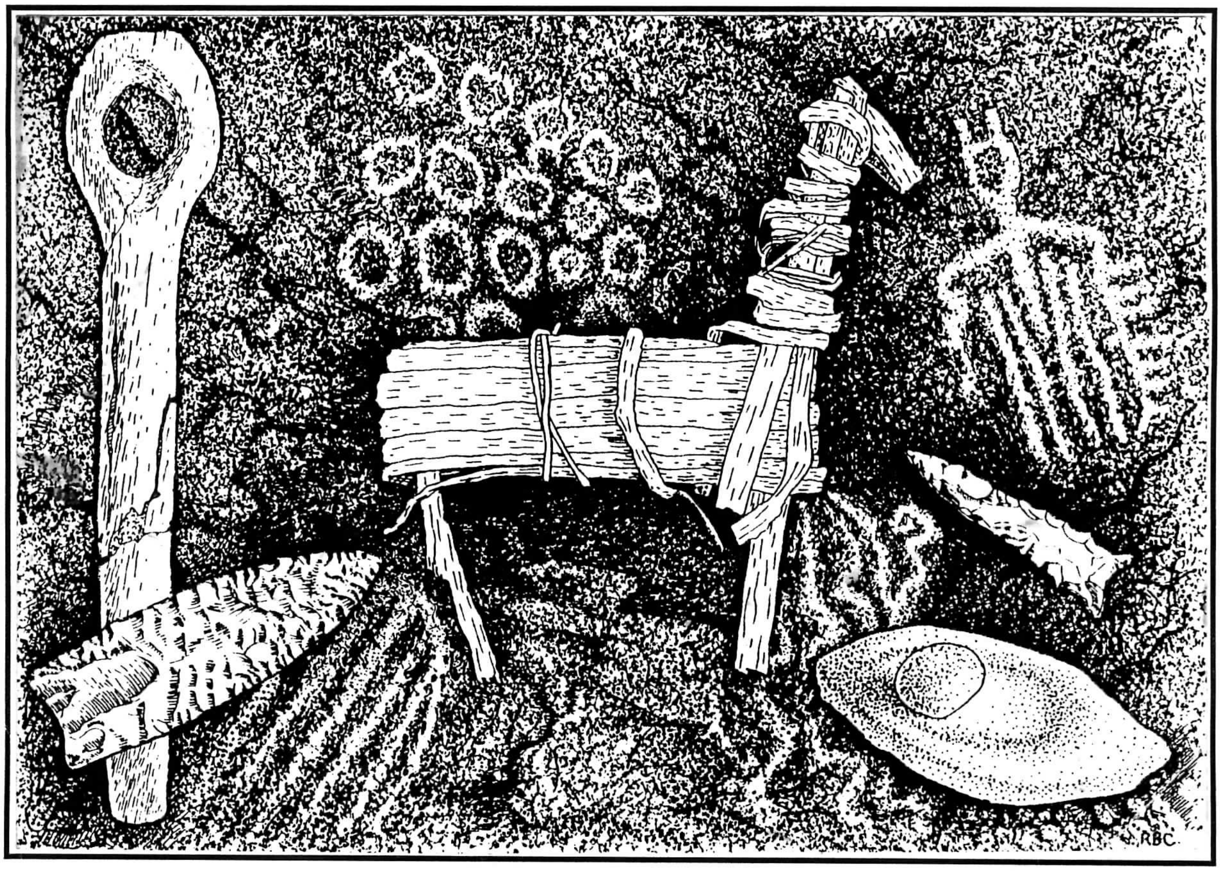
PALEOINDIAN AND ARCHAIC SITES IN ARIZONA



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Paleoindian and Archaic Sites in Arizona

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ABSTRACT

The length of time that Paleoindian and Archaic peoples lived in Arizona represents the majority of the duration of human occupation in southwestern North America. Archaeological investigations at Paleoindian and Archaic sites in Arizona have played important roles in extending New World prehistory back to the Pleistocene, in reconstructing Archaic culture sequences for the Southwest, and in increasing our understanding of the earliest transition to agriculture in North America. As part of the statewide historic preservation plan, this document has been prepared to define contexts for the preservation and investigation of the Paleoindian and Archaic archaeological record in Arizona.

The eligibility of a Paleoindian or Archaic archaeological property for the Arizona and National Registers of Historic Places is judged by its *significance* and *integrity*. Most often, the significance is in terms of the property's contribution of, or potential for yielding, important information about prehistory (Criterion D for National Register eligibility). The information may be relevant to one or more *research issues* identified here, including colonizations and migrations; cultural responses to environmental changes; technologies; subsistence and settlement strategies; social structures; and cultural identities. A Paleoindian or Archaic property in Arizona is considered to have enough integrity to convey its significance if it has at least some intact surface distributions or subsurface deposits of artifacts and/or cultural features. Documentation for nominated sites should include assessments of their representativeness of specific environmental periods, physiographic regions, subsistence adaptations, cultural complexes, site patterns, and site types.

Based on comparisons of geological and biological proxy records of environmental history, the major Late Quaternary *environmental periods* of the Southwest during the known timespan of human occupation included the latest Wisconsin, ca. 14,500-10,500 b.p.; the early Holocene, ca. 10,500-7500 b.p.; the middle Holocene, ca. 7500-4500 b.p.; and the late Holocene, ca. 4500-0 b.p. (b.p. = uncalibrated radiocarbon years before present).

Major *physiographic regions* occurring in Arizona include the Colorado Plateau, the Mountain Transition Zone, the Southern Basin and Range Province, and the Lower Colorado River Valley.

Paleoindian *subsistence adaptations* in Arizona may have included pre-projectile point (pre-Clovis) foraging economies, but terminal Wisconsin and early Holocene Paleoindian hunting and gathering economies are better documented. The latter included hunting of now-extinct large mammals (megafauna) with fluted or lanceolate projectile points. Archaic adaptations included early, middle, and late Holocene hunting and gathering economies based on more diverse and/or intensively processed food resources, and mixed farming and foraging economies in which domesticated plants supplemented wild foods. Early Agricultural adaptations, considered "Late Archaic" in the southern Southwest, were economies in which cultigens were the primary subsistence resources.

Cultural complexes are identified in terms of temporal-spatial patterns in the archaeological record that represent both cultural traditions and communication networks. The complexes described in this document are defined primarily in terms of projectile point types. To varying degrees, these overlapped in space and time with each other and with complexes defined in terms of rock art styles, figurine traditions, basket-weaving techniques, mortuary practices, and other aspects of material culture.

Site patterns within the sample universe of 4,501 recorded sites in Arizona (included in a database with information on 55 Paleoindian, 3,639 Archaic, and 383 Early Agricultural site occupations and 596 large aceramic sites) are summarized according to various characteristics. These include levels of archaeological investigation, jurisdiction/ownership, dating criteria, regions, elevations, landforms, sizes, artifact and feature contexts, artifact classes present, and feature types.

Identified *site types* within the sample universe include lithic quarry/initial reduction sites, animal kill/butchering sites, plant gathering/processing sites, rock art sites, shrines, trails, cemeteries, and settlements.

Although a pre-Clovis human presence in South America is now accepted, none of the possible pre-projectile point sites in western North America are dated well enough to confirm their claimed ages. Currently, the earliest well-dated evidence of humans in Arizona and the rest of North America is from terminal Wisconsin age Clovis sites dated to 11,600-10,900 b.p. During the early Holocene, Paleoindian and early Archaic adaptations overlapped in Arizona.

During the middle Holocene, the population of the Southwest was greatly reduced and may have survived in Arizona only at higher elevations. This withdrawal from the lowlands may have been a cultural response to decreased effective moisture during the peak in post-Wisconsin temperatures known as the "Altithermal."

Many recorded Archaic sites in Arizona date to the first part of the late Holocene, ca. 4500-2500 b.p., when effective moisture increased in the Southwest. Through either migration or diffusion, agriculture also arrived from Mexico early in that interval. Flood farming spread from the lowlands to the highlands, where dry farming was then developed.

Agricultural villages were established across most of Arizona and the rest of the Southwest by about 1500 b.p. However, Archaic adaptations continued, and hunter-gatherers survived in the driest and coldest regions until the mid-nineteenth century.

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CHAPTER 1

FRAMEWORKS FOR ARIZONA'S EARLY PREHISTORY

INTRODUCTION

Arizona's Paleoindian and Archaic prehistory represents at least 85 percent of the cultural history of this part of the world, and even more if the claims for cultures older than Clovis are true. When we look at the preserved records of the natural history of that vast span of time, we see evidence that Arizona's climate, landscape, and plant and animal communities changed many times, sometimes rapidly, and often dramatically. And when we examine the archaeological record of that timespan, we see evidence of the ways in which humans adapted their subsistence strategies and movements across the land, redesigned their implements and added new ones as needed, and expressed their cultural identities and marked their territories—consciously and unconsciously—with the styles of their artifacts and arts.

This document has been prepared to provide contexts for the preservation and investigation of this archaeological record. These efforts are important if we want to learn how Arizona's ancient inhabitants lived off the land before agriculture was adopted and during its initial stages, and how they adjusted to significant environmental changes. We can also learn how they formed social groups and maintained cultural traditions before village lifeways were established, and many other lessons about living in marginal environments without industrial technology and at lower concentrations of population.

As part of the statewide historic preservation plan, the development of these contexts is intended to assist in the identification, evaluation, nomination, and management of Paleoindian and Archaic sites in Arizona that are eligible for listing in the Arizona and National Registers of Historic Places. To identify and define these contexts, this document summarizes the current state of knowledge about Arizona's Paleoindian and Archaic prehistory. This summary is based on a review of archaeological reports, relevant secondary literature, and an inventory of recorded Paleoindian and Archaic sites in Arizona. Early Agricultural sites, considered to be "Late Archaic" by many archaeologists working in the southern Southwest, are also included in the summary and site inventory.

This introductory chapter first reviews how discoveries in Arizona during the late nineteenth and early twentieth centuries played a major role in recognition of the Paleoindian and Archaic prehistory of North America and the Southwest. Following this review, certain terms and conventions used in this context statement are defined, possible meanings and archaeological uses of projectile point types are discussed, regional and local chronologies are compared, and examples of geoarchaeological approaches to Paleoindian and Archaic sites are presented.

THE DISCOVERY OF PALEOINDIAN AND ARCHAIC PREHISTORY IN THE SOUTHWEST

The mixed group of government officials, museum collectors, and ranchers who were exploring and digging in the Southwest in the 1870s and 1880s, all self-trained archaeologists, was at first focused on cliff dwellings and visible masonry ruins on the Colorado Plateau. The ancient peoples presumed to have constructed these buildings were commonly referred to as the "Cliff-Dwellers." A group of ranchers who were amateur archaeologists, including John and Richard Wetherill, Charles McLoyd, and Howard Graham, explored the Grand Gulch area of southeastern Utah in 1891 and found a series of caves containing archaeological remains very different from those of the Cliff-Dwellers. These included a number of burials that lacked the characteristic cranial deformation of the Cliff-Dwellers, while the associated grave goods were baskets rather than pots. Further investigations in the Grand Gulch area and at Mesa Verde in 1892 and 1893 produced stratigraphic evidence that the "Basket-Makers," as they were named, were an earlier people than the Cliff-Dwellers (Moseley 1966).

Alfred Kidder and Samuel Guernsey began working in northeastern Arizona in 1912, and in 1914 and 1915 they excavated a series of caves with remains that confirmed that the Basket-Makers were indeed earlier than the "Pueblo culture," as they now called the Cliff-Dwellers (Kidder and Guernsey 1919; Guernsey and Kidder 1921). In Sunflower Cave, Pueblo culture remains superimposed on Basket-Maker burials confirmed the sequence. On the basis of their discoveries, they defined the Basket-Makers in terms of the absence of both pottery and cranial deformation, and the presence of baskets, square-toed sandals, cradles, twined bags, hair cordage, and maize cultivation.

By 1924, Kidder postulated the existence of a preagricultural "Early Basketmaker" culture. When he assembled Southwestern archaeologists at his field camp at Pecos Pueblo in 1927, he designated this as the "Basketmaker I" stage in a sequence of Southwestern cultural stages characterized by different material culture traits. The presence of humans in the Southwest concurrent with extinct Ice Age animals was demonstrated at about the same time (see below), but this post-Paleoindian, preagricultural stage remained hypothetical until the 1930s, when the Gypsum "complex" was defined in Nevada and southeastern California (Harrington 1933); the Pinto Basin and Lake Mohave "cultures" were defined in southeastern California (Campbell and Campbell 1935; Campbell et al. 1937); the Malpais, Playa, Pinto-Gypsum, and Amargosa "industries" were defined in southeastern California and western Arizona (Rogers 1939); and the "Cochise Culture" was defined in southeastern Arizona (Sayles and Antevs 1941). The Basketmaker I term was abandoned with the recognition of these many preceramic, preagricultural complexes, which are today subsumed under the term "Archaic."

