systems at various points in time. Moreover, to present a truly regional perspective, we refer to several important sites across the state line in New Mexico.

Also included in this chapter are an update and a synthesis of recent archeological research on the Protohistoric and Spanish Colonial periods. Often ignored or downplayed in culture history overviews, the archeology of these periods is achieving increased interest and importance. We do not, however, offer a detailed compendium of historical events involving Spanish expeditions or the establishment of missions and presidios but prefer to focus on archeological aspects of these periods and the information they provide in terms of the effects of European colonization on the settlement and social organization of indigenous Native American groups.

Environment and Climate

The western two-thirds of the Trans-Pecos is part of a large physiogeographic region known as basin and range (Hawley 1975) that is characterized by generally north-south trending mountain ranges separated by wide internal drainage basins termed bolsons (see Fig. 7.1). Two of the most prominent such drainage features are the Hueco Bolson and Salt Flat Basin in El Paso, Hudspeth, and Culberson Counties (Fig. 7.2). The basin and range physiography terminates with a northwest to southeast chain of mountains, beginning with the Guadalupes on the north, followed by the Delawares, Davis, Rosillos or Glass, and Chisos. East of these mountains are the Delaware Basin, Toyah Basin, and the dissected Stockton Plateau, all of which terminate at the Pecos River. Elevations range from 8,751 feet at Guadalupe Peak, the highest elevation in Texas, to 1,600 feet at the confluence of the Pecos River and the Rio Grande, with the majority of landforms ranging between 3,000 and 5,000 feet in elevation.

To visitors from well-watered, flora-rich lands to the east, the Trans-Pecos may appear harsh and unforgiving. Such a view is deceptive. The land supports a wide range of flora and fauna, and the material recovered from excavations in the region provides evidence that the region's prehistoric inhabitants exploited many of these resources. Plant resources used for food, fuel, or construction wood, medicine, or fibers include honey and

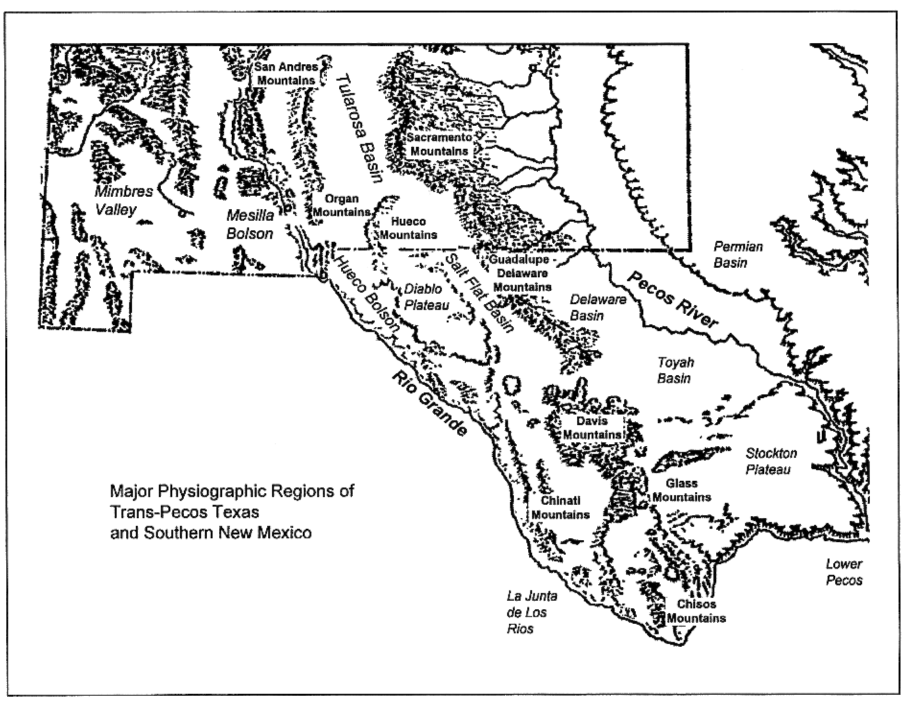

Fig. 7.2. Major physiographic regions of Trans-Pecos west Texas and southern New Mexico.

screwbean mesquite (*Prosopis juliflora, P. pubescens*), sotol (*Dasylirion wheeleri*), agave (*Agave lechuguilla, A. americana*), yucca (*Yucca elata, Y. baccata*), prickly pear (*Opuntia* sp.), and various other cacti (*Echinocereus* sp., *Mammalaria* sp.). Faunal resources include rabbits (*Sylvilagus auduboni, Lepus californicus*), deer (*Odocoileus hemionus*), pronghorn antelope (*Antilocapra americana*), bison (*Bison bison*), and various reptiles, rodents, and fish.

Besides the Rio Grande and, in some years, the Pecos River, springs provide the only source of permanent water throughout much of the region. Certain springs, such as those associated with site 41CU460 at the head of South McKittrick Canyon in the Guadalupe Mountains, are small, and the limited archeological remains at such sites suggest that they were infrequently utilized for brief stays (Kenmotsu 1993). In contrast, the archeological materials at Phantom Springs (41JD63), a large permanent spring in Jeff Davis County near Balmorhea, show repeated, intensive occupation from 4500 B.C. to A.D. 1500 (Charles 1994). Here, burned rock middens, hearths, and activity areas (i.e., horizontal zones within a site where the patterns of artifacts and/or features indicate that one or more specific activities occurred) document the importance of this water source as a camp site for intervals of at least several days at a time. Playas distributed throughout the central bolsons also served as an important yet often unpredictable water source and were a focus of agriculturally based settlements after ca. A.D. 1200 in the western Trans-Pecos.

James T. Abbott (1996), Raymond Mauldin (1995), and Robert J. Mallouf (1981) provide comprehensive summaries and critiques of regional paleoclimatic findings. Data from packrat middens indicate that woodland and grassland savanna communities were present throughout the region at the end of the Pleistocene. H. Curtis Monger and Brenda J. Buck (1995; see also Monger 1993) note that the presence of lagged carbonate nodules in deposits dating to ca. 7000 B.C. indicates that a major erosional event occurred at this time. Additional geomorphological, pollen, and stable isotope analyses (Monger and Buck 1995) point to the beginning of a drying trend at 7000 B.C. that persisted through the Middle Holocene. By then, climate and vegetation communities similar to modern conditions were becoming established. In agreement with studies from adjacent regions of the Southwest and Southern High Plains (G. Hall 1985; Holliday 1989b; E. Johnson and Holliday 1986; see E. Johnson and Holliday, chapter 9, this volume), packrat midden data and measures of stable isotope ratios in soils throughout the El Paso area of west Texas show that this period was essentially warm and arid, although with several relatively brief periods of increased moisture and cooler temperatures.

Essentially modern conditions were established during the Late Holocene throughout the Chihuahuan Desert (Van Devender 1990). Plant materials incorporated into packrat middens at several locations include high proportions of species adapted to dry environments. More detailed reconstructions of paleoclimatic patterns during the Late Holocene have been obtained through proxy indicators of temperature and precipitation. Using data on tree-ring sequences and historic precipitation and temperature records, Mauldin (1995) has summarized climatic trends during the period between A.D. 450 and 1950. Mauldin identifies at least three intervals (A.D. 500–700, 1000–1300, and 1550–1950) that may correspond to periods of higher rainfall and greater stability in climate. As an indicator of moisture stress, and therefore an additional proxy measure of rainfall and temperature, Myles R. Miller (1996a) illustrates trends in measured delta ^{13}C values from more than seven hundred radiocarbon-dated C3 wood charcoal samples from the El Paso area. Although these analyses are problematic in some regards, the two sequences show several general correspondences in periods interpreted as having increased precipitation and perhaps a more stable and predictable climatic regime. Interestingly, several of these intervals correlate with broad trends and transitions in adaptive systems and other archeological patterns during the Formative period in west Texas and southern New Mexico (see below).

The present-day topography of much of the region consists of mesquite-stabilized coppice dunes. The prevalence of desert shrub plants such as mesquite and creosote is thought to have resulted from the introduction of cattle and resultant overgrazing in the late 1800s, combined with episodic periods of drought. The modern climate of the region is characterized as semiarid. Average annual rainfall throughout most of the Trans-Pecos is less than eight inches, with much of the rainfall occurring during July, August, and September, and the spring usually being the driest period of the year. As with most desert environments, substantial variation exists in precipitation rates over a period of years or decades. Rainfall during the summer monsoon occurs in localized, high-intensity thunderstorms. In addition, evaporation rates are high due to high temperatures. Taken together, these climatic patterns created an uncertain, unpredictable, and geographically variable environment from year to year. Accordingly, subsistence, mobility, and scheduling patterns of prehistoric populations were, to a large extent, influenced by these parameters.

Status of Archeological Investigations and Background for Inquiry

Following Mallouf (1985), we divide the Trans-Pecos region into eastern and western segments. The western segment, including El Paso, Hudspeth, and western Culberson Counties, has traditionally been subsumed within the Jornada Mogollon culture region of the greater Southwest (Lehmer 1948; Leslie 1979). The eastern segment includes Brewster, Presidio, Jeff Davis, Terrell, Pecos, and Reeves Counties.

The division is certainly arbitrary, based as it is primarily on such trait markers as the presence of ceramics and architectural settlements. The use of such an artificial construct undoubtedly obscures some important aspects of prehistoric occupation and interaction in the region. Nevertheless, it serves as a useful point of departure for discussions to follow. Equally important, the division also reflects the disparity in data available from the western and eastern segments. Because of several factors, including the predominance of private land, the remoteness of the region, and absence of major urban centers, archeological surveys in the eastern Trans-Pecos and indeed anywhere east of El Paso County have been few and far between.

To further illustrate this problem, site records at the Texas Archeological Re-

Table 7.1. Recorded Archeological Sites Compared to County Size, Number of Radiocarbon Dates, and Number of Dated Sites by County

	Size of County mi²	*Number of Recorded Sites*	*Number of Sites per mi²*	*mi² per Site*	*Number of ¹⁴C Dates*	*Number of Dated Sites*
El Paso	1014	5340	5.27	0.2	716	185
Culberson	3812	585	0.15	6.5	67	9
Hudspeth	4572	527	0.12	8.7	48	7
Western Totals	9398	6452	0.69	1.5	831	201
Brewster	6193	1202	0.19	5.2	10	4
Jeff Davis	2264	169	0.08	13.4	19	1
Pecos	4765	477	0.10	10.0	19	3
Presidio	3856	756	0.20	5.1	18	2
Reeves	2642	23	0.01	114.9	0	0
Terrell	2357	581	0.25	4.1	14	7
Eastern Totals	22,077	3208	0.15	6.9	70	17

Source: Texas Archeological Research Laboratory 1997; M. Miller 1996a; Mallouf 1985, 1990; Charles 1994.

search Laboratory, at the University of Texas, and Texas Site Atlas Project, under the aegis of the Texas Historical Commission (Table 7.1 and Fig. 7.3), for each of the counties in the region were compared with the size of the county. El Paso County has the highest number of recorded sites (in fact the highest quantity of recorded sites of any county in the state) because of environmental laws that have required large-scale systematic archeological surveys by the U.S. Army at Fort Bliss (Burgett n.d.; Lukowski 1997; Lukowski and Stuart 1996; Whalen 1977, 1978), the Texas General Land Office (Lynn et al. 1975), the Texas Water Development Board (Peterson and Brown 1992a), the City of El Paso (Kauffman and Stuart 1994), and other project sponsors prior to land development and construction projects. East of El Paso, however, many fewer construction and development projects have been undertaken, and the number of sites dramatically decreases while county size increases. For example, in Culberson County a series of surveys near Van Horn (Hedrick 1968, 1975, 1989, 1991) and inventories of sites within the Guadalupe Mountains National Park (Applegarth 1976; Boisvert 1980; Katz and Katz 1974; P. Katz 1978; Kenmotsu 1993; Phelps 1974; Shafer 1970) are responsible for the bulk of the recorded sites. Similarly, most sites in Brewster and Presidio Counties have been recorded during inventories in Big Bend National Park and Big Bend Ranch State Park (Campbell 1970; Ing et al. 1996; Mallouf 1993; Mallouf and Wulfkuhle 1989). Hudspeth, Pecos, and Terrell Counties have seen systematic surveys for land impacts (Cloud 1989; Shafer 1971; Warren 1977), but these have largely been confined to small areas and most of these counties remain largely unknown. Elsewhere, systematic archeological surveys have been sporadic, often consisting of linear surveys for pipelines (Ackerly et al. 1987; Zier 1996), highways (Crawford 1971), or road improvements as part of the Joint Task Force 6 project (Lowry 1999; Sale and Gibbs 1998). Reeves County, with only twenty-three recorded sites, has received the least amount of archeological attention.

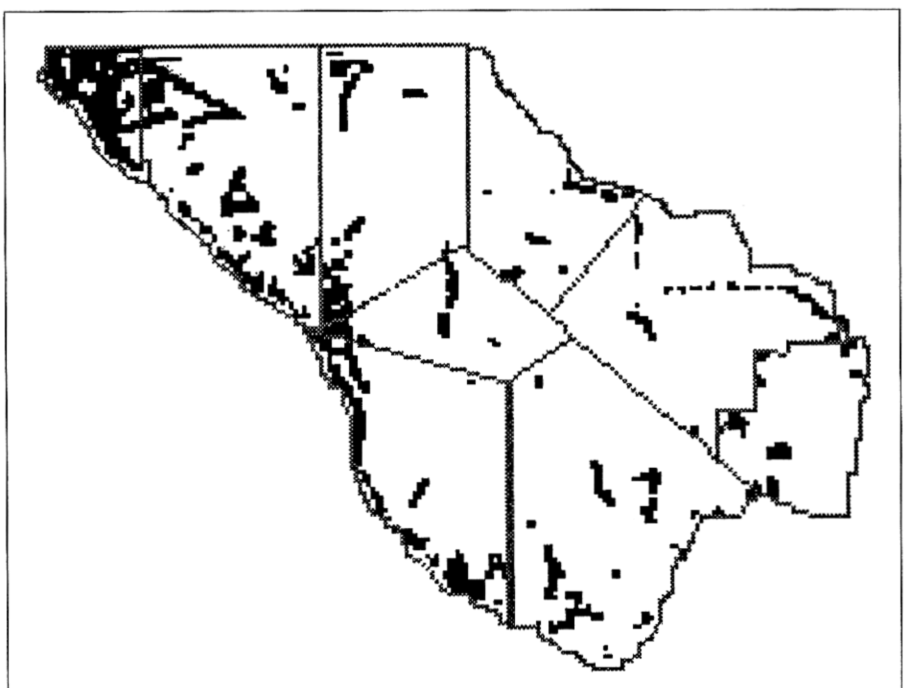

Fig. 7.3. Distribution of recorded archeological sites in the Trans-Pecos. Note the density of sites recorded for El Paso County at the far western edge of the study area.

Survey level data are often problematic, and thus an even greater issue is the paucity of excavation data from the eastern Trans-Pecos. The few excavations that have been conducted in the Guadalupe Mountains have largely focused on caves and rockshelters (Ayers 1936; Mera 1938; Roney 1985, 1995; Schroeder 1983) that represent only a handful of the total sites in the range. Only Susan M. Applegarth (1976) and Susana R. Katz (1978) have investigated open sites. A small number of sites have been investigated in the La Junta region (Cloud et al. 1994a; J. C. Kelley 1949; Mallouf 1990, 1995a; Shackelford 1951, 1955), but few other excavations have taken place. Fortunately, this situation is being altered with a renewed emphasis on archeological investigations at the Center for Big Bend Studies in Alpine.

Obtaining a firm count of excavated sites across the region proved impractical, and as an alternative we have summed the number of radiocarbon dates and radiocarbon-dated sites within each county (see Table 7.1). We intend this information to serve as a proxy measure indicating the relative numbers of sites at which some excavations have taken place. As expected, El Paso County has had by far the most intensive work (716 radiocarbon dates from 185 sites). Several habitation sites (Batcho et al. 1985; Bentley n.d.; Bradley 1983; Browning et al. 1992; Carmichael 1985; Fields and Girard 1983; Foster and Bradley 1984; Hard 1983a, n.d.; Kauffman 1984; Kegley 1982; M. Miller 1989, 1990; M. Miller and Stuart 1991; O'Laughlin 1980; Scarborough 1986a, 1986b; Whalen 1994a) and virtually hundreds of small sites within Fort Bliss (Burgett n.d.; Lowry and Bentley 1997; Mauldin et al. 1998; O'Laughlin and Martin 1989, 1990; Whalen 1980a) and elsewhere in the vicinity of El Paso have been investigated (Camilli et al. 1988; Doleman et al. 1991; O'Leary 1987; Seaman et al. 1988). A recent and particularly welcome development is the increasing number of investigations taking place in the Rio Grande Valley (Lower Valley of El Paso) that have broadened our understanding of Spanish Colonial period settlement and adaptation (D. O. Brown et al. 1994, 1995; D. Martin 1999; M. Miller and O'Leary 1992a; Vierra et al. 1997, 1999).

Culberson and Hudspeth Counties follow, with intensive dating studies conducted at Wind Mountain (Hines et al. 1994), Granado Cave (Hamilton 1998), and several sites investigated along the All American Pipeline (M. Miller 1994; New Mexico State University and Continuum Corp. 1989) and Samalayuca Pipeline (Mauldin and Leach 1997; Staley and Turnbow 1995). Radiocarbon dates have recently been obtained from important settlements in the La Junta and Big Bend regions (Cloud et al. 1994; Mallouf 1990) and from Balmorhea State Park in Jeff Davis County (Charles 1994). Elsewhere throughout the Trans-Pecos, however, few or no radiocarbon dates are available, particularly in those counties centered on the Stockton and Delaware Basins, and therefore prehistoric patterns and developments based on absolute dates in these areas are very poorly known.

With these factors in mind, the outline of the human occupation of this vast region that we offer is tentative, and, at times, we draw heavily on data from surrounding regions. Like other culture histories and overviews of the eastern Trans-Pecos (Cloud et al. 1994; J. C. Kelley et al. 1940; J. C. Kelley 1985, 1986; Kenmotsu 1994; Mallouf 1985, 1990; see also Sebastian and Larralde 1989), our discussion relies on a variety of published and unpublished material from archeological investigations that have taken place in the region over the last eight decades. Also, because we use previously published data, a few words about the nature of that data are in order. First, the data are of varying quality. Field methods today emphasize thorough documentation during site investigations and typically include the recovery of special samples for radiocarbon dating, macrobotanical remains, or other specific analyses. These methods, and many of the analyses, were either unknown or not used in the past. Thus, the modern researcher who seeks to study excavations from the 1950s through 1970s can find it difficult to correlate specific artifacts with one or another level in the site or to understand how one area of a site may relate to another. That successful correlation is not impossible is demonstrated by Christine G. Ward (1992), who analyzed the collections recovered fifty years earlier from the Shelby Brooks Cave in eastern Culberson County.

The following discussion is structured within the traditional cultural-historical sequence of Paleoindian, Archaic, Late Prehistoric/Formative, and Protohistoric/Spanish Colonial periods. When necessary, we refer to more specific phase designations or subdivisions. The taxonomic sequences used in this chapter for the western and eastern Trans-Pecos regions are illustrated in Fig. 7.4. Problems with

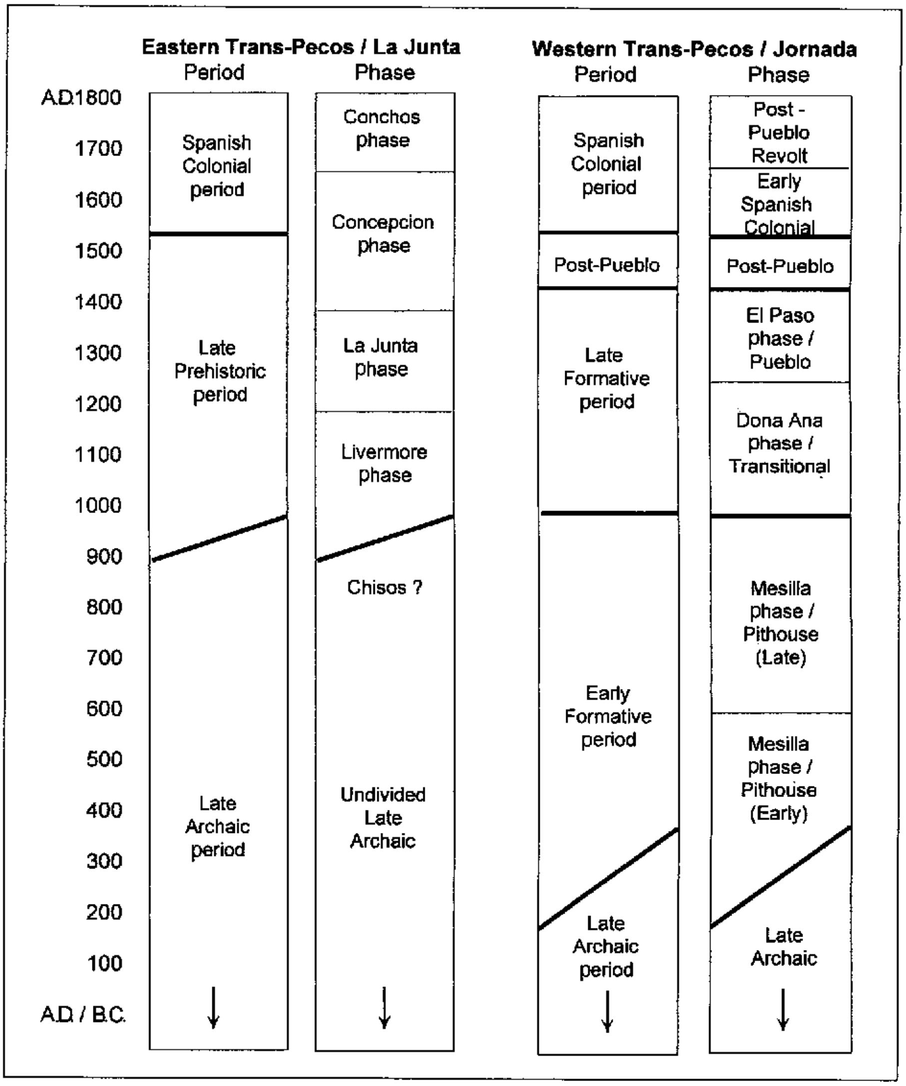

Fig. 7.4. Late Archaic through Spanish Colonial, and Paleoindian through Late Archaic cultural sequences of the eastern and western Trans-Pecos.

continued reference to, and reliance on, phase sequences have been noted by several archeologists in the region (Carmichael 1982a, 1984, 1985; Mauldin 1995; M. Miller 1993a), and while acknowledging the validity of these arguments, the conventional use of periods and phases provides a convenient framework for discussions of long-term processes in prehistory.

We also rely on inferences and pattern identifications that are heavily based on radiocarbon dates. These patterns are usually contrasted with other lines of evidence to arrive at a wider view of trends and transitions in prehistoric settlement and adaptation. The use of chronometric dates to examine broad trends also reflects the fact that for most of the region, and particularly in central basin landforms where most archeological work has been conducted from about 1980 to the end of the century, settlements spanning the entire Archaic and Formative period sequences are compressed within shallow (less than 1 m) geomorphic deposits.

Pre-Clovis and "Pre-Projectile Point" Cultural Traditions (ca. 35,000 to 10,000 B.C.)

The existence of pre-Clovis occupations—or a "Pre-Projectile Point Horizon" as occasionally referred to in earlier studies—in North America has been the subject of considerable debate since Alex D. Krieger first suggested that pre-Clovis lithic traditions existed in Texas and elsewhere throughout the United States between 40,000 and 15,000 B.C. (Krieger 1953, 1962, 1964; see also Meltzer et al. 1997). Claims of pre-Clovis manifestations in the Jornada Mogollon region have recently been resurrected, and unsurprisingly they have also created a substantial amount of controversy and skepticism. While often disregarded in prehistoric overviews of the Trans-Pecos, the subject of pre-Clovis occupations deserves some mention in light of recent findings throughout the Americas (e.g., Dillehay 1989, 1997; Meltzer 1993a, 1993b; Meltzer et al. 1997), particularly since one of the more controversial candidates for having a pre-Clovis occupation, Pendejo Cave, is situated north of and just across the Texas-New Mexico state line from El Paso.

Recently, the existence of a pre-Clovis cultural tradition in the American Southwest has been proposed by Richard MacNeish based on his excavations at Pendejo Cave, a deeply stratified rockshelter located on McGregor Guided Missile Range east of Orogrande, New Mexico (MacNeish 1993a; MacNeish et al. 1993; see also Chrisman et al. 1996). Zones C1 through O, with a seemingly well-stratified sequence of radiocarbon dates ranging between twelve thousand and more than fifty thousand years in age, contained large quantities of Pleistocene faunal material, well-preserved plant remains, and other ecofacts purportedly in association with hearths, stone artifacts, modified animal bones, and human skin impressions and hair.

Middle and Late Holocene occupations of the shelter by human groups are not contested. Zones A through C contained preserved corncobs, cordage, and a sample of recognizable chipped stone and ceramic artifacts. The ages of these items, plus two radiocarbon age estimates obtained directly from sandal fragments recovered from these strata, occupy a range within the Early and Late Archaic periods. Arguments for a human presence in the cave during the Late Pleistocene, prior to 10,000 B.C. and up to thirty-five thousand years in age, are based on less conclusive findings. Claims of pre-Clovis occupations rest primarily on a small quantity of crudely manufactured stone artifacts, a very small number of bones with fractures or marks suggestive of human modification, hearth features constructed of stones differing petrologically and chemically from the limestone rock formations comprising the natural setting of the cave, and the presence of hair and

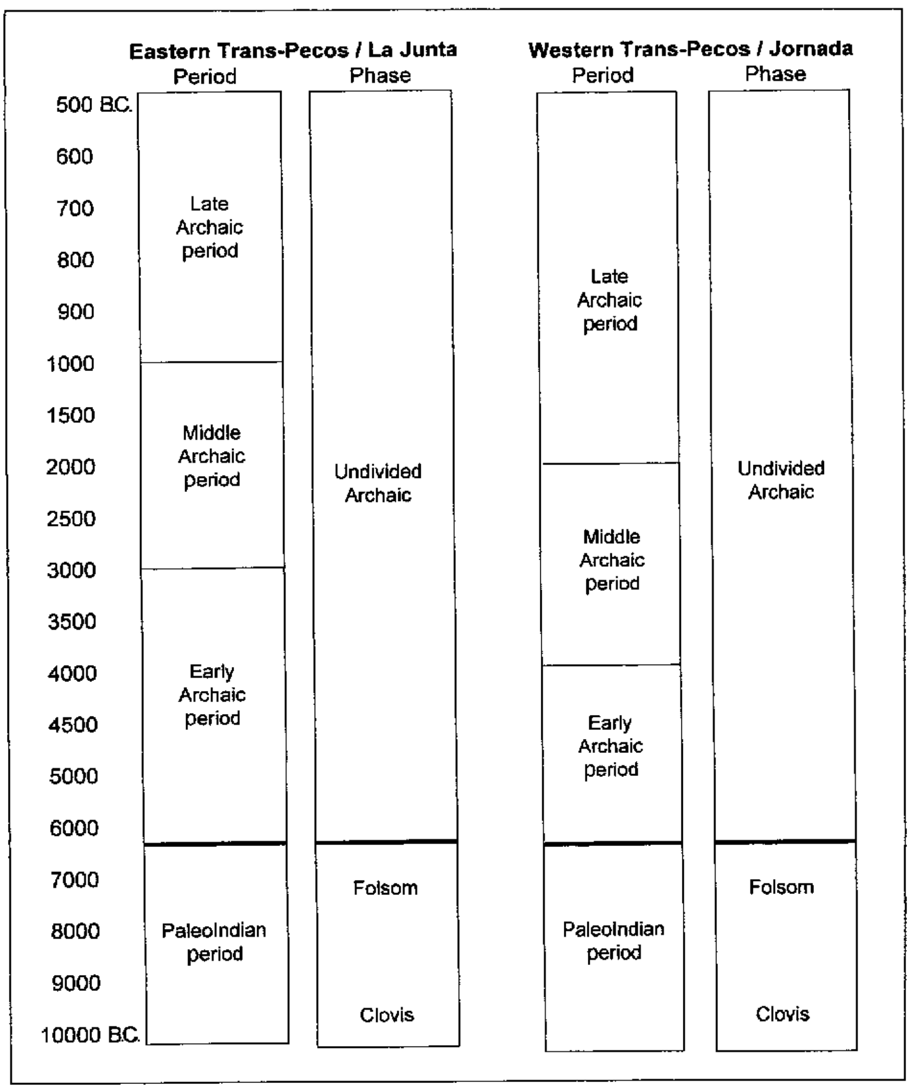

Fig. 7.4. (continued)

skin imprints claimed to be of human origin.

Aside from the manuscripts cited above and the *American Antiquity* article (Chrisman et al. 1996) describing claims for human friction skin impressions and that also provides the first coherent list of chronometric dates from the shelter, the only fully reported analysis and discussion of materials from the cave involves the sample of Pleistocene faunal remains (A. Harris 1995). Most of the special studies cited in support of arguments for human occupation or manipulation of certain materials and artifacts remain in manuscript form at the Andover Foundation for Archeological Research. Apparently a sample of rock used in the hearth features was submitted for neutron activation analysis (Pavlish 1994, cited in Chrisman et al. 1996); however, no formal description of the study has been published, and therefore the sampling criteria, element concentration data, and statistical basis for claiming a nonlocal origin for the hearth stones have not been independently evaluated. Similarly, petrographic analyses of a flake artifact and other lithic materials have been used to support the claim that the artifacts were also made of a material foreign to the cave (Clemons 1992, partially reproduced in MacNeish 1993a; also cited in Chrisman et al. 1996). In addition, Richard S. MacNeish (1993a) notes informally that thermoluminescence analysis of the hearth stones demonstrated that interior stones were subjected to higher temperatures than those at the margins of the feature, and he argues that this finding verifies that the features were used by humans and did not represent natural clusters of rock.

The article by Chrisman et al. (1996) describing human skin friction imprints promptly became the subject of several commentary articles. In support of criticisms regarding the skin imprints, it should be noted that Fort Bliss retains a copy of the original study conducted by the Ontario Provincial Police Forensics Laboratory, which states that no evidence of sweat pores could be detected among the imprints, leading one investigator to conclude that a nonhuman agent could possibly have made the marks. The small sample of bone and stone artifacts has been examined by several researchers, including the authors of this chapter during a 1991 visit to the site. Most who have viewed the material have informally commented on the extremely crude nature of the tools and the absence of attributes typical of chipped stone artifacts and accordingly have expressed serious reservations over their human origin. A final point is that Arthur Harris's detailed study of more than thirty-six thousand faunal specimens found no evidence of human action or modification in the assemblage, and he explicitly states in the summary that "other than the widespread occurrence of burned bone, the sample appears no different than natural, nonhuman-related cave accumulations that have been examined elsewhere. At least some of the burning seems consistent with burning or smoldering of strata post-depositionally, as also seen elsewhere" (A. Harris 1995, 37).

An independent evaluation of the site conducted in 1995 by Fort Bliss archeologists and Tom Stafford (INSTAAR, University of Colorado) resulted in a revised interpretation of the stratigraphic sequence. In addition, fifteen AMS radiocarbon dates were obtained from rodent pellets collected from well-documented columns in two exposed profiles in the shelter. The results of this study have not been reported, but initial analyses suggest that the stratigraphic sequence and assumed integrity of the layered deposits may require substantial reconsideration (Galen Burgett 1998, personal communication; Thomas Stafford 1995, personal communication). Extensive packrat middens are present throughout the shelter, and preliminary results of the radiocarbon dating suggest that the degree of disturbance in the deposits is greater than previously assumed (Thomas Stafford 1995, personal communication). Another potentially serious issue is that alternating layers of uncharred and charred organic material were often characterized as discrete, sealed stratigraphic units, while many such deposits may represent individual, natural depositional units exposed to different levels of heat during major fires inside the cave (i.e., a lower level of unburned material; a middle level comprising incompletely combusted materials and charcoal; and an upper level of materials reduced to ash). Based on examination of the remaining deposits, Burgett suggests that the sediments at Pendejo Cave represent a massive but complex depositional sequence in which bioturbation and burning have played a major role and that it will take much higher resolution methods than used during the original excavation to accurately define and characterize the stratigraphic sequence or to support the argument for a Pleistocene human presence.

Although Pendejo Cave has received the greatest degree of attention—or notoriety—since first publicized in the early 1990s, additional claims of pre-Clovis occupations have been made for the eastern Trans-Pecos. A. A. Andretta (1976, 1977) proposed the existence of a pre-projectile point (pre-Clovis) horizon on the basis of several anomalous collections of desert-varnished lithic artifacts found throughout the Davis Mountains. Subsequent studies (Andretta 1982; Ezell 1982) linked the Davis Mountains lithic complex to geologic deposits with an estimated age of approximately nineteen thousand years ago, and several similarities between the Davis Mountains materials and the San Dieguito cultures of southern California and the north Mexican state of Sonora have been claimed (Hayden and Andretta 1984). No chronometric dates have been obtained from the geologic formation, and the criteria on which the deposits were dated remain mostly unspecified. Moreover, the association between artifacts and the deposit remains tentative, and whether they represent occupation surfaces on past erosional surfaces remains unclear. The rate of desert varnish formation has not been critically evaluated to determine whether the artifacts could be of great age, but as no further investigations have been conducted since the mid-1980s the purported antiquity of the deposits and the cultural origin of the artifacts remain unresolved.

Paleoindian Period (10,000–6000 B.C.)

The earliest accepted evidence of prehistoric human occupation in the Trans-Pecos is from the Paleoindian period. Paleoindian adaptations have typically been viewed as a tradition of small, highly mobile bands with a subsistence economy centered around the hunting of large mammals such as mammoth and bison (Judge 1973). The period may be subdivided into three sequential traditions marked by functional and stylistic differences in tool kits thought to reflect changing hunting and settlement adaptations: the Clovis Complex, Folsom Complex, and the Plano/Cody Complexes.

The Paleoindian period in the Trans-Pecos is generally dated from 10,000 to 6000 B.C., although this time range is subject to revision since no chronometric dates have been obtained from contexts unambiguously associated with Paleoindian materials. Recognition of Paleoindian sites and traditions in the Trans-Pecos has been accomplished mostly through cross-dating distinctive lanceolate projectile point forms with those found at chronometrically dated occupation or kill sites in adjacent regions of the Texas Panhandle, eastern New Mexico, and across the Great Plains (see, e.g., Haynes 1992; Holliday 1997a; Johnson and Holliday 1981; Wheat 1972).

At the present time, no absolute chronometric dates have been obtained from contexts or features in secure association with Paleoindian materials in the Trans-Pecos (Table 7.2). The only radiocarbon dates falling within this period were obtained from undescribed deposits of charred material deeply buried in floodplain alluvium of the Rio Grande Valley north of Las Cruces, New Mexico. The samples were collected during geomorphological studies of Quaternary surfaces in the valley (Gile et al. 1981; Metcalf 1969). Unfortunately, the features or deposits from which the samples were obtained were not described, and whether they represented hearths or noncultural deposits of charred material is unknown. Two dates from the deepest deposits in Fresnal Shelter partially extend into the latter part of the Paleoindian period, and the earlier of the two dates (ISGS-812) and the stratigraphic context from which it was obtained suggested a Late Paleoindian occupation (Carmichael 1982b; R. Jones 1990). Edgar B. Howard (1932, 1935) reported the recovery of a fluted point from a deposit containing bones of extinct fauna at Burnet Cave in the Guadalupe Mountains. A radiocarbon date of 7432 ± 300 B.P. has been reported during a subsequent study conducted on materials from the cave (see discussion in Roney 1995, 17), but the association between the radiocarbon age, projectile point, and faunal material could not be clearly established.

Finally, radiocarbon dates ranging slightly earlier than the accepted age of the Clovis Complex have been obtained from two sites. MacNeish reports five dates from Zones C1 and C2 at Pendejo Cave (Chrisman et al. 1996), and two are claimed to be in association with human friction skin imprints. Both dates tend to be earlier than accepted dates for Clovis, but other dates from strata situated above or below Zones C1 and C2 substantially predate or postdate the Paleoindian period. Similarly, Edwin N. Ferndon, Jr. (1946), and C. Bertrand Schultz et al. (1970) describe the excavations at Hermit Cave in the Guadalupe Mountains where basal deposits in the shelter contained Pleistocene fauna in association with a purported hearth feature. Although no artifacts were found in the deposit, the excavators claimed that the entrance had been partially barricaded with logs. Calibrated radiocarbon dates obtained from charcoal and wood in the hearth and one of the logs range from 14,360 to 11,100 B.C.

Despite the absence of chronometric dates in unquestionable association with Paleoindian artifacts or features, a substantial number of Paleoindian manifestations have been recorded across the Trans-Pecos. Fig. 7.5 presents a summary of these findings based on figures provided in Amick (1994a), Mallouf (1985), Mauldin and O'Leary (1994), and Sommer (1974). However, Paleoindian components are rare when compared to the numbers of sites documented for later time periods. Problems of archeological recognition may have contributed to this perception. Paleoindian sites probably exist in greater numbers but are buried by later alluvial deposits and remain undetected during surface survey. In a remarkably rapid case of alluvial deposition in the La Junta region, Robert Mallouf (1991, 5–6) describes a hearth feature buried at a depth of 6 m in an arroyo profile at the Adobe Walls Draw site (41BS751) that provided a radiocarbon age estimate postdating A.D. 600. It is also possible that Paleoindian components consisting of scatters of lithic debitage but otherwise lacking distinctive projectile

Table 7.2. Late Pleistocene and Early Holocene Radiocarbon Age Estimates from the Jornada Mogollon and Eastern Trans-Pecos Regions Possibly Associated with Human Occupations

Location	*Context*	*Lab #*	*^{14}C Age B.P./ St. Error*	*Calibrated 2-sigma Age Range*[c]
Fresnal Shelter	C27 Fea. 3	ISGS812	7310 ± 75	6340–5980 B.C.
Fresnal Shelter	B26E Unit K	ISGS845	7110 ± 75	6110–5770 B.C.
Burnet Cave	n/a	n/a	7432 ± 300[a]	7010–5670 B.C.
Chandler Tank	Fillmore Alluv.	I-4282	7340 ± 285[a]	6760–5630 B.C.
Garfield Loc.	Leasburg Alluv.	I-3784	9360 ± 150[a]	9000–8050 B.C.
Pendejo Cave	Zone C1	UCR2602	11300 ± 110	11540–11020 B.C.
Pendejo Cave	Zone C1	UCR2641	11900 ± 150	12370–11540 B.C.
Pendejo Cave	Zone C2	CAMS12367	12240 ± 70[b]	12700–12050 B.C.
Pendejo Cave	Zone C2	CAMS12366	12370 ± 80	12900–12190 B.C.
Pendejo Cave	Zone C2	UCR2603	12970 ± 170[b]	13990–12800 B.C.
Hermit Cave	Hearth? wood	n/a	11850 ± 350[a]	12820–11100 B.C.
Hermit Cave	Log, mouth of cave	n/a	12270 ± 300[a]	13320–11630 B.C.
Hermit Cave	Hearth? charcoal	n/a	12900 ± 350[a]	14360–12260 B.C.

[a]Age estimate not corrected for isotopic fractionation.
[b]Reported to be in association with human friction skin imprints.
[c]Bidecadal calibration data sets of Linick et al. 1986; Stuiver and Pearson 1993; and coral spline model of Bard et al. 1993.
Source: Compiled from Carmichael 1982b; Chrisman et al. 1996; Gile et al. 1981; R. Jones 1990; Metcalf 1969; M. Miller 1996a; Roney 1995; Tagg 1996.

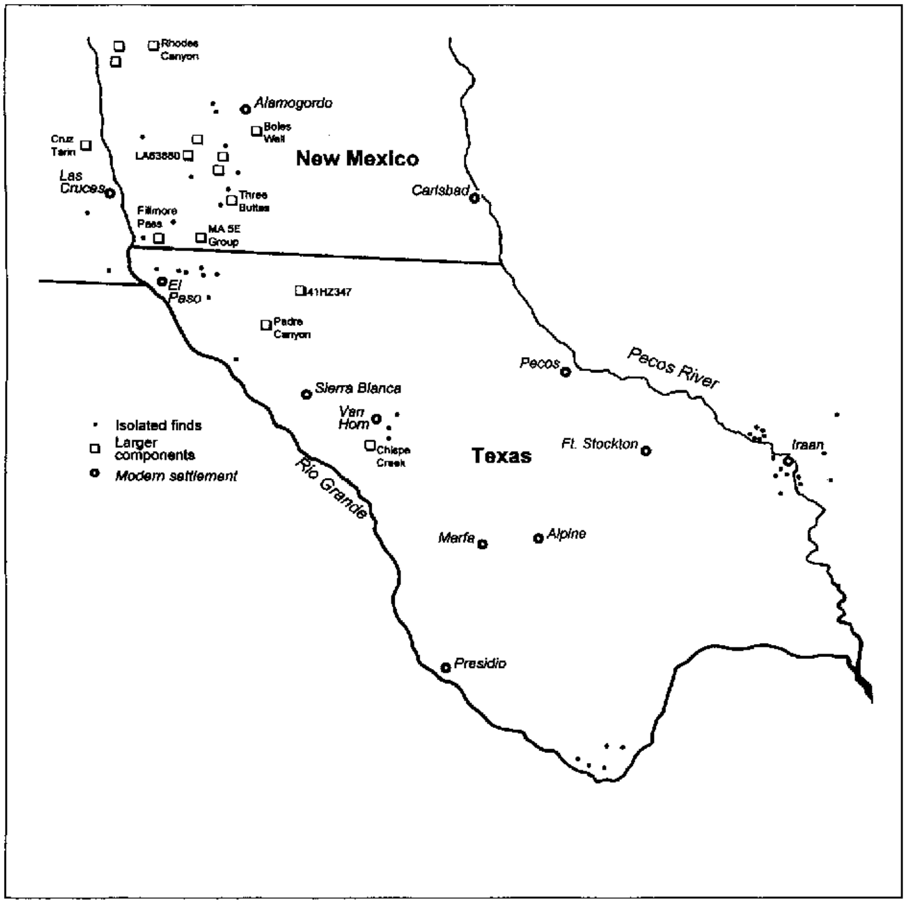

Fig. 7.5. Paleoindian components in Trans-Pecos Texas and south-central New Mexico.

points, bifaces, end scrapers, and other diagnostic tool forms of the period may have been unrecognized during surveys. Paleoindian tools are also common among private artifact collections, and the degree to which removal of these artifacts has contributed to this recognition problem is unknown.