The debate over the antiquity of humans in the New World lasted until well into the twentieth century. As in Europe a century earlier, the first sites that were convincingly older than a few thousand years contained stone tools and human bones dated by their deep positions within alluvial and cave sequences, sometimes in association with the bones of extinct Ice Age fauna. Each of these finds was eventually dismissed by the majority of the scientific community because, at the time, claims for an "American Paleolithic" were considered "dangerous to the cause of science" by scholars from the United States Geological Survey and the Bureau of American Ethnology (Meltzer 1993).

Wide acceptance of the Ice Age presence of humans in North America did not come until 1926, when excavations near Folsom, New Mexico uncovered flaked stone projectile points in indisputable association with the bones of a Pleistocene species of bison (Figgins 1927). Despite the previous discovery of three such sites elsewhere in the West, it took the eyewitness verification of three other scientists (Barnum Brown, Frank Roberts, and Alfred Kidder) to convince *the skeptics* of the find at Folsom (Meltzer 1993). In Arizona that same year, Emil Haury and Byron Cummings from the University of Arizona excavated a nearly complete mammoth skull (discovered by a group of schoolchildren on an outing) in a deposit overlying artifacts exposed in the bank of Whitewater Draw (see Haynes 1986).

Perhaps because of Cummings' embarrassment over the nationwide controversy surrounding his assessment of the authenticity of "Roman" metal crosses and spears found near Tucson in 1924, he reported only in obscure local journals about the Whitewater Draw discovery (Cummings 1927a, 1927b). Another summary of the finds was not published until 1935, in the first issue of *The Kiva* (below is the full text of the article):

> PRIMITIVE MAN IN AMERICA
>
> Evidences found in southern Arizona seem to point quite definitely to the presence of man there in Pleistocene times. In Whitewater wash was found in an undisturbed pleistocene clay stratum fifteen feet below the surface the fossilized head of a mammoth and the bones of extinct bison and horses. Some hundred feet from the head of the mammoth and in an undisturbed stratum of gravel five and one-half feet below the clay stratum were uncovered a fireplace about which lay six crude hammers and rubbing stones.
>
> In a side wash of the San Pedro near Hereford, Arizona was found part of the fossilized skeleton of a mammoth near which in the same stratum was found a fireplace and a number of stones that had been subjected to heat in the primitive method of cooking.
>
> In the Cienega wash on the Empire ranch some fifty miles southeast of Tucson were uncovered in pleistocene strata similar to the formation in Whitewater wash twelve feet below the surface the remains of two humans that had plainly been buried where they lay. The bodies had been folded and buried in shallow graves as was customary in the early stages of human development in America (Cummings 1935, *The Kiva*, Vol. 1, No. 1:2-3).

Although the bones of extinct fauna in Whitewater Draw have since been determined to be in secondary context (Waters 1986b), Cummings' claims of artifacts associated with bones of Pleistocene fauna in the San Pedro Valley have been confirmed through a series of excavations (Haury et al. 1959; Haynes 1982).

By World War II, discoveries in Arizona had played an important role in extending New World prehistory back to the Pleistocene. The notion of a uniform preagricultural, preceramic Southwestern culture ancestral to the better-known farming and pottery-making cultures of later prehistory had been abandoned. After World War II, a large number of preceramic "complexes," "cultures," and "traditions" were defined in different parts of the Southwest. Today, many of these have fallen out of use because "Most were poorly dated, and of geographically limited extent, and, in retrospect, most were based on small samples from surface sites spanning several millennia. With few exceptions, these have passed into obscurity or been subsumed by more comprehensive formulations" (Huckell 1996a:321).

In this document, the most well-known and widely used cultural constructs for Southwestern Paleoindian and Archaic prehistory will be described and treated as material culture complexes, or as phases of material culture traditions (see discussion of these terms below). However, the well-known Early Agricultural complexes of the Southwest (e.g., San Pedro, Cienega, Basketmaker II variants, En Medio) are not described here.

TERMS AND CONVENTIONS

Compared to later intervals of prehistory, the Paleoindian and Archaic periods are still "dark ages" in Arizona and the rest of the Southwest. The dating, cultural origins, subsistence patterns, and material cultures of the earliest Paleoindian and Archaic groups remain controversial. There is continued debate about whether there were any cultural complexes preceding Clovis, and there is little consensus even about how to define the beginning and the end of the Archaic period.

Competing for recognition as the earliest signs of human occupation of the Southwest are, on one hand, crude flaked stone chopping and scraping tools found on the surfaces of ancient lake beaches and river terraces and covered with thick desert varnish and, on the other hand, well-made, fluted, flaked stone spear points found in buried alluvial deposits along with the remains of extinct Pleistocene megafauna such as mammoth, certain bison species, camel, and horse. The appearances in the archaeological record of certain artifact and feature types, such as stemmed and notched projectile points, rock-filled roasting pits, and ground stone milling tools, have all been proposed as archaeological markers of the beginning of the Archaic "period." Similarly, the appearances of cultural traits such as pottery use and agriculture are each considered the sign of the end of the period in the Southern Basin and Range Province and on the Colorado Plateau, respectively.

In addition to a lack of detailed knowledge of an enormous span of prehistory due to the relative paucity of known Paleoindian and Archaic archaeological remains in the Southwest, much confusion is created by *the conflated* meanings and multiple definitions of the terms "Paleoindian" and "Archaic" in North American archaeology. Since it was coined by Roberts (1940), the term "Paleoindian" (originally "Paleo-Indian") has been applied variously to 1) lifeways based on specialized "big-game" hunting (Sellards 1952); 2) complexes with fluted points associated with the remains of now-extinct Pleistocene mammals (Wormington 1957; Krieger 1964); 3) all sites that have yielded large fluted and lanceolate points, whether the remains of extinct mammals are present or not (Tuohy 1974); and 4) any artifact finds that date to the late Pleistocene (Haynes 1969). "Archaic" has been defined variously as 1) preceramic, preagricultural shell midden complexes in eastern North America based on semi-sedentary, intensive foraging, and a diversified technology (Ritchie 1932, 1944); 2) a broad-spectrum subsistence strategy based on hunting, gathering, and fishing (Jennings and Norbeck 1955; Caldwell 1958); and 3) a continental evolutionary stage of mobile hunting and gathering cultures postdating the extinction of the late Pleistocene megafauna (Willey and Phillips 1958). Of course, these are only some of the most frequently cited definitions of the many that have been proposed.

For the Southwest region, definitions of Paleoindian and Archaic have tended to emphasize the concept of subsistence economy or "adaptation." Perhaps influenced by the increasing use of the term by archaeologists working in eastern North America, Cummings (1953) was the first to refer to the preceramic cultures of the Southwest as "Archaic." Irwin-Williams (1968a) was then the first to define the "Southwest Archaic" as a coherent, distinctive pattern. The term "Archaic" has since been used in Southwestern archaeology to variously mean 1) an eclectic, less specialized economy (Irwin-Williams 1979); 2) a cultural adaptation following specialized "big-game" hunting and preceding sedentary village life with pottery and agriculture (Lipe 1983); 3) an economy based on increased dependence on plant foods and hunting of smaller, modern species of game animals, as represented by the use of milling stones and less specialized projectile points (Cordell 1984); 4) an adaptation based on a broader diet and a greater reliance on plant seeds than was the case for the preceding Paleoindian adaptation, marked by the appearance of ground stone seed milling equipment and smaller projectile points (Huckell 1993b); and 5) an economy in which plant gathering was primary, rather than hunting (Plog 1997).

Even when framed in adaptive terms, these various definitions of the Archaic have intertwined evolutionary and temporal connotations (Huckell 1993b). However, both Paleoindian and Archaic adaptations were probably more varied than is generally acknowledged. Archaic adaptations may have been established as early as some Paleoindian adaptations and therefore did not evolve from them, and Archaic adaptations are known to have lasted into historic times in some regions of the Southwest. Because major shifts in subsistence, settlement, and population were clearly related to the significant environmental changes that have occurred in the Southwest since the late Pleistocene (called the "Wisconsin" or "Pluvial" in North America), perhaps the terms "Paleoindian" and "Archaic" should eventually be abandoned in favor of material culture complexes, local phases, and subsistence adaptations referenced to a regional framework of Late Quaternary environmental periods. This is the approach taken here.

Because "Paleoindian" and "Archaic" are terms well established in the archaeological literature, they will be used in this context statement, but they will be correlated with identifiable environmental-temporal units and defined in adaptive terms. The term "Paleoindian" will be applied to *possible pre-projectile point, generalized foraging adaptations of the Wisconsin period*, and also to *terminal Wisconsin and early Holocene adaptations based on mobile settlement and some hunting of now-extinct, large mammals (megafauna)*. The term "Archaic" will be applied to *adaptations based on mobile settlement and generalized hunting and gathering, overlapping and following early Holocene Paleoindian adaptations, and preceding and overlapping late Holocene Early Agricultural adaptations.* The term "Early Agricultural" will be applied to *late Holocene adaptations based primarily on agriculture and lacking well-developed pottery technologies.*

The chronological terms "early," "middle," and "late" mean different things in each region of the Southwest when used with these adaptational terms (see section on Chronologies below), and here their use is avoided when possible. "Early" and "Late" Paleoindian complexes and adaptations will instead be treated within the contexts of the latest Wisconsin and early Holocene environmental periods, respectively, while "Early," "Middle," and "Late" Archaic complexes and adaptations will be discussed within the contexts of the relevant environmental periods of the Holocene.

Paleoindian, Archaic, and Early Agricultural complexes have been identified in terms of projectile point types, rock art styles, figurine traditions, sandal and basket weaving techniques, mortuary patterns, and other aspects of material culture. These different types of material culture complexes do not necessarily correlate completely with each other; rather, they overlap each other to varying degrees in space and time. In this context statement, the term "complex" will be applied to *a temporal-spatial pattern in the archaeological record representing both a cultural tradition and a communication network.* The material records of some prehistoric Southwestern "cultures" or "traditions" display continuity over long spans of time, though with some changes, and have traditionally been divided into "phases" or "stages"; these established terms are also retained here, but are treated only as intervals within long-lived material culture complexes.

For the sake of simplicity, the terms "complex," "culture," "tradition," "stage," "period," and "phase" will not be capitalized in this context study, even if they were in their initial definitions. Dates based on radiocarbon assays are standardized to uncalibrated radiocarbon ages, and sometimes they are also converted to calibrated years B.C. Uncalibrated radiocarbon ages are designated by "b.p." ("before present," which is calculated from the year A.D. 1950 by international convention). Ages are not expressed in calibrated radiocarbon years before present ("B.P." capitalized according to international convention). Because dendrocalibration is currently not possible beyond about 10,000 radiocarbon years of age, and other methods of calibration are still experimental, ages older than that will be expressed only in uncalibrated radiocarbon years b.p., or a question mark will indicate an estimated B.C. age.

PROJECTILE POINT TYPES

Most constructs of Paleoindian and Archaic cultures, such as "complexes," and models of relationships and divergences between them, are based on the treatment of flaked stone projectile point types as cultural and temporal markers. This focus is the result of the variability in morphology, technology, and labor investment represented by the large variety of projectile points that have been found. Variation in their characteristics, in addition to their durability and visibility in the archaeological record, means that projectile points "are probably the only artifacts routinely discovered at Archaic sites that have the potential to inform us about the movement of information, ideas, and perhaps even people over the landscape that is today the Southwest" (Huckell 1996c:3).

Ethnographic and ethnohistoric studies, however, have shown how the interpretation of variability in the forms and distributions of projectile points is complicated by their multiple cultural functions. Because many aspects of projectile point shape are not related to function, and because projectile points are highly visible objects during their use, they may serve to transmit information. Weissner (1983) has documented how contemporary hunter-gatherer groups in the Kalahari Desert of southern Africa use stylistic differences in projectile point shape, size, and type of barbing to express personal, social, and ethnic differences. Masse (1981) has observed that protohistoric Sobaipuri points and historic Papago points in southern Arizona are identical except for the serrations on the former.

The function of some variability in prehistoric projectile points was probably related to communicating cultural identities, and the distributions of point types may partially reflect the ranges of mobility of different groups. However, in the archaeological record, points do not equal people any more than pots do. Holmer (1986:112) remarks that such thinking can lead to "a picture of successive hoards swarming across the West, subjugating the makers of previous projectile point types." Instead, he views each temporal/spatial pattern of prehistoric projectile point types in the Great Basin as "a time and area of shared technology" which was a product of information flow:

> The sharing of a point style requires only that groups are mobile and consistently communicate with adjacent groups, whether or not they are of the same ethnic origin. Consistent communication among hunter-gatherer groups could easily result from frequent encounters during subsistence activities, e.g., pursuit of the same resources in the same area. Therefore, the more sharing of resource areas, the more potential for the sharing of the technology that was appropriate to harvest the resources (Holmer 1986:112).