Although several sites of this period have been investigated, results of excavations have been reported in detail only in relatively recent years (Elyea 1988; Mauldin and Leach 1997; Mauldin and O'Leary 1994). Two of the more promising sites represent longer or more intensive occupations with some degree of integrity—Chispa Creek and Mockingbird Gap—but they were excavated during the late 1960s and have never been fully reported. To further complicate matters, many known sites are severely eroded, and Paleoindian materials are often mixed with artifacts deposited during later occupations. For instance, seventeen charcoal and bulk soil samples from hearth features distributed throughout the eastern segment of the Fillmore Pass site on Fort Bliss yielded radiocarbon dates ranging in age from 1890 B.C. to the Historic period (Carmichael and Meyer n.d.), despite the fact that a sizable collection of Folsom tools, preforms, and channel flakes was recovered during excavations in the western segment.

Environmental conditions during the Paleoindian period in the Trans-Pecos are characteristic of the Pleistocene-Holocene transition: West Texas was characterized by moist woodlands and continual stream flow in mountain zones, with standing lakes and marshes throughout interior basins. Studies of packrat middens (Van Devender 1990) suggest juniper-oak woodland communities along with grassland savannas in interior basins during the early half of the period. Increasingly dry conditions prevailed from 10,000 to 6000 B.C., when most of the woodland environments had been displaced by plant communities characteristic of the Chihuahuan Desert (Mallouf 1981; Monger and Buck 1995; Van Devender 1990). These environmental changes were also marked by the extinction of the large game animals such as mammoth, mastodon, and bison thought to have been a primary food resource for Paleoindian groups (Mallouf 1981).

Early Paleoindian: Clovis Complex

Knowledge of Clovis occupation of the Trans-Pecos and Jornada Mogollon regions has been obtained almost entirely through rare and isolated finds of the distinctive, fluted lanceolate Clovis projectile points (Campbell 1970; Harkey 1981; Krone 1976; MacNeish 1993b; O'Laughlin et al. 1988). Similar artifacts have been observed in private collections, but overall, few Clovis points and even fewer Clovis sites have been documented (particularly when comparing the Trans-Pecos and Jornada Mogollon regions to the Southern Plains and south Texas; see Meltzer and Bever 1995), despite several extensive and intensive archeological surveys in southern New Mexico (Beckes et al. 1977; Carmichael 1983, 1986; Camilli et al. 1988; Doleman et al. 1991; Duran 1982; Lukowski and Stuart 1996; Mauldin et al. 1997; Oakes 1981; Ravesloot 1988; Seaman et al. 1988; Skelton et al. 1981), the western Trans-Pecos (Lynn and Baskin 1976; Lynn et al. 1975; Whalen 1977, 1978), or the eastern Trans-Pecos (Ing et al. 1996; Mallouf 1993). Clovis manifestations were seldom mentioned among the collected findings of several avocational groups presented at the 1973 Southwest Federation of Archaeological Societies Early Man Conference (Sommer 1974, 134–36).

Two habitation sites of this period have been reported from the Jornada Mogollon region. Patrick H. Beckett (1983) notes Clovis tools mixed with later Paleoindian materials at a site in Rhodes Canyon in the southern Tularosa Basin of New Mexico. A substantial Clovis occupation is reported in Weber and Agogino (1968) at Mockingbird Gap in the northern Tularosa Basin. The site apparently had several suspected living surfaces and approximately one hundred whole and partial Clovis points, but the site and artifact assemblage have not been reported in sufficient detail to make any firm interpretations regarding the site's function. No habitation sites or kill sites have been identified in the eastern Trans-Pecos. Due to the absence of excavation and distributional data, the nature of Clovis settlement types, hunting and subsistence adaptations, mobility patterns, and technological organization in the Trans-Pecos is poorly known.

Early Paleoindian: Folsom Complex

Folsom manifestations in the Trans-Pecos are much better known than are their Clovis predecessors. Several excavations at Folsom components have been undertaken from the late 1980s to 1990s (Ackerly et al. 1987; Carmichael and Meyer n.d.; Mauldin and Leach 1997; Mauldin and O'Leary 1994). In addition, the nature of Folsom tool forms, subsistence adaptations, and mobility patterns has recently been the subject of inquiry (Amick 1994a, 1995, 1996).

In contrast to the preceding Clovis period, numerous Folsom period points and occupation sites have been recorded during archeological surveys (e.g., Beckes 1977; Beckett 1983; Carmichael 1986; Hester 1977c; O'Hara 1988; M. Miller et al. 1988; Whalen 1978). Stuart (1997) has reported a cluster of Folsom components distributed around the margins of a drainage channel leading from a fault line escarpment north of El Paso. Surface collection activities recovered more than a dozen fragmentary and whole Folsom points, in addition to a substantial number of steep edge angle tools (Fig. 7.6). Isolated Folsom and Midland points have been described by Brook (1968a) and Quimby and Brook (1967), while Anderson and Carter (1985; see also Kauffman 1984) report on a fragmentary Folsom point at the Vista Hills site in east El Paso. Several of the larger sites in the region have been reported by avocational archeologists (e.g., J. Davis 1975), including the Cruz Tarin site (Everitt and Davis 1974), Moody Tank (Russell 1968), and Three Buttes (Krone 1975).

In the eastern Trans-Pecos, Folsom finds have been reported from the Guadalupe Mountains (Boisvert 1980; P. Katz 1978), and Hedrick (1989) reports a fragmentary Folsom point at site 41CU373 several miles east of Van Horn in the Salt Flat Basin. Sommer (1974) provides a comprehensive list of sites documented by professional and avocational groups, noting concentrations of Paleoindian occupations along the Pecos River valley in

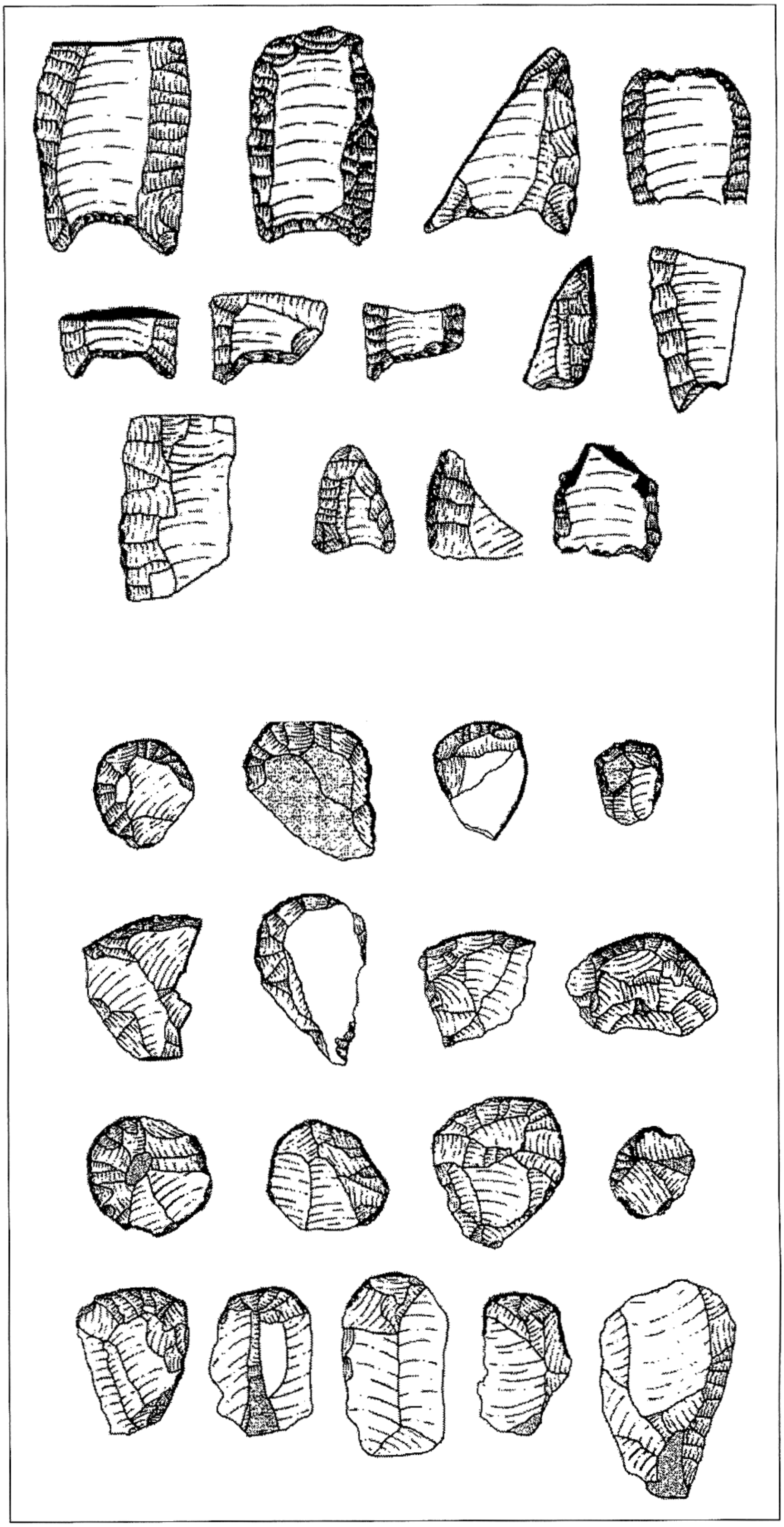

Fig. 7.6. Projectile points and tools from a cluster of Folsom components in Fort Bliss Maneuver Area 5E north of El Paso (adapted from Stuart 1997, 56–57).

the Stockton Plateau, the Big Bend region, the Marfa Plains south of Van Horn, and in the Hueco/Tularosa Bolsons.

Folsom occupation in the eastern Trans-Pecos is known primarily through the excavation of an extensive occupation site on Chispa Creek south of Van Horn in Culberson County. Chispa Creek is a tributary to Wild Horse Draw, which, in turn, is part of the southern watershed of Salt Flat Basin and therefore is strategically situated along a major north-south transit corridor. The excavations were conducted by the University of Colorado in 1967 under the direction of Joe Ben Wheat. Although the results of the excavations have not been formally reported, Lindsay (1969) summarized the findings. Three areas having high numbers of Folsom points were chosen for excavation. The artifact assemblage includes more than one hundred Folsom points and many channel flakes, five hundred scrapers, numerous other tools such as gravers and bifacial knives, and large quantities of chipping debris. East of the Pecos River in Loving County, a Folsom component at 41LV3 was excavated in 1985. A Folsom base, a small collection of tools and channel flakes, and a large quantity of debitage were recovered there (Ackerly et al. 1987). Situated in eolian deposits at times reaching depths of 2 m, the assemblage was apparently heavily mixed with later Archaic materials.

The problem of assemblage mixing is typical of many Paleoindian sites in the Trans-Pecos. With the possible but unconfirmed exception of Chispa Creek, most investigated Paleoindian sites also contain substantial occupations of later periods mixed throughout heavily disturbed eolian soil deposits. In other cases, Folsom and other Paleoindian materials occur in lag contexts on paleodeflational surfaces, such as the surface dating to 7000 B.P. identified by Monger (1993).

The general absence of discrete stratigraphic zones or depositional units makes it difficult to separate nondiagnostic debitage associated with Paleoindian occupations from that deposited during subsequent use of a locality. Accordingly, analyses of Paleoindian lithic assemblages have focused on diagnostic bifacial tools and projectile points, transverse or "snubnose" scrapers and other tools with steep edge angles, channel flakes, and denticulate radial break tools. When coupled with detailed studies of raw material types, important insights into regional mobility patterns of Paleoindian groups and functional aspects of their settlements are emerging. Such studies are being pursued at substantial Folsom components, such as Fillmore Pass on Fort Bliss (Carmichael and Meyer n.d.), Boles Well in the Tularosa Basin (Mauldin and O'Leary 1994), and Padre Canyon sites 41HZ504 and 41HZ505 in the Hueco Bolson southeast of El Paso (Mauldin and Leach 1997). Lithic assemblages typically contain very high proportions of high-quality, fine-grained materials. For example, more than 95 to 99 percent of the lithic assemblages from 41HZ505 and 41HZ504, respectively, consist of fine-grained cherts and chalcedonies (Mauldin and Leach 1997). The lithic assemblage from Fillmore Pass had a higher proportion of obsidian than occurs naturally in local gravel deposits (Carmichael 1994).

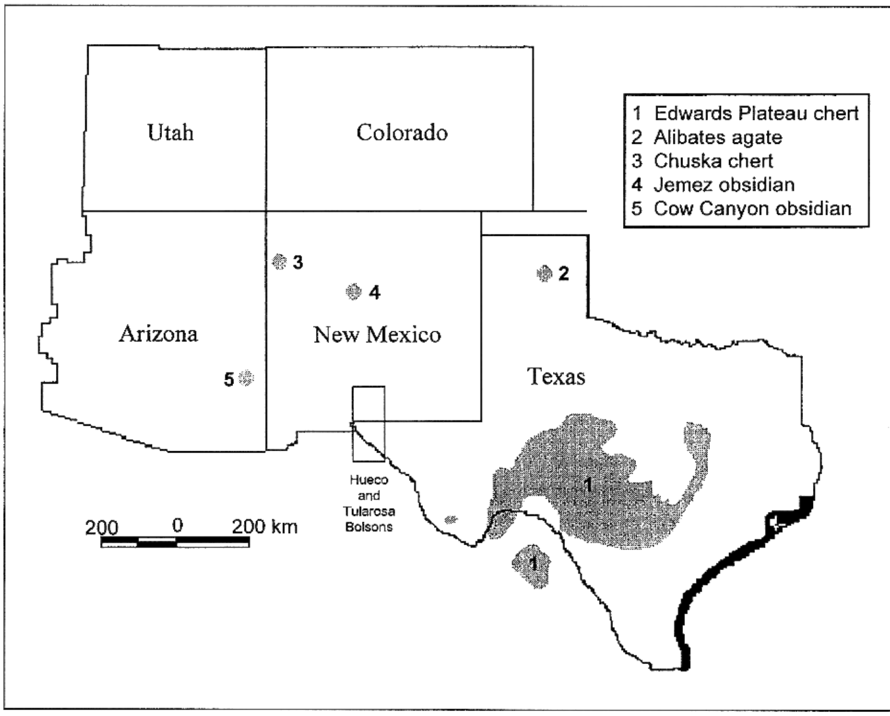

Fig. 7.7. Primary source locations and geologic formations for nonlocal lithic raw materials identified in Folsom assemblages from the Hueco and Tularosa bolsons, west Texas and south-central New Mexico. Distribution of Edwards Plateau chert is based on Frederick et al. (1994).

More detailed examination of recent collections has identified several raw material types obtained from primary sources located a distance of up to 450 km from the Hueco and Tularosa Bolsons (Fig. 7.7). This situation is consistent with patterns of raw material movement detected among several North American Paleoindian assemblages (Bamforth 1985; Emery and Stanford 1982; Frison and Stanford 1982; Hester et al. 1985; Meltzer 1985; Wilmsen and Roberts 1978). Amick (1994a, 1994b) has identified Chuska and Edwards Plateau chert from northwestern New Mexico and the Texas Panhandle, respectively, among the collection of Folsom points and tools from the Jornada region, and similar findings have been reported from Boles Well and Padre Canyon (Mauldin and Leach 1997; Mauldin and O'Leary 1994). Carmichael (1998, personal communication) also notes that Edwards Plateau chert, along with suspected Alibates material, was present in around 1 percent of the Folsom assemblage from Fillmore Pass. X-ray fluorescence analysis of obsidian artifacts from Fillmore Pass has identified several specimens from the Cow Canyon source in eastern Arizona (Shackley 1994), and at least one artifact assigned to the Jemez region of northern New Mexico retained a remnant of non-waterworn cortex, indicating procurement of this material at the primary source rather than from secondary gravel deposits in the Rio Grande Valley.

Distributions of local and nonlocal

materials among various classes of tools and debitage have been used to infer aspects of site function during Folsom times. Carmichael (1998, personal communication) observes that discarded Folsom point basal fragments at Fillmore Pass are entirely of nonlocal materials. Conversely, the Folsom preforms and many channel flakes are predominantly of local materials (including the distinctive Rancheria chert), suggesting that inhabitants were retooling at the site. Additionally, a distinctive brown chert thought to be of nonlocal origin was observed only among the collection of finished formal tools at the Padre Canyon sites, suggesting that these tools had been manufactured elsewhere and transported to the site in final form (Mauldin and Leach 1997).

Considered within a larger perspective, these findings lend support to interpretations regarding the distinctive nature of Folsom subsistence and land use in the Southwest (Amick 1994a, 1996). Daniel Amick's comprehensive review of Folsom occupations in the Jornada Mogollon region, including several collections from west Texas, considers a sample of more than 500 point specimens and several hundred preforms and channel flakes. Included in this study were 173 Folsom points, 69 preforms, and 206 channel flakes from the Lone Butte and Three Buttes Folsom localities of the Tularosa Basin north of El Paso. Amick (1994a, 1996) argues convincingly on the basis of assemblage content and raw material sources that Folsom settlement in the Tularosa/Hueco Bolsons involved a pattern of residential settlements oriented toward hunting game animals other than bison, a pattern that differs significantly from that of the Southern Plains, where typical Folsom land use patterns involve logistical sites occupied during the course of bison hunts. In addition, Folsom occupations in the Tularosa Basin can be linked to an extensive regional land use system that included the Southern Plains.

Late Paleoindian Plano and Cody Complexes

A variety of tool traditions that have been recognized for the Late Paleoindian period are collectively referred to as the Plano and Cody Complexes (Wheat 1972). Meserve, Golondrina, Angostura, Eden, and Scottsbluff points characterize the period, although based on the recorded distribution of projectile point forms through the Trans-Pecos (Sommer 1974), it appears that the last two forms may occur mostly in the western Trans-Pecos.

As with the Early Paleoindian period, Plano and Cody Complex occupations have been documented through numerous surface finds across the Trans-Pecos, but again substantial or well-documented occupation sites of this period are rare. On the basis of survey data it appears that Late Paleoindian materials are more common than Clovis and Folsom in the eastern Trans-Pecos, although this may be a product of site visibility and recognition. Projectile types attributed to the Plano and Cody traditions have been found at several small sites in the Davis Mountains (Marmaduke and Whitsett 1975), Big Bend National Park and State Ranch (T. N. Campbell 1970; Cloud and Mallouf 1996; Mallouf and Wulfkuhle 1989), and the Stockton Plateau (Sommer 1974). In the western Trans-Pecos, these materials are also well represented in the Guadalupe Mountains (Boisvert 1980; P. Katz 1978; Katz and Katz 1975; Marmaduke 1978a), the Diablo Plateau (Ackerly et al. 1987), and Salt Flat Basin (Hedrick 1968, 1975). Isolated finds of Plano and Cody Complex tools are common throughout the Tularosa, Mesilla, and Hueco Bolsons (Beckes 1977; Brook 1968b; Carmichael 1986; Hester 1977c; O'Hara 1988). Unlike the situation in the eastern Trans-Pecos, the frequency of Late Paleoindian components in the western Trans-Pecos does not appear to be greater than that of the earlier Folsom components.

Late Paleoindian components occur across a wide range of topographic zones, including mountains, alluvial fans, and the Diablo Plateau. Most finds, however, have been in basin landforms near major playas or along the margins of the Rio Grande Valley, a pattern observed by Carmichael (1986) in the Tularosa Basin. Presumably, this widespread pattern reflects the adaptation of hunting large game animals that remained close to these large permanent water sources. As suggested by Mallouf (1981, 1985), this pattern may also reflect a continuation of hunting traditions in what were probably the last locations with suitable habitats for large game animals, while populations in other areas of the Trans-Pecos may have begun the transition to Archaic hunting and gathering economies as a response to changing environmental conditions.

The finding of a significant Plano Complex occupation site at 41HZ347 indicates major drainages or intermittent streams in the Diablo Plateau may have served as important settlement locations. Located in northwestern Hudspeth County just east of the Hueco Mountains (see Ackerly et al. 1987), the site is situated on a low, rocky knoll overlooking a wide drainage channel. Three Plainview points and one Angostura point were collected from the site surface, along with more than six hundred chipped stone artifacts.

The most intensively studied site of this period is LA63880, located in the southern Tularosa Basin north of El Paso (see Fig. 7.5). One of the largest known Paleoindian sites in the region, the LA63880 site covers an area of approximately 78,000 m^2 and is situated 2 km from a playa. There are four primary artifact concentrations along with several low density scatters distributed among coppice dunes. Based on the presence of two biface fragments with parallel flaking, the site has been provisionally assigned to the Cody Complex.

Janette M. Elyea (1988) describes the assemblage of 132 formal tools recovered from LA63880. The majority of the tools (76.5 percent) consist of transverse end scrapers, although other forms included side scrapers, bifaces, projectile point fragments, and a burin spall. All but three of the artifacts were manufactured from high-quality, fine-grained cherts and chalcedonies, including a possible specimen of Chinle chert from the middle Rio Grande Valley (100 km to the north). Comparing the low diversity of tool forms and the setting of the site to Judge's (1973) typology for the middle Rio Grande Valley, Elyea interprets the location as a processing site or base camp rather than a kill or armament site. In addition, the majority of tools were worn and had been extensively resharpened, suggesting extractive tasks were performed at the location. Based on the extensive site size and the unusually high number of artifacts for Paleoindian components in the region—combined with the low diversity of tool forms and spatial distribution of artifacts among several concentrations—Elyea (1988) also interprets the site as representing a series of occupations by several small bands.

Environmental changes during the Early Holocene brought about several changes in human adaptation at the close of the Paleoindian period. The persistent drying trend continued, with a resultant demise of large game mammals, expansion of plant communities adapted to drier conditions, and constriction of perennial water sources. These changes undoubtedly contributed to large-scale changes in subsistence strategies, requiring a diversification of the Paleoindian subsistence base with a greater focus on exploitation of plant foods. Such changes, and accompanying shifts in settlement and technology, mark the onset of the Archaic period at ca. 6000 B.C.

Archaic Period (6000 B.C. to A.D. 200)

The Archaic period in the Trans-Pecos is known through excavations in rockshelters and open-air sites throughout most environmental zones of the region. The period encompasses more than six thousand years, and several broad adaptive trends and important changes in subsistence and technology took place during this time. Notable developments include the first archeological evidence for agriculture, habitation of residential pithouse or hut structures, and the widespread use of rock or caliche in the construction and use of thermal features. An increase in the range of plant materials utilized as well as technological changes reflecting the processing of these foods indicate a greater diversification of subsistence practices than during the Paleoindian period.

It is generally agreed that Archaic adaptations involved a seasonally mobile, broad spectrum hunter-gatherer subsistence and settlement adaptation with a technology that reflected specific strategies to deal with semiarid conditions as well as geographic and temporal variability in the Trans-Pecos environment. While populations were seasonally mobile, what is envisioned is an increasingly restricted mobility range or territoriality. In terms of general, long-term trends over this period of more than six thousand years, it appears that increasing population levels coupled with more diverse subsistence economies led to an intensification of land use patterns as well as the exploitation of a continually increasing range of environmental zones. Ultimately, in the western Trans-Pecos these processes (although the subject of debate) may have contributed to the adoption of agriculture between ca. 1500 and 1000 B.C.

The six-thousand-year Archaic period has been conventionally divided into Early, Middle, and Late subperiods. These subdivisions have been defined primarily on the basis of projectile point typologies and sequences developed in adjacent regions (Carmichael 1986; MacNeish 1993b; MacNeish and Beckett 1987; Mallouf 1985, 1990; Roney 1995). However, no reliable and independently dated projectile point sequence has been developed for the region (S. Katz 1992; Mallouf 1985; M. Miller 1996a; Seaman et al. 1988), and the use of extraregional typologies carries a substantial amount of classification error and chronological imprecision. Archaic period subdivisions also broadly correspond to paleoenvironmental and paleoclimatic intervals (Mallouf 1981; Mauldin 1995). Accordingly, the estimated beginning or ending dates for Early, Middle, and Late Archaic subperiods vary considerably between the eastern and western Trans-Pecos.

MacNeish and Beckett (1987) and MacNeish (1993b) have proposed an Archaic period phase sequence for the Chihuahua Archaic tradition. Their work mainly provides new phase names to existing Early Archaic (Gardner Springs phase) and Middle Archaic (Keystone phase) time intervals, while subdividing the Late Archaic into two phases, the Fresnal and Hueco. Aside from minor temporal adjustments, the sequence maintains the general structure established during previous studies. Few studies have been undertaken to confirm or refine the sequence in terms of changing settlement or technological adaptations (but see S. Anderson 1993).

Prior to the 1980s, much of the information on Archaic period material culture and settlement systems was acquired during early and mid-1900s excavations in a series of rockshelters in the Hueco Mountains (Alves 1930; Cosgrove 1947; Ellis and Hammack 1968) and the eastern Trans-Pecos (Coffin 1932; A. Jackson 1937; V. Smith 1938; R. Tanner 1949). More recent investigations have been conducted as part of the Organ Mountain Archaeological Project and Chihuahua Archaic Project (M. Johnson and Upham 1988; MacNeish 1993b) in several small rockshelters north of El Paso (Fig. 7.8).

The most abundant evidence of Archaic period occupations has been obtained from Fresnal Shelter, and much of the information on early cultigens, fauna, and other aspects of subsistence and technology has been obtained through investigations at this site. Fresnal Shelter is situated in the Sacramento Mountains 160 km north of El Paso, at an elevation of 6,270 feet in a southern exposure of a cliff overlooking Fresnal Canyon, one of several narrow drainages leading from the mountains to the Tularosa Basin. Excavations were conducted between 1969 and 1972 by Human Systems Research of Tularosa in collaboration with Cynthia Irwin-Williams of Eastern New Mexico University (Human Systems Research 1972). Approximately 50 percent of the shelter was excavated, documenting stratified deposits up to 2 m in depth with numerous unlined and rock-lined conical pits (Fig. 7.9). Radiocarbon dates suggest occupations primarily between ca. 4000 B.C. and A.D. 600, spanning the Middle and Late Archaic and the first few centuries of the Formative period. While calibrated age ranges for about 75 percent of the twenty-seven radiocarbon dates tend to fall within the Late Archaic (between 2000 B.C. and A.D. 200), sampling bias may have affected the distribution to an unknown extent; a significant number of Middle Archaic projectile points were also recovered (R. Jones 1990). No ceramics were found in the shelter and only a small number of arrow points. The majority of deposits, features, and cultural materials from Fresnal Shelter can confidently be assigned to the Middle and Late Archaic periods.

The material culture recovered during the excavations is immense and constitutes one of the largest well-documented collections from a stratified rockshelter in the American Southwest. As described by Robert C. Jones (1990, 24–25; see also Tagg 1996), the catalog of materials at Eastern New Mexico University lists approximately 6.5 million specimens of lithic material, although the majority consist of roof spalls and fire-cracked rock. Perishable materials include 25,269 faunal specimens, 700 pounds of vegetal material, rabbit and deer hides, more than

400 complete and fragmentary sandals, 30 basket fragments, more than 200 feathers, several thousand cordage specimens, and hundreds of preserved wood artifacts such as atlatl foreshafts and digging sticks. Plant remains were abundant throughout the deposits, and several hundred corncobs, kernels, beans, and cucurbit samples were recovered.

Excavations at open-air sites in the central basins, alluvial fans, and river margin terraces of the Hueco, Tularosa, Mesilla, and Salt Flat Basins have also contributed important information on Archaic period archeology in the Trans-Pecos. While the rich material culture preserved in rockshelters is typically absent at open-air sites, these studies have provided much of the information for interpreting settlement patterns and land use. Investigations at Keystone Dam led to the identification of Archaic house structures, several among the earliest in the southern Southwest. Extensive studies of small sites throughout the Hueco and Tularosa Bolsons at Fort Bliss and White Sands Missile Range (Burgett n.d.; Doleman et al. 1991; Mauldin et al. 1998; O'Laughlin and Martin 1989; Seaman et al. 1988; Whalen 1980a), in addition to several projects in the Mesilla Bolson west of El Paso (Camilli et al. 1988; O'Leary 1987; Ravesloot 1988), have identified an extensive Late Archaic use of the central basins, marked by small, shallow pithouses or "huts" and thermal features. Excavations at several sites with large burned rock features situated on alluvial fans and terraces (Carmichael 1985; Fields and Girard 1983; Hard 1983a; O'Laughlin 1979) have also provided important information and insights into Archaic adaptations.

For the eastern Trans-Pecos, Mallouf's (1985) summary offers a much more detailed overview than can be provided here, and several observations in Sebastian and Larralde's (1989) overview of southeastern New Mexico are also relevant for our understanding of Native American life in the Archaic. A small number of studies have been completed since the publication of Mallouf's extensive overview, including investigations at Phantom Lake Spring in Jeff Davis County (Charles 1994), Ward's (1992) study of materials from sinkholes and rockshelters in the Delaware Basin, a detailed analysis of Late Archaic projectile

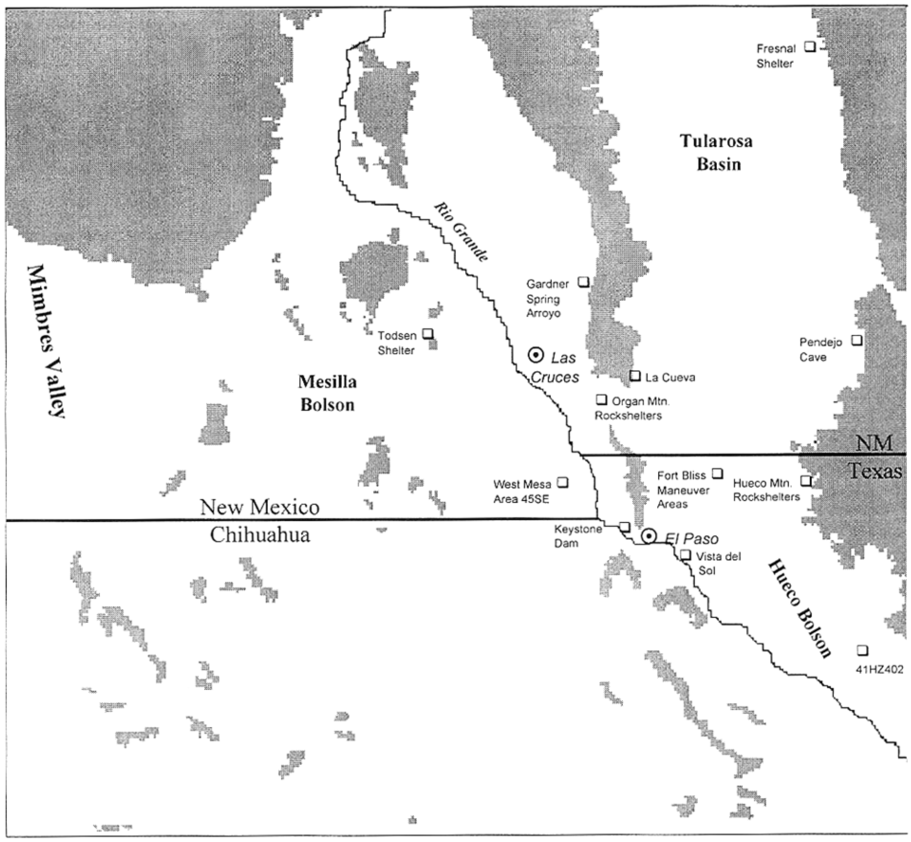

Fig. 7.8. Location of major Archaic period components of the western Trans-Pecos mentioned in text.

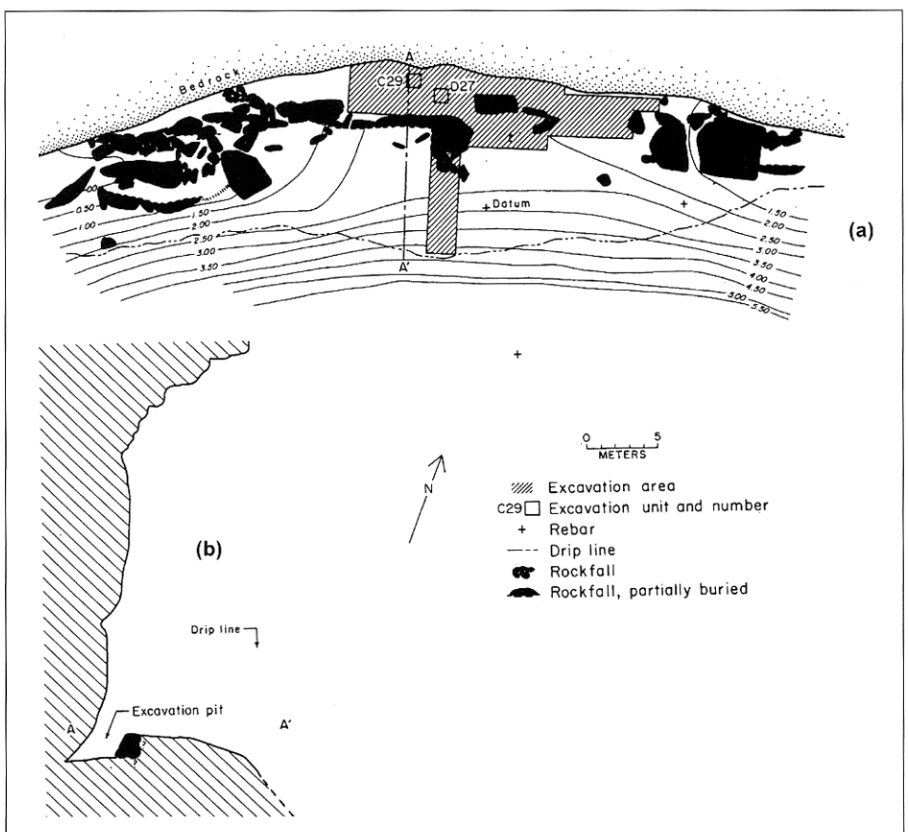

Fig. 7.9. Map of Human Systems Research/Eastern New Mexico University excavations at Fresnal Shelter (LA10101), Otero County, New Mexico: a, plan view; b, profile (from Tagg 1996, 313).

points from Hooper Canyon Cave in the Guadalupe Mountains (Roney 1985, 1995), and several excavations along the All American Pipeline in Hudspeth and Culberson Counties (Ackerly et al. 1987; New Mexico State University and Continuum Corp. 1989).

Early Archaic Period
(6000 to 4000/3000 B.C.)

The Early Archaic period is one of the more poorly known intervals in the Trans-Pecos. In the western part of the region, occupation is known from surface finds of projectile points, a few thin deposits in rockshelters, and a small number of radiocarbon dates from hearths or rockshelter deposits. Intensive surveys conducted throughout Fort Bliss and adjacent areas of El Paso County and New Mexico have recorded several surface finds of Early Archaic projectile points, but only rarely have features or substantial settlements been identified. While numerous projectile point finds have been documented, the number of Early Archaic projectile points collected during surface surveys is only slightly greater than the number of Paleoindian specimens (Beckes 1977; Camilli et al. 1988; Carmichael 1986; Lukowski and Stuart 1996; O'Hara 1988). A similar situation exists in the eastern Trans-Pecos, where, as noted by Mallouf, the region is "distinguished by a perplexing lack of substantive data concerning even the barest outlines of Early Archaic Cultures" (Mallouf 1985, 101). Material culture from the few Early Archaic features or rockshelter deposits in the eastern Trans-Pecos is sparse, and no firmly dated substantial Early Archaic occupation has been identified or investigated. Mallouf (1990) further notes that only twelve out of several hundred projectile points examined in private collections from northeastern Chihuahua have Early Archaic affiliations.

The Early Archaic period in the western Trans-Pecos is conventionally dated from the close of the Paleoindian period at 6000 B.C. to 4000 B.C., although neither temporal estimate is firm. In the eastern Trans-Pecos, Mallouf (1985, 1990) dates the period from 6500 to 3500/3000 B.C. The recognition and temporal placement of the Early Archaic are based almost entirely on cross-dating projectile point forms (i.e., Jay, Bajada, and Uvalde) characteristic of the Oshara (Irwin-Williams 1973, 1979) and central Texas (Prewitt 1981; Weir 1976). The current radiocarbon data base from the western Trans-Pecos (M. Miller 1996a) has only eleven dates with 2-sigma calibrated age ranges falling securely between 6000 and 4000 B.C. and an additional nine dates that partially overlap between 4000 and 3500 B.C. To our knowledge, only one radiocarbon date has been obtained in association with Early Archaic materials in the eastern Trans-Pecos (Charles 1994).

The context and distribution of dates from the western Trans-Pecos demonstrate the problems of archeological recognition that hinder identification of Paleoindian, Early Archaic, and Middle Archaic components. Significantly, 50 percent of the Early Archaic dates have been obtained from thermal features buried at depths of 1 m or more in alluvial deposits flanking local mountain chains. Several were obtained from features at the Gardner Springs radiocarbon site, investigated during the Desert Project in initial attempts to establish age limits for the Organ (Holocene) alluvial sequence (Gile and Hawley 1968). Throughout the Gardner Springs area, deep erosional channels cutting through Middle-to-Late Holocene alluvium have exposed numerous hearth features distributed at varying depths in the alluvial deposits. In many cases artifacts have been found in association with these features, including an intact metate adjacent to a hearth (Beckett 1973) with a calibrated age range of 5570 to 5070 B.C. (I-4281). Monitoring of road construction in Gardner Springs Arroyo resulted in the discovery of an additional site (Almarez 1990) and excavation of a moderate-sized Early Archaic fire-cracked rock feature. Other cases of deeply buried Early Archaic features include fire-cracked rock hearths at Vado, New Mexico, just north of El Paso (Henry and Batcho 1984), the North Mesa site (MacNeish 1993b) east of Las Cruces, and an isolated location in the San Andres Mountains (Human Systems Research 1991).

Seven Early Archaic dates have been obtained from Fresnal, Pendejo, and Todsen rockshelters (Carmichael 1982b; R. Jones 1990; MacNeish 1993b; Tagg 1996) located north of El Paso, although there is some question as to whether the two Fresnal dates represent a Late Paleoindian occupation. In addition, a human femur recovered from Bishop Cap Cave between El Paso and Las Cruces yielded an Early Archaic date (L. Davis 1969; King 1984), but both the context of the specimen and the reliability of the date are questionable.

In only four cases have features in basin landforms yielded Early Archaic dates. Among these are sites 41EP1143, FB7483, and FB7520 in the Hueco Bolson on Fort Bliss (Mauldin et al. 1998; O'Laughlin and Martin 1989) and 41HZ403 in Hudspeth County (O'Laughlin and Martin 1992). The date from 41HZ403 was from Feature 17, an eroded hearth associated with a small quantity of lithic debitage and groundstone fragments. The remaining localities had hearths and limited numbers of chipped stone and groundstone artifacts and were often part of larger, multicomponent sites. Despite the rarity of features, Early Archaic projectile points are relatively common in the central basins (Carmichael 1986), and thus it remains unclear whether the lack of chronometrically dated features indicates the sparse use of this landform or the possibility that features have been eroded.

These findings do suggest that a large portion of the Early Archaic landscape is buried in alluvial deposits or that occupations are present within lower strata of rockshelters; therefore, many components have remained invisible during archeological surveys. Accordingly, the most productive archeological investigations will be buried contexts in alluvial fans and rockshelters. However, even rockshelters in both the eastern and western Trans-Pecos contain significant components of this period. For example, Zone K1 at Todsen Shelter was assigned by MacNeish (1993b) to the Gardner Springs phase, dating to the Early Archaic period. This zone consisted of a small, mixed deposit with burned rock, charcoal, and a small sample of chipped stone. A more substantial occupation may have been present in Pendejo Cave, where Chrisman et al. (1996) report an Early Archaic radiocarbon date obtained from a sandal fragment in Zone C, but further information on this deposit has not been reported in detail. Two dates from Fresnal Shelter indicate some limited occupation during the Early Archaic or Late Paleoindian period, but the problems with age estimates derived from charcoal samples and the potential mixing of deposits observed by R. Jones (1990) and Tagg (1996) have not permitted detailed study of materials from contexts associated with the dates.

To add to the problems of definition and temporal placement of Early Archaic settlement, few secure chronometric dates have been obtained from contexts in association with technologically or stylistically characteristic artifact types. A Bajada point may have been recovered from a level in Fresnal Shelter in association with the two earliest radiocarbon dates (ISGS-812 and ISGS-845), but the context is uncertain. In his study of bifacial tools from the shelter, R. Jones (1990) does not assign an associated date to this specimen. A sandal fragment from Pendejo Cave provided a direct radiocarbon age of 5480 ± 60 B.P. (UCR-2643), indicating the presence of an Early Archaic occupation in the shelter, but again the context is unknown. Investigations at buried sites in alluvial settings have involved limited exposures, and open sites in central basin landforms are eroded. However, Charles (1994) reports Early Archaic point forms in association with deeply buried hearth features and depositional units at Locality 21 of the Phantom Springs site (41JD63) in the eastern Trans-Pecos. In one of the few cases from the Trans-Pecos involving direct associations between a feature, a diagnostic tool form, and a radiocarbon age estimate, a Uvalde point (Fig. 7.10) was recovered from a hearth feature with an uncorrected soil humate date of 6050 ± 100 B.P. (calibrated age is 5300–4700 B.C., with variance added to the radiocarbon error estimate to compensate for the imprecision of soil humate age estimates).

Aside from locational information for projectile points and a limited number of settlements, we currently have very little information on Early Archaic material culture, subsistence, or technology. Nevertheless, several aspects of technology during this period provide some insights into changing adaptations. Based on the small sample of dated features, it is evident that the use of rock or caliche as cooking stones and heating elements in thermal features appears during this time. While the apparent absence of burned rock thermal features during the preceding Paleoindian period may be due to preservation and visibility biases, there are no documented cases of burned rock in secure association with a Paleoindian occupation. In contrast, several medium to large thermal features of Early Archaic age found buried in alluvial fans contain moderate quantities of burned rock, and smaller stains in the central basins often contain limited quantities of burned rock or caliche. Mallouf (1985) also notes that burned rock features and middens throughout the eastern Trans-Pecos occasionally have Early Archaic materials, although these associations are tentative. The nature and function of Early Archaic thermal features is unclear, as the small sample of such features has yielded few or no macrobotanical remains. Yet their presence does suggest an important change in subsistence practices involving an increased emphasis on plant processing. Variability among features, including small hearths in the central basin and larger, more substantial burned rock hearths in alluvial fans, may indicate differences in the season or intensity of settlement and plant processing among differing environmental zones. Coincident with the use of burned rock thermal features is the appearance of groundstone artifacts (Beckett 1973; O'Laughlin and Martin 1992), also implying a greater emphasis on plant processing.