It is likely, however, that variability in projectile points was related to multiple functions. For example, the co-occurrence of different point types with similar known age ranges represents, equally, the possibilities of point designs being related to coeval but distinctive cultural affiliations, to differences in technological traditions, and to contrasting site uses. Shackley (1996a) suggests that, in terms of both stylistic expressions of identity and technological functions, relevant differences among Southwestern Archaic points were in blade morphology as well as hafting arrangement:

> If Archaic projectile points were used as emblemic markers, only the blades would be visible when hafted; the blades, therefore, would have to be distinctive. Additionally, long blades (San Jose) or thick blades (Chiricahua) would serve to insure that some blade would remain for rejuvenation when broken in the haft. So the two blade styles serve both stylistic and technological functions. It is quite possible that this same style/technology strategy occurs in the Late Archaic, with the Elko [Corner-notched] form exhibiting a large and wide blade and the San Pedro *exhibiting* a large and narrow, but thicker blade (Shackley 1996a:429).

Hafting elements of coeval point types could also be ethnically distinctive, as in the cases of corner-notched Elko points and side-notched San Pedro points. From this perspective, the co-occurrence of San Jose and Chiricahua points in the same area of the Picacho Dune Field in central Arizona (Bayham 1986; Shackley 1986), the presence of Pinto-like (and Chiricahua?) points and Cortaro points in discrete areas of the same stratum at the Los Pozos site in the Santa Cruz floodplain in southern Arizona (Gregory 1997a), and the co-occurrence of Elko Corner-notched and San Pedro points at the White Tanks site in the Tank Mountains of western Arizona (Shackley 1993, 1996a) may each represent an overlapping of the mobility ranges of coeval, but culturally-distinct, groups of hunter-gatherers whose different projectile point blade and haft styles were simultaneously expressions of cultural identity and alternative solutions to similar technological problems.

An alternative perspective on variability among projectile points is represented by "hafting traditions" models (Bryan 1980; Keeley 1982; Holmer 1986; Musil 1988), which reject the assumption that discrete distributions or regional sequences of projectile point types must necessarily represent either different cultural preferences, successions of distinct groups or adaptations, or culturally internal stylistic changes through time. These models maintain that, instead, the general form of a projectile point is primarily related to the hafting element, which is determined by the technique used to attach the point to the shaft.

For example, fluted points such as Clovis and Folsom, and lanceolate points such as Plainview/Goshen and Agate Basin, can all be considered as representing the same hafting tradition, as they were all attached to the shaft in a split-haft technique. Stemmed points, however, can be divided into two subtraditions based on different hypothesized methods of hafting: 1) Shouldered-lanceolate points with wide, parallel-sided stems, such as Eden, Scottsbluff, and Alberta (Cody complex) in the Plains and Windust in the Intermontaine West, represent a continuation of the split-haft method; 2) Points with long, tapering, convex-based stems, such as Agate Basin in the Plains and Lake Mojave and Haskett in the Intermontaine West, used a socketed hafting design (Bryan 1980).

The new shouldered design of the lanceolate points with stems protected the bindings and provided unobstructed cutting edges. It also made reworking of the point possible in many cases of breakage; if the break occurred at the stem, the shoulders could be moved up the blade edges, and the point could be rehafted in the original shaft. The socketed hafting design, on the other hand, removed the bindings from the blade edges, reducing the necessary amount of stem edge grinding, while the bluntness of the stem base, and contact of the tapering stem over a larger area of the shaft, absorbed impact forces better.

Notching of points, the "last major indigenous hafting tradition on the North American continent" (Musil 1988:382), appeared in the Southern Plains between 10,300 and 9500 b.p. (Patterson 1989), between 9000 and 8000 b.p. in the northern Rocky Mountains (Swanson 1972; Black 1991), between 9000 and 8000 b.p. in the eastern Great Basin and on the northern Colorado Plateau (Holmer 1986; Ambler 1996), and before 7500 b.p. in the western Great Basin (Basgall et al. 1995). Notching allowed attachment of points to split hafts (like fluted points), but removed the bindings from the blade edges like the socketed design, and allowed resharpening of damage to the distal tip like all of the previous hafting designs. But even if breaks occurred across the notches on the proximal end, the remaining blade could be renotched and reused. Two other point types, referred to here as "bifurcate-stemmed" and "contracting stemmed" (or "tapering stemmed") that were used by Archaic groups in the Great Basin and Southwest may represent regional hafting traditions, rather than continental ones.

Stemmed and shouldered points with indented or "bifurcate" bases, such as most of the subtypes of Pinto points, appeared earlier than notched points in the Great Basin and the Southwest (Holmer 1986; Huckell 1996c; Schroth 1994) and had some of the same technological advantages as notched points. Bifurcate-stemmed points appeared as early as 9500 b.p. in the southwestern Great Basin (Schroth 1994) and by 8700 b.p. on the northern Colorado Plateau (Ambler 1996) (see Chapter 4). Their known distribution extends from the coast of northwest Mexico to the rim of the Columbia Plateau, and from the Mojave Desert to the edge of the southern Plains (Lister 1953; Hayden 1956; Kelley 1959; Formby 1986; Holmer 1986; Schroth 1994).

Simms (1988) suggests the possibility that the Pinto series evolved from earlier stemmed point traditions, based on his assumption that Pinto points have contracting stems and were hafted with a socketing technique like the tapering-stemmed points. However, many subtypes of Pinto points (and other bifurcate-stemmed points) have expanding stems, and so could not be socketed. Formby (1986) reports that about 20 percent of the Pinto points in a collection of 1,706 from surface sites in Arizona and New Mexico have ground bases and stem edges. Most likely, Pinto points were secured with sinew to wooden shafts with split hafts, as were earlier fluted points and later notched points. The shoulders and expanding stems protected the bindings, and grinding of the stem edges also prevented the bindings from being cut. The concave or bifurcated base seated the point in the haft more securely, and grinding of the base blunted the basal edge, and thereby decreased the likelihood of the shaft splitting upon impact.

Holmer (1986) identifies another hafting tradition that appeared after notching in the Southwest and southern Great Basin, near the beginning of the late Holocene. Points with short, contracting stems (known variously as Gypsum Cave, Augustín, and Pelona in the Southwest, and Elko Contracting Stem and Gatecliff Contracting Stem in the Great Basin) appeared between 4500 and 4000 b.p. in the lower Rio Grande Valley in Texas (Marmaduke 1978), the Southwest (Berry and Berry 1986), and the eastern Great Basin (Holmer 1986).

Holmer (1986) points out that pine pitch, clearly used as a hafting adhesive, has been identified on many points of this type, and that very few of the points were resharpened compared to notched points. With notched points secured by sinew, the points usually broke long before the haft, and replacing broken points took time, effort, and new materials. The use of an adhesive to secure a contracting stem point into a socketed haft was an improvement because it increased the ease of changing a broken point and, because the pitch could be melted and reused, required no new materials other than a point. Perhaps this hafting tradition did not spread across the continent, and generally went out of use in the Southwest, possibly by 3000 b.p. (Berry and Berry 1986; Huckell 1996c), because the contracting stemmed points secured with an adhesive were less secure in the haft, despite being an improvement over the notched point hafting technique in terms of ease of point replacement.

It should be noted that Holmer (1986) does not cite reported evidence of bitumen (or asphaltum) on much older San Dieguito projectile points (Ezell 1977). This evidence suggests, counter to Holmer's assertion that it was a new technique, that the Gypsum point hafting tradition was actually a reintroduction of an indigenous North American adhesive hafting technique that had died out.

Wills (1988) cites studies that indicate that hafting design determines the effective diameter of a projectile point, and infers that the larger blade-to-base width ratio of "Late Archaic" point types in the Southwest increased penetration. Along with elongation of the blade, making the projectile more accurate, this modification made Late Archaic points more efficient.

According to the models of hafting traditions, changes in point form were not necessarily related to cultural or adaptational changes. Rather, the changes were functional and involved improvements in the hafting designs which increased the killing efficiency of points, decreased the frequency of shaft damage, and allowed easy rehafting of new or reworked points after breakage. Following this reasoning, the widespread adoption of each of these functional improvements represents the successive diffusion of increasingly efficient technological traditions across cultural and environmental boundaries:

> Changes in projectile point traditions across large areas of North America should not be seen as the movement of different peoples carrying differing projectile point types as their cultural trademarks or as differences in environmental or economic adaptations. Rather, these changes should be seen as successive technological developments resulting in a more functional killing implement and a more efficient hafting design—developments which were adopted by various peoples at generally the same time periods in many regions of the North American continent (Musil 1988:385).

There is not complete agreement between these various hafting traditions models, however. While Musil (1988) believes that the parallel-sided stem subtradition evolved directly from the Fluted/Lanceolate tradition, Bryan (1980, 1988) views the tapering stem subtradition as coeval with the Fluted/Lanceolate tradition. There are also problems with the reconstruction of the socketed hafting design: the shafts would have had very large diameters to accommodate large enough sockets; drilling of a socket is much more labor-intensive and time-consumptive than splitting a haft; and the common practice of grinding the base and edges of the point stem would have been unnecessary. Finally, the conceptualization of an evolutionary sequence of increasingly efficient hafting designs ignores the role of changing hunting strategies and techniques as changes occurred in the types of game available (Howard 1995).

In support of the latter model are Holmer's (1980a, 1980b) factor analyses of the artifacts and animal bones in Sudden Shelter and Cowboy Cave, which identify strong associations between the presence of Pinto points and the presence of deer bones, and between Gypsum points and bighorn sheep bones. Holmer interprets these correlations as possibly indicating that Pinto points were specialized tools for the hunting and butchering of deer, while Gypsum points were specialized for hunting bighorn sheep.

Despite the probability that some combinations of projectile point forms and hafting techniques were specialized for specific types of game and associated hunting strategies, the models of hafting traditions remain useful because it is clear that there were several distinct Paleoindian and Archaic hafting traditions in the Southwest, within which can be grouped most of the named projectile point types. However, within each of these hafting traditions there was variability in point shapes that probably represents, simultaneously, alternative solutions to the same technological goals (such as minimizing breakage and simplifying point rejuvenation and rehafting) and expressions of cultural identities.

In this context study, named projectile point types are described and compared in terms of both morphologies and hafting designs. Their time ranges and distributions are not necessarily equated with the longevities and territories of particular cultures, but are assumed to represent temporal and spatial continua of stylistic and technological traditions.

These overlapped to varying degrees with other types of material culture complexes and subsistence adaptations, often crosscut geographical and cultural boundaries, and sometimes spanned several environmental periods. Projectile point types are used here as temporal markers only by reference to their occurrences in stratified and single-component deposits dated independently by radiocarbon assays of associated organic materials, and their co-occurrences and relative stratigraphic relationships with other well-dated point types. Multiple intervals of use of a point type are referred to as "floruits," and separate areas of use are called "patches."

CHRONOLOGIES

Current chronologies of Paleoindian and Archaic cultural history in the Southwest vary by geographic region. Figures 1.1 and 1.2 show the boundaries of the major physiographic regions of western North America as they occur in Arizona. Within each of these regions in Arizona, the identified Paleoindian, Archaic, and Early Agricultural complexes, phases, and cultures have traditionally been grouped into cultural "periods" that are subdivided into "Early" and "Late," or "Early," "Middle," and "Late" units. These types of chronologies generally work well within each region, but they are the source of considerable confusion when comparisons are made between regions. At an interregional scale, Paleoindian, Archaic, and Early Agricultural "periods" overlap in time, and "Early," "Middle," and "Late" subdivisions have different timespans in each region; the "Middle Archaic period" in one region may completely or partially overlap the "Late Archaic period" in the neighboring region.

Throughout the Southwest, Paleoindian complexes are generally dated to the period between about 11,600 and 7500 b.p., equivalent to the terminal Wisconsin and early Holocene, and are recognized by the presence of fluted, lanceolate, and lanceolate/shouldered projectile points. The possible pre-projectile point Paleoindian complexes are estimated to be older than 11,600 b.p., but probably not older than the beginning of the Wisconsin about 120,000 years ago.