Projectile point technology emphasizes a change from lanceolate forms of the preceding Paleoindian period to stemmed forms such as the Jay, Bajada, and Uvalde types, as well as perhaps a Nolan-like form (Fig. 7.11). An increasing regionalization among the distribution of these projectile forms is apparent, with types having technological affinities with the central Texas sequence (i.e., Uvalde and Nolan-like; see Prewitt 1995) somewhat more prevalent in the eastern segment (Mallouf 1985). While Uvalde forms are occasionally found in the western Trans-Pecos, the Jay and Bajada types of the Oshara Tradition are much more common.

With the adoption of stemmed forms in the western Trans-Pecos comes a noticeable change in the use of coarser-grained raw materials for the manufacture of projectile points. In contrast to the common use of high-quality, fine-grained materials for the manufacture of Paleoindian tools, the majority of Bajada and Jay specimens are coarser-grained igneous, metamorphic, and sedimentary rock types (including medium- or coarse-grained cherts). Fig. 7.12 illustrates the distribution of general material texture groups among a sample of sixty Early and Late Paleoindian and thirteen Early Archaic projectile point specimens in the Fort Bliss collection. Of the Early Archaic points, 69 percent were manufactured from medium- or coarse-grained materials compared to only 10 percent among the sample of Paleoindian points. Although the sample of Early Archaic Jay and Bajada points is small and the Fort Bliss sample may not be representative of the Trans-Pecos, or for that matter even the Jornada Mogollon, Wirt H. Wills (1988, 79) notes the prevalence of coarser-grained materials among Early Archaic projectiles, with 83 percent of a sample from central New Mexico having been manufactured of basalt. Examination of private artifact collections from west Texas, south-central New Mexico, and northern Chihuahua by the senior author has also shown the common occurrence of coarse-grained materials among Early Archaic projectile points.

Factors underlying this apparent shift in material utilization may reflect a change in prey selection and hunting practices during the Early Archaic (given the current lack of knowledge regarding settle-

Fig. 7.10. Uvalde projectile recovered in situ from a hearth (Feature 3) at Locus 21, Test Unit 1, Stratum 4 of the Phantom Springs site (41JD63), Jeff Davis County, Texas (from Charles 1994, 104).

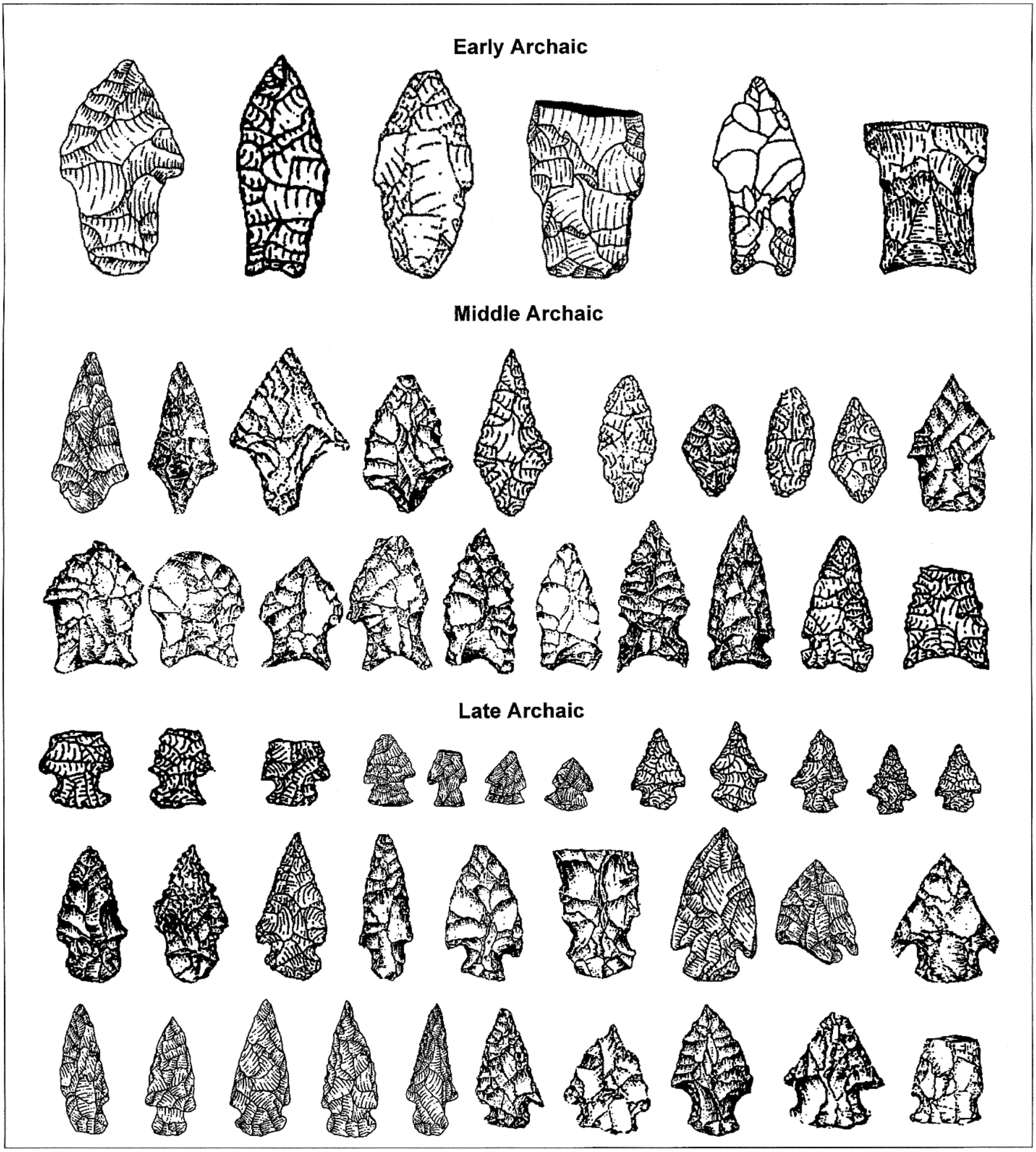

Fig. 7.11. Common projectile point forms of the Archaic period in the western Trans-Pecos. Note first three specimens in the second row of the Middle Archaic group illustrating extensive blade reworking typical of this period.

ment location, mobility, and subsistence)—as suggested by the adoption of stemmed projectile point forms—or more restricted mobility ranges resulting in an increased use of locally available raw materials, a reduced emphasis on tool maintenance combined with a greater emphasis on reliability (e.g., Bleed 1986), or a combination of these factors.

Inferences regarding settlement location and subsistence are highly conjectural based on the present state of knowledge. But Early Archaic settlements are characterized by an absence of substantial occupational deposits. Most sites consist

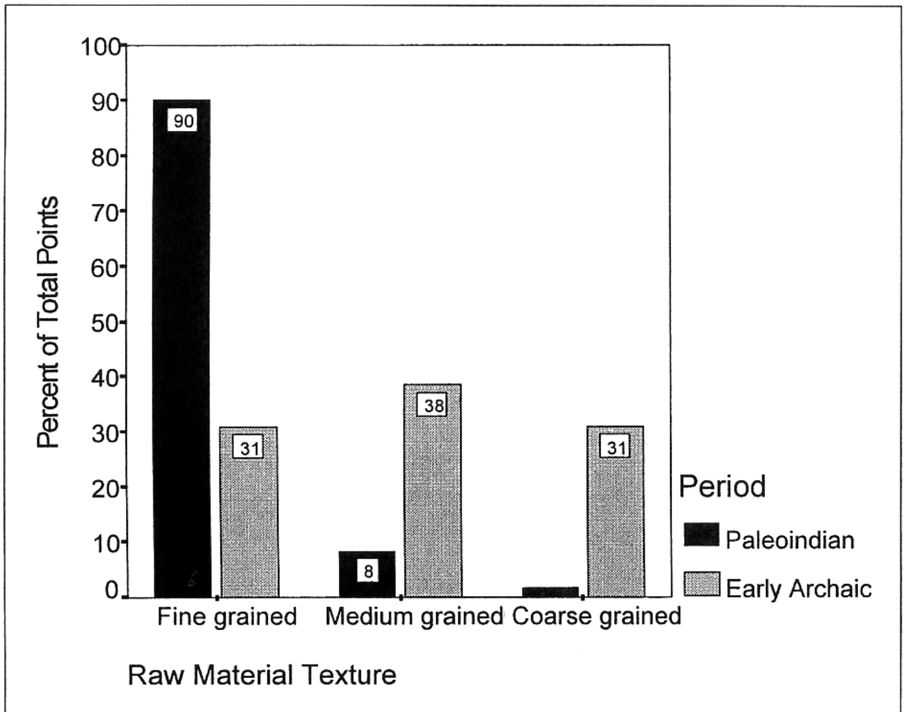

Fig. 7.12. Bar graph showing shift in raw material utilization for projectile points between the Paleoindian and Early Archaic periods. Fine-grained materials include chert, chalcedony, and obsidian; medium-grained materials include coarser cherts (Rancheria and others); and coarse-grained materials include limestone and other igneous and metamorphic types.

of small hearth and artifact scatters distributed among a variety of environmental zones. However, the presence of larger burned rock features along alluvial fan zones establishes a land use pattern involving burned rock thermal features that persists throughout the remainder of the Archaic and much of the Formative period. Technological changes over the preceding Paleoindian period are apparent in different hafting methods and patterns of raw material utilization for projectile points, the utilization of rock for heating elements in thermal features, and the use of groundstone tools. These changes suggest a seasonally mobile settlement system of small bands, although possibly more restricted than during preceding periods. What these changes actually mean in terms of subsistence and adaptation await additional data on macrobotanical and faunal collections as well as analyses of tool and lithic debitage assemblages. As noted by Mallouf (1985, 108) for the eastern Trans-Pecos, much more work is needed to determine whether the patterns perceived for Early Archaic occupations are the result of survey bias—an observation that applies equally to the Jornada Mogollon region.

Middle Archaic Period (4000/3000 to 1200 B.C.)

Fundamental subsistence, settlement, and technological adaptations established in the Early Archaic tend to be maintained through the Middle Archaic, although they may have become intensified throughout the latter part of this two-thousand-year-long interval. Based on the locations and increasing numbers of Middle Archaic occupations, some degree of population growth probably took place in the Trans-Pecos (Carmichael 1986; Mallouf 1985; O'Laughlin 1980). Examination of the radiocarbon record from the western Trans-Pecos supports this view, as there appears to be an increase in the number of radiocarbon-dated features and contexts throughout the region, particularly during the latter half of the period. Paleoclimatic reconstructions indicate a continued drying trend during this period, suggesting that the timing and distribution of food resources may have been more restricted and variable, and therefore a more seasonally intensive land use pattern that focused on specific resources may also account for perceived patterns of Middle Archaic site numbers and distributions.

A total of fifty-one dates with calibrated age ranges falling securely within this interval is known from the western Trans-Pecos, along with a dozen or so that partially overlap this temporal interval. The distribution of the dates differs from the Early Archaic, with buried burned rock features and rockshelter deposits providing a smaller proportion of the available dates. A surprisingly small number (n=5) of dates overlapping the Middle Archaic time interval have been obtained from rockshelter deposits, although whether this is due to sampling bias or a reduced focus on occupation of rockshelters is unknown. A small number of deeply buried burned rock features of Middle Archaic age have been documented, including examples buried at depths of 2 m in the Delaware Mountains south of Guadalupe Peak (M. Miller 1994) and in the vicinity of Gardner Springs Arroyo (Almarez 1990; Gile and Hawley 1968; M. Miller and Stuart 1991).

In contrast, the majority of Middle Archaic radiocarbon dates have been obtained from sites in the more exposed interior basin landforms, including several small sites in the Hueco and Tularosa Bolsons (Doleman et al. 1991; Mauldin et al. 1998; O'Laughlin et al. 1988; O'Laughlin and Martin 1989; Seaman et al. 1988). Middle Archaic settlements are also known from the lower and upper terraces of the Rio Grande Valley, such as Vista del Sol (41EP2970), Keystone Dam (41EP492 and 41EP493), and 41EP2611 (Earls and Newton 1988; O'Laughlin 1980; M. Miller et al. 1993).

Mallouf (1985) observes similar patterns among Middle Archaic sites in the eastern Trans-Pecos. Based on data from surface archeological surveys, sites appear to be more numerous and tend to be larger or contain greater numbers of features. In contrast to the Paleoindian and Early Archaic period sites, there is an increased focus of Middle Archaic settlements along drainages. Mallouf (1985) also notes that Middle Archaic components in the eastern Trans-Pecos are found among a variety of settings, suggesting an expansion into and exploitation of new environmental niches.

A common pattern among these Middle Archaic sites is the presence of two or more thermal features with overlapping radiocarbon age estimates. In addition, artifact assemblages tend to be slightly more substantial in number than Early Archaic components. Preservation factors may account for this variance. However, because the resolution of available chronometric methods is not sufficient to confidently determine whether features are contemporaneous, the common finding of clusters of thermal features may indicate greater levels of settlement intensity and perhaps the presence of larger social groups. Moreover, the existence of discrete Middle Archaic residential settlements has been demonstrated through Thomas C. O'Laughlin's discovery in the late 1970s of pithouses at Keystone Dam site 33, situated along the lowermost terrace of the Rio Grande Valley in northwest El Paso.

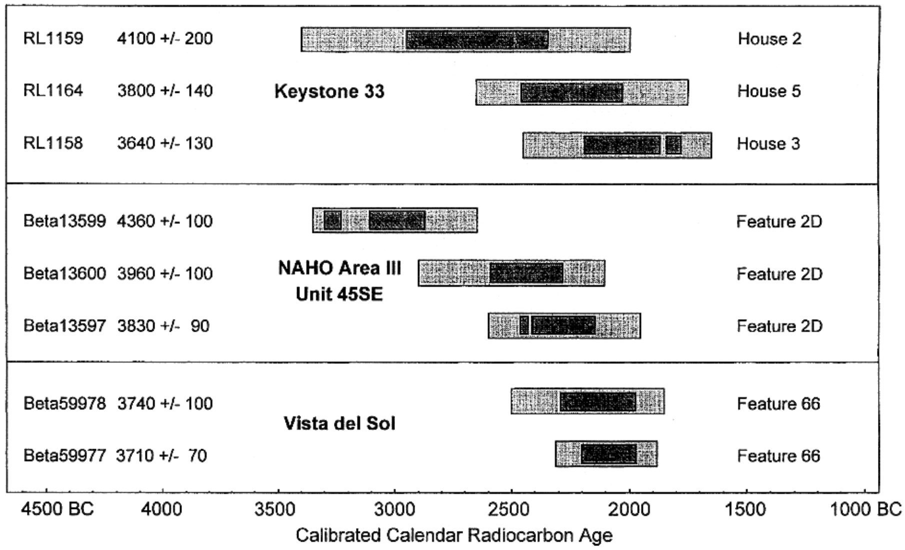

Fig. 7.13. Radiocarbon age determinations for Middle Archaic period residential structures at Keystone Dam 33 (41EP493), NAHO Area III/Unit 45SE, and Vista del Sol (41EP2970). Radiocarbon age estimates from the Keystone Dam and NAHO projects are not corrected for isotopic fractionation.

Considered one of the most significant sites in the southern Southwest, Keystone 33 contains several of the earliest house structures documented in the region. On the basis of a testing program conducted in advance of dam construction, O'Laughlin (1980) recorded the presence of twenty-three known or suspected houses. A series of radiocarbon dates suggest occupations of these structures occurred between 2500 and 1800 B.C. Similar structures excavated during the Navajo-Hopi Land Exchange Project west of El Paso (Camilli et al. 1988) and at the Vista del Sol site in east El Paso (M. Miller et al. 1993) have provided additional dates that are contemporaneous with the structures at the Keystone Dam sites (Fig. 7.13). The construction and use of such structures was probably more widespread during the Middle Archaic than indicated by the current sample, but because of their ephemeral nature it is likely that many such structures have been eroded or naturally destroyed. Furthermore, several features described as large stains or "roasting pits" but lacking associated rock or burned caliche have been excavated in the Hueco Bolson (Burgett n.d.; O'Laughlin and Martin 1989), and these features may in fact represent additional examples of Middle Archaic house structures.

The Middle Archaic house structures, or "huts" as they are more commonly known, are round, shallow constructions measuring an average of less than 2.0 m in diameter and 15 to 20 cm in depth (Fig. 7.14). Floor and subfloor features are rare, although burned and ashy areas possibly represent interior hearths. O'Laughlin notes the presence of daub with stick and pole impressions, indicating that some form of brush or *jacal* superstructure was present over the structures at Keystone Dam 33. Overall, the labor investment involved in constructing and maintaining these features is low, and they have generally been interpreted as short-term residences. Based on the results of soil cores, O'Laughlin suggests that as many as two dozen such structures are present at Keystone Dam 33 and that several appear to be arranged in groups, suggesting a level of social organization involving multifamily or extended family groups.

The hut structures identified at Keystone Dam and elsewhere in the western Trans-Pecos are among the earliest evidence for semisedentary settlements in the Southwest. Interestingly, residential structures of the Middle Archaic period, and by extension evidence for semisedentary settlement systems, predate the first conclusive evidence of agriculture in the Jornada Mogollon region, as well as the southern Southwest, by several hundred to more than one thousand years.

Unfortunately, it is difficult to arrive at concise impressions of subsistence practices during the Middle Archaic. The presence of groundstone tools and thermal features indicates the continued exploitation of plant foods, and the common association of Middle Archaic projectile points with burned rock middens and extensive hearth fields in the eastern Trans-Pecos suggests to Mallouf (1985) that processed cacti and desert succulents became a staple of the subsistence base during this time. However, more direct evidence of subsistence practices is largely unavailable, as preservation of botanical and faunal remains is extremely poor at exposed sites in central basin and river terrace landforms and the few available studies of materials from rockshelters have not explicitly differentiated among Early, Middle, and Late Archaic materials. Only twenty-five faunal specimens were recovered from features in the Middle Archaic (Zone 2) deposits at Keystone Dam. Along with five eggshell fragments, the specimens included mostly the remains of rabbits or small and medium-sized mammals. Analysis of flotation samples from Zone 2 features at Keystone Dam noted four-wing saltbush, cheno-ams, purslane, mesquite, rushes and grasses, and cacti such as Turk's Cap and prickly pear. Similar botanical assemblages have been recovered from the small number of Middle Archaic thermal features in the Tularosa and Hueco Bolsons (e.g., Swift et al. 1991).

Few distinct technological changes or trends have been observed in the Early,

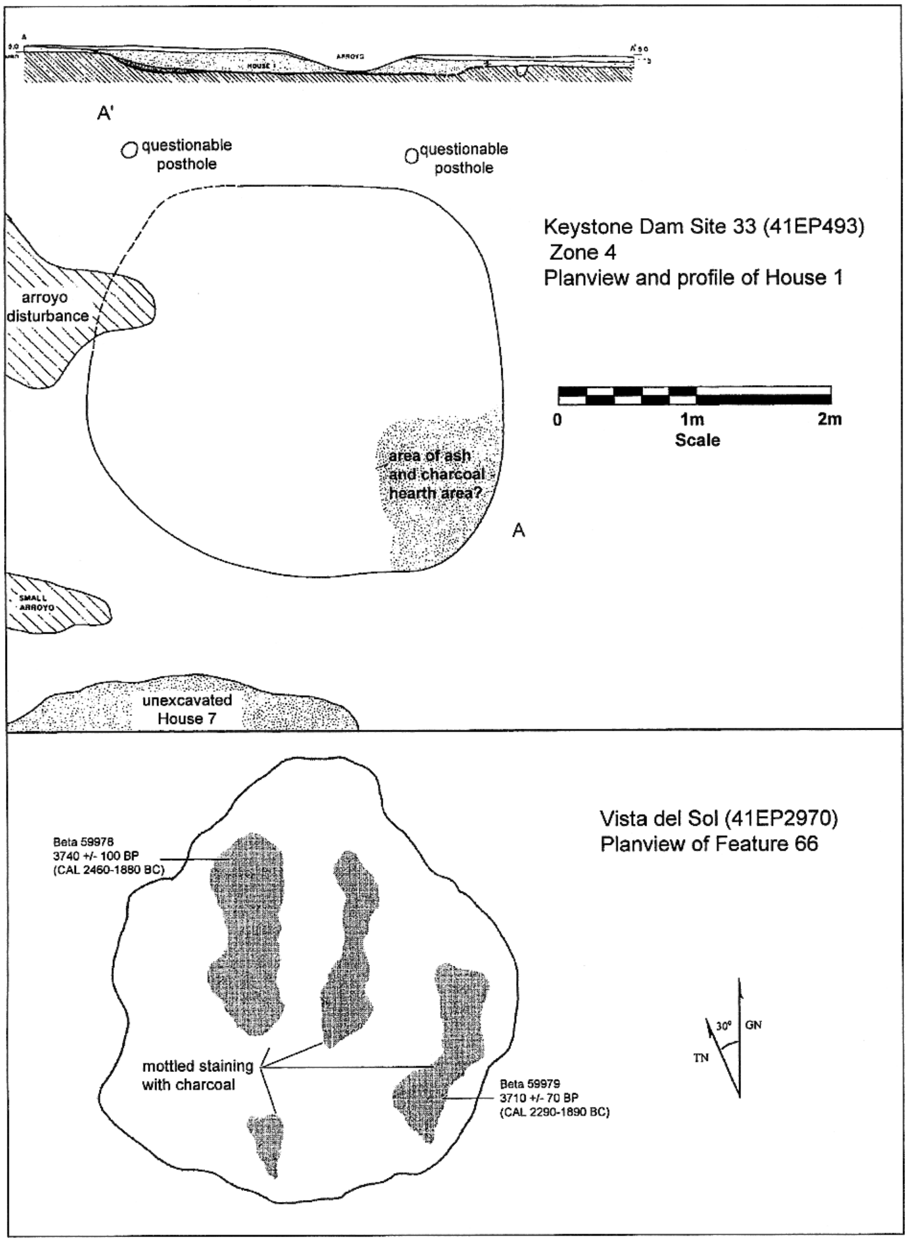

Fig. 7.14. Middle Archaic period house structures from El Paso County (after M. Miller et al. 1993; O'Laughlin 1980).

Middle, and Late Archaic period archeological record in terms of lithic and groundstone tool assemblages or thermal features; this is certainly due in part to the paucity of sites and well-documented assemblages. Technological changes between the Early and Middle Archaic have been inferred primarily through observed differences in projectile point form. One commonly noted aspect of Middle Archaic tool technology is the diversification of projectile point types. Mallouf (1985) notes an increasing regional spatial pattern of projectile point forms, with western Trans-Pecos sites having a combination of Trans-Pecos, Coahuilan, and Cochise forms while forms of the eastern Trans-Pecos have closer affinities with the central Texas, Coahuilan, and Lower Pecos traditions.

In reviewing the most prevalent Middle Archaic projectile forms, however, it is evident that many forms have several broad morphological similarities. This condition is particularly true in the design of the haft element, and the degree to which small variations in shoulder, blade form, and haft elements represent technological design choices or cultural norms (see Tomka and Prewitt 1993) or are attributable to breakage and reworking has not been established.

It is evident from published projectile point collections from the region that two hafting configurations represent the most common Middle Archaic forms: contracting stems with flat, rounded, or pointed bases and expanding stems with concave bases. Again, there appear to be regional differences in the distribution of these forms, with expanding stem/concave base forms having general affinities with the Oshara Tradition and Cochise sequences more prevalent in the western Trans-Pecos, while contracting stem forms are more prevalent among the central Texas and Coahuila traditions present in the eastern Trans-Pecos. Another trait of Middle Archaic projectile points in the western Trans-Pecos is the variety in blade modifications, including beveling, serration, and extensive retouching. While simple retouching and reworking is common among Early and Late Archaic points from the western Trans-Pecos, beveled and serrated blades occur predominantly among Middle Archaic forms. Such patterns may indicate an increased emphasis on the conservation of raw materials, blade modification related to multiple uses of the tools, or an aspect of increased efficiency in felling prey. These possibilities suggest that the design and use of projectile points among Middle Archaic groups reflects different patterns of technological and settlement organization than was the case among earlier and later intervals of the Archaic period.

In summary, our present knowledge of Middle Archaic settlement and adaptation is only slightly more substantial than for the Early Archaic. Radiocarbon-dated features increase during the latter half of the period, and occupations increase in number across a wider range of environmental and topographic zones. The majority of sites consist of isolated hearths, burned rock accumulations, or clusters of several thermal features, although the presence of residential structures clearly implies the existence of settlements of longer, seasonal duration within some environmental zones.

Late Archaic Period
(1200 B.C. to A.D. 200/900)

In terms of settlement, subsistence, and technological adaptations, the Late

Archaic—particularly the latter half of the period—represents a true break in the long Archaic sequence of the previous four thousand years. Several technological innovations and changes in settlement adaptations characteristic of this period presage developments during the subsequent Formative period. In fact, aside from the initial use of plain brownware ceramics, it has become increasingly difficult to identify distinct changes in adaptation, subsistence, settlement patterns, or technology between the latter portion of the Late Archaic and the early portion of the Formative period Mesilla phase.

Recognition of the Late Archaic archeological record in the western Trans-Pecos increased dramatically in the 1990s. In contrast to the minimal numbers of chronometric dates available for the Paleoindian, Early Archaic, and Middle Archaic periods, more than 550 radiocarbon dates, representing more than 300 features, rockshelter strata, or other cultural contexts, fall within this period in the Jornada Mogollon region of the Trans-Pecos and south-central New Mexico.

MacNeish (1993b; see also MacNeish and Beckett 1987) subdivide the Late Archaic into two phases: Fresnal (2500–1000 B.C.) and Hueco (1000 B.C.–A.D. 200). While the specific criteria for differentiating these phases and their temporal divisions are not clearly presented, these temporal divisions do tend to reflect broad developments across the Trans-Pecos and southern New Mexico that occurred between 1500 and 1000 B.C. Because the total number of Late Archaic dates is still small and at least half were from mixed contexts (such as crescent and ring middens) or did not have artifacts in association, the recognition and temporal divisions of the Late Archaic are still based mainly on the presence of side- and corner-notched dart points (one of the hallmarks of the period) that have been associated with radiocarbon dates in the Lower Pecos and central Texas. The available evidence for the Late Archaic in the eastern portion of the Trans-Pecos indicates a beginning date roughly contemporaneous with the Fresnal/Hueco phase boundary and an ending date around A.D. 900 or 1000, several centuries after its termination in the Jornada region. Radiocarbon dates from the Big Bend (Baskin 1978; Mallouf 1985), Stockton Plateau (Bandy 1980; Prewitt 1981), Delaware and Pecos Basins (Charles 1994; Skinner et al. 1980; Valastro et al. 1979; Young 1981, 1982), and the Guadalupe Mountains (Bradford 1980; Roney 1995) support the temporal span of the Late Archaic in the eastern Trans-Pecos.

In terms of settlement patterns and land use intensity, an important aspect of Late Archaic settlement is the dramatic increase in sites, features, and associated material culture. Indeed, whether measured by site densities, numbers of projectile points, or counts of radiocarbon dates and dated features, the Late Archaic period represents the peak of occupational intensity in several major environmental zones in the region. In the western Trans-Pecos, projectile point frequencies and the distributions of features with radiocarbon dates led Carmichael (1986), Seaman et al. (1988), and Whalen (1980a, 1985a) to conclude that a substantial occupation of interior basin landforms occurred during the Late Archaic. These impressions have been confirmed by recent studies emphasizing more intensive chronometric dating. Radiocarbon dates from several large-scale testing and mitigation projects (Burgett n.d.; Camilli et al. 1988; Mauldin et al. 1998; O'Laughlin and Martin 1990) have consistently identified Late Archaic components in the central basin landforms, and Mauldin's (1994, 1995, 1996a) summary of these data clearly demonstrates that a substantial proportion of more than five hundred dated features in the Hueco Bolson represent Late Archaic occupations. Late Archaic components are equally common and widespread in the Mesilla, Tularosa, and Salt Flat Basins.

In addition to the central basins, radiocarbon-dated features and components are widely distributed among nearly all environmental and topographic zones in the western Trans-Pecos. Late Archaic components are present on alluvial fans, including both surface sites and buried components. Most rockshelters have considerable Late Archaic deposits, and this period is often the primary time interval represented in rockshelters. Rockshelters in the Guadalupe Mountains also have predominantly Late Archaic deposits (Roney 1985, 1995).

Research on the Late Archaic in the eastern Trans-Pecos (Mallouf 1985, 1990) and adjacent regions (Sebastian and Larralde 1989) documents similar trends. Foremost, there was a remarkable increase in the number of Late Archaic sites over previous periods. They have been identified in all environmental settings, including river terraces that are not prone to flooding (Cloud et al. 1994), high mountain environments (Cloud 1989; Ferndon 1946; Kenmotsu 1993), intermountain bolsons (Hedrick 1989), adjacent to springs (Charles 1994; Mallouf 1985), and in every other ecological zone in the region. The increase in Late Archaic sites, and their expansion into all ecological zones, has been interpreted to be the result of wetter environmental conditions (Mallouf 1990) that ended around 500 B.C. but that had promoted interregional interactions among hunting-gathering groups (Mallouf 1985). The numeric increase in Late Archaic sites is so dramatic that it is believed to have represented some level of concomitant expansion "in population, changes in socioeconomic practices, or a combination of these factors" (Mallouf 1985, 125).

Subsistence and Agricultural Developments during the Late Archaic Period

Among the most important developments during the Late Archaic in the western Trans-Pecos is the first conclusive evidence for the use of cultigens. Steadman Upham and Richard MacNeish (1993) identify the presence of cultigens—and hence the adoption of horticultural or agricultural subsistence practices—as one of the signature traits marking the initiation of the Fresnal phase at ca. 2500 B.C. The inception date of this phase is based on the presence of tentatively identified *Zea mays* pollen from Zone 4 at Keystone Dam (O'Laughlin 1980). Pollen Type A was provisionally identified as *Zea,* but not conclusively so due to the poor condition of the pollen grains. Moreover, calibration of the uncorrected radiocarbon age estimates from wood charcoal samples retrieved from pithouse structures within Zone 4 range from 3400 to 1200 B.C., and error estimates of the individual dates range between 120 and 200 years. Therefore, the inception of the Fresnal phase, based as it is on these data, carries a substantial degree of imprecision. Recent chronometric studies involving direct age estimates obtained from corn samples indicate that MacNeish's inception date for the Hueco rather than Fresnal phase may more accurately reflect the introduction and adoption of cultigens in the Jornada Mogollon region.

More conclusive evidence for the appearance of cultigens has been obtained through direct conventional and accelerator mass spectrometry (AMS) radiocarbon dating of corn specimens recovered from Fresnal and Tornillo rockshelters. The earliest direct date was obtained from a composite sample of eight corncobs from Tornillo Shelter, situated a few miles north of El Paso. Upham et al. (1987) report a corrected age estimate of 3175 ± 240 B.P. (GX-12720), which calibrates to 2030–830 B.C. (at 1-sigma). Because the sample was a composite, it may have incorporated younger and earlier cob specimens. Therefore, the age estimate cannot be considered entirely accurate, and the imprecision of the calibrated age estimate (a span of twelve hundred years) must also be taken into account.

A more concise and intensive dating study was undertaken using cultigens from Fresnal Shelter (Tagg 1996). Seven corn samples and three beans from several pits and excavation levels in Units D27 and C29 were directly dated using AMS to help establish the ages of these materials as well as to reconcile earlier debates regarding the context and association of radiocarbon age estimates obtained from wood charcoal and cultigens. The earliest of the series of dates obtained from a corn sample is 2945 ± 55 B.P. (AA-6402, calibrated age range is 1370–940 B.C.), while the remainder of the dates range between 1200 B.C. and A.D. 600 (Fig. 7.15). Direct dates were also obtained for three samples of common bean, and Tagg (1996) notes that the distribution of these dates suggests a somewhat later occurrence at ca. 350 B.C.

The Fresnal cultigen dates accord well with other evidence for the introduction of cultigens in the southern Southwest. By most recent accounts, maize and other cultigens first appear sometime between 1050 and 850 B.C. in southern New Mexico and southern Arizona (Fish et al. 1986; Matson 1991; Minnis 1992; Tagg 1996; Wills 1988), as well as in northern Chihuahua (Wills 1988; see also Hard and Roney 1998). Wills (1988) suggests that the earliest maize specimens have not yet been found and that it would be reasonable to assume an introduction period between 1550 and 1050 B.C. (see also Minnis 1992), an estimate that is in agreement with the evidence from Fresnal Shelter.

Causal factors underlying the adoption of corn, beans, and other cultigens during the Late Archaic period are not well known, and the origins of agriculture in the Jornada Mogollon region are best viewed within the larger perspective of developments across the Southwest. Many argue that the use of cultigens is part of an increasing diversification and range of plant foods exploited during Late Archaic times, a practice that also provided additional stability, buffering, and/or predictability to the subsistence base (e.g., Matson 1991; Minnis 1992; Wills 1988). It is not well understood, however, whether this diversification may have been a cause or effect of increasing population levels and, as a result, reduced territories available for population movements.

Crucial for understanding the integration of agriculture into the subsistence economies of Late Archaic groups in the Trans-Pecos is defining the extent and degree of agricultural production. Several rather contradictory data sets are available. Referring to an outstanding case of plant preservation, Vorsila L. Bohrer (1981, 45) provides several ubiquity calculations from Fresnal Shelter. Based on her analysis, corn was identified in 50 percent of ten 120 ml samples collected from natural strata, 57 percent of samples (n=7) of equivalent volume collected from pits in Unit D27, and 52 percent of the screened excavation levels (n=44). The high degree of preservation of deposits in the shelter undoubtedly contributed to these counts, as other seeds and plant parts have even greater ubiquity values. Yet the consistent distribution of corn throughout deposits and features is surprising when compared to the generally low ubiquity values for corn at other Late Archaic components, and it is even more striking when compared to the low ubiquity values at Early Formative period sites occupied by groups presumably having a greater agricultural subsistence base (see below). The pattern observed at Fresnal is also evident at Todsen Shelter and the Organ Mountain rockshelters where Upham and MacNeish (1993) document more than one hundred corncobs—a total that does not include individual kernels and cupules—recovered from several generally shallow deposits. While counts or ubiquity measures cannot be determined for individual stratigraphic zones

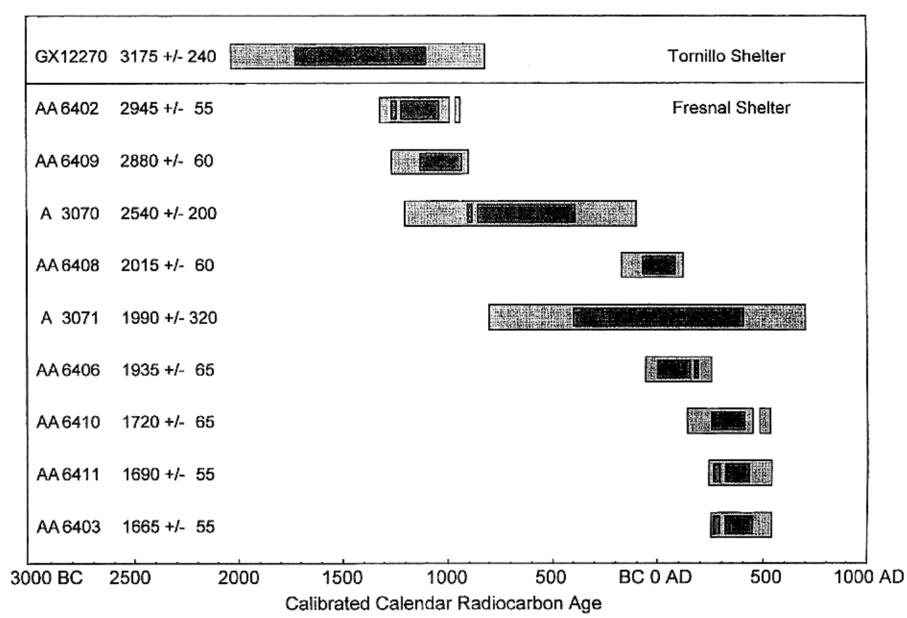

Fig. 7.15. Direct radiocarbon age determinations from corn samples at Tornillo and Fresnal Shelters, New Mexico (data from R. Jones 1990; Tagg 1996, 316–17; Upham et al. 1987). Samples with laboratory designations A and AA have assumed ^{13}C correction of –10.0 percent.

at these sites, a substantial proportion of the samples was obtained from Late Archaic contexts.

Open-air sites present quite a different matter. Despite the possible presence of corn pollen in Zone 4, no macrobotanical specimens of corn were identified during the examination of more than one hundred flotation samples from houses, pits, and thermal features at the Middle and Late Archaic components of Keystone Dam sites 33 and 34 (O'Laughlin 1980). Keystone 33 is located in sandy alluvial and eolian deposits of the lower Rio Grande terrace, and the generally limited recovery rate for macrobotanical remains throughout the site suggests that the absence of corn may be partially attributable to poor preservation. Despite preservation biases, however, it is noteworthy that corn is virtually absent in flotation samples collected from Late Archaic residential structures, pits, and virtually hundreds of thermal features throughout the Jornada Mogollon region (Ford 1977; Gasser 1983; Holloway 1994, 1998; Minnis and Toll 1991; O'Laughlin 1988; Wetterstrom 1978), including numerous intact examples with well-preserved deposits.

Additional evidence contrary to any view of moderate or high levels of agricultural dependence during the Late Archaic is provided by stable isotope analysis of human skeletal remains. Trends in $^{15}N/^{14}N$ and $^{13}C/^{12}C$ ratios among human remains of Archaic age does not indicate a high level of maize in the diet (MacNeish and Marino 1993).

While evidence of agricultural dependence during the Late Archaic involves contradictory evidence, the problem may be due, in part, to the seasonal nature of rockshelter occupations as opposed to settlements situated at lower elevations in the central basin, alluvial fan, and river terrace landforms. Identifying the specific season of occupation for low-elevation settlements is difficult because of the frequent absence of plant and faunal remains, yet it may be surmised that these locales were used at different periods of the year than were the upland rockshelters. Based on several aspects of the plant and faunal collections, convincing arguments for the presence of seasonal occupations at Fresnal Shelter and Keystone Dam have been presented by Bohrer (1981), O'Laughlin (1980), and Wimberly and Eidenbach (1981). Seasonal settlements may also be indicated by the highly variable quantities of materials recovered from rockshelters as opposed to lowland open sites, as seasonal occupations of different intensity or duration (along with varying deposition rates) may partially account for the generally minimal subsistence remains and artifact inventories recovered from lowland sites. Accordingly, reconstructions of subsistence and settlement strategies that neglect to incorporate data from settlements across several environmental zones may present a biased picture of Late Archaic adaptations.

Placing the issues of agricultural dependence aside for the moment, it is evident that agricultural production was only one facet of what was clearly a broad-spectrum subsistence economy. Bohrer identified eleven subsistence items in high abundance throughout deposits at Fresnal Shelter, noting that most represent "a well-buffered system of collecting that provides a minimum of risks" and "have a maximum emphasis on predictability in terms of location and availability" (Bohrer 1981, 45). These plant foods include four-wing saltbush (*Atriplex canescens*), buffalo gourd (*Cucurbita foetisdissima*), turk's head cactus (*Echinocactus horizonthalonius*), juniper berries (*Juniperus* sp.), four o'clock (*Mirabilis multiflora*), prickly pear cactus (*Opuntia* sp.), New Mexico feathergrass (*Stipa neomexicana*), and mesquite (*Prosopis glandulosa*). Less economically reliable species included pigweed (*Amaranthus* sp.), dropseed (*Sporobolus* sp.), and *Paniceae* grasses. Sotol (*Dasylirion wheeleri*) is equally common throughout the deposits but is not mentioned in Bohrer's discussion. Flotation analysis of several hundred thermal features and hut structures in the Hueco, Tularosa, and Mesilla Bolsons has identified similar inventories of plants, along with various annual seeds (cheno-ams, purslane, grasses), mesquite, and cacti.

Hunting continued to play an important role in the Late Archaic. A study of nearly 26,000 faunal remains from predominantly Late Archaic deposits in Fresnal Shelter led Wimberly and Eidenbach (1981) to conclude that large or medium-sized mammal bones represented slightly more than 90 percent of the remains. Of 869 identifiable fragments, 99 percent were mule deer, with trace amounts of antelope, bighorn sheep, and bison. Wimberly and Eidenbach (1981) also note that the proportional representation of these taxa is the same throughout deposits in the shelter, and they suggest that this indicates a continuity in upland hunting and subsistence practices. Inventories of faunal remains from Todsen Shelter (Dawson 1993) found few differences between Middle (Keystone phase) and Late Archaic (Fresnal and Hueco phases) deposits, with rabbit comprising the majority of faunal remains in both periods. However, aquatic species, most likely obtained from the Rio Grande, were also recovered from Late and Middle Archaic deposits.

Faunal remains from open-air sites consist predominantly of various leporid (rabbit) species. In lowland settings, it appears that large and medium-sized mammal remains decrease steadily through the Middle and Late Archaic, with a correspondingly greater emphasis on rabbits, a pattern that is maintained through the subsequent Formative period. This view is impressionistic, however, as no quantitative studies have been attempted and such studies would have to rely primarily on small, poorly preserved samples from hearth features. An exception to this lowland hunting pattern is La Cueva, a small shelter at the base of the Organ Mountains north of El Paso, where substantial quantities of deer, antelope, and mountain goat remains were found (Beckett 1979). In contrast to the typically low numbers of projectile points from lowland sites, Beckett notes that an average of ten points per cubic meter of fill were found, indicating that hunting of large game continued in proximity to larger mountain ranges during the Late Archaic.