In contrast, the subdivision and dating of the Archaic "period" varies in the northern and southern

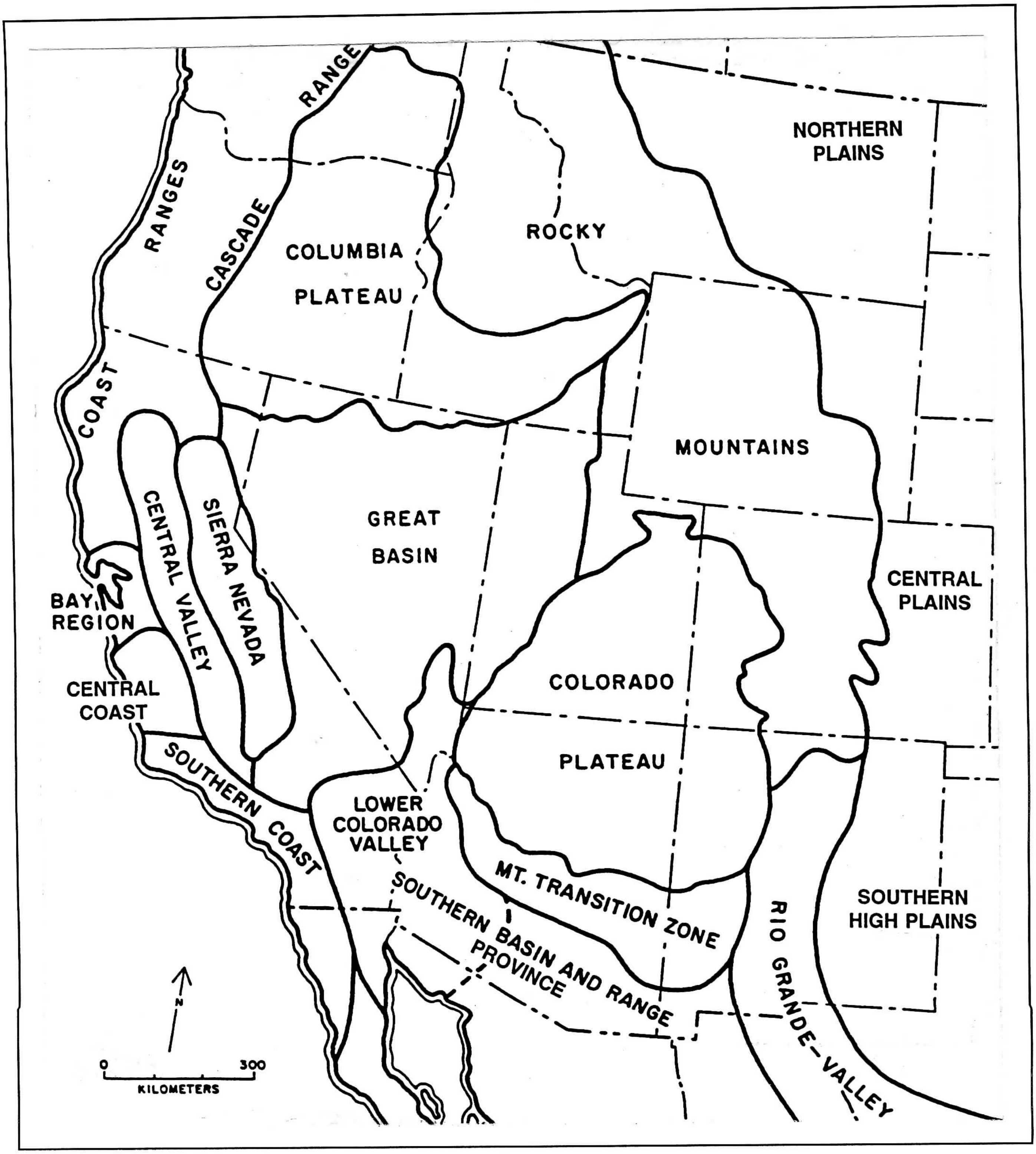

Figure 1.1. Physiographic regions of western North America.

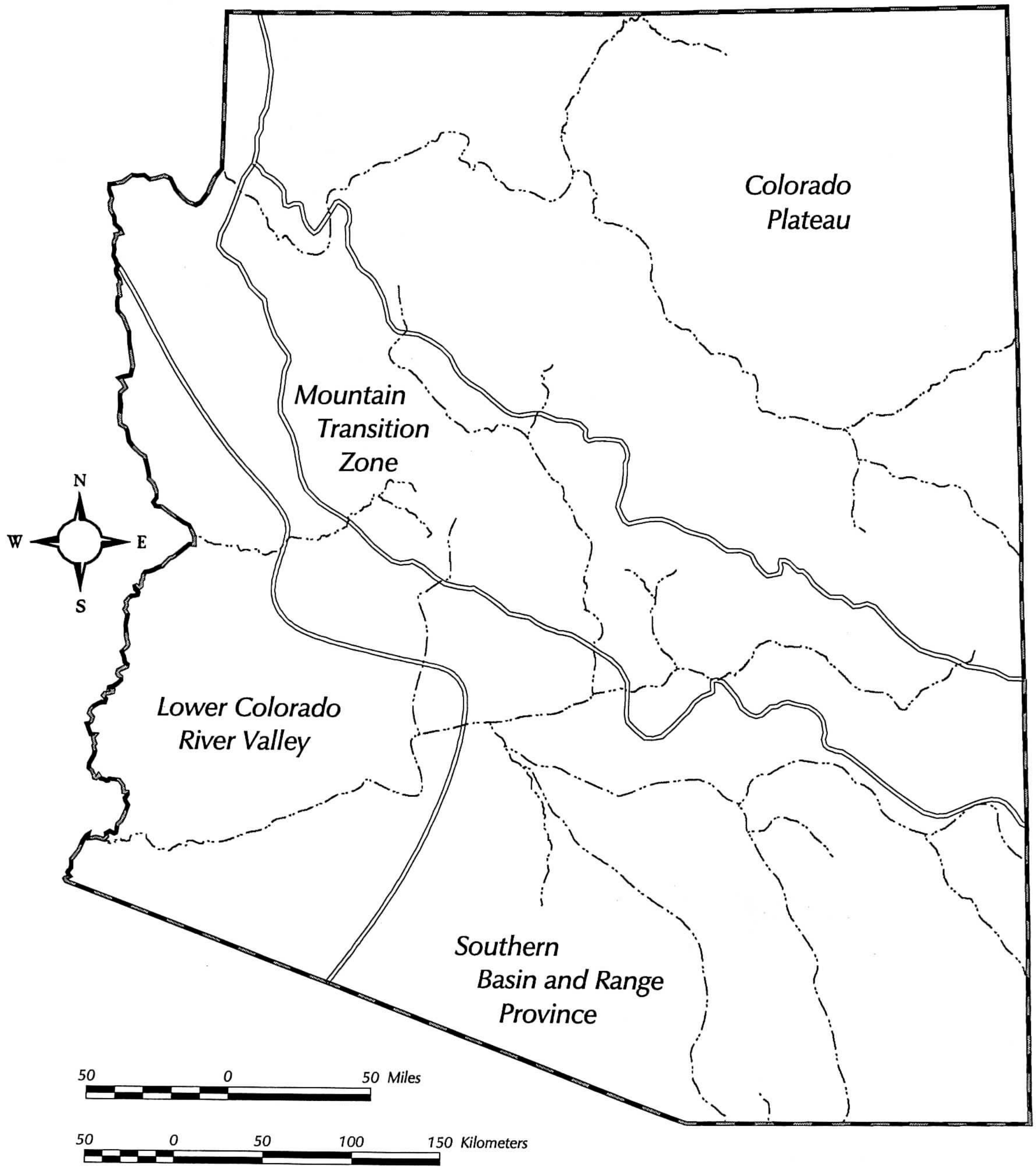

Figure 1.2. Physiographic regions of Arizona.

parts of the Southwest, resulting in use of the same terms for different time intervals and, sometimes, the same point types as diagnostics for differently named periods. In the northern Southwest, the Early and Middle Archaic periods fall largely within the middle Holocene, and are associated with various stemmed and notched point types. For the northern and central Colorado Plateau, Matson (1991) and Geib (1996) date the Early Archaic to 9000/8500-6000 b.p. (ca. 8000/7500-4900 B.C.), and the Middle Archaic to 6000-4000 b.p. (ca. 4900-2500 B.C.), while Altschul and Fairley (1989) date the Early and Middle Archaic in the Arizona Strip (the portion of northwest Arizona north of the Grand Canyon, within the southwestern Colorado Plateau/southeastern Great Basin) to about 7000-4250 B.C. and 4250-2650 B.C., respectively. In these Colorado Plateau chronological schemes, Pinto, Humboldt series, Northern Side-notched, and Elko series points are considered diagnostics of the Early Archaic, while various side-notched (Sudden, Rocker, Hawken) and Elko series (Side-notched, Corner-notched, Eared) points are considered the diagnostic point types for the Middle Archaic.

In the Southern Basin and Range Province, the Early and Middle Archaic periods fall largely within the early and middle Holocene intervals, respectively. From an implicitly southern perspective, Huckell (1996a) dates the Early Archaic of the Southwest to 8500/8000-5500 b.p. (ca. 7500/6900-4300 B.C.), to which he attributes large, tapering-stemmed points. However, radiocarbon dates of about 9900 and 9800 b.p. (ca. 9100 and 9000 B.C.) in association with artifacts overlying the Clovis occupation at the Lehner site (Haynes 1982), 10 radiocarbon dates between about 9300 and 8100 b.p. (ca. 8500 and 7000 B.C.) from four Sulphur Spring stage localities in Whitewater Draw (Waters 1986b), and 10 radiocarbon dates between about 10,700 and 8700 b.p. (ca. 9900?-7700 B.C.) associated with the Ventana complex assemblage in the Volcanic Debris layer in Ventana Cave (Huckell and Haynes 1995) indicate that the Archaic may have begun earlier in southern Arizona, overlapping with Paleoindian complexes in the early Holocene. Huckell (1996a) considers Gypsum, San Rafael Side-notched, Chiricahua, San Jose, and Cortaro points to be hallmarks of the Middle Archaic period in the southern Southwest, which he dates to about 5500-3500 b.p. (ca. 4300-1800 B.C.).

For the Colorado Plateau, Geib (1995, 1996) dates the Late Archaic to 4000-2400 b.p. (ca. 2500-400 B.C.), and considers Gypsum and Elko Eared points and split-twig figurines as diagnostics. But he recognizes that Archaic adaptations probably overlapped the beginning of the Basketmaker II agricultural adaptation sometime between 1500 and 400 B.C. Matson (1991) refers to the interval between about 2500 and 1200 B.C. on the Colorado Plateau, and until at least 500 B.C. in parts of the Southern Basin and Range Province, as the "Late Archaic," for which he considers Gypsum and Chiricahua points to be diagnostic. For the northern Colorado Plateau only, Matson refers to the poorly known, (still) preagricultural period from about 1200 B.C. to A.D. 500 as the "Latest, or Terminal Archaic." Altschul and Fairley (1989) date the Late Archaic in the Arizona Strip from about 2600 to 300 B.C., and consider Gypsum, Elko Eared, San Rafael Side-notched, and McKean Lanceolate points to be the diagnostic types.

For the period from about 3500 to 2000/1500 b.p. (ca. 1800 B.C. to A.D. 1/600) throughout the Southwest, Huckell (1996a) distinguishes between "Late Archaic" hunting and gathering populations and "Early Agricultural" populations engaging in agriculture. Characteristic points include San Pedro and Cienega points in the Southern Basin and Range Province and the Mogollon Highlands (Mountain Transition Zone), Basketmaker Side- and Corner-notched points on the southern Colorado Plateau, and Elko Corner-notched points on the northern Colorado Plateau.

Huckell (1996a) refers to the introduction of pottery in the early first millennium A.D. as representing the end of the Late Archaic/Early Agricultural period in the Southwest. However, in an earlier paper he noted:

> There is a major north-south difference in how the end of the Archaic period is identified [in the Southwest]; the split occurs, perhaps appropriately, at that major zone of transition, the Mogollon Rim. From the Rim southward, the Archaic period is treated as lasting until the arrival of ceramics; to the north of the rim, on the Colorado Plateau, the arrival of agriculture heralds the end of the Archaic period (Huckell 1993b:2).

Berry and Berry (1986) attempted to avoid terminological confusion by dividing Southwestern Archaic prehistory into three periods related to major environmental periods and archaeological continuities: 8000-3000 B.C., 3000-1000 B.C., and 1000 B.C.-A.D. 500. This is the approach taken in this context study, although the subdivisions and dating of the environmental periods are different, based on the types of evidence reviewed in Chapter 2.

Summarizing the system used here, Figure 1.3 compares the estimated time ranges of currently identified possible Pre-projectile Point, Paleoindian, Archaic, and Early Agricultural complexes in Arizona by environmental periods, adaptations, and geographic regions and subregions. Within each subregion, phase names are provided by the most important complexes, or are based on previous chronological schemes. By grouping the cultural complexes in terms of *environmental periods* and *subsistence adaptations*, this system (based on the matrix of contexts described in a previous section) avoids the consider-

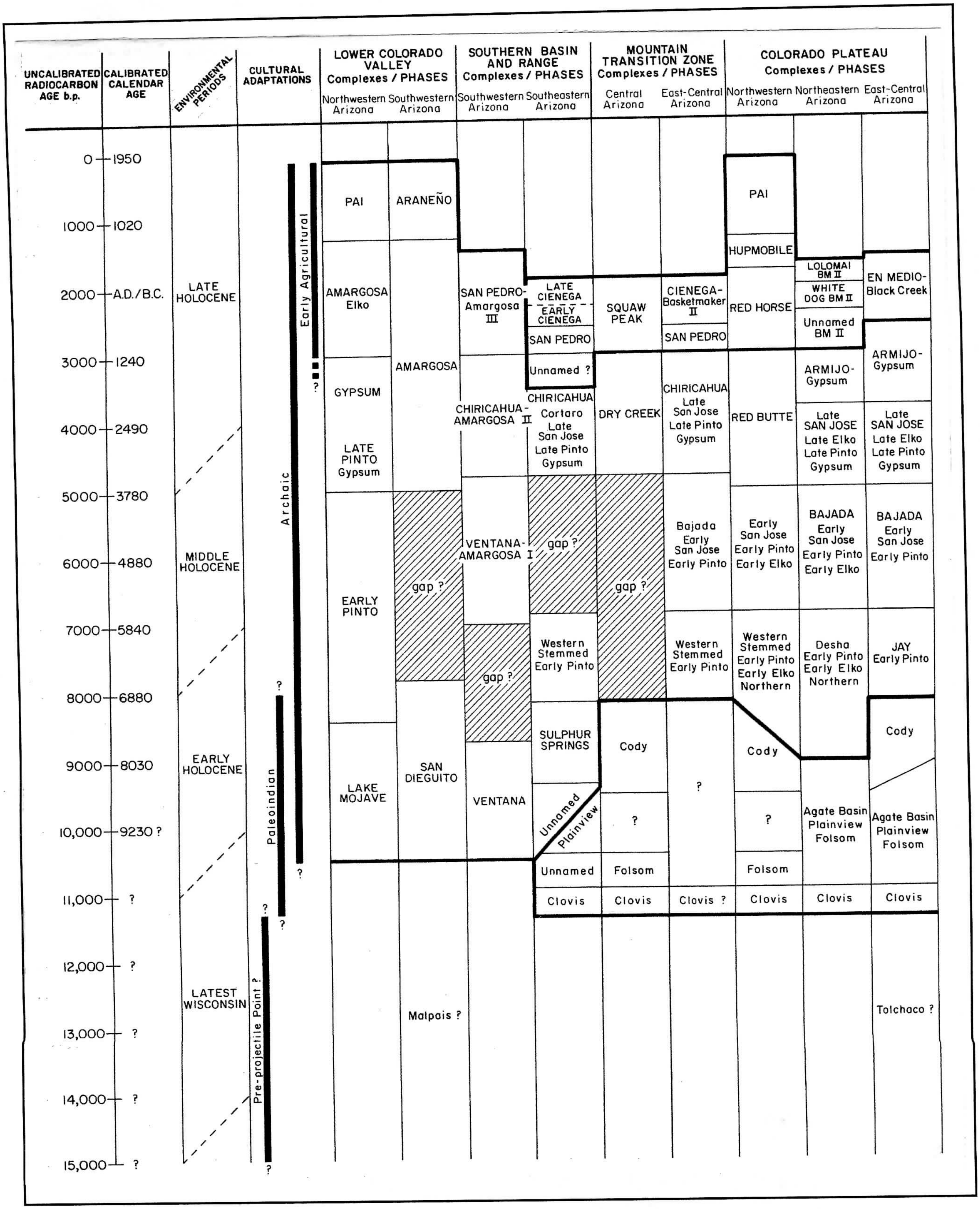

Figure 1.3. Estimated time ranges of possible Pre-Projectile Point, Paleoindian, Archaic, and Early Agricultural complexes/phases in Arizona by environmental periods, adaptations, and geographic regions and subregions.

Table 1.1. Projectile point types associated with Paleoindian, Archaic, and Early Agricultural complexes/phases in Arizona by environmental periods and adaptations.

Environmental Period	Date Range	Adaptation	Complexes	Associated Point Types
Terminal Wisconsin	~11,500-10,500 b.p.	Paleoindian	Clovis	Clovis
Early Holocene	~10,500-7500 b.p.	Paleoindian	Folsom	Folsom
			Plainview	Plainview, Goshen, Belen, Midland?
			Agate Basin	Agate Basin, Angostura, Hell Gap?
			Cody	Eden, Scottsbluff, Portales, Alberta
		Archaic	Lake Mohave	Lake Mojave, Silver Lake
			San Dieguito	San Dieguito, Lake Mohave, Silver Lake
			Ventana	Tapering stemmed
			Sulphur Springs	Tapering stemmed?
			Jay	Jay
			Early Concho	San Dieguito, Silver Lake, Jay
			Early Pinto	Early Pinto series (incl.bifurcate-stemmed)
Middle Holocene	~7500-4500 b.p.	Archaic	Early Pinto	Early Pinto series
			Ventana-Amargosa I	Wide-stemmed
			Bajada	Bajada (Pinto-variant?)
			Early San Jose	Early San Jose (Pinto variant?)
			Middle Concho	Early Pinto series, Bajada
			Desha	Sand Dune Side-notched, early Elko series
			Eastern Great Basin	Early Elko series, Northern Side-notched, San Rafael Side-notched, Sudden Side-notched, Hawken Side-notched, Humboldt Concave-based
Late Holocene	~4500-0 b.p.	Archaic (~4500-1500 b.p.)	Late Pinto	Late Pinto series, Gypsum?
			Gypsum	Gypsum, San Augustin
			Chiricahua-Amargosa II	Chiricahua, late Pinto/San Jose, Gypsum
			Red Butte	Late Pinto series
			Dry Creek	Leaf-shaped
			Late San Jose	Late San Jose
			Late Concho	Late Pinto series, San Jose, Gypsum
			Chiricahua	Chiricahua
			Cortaro	Cortaro, late Pinto series?
			Gypsum	Gypsum Cave, San Augustin
			Chiricahua	Chiricahua
			Eastern Great Basin	Late Elko series, San Rafael Side-notched, Sudden Side-notched, Hawken Side-notched, Humboldt Concave-based
			Amargosa	Amargosa, late Elko series
			San Pedro-Amargosa III	San Pedro, Amargosa
		Early Agricultural (~3500?-1500 b.p.)	San Pedro	Early San Pedro
			Squaw Peak	?
			Red Horse	?
			Basketmaker II	Early Basketmaker
			En Medio	En Medio, early Basketmaker
			Black Creek	?
			Cienega	Early Cienega, late San Pedro

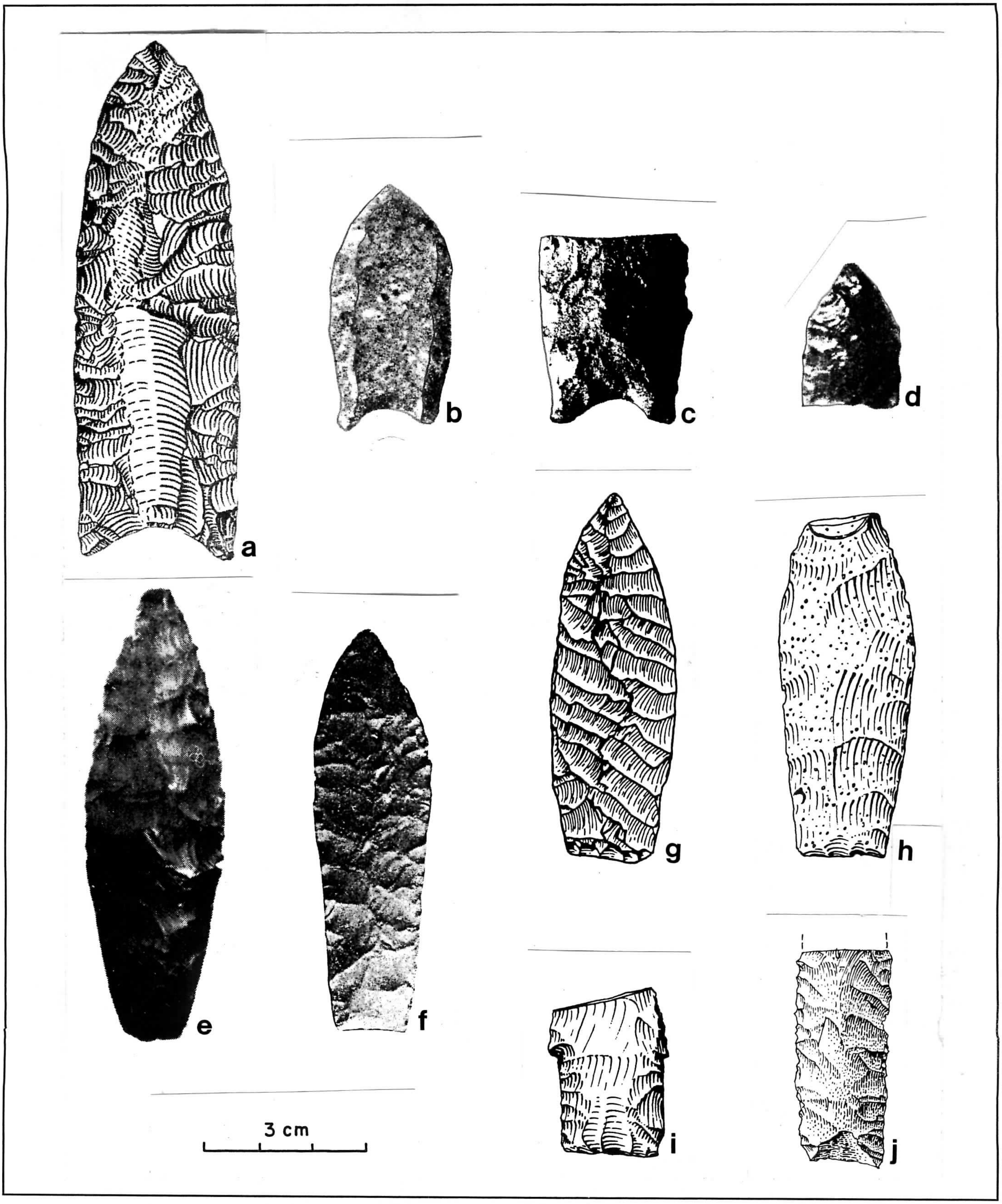

Figure 1.4. Examples of common fluted and lanceolate Paleoindian projectile points in Arizona: a) Clovis point, Naco site, upper San Pedro Valley, Agenbroad 1967; b) Folsom point, Concho-St. Johns area, upper Little Colorado River Valley, Huckell 1982; c) Plainview/Goshen point, Winchester Mountains, Carlson et al. 1989; d) Belen point, Mijo Cajón, Mogollon Rim, Neily 1988; e) Agate Basin point, Concho area, upper Little Colorado Valley, Wendorf and Thomas 1951; f) Angostura point, Prayer Rock area, central Colorado Plateau; g) Foothills-Mountains complex point, Badger Springs site, central Colorado Plateau, Hesse et al. 1996; h) Hell Gap point, Petrified Forest National Park, southern Colorado Plateau, Burton and Farrell 1993; i) Scottsbluff point, Petrified Forest National Park, southern Colorado Plateau, Tagg 1987b; j) Eden point, Voigt Mesa, upper Little Colorado Valley, Schreiber and Sullivan 1984.