Both hunting and gathering played prominent roles in the Late Archaic economies of eastern Trans-Pecos groups, but differing emphases given to these two subsistence economies can be noted between north to south. In the north, analyses of coprolites from site 41CU1 (Holloway 1985), which is a sinkhole/cave, and of artifacts from nearby Shelby Brooks Cave, (site 41CU8 [Ward 1992] in the Rustler Hills of the Delaware Basin) indicate an emphasis on vegetal and small game food sources. Only one dart point and a few fragments of atlatls and/or foreshafts were recovered from Shelby Brooks Cave. These hunting implements were overshadowed by forty-one rabbit sticks and a small hunting net (Ward 1992). Coprolites from 41CU1 support the notion that Late Archaic populations in the northern portion of the Trans-Pecos consumed more vegetal foods (Holloway 1985). All coprolites contained a relatively large quantity of grass seeds prepared by parching. Most had smaller quantities of chenoams, *Artemisia* (sage), prickly pear, Liliacaeae (cacti or wild onion), and mesquite seeds. Several had no evidence of mammalian consumption while others contained bones and/or hair from rabbits, packrats, and other rodents, and one contained an insect exoskeleton. Creosote and Ephedra were present in several coprolites, and these likely represented treatments for diarrhea since water available near Caldwell Cave is especially high in magnesium, a known laxative (Holloway 1985, 326).

Approximately 150 miles southeast of Rustler Hills, data from Roark Cave (41BS3; see Kelly 1963) in southeastern Brewster County provide an interesting counterpoint. Roark Cave is one of several occupied rockshelters in Reagan Canyon, situated a few miles north of the Rio Grande in the western portions of the Stockton Plateau (Kelly and Smith 1963). At Roark Cave, Thomas C. Kelly's small block excavation yielded a substantial quantity (238) of projectile points, many of which (45 Paisano, 15 Ensor, 8 Frio, and 6 Palmillas), along with a foreshaft, date to the Late Archaic. Scrapers, bone tools, spokeshaves (burins?), and gravers were also present in the rockshelter in relatively high quantities. These artifacts suggest that Late Archaic occupants in the southern sector of the Trans-Pecos placed greater emphasis on hunting than did their northern counterparts.

Trends among several technologies track the changes in Late Archaic subsistence and demographic patterns. While thermal features with burned rock first appear during the Early Archaic and continue to be used during the Middle Archaic, they become more numerous in the Late Archaic. There is an increase in numbers and weights of large rock accumulations, indicating increasing intensification of plant processing. Mounds of discarded rock associated with Late Archaic thermal features, such as those excavated at the Keystone Dam sites (Carmichael 1985; Fields and Girard 1985; O'Laughlin 1980) and other locations often contain rock weights in excess of several hundred kilograms.

A distinguishing feature of the Late Archaic outside of the Hueco Bolson is the prominence of ring middens: circular to oval heaps of burned rock, sometimes accompanied by large quantities of ash, charcoal, and lithic artifacts, with a central depression. The sheer number of these features across the landscape "suggests widespread exploitation of desert succulents" (Mallouf 1985, 125). While mounded middens of burned rock (lacking the central depression) were built during earlier periods, they are less numerous and present in fewer ecological niches. Late Archaic ring middens have been found in high rockshelters (Ferndon 1946; Mera 1938; Roney 1995), near occupied sinkholes (A. Jackson 1937; Ward 1992), near *tinajas* (box canyons with waterholes; Coffin 1932), in high mountain basins (Cloud 1989), and in most ecological niches of the Trans-Pecos.

Occupants of the Trans-Pecos east of the Hueco Bolson continued to form these ring middens into the Historic period. These features were constructed by Apaches and other Native Americans to cook sotol and lechuguilla bulbs (Bell and Castetter 1941; Castetter 1935), and remnants of these same desert succulents have been recovered from excavations of prehistoric ring middens (Bohrer 1994; P. Katz 1978). Thus, it has long been held that similar functions can be ascribed to prehistoric ring middens (Black et al. 1997; Hines et al. 1994; J. C. Kelley et al. 1940; Roney 1995). Ethnographic data from the Apache (Bell and Castetter 1941) and elsewhere (Black et al. 1997) show that the bulbs cooked en masse in these features could be stored for long periods of time. The discovery of "about a bushel of pieces of leaves which had been stripped from the outside of roasted crowns of sotol" at Bee Canyon (41BS8) (Coffin 1932, 15) suggests that prehistorically the bulbs were also cooked en masse and stored for later consumption.

Several other cultural trends make their appearance in the Late Archaic. First, dry rockshelters with their greater preservation contain a rich Late Archaic material assemblage of not only lithic tools and grinding stones but also fiber netting and cords, basketry (mats, parching trays, baskets), animal skin pouches, gourd vessels, throwing sticks, foreshafts, wooden and shell pendants, wooden tongs, sandals, and various other perishable and nonperishable artifacts (J. C. Kelley et al. 1940; Mallouf 1985; R. Tanner 1949; Ward 1992). One of these, a wooden mortar recovered from a crevice in Terrell County (41TE170), dated between A.D. 875 and 1055 (Prewitt 1981), while a wooden slab from Pratt Cave (41CU196) dated to A.D. 530 ± 60 (Valastro et al. 1979, 262–63). Ward (1992) has noted that these assemblages represent fragments of containers, hunting and gathering implements, clothing (sandals, pendants, skins), and leisure time activities (rhythm sticks), while the preparation of the dead with animal skin and woven wrappings and occasional grave goods indicates that the people cared deeply about each other. Grass-lined pits (Ferndon 1946; Kelly 1963) and grass-lined floors, perhaps for sleeping (Coffin 1932), have also been attributed to the Late Archaic.

Projectile point technologies undergo several modifications, including the characteristic shift to corner- and side-notched forms. In addition, points made in the second half of the Late Archaic and the Early Formative periods are significantly smaller in size. How do these factors relate to combined changes in hunting practices and settlement mobility? A corresponding increased use of local raw materials for the manufacture of projectiles, combined with increasing land use intensity as indicated by the dramatic increase in features and radiocarbon dates during this period, may reflect a reduction in territorial ranges available for exploitation by Late Archaic groups.

In summary, the Late Archaic period is marked by several distinct changes from the preceding Early and Middle Archaic periods, particularly in demographics, land use intensity, feature variability, and technology. Patterns accentuated or intensified during the Late Archaic persist through much of the subsequent Formative period. Most Late Archaic components are small in size, consisting of one or more thermal features and occasional structures. While not exceedingly greater in size or in artifact density than those of preceding periods, the Late Archaic sites' sheer numbers indicate a much more intensive land use pattern.

General Trends of the Archaic Period

In this section we examine three broad trends of the Archaic period archeological record. First, the radiocarbon record can be employed as a proxy indicator of land use intensity, population growth, and the introduction of various technologies. Second, quantitative and qualitative data have been collected on a large sample of projectile points from Fort Bliss, permitting us to draw tentative inferences regarding trends in projectile technologies, hunting strategies, and settlement mobility. Finally, issues of regional hunter-gatherer mobility or territorial ranges can be considered through visual or geochemical sourcing studies of lithic raw materials and a consideration of projectile point distributions.

Settlement and Demographic Trends as Revealed by the Radiocarbon Record and Projectile Point Frequencies

As mentioned above, it has been noted that through time there are increasing numbers of occupations from the Early and Middle to Late Archaic periods. Site counts and densities have been presented in support of these observations (Carmichael 1986; Mallouf 1985; Whalen 1980a), and while interpretations derived from such data (e.g., S. Anderson 1993) are certainly useful and sufficient to obtain a general impression of population trends or increasing levels of settlement intensity through time, the multicomponent nature of most archeological sites in the region may tend to inflate or reduce "site" counts within various temporal periods and ultimately provide an inaccurate conception of population or settlement trends.

As another measure of these trends—albeit imperfect in its own right—we refer to the radiocarbon record using recent compilations of chronometric dates from the region (Mallouf 1985; M. Miller 1996a). Fig. 7.16 illustrates a portion of the Jornada Mogollon/western

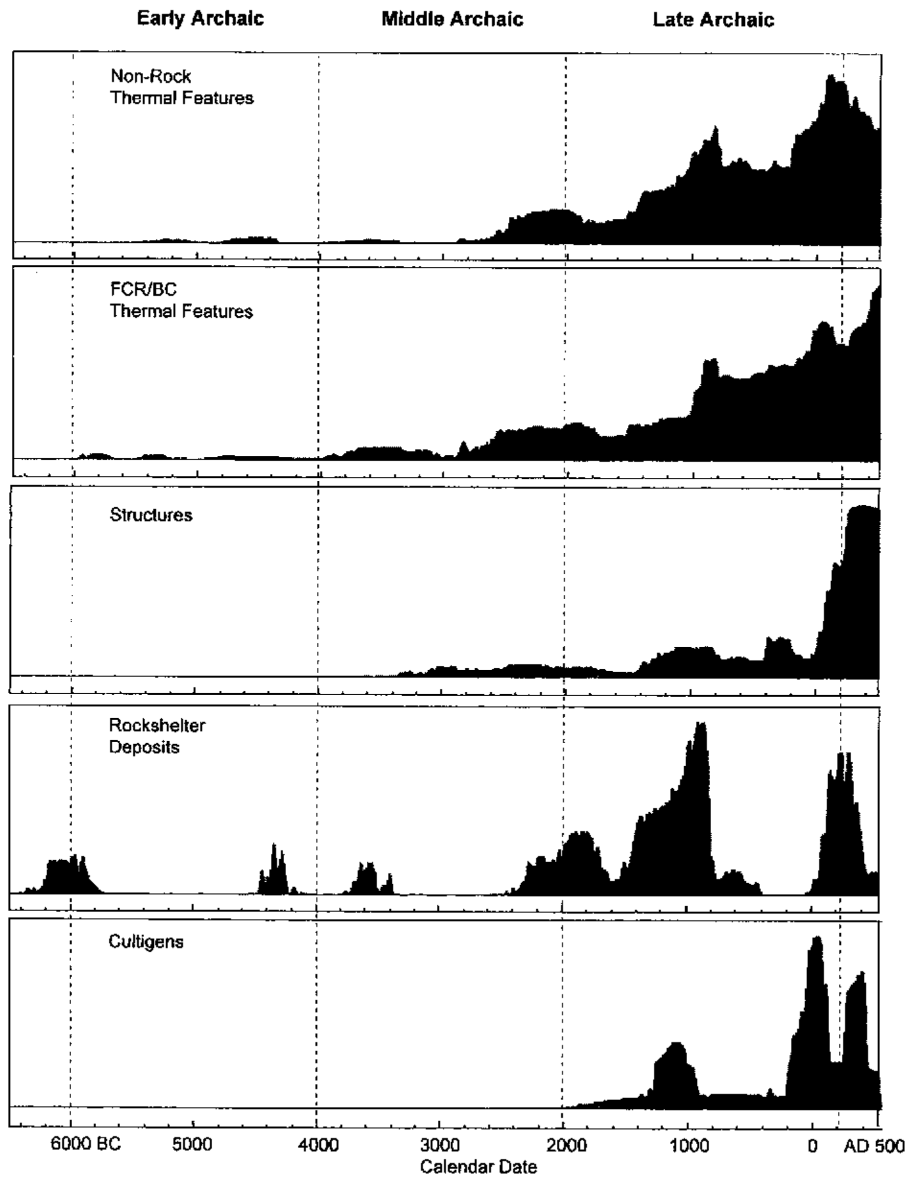

Fig. 7.16. Trends in summed radiocarbon probability distributions for Archaic period feature contexts and cultigens in the western Trans-Pecos/Jornada Mogollon region (data from M. Miller 1996a; Tagg 1996).

Trans-Pecos radiocarbon record between 6000 B.C. and A.D. 500, encompassing the Early, Middle, and Late Archaic periods and early centuries of the Formative period. Four major archeological feature classes or contexts are depicted: residential structures, rockshelter deposits, and thermal features with and without rock heating elements. A fifth graph displays the distribution of early cultigen dates from Fresnal and Tornillo Shelters (see Fig. 7.16).

Radiocarbon-dated contexts are rare during the Early Archaic and first half of the Middle Archaic periods. A slight increase in the number of radiocarbon-dated contexts occurs around 2500 B.C. during the Middle Archaic, along with the first evidence for the construction of residential structures. Otherwise, a cursory examination of the radiocarbon record suggests the sporadic or low-intensity use of the region during these periods or at least that adaptive strategies involving thermal features or other subsistence and economic activities resulting in the deposition of datable materials were uncommon. During the Late Archaic, a pro-

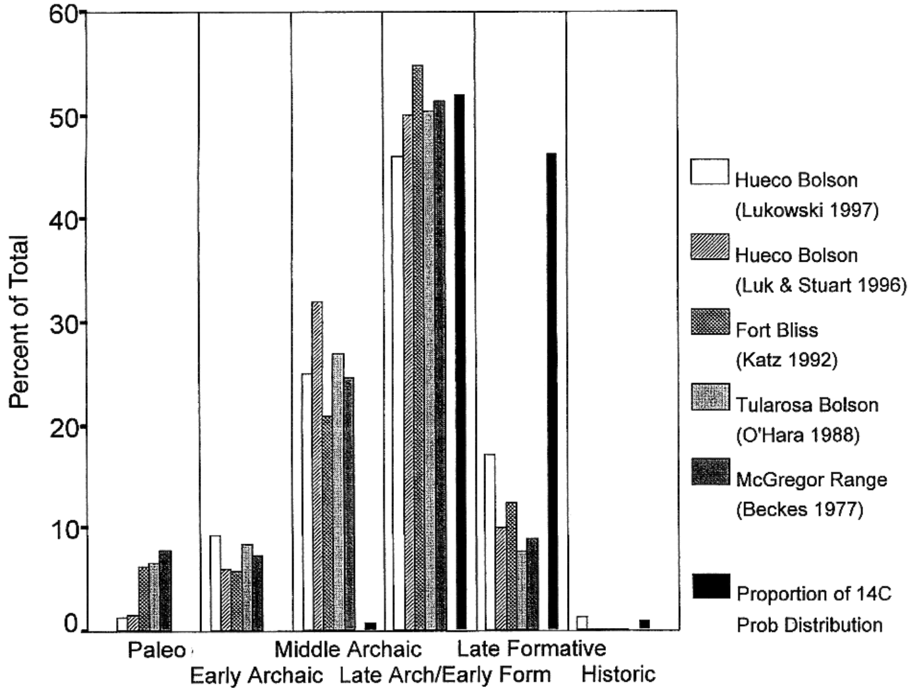

Fig. 7.17. Comparison of projectile point forms among major temporal intervals in the western Trans-Pecos.

nounced increase in the numbers of radiocarbon-dated features and contexts begins between 1200 and 1000 B.C., a time period corresponding to the appearance of cultigens. Another more pronounced rise in date frequencies across all feature types and contexts occurs near the close of the Late Archaic (between 200 B.C. and A.D. 1), particularly for the numbers of dated house structures and cultigen dates (see Fig. 7.16). The majority of these contexts show similar trends, with the exception that the trajectory for house structures lags behind thermal features.

There does appear to be a general correlation between the appearance of cultigens and an increase in the number of radiocarbon-dated contexts that, based upon an initial and uncritical appraisal, could suggest a linkage between changing demographic patterns and the adoption of cultigens. Does the appearance of cultigens represent a cause or effect of increasing population levels and/or land use intensity as represented by much higher numbers of dated features and components? We also wonder whether increasing levels of feature construction, site counts, or occupational intensity (via increasing numbers of radiocarbon-dated contexts) represent population growth within the Jornada and Trans-Pecos regions or reflect extraregional population factors that resulted in reduced territorial ranges available for exploitation. That is, population growth per se may not have occurred, but what took place instead was an increasing intensification of land use within the region, resulting from increasingly restricted territorial ranges, while population levels may have remained relatively stable. As will be shown below, pronounced changes in regional territories and dynamics may have occurred during—and particularly at the end of—the Archaic period.

Additional questions remain, however, regarding how accurately or reliably the radiocarbon record reflects prehistoric demographics or patterns of feature and land use. Another independent measure of these patterns is provided through data collected in the region during surveys on the relative proportions of projectile points representative of each Archaic period time interval (Fig. 7.17). These surveys produced projectile point data from five studies within the limits of Fort Bliss and White Sands Missile Range in the Hueco and Tularosa Bolsons, including the BorderStar 85 and McGregor Range surveys in the southern Tularosa Basin (Beckes 1977; O'Hara 1988), two recent site revisitation projects in the Hueco Bolson (Lukowski 1997; Lukowski and Stuart 1996), and Katz's (1992) overview of projectile points collected from the Fort Bliss maneuver areas of the Hueco and Tularosa Bolsons.

Some degree of variation among these studies should be expected because of variable survey intensities and coverage of different topographic zones, as well as idiosyncrasies and differing classification approaches. Despite this variation, the five series show similar trends. Paleoindian and Early Archaic projectile points, respectively, do not exceed 10 percent of the respective samples. The proportion of Middle Archaic forms averages 25 percent. The largest increase occurs during the Late Archaic and Early Formative, with most studies recording proportions of more than 50 percent for projectile forms of these periods. Proportions of later Formative period (ca. A.D. 600–1450) forms decrease sharply and are present in only slightly higher proportions than Paleoindian and Early Archaic forms (see Fig. 7.17). Projectile points of unambiguous Historic period age (e.g., metal points) have been formally recorded during only two surveys at Fort Bliss and Holloman Air Force Base (Hawthorne 1994; Lukowski 1997) and overall are exceptionally rare (see Thompson 1980, however, for examples from uncontrolled collections in the northern Tularosa Basin). However, it should be noted that specimens of small, triangular points identical to Late Formative period arrow points have been recovered from Spanish Colonial period components in the El Paso lower valley (Graves 1995; Melton and Harrison 1996; O'Leary and Miller 1992); therefore, it is possible that similar specimens from various sites in the region represent Historic period occupations.

An initial impression suggests that trends in projectile point frequencies appear to support the inference of increasing population levels and/or land use intensity through the Archaic period. Yet what do these trends really represent? The final bar in Fig. 7.17 indicates the proportion of the summed radiocarbon distribution for the Jornada region falling within each time interval. This trend in radiocarbon proportions is quite different from that suggested by projectile point frequencies. Although we acknowledge that smaller points may have been missed more often during surface surveys and that this situation may have biased the sample, it is still clear that the disproportionate representation of radiocarbon dates and projectile points during the Late Formative period indicates a distinct change in subsistence and land use, including a reduced emphasis on hunting and, as suggested by Mauldin (1995, 1996a), an increase in the logistical use of the basin topographic zone that did not require the construction and use of thermal features or habitation structures.

As differences among the two data sets illustrate changing settlement adaptations during the Late Formative period, a further possibility is that the lack of concordance between the respective proportions of projectile points and radiocarbon dates for the Middle Archaic may also indicate shifts in subsistence and mobility strategies in contrast to the Early and Late Archaic periods. Of course, the rarity of Middle Archaic radiocarbon dates may be due to preservation and visibility biases, with Middle Archaic components having been more commonly buried in alluvial deposits or eroded within basin landforms. Indeed, evidence for a major erosional event between 7000 and 6000 B.C. is evident in lagged carbonate nodules (Monger 1993) and thus may account for the absence of Paleoindian dates and the frequently lagged context of artifacts at sites of this period.

Yet, as observed for the Late Formative, the lack of concordance between projectile points and dates may be evidence that different patterns of settlement and land use occurred during the Middle Archaic as opposed to the Early and Late Archaic. There are one or more alternative explanations to those based solely on preservation and visibility factors. First, Middle Archaic adaptations may have involved a greater emphasis on hunting and did not require thermal features. Second, Middle Archaic occupations may have involved low-intensity logistical use of basin landforms, with a greater settlement focus in alluvial fans and river margins. In provisional support of this argument is the fact that the currently known distribution of Middle Archaic house structures at Keystone Dam, Vista del Sol, and the NAHO project area are all in proximity to the Rio Grande Valley. Based as it is on a sample of three sites, this observation is tenuous, however. Third, Middle Archaic adaptations may represent different patterns of mobility and territorial exploitation, with concomitant changes in technology.

Trends in Projectile Point Form and Technology

An examination of projectile technologies provides some insights into these issues. While projectile points were only one aspect of compound weapon systems that through time included atlatls, bows, foreshafts, and spear or arrow shafts, changes in subsistence and settlement adaptations would alter the technological requirements underlying the use and design of the various compound weapons, and this in turn should be reflected by changes in their individual components, including projectile points.

The most obvious trend involves distinctive changes in the hafting element of Archaic points: a change from strong-stemmed or split-stem Early Archaic forms, to contracting stem and concave base forms as well as expanding stem forms of the Middle Archaic, to side-notched, convex, or flat-based Late Archaic varieties. The significance of changing hafting designs has been considered in numerous studies (see Christenson 1987; Keeley 1982; Odell 1994; Tomka and Prewitt 1993). Possible explanations for different haft configurations, as well as the corresponding presence of barbs or shoulders, include efforts to modify the security of the point's attachment to the shaft, to increase the damage or depth of penetration of a point, or to either allow a projectile to remain inside or make it easy to extract from prey. Different haft configurations also affect the overall durability of a tool in that barbs and basal protrusions may be more easily broken during use and require more time to manufacture. Little experimental work has been conducted to assess these patterns, and thus the specific functional aspects of differing haft elements remain conjectural. However, it is probable that choices in the design and manufacture of projectile point haft elements (and other elements) should reflect differing subsistence and settlement adaptations (Odell 1994; Tomka and Prewitt 1993).

Haft configurations may convey or reflect stylistic information (see Tomka and Prewitt 1993). While slight variations in hafting or blade form evident in general trends of point form throughout the Trans-Pecos may have stylistic origins or otherwise be due to culturally constrained norms of manufacture, we believe that the larger technological trend of Early, Middle, and Late Archaic haft and shoulder configurations does indeed represent specific technological requirements of tool use as related to broad patterns of changing subsistence and mobility adaptations.

In addition to these general morphological attributes, aspects of projectile size, raw material composition, and blade modifications offer more specific information. Fig. 7.18 illustrates several trends among a sample of 1,233 projectile points recovered during surface collections and testing projects at Fort Bliss. The first two graphs (Fig. 7.18a, b) concern several metric variables involving blade and haft elements. It is clear that while the majority of these variables are highly correlated, they do document a consistent trend of decreasing projectile point size through time. The most distinctive change occurs between the Late Archaic and Early Formative periods, which in part reflects the shift to arrow points and the adoption of the bow and arrow. However, Early Archaic projectiles are among the largest of the sequence, particularly among several dimensions of the haft element (stem).

Examination of the 1,233 projectile point specimens revealed that 39 percent had evidence of retouch, primarily along blade margins, shoulders, and haft elements (M. Miller 1996a). While simple retouching and reworking of projectiles is commonly seen among Early and Late Archaic points from the western part of the Trans-Pecos, more extensive modifications in the form of beveled and serrated blades occur predominantly among Middle Archaic forms; this provides additional evidence for a distinctive Middle Archaic technological pattern (see Fig. 7.18). Two major forms of blade modifications were investigated: beveling and serration. More than 35 percent of the Middle Archaic points have these blade modifications, compared to less than 5 percent of the Late Archaic or Late Archaic/Early Formative projectile points. While the presence of edge serration and beveling on points is not uncommon in the southern Southwest (e.g., Wills 1988), it appears that the Jornada region has an unusually high incidence compared to several other regions.

The specific tool performance characteristics of beveled and serrated blades are uncertain. Experimental work conducted by Stanley A. Ahler (1971) indicates that serrated edges are more suitable for hide cutting and skinning and may increase the piercing power of the projectile. Andrew L. Christenson (1987) and others view serration as reflecting raw material conservation. Resharpening a projectile blade by adding serrations increases the overall cutting edge surface or length while conserving the material of the edge. Blade beveling—the resharpening of alternate edges along the blade—is also seen as a means of conserving raw material (Sollberger 1971). There is also some question as to whether blade beveling indicates the use of the projectiles as multifunctional bifacial tools (Ahler 1971). In either case, these patterns indicate that Middle Archaic projectile points are part of a distinctive technology in the Archaic tradition, one that may have had a specific emphasis on raw material conservation and highly maintainable, multifunctional bifacial tools.

Patterns of raw material utilization provide additional evidence of Archaic projectile point technology (see Fig. 7.18). As noted previously, Early Archaic projectiles have a greater incidence of medium- and coarse-grained materials. Utilization of fine-grained cherts remains relatively stable throughout the Paleoindian-Archaic-Formative sequence, while medium-grained varieties decline steadily through time. Aside from these gradual changes, the most pronounced difference in raw material use occurs during the Late Archaic/Early Formative, when obsidian and Rancheria chert use increases dramatically. Obsidian, obtained primarily from secondary gravel deposits along the ancestral and present course of the Rio

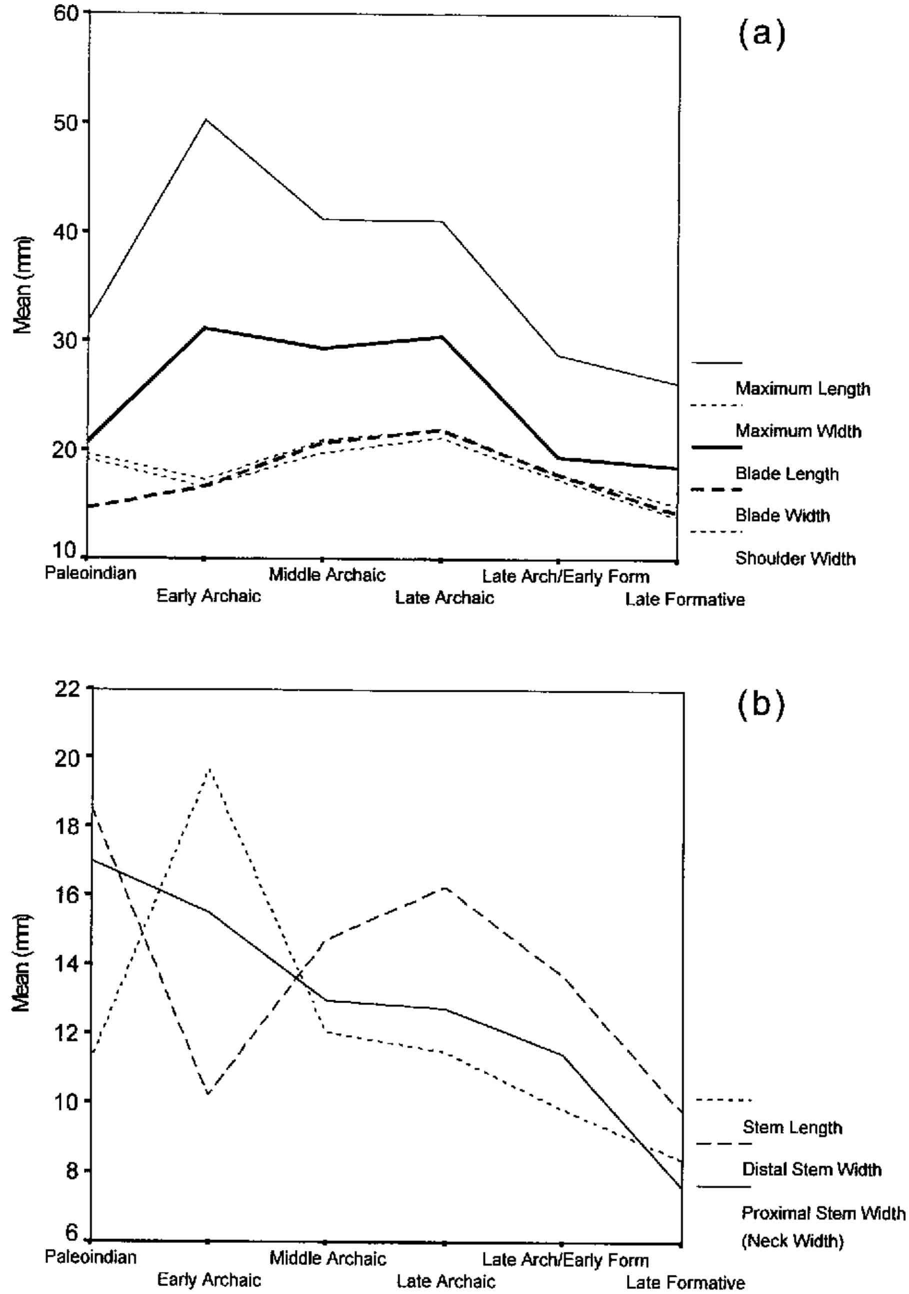

Fig. 7.18. Attributes of projectile point assemblages by major temporal period in the western Trans-Pecos: a, distribution of mean size and blade/shoulder measurements; b, distribution of mean stem/haft measurements; c, distribution of blade modification characteristics; d, distribution of raw material categories.

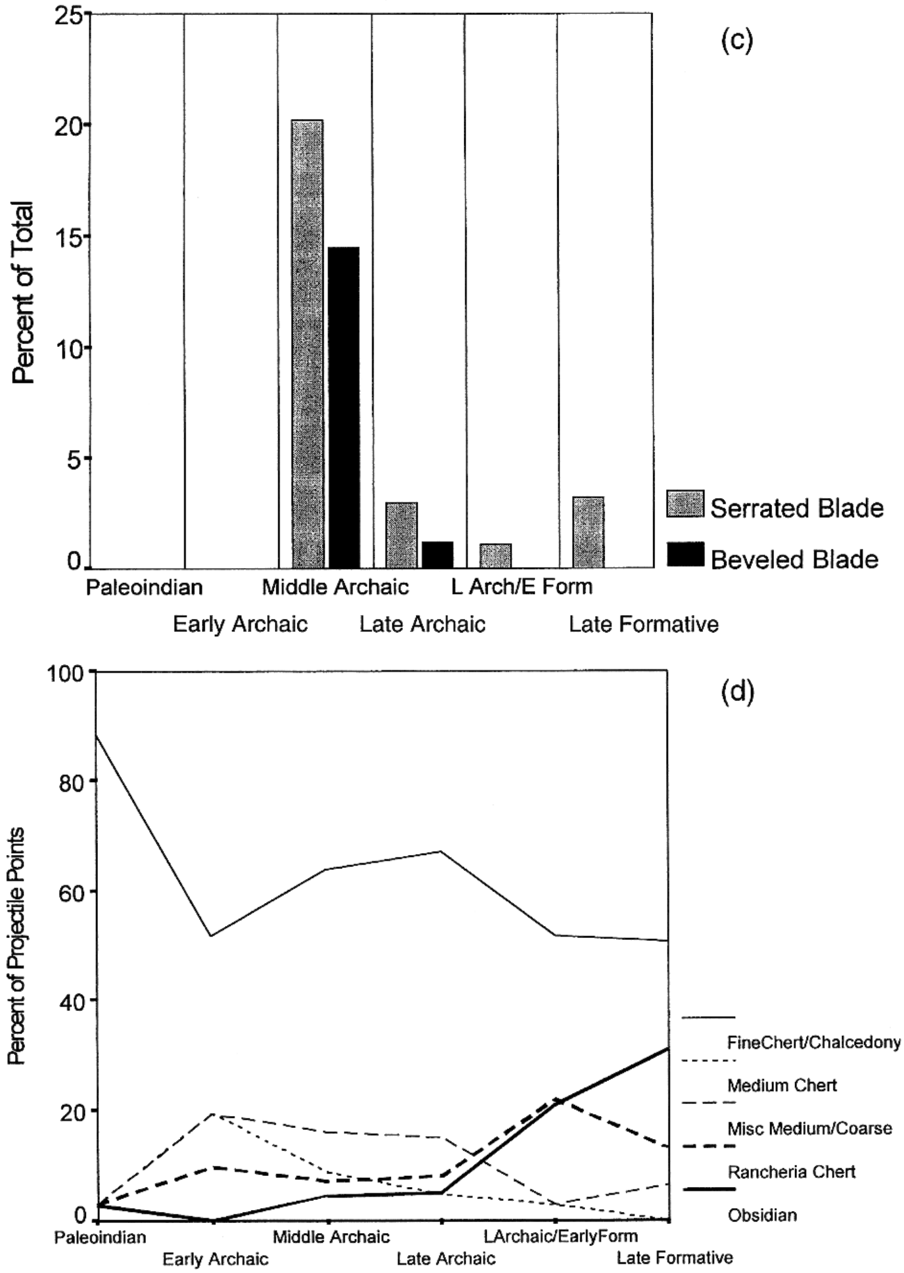

Fig. 7.18. (continued)

Grande, may be considered primarily a local material in that 95 percent of the geochemically sourced obsidian artifacts have been assigned to source groups from northern New Mexico present in the Pliocene- and Pleistocene-aged gravels of the valley (Church 1998a; M. Miller and Shackley 1998). Rancheria chert is another distinctive, easily recognized raw material (O'Laughlin 1980; Carmichael 1985) that outcrops in several locations in mountain chains bordering the Hueco and Mesilla Bolsons (Loudon and Bowsher 1949). Both of these materials are of inferior quality to many other regional sources; Rancheria chert often contains solution joints and has a blocky fracture, while the small size of obsidian nodules limits the range and size of tool forms that can be manufactured from them. However, both sources are abundant throughout a large part of the Jornada region, and the drastic increase in their use indicates a greater utilization of easily obtained materials.

Considered in tandem, these patterns of projectile point design, raw material composition, and use indicate distinctive changes in technological organization that, in turn, reflect changes in subsistence and mobility through the Archaic. Recent studies of hunter-gatherers emphasize the relationship between technology, subsistence resources, and settlement mobility. As suggested by Bleed (1986) and Kuhn (1994), mobile groups should employ maintainable, portable, and durable tools, while Schott (1986) proposed that mobile groups would also require a greater degree of versatility among their tools.

In this sense, Early Archaic forms may be considered "overdesigned" (see Bleed 1986; Nelson 1991) in that they are among the largest and thickest projectile points in the Trans-Pecos, were commonly manufactured of durable materials more resistant to breakage (although often less amenable to resharpening), and had simple, reliable haft elements (or strong stems) that lacked notches, barbs, basal protrusions, and other easily breakable items. Reliability and durability appear to be the preferred design characteristics among Early Archaic projectile points. Subsistence and settlement changes during the Early Archaic may be reflected by a change in prey selection and hunting practices, as suggested by the adoption of stemmed projectile point forms, in addition to a reduced emphasis on tool maintenance and a greater emphasis on reliability.

The most distinctive trait of Middle Archaic projectile points lies in the frequency of blade modifications, including beveling, serration, and extensive retouching. It has not been determined whether such patterns indicate an increased emphasis on the conservation of raw materials, multiple uses of the tools, and/or an increased efficiency in felling prey. Nevertheless, they suggest that the design and use of projectile points among Middle Archaic groups reflect patterns of technological and settlement organization different from those in earlier and later intervals of the Archaic. By contrast with the Early Archaic, the design of Middle Archaic projectile points indicates a greater emphasis on renewability and maintainability, and in the sense that projectiles may have served more than one function, they also constitute a highly portable and versatile tool kit.

The early portion of the Late Archaic does not differ appreciably in these respects from the Middle Archaic. However, projectile technologies undergo several major modifications during the second half of the Late Archaic and the early part of the Formative periods. These modifications include the shift to corner- and side-notched forms, a significant decrease in size, and a much reduced emphasis on blade modifications. An increase in the use of locally abundant raw materials also occurs during this time. The design and raw material characteristics of these projectile points reflect less intensive maintenance and a reduced durability or versatility. When considered in terms of the considerable increase in the numbers of radiocarbon-dated thermal features and structures present across several environmental zones in the western Trans-Pecos, these changes in Late Archaic/Early Formative projectile technology indicate: (a) a more intensive land use pattern and (b) a concomitant decrease in group mobility, in terms of either the number and duration of group moves across the landscape or a reduction in territorial ranges available for exploitation by populations, which resulted in a more intensive use of smaller areas.

Additional Aspects of Mobility, Territoriality, and Regional Dynamics

The study of projectile point form also offers a more traditional means of considering regional dynamics. Unfortunately, this research has taken place primarily under the rubric of "regional interaction" and accordingly has been reported almost entirely by means of comparing projectile point forms of one region with those of adjacent regions. For example, based on similarities of projectile forms of the Cochise (Sayles 1983) and Oshara Traditions (Irwin-Williams 1973, 1979), Katz (1992) makes a definitive statement that the cultural affinities of the western Trans-Pecos are primarily toward the west and north. This perspective belies the fact that many projectile forms have analogs in several regional sequences and may instead represent broad technological patterns rather than specific cultural traditions.

Specific geographic distributions of projectile point forms do exist throughout the Trans-Pecos. Late Archaic dart points common to the southern portions of the region (Brewster, Terrell, and Presidio Counties) include Shumla, Palmillas, Paisano, Ensor, San Pedro, Figueroa, Frio, Marcos, Paisano, Conejo, and Charcos (Mallouf 1990). In the northern sector of the eastern Trans-Pecos, Shumla and Paisano forms are rare and Charcos and Conejo are absent (Roney 1985). It is possible that some projectile point forms may indeed represent distinct cultural traditions or specific instances of population movements. We also believe that it is unlikely that populations inhabiting different regions existed without any form of contact with each other. However, we currently lack the chronological resolution necessary to determine whether many of the highly variable projectile forms characteristic of each Archaic subperiod were manufactured contemporaneously.

More consistent information on Archaic period mobility and territoriality can be obtained from studies of chipped stone raw material distributions, and recent geochemical analyses suggest that it is quite likely that territorial ranges of Archaic groups have been underestimated. Geochemical sourcing studies are in a developmental stage, and problems with differentiating among a multitude of local and nonlocal chipped stone materials using visual or geochemical methods pose several interpretative problems (Church et al. 1996). Most problematic is determining the range of within-source variation versus between-source variation for the myriad of raw material types available and used by prehistoric groups that are widely distributed among primary and secondary sources of igneous, metamorphic, and sedimentary materials across the Trans-Pecos. Yet, as seen with recent studies of Paleoindian technology and toolstone, such evidence is present.

Obsidian geochemical sourcing studies provide the most reliable and extensive data for considerations of mobility and territoriality. R. Jones (1990) notes that obsidian accounts for 1.2 percent of the lithic sample from Unit C29 in Fresnal Shelter. Four samples were chemically characterized, three of which were sourced to the Jemez region of north-central New Mexico, although it is likely that the obsidian was actually procured from secondary gravel deposits in the Rio Grande Valley. The fourth sample was identified as Cerro del Medio. It may indicate procurement at the source in the Jemez region because recent studies suggest that this material does not enter the Rio Grande gravels (Church et al. 1996; LeTourneau and Shackley 1998). Obsidian does not naturally occur in the vicinity of Fresnal Shelter, so the samples found in the region indicate that there were population movements of at least one hundred kilometers between Fresnal Shelter and natural obsidian procurement areas in the Rio Grande Valley. The presence of Cerro del Medio obsidian may indicate either contact with groups in northern New Mexico or that this region was part of the territorial range of Archaic period inhabitants of Fresnal Shelter.

Movements of equivalent or greater distances are evident through the recent identification in Jornada Mogollon assemblages of obsidian from several sources in Chihuahua, Mexico (M. Miller and Shackley 1998). One of the Chihuahuan sources, Sierra Fresnal, is situated approximately one hundred kilometers southeast of the Hueco and Mesilla Bolsons. While the sources of obsidian represented in Archaic period assemblages are not nearly as distant as those noted for nonlocal materials in Paleoindian assemblages, they nevertheless suggest a considerable geographic area of mobility, extending from northern Chihuahua to northern New Mexico.

The temporal distribution of datable specimens from Chihuahuan sources is bimodal (Fig. 7.19a), occurring almost exclusively during the Archaic period, although several specimens have been identified at a single early Historic period site. No occurrences of these Chihuahuan groups have yet been identified in Formative period contexts. More specific attribution to Archaic subperiods is seldom possible, but the majority appear to be associated with Middle and Late Archaic occupations. Although the sample is very small, Middle Archaic contracting-stem projectile forms (Pelona or Augustin types) tend to be particularly pronounced among these Chihuahuan compositional groups. A comparison of the proportional distributions of obsidian sources among projectile points or bifaces versus other artifact types (see Fig. 7.19b) indicates that the occurrence of obsidian from Chihuahua is disproportionately higher than for all other sources, including those common in the Rio Grande gravels (M. Miller and Shackley 1998). This situation indicates that such tools were transported in finished form.

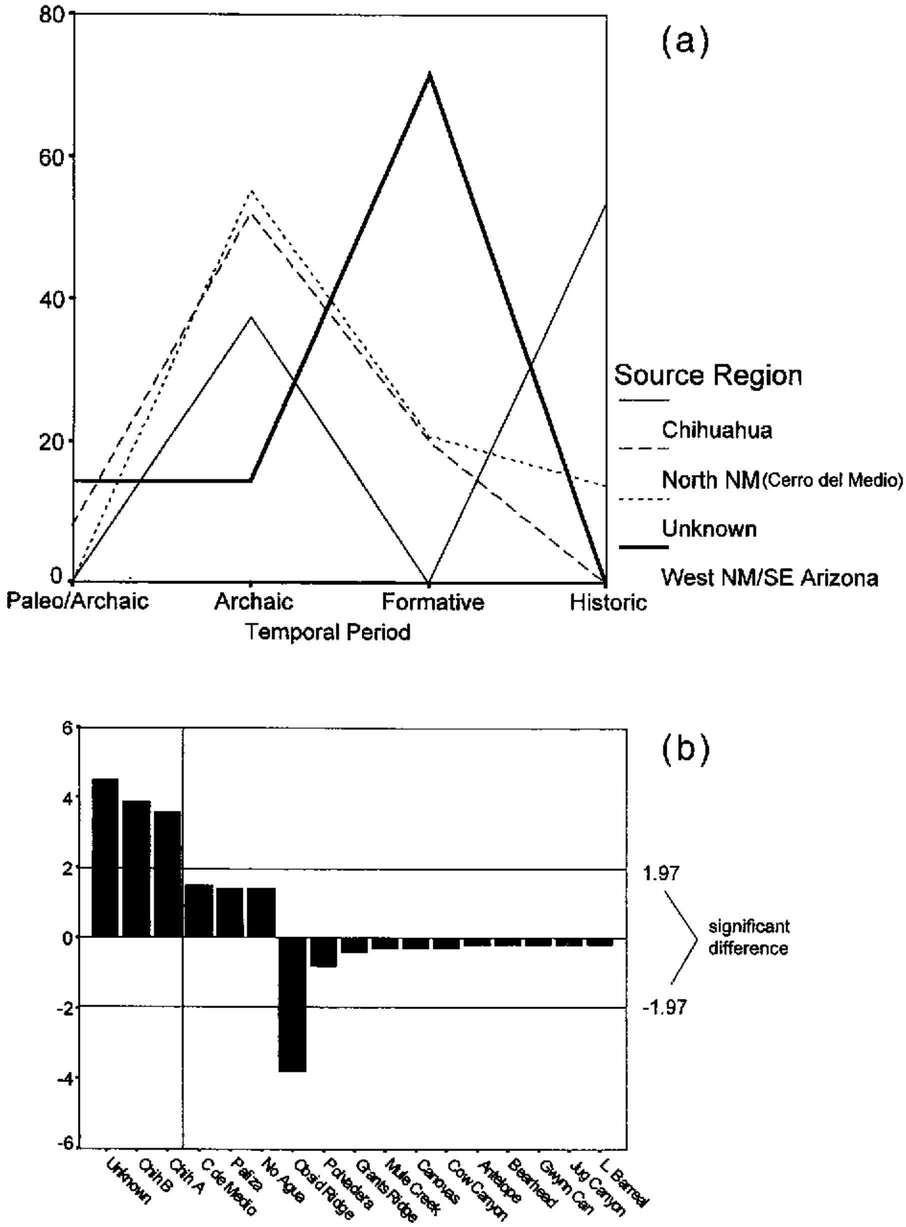

Fig. 7.19. Distribution of obsidian sources identified in Jornada Mogollon artifact assemblages: a, major temporal periods; b, projectile points and bifaces (from M. Miller and Shackley 1998).