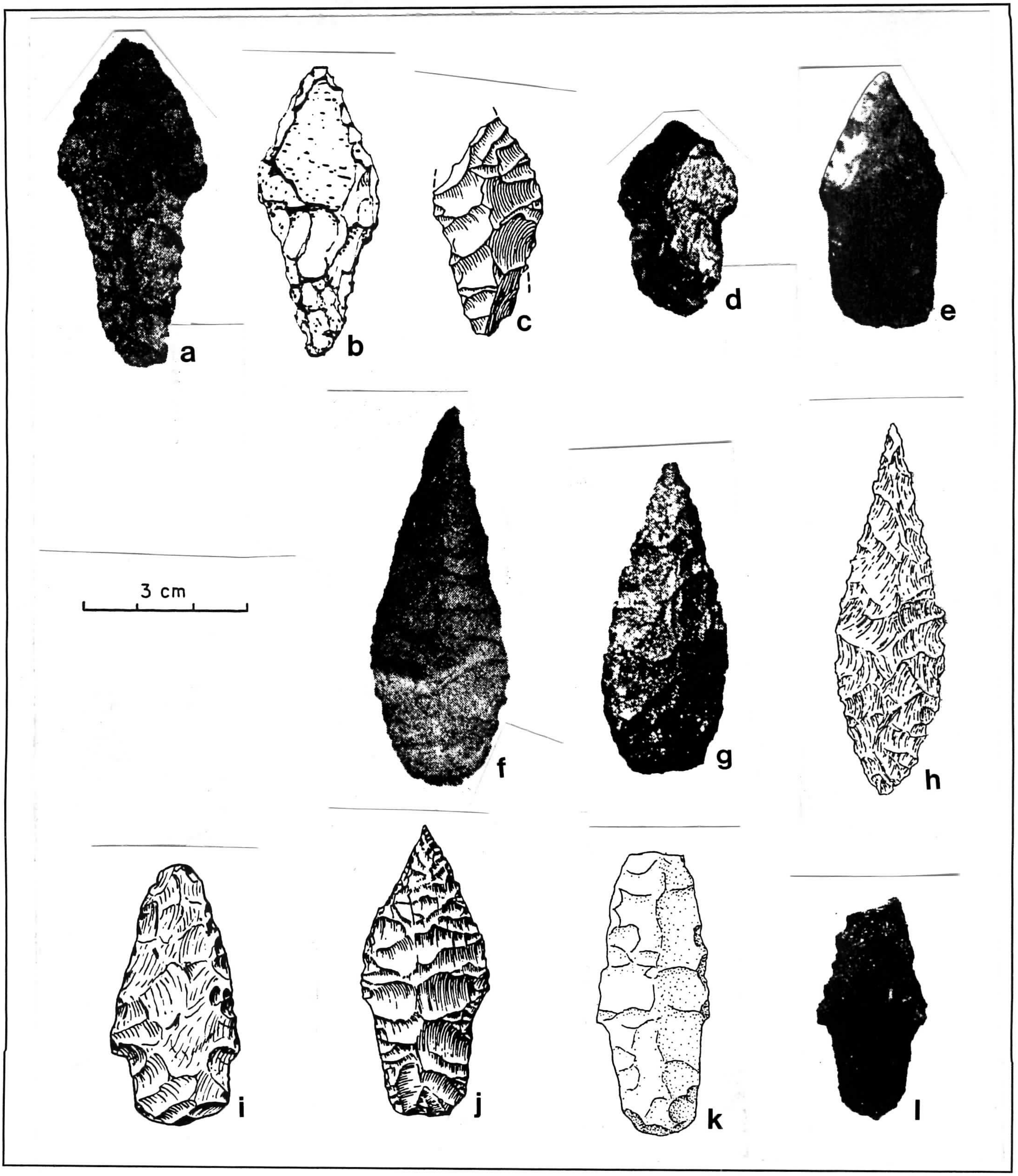

Figure 1.5. Examples of common tapering stemmed and leaf-shaped Archaic projectile points in Arizona: a) Lake Mojave point, lower Colorado River Valley, Rogers 1939; b) Lake Mojave point, Buried Dune site, Picacho Dune Field, Bayham et al. 1986; c) Lake Mojave point, Chevelon region, southern Colorado Plateau, Reid 1982; d) Silver Lake point, lower Colorado River Valley, Rogers 1939; e) Silver Lake point, Concho area, upper Little Colorado Valley, Wendorf and Thomas 1951; f) Leaf-shaped point, lower Colorado River Valley, Rogers 1939; g) Leaf-shaped point, Papaguería, Ezell 1954; h) Leaf-shaped point, Flying V Ranch, Tucson Basin, Douglas and Craig 1986; i) Ventana-Amargosa I point, Ventana Cave, Papaguería, Haury 1950; j) Tapering stemmed point, Voigt Mesa, southern Colorado Plateau, Schreiber and Sullivan 1984; k) Tapering stemmed point, White Lake Site, Mogollon Rim, Hoffman and Neeley 1996; l) Tapering stemmed point, Wasp Canyon site, Santa Rita Mountains, Huckell 1984.

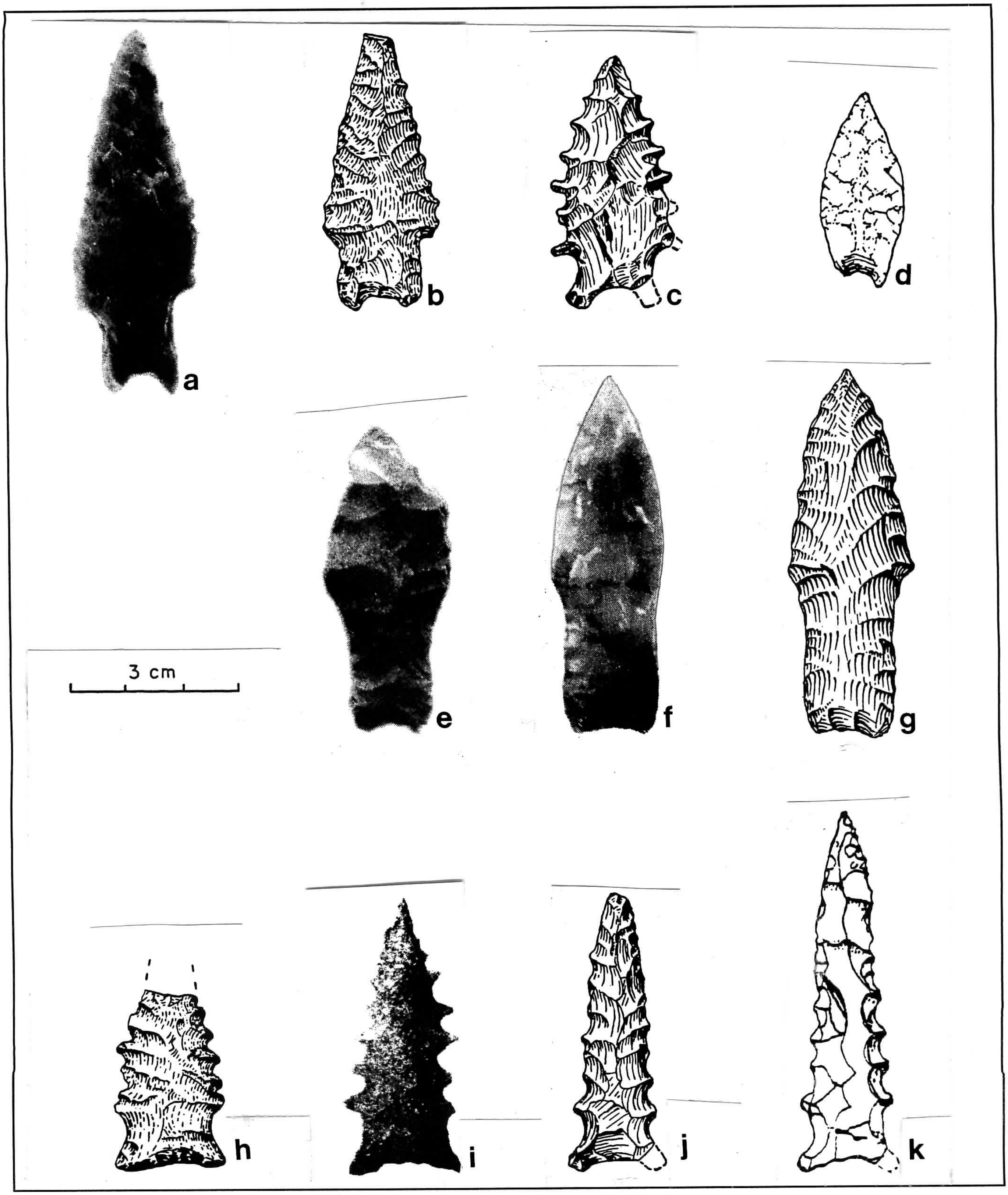

Figure 1.6. Examples of common bifurcate-stemmed and related Archaic projectile points in Arizona: a) Pinto point, St. Johns area, upper Little Colorado River Valley, Westfall 1981; b) Pinto point, middle Little Colorado River Valley, Tagg 1987b; c) Pinto point, Ventana Cave, Papaguería, Haury 1950; d) Pinto point ("Shoulderless," or McKean Lanceolate), Tator Hills site, Santa Cruz Flats, Halbirt and Henderson 1993; e) Bajada point, St. Johns area, upper Little Colorado River Valley, Westfall 1981; f) Bajada point, Concho area, upper Little Colorado Valley, Wendorf and Thomas 1951; g) Bajada point, Petrified Forest National Park, southern Colorado Plateau, Burton and Farrell 1993; h) San Jose point, middle Little Colorado River Valley, Tagg 1987b; i) San Jose point, Mijo Cajón, Mogollon Rim, Neily 1988; j) San Jose point, Ventana Cave, Papaguería, Haury 1950; k) San Jose point, Buried Dune site, Picacho Dune Field, Bayham et al. 1986.

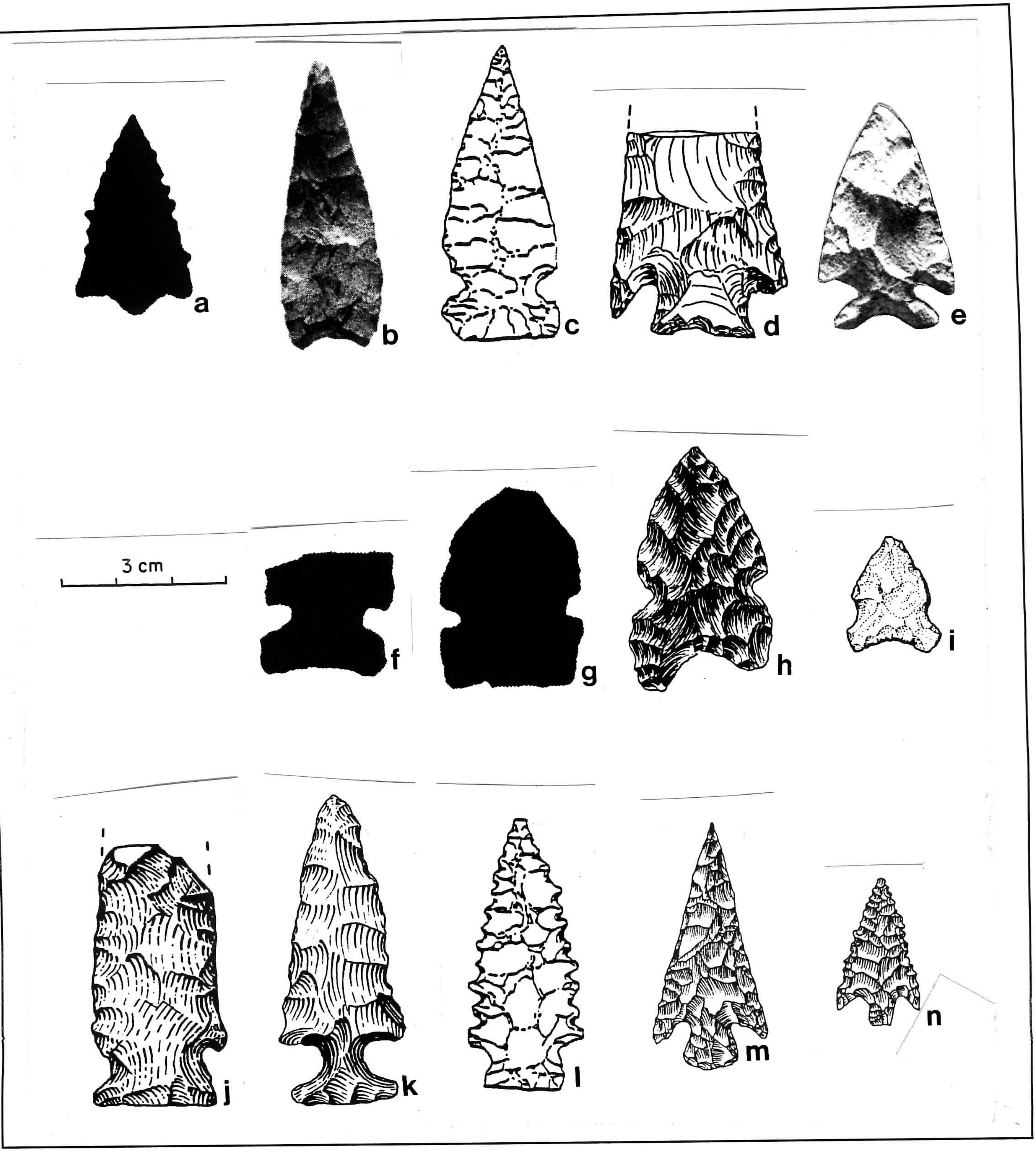

Figure 1.7. Examples of common unstemmed and notched Archaic and Early Agricultural projectile points in Arizona: a) Gypsum point, Arizona Strip, Moffitt et al. 1978; b) Cortaro point, Cortaro Fan site, Tucson Basin, Roth and Huckell 1992; c) Elko Side-notched, The Apothecary, Harquahala Valley, Bostwick 1988; d) Elko Corner-notched, White Tanks, lower Colorado River Valley, Shackley 1993; e) Elko Eared point, Black Mesa, central Colorado Plateau, Christenson 1987; f) Northern Side-notched, Arizona Strip, Moffitt et al. 1978; g) Sudden Side-notched, Arizona Strip, Moffitt et al. 1978; h) San Rafael Side-notched, Rock Canyon Shelter, Uinkaret Plateau, Janetski and Wilde 1989; i) Chiricahua point, La Paloma, Tucson Basin, Dart 1986; j) San Pedro point, Milagro site, Tucson Basin, Huckell 1990; k) Basketmaker II point, Petrified Forest National Park, southern Colorado Plateau, Burton and Farrell 1993; l) late Amargosa point, The Lookout, Harquahala Valley, Bostwick 1988; m) Cienega point, Clearwater site, Tucson Basin, Sliva 1997; n) Cienega point, Los Pozos, Tucson Basin, Sliva 1998.

able confusion that can derive from grouping them in terms of *cultural periods*. Table 1.1 lists the projectile point types associated with each complex, and Figures 1.4-1.7 show some examples. Appendix A also provides descriptions and illustrations of common Paleoindian and Archaic projectile point types in Arizona, and information about their original definitions and known distributions.