Obsidian sources present in Archaic assemblages are distributed primarily along a north-south axis, while sources present in Formative period contexts have an east-west geographic distribution. Overall, a surprisingly minor amount of Archaic period obsidian is from sources in western New Mexico and southeastern Arizona, indicating that territorial ranges were primarily restricted within the Chihuahuan Desert basin and range ecozone of the Trans-Pecos, south-central New Mexico, and northern Chihuahua.

Interestingly, a similar interpretation has been proposed by Michael R. Beckes and James M. Adovasio (1982; see also Adovasio 1974). Detailed studies of Archaic period textiles from rockshelters throughout the Trans-Pecos, the Mogollon region of western New Mexico, and Coahuila identified several similarities in diagnostic basketry and weaving methods between the Trans-Pecos and northern Mexico. Beckes and Adovasio propose the existence of a related tradition and similar developmental continuum and also that the "TransPecos Archaic north of the Rio Grande is but a single expression or a series of regional expressions of the Archaic culture(s) directly to the south of that artificial border" (Beckes and Adovasio 1982, 207). In stark contrast to this broad Archaic tradition, textiles from Formative or Late Prehistoric period contexts have predominantly Mogollon (western New Mexico) characteristics. Together, data from obsidian distributions and textiles indicate that a pronounced shift in regional dynamics occurred at the close of the Archaic period.

Summary of the Archaic Period

Important changes in subsistence, settlement mobility and land use, territorial ranges, and technological organization apparently took place during the Archaic period. However, several of the observed trends, and particularly inferences derived from these observations, are tentative. Clearly, additional information in the form of corroborative data sets is required, particularly through analyses of faunal, macrofloral, and other subsistence data, settlement patterns, chipped stone assemblages, and raw material distributions. It is hoped that our discussion will provoke a broader consideration of settlement and adaptation over the long Archaic sequence.

The rarity of radiocarbon-dated features during the Middle Archaic period may be due to large-scale changes in subsistence practices and landscape use that are distinct from the Early and Late Archaic. Such a perspective offers an alternative means of investigating this temporal interval that reaches beyond explanations based solely on site preservation and archeological visibility. The Late Archaic period is also marked by several distinct changes in demographics, land use intensity, feature variability, and technology. These cultural patterns that became accentuated or intensified during the Late Archaic persist through much of the subsequent Formative period.

Formative Period/Late Prehistoric Period (A.D. 200–1450)

The Formative period encompasses several important transitions in prehistoric settlement adaptations. In the western Trans-Pecos, a relatively rapid succession of changes in architectural form, settlement structure, subsistence, and technology occurred, including a decreasing mobility coupled with increasing agricultural dependence and specialization, culminating in the A.D. 1250/1300–1450 Puebloan occupations. A similar pattern took place in the La Junta district of the eastern Trans-Pecos. While the agriculturally based Puebloan occupations of the Jornada and La Junta regions have received the most attention, the results of sporadic work conducted throughout other areas of the Trans-Pecos suggest that Native Americans in those locations were also affected to some degree by these significant cultural changes.

Chronological sequences for the Late Prehistoric period are generally undefined throughout much of the eastern Trans-Pecos. Developments in these areas have often simply been assigned to a generic Late Prehistoric temporal interval, although cultural-historical sequences from adjoining regions have occasionally been adopted. Three generally contemporaneous phases have been defined for the Jornada and La Junta regions. In the La Junta district (J. C. Kelley et al. 1940), these include the poorly defined Chisos phase (A.D. 1–900/1000), the Livermore phase (A.D. 900/1000–1200), and the La Junta phase (A.D. 1200–1400).

The Formative period in the western Trans-Pecos also has been traditionally divided into three phases (Lehmer 1948): Mesilla (A.D. 900–1100), Doña Ana (A.D. 1100–1200), and El Paso (A.D. 1200–1400). Lehmer's original beginning date of A.D. 900 for the Mesilla phase has been extended to A.D. 200/400, depending on the source and consideration of when El Paso brownware ceramics first appear (see Miller's discussion in Perttula et al. 1995a). Whalen (1978, 1985b) subsequently integrated these phases into larger taxonomic units, placing the Mesilla phase within the Early Formative, or Pithouse period, and the Doña Ana and El Paso phases within the Late Formative, or Pueblo period.

The tripartite sequence of Mesilla, Doña Ana, and El Paso is used in most cultural-historical overviews, and regional developments and/or evolutionary trends are described accordingly within this structure. Commonly cited characteristics of the Mesilla phase include insubstantial pithouse architecture, plain El Paso brown ceramics (Fig. 7.20), and nonlocal wares such as Mimbres whiteware. Domesticated plant species were utilized, although cultigens appeared to have played a minor role in what continued to be a mobile hunter-gatherer adaptive system. The Doña Ana phase, the existence of which has long been a subject of contention, has been considered part of the pithouse-to-pueblo transition. Architectural forms included pithouses as well as surface rooms. El Paso plain brown, bichrome, and polychrome ceramics were produced, and the presence of a wider variety of nonlocal ceramic wares suggests greater levels of interaction with adjoin-

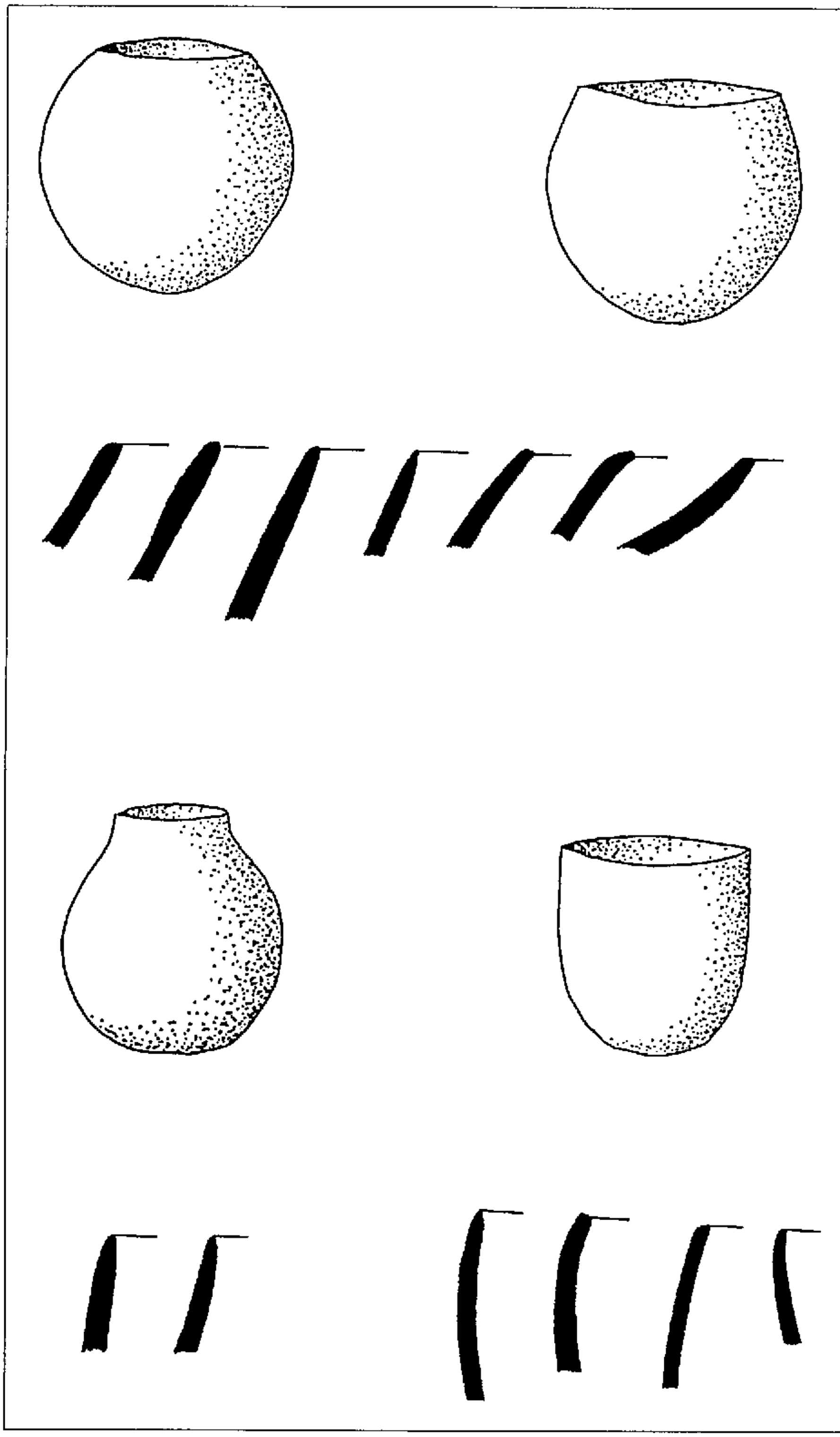

Fig. 7.20. El Paso Brown vessel forms and rim profiles.

ing regions. The El Paso phase, considered to be the apex of Native American cultural development in the region, includes habitation in pueblos by agriculturally dependent populations, reduced settlement mobility, a more restricted settlement distribution focusing on well-watered landforms across the landscape, and greater levels of social complexity and religious expression.

Recent temporal and taxonomic revisions to this Formative period sequence in the western Trans-Pecos suggest that the Mesilla phase (Pithouse period) probably dates from A.D. 200/400 to 1000, the Doña Ana or Transitional phase from A.D. 1000 to 1250/1300, and the El Paso phase (Pueblo period) between A.D. 1250/1300 and 1450. It would be equally plausible to characterize the A.D. 1000–1150 period as a terminal extension of the Mesilla phase, with recognition of a transitional pithouse-to-pueblo interval between A.D. 1150 and 1250/1300. However, the terms "Pithouse period," "Pueblo period," and "pithouse-to-pueblo transition" are somewhat misleading in that pithouses were used throughout the Formative period, as well as during the earlier Middle and Late Archaic periods.

Clearly, there exists a substantial degree of confusion and debate over the present sequence of phases, their nomenclature and material culture manifestations, and other aspects of regional phase-based systematics. As argued by M. Miller (1993a, 1996b), resolution depends on which criteria—adaptive changes or normative lists of material traits (such as ceramics and architecture)—are used to partition the archeological sequence. Considerable overlap exists among material culture traits conventionally used to partition cultural-historical phases and periods, and as such the chronological periods may be best viewed in a heuristic sense. The use of phases and periods serves not only to obscure important patterns in the prehistory of the region but also may often accentuate the importance or apparent abruptness of certain cultural patterns that realistically can be viewed as part of a continuum. For example, the A.D. 1000 beginning date for the Transitional or Doña Ana phase implies that subsequent developments occurred independently of, or at least signify a major departure from, those of the preceding Mesilla phase. However, several aspects of the Mesilla phase may also be considered part of this long trajectory. The trend toward sedentary—or at least semisedentary—and agriculturally based adaptations that are characteristic of the El Paso and La Junta phases had their initial origins in developments beginning during the latter part of the Mesilla phase (A.D. 600–1000), if not in the earlier Late Archaic.

Developments between A.D. 200/400 and 1450 are considered part of a continuum of increasing agricultural dependence and social integration, and this continuum is reflected in a corresponding decrease in settlement mobility. The refined chronometric resolution and extensive database compilations available for study can be employed to document synchronous trends among a number of regional patterns. Changes in architectural form and site structure are reflected by changes in regional settlement patterns and land use. These changes, in turn, closely correspond with periods of change or stability in technologies such as groundstone, ceramics, chipped stone, and thermal features. Several of these trends cut across one or more of the time intervals traditionally assigned to the Mesilla–Doña Ana–El Paso phase sequence, and important transitional periods in the archeological record do not match the specific points in time conventionally used to delimit phase boundaries, inasmuch as such phase boundaries are intended to denote major periods of change.

Formative period cultural developments as reflected by changes in architecture, settlement pattern, and technology have almost universally been perceived in terms of increasing agricultural dependence; current evidence does not appreciably alter this. However, archeological information from the Jornada region also suggests that prehistoric populations may have become more agriculturally *specialized* between A.D. 1250/1300 and 1450. While similar architecture and material culture patterns exist in the La Junta district of the eastern Trans-Pecos, the degree of agricultural dependence or specialization may not have been as pronounced. Elsewhere throughout the eastern Trans-Pecos, corresponding changes suggest that agricultural developments in the Jornada and La Junta regions had a broad reach or that at least some level of interaction occurred between these various Native American groups.

Architectural Forms and Settlement Structure

The most conspicuous aspect of the Formative period involves the increasingly formal organization of residential settlements and accompanying changes in architectural form that occurred between A.D. 200 and 1250/1300. Several important trends occurred during this thousand-year period, beginning with habitation primarily in informally constructed huts and pithouses, moving on to more formally constructed rooms, and ultimately the joining of rooms to form contiguous room blocks, or pueblos.

Much of the early avocational and professional archeological work in the region prior to the 1980s emphasized the definition and description of Formative period architectural forms, often to the exclusion of detailed studies of material culture and subsistence remains. Despite this shortcoming, the sequence of architectural developments in the western and eastern Trans-Pecos serves as a fundamental point of reference for interpretations of changing patterns of settlement mobility and sedentism, agricultural dependence, and changes in social and technological organization. Discussions of residential structures in the Southwest and other regions have acknowledged the energy investment of differing house forms as an indication of the mobility of the inhabitants (e.g., Binford 1990; Gilman 1983, 1987). The ephemeral and shallow pithouse structures characteristic of many Mesilla phase occupations involved little energy expenditure, implying occupations of shorter duration or lesser intensity than the formal house structures and pueblos of later periods. With these issues in mind, we preface the following discussion with an updated review of the architectural sequence of the Trans-Pecos. Newly acquired chronometric dates from several habitation sites allow the sequence to be placed in a reliable temporal framework.

There has been considerable discussion of various forms of prehistoric residential structures in the Trans-Pecos (e.g., Brook 1975; Carmichael 1985; Hard 1983a, n.d.; J. C. Kelley 1985, 1986; Lehmer

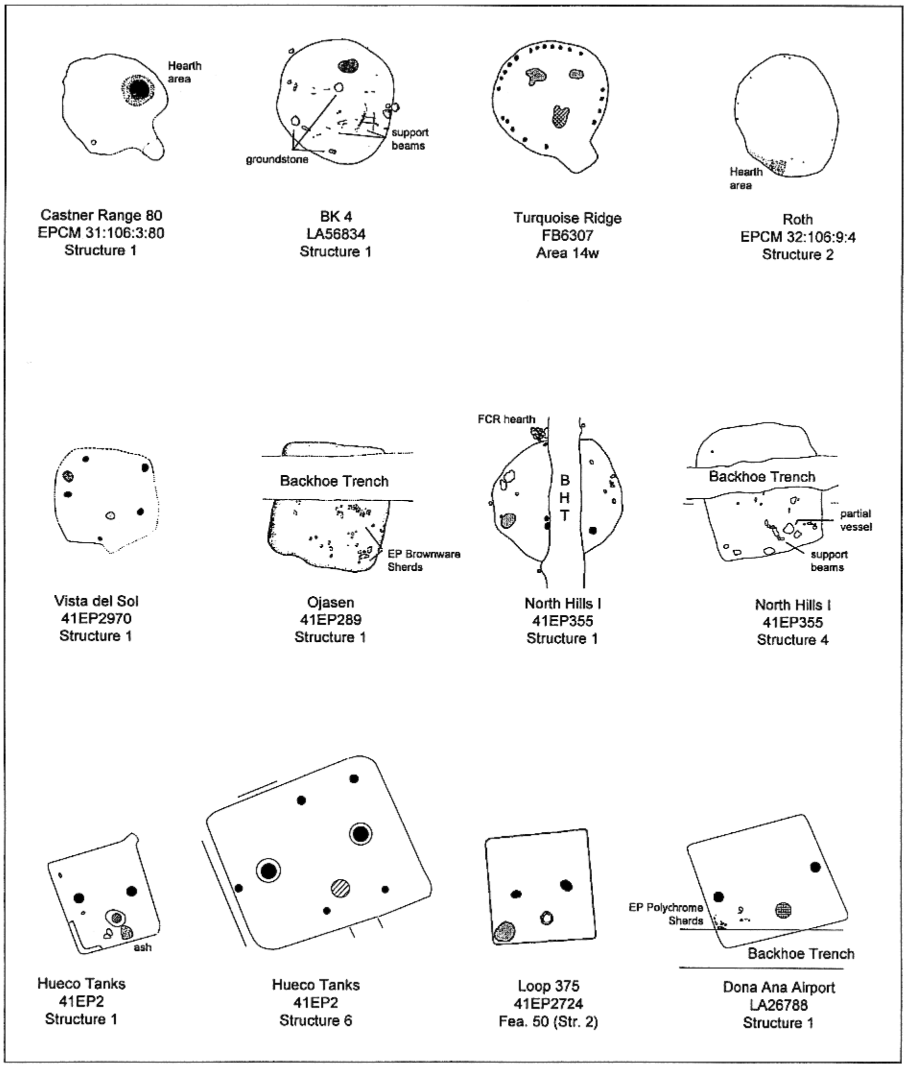

Fig. 7.21. Examples of Formative period house forms from the western Trans-Pecos. The upper two rows show examples of structures representative of the Mesilla phase and earlier part of the Transitional period; the lower row illustrates examples of isolated rooms from the later Transitional period and the El Paso phase.

1948; Marshall 1973; M. Miller 1989, 1990, 1994; O'Laughlin 1980; O'Laughlin and Martin 1990; Whalen 1977, 1980b, 1994a). Architectural forms of the Formative period may be subsumed under four categories: huts, pithouses, formally constructed noncontiguous (isolated) rooms, and contiguous room blocks or pueblos (Fig. 7.21). These categories are intended primarily to facilitate comparisons and should not be understood as representing the entire range of architectural diversity in the region.

A common form of residential structure found at many habitation sites of apparently short duration is what Whalen (1981a) and Hard (1983a, 44) termed "huts." These structures have small diameters (averaging 2.5 m) and shallow (15–30 cm) dish-shaped basins with sloping, insubstantial walls. They lack prepared floors or walls and have roughly circular occupation floors (average floor area of 6.5 m^2). Common at Mesilla phase sites (Camilli et al. 1988; Hard 1983a; O'Laughlin 1981; Whalen 1978, 1980b, 1994a), similar structures dating to the Archaic period have also been documented at Keystone Dam site 33 (O'Laughlin 1980) as well as at the Late Formative period component of Keystone Dam site 37 (Carmichael 1985). In each case, the structures have been interpreted as a form of ephemeral brush hut or wickiup, and a high degree of mobility has been inferred for the Native American occupants (Carmichael 1985; Hard 1983a; O'Laughlin 1980; Whalen 1994a).

Pithouse structures include circular and subrectangular or square shapes. Later pithouses tend toward subrectangular and square shapes, but there is considerable variation across the region, and two or more shapes may occur within individual sites. Circular pithouses of the Late Formative period tend to be more substantial than their predecessors of the Mesilla phase, often having greater depths and floor space, although a clear lack of formality in construction continues. These differences may also reflect shifting settlement locations, as pithouses situated in riverine zones and alluvial fans tend to be more substantial than those documented in the central basin landforms. Prepared or plastered floors and walls are rare in pithouses, but subfloor features include small, unlined hearths, few and irregularly positioned postholes, and occasional storage pits. Many structures, however, lack subfloor features.

More formally constructed structures, namely formal, noncontiguous rooms, or simply isolated rooms, appear during later time intervals; the term "pit room" has also been used, along with the somewhat inappropriate term "pithouse." These structures have a substantially greater formality and uniformity in construction than pithouses. Typically, they are square in shape, shallow in depth, and have prepared caliche or adobe-plastered floors; walls are also occasionally plastered. Interior subfloor features include centrally located fire pits surrounded by raised, plastered collars, occasional storage or burial pits, and sometimes stepped entryways. Exterior and interior posthole arrangements vary, but two main support posts are usually present along a central axis (see Fig. 7.21).

This architectural form may be a precursor to pueblo rooms, and similarities between the two room forms have been noted (Batcho et al. 1985; O'Laughlin and Martin 1990). The primary distinction between the two forms is that pueblo rooms are joined together to form contiguous room blocks, although isolated rooms tend to have smaller floor areas than pueblo rooms. Characteristics shared between the two forms include square or rectangular shapes and caliche-plastered floors and walls. Pueblo floor and subfloor features include collared hearths, storage or cache pits, and burial pits (see Fig. 7.21). Entry steps are often present in pueblo rooms, as are occasional small, raised platforms (sometimes referred to as "altars"). Primary posthole patterns in pueblo rooms follow a three- or four-post pattern.

Dating the Trans-Pecos Architectural Sequences

Chronological placement of these architectural forms and accompanying settlements has long been a matter of uncertainty and debate. Until recently the chronological placement of pithouse and pueblo settlements was based on ceramic cross-dating and a small sample of chronometric dates (see Brook 1970; Whalen 1983, 1985a). Indeed, as of 1992 only twenty-eight radiocarbon and fourteen archeomagnetic age estimates had been obtained for El Paso phase residential sites, and the majority of radiocarbon dates were from isolated pit room sites (Batcho 1987; Browning 1991; Browning et al. 1992; Duran and Batcho 1983; O'Laughlin and Martin 1990). Radiocarbon dates were often from vague or ambiguous contexts and were seldom corrected for isotopic fractionation. Moreover, the few archeomagnetic dates were based on early experimentation with the method and derived from secular variation curves (DuBois 1989) that have yet to be fully reported; they also differed substantially from those proposed by other archeomagnetic laboratories.

Recent compilations of chronometric dates, combined with intensive dating studies undertaken during the Fort Bliss Chronometric and National Register Pueblo projects (Bentley n.d.; M. Miller 1996a), have provided a data base of more than 400 radiocarbon dates for Formative period pithouse, pueblo, and isolated room components. Archeomagnetic sample cubes were reanalyzed using improved instrumentation, and the age estimates were revised using the most recent secular variation curves. Hot Well Pueblo, with 41 radiocarbon and 10 revised archeomagnetic dates, is now the most intensively dated site in the Trans-Pecos region. Fig. 7.22 presents series of summed probability distributions for the sample of more than 350 radiocarbon age estimates obtained from contexts directly associated with the major architectural forms.

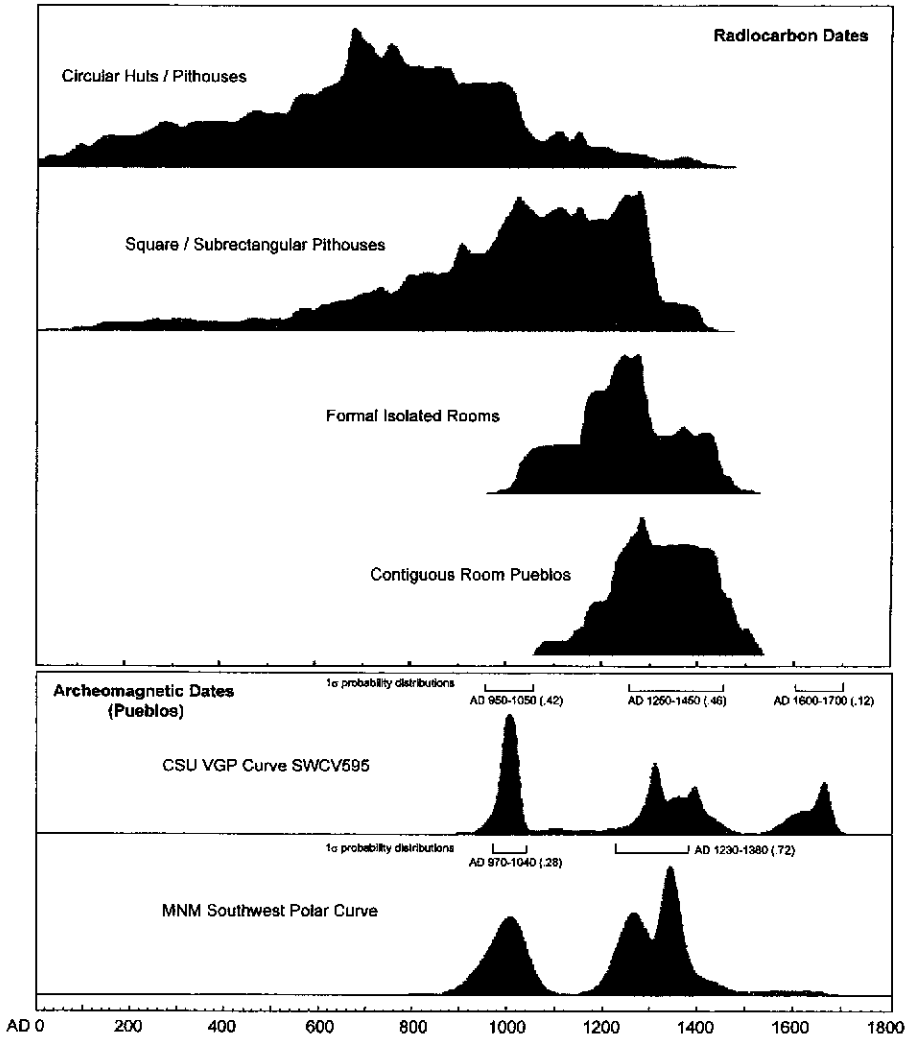

Fig. 7.22. Summed probability histograms of radiocarbon and archeomagnetic age estimates for Formative period architectural forms in the western Trans-Pecos/Jornada Mogollon region. Note that archeomagnetic dating provides multiple age ranges due to inversions in the secular geomagnetic polar curves and that curves developed by differing laboratories provide varying age estimates.

Rather than attempt to isolate specific differences between huts and pithouses, for this study we have assigned round or square/subrectangular forms to structures.

Several architectural trends and transitions are apparent. First, there is a shift from circular huts/pithouses to square pithouses between A.D. 700 and 1000, with several more abrupt architectural changes at approximately A.D. 1000, 1150, and 1250/1300 (see Fig. 7.22). At ca. A.D. 1000, circular pithouses are almost entirely replaced by rectangular structures; the first isolated rooms appear at this time. A less pronounced change occurs at A.D. 1150, when the number of chronometrically dated isolated rooms increases by more than 100 percent while the proportion of informal pithouses decreases. A fourth change occurs between A.D. 1250 and 1300. The precise dating of this fourth event involves a greater degree of imprecision because a major inversion point, or "wiggle," occurs in both the bidecadal and decadal dendrochronological calibration curves at this time, with the result that radiocarbon age estimates tend to either begin or end at around A.D. 1280. The construction and occupation of pithouse structures essentially ends between A.D. 1250 and 1300, and the use of formal isolated rooms declines to that of the preceding A.D. 1000–1150 interval. Coincident with the decline in the use of pithouses and isolated rooms, the majority of contiguous pueblo rooms and

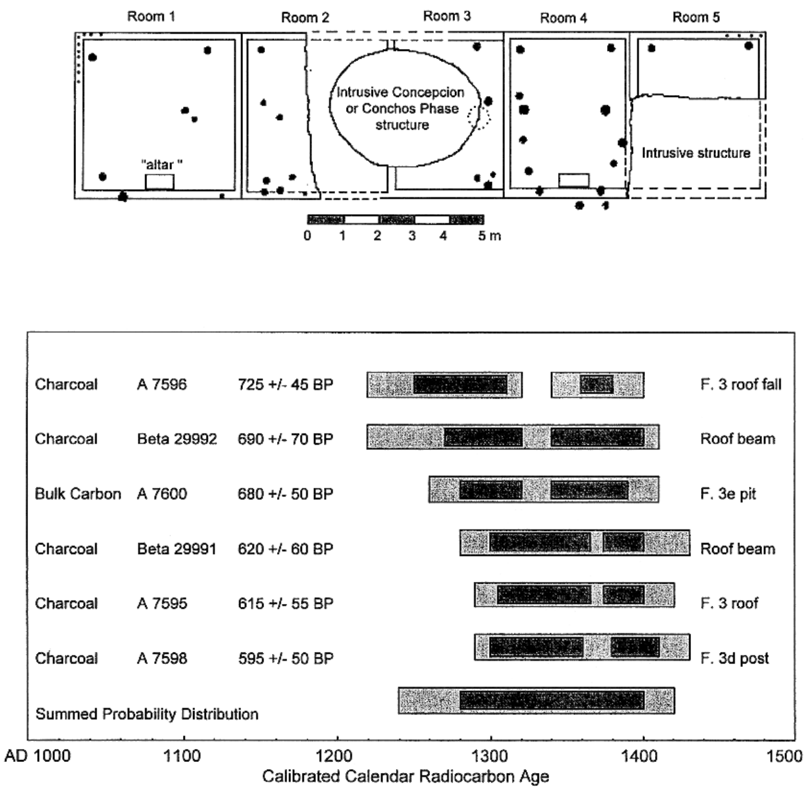

Fig. 7.23. Planview of the La Junta phase pueblo at the Millington site, Presidio County, Texas (after J. C. Kelley 1985, 153) and radiocarbon dates from La Junta phase architectural features at the Polvo site (41PS21), Presidio County, Texas (data from Cloud et al. 1994, 35; Mallouf 1990, table 1). Summed probability distribution of these age estimates is A.D. 1280–1400 (1-sigma) and A.D. 1240–1420 (2-sigma).

room blocks date to between A.D. 1300 and 1400.

In the eastern Trans-Pecos, Mallouf (1990; see also J. C. Kelley and E. A. Kelley 1990) obtained two radiocarbon dates from a La Junta phase structure. Further test excavations (Cloud et al. 1994) obtained an additional sequence of dates. The six age estimates provide the first chronometric data for architectural forms in the region (Fig. 7.23). The six dates consistently range between A.D. 1240 and 1420, contemporaneous with the period of pueblo construction in the Jornada region. Two shallow, circular pithouses were also excavated at the margin of Salt Lake in Salt Flat Basin, east of the Guadalupe Mountains (M. Miller 1994). Five radiocarbon dates from floor and fill contexts range between A.D. 600 and 1280. Another small hut structure in the Delaware Mountains is associated with several thermal features that yielded radiocarbon dates ranging from A.D. 1000 to 1400. While few structures and even fewer dates are available from this region, preliminary evidence suggests that the general sequence of architectural forms in the La Junta District follows the trend of increasing formality apparent in the western Trans-Pecos. Elsewhere in the Trans-Pecos, architectural forms are more conservative, with small huts and pithouses predominant throughout the sequence.

The clarification of the chronological sequence of architectural trends and transitions establishes an important framework for understanding the nature of changing demographic, mobility, and subsistence patterns during the Formative period. First, it is important to understand that during any given temporal interval at least two architectural forms were in use, each representing different levels of formality and labor investment in construction. Second, each temporal interval represents a progressively greater level of architectural formality. Shallow, circular pithouses (huts) were common throughout the Mesilla phase (and Archaic period), as were more substantial square or subrectangular pithouses, although at the regional scale the frequency of these structural forms covary through time until A.D. 1000, when circular structures were apparently no longer built. Both subrectangular pithouses and isolated rooms were inhabited between A.D. 1000 and 1250/1300. Again, the relative frequencies of these two forms covary until sometime between A.D. 1250 and 1300, when, for the most part, pithouses were no longer constructed. Pueblos were occupied during the A.D. 1250/1300–1450 interval, but habitation of isolated rooms persists through this period (see Fig. 7.23).

The dated architectural sequence also provides important insights into changing patterns of mobility. Cross-cultural studies of architectural form have noted a recurrent pattern linking round, insubstantial structures with mobile settlement systems, while angular structures tend to be affiliated with more sedentary groups (Binford 1990; Hunter-Anderson 1977). Lewis R. Binford (1990) also noted that groups with variable or seasonal mobility patterns tend to construct two or more house forms. Seen in this perspective, the shift from circular to square or rectangular structures, as well as the increasingly formal nature of the angular structures, can be interpreted as evidence for decreasing mobility during the Formative period and that variable mobility and adaptive strategies may have existed during any given temporal interval.

Variation in Settlement Layout

The architectural picture becomes more complex when variations in settlement layout (site structure) and site formation processes are considered. Site settlement layout in earlier components of the Formative period is known from a small sample of sites; therefore our impression may not represent the range of spatial variability. In particular, information on the layout of riverine settlements of this period is lacking. Yet a range of intrasite arrangements of residential structures, extramural features, and activity areas is apparent.

Several sites belonging to the Mesilla phase and early part of the Transitional period, including Turquoise Ridge, North Hills, Gobernadora, and Ojasen (M. Miller 1989, 1990; Shafer et al.

1999; Whalen 1994a), have central clusters of pithouses surrounded by discrete activity areas with groups of fire-cracked rock features (Fig. 7.24). The most common type of activity area is one or more rock-lined pits adjacent to scatters or mounds of discarded, fractured rock. Dense trash middens are also present. Extramural hearths and pits are rare.

Despite the apparently coherent settlement layout of these sites, unequivocal evidence for temporal differences among different site areas and feature types has now been recognized (M. Miller 1990, 1995b; Whalen 1994a), most notably with stratigraphic and horizontal differences in midden formation and pithouses at North Hills. Fig. 7.25 illustrates one of the more intriguing aspects of site use. While chronometric dates for pithouses and midden deposits range between A.D. 900 and 1150, the majority of age estimates from rock-lined pit features date between A.D. 1150 and 1250/1300, coeval with subsequent architectural and settlement changes involving isolated rooms. While not discounting the fact that these are terminal use dates for these features and that the features may have been used during earlier occupations, it is nevertheless clear that a specialized use of these sites involving rock-lined thermal features continued after the abandonment of residences.

Occupations representing the later portion of the Transitional period, such as Meyer Range, present quite a different arrangement of pithouses, isolated rooms, and extramural features. Here, central clusters of pithouses are surrounded by a large number of features: hearths, trash pits, and other forms of pits. Again, however, evidence for multiple occupations is indicated by dense trash deposits in structure fills, superpositioned features, and chronometric dates. The latter indicate that Meyer Range dates between the North Hills and Hueco Tanks Transitional period occupations, with Hueco Tanks dating the latest (M. Miller 1996b). The latest Transitional period sites have distinctive house structures that mark a departure from earlier pithouses. Recent investigations during the Loop 375 Archeological Project (O'Laughlin and Martin 1990) have documented two sites similar to Hueco Tanks in terms of layout and architectural form (see Fig. 7.24). As with Meyer Range, numerous and varied

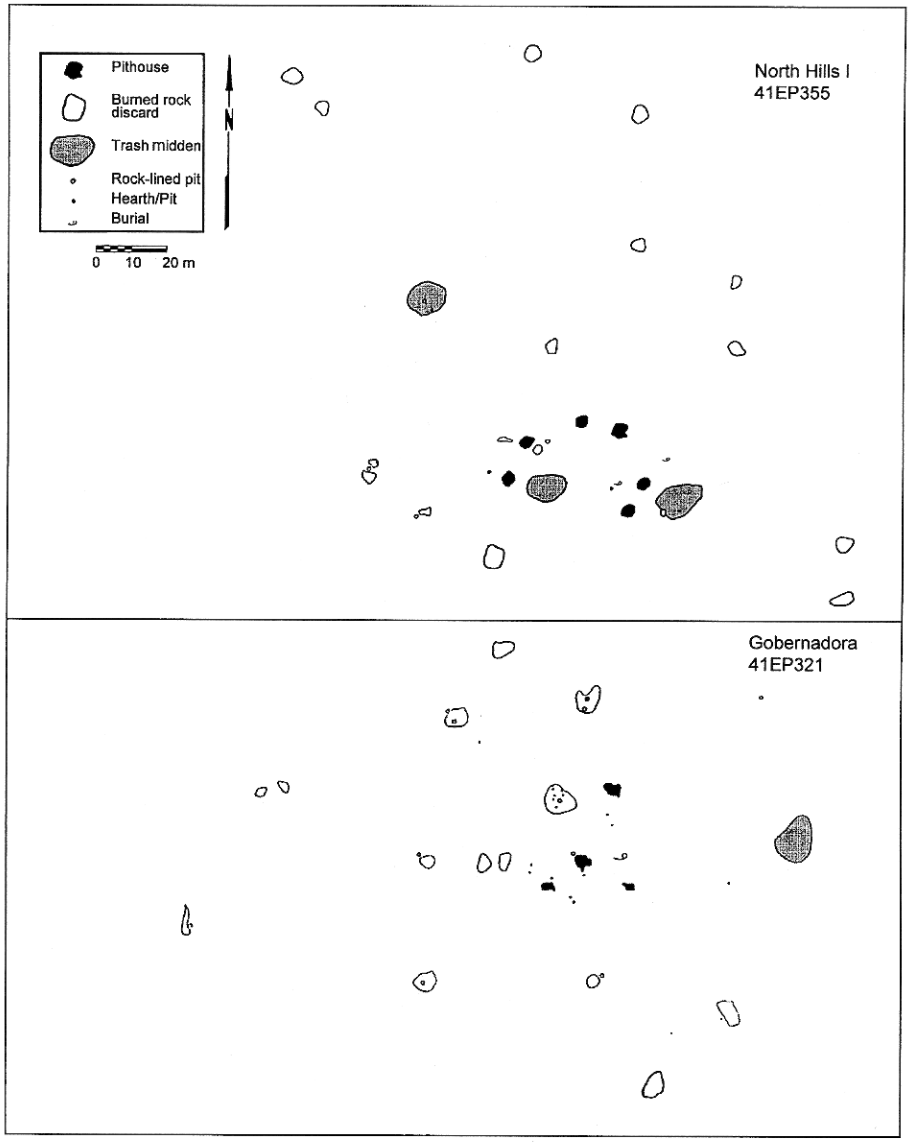

Fig. 7.24. Site structure at the Transitional period settlements of North Hills I and Gobernadora, El Paso County, Texas (from M. Miller 1989, 1990), Meyer Range (FB6281), and 41EP2774 (after O'Laughlin and Martin 1990; Peterson 1996; Scarborough 1986a).

extramural features are present within the house cluster. Based on this preliminary sample, there appears to be a correlation between change in architectural form and site layout, most notably in the presence of extramural features such as formal refuse pits and storage facilities.

Settlement layouts at pueblo components of the El Paso phase are equally complex and variable. Michael Marshall (1973) defines two major room block arrangements for Jornada Mogollon pueblos: linear and plaza. Linear room blocks are oriented along an east-west axis, except in riverine settings or along major drainages where the orientation is generally parallel to the watercourse. Plaza arrangements are less common and are known from only a few of the larger pueblos (up to one hundred rooms), such as Indian Tank in the San Andres Mountains north of El Paso and Alamogordo Site 3 near Alamogordo, New Mexico (Browning 1991; Lehmer 1948; Lekson and Rorex 1987).