THE ORGANIZATION OF THIS OVERVIEW

Chapter 2 reviews the available evidence of Late Quaternary environmental changes in the Southwest and identifies major environmental-temporal units. Chapters 3 through 6 summarize the current state of knowledge of the archaeology of Paleoindian and Archaic sites in Arizona. Following the archaeological frameworks discussed in this chapter, this review is organized by environmental periods, physiographic regions, subsistence adaptations, and material culture complexes. These review chapters also include sum maries and discussions of projectile point types, dating evidence, and models of cultural relationships and transitions. Chapter 7 summarizes site patterns based on the statewide site inventory and describes known site types for each combination of period/adaptation. Chapter 8 describes eligibility criteria for listing Paleoindian and Archaic sites on the National Register of Historic Places. Included as an appendix is an illustrated guide to common Paleoindian and Archaic projectile point types in Arizona.

CHAPTER 2

LATE QUATERNARY ENVIRONMENTAL PERIODS

RECORDS OF LATE QUATERNARY ENVIRONMENTAL HISTORY

The Paleoindian and Archaic cultural history of southwestern North America cannot be separated from its environmental history. Understanding of Paleoindian and Archaic site contexts and subsistence adaptations in this region requires evaluation of environmental characteristics and changes during the Late Quaternary period. Paleoclimatic models based primarily on the predicted effects of the earth's orbital patterns on solar energy inputs and atmospheric dynamics (e.g., Kutzbach 1987; Kutzbach et al. 1993) do not entirely match the evidence from geological and biological proxy (indirect) records of significant changes in the climates, vegetations, and landscapes of this region during the last 40,000 years. Here, alluvial stratigraphy, lake and playa deposits, dune formations, mammal remains, insect fossils, pollen sequences, and packrat midden series will be reviewed because they record actual paleoenvironmental signals. It is recognized, however, that each of these proxy records has different information potentials and limitations.

Virtually all sedimentary deposits in the Southwest record a paleoenvironmental signal to some degree. Soils, faunal remains, artifacts, and radiocarbon dating allow stratigraphic correlations of the alluvial deposits of tributary streams over a wide area, as well as inferences about climatic and human agency to explain generally synchronous events (Haynes 1968; Butzer 1980; Mabry 1992; Waters 1992). However, alluvial events may not directly correlate with climatic events because of complex temporal and spatial patterns of response (Patton and Schumm 1981), and both increases and decreases in precipitation can trigger fluvial adjustment (Petts and Foster 1985). Correlations are also complicated by the time-lags between climatic changes and responses in cover vegetation, resulting in variable timing of fluvial responses (Knox 1983). Lacustrine deposits also provide information about climatic changes, but rather than correlating directly with changes in precipitation, fluctuations in lake levels and salinities more directly represent changes in effective moisture, which are partly related to evaporation rates controlled by temperatures (Smith and Street-Perrott 1983). Soil marker-beds, archaeological inclusions, and radiocarbon dating can bracket intervals of dune activity and stability, but eolian deposition is not only related to climatic aridity, but also to sediment supply and relative surface moisture (Mehringer and Warren 1976; Wells et al. 1990).

Biological remains are generally more sensitive indicators of paleoenvironments than are geological types of evidence. Directly radiocarbon-dated assemblages of plant macrofossils in packrat middens represent detailed, well-preserved samples of local vegetation, potentially down to the level of species, at single points in time (Van Devender et al. 1985). Midden time series are usually constructed from radiocarbon-dated macrofossil assemblages from middens recovered from several different localities in a specific area. However, even midden time series comprised of large numbers of dated assemblages have significant chronological gaps. And, in contrast to biological sequences from single sites, these incorporate variability that is due to inter-site differences in vegetation. Fossil pollen records from high elevation lakes and bogs with continuous sedimentation represent complete temporal coverage in single localities (Davis and Shafer 1992). Even so, lacustrine pollen records are usually bracketed by only a few radiocarbon dates, requiring estimations of the timespans of pollen zones based on calculated rates of deposition. These estimations are reliable only to the extent that there have been no changes in deposition rates, and that there are no undetected hiatuses. Pollen records from low elevation playas often have gaps in their sedimentary sequences because of intervals of dessication and deflation. Fossil pollen assemblages from stratified alluvium also record vegetation changes, but are often incomplete because of interruptions in deposition or truncations by erosion. Also, pollen in alluvial contexts is frequently poorly preserved, and the majority of the pollen usually derives from outside the floodplain (Hall 1985, 1989; Fall 1987).

Bone and shell preserved in a variety of natural and cultural sedimentary contexts can provide information on environmental characteristics at the times of deposition, but samples are typically small and nonrepresentative because of selective deposition, hunting, or preservation (Butzer 1971). However, comparisons of the faunal assemblages of multiple localities in a region, in conjunction with analyses of stratified sequences in single localities, can provide much information on ancient environments and directions of changes. Insect fossils preserved in lake sediments, peats, and other types of sediments, and in packrat middens in southwestern North America, can often be identified to species level because of unique patterns of microsculpture on exoskeletons. Because each species often has very specialized habitats that apparently have not changed significantly during the Quaternary, and because they respond quickly to environmental changes, they represent excellent indicators of local environmental conditions and the timing of changes (Elias 1994, 1997). Not included in this review are paleoclimatic reconstructions based on comparisons of tree-ring widths (Euler et al. 1979; Dean et al. 1985; Dean 1994) which cover only the last 2,000 years, and so do not have enough temporal depth to compare to the Paleoindian and Archaic portions of the archaeological record.

Despite their different levels of completeness, correlation, sensitivity, and temporal precision, these proxy records can potentially complement each other to provide a more complete and accurate picture. In the following, several independent lines of geological and biological evidence are reviewed and compared to provide a temporal-environmental framework for Southwestern prehistory, and an understanding of the environmental contexts of Paleoindian and Archaic adaptations in this region. Because the timescales of most of these paleoenvironmental records are provided by radiocarbon dating, ages are expressed in terms of uncalibrated radiocarbon years before present (b.p.) throughout this section.

Alluvial Stratigraphy

Beginning with Herbert K. Gregory's dating of prehistoric terraces in canyons of the southern Colorado Plateau by the presence of "buried corn cobs and pottery buried beneath terrace gravels" (1917:130-131), and the more extensive work of his student, Kirk Bryan (1922, 1926, 1928, 1942, 1954), and Bryan's student, John T. Hack (1939, 1942), sequences of alluvial deposits in valley bottoms have provided local records of Late Quaternary environmental history in southwestern North America (cf. Haynes 1990). During the same years that Bryan and his students were piecing together a regional postglacial alluvial chronology, Ernst V. Antevs was estimating the ages of Paleoindian sites in the Southwest by correlating the alluvial deposits containing them with lake beds in the Great Basin bearing the bones of extinct Pleistocene fauna (Antevs 1935, 1937; Sayles and Antevs 1941).

Based on his own interpretations of alluvial sequences in the Southwest, which he correlated with sequences of sand dunes, soil formations, lake varves, and playa beaches throughout the Southwest and Great Basin, Antevs (1948, 1955, 1959) reconstructed four major periods of aridity during the "Neothermal" (Holocene). These he correlated with the major erosional intervals in Bryan's alluvial chronology, including the "Altithermal Long Drought" (between 7,500 and 4,000 years ago) between Bryan's depositions 1 and 2a, the "Fairbank Drought" (about 2,500 years ago) between depositions 2a and 2b, the "Whitewater Drought" (about 1,700 years ago) between depositions 2b and 3, and the "Pueblo Drought" (about 700 years ago) terminating deposition 3. Bryan and his students, in turn, began to refer to Antevs' (1931) varve chronology for North America to aid in their dating of late glacial advances in the Rocky Mountains and Paleoindian sites in the Great Plains and Southwest (Bryan and Ray 1940; Bryan and McCann 1943).

Through comparison of radiocarbon-dated terrace deposits and incorporated archaeological sites, C. Vance Haynes Jr. (1968) significantly refined the alluvial chronology for the Great Plains and the Southwest, identifying five major aggradational cycles during the last 11,000 years on the basis of 93 radiocarbon dates from well-documented stratified contexts from Wyoming to Arizona. These comparisons indicated deposition of graded alluvial sediments, fining upward, during the deglacial period. The period between about 11,500 and 11,000 b.p. is represented only in certain localities by spring-head deposits or channel deposits in spring-fed streams. Deposition of mostly fine-grained alluvium occurred between about 11,000 and 7500 b.p. Arroyo cutting and erosion were widespread between about 7100 and 5800 b.p., and deposition of channel gravel and sand, slope wash, and colluvium was widespread between about 5800 and 4000 b.p. (eolian deposition between 6900 and 4000 b.p. spanned this alluvial cut-and-fill cycle). Soils formed on some stabilized surfaces between about 4500 and 3500 b.p. Fine-grained alluvium was deposited between about 4000 and 1900 b.p. (beginning as early as 4900 b.p. in some areas), but interrupted in some localities by a brief erosional event between 2900 and 2600 b.p. After another possible hiatus between 1900 and 1500 b.p., fine-grained deposits, including wet-meadow (cienega) soils locally, were filled valley floors until the most recent cycle of arroyo cutting began about 150 years ago.

At a level below these general regional patterns, significant local variability is represented in the alluvial sequences of discrete watersheds in the Southwest (e.g., Sayles and Antevs 1941; Hack 1942; Bryan 1954; Haury 1957; Miller and Wendorf 1958; Gile 1975; Hall 1977, 1990; Euler et al. 1979; Haynes

1982, 1987; Dean et al. 1985; Eddy and Cooley 1983; Haynes and Huckell 1986; Karlstrom 1986; Waters 1986a, 1987; Huckell 1996a, 1997; Freeman 1997). These variations show that, while climatic changes effect widespread, synchronous changes in alluvial regimes, the geomorphic character of a drainage basin strongly influences the specific timing of cutting and filling. However, when Haynes' comparative approach is applied to the currently available set of local alluvial chronologies in the Southwest (not combining evidence from the Great Plains, as Haynes did), a number of regional-level trends, probably related to changes in climate and vegetation, are evident (Mabry 1992). Deposition of coarse channel gravels predominated in the late Wisconsin until about 11,000 b.p. During the early Holocene, between about 11,000 and 8000/7500 b.p., mostly fine-grained alluvium was deposited by overbank floods. A widespread hiatus in deposition and/or erosion between about 8000/7500 and 5500/5000 b.p. was followed by slope wash and colluvial deposition and soil formation until about 4000 b.p. in many sequences. A period of rapid deposition of fine-grained alluvium and slope wash sediments between about 4000 and 2500 b.p., followed by steady deposition at a slower rate until about 1000 b.p., is recorded in many valleys. Most alluvial sequences were interrupted near 1000 b.p., and have experienced between one and three cut-and-fill cycles between then and today.

Lake and Playa Deposits

The usefulness of lake-level fluctuations in western North America in reconstructing climatic changes has been recognized since the late nineteenth century (cf. Smith and Street-Perrott 1983). A map of extinct "pluvial" (Wisconsin) lakes in the Basin and Range Province, and their paleoclimatic implications, was first compiled by Meinzer (1922). Ernst Antevs was the first to reconstruct chronologies for pluvial lakes in the Great Basin, based on correlations with glacial events in other parts of the world (1925), and with varve sequences throughout North America (1931). Since the mid-twentieth century, radiocarbon dates associated with stranded beaches, lake-bottom marls, and evaporite deposits have provided a chronological scale for fluctuating lake levels during the late Wisconsin and Holocene in a number of basins in western North America, including the Southwest.

In the Trans-Pecos Closed Basin of south-central New Mexico/west Texas, four lake highstands occurred between 22,600 and 16,000 b.p. (Wilkins and Currey 1997). The Laguna de Babícora Basin in Chihuahua, northwest Mexico, was filled with a lake from 10,000 b.p. until 6000 b.p., when it dried out; alternating lacustrine, marsh, and fluvial deposition characterized the last 6,000 years, with weathering (represented by a paleosol) near 3000 b.p., and erosion near 2000 b.p. (Ortega-Ramírez et al. 1992). In the San Agustin Plains, west-central New Mexico, the large lake that existed at 18,000 b.p. shrank between 16,000 and 11,000 b.p., expanded between 11,000 and 8000 b.p., and then shrank again, drying out completely by 5000 b.p. (Markgraf et al. 1984). At least two highstands of Lake Cochise occurred in the Wilcox Basin of southeastern Arizona prior to 14,000 b.p., followed by highstands near 13,500 b.p., 8900 b.p., and 5400 b.p., and a final one between 4000 and 3000 b.p. (Waters 1989).

In general, the Southwestern lake level sequence matches that of the Great Basin. In the Mojave Desert, or southwestern Great Basin, Lake Mojave dried out sometime between 9200 and 8400 b.p., after which there were lake phases near 3600 and 400 b.p. (Enzel et al. 1992). Radiocarbon dates near 3500 b.p. are associated with lake stands in other Mojave Desert basins (Drover 1979; Smith 1979). Maximum recorded lake levels throughout the Great Basin occurred during the early deglacial period, between 16,000 and 12,000 b.p., after which lakes dropped to very low levels between 12,000 and 11,000 b.p.; higher levels than today were attained in several basins between 11,000 and 7000 b.p. (Smith and Street-Perrott 1983; Benson and Thompson 1987). Low lake levels occurred again between 7,000 and 4,000 years ago, followed by a brief interval of reexpansions in some basins about 4,000 years ago (Antevs 1948, 1952).