While a few large plaza-oriented pueblos are known, more common are multiple linear room blocks with occasional isolated rooms distributed among the blocks. For example, it is has been estimated that more than one hundred rooms are present at Hot Well Pueblo, of which forty-five have been excavated. These rooms are distributed among three areas that are more than one hundred meters apart. A fourth equally distant area is

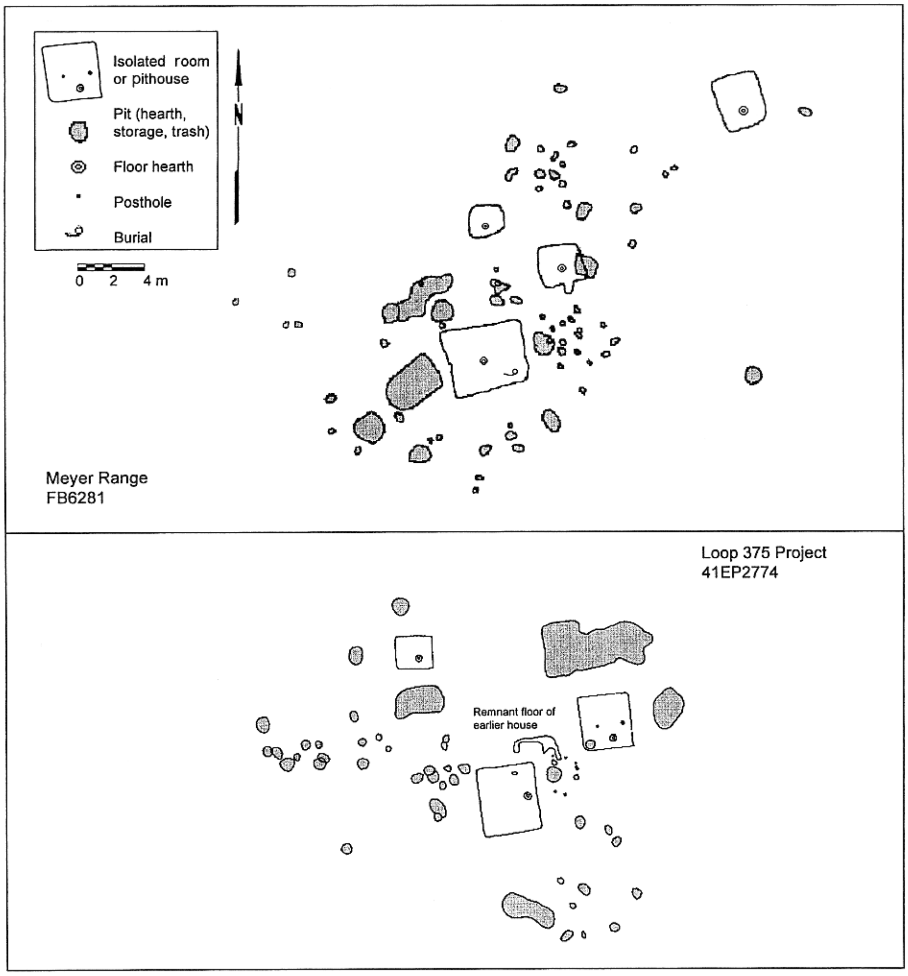

Fig. 7.24. (continued)

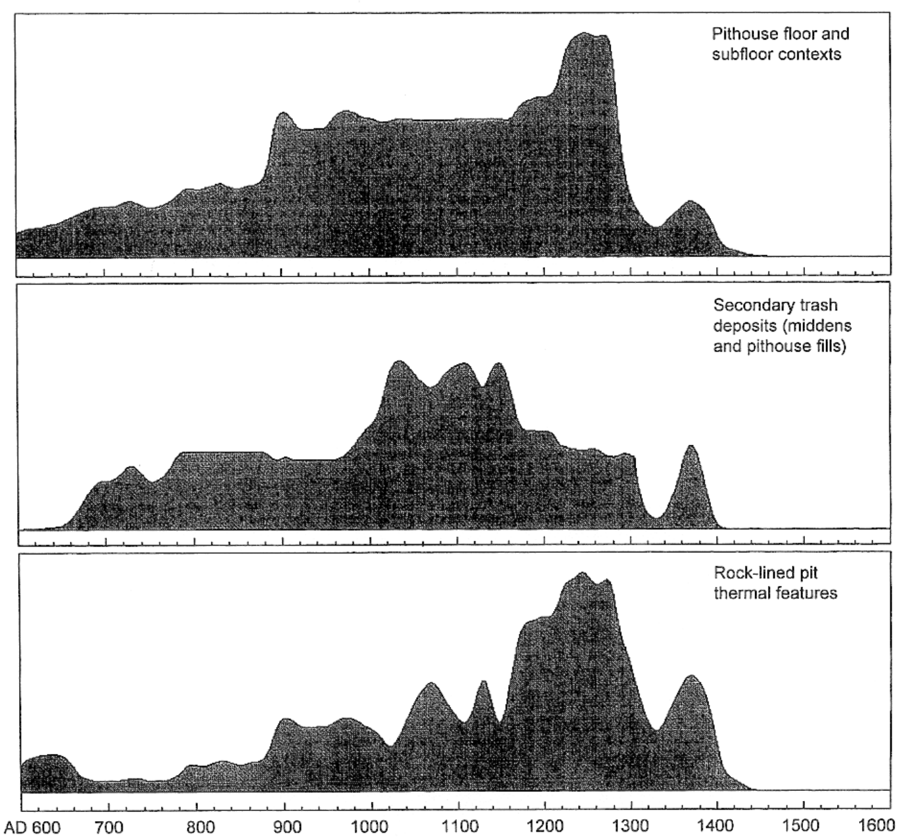

Fig. 7.25. Comparison of chronometric trends among major proveniences at the Gobernadora, Ojasen, and North Hills I sites, showing tendency for rock-lined thermal features to date later than the majority of pithouses and trash deposits (after M. Miller 1995b).

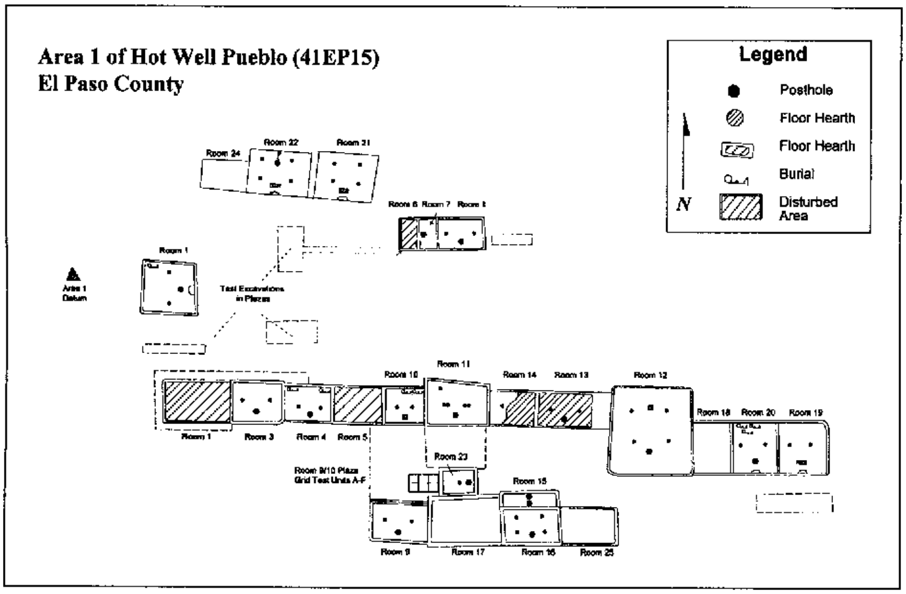

Fig. 7.26. Layout of rooms and room blocks at Area 1 of Hot Well Pueblo (41EP5), El Paso County, Texas.

present, but it is known from only a single excavation unit in a room completed by Vernon L. Scarborough (1986a). Each of the areas consists of two or more room blocks. To date, the largest block excavated is Room Block 1 in Area 1, which consists of twelve rooms (Fig. 7.26). This room count is typical of linear room block arrangements, and the majority of pueblos in the region have fewer than ten rooms (see, e.g., Bradley 1983; Gerald 1988; G. Moore 1947; Scarborough 1985). A notable pattern among linear pueblo room blocks is the presence of a single large room. These rooms have generally been characterized as ceremonial or communal, and their consistent presence within individual room blocks does suggest some common function, possibly associated with lineage or corporate groups inhabiting a room block.

As pointedly observed by O'Laughlin (1996), extramural excavations have rarely been undertaken at pueblos. An exception is Firecracker Pueblo, where several hundred square meters of excavations outside the room block resulted in the discovery of dozens of features: trash and storage pits, hearths, and several types of unknown function. Substantial numbers of rectangular pithouses and isolated rooms were also found. Less extensive excavations at Hot Well Pueblo between two major room blocks in Area 1 also documented several refuse deposits and pits. In contrast to Transitional period sites, dense midden deposits appear to be rare at pueblos, although the only thorough investigation of such features took place at La Cabrana.

Despite the apparent "village" orientation for many Formative period sites, isolated Formative period pithouse structures have been excavated at a substantial number of locations in the western Trans-Pecos (Batcho et al. 1985; Gerow and Hogan 1993; Kauffman and Batcho 1987, 1988; Lowry and Bentley 1997; Mauldin et al. 1998; M. Miller et al. 1993). The functional and economic role of these small sites, consisting of one or two isolated structures, in relation to larger settlements constitutes one of the more intriguing research issues in the Jornada.

The El Paso phase was long considered primarily a Puebloan occupation. Pueblos have been thought to be the predominant architectural form because, being among the more highly visible of site types, they naturally received the greatest amount of attention and excavation. Artifact scatters of lesser extent and density have only recently received notice. The existence of isolated rooms during the Pueblo period was not confirmed until 1983 with the discovery of such a structure at the Dona Ana County Airport project 16 km west of El Paso (Batcho et al. 1985; Duran and Batcho 1983; although see Brook 1966b for another possible example). Because several additional cases of El Paso phase isolated rooms have been encountered (Browning et al. 1992; O'Laughlin 1995, personal communication; O'Laughlin and Martin 1990; Sechrist et al. 1998), it can no longer can be confidently stated that contiguous pueblo room blocks were the primary focus of habitation during the Pueblo period.

Of importance in considerations of regional demographic and adaptive patterns is that changes in the architectural sequence and in site structure reflect shifts in settlement location and mirror temporal patterns expressed in features and artifacts across the region. Comparing these patterns to those identified in other recent overviews of radiocarbon dates (Mauldin 1995; Mauldin et al. 1998; M. Miller 1996a, 1997) reveals that shifts in the use of various architectural forms closely correspond with changes in frequency trends in the distribution of other feature types across different topographic zones. For example, the gradual temporal transition from circular to rectangular pithouses closely corresponds to the shift from settlements centered in the central basins to the alluvial fan piedmonts throughout the region.

Settlement Pattern and Land Use

Several shifts in regional settlement patterns occurred during the Formative period, each reflecting a change in demographic patterns and subsistence economies. In part, these shifts are a function of a change from generalized to more specialized agricultural adaptation, but more subtle patterns are also evident.

Knowledge of regional settlement patterns has been obtained primarily through large-scale surface surveys conducted at Fort Bliss in the 1970s and early 1980s (Beckes et al. 1977; Carmichael 1983, 1986; Mauldin 1993; Skelton et al. 1981; Way 1979a, 1979b; Whalen 1977, 1978, 1980a). Settlement pattern studies conducted by Whalen (1977, 1978) in the Hueco Bolson first identified a shift from a pattern of Mesilla phase settlements widely distributed across the interior basin to one of concentrations or "core areas" of El Paso phase settlements located along distal alluvial fans of the Franklin and Hueco Mountains, often adjacent to the margins of playas. Similar site distributions were observed during Carmichael's (1983, 1986) surveys of the Tularosa Basin, as well as in surveys in New Mexico near the Jarilla Mountains (Mauldin 1993; Way 1979a), the Sacramento Mountains (Sale and Ennes 1997; Skelton et al. 1981) and the San Andres Mountains (Duran 1982).

Both Whalen and Carmichael noted that El Paso phase components tended to be concentrated along alluvial fans, presumably to take advantage of rainfall runoff for irrigation. Carmichael (1983, 1986), however, observed a subtle difference and suggested that Doña Ana components tended to be situated at slightly higher elevations along medial and distal fans, in contrast to El Paso phase components that are generally situated at lower elevations on distal fan surfaces or the basin floor in proximity to large playas (Fig. 7.27). Early Formative (Mesilla phase) components are widely distributed throughout the basin, while Late Formative (Transitional and El Paso) settlements tend to cluster along the alluvial fans of the Organ Mountains or the fan/basin interface in the vicinity of Coe Lake playa. In addition, Transitional components tend to be distributed on higher surfaces of alluvial fans while El Paso phase settlements are closer to playas (see Fig. 7.27).

Recent archeological surveys within alluvial fan piedmonts of the eastern Franklin Mountains near El Paso (Kauffman and Stuart 1994; Sale and Gibbs 1995) and in the Sacramento Mountains (Sale and Ennes 1997), as well as excavations at several habitation sites on the medial Franklin Mountain fans (Aten 1972; M. Miller 1989, 1990; O'Laughlin 1979; Shafer et al. 1999), tend to support Carmichael's interpretation. El Paso phase components, particularly ones with residential structures, are exceptionally rare within the alluvial fan topographic zone.

Accordingly, the concept of El Paso phase "core areas" is still valid, but with modifications. More detailed archeological information, coupled with a refined understanding of chronology and ceramic sequences, suggests that several of these areas may more appropriately be viewed as foci of settlement during much of the Late Formative period, especially between A.D. 1150 and 1275, rather than exclusively during the El Paso phase. Recent investigations in one such core area at the northeastern edge of El Paso (Kauffman and Stuart 1994) involved revisits to several pueblo sites and "small camps" recorded in the 1970s and early 1980s. Numerous sites had been vandalized with small bulldozer trenches. Examination of these pits identified an extensive settlement zone containing isolated rooms and small pueblos.

Formative period settlements have also been recorded near the margins of playas in the central basins, along the upper terrace edges of the Rio Grande, within mountain canyons, or along major drainages in mountain bajada landforms. Isolated house structures of the Mesilla phase are distributed across most environmental zones. In contrast, isolated houses dating to the second half of the Transitional period and the El Paso phase tend to be situated near playas or the Rio Grande Valley terraces. However, the distribution of these late structures is tentative.

The riverine component of the Formative period settlement pattern is largely unknown. Several Mesilla phase pithouse sites such as Los Tules, Tortugas, and Roth are situated along the margins of the valley. Surprisingly few Transitional/Doña Ana residential sites or structures have been documented in this topographic zone. Several large and small pueblos were on the lower terrace of the Rio Grande

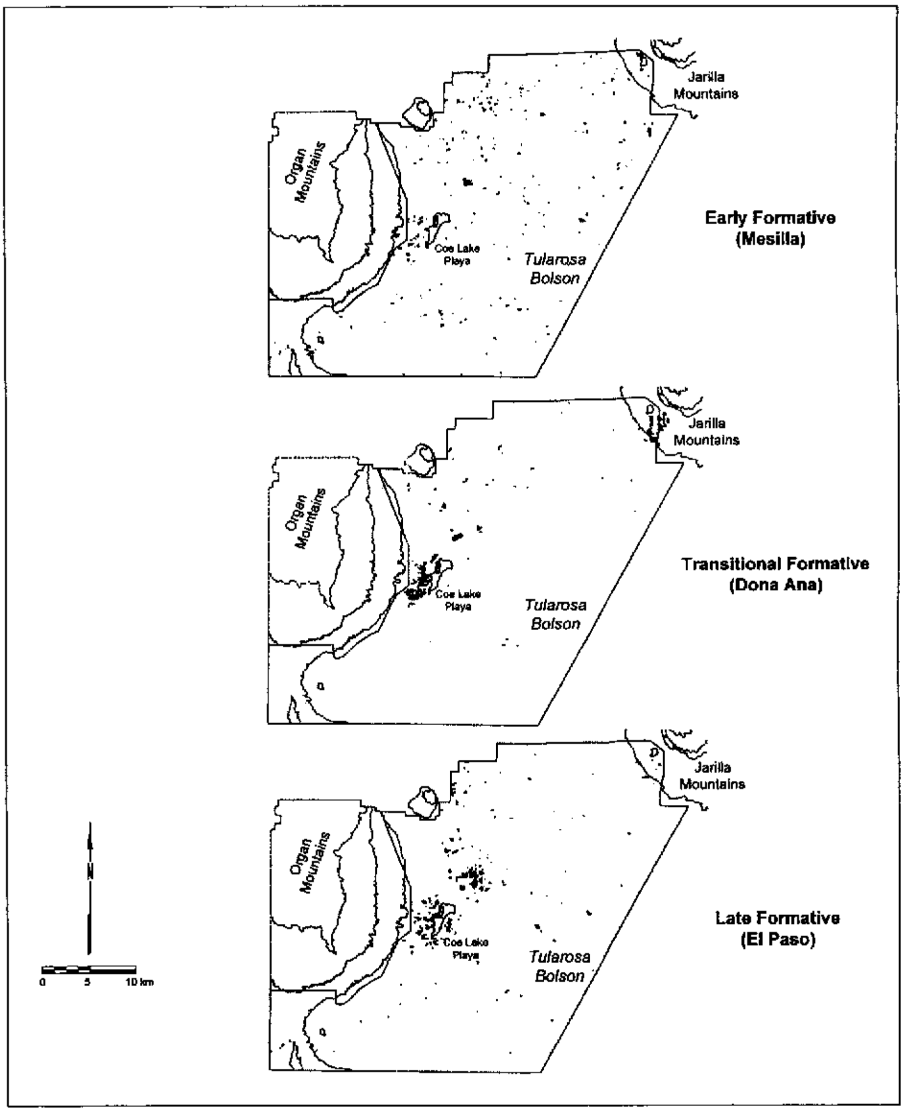

Fig. 7.27. Jornada Mogollon Formative period settlement patterns in the Tularosa basin of Fort Bliss (adapted from Carmichael 1985, 1986). Note position of Transitional components at higher elevations along alluvial fan piedmonts, particularly in the vicinity of the Jarilla Mountains at the northeastern margin of the survey area.

Valley between El Paso and Las Cruces (Brook 1975; O'Laughlin 1980). Unfortunately, several decades of urban and agricultural development have destroyed the majority of these sites and obliterated most of the prehistoric landscape.

An often overlooked aspect in the traditional focus on Formative period architectural sites concerns nonresidential sites or short-term sites with special processing facilities. Michael E. Whalen (1978) proposed the existence during the puebloan El Paso phase of special purpose sites with burned rock features along the alluvial fans of mountain chains. The majority of these features have been dated to before the pueblo interval of A.D. 1250/1300, although radiocarbon ages from some burned rock features range from A.D. 1250 to 1450, indicating that these features were used for subsistence activities even during presumably agricultural periods. Nevertheless, use of the features, and by extension the processing of cacti, succulents, or other items associated with their use, appears to have been substantially reduced during the El Paso phase in comparison to earlier periods (M. Miller 1997).

Reviewing radiocarbon dates from the Hueco Bolson, Mauldin (1994, 1995; see also Mauldin et al. 1998) demonstrates that site formation and use of thermal features significantly declined in the central basins after A.D. 1000. In order to amplify this study, we examine trends among major feature classes and topographic landforms in the Hueco, Tularosa, and Mesilla Bolsons (Fig. 7.28). We consider thermal features and habitation structures within three major environmental zones: the central basin floor, alluvial fans, and the fan/basin interface in proximity to major playas. For comparative purposes, Fig. 7.29 includes the previously reviewed chronometric trends for the four major architectural forms.

All feature types and topographic zones show a gradual rise in use through the early part of the Formative period (between A.D. 200 and 650). Between A.D. 650 and 1000, both residential occupations (as indicated by the presence of the structures) and thermal features are common throughout the central basins. However, this period is marked by a gradual increase in the use of alluvial fans. This subtle shift in settlement location

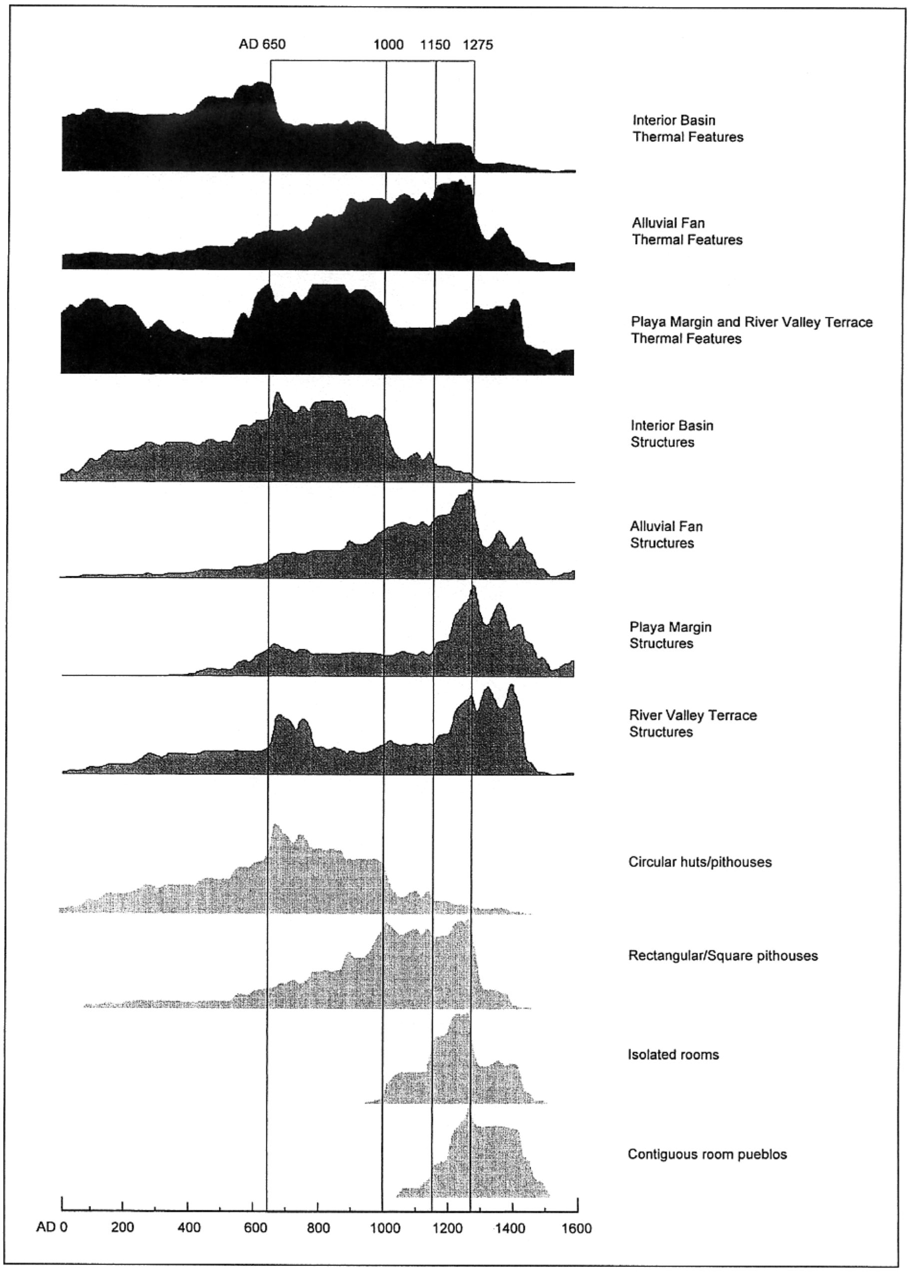

Fig. 7.28. Summed radiocarbon probability histograms illustrating changing land use patterns in the western Trans-Pecos/Jornada Mogollon region.

corresponds with the beginning of a gradual decrease in the use of circular structures as opposed to an increase in the construction of rectangular structures.

A major change in regional settlement takes place at A.D. 1000, one that signifies the relatively abrupt culmination of the landscape and architectural trends observed for the preceding 350 years. The construction and use of thermal features and structures in the central basins declines markedly, while occupation of alluvial fans continues to increase (see Fig. 7.28). Notably, this period of change corresponds with the rapid shift from construction and use of circular pithouses to that of rectangular pithouses. This feature use pattern continues until A.D. 1150, when another subtle shift in feature distributions is apparent across the landscape. At this time, utilization of the alluvial fans reaches an apex, while settlements in proximity to playas (at the fan/basin interface) also become common. Again, this settlement shift corresponds to another transition in the architectural sequence as indicated by a notable increase in the use of formally constructed isolated rooms. A major change in intrasite structure or settlement layout also takes place then.

Finally, feature distributions between A.D. 1275 and 1450 indicate that there is little evidence for settlements within the central basin, at least in terms of occupations requiring the use of structures and thermal features. Moreover, there is a marked decrease in the occupation of alluvial fans. In contrast, occupation of landforms in proximity to playas reaches the peak of intensity.

These results indicate that within any given time interval, variations in architectural form and site structure are greater, and patterns of land use more complex, than previously was recognized in the archeological record. These findings, in turn, mean that Formative period settlement mobility and subsistence adaptations may also have been more variable than was once thought to have been the case.

In summary, the early part of the Formative period is characterized by a dispersed settlement system, the exploitation of several environmental zones, and the use of ephemeral, circular house structures. However, the gradual trend of increasing use of the alluvial fans and construction of more substantial, rectangular pithouses foreshadows a major transition period at A.D. 1000. From then until A.D. 1150 there is a decrease in the occupation of the central basin landform and a rapidly increasing use of the alluvial fans. Construction of circular pithouses is discontinued in favor of rectangular pithouses and occasional isolated rooms.

The period between A.D. 1150 and 1275 is intriguing because it appears to be a time of dual settlement systems for residential occupations in the western Trans-Pecos. While two or more environmental zones were utilized during preceding periods, usually one zone predominated. However, between A.D. 1150 and 1275, the utilization of both alluvial fans and playa zones was roughly equivalent, although pronounced differences existed in the nature of the occupations within these two zones. The construction and use of house structures in both alluvial fans and playa settings suggests the existence of at least two distinctive patterns of mobility and resource exploitation. Additional evidence presented below tends to support this, and indeed this period marks an intensification in several aspects of the subsistence economy. There is not only evidence for increasing agricultural production but also an intensification of traditional subsistence practices based on the exploitation of cacti and other nondomesticated plants. Residential occupations were situated primarily in proximity to playas, while along the alluvial fans occupation evidence consisted primarily of thermal features, occasionally associated with isolated pithouse structures. It is during this period that increasingly formal architectural forms become common, and these house forms are associated with an increasingly coherent and organized use of site space, including a more patterned refuse disposal.

After A.D. 1000, there is a continual reduction in the use of the central basin landform. Overall, both thermal features and structures were rarely used in the central basin during the Late Formative after A.D. 1000, and this was particularly the case after A.D. 1275. Mauldin (1995, 1996a) argues that these changes reflect a major shift in subsistence and settlement organization, in effect marking a change from a predominantly residential use of the central basin to a more logistically organized pattern of exploitation with the advent of increasing sedentism and agricultural dependence. While the obsidian hydration data on which he partially bases his argument may be questioned on several grounds, other lines of evidence nevertheless fully support his interpretation. Studies of ceramics and projectile points collected during large-scale survey and testing projects in central basin landforms show that later varieties of El Paso brownware and small, triangular point forms are present in disproportionately high numbers compared to the low numbers of radiocarbon-dated features. These data do suggest that short-term logistical use of the central basins occurred during the Pueblo period.

In the absence of other forms of corroborative data, these inferences regarding the nature of mobility and subsistence based on observed patterns among architectural forms, site structure, and land use patterns remain unevaluated. Direct information on subsistence practices, in the form of macrofloral and faunal data sets, is required. Major trends in subsistence economies should also be reflected in specific changes in groundstone, ceramic, and chipped stone technologies, as well as other aspects of technological organization such as thermal and storage facilities.

Formative Period Subsistence Patterns

In understanding the changing nature of architectural forms, settlement structure, and landscape use in the western Trans-Pecos, it is critical to assess the degree of reliance on cultivated as opposed to wild or nondomesticated plants. Observed changes in architectural complexity and formality, combined with the location of settlements in relation to hydrologically favorable topographic zones, have been taken as evidence of increasing agricultural dependence and reduced settlement mobility during the Formative period (Carmichael 1983, 1986; Lehmer 1948; Whalen 1977, 1978, 1981a). Qualitative statements regarding the frequency of cultigens observed during a limited number of excavations often were used in support of such arguments (e.g., Brook 1966a, 1980; Carmichael 1986; J. Green 1980; Lehmer 1948; Whalen 1977, 1978, 1981b). Prior to the mid-1980s, however, few quantitative analyses of macrofloral remains from habitation sites had been published (although see Ford 1977 and Wetterstrom 1978), and accordingly, there was little in the way of direct and substantial evidence of subsistence practices that could be used to interpret developments during the Formative period.

While it can be logically surmised that agriculture played a greater role in regional subsistence economies during the Late Formative period than in preceding periods, the extent or proportion of agricultural production in the diet remained unestablished. Aside from a generalized perception that populations of puebloan settlements were more dependent upon agriculture than preceding pithouse populations were, it was difficult to isolate more specific trends in subsistence economies during the Formative period. Since the 1980s, however, an increasing number of macrobotanical studies have been completed, and comprehensive flotation analyses from a representative sample of time intervals and site types are available.

As with most regions of the Southwest, corn (*Zea mays*) represents the most common and important cultigen in the western Trans-Pecos. Other important cultigens include beans (*Phaseolus* sp.), squash (*Cucurbita* sp.), and to a lesser extent a variety of bottle gourd (*Lagenaria siceraria*). Two bean varieties common to lowland environments of the Southwest have been reported from the Jornada Mogollon region: the common bean (*Phaseolus vulgaris*) and tepary bean (*Phaseolus acutifolius*). Lima beans (*Phaseolus lunatus*) have been reported from the Late Formative La Cabrana and Embree pueblos (Bradley 1983; Foster et al. 1981; Thomas C. O'Laughlin 1995, personal communication) but are present in small numbers and have not been identified elsewhere. Cucurbits have occasionally been recovered at pueblo components (Bradley 1983; Ford 1977; Southward 1979) but have not been identified at earlier Formative period sites. Cotton is known to have been utilized in west Texas, as indicated by cordage and fragmentary textiles recovered from dry caves and rockshelters, but its presence in west Texas has not been securely dated. Aside from a quantity of seeds included as burial furniture with two interments at Granado Cave in Culberson County (Hamilton 1998), no evidence of cotton has been recovered in macrobotanical samples, and whether this crop was cultivated in the Jornada remains open to question.

As with the preceding Archaic period, a variety of noncultivated plants were also exploited during the Formative period. More than forty wild plant taxa, including several species of cacti and succulents, mesquite, cheno-ams and portulaca, sunflower, and various grasses, forbs, and annuals have been identified in macrobotanical samples from thermal features, pits, and structures. The habitats of the plant species represent several environmental zones, and their presence indicates that mountain, riverine, alluvial fan, and central basin zones were exploited.

Settlements dating to the earlier part of the Formative period present a complex picture of subsistence practices. Early Formative Mesilla phase settlements have variable recovery rates of plant remains, although they are often disappointingly low. For example, only 23 percent of 345 flotation samples from the Turquoise Ridge site in the eastern Hueco Bolson yielded charred plant remains (Whalen 1994a, 117). Virtually no charred seeds or plant remains were identified in several samples from the Roth site (M. Miller 1997), a cluster of four pithouses and eight burials situated on the Rio Grande Valley terraces west of Las Cruces (O'Laughlin 1981; Stuart n.d.). In contrast, a substantial collection of plant remains was recovered from a burned pithouse at the Tortugas site located across the valley (Stuart 1991). High amounts of plant remains have also been reported from the BK4, BK5, and Conejo sites situated in alluvial deposits on the Organ Mountain fan piedmont (Goldborer 1985; M. Miller and Stuart 1991). In one of the only instances of high recovery rates reported for a Mesilla component in the central basin, Jeff D. Leach, Richard Holloway, and Federico Almarez (1996b) describe the recovery of 50 charred chenopodium seeds from a single flotation sample at FB12719, a cluster of two pithouses in the Hueco Bolson east of El Paso.

Charred corn remains have been recovered at several of these Mesilla phase habitation sites, but again in small quantities. A very small number of domesticated beans have been found at the Conejo and Turquoise Ridge sites (Goldborer 1985; Whalen 1994a). Overall, maize and beans appear to be less common at Mesilla phase occupations predating A.D. 600–700 (see discussion in Whalen 1994a), with the exception of a few sites in the Rio Grande Valley. Other cultigens are virtually absent in Mesilla phase contexts, although one sample of bottle gourd rind has been reported from a pithouse context dating to A.D. 500–700 at the BK4 site east of Las Cruces (M. Miller and Stuart 1991).

Domesticates also appear to be rare at Transitional components dating prior to A.D. 1150. Extensive flotation analyses at Gobernadora, Ojasen, and North Hills I documented very high recovery rates for charred plant remains (Dering 1999a; Hutira 1990; Scott-Cummings 1989). More than seven thousand charred plant remains have been identified in flotation samples from these three sites, including substantial numbers of mesquite, cacti, cheno-ams, and other noncultivated seeds and plant parts. Of these plant remains, cultigens are represented by only nineteen specimens of corn. However, botanical assemblages from later Transitional sites such as Meyer Range and Hueco Tanks include moderate quantities of corn, beans, and cucurbits (M. Miller 1997; O'Laughlin 1996), although several varieties of wild plant species are also present.

In contrast to Mesilla and Transitional components, charred corncobs, cupules, and kernels are ubiquitous at El Paso phase pueblos. Brook (1966b, citing an unpublished 1939 paper by Vermillion) reports the recovery of two hundred bushels of corn remains from a single pueblo room in the southern Tularosa Basin, and J. Green (1980) and V. R. Brook (1966b, 1980) comment on the frequency of corn remains encountered during excavations at the Hot Well and Sabina Mountain sites. Several kilograms of charred corn and beans were also recovered from the floor and subfloor pits of a single room at Embree pueblo north of Las Cruces, New Mexico, and corncobs were recovered from most excavation units throughout the site (Magers 1973; O'Laughlin 1985a). Similar botanical assemblages have been recovered from El Paso phase isolated rooms. Wetterstrom (1983) reports high recovery rates for corn, common beans, and mesquite seeds and pods from several extramural refuse and storage pits at the Dona County Airport sites west of El Paso. Linda Scott-Cummings (1992) recovered maize pollen from a groundstone fragment, a core, and several floor soil samples from the isolated room at the MOTR site on Fort Bliss. Although the recovery of plant remains from the severely eroded house floor was poor, an estimated total exceeding six thousand corn cupules, kernels, and cob fragments was recovered from samples retrieved from an adjacent trash midden. To date, no such quantity of cultigens has been recovered from Mesilla or Transitional components.

Quantitative summaries of these and other macrobotanical studies have been presented by Hard et al. (1996) and M. Miller (1990, 1997). The latter study, a portion of which is reproduced here (Fig. 7.29), utilized data from more than 600 flotation samples, 303 of which were productive, obtained from seven hut/pithouse components dating between A.D. 400 and 1000, three pithouse components dating to A.D. 1000–1150, two pithouse and isolated room components

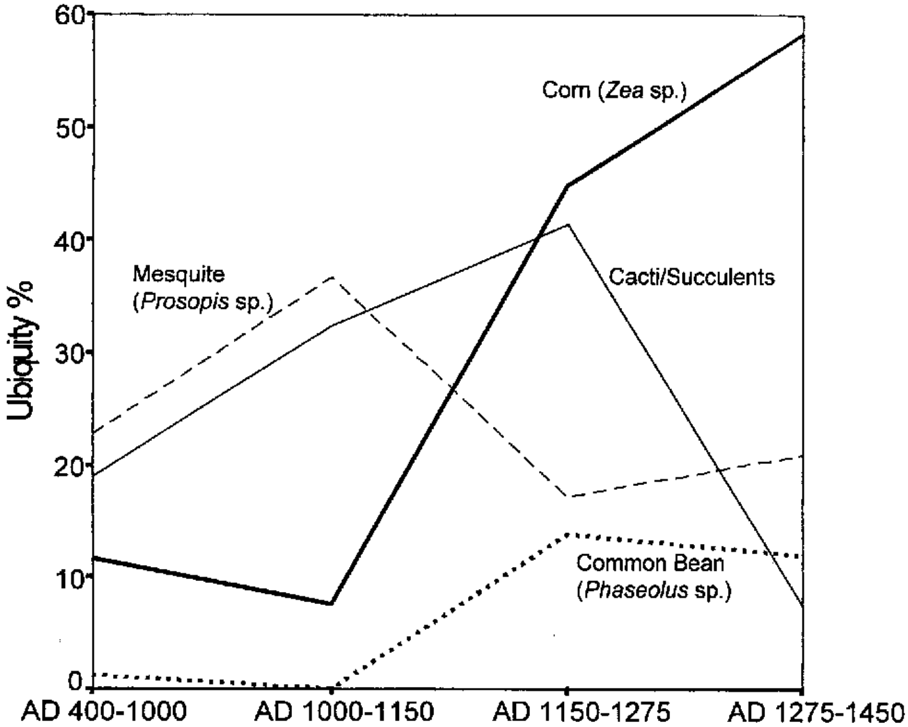

Fig. 7.29. Ubiquity values for major domesticated and nondomesticated plant groups in flotation samples, A.D. 400–1450. Data based on compilation of 303 productive flotation samples from eighteen sites in the southern Jornada Mogollon region.

dating primarily between A.D. 1150 and 1250/1300, and four pueblo and three isolated room sites dating to A.D. 1250/1300–1450. Abundance measures for four major subsistence items are presented (see Fig. 7.29), including the two most common cultigens (corn and beans) and two of the more important noncultivated plants or groups of plants (mesquite and a combined cacti/succulent group). It should be noted that the ubiquity values are subject to a number of preservation biases, particularly in light of the low recovery rates at many pre-A.D. 1000 components, and they should not be considered absolute measures of plant dependence or consumption during a given time interval. Furthermore, the low productivity of flotation samples and small numbers of plant remains from Mesilla phase components may also be a function of settlement intensity, whereas less intensive occupations at these sites resulted in the deposition of lesser quantities of charred materials.

Trends in ubiquity values among the four plant groups point to several significant aspects of Formative period subsistence. Overall, a trend of increasing agricultural dependence is evident between A.D. 1000 and 1250/1300, an observation that generally supports the hypothesized relationship between the increasing formality of architectural forms and settlement structure and a greater dependence on agricultural production. Ubiquity values for maize remain relatively constant at approximately 10 percent between A.D. 400 and 1150 but show a particularly pronounced increase after A.D. 1150 and reach a peak of 60 percent for post–A.D. 1250/1300 pueblo and isolated room components. Ubiquity values for domesticated beans also show an increase only after A.D. 1150 (see Fig. 7.29).

Nondomesticated plants contribute to the subsistence base through all time intervals. Mesquite pods and seeds were a particularly important food resource, although it is noteworthy that ubiquity values show a decline corresponding with the rise in ubiquity values for corn.

Ubiquity values for cacti and succulents such as lechuguilla (*Agave lechuguilla*), banana and soap-tree yucca (*Y. baccata, Y. elata*), sotol (*Dasilyrion wheeleri*), and *Echinocereus* or *Mammalaria* (fishhook, pitaya, and hedgehog cacti) increase steadily between A.D. 400 and 1250/1300 to around 40 percent but fall to less than 10 percent for late Formative components (see Fig. 7.29). This pattern suggests that exploitation of these food resources may have intensified during the latter part of the Transitional period but decreased as agricultural dependence—or perhaps more appropriately, agricultural specialization—increased. Significantly, this plant use pattern is also reflected in the regional decline after A.D. 1250/1300 of the use of rock-lined pits or other thermal facilities presumably used to process these plant foods (see below).

Additional evidence for increased maize dependence among prehistoric populations is available from analyses of stable isotope ratios in human skeletal material. Although inferences regarding prehistoric subsistence based on such analyses often tend to be problematic (see Hard et al. 1996; Mauldin 1996b), they can provide useful corroborative information when combined with flotation data and other lines of archeological evidence (Hard et al. 1996).

MacNeish and Marino (1993) report the results of a preliminary study of stable carbon and nitrogen isotopes measured in a range of samples from the Jornada Mogollon region. Although isotope values have been obtained for several burials, sample numbers for several time periods are limited and some important intervals are not represented. For example, minimal data are available for the Early Formative period (A.D. 200–1000) because only a single Mesilla phase burial provided sufficient collagen for analysis. The Late Formative period sample includes only remains recovered from El Paso phase pueblos, and critical information for settlements dating between A.D. 1000–1250/1300 is lacking. Nevertheless, the preliminary results demonstrate a pronounced trend in increasing $^{13}C/^{12}C$ and $^{15}N/^{14}N$ ratios among samples from Archaic period populations through Late Formative El Paso phase populations (Fig. 7.30). The subsequent decline in stable carbon and nitrogen isotope ratios observed among the population of Historic burials from Socorro Mission presents some interpretive problems but may be attributed to changes in diet involving the introduction of and increased reliance on domesticated animals (MacNeish and Marino 1993).

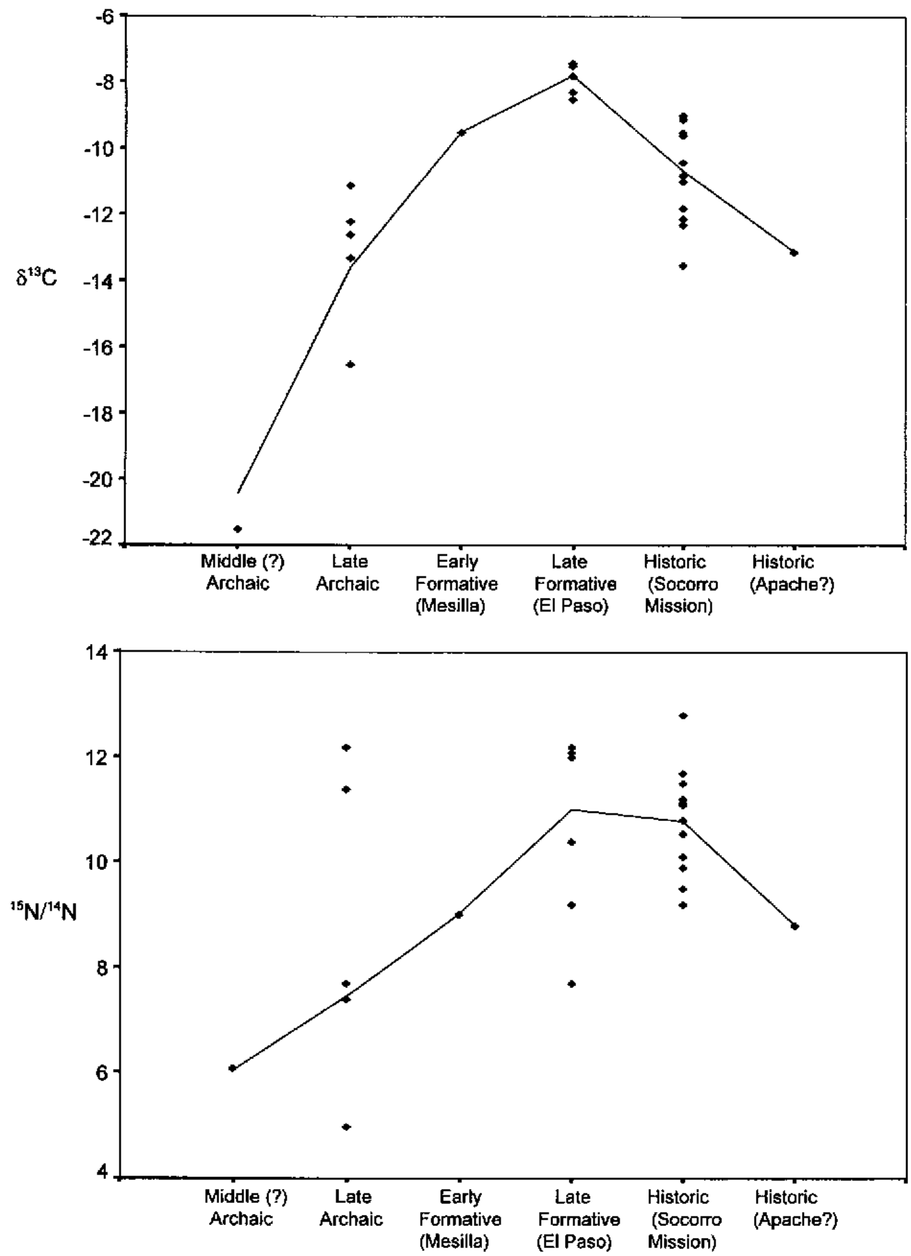

Fig. 7.30. Stable isotope ratios ($^{13}C/^{12}C$ and $^{15}N/^{14}N$) for human burials from the Jornada Mogollon region (data from MacNeish and Marino 1993, 118–21).

Dependence on fauna throughout the Formative period has proven difficult to assess. Few detailed studies are available, and no synthetic overview of faunal data from the region has been attempted. Detailed analyses of faunal collections are available for three Mesilla sites—Conejo, Turquoise Ridge, and BK4 (Russel and Hard 1985; M. Miller and Stuart 1991; Whalen 1994a)—and three Transitional period sites (Bartlema 1996; Hanson 1990; Shafer et al. 1999), but only one pueblo assemblage has been described in detail (Bradley 1983; Foster et al. 1981). Common among all these components is the predominance of lagomorph (rabbit) remains (*Lepus californicus* and *Sylvilagus audubonii*), a pattern common among prehistoric sites in lowland settings across the Southwest. Larger game animals such as deer, antelope, and occasionally bison are present but occur in relatively small numbers compared to lagomorphs. This faunal use pattern continues through the Pueblo period, as Carmichael (1983, 1986) has commented on the common occurrence of rabbit bone in El Paso phase middens. The most compelling analysis of faunal material from a pueblo component is from La Cabrana, located on the first Rio Grande terrace immediately northwest of El Paso (Bradley 1983; Foster et al. 1981). The recovery of more than five thousand fish bones and scales indicates a distinct riverine component to the subsistence base.

Formative Period Technological Patterns

Sequential changes in architectural form and site structure, settlement pattern, and subsistence economies are also reflected in the material culture of the western Trans-Pecos. Several recent studies have used various classes of artifact data to successfully monitor or infer broad-scale changes in subsistence economies during this period (Calamia 1991; Hard et al. 1994, 1996; Mauldin 1995; M. Miller 1997). Changes in groundstone and ceramic technologies have received particular attention because they indicate coincident patterns of increasing agricultural dependence and changes in mobility patterns. Analyses of storage and thermal or burned rock facilities (Leach 1993; M. Miller 1997; Whalen 1994b) also provide important insights into changing aspects of technological organization.

Thermal and Storage Features

Several changes in the form, size, and frequency of burned rock and other thermal features occur throughout the Formative period. Presumably these reflect changing land use and subsistence practices, inasmuch as such features are directly associated with the processing of plant and animal foods. Burned rock features are particularly suited for nondomesticated plant foods, and therefore observed patterns among this type of feature can provide insights into varying degrees of reliance on wild plant foods versus cultigens.

Distribution patterns for one thousand radiocarbon age estimates of artifacts from various thermal features correspond closely with architectural and subsistence trends previously discussed (Fig. 7.31). The use of most categories of thermal features appears to peak prior to A.D. 650

and either decline gradually or remain relatively stable between A.D. 650 and 1000. Considering general size classes, the trend for small thermal features co-varies with large and medium features, indicating that the numbers of thermal features with larger pit sizes and greater accumulations of burned rock increased through the earlier half of the Formative period.

Another significant pattern involves formally constructed rock-lined pit features. While examples of such features have been dated to as early as 2000 B.C. (MacNeish 1993b; M. Miller 1994), they become increasingly common after A.D. 1000 and reach a peak in use between A.D. 1150 and 1250/1300 (see Fig. 7.31). Numerous examples have been excavated at Transitional components, although they often tend to post-date most of the pithouses at these sites. Whether their increasing frequency and formal mode of construction indicates an intensification of plant processing (i.e., bulk processing), continual and repeated use or maintenance, or a combination of both factors, remains unclear. In terms of use intensity, it is noteworthy that several of the largest macrobotanical inventories in the region have been recovered from these features. An estimated 10,000 or more amaranth seeds were recovered from a single rock-lined pit at the Ojasen site, and the discarded fill contents of a similar feature at Gobernadora yielded 2,483 prickly pear, echinocactus, and mesquite seeds (Scott-Cummings 1989).

Additional evidence of changing subsistence and mobility strategies is apparent in the temporal distribution of storage pits and trash pits. (The two feature types are considered together because it is often difficult to determine the original or primary function[s] of these features. Pits containing quantities of charred plant remains often contain discarded faunal bone and lithic debitage as well as broken ceramic and groundstone implements.) As indicated in Fig. 7.31, the construction and use of formal trash disposal pits and storage facilities increases substantially after A.D. 1150, and this feature use continues through the El Paso phase, indicating an increasing emphasis on the storage of foods. Moreover, the presence of discrete trash pits, common at isolated room and pueblo components, suggests more structured patterns of trash disposal as opposed to the more generalized dispersal of sheet trash and large midden accumulations common at earlier Transitional and Mesilla phase components.

The correspondence between formal thermal features (rock-lined pits), storage facilities, and the increase in formal architectural forms (isolated rooms) is interesting when the presumed relationship between agricultural production and architectural formality is considered. The current archeological data indicate that reliance on cacti intensified during the Transitional period, particularly between A.D. 1150 and 1275, coeval with the appearance of formally constructed house forms and an increasing emphasis on storage. Notably, the regional decline in nearly all types and size groups of thermal features occurred after A.D. 1250/1300, and this is when the ubiquity measures of cacti in flotation samples also show a drastic reduction. Intensification of cacti processing and agriculture occurred roughly simultaneously. We suggest that these trends support the argument that subsistence practices between A.D. 1275 and 1450 became not only more agriculturally dependent but also more agriculturally specialized. Moreover, the apparent intensification of both traditional plant processing and agricultural production occurred in tandem and across different environmental zones and marks an important transition in subsistence and settlement. The factors underlying this intensification of plant processing, agricultural production, and architectural formality between A.D. 1150 and 1275 remain more speculative, however, along with the reasons for the decline in cacti

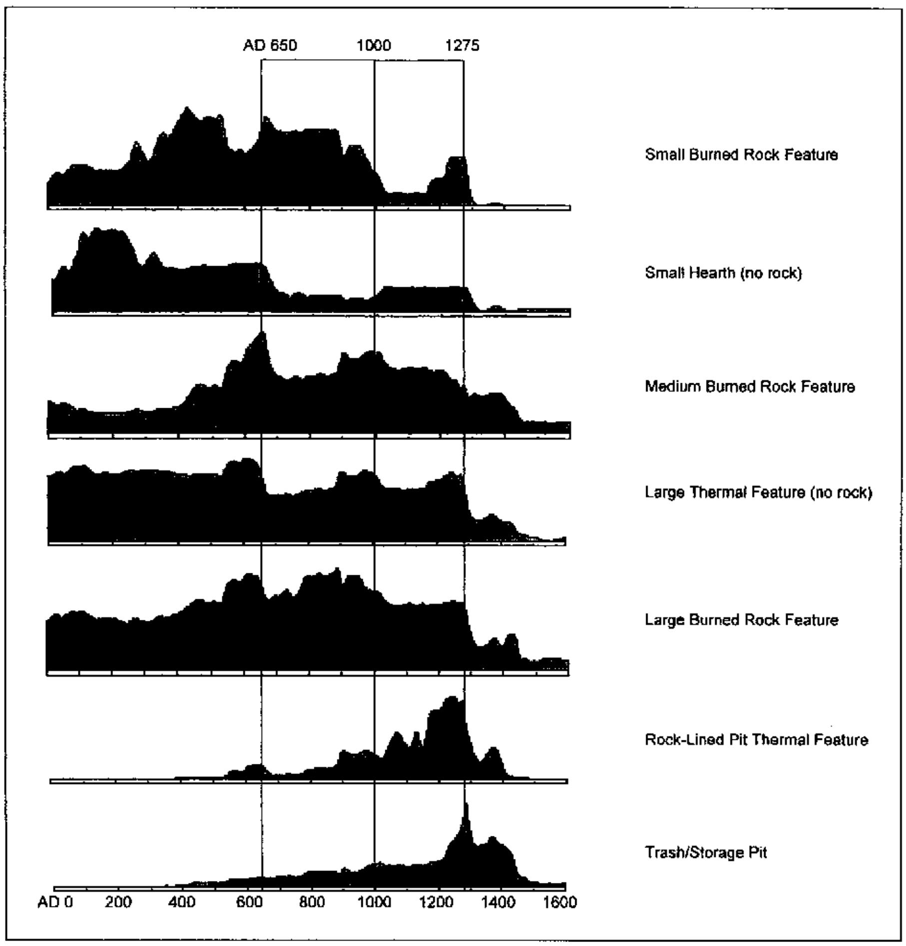

Fig. 7.31. Trends among summed radiocarbon probability distributions for major categories of thermal features and trash/storage facilities in the western Trans-Pecos during the Formative period.

exploitation in favor of agricultural production during the pueblo period.

Groundstone

Trends in groundstone form and use in the western Trans-Pecos are known primarily through studies by Calamia (1991), Hard et al. (1996), and Mauldin (1995). Using multiple lines of evidence, including macrofloral analyses and trends in stable carbon isotopes measured in human bone, Hard et al. (1996) demonstrate that increasing mano size and grinding area correlate with an increase in corn processing. Although part of a larger synthesis of archeological data across the Southwest and the Southern Plains, their study demonstrates that a similar trend of increasing groundstone size, representing a pattern of increasing agricultural dependence, occurred in the Jornada Mogollon between A.D. 200 and 1450. Based on an extensive analysis of manos from both excavated and surface contexts, they further show that greater proportions of two-handed manos, as well as the significant increase in mano size and grinding area, occurred in assemblages dating after A.D. 1000 (Fig. 7.32).

In addition to mano size, the increased prevalence of trough metates over slab and basin forms has been noted at Pueblo components (Lehmer 1948), a factor observed in other regions to be associated with increased agricultural dependence (Morris 1990; Schlanger 1991). Pestles, presumably used to process mesquite, may also show changes in frequency and form through this period. Based on survey data from the Tularosa Basin, Carmichael (1981, 1986) notes that the frequency of pestles observed at post–A.D. 1000 components in the Tularosa Basin decreases from the earlier Mesilla phase, indicating a possible reduction in the importance of mesquite beans as a food resource in the central basin.

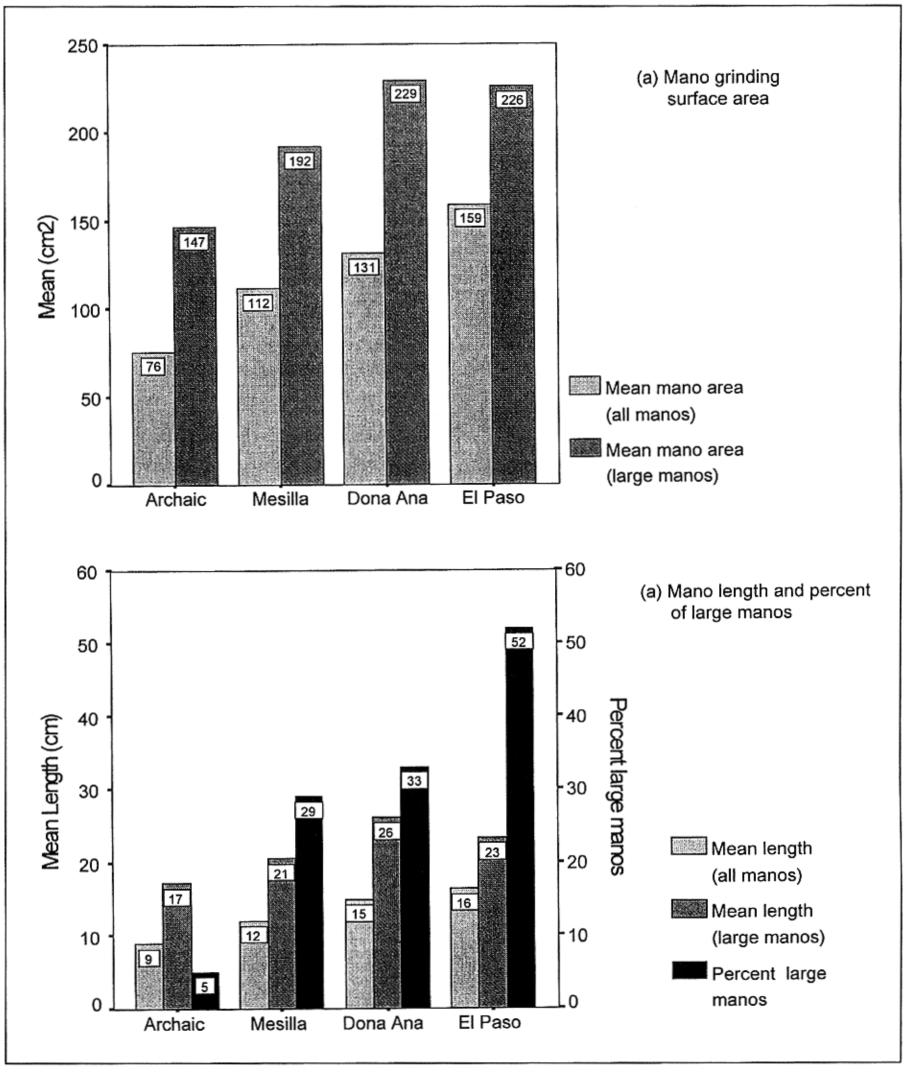

Fig. 7.32. Mano data from the southern Jornada Mogollon region: a, grinding surface area; b, length and percentage of large manos among samples of whole manos (data from Hard et al. 1996, 280).

Ceramics

One of the conventional hallmarks or traits commonly used to demarcate the Formative period is the appearance of ceramics between A.D. 200 and 400. The underlying reasons for the adoption of ceramics during the Early Formative period are not well understood, nor are the technological and functional aspects of ceramic use by populations continuing a subsistence economy predominantly based on hunting and gathering (M. Miller in Perttula et al. 1995b, 219). It is known, however, that the El Paso brownware tradition (see Fig. 7.20) remained remarkably stable during the entire Early Formative Mesilla phase. Studies of rim and vessel form have identified very few differences between assemblages from different times during this period (M. Miller 1996a; Whalen 1993, 1994a), although some technological attributes such as temper size and abundance may show changes reflecting the need for increased thermal resistance (Whalen 1994a), possibly due to an increase in corn processing.

After A.D. 1000, ceramic assemblages change significantly, probably reflecting demographic shifts and changing settlement and subsistence patterns. After six hundred to seven hundred years of technological and stylistic continuity, the local El Paso brownware ceramic tradition underwent several developments between A.D. 1000 and 1300 (M. Miller 1989; O'Laughlin 1985; Perttula et al. 1995; Whalen 1980b, 1981b). Undecorated El Paso brownware of the earlier Mesilla phase becomes part of assemblages with El Paso bichrome and polychrome (Fig. 7.33a, b). Proportions of decorated vessels increase gradually between A.D. 1000 and 1275, until bichrome and early polychrome varieties are completely re-

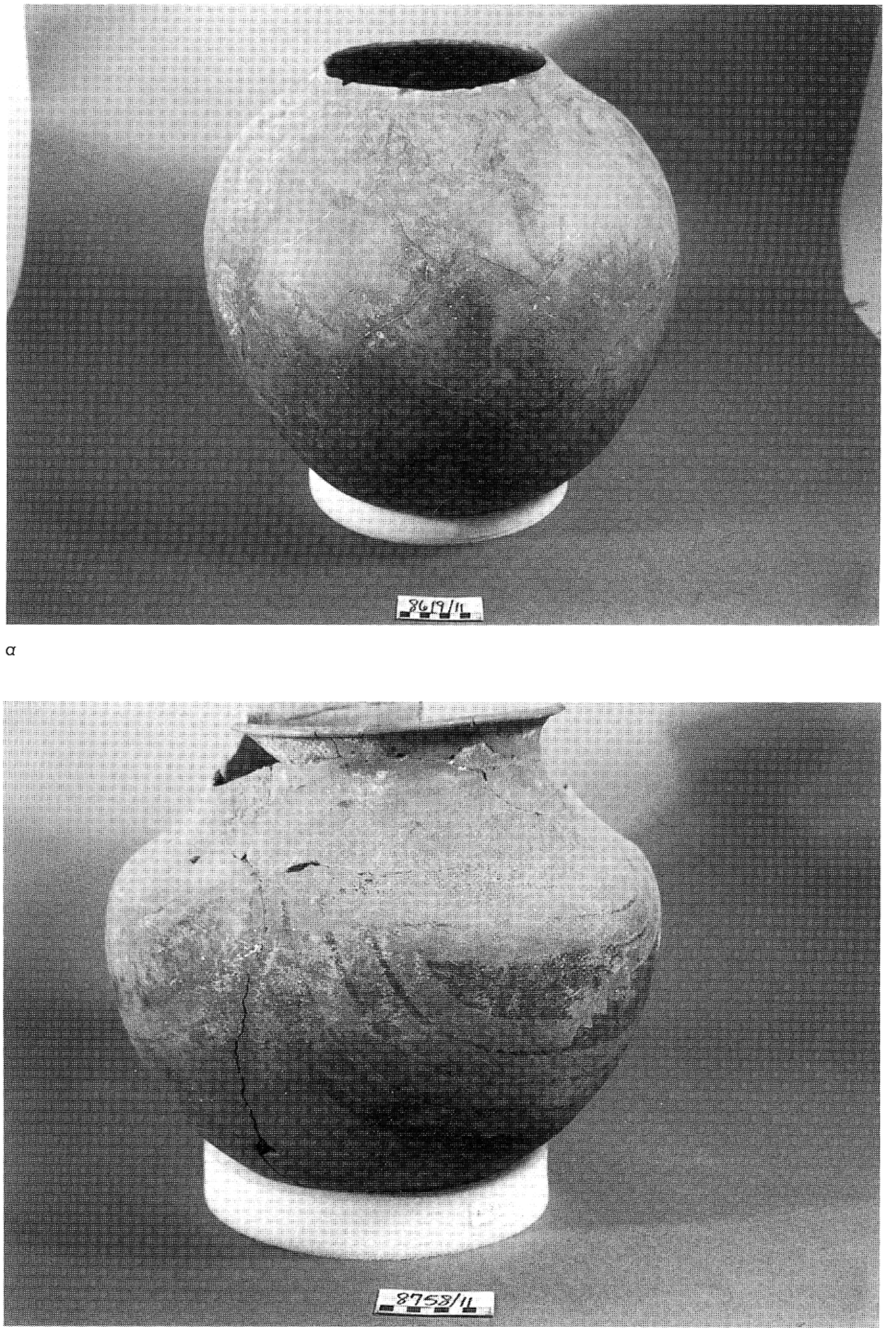

Fig. 7.33. Early/Transitional and classic El Paso polychrome vessels: a, Early/Transitional; b, classic.

placed with El Paso polychrome (late or classic variant) between A.D. 1250 and 1300 (Fig. 7.34). Design trends among bichrome/early polychrome and late polychrome include increasing elaboration and the addition of secondary design elements and complex multiple band layouts (Fig. 7.35).

Additional studies have emphasized technological aspects of vessel form and manufacture in an attempt to identify changing patterns of subsistence and mobility (e.g., Scarborough 1992). In contrast to Mesilla phase assemblages consisting predominantly of neckless (*tecomate*) jar forms, necked jar forms become increasingly common after A.D. 1000, particularly at isolated room components. By A.D. 1250/1300, neckless and short-necked jar forms are replaced by necked jars with everted rims at pueblo and isolated room components. This shift may relate to the greater containment security afforded by necked forms for processing corn (Hard et al. 1994; Seaman and Mills 1988a, 1988b; see also Braun 1983).

Miller's (1997) comparative analysis of vessel form utilizing a sample of more than five thousand El Paso brownware rim sherds from twenty assemblages dating between A.D. 200 and 1450 documented that vessel form assemblages from components dating to the Mesilla phase and the earlier part of the Transitional period vary widely among the seven vessel classes used in the analysis, while assemblages from Pueblo settlements are remarkably consistent in terms of the proportional representation of vessel form classes. This situation at first appears counterintuitive, in that one would expect residential occupations of longer duration at pueblos to have a greater variety of vessel forms. However, this finding does not necessarily reflect the variety of vessels (i.e., the number of specific vessel classes, or "richness") observed in the assemblages, but rather the variation, or "evenness," among the proportional representation of vessel classes. That is, Mesilla and early Transitional sites have uneven representations of vessel forms; one may have a high proportion of neckless jars, a moderate proportion of necked jars, and a small proportion of bowls, while another site has a moderate proportion of neckless jars, moderate proportions of necked forms, and a high proportion of bowls. In contrast, the proportional representation of the vessel classes at all seven pueblo sites is comparatively uniform. Clearly then, Mesilla and early Transitional sites have variable collections of vessels. This variety may, in turn, reflect a greater range of functional and seasonal occupations by more mobile populations with generalized subsistence economies. Conversely, this variety may be evidence of a more uniform function in ceramic use at pueblos.

An important exception to the El Paso phase use of ceramics concerns the cluster of four outliers representing vessel assemblages from isolated room components.

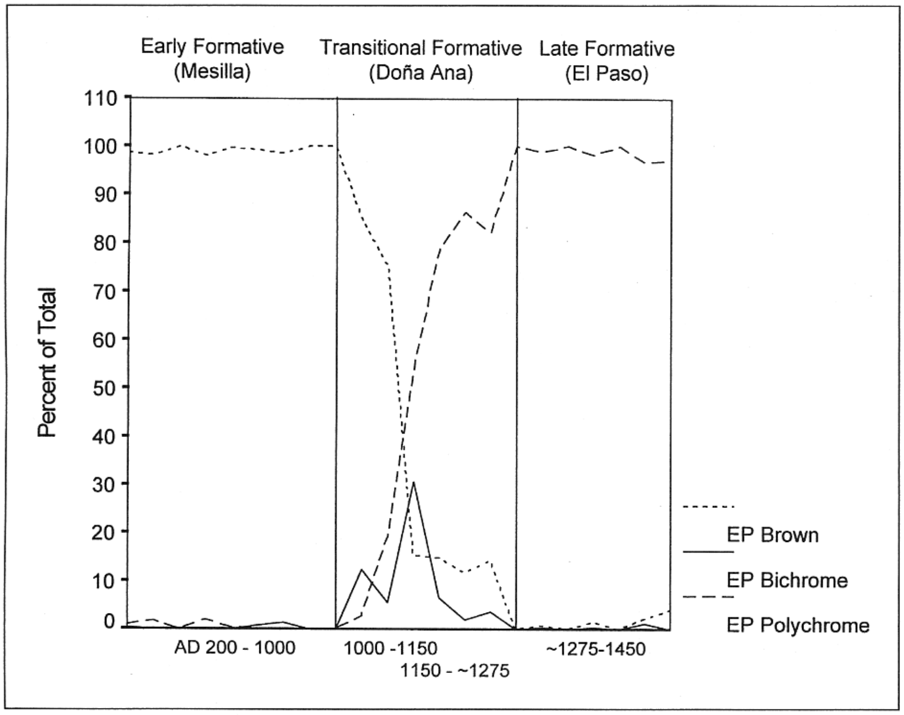

Fig. 7.34. Proportions of El Paso Brown ceramic varieties observed among rim collections from twenty-two sites illustrating shifts in ceramic decoration during the Transitional period. Sites are presented from left to right in order of decreasing age based on calculating interquartile ranges of radiocarbon age distributions.

Fig. 7.35. El Paso polychrome stepped-fret bowl. Photograph courtesy of Museum of Indian Arts and Culture, Laboratory of Anthropology, Santa Fe, New Mexico.

Vessel assemblages at these sites have much higher proportions of necked jar forms with highly everted rims. In addition, vessel walls are significantly thinner. This combination suggests that while necked jar forms may reflect technological requirements for processing corn, an ancillary technical factor of facilitating ease of vessel transport may also be likely (M. Miller 1997).

Chipped Stone

While our understanding of ceramic and groundstone technologies is relatively well founded for the Formative period, studies of chipped stone assemblages have lagged. Formative period lithic technologies are poorly known, and there is little information on whether any substantial changes in reduction technology, tool form, or raw material procurement occurred during this period. Information on lithic assemblages of puebloan occupations is especially limited. Aside from a small number of descriptive accounts listing general artifact classes and raw material types at Hot Well, La Cabrana, and Pickup Pueblos (Bentley n.d.; Bradley 1983; Garcia 1988), technological and functional studies of lithic assemblages from pueblo occupations are virtually nonexistent, and the assemblage from only one isolated room component of this period has been reported in much detail (Browning et al. 1992).

Based upon the available information, it appears that no major shift in technological organization occurred from preceding periods in terms of raw material procurement and reduction, nor was there a significant change in the range and types of tools produced. Informal core technologies and the production of informal flake tools remained dominant, as did the exploitation of local valley terrace and alluvial gravel sources for the majority of raw materials.

Several studies have noted the common trend of decreasing proportions of fine-grained materials over the preceding Archaic period (Carmichael 1986; Whalen 1980a). Obsidian tends to be more common among Late Formative assemblages. While this may reflect an increased preference for this material, it is more likely that this is due to a shift in settlement location to alluvial fans and the margins of the Rio Grande Valley, areas where obsidian nodules are present in the local gravels (M. Miller 1996a).

Likewise, attributes of lithic assemblages that can suggest changes in mobility remain very poorly known. As Mauldin (1984, 1986) noted, there has been little effort to develop models with expectations regarding the relationships among settlement duration, mobility, and lithic reduction for the various settlement types characteristic of the Formative period. A model linking several characteristics of expedient core reduction to settlement duration proposed by M. Miller (1990), and considerably critiqued, refined, and improved by Dockall (1999a, 1999b), has been used to investigate assemblages at a limited number of sites in the Hueco Bolson. These studies have been designed primarily to test the utility of the model, which has not been applied to a larger comparative data base.

One of the more noteworthy aspects of Formative period lithic assemblages is the rarity of projectile points at major habitation sites. Archeological investigations at the Turquoise Ridge, Gobernadora, Ojasen, North Hills, and Meyer Range sites (more than 3,000 m² of hand excavations, including at least 35 pithouses and hundreds of burned rock features, pits, and middens) recovered more than 130,000 lithic, ceramic, and groundstone artifacts, but projectile points are represented by only 27 specimens (Fig. 7.36). An exception to this pattern is Hueco Tanks, where more than 70 points were found in house fill and extramural contexts (Kegley 1982). While it remains uncertain whether these findings reflect off-site manufacture and discard or loss of projectile points, debitage analyses have noted that evidence for biface production (such as preforms, thinning flakes, or flake debitage with faceted platforms) is exceedingly rare. Assemblages with a similar character have been noted at pueblo settlements, with a total of only 36 points recovered from Hot Well Pueblo. The rarity of projectile points at Formative period habitation sites is an indirect estimate of the reliance of groups on small and medium-sized game animals, and it generally confirms the observation that large game animals are rare among faunal assemblages of this period. When compared to mountain settlements such as the Robinson Pueblo in the Sacramento Mountains of New Mexico, where more than 3,000 points were recovered (J. H. Kelley 1991, 171), the rarity of projectile points at lowland Jornada Mogollon pueblo sites is striking.

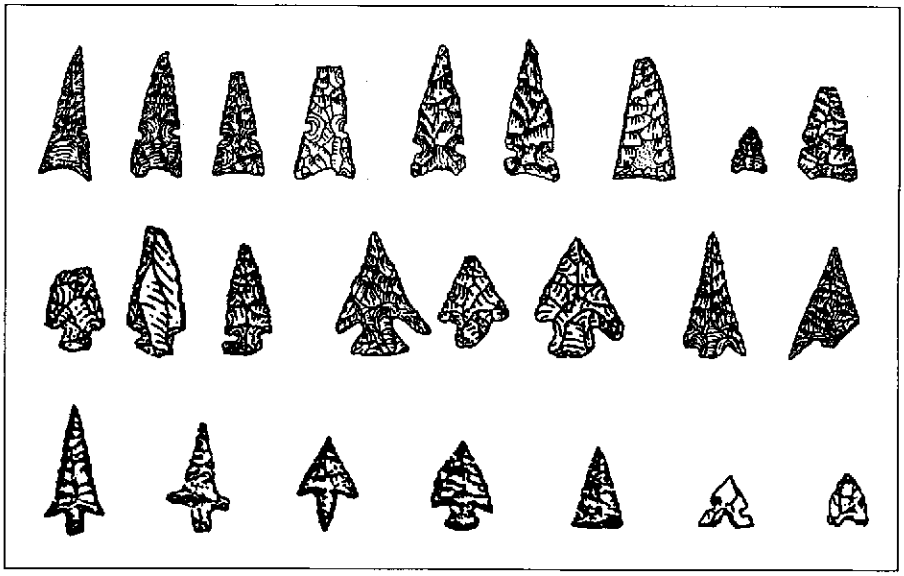

Fig. 7.36. Typical Late Formative period arrow points from the Trans-Pecos: upper two rows from the western Trans-Pecos; lower row includes examples from the eastern Trans-Pecos (after Mallouf 1990, 1991).

Water Control Features and Other Miscellaneous Technologies

A final technological innovation associated with puebloan occupations in the western Trans-Pecos involves the construction and maintenance of water control features. Foremost among these is a reservoir documented at Hot Well Pueblo (Scarborough 1988). James Neely and Chris Caran (1998, personal communication) have recently identified a possible reservoir at Hueco Tanks State Park, and further investigations of this feature are planned. The presence of additional reservoirs or other forms of water control features such as canals and terraces (Hubbard 1987; Leach et al. 1996a) are unconfirmed, but lack of evidence does not necessarily preclude their existence, particularly since many areas have been extensively modified by natural and human developments.

Late Prehistoric Period Developments in the Eastern Trans-Pecos

The changes taking place in the Hueco Bolson and north of the Trans-Pecos (Jelinek 1967) in the manufacture of pottery, the development of agriculture, the establishment of villages, and the use of the bow and arrow do not appear in the archeological record in the remaining portion of the Trans-Pecos until about A.D. 1000. In addition to their late arrival, the changes were variously adopted. Throughout most of the eastern Trans-Pecos, the bow and arrow were universally adopted; few other changes were. Instead, the archeological record there indicates that settlement patterns, subsistence economies, and group mobility strategies established during the Late Archaic persisted despite an awareness of changes taking place to the west and north.

Prominent site types are ring middens (Greer 1968a, 1968b), hearth fields, lithic scatters, wickiup or tipi rings, and the use of rockshelters and sinkholes. Rock art is commonly etched or painted on boulders and walls of caves and shelters. Frequently, these types of sites cooccur, and they are present in all ecological zones. This situation mirrors the distribution of Late Archaic sites and their presence in all ecological zones. In fact, Late Prehistoric sites often overlie Late Archaic components.

In the foothills of the Cienega Mountains, the Cat Spring site (41PS660) has four ring middens associated with a lithic scatter (Mallouf 1993). The Squawteat Peak site (41PC14), with Perdiz points, prismatic blades (common in the Late Prehistoric in central and south Texas; see Collins, chapter 3, and Hester, chapter 4, this volume), and radiometric assays averaging around A.D. 1300, is defined by a burned rock midden, at least fourteen tipi rings, multiple hearths, mortar holes, and lithic scatters (Young 1981). Similarly, A. T. Jackson (1937) noted that sinkhole/cave sites in the Rustler Hills with Formative period arrow points and ceramic sherds were surrounded by ring middens, hearths, lithic scatters, and, at times, rock art panels. This pattern obtains throughout much of the eastern Trans-Pecos, including the Stockton Plateau (Kelly and Smith 1963), the terraces of the Rio Grande (C. Johnson 1977), and in the Guadalupe Mountains (Katz and Katz 1974).

Thus, it is not surprising that only a handful of Late Prehistoric sites in the eastern Trans-Pecos have yielded evidence of cultigens. Carved Rock Shelter near Alpine (V. Smith 1938), site 41BS8 in Brewster County, Pratt Cave (Schroeder 1983, 65), and Williams Cave and an unnamed cave in the Guadalupe Mountains (Roney 1995) produced corn, and cotton cordage was recovered from the Shelby Brooks site (A. T. Jackson 1937) and Granado Cave (Hamilton 1998). Instead, the evidence for Late Prehistoric subsistence practices continued to indicate a generalized diet focused on desert succulents and hunting (J. C. Kelley et al. 1940; Mallouf 1990). It appears that, having established an effective mode of making a living, occupants of the region chose to maintain old patterns, selectively learning new technologies to enhance, rather than change, their lives. Lehmer (1958), Marmaduke (1978a, 1978b), Mallouf (1985), and Sebastian and Larralde (1989) have long noted this reluctance for change in the eastern Trans-Pecos.

Despite this trend to conservatism, subtle differences exist throughout the region. Ward (1992) noted the popularity in the Rustler Hills of sandals woven with a fish-tail pattern. While the style is not unknown to the south, other styles are more prominent. Similarly, in the north, pottery is found in low quantities on Late Prehistoric sites outside of the Salt Flat Basin (Charles 1994; Hedrick 1989; Katz and Katz 1974; Perttula et al. 1995; Ward 1992), but as one moves south, "ceramics become [even] more rare" (Mallouf 1985, 130). While Late Prehistoric site locations mimic Late Archaic site locations in the Rustler Hills (A. T. Jackson 1937; R. Tanner 1949; Ward 1992), the Guadalupes (Katz and Katz 1974), and most other sectors of the eastern Trans-Pecos (Mallouf 1985, 127), Marmaduke's (1978b) work at the Bear Creek sites in the Stockton Plateau noted a reduction in the number of Late Prehistoric sites on ridges. At the same time, occupational debris at these Late Prehistoric sites was substantially greater than the debris from earlier occupations, and he concluded that there was an overall increase in the population utilizing the area and a trend to coexist in larger groups. These differences lead to our hypothesis that groups knew and interacted with one another but maintained traditions unique to their own area.

Data from the Wind Canyon site (41HZ118) in the Eagle Mountains fit this hypothesis. The site has a ring midden that spans the period from A.D. 340 to 1480 (Hines et al. 1994). Although a sizable number of dart points came from the site, only four arrow points were recovered, and faunal remains show that limited taxa were hunted (deer, rabbit, squirrels, and a bird). In contrast, macrobotanical evidence indicates a "continuity in the flotation record . . . spanning hundreds of visitations to the site over a long period of time" (Bohrer 1994, 180). Together, these data reinforce our notion of the retention of Late Archaic food preferences, cooking techniques, and settlement patterns. The latter, a settlement pattern of small groups—aware of and selectively adopting the technologies of the Late Prehistoric—whose mobility was confined to a particular area, is supported by the lithic and ceramic record. Using data from Hedrick (1989), Hines et al. (1994) tentatively conclude that the three Toyah arrow points and one Livermore point from Wind Canyon were manufactured with raw material from southwestern Culberson County, 50 to 65 km east of the site. Lithic materials (trachyte and syenite) locally available in the Eagle Mountains made up 48 percent of the 4,944 pieces of unmodified lithic debitage (Hines et al. 1994, 62, and table 4). The 63 sherds recovered during excavations similarly suggest local manufacture. Most were El Paso polychrome and El Paso or Jornada brownwares. However, petrographic analyses suggest that they were made locally using igneous material of the Eagle Mountains. Nonlocal material, in relatively limited quantities, includes mussel shell and lithics from the Rio Grande and a few sherds of northern Chihuahuan polychrome from the regions southwest of the Rio Grande and others from the Tularosa Basin of New Mexico.

In sum, excavations at the Wind Canyon site support the hypothesis of small groups continuing traditional subsistence practices, returning to locales that had been used for centuries, and moving within a local region. Nonetheless, the archeological data also indicate that the Late Prehistoric occupants were not only aware of new technologies (e.g., the manufacture of arrow points and pottery and the growing of domesticated crops) but also became sufficiently knowledgeable about these techniques that they manufactured both arrow points (see Fig. 7.36) and pottery from locally available materials. The people of Wind Canyon did not, however, restrict themselves to just their local area. Shell and ceramic material from regions to the south and southwest indicate contacts with those regions, and, given the fact that the bulk of the sherds stylistically mirror the pottery of the Hueco Bolson, either the residents spent extended stretches of time in that region or the residents of the Hueco Bolson visited the general Wind Canyon area with some frequency.

There are two areas of the eastern Trans-Pecos where the patterns of the Late Archaic were not continued: the Presidio Bolson, an intermountain basin traversed by the Rio Grande where modern Presidio, Texas, is situated, and in the Salt Flat Basin on the west side of the Guadalupe and Delaware Mountains. Here, the archeological evidence indicates that local Native American residents constructed and lived in small villages for all or part of the year, manufactured pottery, and cultivated crops, and, at least in the southern portion of the region, the Late Prehistoric period changes persisted into the Historic period.

In the La Junta district, situated in the Presidio Bolson, small pithouse villages whose residents manufactured pottery and grew some cultigens developed around A.D. 1200 (J. C. Kelley et al 1940; J. C. Kelley 1985, 1986). Known as the La Junta phase (J. C. Kelley et al. 1940), the pithouses that mark this period are relatively small, measuring approximately 3.4 by 4.2 m (J. C. Kelley 1949, 1986; Shackelford 1951), and have been investigated at the Millington (41PS14), Loma Alta (41PS15), Polvo (Cloud et al. 1994; J. C. Kelley and E. A. Kelley 1990; Shackelford 1951), and Shiner (J. C. Kelley et al. 1940) sites. Shiner, on the northern edge of the Cienega Mountains, is the only one of the group not located on the alluvial and Pleistocene terraces of the Rio Grande in the Presidio Bolson.

The pithouses at these sites have *jacal* walls over a relatively deep pit, often accompanied by well-made adobe floors and altars (J. C. Kelley and E. A. Kelley 1990). One had "two, possibly three, superimposed floors . . . one well-defined post mold, and one sub-floor pit or additional large post mold" (Cloud et al. 1994, 58). Two wood samples from Polvo recovered by J. Charles Kelley in 1948 from charred beams taken from a La Junta phase pithouse had calibrated dates of A.D. 1265–1405 and A.D. 1240–1350 (Mallouf 1990). More recent investigation and dating of the La Junta phase pit structure (Cloud et al. 1994) with superimposed floors indicates that initial construction occurred around A.D. 1200–1250, that the structure was renewed with a second floor of sandy base material with pea gravels after A.D. 1250, and that the structure was capped with a third floor of clean, silty sand between A.D. 1300 and 1350. After its abandonment around A.D. 1350, the structure burned. While it is not known if the fire was accidental or purposeful, the other three pithouses investigated at Polvo (Shackelford 1951; J. C. Kelley 1949) also contained associated burned roof debris.

The reason why pithouse villages were established along this stretch of the Rio Grande, at some distance from their nearest counterpart, is not clear, but they are generally believed to derive from the Hueco Bolson (J. C. Kelley 1952; J. C. Kelley and E. A. Kelley 1990; Lehmer 1958). Several aspects of the architecture and material culture lend support to this belief. First, a five-room surface pueblo was constructed at the Millington site, the type site for the La Junta phase. J. Charles Kelley and Ellen Abbott Kelley believe that this small pueblo preceded construction of the La Junta phase pithouses at the site, leading to the conclusion that "a small El Paso phase colony at the Millington Site . . . was responsible for the ensuing sedentary development in the La Junta area" (J. C. Kelley and E. A. Kelley 1990, 11). The pueblo differed from La Junta phase pithouses in its surface rather than pit construction and in the use of attached, adobe walls. This construction is identical to the construction of contemporaneous pueblos of the El Paso phase (see Fig. 7.26). While La Junta phase pithouses are similar to El Paso phase pueblos, differences are apparent: the La Junta phase structures were built of *jacal* rather than adobe, placed in shallow or deep pits rather than on the surface, and had separate walls (J. C. Kelley and E. A. Kelley 1990). Similarities include the construction of La Junta phase pithouses in rows and the fact that they frequently had altars in their south wall. Another similarity is the presence of El Paso style pottery. At Millington, two large *ollas* of El Paso polychrome pottery were associated with the surface pueblo. Moreover, El Paso polychrome is the dominant ware in La Junta phase occupations (J. C. Kelley et al. 1940; Shackelford 1951, 71–72, and tables 3 and 4). El Paso polychrome was also used as offerings for La Junta phase burials, and some El Paso ware sherds are believed to have been locally made (see Cloud et al. 1994). Together, these data lend credence to the idea that these small villages derive from the Hueco Bolson.

Circular pit structures, such as those excavated at both Millington and Loma Alta, are among other traits of the La Junta phase. Two were excavated at the Polvo site, averaging just over 1 m in diameter and approximately 1 m deep (Shackelford 1951). These structures may have served as either granaries or sweat houses (J. C. Kelley and E. A. Kelley 1990), but almost no associated artifacts have been recovered in them and no macrobotanical samples were taken.

Burials from the La Junta phase are usually found beneath the clay floors of the pithouses in small burial pits and in flexed positions. Five burials were recovered from the Polvo site, including one adult and four infants, leading Shackelford (1951) to suggest a fairly high infant mortality rate. Although El Paso polychrome is the dominant pottery type in the La Junta phase, Chihuahua polychromes, Playas Red, Chupadero Black-on-white, and several unnamed brown and red wares have also been recovered at these sites (Cloud et al. 1994; J. C. Kelley et al. 1940). Lithic artifacts include shallow basin metates, manos, pestles, stone bowls, notched pebbles or sinkers, and scrapers (Shackelford 1951).

Arrow points recovered from La Junta phase sites are problematic, largely because most were recovered during early excavations where stratigraphic controls were minimal (see Fig. 7.36). They include Toyah, Perdiz, Fresno, and basally notched and basally indented variants (Shackelford 1951) now referred to as Garza (Runkles 1964) or Soto arrow points. Mallouf (1990) and Eileen Johnson et al. (1977) assign the Garza points to the seventeenth century, well after the La Junta phase, and Abby C. Treece et al. (1993e) note that radiocarbon dates from sites with Garza points in western central Texas range from A.D. 1410 to 1630. Garza points from excavations at Justiceburg Reservoir (Boyd et al. 1993, 1997b) in the Southern Plains support these dates. Similarly, Soto points of northern Chihuahua and the Trans-Pecos are generally considered fairly late in age (G. L. Fritz 1989; Mallouf 1990). Perdiz and Fresno arrow points have a fairly wide distribution in Texas (Prewitt 1995; E. Turner and Hester 1993; Treece et al. 1993e). Both have been found in Late Prehistoric and Historic period contexts throughout much of Texas (Mallouf 1985; Prewitt 1981; Treece et al. 1993e).

Forty-four arrow points recovered during excavations at Polvo (Cloud et al. 1994) may help to resolve this issue. Despite the apparent mixing of deposits in some units, a deep refuse pit in one unit dated to A.D. 1190–1280 contained only two Toyah specimens. This date, plus the "juxtaposition of the arrowpoints in the stratigraphic column" suggest that Toyah arrow points predate the Perdiz, Garza, triangular (Fresno?), and other types recovered at Polvo (Cloud et al 1994, 73).

In summary, around A.D. 1250 small pithouse villages began to be constructed in the Presidio Bolson. The similarity of the villages to the small pueblos of the Hueco Bolson, together with the dominance of ceramic styles from that region, albeit possibly locally made, certainly indicates strong influences, if not actual movement of peoples, from the El Paso area.

At the same time, Sebastian and Larralde (1989) and M. Miller (1994), working in the northern region of the Trans-Pecos, recommend an alternative hypothesis. Specifically, they suggest that at least some sites in the region represent seasonally mobile groups that moved into the eastern Trans-Pecos to gain access to selected resources. Evidence from the Snakepit site (41CU310), a small El Paso phase camp on the Brushy Mesa escarpment of the Delaware Mountains in eastern Culberson County, supports this view. Excavated during the All American Pipeline Project (New Mexico State University and Continuum Corp. 1989; M. Miller 1994), the Late Prehistoric component consists of several hearth features surrounding a small, ephemeral hut structure. Radiocarbon dates confirm an El Paso phase occupation, along with characteristic El Paso polychrome vessel forms and styles; however, the circular form of the structure is not characteristic of the formal isolated rooms and pueblos typical of this time period in the Jornada region but rather is much more similar to the ephemeral hut structures of the Mesilla phase. The artifact assemblage and architectural form indicate a high level of mobility with little evidence of agricultural dependence. Pithouse settlements have also been identified in the Salt Flat Basin. Whether these settlements were agriculturally based is open to question because analyses of macrobotanical and pollen samples identified few plant remains.

Post-Pueblo through the Early Spanish Colonial Period (A.D. 1450–1750)

Between A.D. 1450 and 1500, pueblo settlements across the Jornada Mogollon region of the western Trans-Pecos and southern New Mexico were abandoned. Whether isolated rooms or pithouses continued to be occupied is open to question, although no post–A.D. 1450 radiocarbon dates have been obtained from the small sample of such structures. Burned rooms with in situ floor assemblages have been observed at Hot Well, Escondida, and Embree Pueblos (Bentley n.d.; Hedrick 1967; Magers 1973; O'Laughlin 1985a), and there is some disputable evidence for large-scale burning of structures at Embree pueblo. These cases appear to be relatively isolated, and the majority of several hundred excavated pueblo rooms were not burned.

The demise of El Paso phase pueblo settlements after A.D. 1450 presents another instance, along with Casas Grandes, of regional abandonment by agricultural populations throughout the southern Southwest during the fifteenth century. Although several explanatory scenarios have been proposed for the decline of Puebloan occupations in west Texas (e.g., Upham 1984), two have some merit. Foremost is the view that terminal events in the El Paso phase were a result of environmental change—such as an extended period of drought—or more appropriately that such change was coupled with subsistence failure resulting from an overspecialized agricultural economy (O'Laughlin 1980; Upham 1984). A second position is that the fall—as well as the rise—of the Jornada pueblo system was a direct result of the influence of the Casas Grandes regional system (Schaafsma 1979; Wimberly 1979). J. C. Kelley (1990; see also J. C. Kelley and E. A. Kelley 1990, 1991) proposes a similar explanation for developments during the La Junta phase in the eastern Trans-Pecos. A third position offered by Carmichael (1986) for the Jornada region, and echoed by Mallouf (1990) for the termination of the La Junta phase in the Big Bend region, takes issue with the concept of abandonment. Carmichael suggests that populations reverted to a less intensive hunting-gathering subsistence organization similar to that practiced by indigenous groups and documented by Spanish explorers during the sixteenth and early seventeenth centuries. Such adaptations often left few visible archeological traces, although, based on recently obtained chronometric data, the Cielo Complex appears to represent an archeologically distinct entity of this period in the Big Bend region (Mallouf 1985, 1990).

As established above, there is sufficient evidence to indicate that populations had become increasingly specialized during the El Paso phase. Therefore, it is likely that even small-scale climatic deviations may have resulted in a serious disruption of the Puebloan subsistence economy. It is also plausible that this climatic factor, when combined with the disorder apparent among social and economic systems across the southern Southwest, may have systemically contributed to problems in the western Trans-Pecos.

Regardless of the nature of the underlying causes, the demise of the pueblo settlement system represents a profound change in social, economic, and subsistence systems. A drastic reduction in radiocarbon age estimates occurs between A.D. 1400 and 1500 (Fig. 7.37). Using this record as a proxy measure of feature construction and site formation, it may be estimated that rates of feature construction after A.D. 1450 declined to levels equivalent to those of the Middle Archaic or earlier, clearly suggesting a major

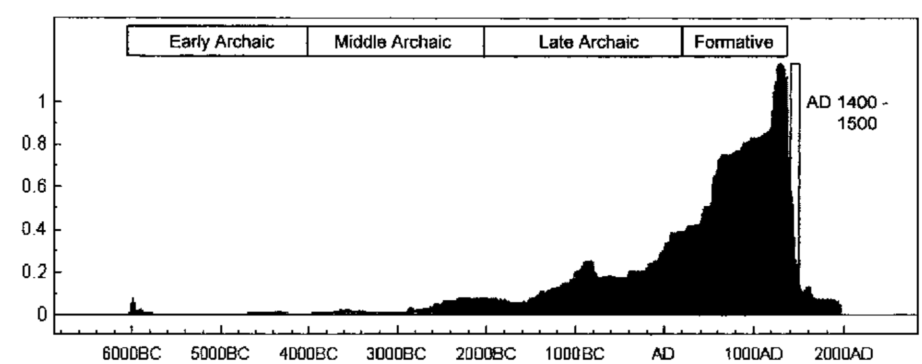

Fig. 7.37. Summed probability histogram of 1,289 radiocarbon age estimates from the Jornada Mogollon region of El Paso, Hudspeth, and Culberson Counties, Texas, and south-central New Mexico.

decline in regional population. Another indication that profound social and demographic changes took place is that the El Paso brownware ceramic tradition, representing nearly twelve hundred years of relative technological continuity in manufacturing methods and raw material utilization, disappears from the archeological record after A.D. 1450.

Subsequent to the abandonment of the El Paso phase puebloan system and preceding the Spanish *entradas* in the mid- to late 1500s, events in the western Trans-Pecos remain almost entirely unknown. Noting the presence of several post–A.D. 1450 radiocarbon dates throughout the western Trans-Pecos, Patrick H. Beckett and Terry L. Corbett (1992; see also Beckett 1985) suggest that these dates provide evidence of post-pueblo habitation. They further propose that the inhabitants of El Paso phase pueblos were ancestral to indigenous Manso groups described by early Spanish chroniclers. M. Miller (n.d.) offers a critical appraisal of these dates, noting that very few post–A.D. 1450 radiocarbon age estimates are free from serious contextual and interpretive problems. However, several radiocarbon age estimates do fall within this interval, most notably a series of dates obtained from Firecracker Pueblo in northeast El Paso (M. Miller 1996a). While we believe the region was occupied during this period, unambiguous archeological evidence to substantiate such beliefs is lacking. Unfortunately, aside from the issue of late chronometric dates, current arguments regarding the existence of post-pueblo occupations are phrased primarily in terms of negative evidence, and accordingly the nature of prehistoric occupation between A.D. 1450 and the late 1500s remains entirely open to question.

Commencing in 1581, several *entradas* by Spanish explorers passed through portions of the Trans-Pecos. Among the more important and well-documented early *entradas* are the Rodriguez-Chamuscado, Espejo, and Oñate expeditions. Spanish accounts of these travels note the presence of several indigenous groups occupying the La Junta and western Trans-Pecos regions. Although varied and contradictory names are often provided in the documentary sources (Gerald 1973; Naylor 1969), the most common terms include the Manso and Suma in the vicinity of El Paso and southern New Mexico, and the Jumano and Patarabueye in the La Junta region (J. C. Kelley 1986). Ethnohistorically, little is known of these groups beyond rather brief and vague accounts provided by Spanish chroniclers of the expeditions (Beckett and Corbett 1992; Benavides 1965; Hammond and Rey 1929; A. Hughes 1914; J. C. Kelley 1952, 1953, 1986; Kenmotsu 1994; Scholes and Mera 1940; Walz 1951).

Fray Alonso de Benavides (1965 [1916]) and Diego Pérez de Luxán (Hammond and Rey 1929) provide the most thorough accounts of the encounters between Spanish and indigenous groups in the Trans-Pecos. In the western Trans-Pecos, both accounts describe Manso groups living along the Rio Grande in communities, or *rancherias,* composed of straw houses (*jacales*) and subsisting primarily on hunted and gathered foods. Descriptions of food items include mesquite, fish, and mice, in addition to corn, which may have been cultivated to a limited extent. Luxán's account of settlements in the La Junta district provide several insights into house form and subsistence, describing the presence of flat-roofed semisubterranean habitations similar to the *jacal* structures excavated at the Millington, Loma Alta, and Polvo sites (J. C. Kelley 1939, 1949, 1986; Shackelford 1951, 1955). The inhabitants of these sites, collectively referred to as Patarabueyes, are described as having an agricultural subsistence base, with corn, beans, and gourds mentioned as primary food items. In addition to the sedentary groups along the Rio Grande, the Jumanos are also first mentioned the Espejo expedition and are described as having a similar appearance and dress to the Patarabueyes but constructing different house forms and subsisting on hunted and gathered foods such as roasted calabashes, prickly pear cactus, buffalo, and fish. Benjamin L. Everitt (1977) makes an important observation that such groups were frequently encountered by Spanish explorers traveling through the Rio Grande Valley during the winter months, but they found the region devoid of inhabitants during the summer months, a pattern suggestive of a mobile, seasonal settlement round.

Archeological evidence of occupations by protohistoric Manso or Suma groups in the western Trans-Pecos has been elusive (Gerald 1974). No settlement of this period has been conclusively identified despite extensive surveys in El Paso County and south-central New Mexico. Since Spanish documents often note that portions of the valley were occupied, the apparent absence of such sites probably is due to problems of archeological recognition and geomorphic factors, the latter being a particularly salient issue if such settlements were situated in the floodplain of the Rio Grande Valley.

One site that may be provisionally attributed to Manso or Suma settlement is LA26780, at the Dona Ana County Airport 8 km west of El Paso (Batcho 1987; Batcho et al. 1985; M. Miller 2001). Surface collections and limited excavations documented a multicomponent occupation with several clusters of hearths and artifacts distributed along an upper terrace of the Rio Grande Valley.

Aspects of the artifact collections from some clusters at LA26780 are unusual when contrasted with other prehistoric and historic assemblages in the vicinity. Nearly 64 percent of the lithic assemblage was obsidian, an unusually high proportion in a region where, even at sites situated near obsidian-bearing gravels, this material rarely exceeds 10 percent of prehistoric lithic assemblages. Of forty obsidian samples submitted for source identification, one is from the Antelope Wells source in southwestern New Mexico; thirty-nine samples are assigned to three obsidian geochemical compositional groups that derive from the Lago Barreal, Sierra Fresnal, and one as yet unidentified source in northern Chihuahua (M. Miller and Shackley 1998). None of the forty samples is from a source in the Rio Grande gravels, despite the site's location at the edge of the Rio Grande Valley terrace. The artifact assemblage also includes coarsely manufactured and poorly fired sand-tempered brownware sherds and small, triangular Harrell-style projectile points. Duran and Batcho (1983) also note that a partial rowel from a Spanish spur was recovered from the surface near a hearth that yielded a calibrated radiocarbon age range of A.D. 1420 (1516, 1588, 1622) 1950. These data are not particularly convincing if considered individually, and the multicomponent nature of the site (i.e., prehistoric materials at several hearth/artifact clusters) creates further interpretive problems. At the present time, however, LA26780 is the most promising candidate for a Manso settlement. If this can be confirmed, obsidian sourcing studies and other aspects of material culture from this settlement may provide insights into the mobility ranges or nature of extraregional contacts of protohistoric Manso groups in the area.

Archeological and historical evidence indicates that quite a different series of events took place during this period in the eastern Trans-Pecos. Unlike the western region, the villages of the La Junta district were not abandoned around A.D. 1400 but continued to be occupied until 1683, when Spanish missions were established in the Presidio Bolson. This period of time has been named the Concepcion phase (J. C. Kelley et al. 1940; J. C. Kelley and E. A. Kelley 1990), but the dates are tentative, and the phase needs further archeological research.

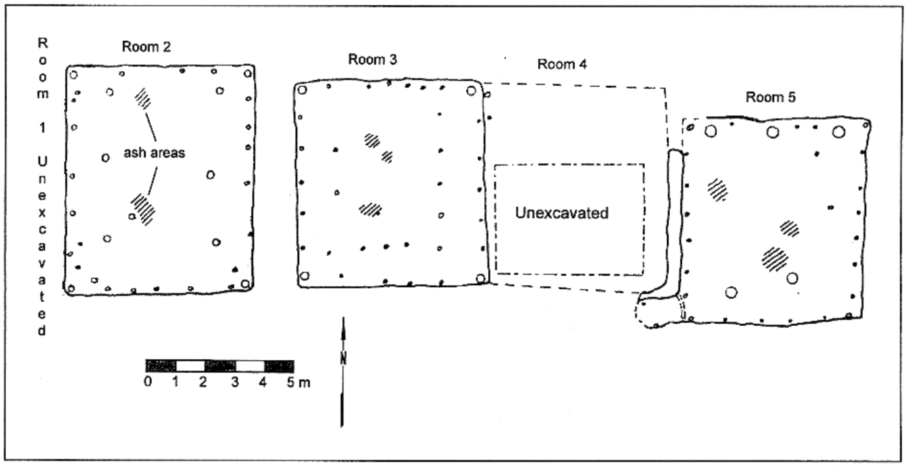

Fig. 7.38. Concepcion phase room block at the Millington site, La Junta de los Rios district, Presidio County, Texas (after J. C. Kelley 1985, 153).

The distinguishing features of the phase are its house and pottery styles. Houses of the Concepcion phase are distinct from the earlier houses in their much larger size (measuring ca. 7.3 by 8.8 m) and "by [their] lack of adobe floors, curbs, altars, and fire pits" (J. C. Kelley 1986, 82). They did continue to be constructed in a pit and were frequently constructed in rows (Fig. 7.38). Excavated examples of these structures resemble those described by Spanish explorers. Kelley and Kelley conclude that their large size, and the presence of multiple hearths, indicates they were used by "several families, probably an extended family group" (J. C. Kelley and E. A. Kelley 1990, 11). Circular pit structures, believed to be granaries or storage facilities in the preceding phase, were also constructed in the Concepcion phase. However, like the rectangular pithouses of this phase, these structures are much larger than those of the La Junta phase. If Kelley and Kelley (1990) are correct in their interpretation of multifamily settlement, then it would make sense that the size of storage facilities would have increased to accommodate greater needs.

While nearly all artifact types present in components of the La Junta phase are present in Concepcion phase deposits (J. C. Kelley 1986), the ceramic wares in the latter are quite distinct. In contrast to the prominence of El Paso styles during the La Junta phase, locally produced plainwares dominate the assemblage. Tentative type names assigned to Concepcion phase ceramics are Chinati Plain, Capote Red-on-brown, and Paloma Red-on-gray (J. C. Kelley et al. 1940). Another distinction of the Concepcion ceramic assemblage is that intrusive wares from New Mexico or northern Chihuahua are not present (J. C. Kelley 1986). One exception to this is two sherds of Patton Engraved, a pottery type manufactured by the historic Hasinai Caddo of east Texas (see Story 1995), recovered from the Millington site. As noted above, another possible distinction between the two phases is the replacement of Toyah arrow points with Perdiz, Garza/Soto, and Fresno styles.

More recently, Mallouf (1985, 1990, 1993) has documented a unique archeological manifestation designated the Cielo Complex. One of the more distinctive aspects of Cielo Complex settlements is an architectural style of oval or round house enclosures (2.7 to 3.4 m in diameter) bounded by stacked stones (Fig. 7.39). Cielo Complex settlements are present throughout the Big Bend region, northeastern Chihuahua, and northwestern Coahuila. In the La Junta district they tend to be situated on higher alluvial terraces and landforms than La Junta and Concepcion phase villages. Bone tools, formal stone tools, groundstone, and Perdiz arrow points are commonly found at Cielo Complex sites, and turquoise and shell ornaments have also been recovered. The material culture of the complex is similar to that of the La Junta and Concepcion phase settlements. However, an important distinction between Cielo Complex occupations and La Junta and Concepcion phase settlements is that ceramics are entirely lacking at the former. Recently obtained radiocarbon dates indicate occupations between ca. A.D. 1330 and 1680 (Mallouf 1990).

The particular settlement and adaptive system represented by the Cielo Complex cuts across the La Junta and Concepcion phases and offers intriguing support for the idea of a continuum of hunter-gatherer adaptations coexistent with agriculturalists in the Presidio Bolson, a continuum transcending the demise of agriculturally based settlement systems in the adjacent Jornada Mogollon region. In addition, Mallouf (1985, 1990) notes the presence of turquoise and shell in Cielo Complex sites, evidence for symbiotic relationships between hunter-gatherer groups and sedentary agriculturalists in the eastern Trans-Pecos.

Establishment of Missions and the Pueblo Revolt

Beginning in the late 1600s the pace of Spanish colonization increased with the establishment of missions and settlements in the La Junta district and the

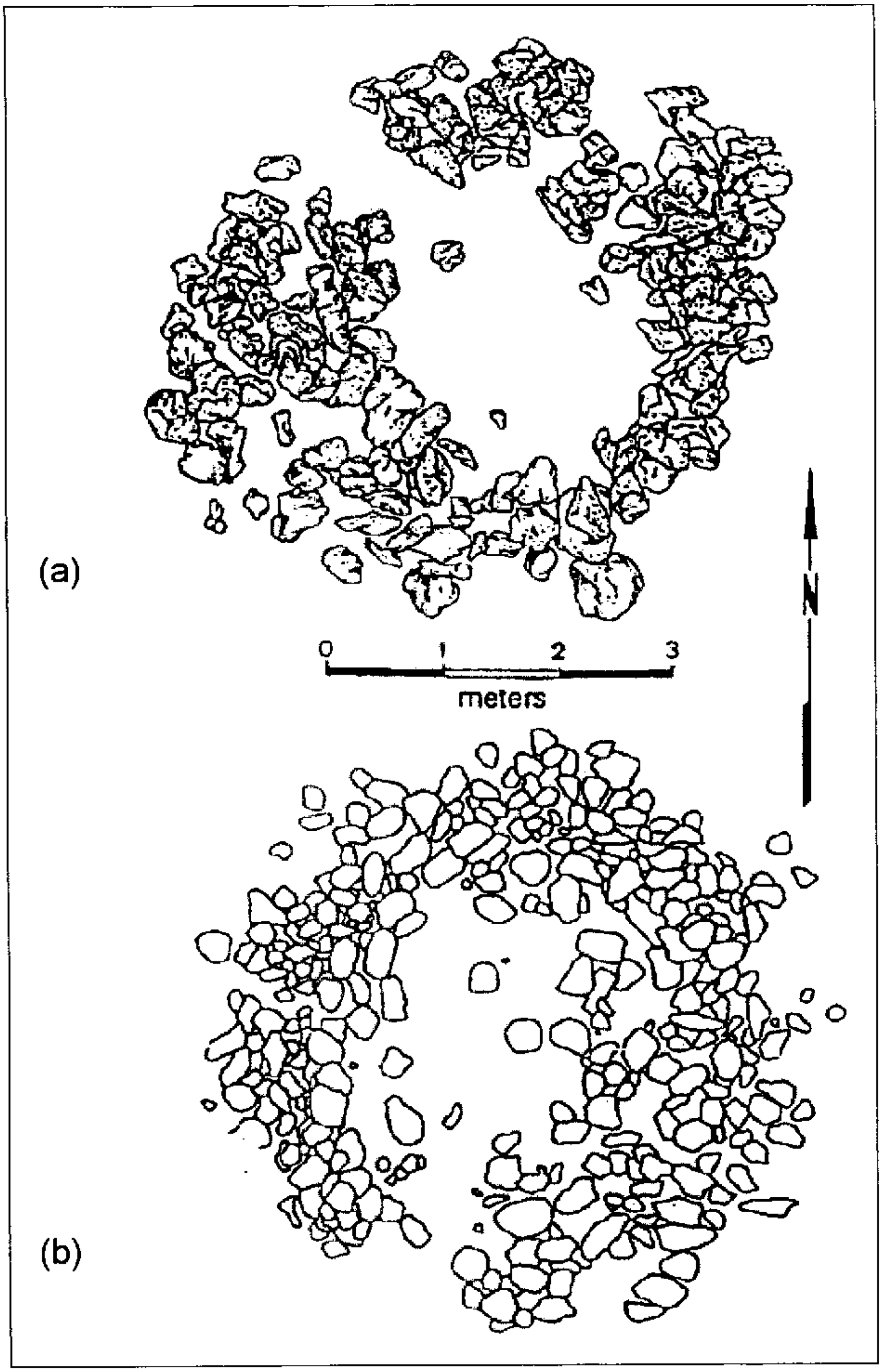

Fig. 7.39. Examples of Cielo Complex house structures: a, Paint Gap site (41BS111); b, Cielo Bravo site (41PS52) (adapted from Mallouf 1990, fig. 6).

lower valley of El Paso. The first mission in the western sector was Nuestra Señora de Guadalupe de los Mansos, established in 1659 on the southern side of the Rio Grande in what is today Ciudad Juárez, Chihuahua (Gerald 1990a). The mission was refurbished in 1662, and a restored version stands today adjacent to the Juárez cathedral. Records indicate that four hundred Mansos were present at the dedication ceremony (Forbes 1960). Little else is known of this settlement, and much of the original site remains buried under urban developments in downtown Juárez. Additional missions and settlements were established along the Rio Grande Valley, but none has yet been identified archeologically (A. Hughes 1914; Gerald 1990a).

The Pueblo Revolt of 1680 in New Mexico and the Manso Revolt of 1684 in the El Paso area provided the impetus for the next series of mission and presidio establishments. After the Pueblo Revolt among puebloan groups in northern New Mexico, an estimated two thousand Spanish refugees and Native Americans loyal to the Spaniards were resettled around missions in the El Paso Lower Valley. Tiwa (Tigua), Piro, and Tompiro groups from the Rio Abajo pueblos of the central and northern Rio Grande Valley of New Mexico were resettled at the missions of Ysleta and Socorro. The original Ysleta mission and at least two locations of the mission at Socorro were destroyed by floods. In the 1980s, Rex Gerald, working at site 41EP1532, identified the location of what is suspected to be the Socorro mission occupied until 1760 (Gerald 1990b; D. Martin 1999). Missions were also first established in the La Junta district in 1683. J. C. Kelley (1953) and Madrid (1993) have tentatively identified the Polvo site (412PS21) as the location of the San Antonio de los Puliques mission and pueblo known as Tapacolmes. Unfortunately, Spanish Colonial period sites in the La Junta district have received little archeological attention aside from limited work completed at the Polvo site (Cloud et al. 1994).

Archeological aspects of the Pueblo Revolt period in the western Trans-Pecos have recently come to light in excavation and survey projects in the El Paso Lower Valley in the vicinity of the present-day towns of Ysleta, Socorro, and San Elizario (D. O. Brown et al. 1994, 1995; M. Miller and O'Leary 1992a; Peterson 1993; Peterson and Brown 1992a, 1992b; Sale et al. 1987; Vierra et al. 1997, 1999). These investigations have provided information on site locations, feature types, chronology, and material culture of this period. However, in many ways, the Spanish Colonial period archeology in the western Trans-Pecos remains in a developmental stage, and inferences regarding changing subsistence adaptations and social organization remain conjectural. There are also fundamental problems in differentiating among archeological remains attributable to Native American and

Hispanic groups. However, a chronological and material culture framework has now been established to guide the design of future research.

During this period, the focus of regional settlement shifted to the floodplain and terrace margins of the Rio Grande Valley, with residential settlements centered in proximity to missions or presidios established at Ysleta, Socorro, and San Elizario. Such sites have rarely been encountered far from these core settlement zones, although some important components may be difficult to identify because they may be buried at depths of greater than 1 m below recent floodplain alluvium and agricultural fields. Recent surveys of the terrace margins have recorded small camp sites with historic brownware ceramics, suggesting intermittent and short-term occupation of this topographic zone (Graves et al. 1997). Oral traditions note that the Hueco Bolson was used for hunting forays, and macrofloral and faunal assemblages from Spanish Colonial deposits commonly include game animals and plants indigenous to habitats outside the riverine environment of the Rio Grande Valley. Direct archeological evidence of land use or settlement in the Hueco or Mesilla Bolsons is rare, however. Isolated finds of historic brownware sherds have occasionally been reported there, and a few sherds have been found associated with small artifact scatters or hearths (see M. Miller et al. 1998). There appear to be no substantial residential sites of this period within the central basin, alluvial fan piedmont of local mountain chains, or river margin terraces.

Community structure of post–Pueblo Revolt settlements remains poorly known. Evidence for pueblos is absent, and instead settlement involved isolated *jacal* structures near agricultural fields or clusters of such houses loosely arranged around central plazas. The majority of test excavations in these contexts throughout the valley have encountered generally undifferentiated deposits of cultural debris and refuse mixed within floodplain deposits, although trash pits and occasional *jacal* structures or suspected remnants of such structures have been encountered. Excavations have usually been restricted to small areas, such that it is seldom possible to determine the overall layout of settlements or whether adjacent structures are present. Based on current information, it does appear that most house structures are relatively isolated, and it may be surmised that community layouts were similar to those observed by J. Walter Fewkes at the Tigua pueblo at Ysleta: "The cacique remembers that formerly Indian houses were arranged in that site in rectangular form about the plaza, each building being a small one-story habitation made of upright logs chinked and plastered with adobe, forming a type of building called by the Mexicans jacal" (Fewkes 1902, 60).

Early work focused on remains of missions and presidios, including Rex Gerald's pioneering work at Socorro Mission (Gerald 1990a, 1990b; see also D. Martin 1999), or Hispanic homesteads (Morrow 1978), and consequently Native American settlements received less emphasis. An exception is Consuelo T. Evans's (1988) study of burials from Socorro Mission that provided an important source of bioarcheological information for this period. The burial population of thirty-two individuals recovered from below the floor and in the nave of the mission consisted mostly of Native Americans, although some were of mixed Native American/Spanish descent. Carbon isotope studies on a sample of the burials (MacNeish and Marino 1993) indicate a reliance on domesticated cultigens and animals.

The best known Native American settlement of the Pueblo Revolt period is 41EP2840, also known as the Ysleta WIC Clinic site (Miller and O'Leary 1992a). The Ysleta WIC Clinic site has been securely dated on ceramic and stratigraphic grounds to A.D. 1680–1725, and therefore it was inhabited within the first two generations after the Pueblo Revolt. Excavations at a depth of 1 m below the plow zone and floodplain deposits unearthed a collapsed, burned *jacal* structure surrounded by numerous trash pits, borrow pits, and a possible hearth feature (Fig. 7.40). Large quantities of animal bone and ceramics were recovered from these features. Aside from the ceramics and subsistence remains, the artifact assemblage from the Ysleta WIC Clinic site appears distinctly Native American. Chipped stone tools, spindle whorls fashioned from reworked brownware and majolica sherds, and a fragmentary ceramic figurine were recovered at the site. Items of metal or glass were extremely rare, as were nonlocal ceramic wares.

The artifacts and features at the Ysleta WIC Clinic site are among the earliest well-documented Spanish Colonial period assemblages in the valley, and aspects of material culture from this settlement provide an important data set to compare with materials recovered from later eighteenth- and nineteenth-century deposits in the vicinity. Beginning in the 1700s, the El Paso area missions became part of a commercial network along the Camino Real between Santa Fe and Chihuahua, Mexico. Comparative studies of artifact assemblages offer an opportunity to examine the impacts of this increasing tempo of economic activity and Spanish influence on Native American groups.

Subsistence practices are becoming known through recent work, and the picture is one of mixed subsistence of traditional wild and domesticated foods and the addition of European cultigens and livestock. The influence of Spanish colonization is readily apparent by the common presence of introduced, domesticated animals in faunal collections from this period (Bartlema 1994, 1995; M. Brown 1997, 1999; Hanson et al. 1992; Stratton 1996). The most common faunal remains include cow (*Bos taurus*), domesticated sheep (*Ovis aries*), and goat (*Capra hircus*). Other domesticated species such as pig (*Sus scrofa*), chicken (*Gallus gallus*), and horse (*Equus caballus*) are present in smaller numbers, as occasionally are canids (dogs, coyote), probably nonfood items. Despite the predominance of domesticated species and the hunting of deer, animals such as cottontail, jackrabbit, antelope, and various bird species continued to be important. Riverine species include turtle, fish, and shellfish, but such remains are surprisingly rare given the locations of the settlements in the Rio Grande floodplain, and their rarity suggests that they served as supplemental food resources. Quantitative summaries indicate that the meat diet comprised domesticated cow and caprines (goat or sheep). Intersite comparative analyses are hindered to an extent by sampling and

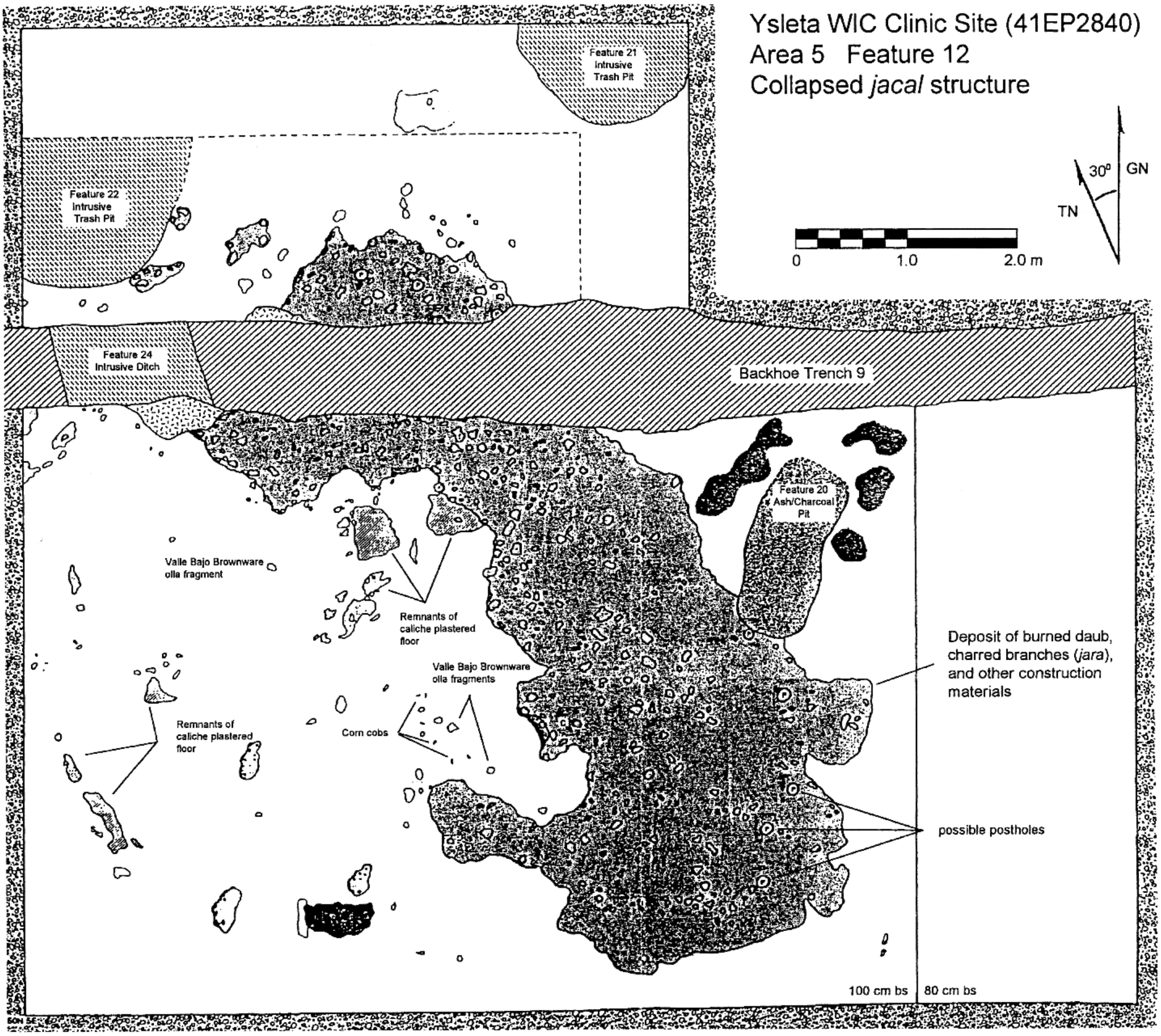

Fig. 7.40. Collapsed and burned Pueblo Revolt period jacal structure excavated at the Ysleta WIC Clinic site, El Paso County (after M. Miller and O'Leary 1992a).

taphonomic problems, yet it does appear that the early occupation at the Ysleta WIC Clinic site has proportionally greater amounts of rabbit, deer, and antelope remains when compared to faunal collections from post–A.D. 1750 occupations (Fig. 7.41).

Several intriguing patterns are also emerging from recent macrobotanical studies (Holloway 1996; Holloway and Toll 1992; McBride 1997, 1999). Not surprisingly, corn is the most common domesticate. Morphometric studies of preserved corncobs from the Ysleta WIC Clinic site have shown that distinctive Spanish hybrids were absent (Holloway and Toll 1992, 179). Instead, the structure and dimensions of the *Zea* samples are similar to early post-contact southwestern types, demonstrating that local groups during early post–Pueblo Revolt times maintained an emphasis on traditional crops. The pits of peaches, a food item introduced by the Spanish, are frequently recovered from trash pits and house contexts, and other introduced plants such as wheat and grapes have been found in contexts postdating A.D. 1750. Despite the rather thorough sampling of deposits at several sites in the valley, evidence of domesticated beans has rarely been found in early Spanish Colonial deposits, and the only mention of cucurbits is from the Garcia site (Peterson 1993, 505). Wild plant foods continue to be an important supplement to the diet. Mesquite and prickly pear cactus seeds have been recovered from numerous contexts both predating and postdating A.D. 1750, indicating that these resources continued to play an important role in subsistence. Other wild plant remains include sun-

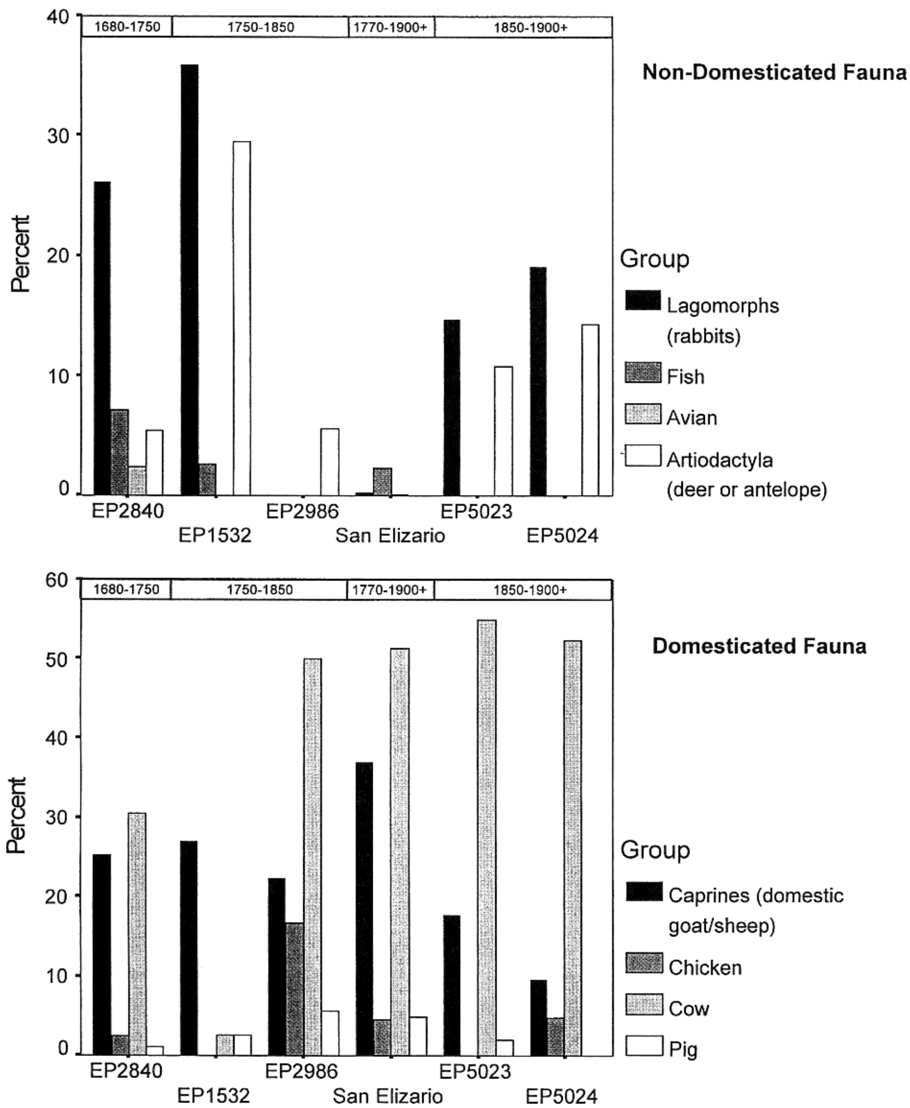

Fig. 7.41. Comparison of faunal assemblages from Spanish Colonial and Historic period contexts in the El Paso lower valley showing proportions of domesticated and nondomesticated groups through time.

flower, atriplex, cheno-ams, milkweed, cocklebur, and purslane, although it has not been determined whether these represent food or medicinal items as opposed to background seed rain from agricultural fields and plazas.

Interestingly, stone tool technologies show little fundamental change from prehistoric sites in the western Trans-Pecos (Graves 1995; O'Leary and Miller 1992; Vierra 1997a, 1999). One recently investigated aspect of chipped stone assemblages indicates that gunflints were manufactured in the vicinity of the presidio at San Elizario (Vierra 1997a), but production of such implements was probably associated with Spanish military occupation of the presidio. Otherwise, lithic technology among Native American groups continues the tradition of informal core technologies and flake tools using raw materials procured from local gravel deposits. Small, triangular projectile points (Harrell style) are common in some Spanish Colonial contexts, particularly those predating A.D. 1750. Groundstone manos and metates are also present.

The most striking technological change involves ceramics. A new tradition known as Valle Bajo brownware makes its appearance, marking a distinct departure from prehistoric El Paso brownware. As noted by Marshall (1997), Valle Bajo brownware represents a local expression of the regional *corriente* ware produced throughout New Mexico, west Texas, and northern Mexico during Spanish Colonial times. The earlier expression of the tradition is represented at the Ysleta WIC Clinic site (Miller and O'Leary 1992b) and has a distinctive continuity with northern New Mexican Native American ceramic traditions because of the presence of carinated bowl forms. Carinated bowls (vessels with polished red slips or washes) and an absence of red-on-brown designs mark production and stylistic attributes distinguishing the early period from post–A.D. 1700/1750 assemblages from sites in Socorro and San Elizario (Brown and Driver 1994; Marshall 1997). The Valle Bajo tradition shares several generic similarities with Spanish Colonial brownware collections of the Conchos phase in the La Junta district. While certain differences in temper and paste can be expected given the distance between El Paso and La Junta de los Ríos, sufficient similarities exist in design and form to indicate that the historic brownware of the Conchos phase represents another local expression of the *corriente* ware tradition of the greater Southwest.

Summary of the Post-Pueblo and Early Spanish Colonial Periods

Only a cursory account of the variety of recent archeological investigations of the Spanish Colonial period has been presented in this chapter, but the relevance of this period for examining larger anthropological issues of regional reorganization, economic and social interaction, and processes of assimilation and acculturation is evident. Peterson and Brown (1992b) define two overarching themes for Spanish Colonial period archeological research in the El Paso Lower Valley: culture group interaction and community evolution. Central to these themes are the study of the dynamic and complex relationships between indigenous populations (Manso, Suma, and Apache), resettled puebloan groups from New Mexico (Piro and Tiwa), and European colonists and how rapidly changing economic and social arrangements among these groups are reflected in aspects of material culture and the structure of communities. While the picture is far from clear, the archeological record of settlements in the El Paso Lower Valley shows a dilution of traditional subsistence practices and material culture, indicating that Native Americans assimilated to some degree into Spanish Colonial culture. As noted by Vierra (1997b), such events in the El Paso area proceeded much more abruptly than in the northern New Mexico pueblos. Examining the degree of community evolution and cultural assimilation—as well as the continued resistance to assimilation—is one of the more promising aspects of Spanish Colonial period archeology in west Texas.

Equally interesting are contrasting developments in the eastern and western Trans-Pecos that present an important opportunity to further our understanding of processes of regional reorganization and cultural collapse. What factors led to the abandonment of puebloan settlements toward the west while similar subsistence and settlement systems to the east were largely unaffected, or at least were maintained with only minor changes in architecture and material culture? An important component of this issue involves mutualistic relationships between hunter-gatherer groups and agriculturalists (Kenmotsu 1994; Mallouf 1990), and the eastern Trans-Pecos holds great promise for further investigations of such relationships.

Summary

The La Junta district, Salt Flat Basin, the Guadalupe Mountains, and other areas of the Trans-Pecos are often accorded only passing reference, if they are mentioned at all, in culture history overviews of the Jornada Mogollon region. Likewise, the Jornada Mogollon region is often given limited attention in culture histories of the eastern Trans-Pecos. Cultural events and processes in the La Junta district and Jornada Mogollon region are distinct and rightfully should be viewed within their specific environmental, ecological, and cultural contexts. However, of equal significance is the interplay between Prehistoric and early Historic groups throughout these and more distant regions of the Southwest. Again, these issues reflect our scale of inquiry. By focusing on single regions, adaptive patterns and processes that transcend regional boundaries are often overlooked. A combined focus on the regional and the transcendent can provide a more realistic vision of prehistory, not only for the Trans-Pecos but also for the greater Southwest, north-central Mexico, the Southern Plains, and central Texas.

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