Eolian Formations

The largest areas of eolian deposits in the Southwest occur on the southeastern Colorado Plateau. John T. Hack (1941) was the first to conclude, based on correlations with alluvial and lacustrine sequences, that the oldest dune formation in that region is Late Pleistocene in age. Near the town of Grants in northwestern New Mexico, Bryan and McCann (1943) dated a sequence of Holocene dune deposits by the associated artifacts. Artifacts of the preceramic "San José complex" occurred in the paleosol capping the top of the "Old Dune Sand," while the artifacts of the ceramic "Lobo complex," dated to about A.D. 875-1100 by the presence of Pueblo I pottery, occurred within the overlying "Late Dune Sand." The uppermost deposit was called the "Modern Dune Sand" because of the inclusions of cartridge shells, tin cans, and other modern artifacts.

Farther north on the southeastern Colorado Plateau, the sequence of eolian deposition in the

Chaco Dune Field is based on associated radiocarbon dates, calcic horizons, and soils (Hall 1990; Wells et al. 1990). The earliest eolian unit was formed during deglacial time, between about 16,000 and 12,000 b.p. After a period of several thousand years of stabilization and soil formation, deposition of the second eolian unit occurred between 5900 and 2200 b.p. (Hall 1990), but mostly between about 4000 and 2800 b.p. (Wells et al. 1990). Burying a less well-developed soil, the third and final eolian unit began forming about 1900 b.p., and is still accumulating today. Based on the conditions under which they have been observed forming today—the presence of a limited sand supply and a moist ground surface, the sand sheets and parabolic dunes of the first and second units are attributed by Wells et al. (1990) to the relatively wet and cool climates of the deglacial and early Neoglacial periods, respectively; the diversity of eolian landforms representing the third unit (and comprising the largest proportion of eolian sediments by volume) is attributed to decreased effective moisture and widespread dissection of the landscape during the late Holocene.

Radiocarbon dates of cultural and noncultural charcoal in eolian deposits in the Picacho Dune Field in southeastern Arizona (in the Southern Basin and Range Province) indicate an initial period of dune formation centered near 4300 b.p., and a subsequent one between about 2640 and 400 b.p., separated by a period of surface stability represented by a paleosol representing more than a thousand years (Waters 1986b). Because the earlier interval of dune formation overlapped in time with the formation, between about 4850 and 3900 b.p., of a cultural midden containing cattail (*Typha*) pollen and interbedded with highly organic and clayey marsh (cienega) deposits, Bayham and Morris (1990) concluded that periods of dune formation correlated with periods of increased effective moisture, which they attributed to intervals of higher summer rainfall correlated with multiple thermal maxima during the Holocene.

In the Las Vegas Valley and Amargosa Desert in southern Nevada, just west of the Colorado Plateau, dunes stabilized between 5500 and 4700 b.p. after a long period of eolian deposition (Haynes 1967; Mehringer and Warren 1976). At Ash Meadows in the Amargosa Desert, two cycles of dune formation, the first between 5300 and 4500 b.p., and the second between 4500 and 3000 b.p., dammed spring-fed drainages to create salt marshes in which peats formed (Mehringer and Warren 1976). These dunes were deflated and soils formed on stabilized surfaces between 3000 and 2000 b.p. Dunes began to form again about 1000 b.p., then deposition ceased and weathering occurred before 400 b.p., when peat deposition resumed. The stratigraphic relationships between the peats and dune sands indicate that peat deposition was coeval with dune movements, and that eolian deposition continued thereafter, burying the marshes. These cycles were initiated by regional changes in source material, vegetation cover, and possibly other factors, but variations in rainfall and spring discharge could not be confidently identified.

As paleoclimatic indicators, dunes are generally treated as representing increased aridity (e.g., Sarnthein 1978), but the studies in the Chaco and Picacho dune fields and at Ash Meadows indicate that 1) sand sheets and parabolic dune forms correlated with moist ground surfaces and limited sediment supplies; 2) active dunes correlated with marsh deposits in spring-fed drainages; and 3) increases in rainfall or changes in rainfall seasonality, increases in alluvial discharges, and fluctuating lake levels all served to increase sand supplies for continued or renewed dune formations. On the other hand, dune formation and reactivation did sometimes correlate with extremely arid climates, while soil formation on stabilized dunes generally correlated with increases in rainfall that coincided with decreased sediment supplies.

Pollen Sequences

After Paul B. Sears (1937) demonstrated that pollen preserved in alluvial terraces in Tsegi Canyon, northeastern Arizona, could be used to reconstruct environmental conditions during a prehistoric timespan, Paul S. Martin and his students began analyzing pollen from alluvial, lacustrine, spring, and archaeological deposits across the Southwest in the late 1950s. Comparisons of these and other pollen sequences have been the basis of several regional syntheses of Late Quaternary environmental changes in the Southwest, independent of the regional alluvial sequence (Sears 1961; Schoenwetter 1962; Martin 1963; Martin and Mehringer 1965; Mehringer 1967; Petersen 1981; Baker 1983; Hall 1985).

Most Southwestern pollen sequences either end or begin during the latest Wisconsin deglaciation of North America; the few sequences that span this interval indicate that the transition to postglacial vegetation occurred throughout the region between 15,000 and 10,000 b.p. in general, but specifically between 11,000 and 10,500 b.p. in many areas. Pollen sequences from high montane lakes and bogs in the San Juan and La Plata mountains of southwestern Colorado, at the eastern edge of the Colorado Plateau, and at the southern tip of the Rocky Mountains indicate disappearance of glaciers between 15,000 and 9000 b.p., and climbing timberlines and a shift from spruce to pine forest between 9000 and 8000 b.p.

(Andrews et al. 1975; Carrera et al. 1984). Pollen preserved in alluvium at the mammoth-kill site at the Lehner ranch in southeastern Arizona indicates a desert grassland similar to that of today, but slightly higher precipitation and lower temperatures, radiocarbon-dated during the Clovis occupation to about 11,200-11,000 b.p. (Mehringer and Haynes 1965; Mehringer et al. 1971). On the basis of surface sampling of pollen in the Empire Cienega in southeastern Arizona (Martin 1963), the decrease in arboreal and Cheno-Am pollen and increase of short-spine Compositae (*Ambrosia* spp.) beginning sometime between 10,940 and 10,410 b.p. in the Lehner site sequence indicate a shift to wet meadow (cienega) vegetation during the early Holocene. At Potato Lake on the Mogollon Rim in central Arizona, a shift from conifer, pine, sagebrush, and Cheno-Am vegetation to pine, oak, grasses, and other Compositae occurred about 10,400 b.p., interpreted as representing a change to warmer temperatures (Anderson 1993).

In general, Southwestern pollen sequences that span the Pleistocene/Holocene transition reflect a shift from cooler temperatures and winter-dominant rainfall to warmer temperatures and summer-dominant rainfall. Pollen sequences from caves on the Colorado Plateau, including Cowboy Cave and Bechan Cave in southeastern Utah (Spaulding and Petersen 1980; Davis 1996), and Stanton Cave and Tse'an Bida Cave in the Grand Canyon, northwestern Arizona (Martin 1984; O'Rourke and Mead 1985), record a shift from late Wisconsin vegetation in which sagebrush and montane conifers played an important role, to an early Holocene vegetation in which juniper was important and sagebrush was much reduced. This represents a shift from plant communities with species of Great Basin affinities to ones with species common in the Southwest today. This is consistent with a shift from winter to summer rainfall regimes, and a warming of temperatures, particularly during the winter. The dominance of spruce in the late Wisconsin pollen zones of lacustrine sequences on the mountainous southern edge of the Colorado Plateau (the Mogollon Rim) indicates significantly cooler temperatures than today (Jacobs 1983; Anderson 1993).

In the San Juan and La Plata mountains of southwestern Colorado, at the northeastern edge of the Colorado Plateau, timberlines were higher during the early Holocene (Carrera et al. 1984; Petersen and Mehringer 1988). Pollen from early Holocene deposits in lakes and bogs along the Mogollon Rim, including Laguna Salada (Hevly 1964), Hay Lake (Jacobs 1983), Montezuma Well (Davis and Shafer 1992), Potato Lake (Anderson 1993), and Stoneman Lake (Hasbargen 1994) indicate greater abundance of plants representing cooler and moister conditions than today (but warming), summer-dominant rainfall, and retreating of conifer forests to higher elevations between about 10,500 and 8000 b.p. Pollen sequences from early Holocene alluvial contexts at the Lehner (Mehringer and Haynes 1965) and Double Adobe I (Martin 1963) sites in southeastern Arizona also indicate cooler and moister conditions than today in the Southern Basin and Range Province.

The higher proportions of oak in the early Holocene pollen zones of many of these sequences have been interpreted as indicating summer-dominant rainfall (Davis and Shafer 1992), as oaks in the Southwest today are restricted to areas affected by summer monsoons (Neilson and Wullstein 1983). Van Devender et al. (1994), however, point out that oak is also a constituent of the chaparral that characterizes areas of winter-dominant rainfall. Like the disappearance of Great Basin plant communities on the Colorado Plateau, the disappearance of all Mojave Desert plants in the Lower Colorado Valley by 9300 b.p., recorded in a pollen core from the northern Gulf of California (Davis et al. 1992)—as well as in packrat midden sequences from the Lower Colorado River Valley (Cole 1986, 1990b; Van Devender 1990; see below)—is interpreted as representing a decrease in winter rainfall.

According to the interpretations of Mehringer (1967) and Hall (1985) of the Southwestern pollen data, an interval of higher temperature and decreased effective moisture occurred between 7500/7000 and 5000/4500 b.p., as described by Antevs' "Altithermal" model. In an alternative model, Martin (1963) argued for a middle Holocene wetter than today on the basis of radiocarbon-dated alluvial pollen profiles from southeastern Arizona, primarily the sequences obtained from Double Adobe I, the type site for the Sulphur Springs stage of the Cochise culture, and Murray Springs, a Clovis mammoth-kill site. Martin criticized the geographical extensions of Antevs' hot-dry model of the middle Holocene, arguing that while warmer temperatures would have led to greater aridity in the winter-wet northern Great Basin, this same trend would have intensified summer monsoonal circulation in the summer-wet Southwest. More recently, Van Devender's (1987, 1990) and Betancourt's (1990) interpretations of packrat midden sequences have supported this mesic model of the mid-Holocene in the Southwest (see section on packrat midden evidence below).

In response, Antevs (1962) disputed Martin's interpretations of alluvial stratigraphy, while others pointed out problems with both the method of alluvial pollen analysis (Fall 1987) and Martin's conclusions about his pollen data (Solomon et al. 1982; Hall 1985). In addition to these criticisms, it has been determined that the interval between about 7500 and 4500 b.p. was not represented in the alluvial sequences Martin sampled for pollen (Mehringer et al. 1967; Haynes 1968; Hall 1985; Waters 1986a), or in the packrat midden sequences summarized by Van Devender (Spaulding 1991). Also, on the basis of a canonical analysis of a series of surface pollen samples from southern Arizona (Adam 1970; Mehringer et al. 1971), the simultaneous increase in Chenopodiineae pollen and decrease in Compositae pollen about 8000 b.p. in the alluvial sequence at the Double Adobe I site indicates a shift to warmer, drier climate following an early Holocene climate that was cooler and moister than today. Also, the elevated *Pinus* pollen in this part of the Double Adobe I sequence is typical of a regional pattern of over-representation because of long distance wind dispersal and relatively higher resistance to deterioration (Hall 1985).

Most Southwestern pollen-stratigraphic sequences were interrupted during the middle Holocene. The pollen record at Kane Springs in southeastern Utah is broken by an erosional event (downcutting in the gulch) at 6600 b.p. (Agenbroad and Mead 1989). Walker Lake, on the southwestern Colorado Plateau in north-central Arizona, dried out completely about 6000 b.p. (Hevly 1985). Laguna Salada, Potato Lake, and Hay Lake along the Mogollon Rim of central and east-central Arizona had greatly reduced sedimentation rates and dried out repeatedly during the middle Holocene (Cooley and Hevly 1964; Jacobs 1983; Anderson 1993). Downcutting and erosion interrupted the pollen-bearing alluvial sequences at Double Adobe I and Murray Springs between 8000/7000 and 5000/4000 b.p. (Mehringer et al. 1967; Haynes 1968). Only Stoneman Lake and Montezuma Well on the Mogollon Rim have continuous Holocene pollen sequences, because they continued to be fed by artesian springs (Davis and Shafer 1992; Hasbargen 1994). Both of these sequences indicate higher temperature, lower effective moisture, lower lake levels, and higher salinity than today from about 8000 b.p. until sometime between 3700 and 2500 b.p. (the closest bracketing dates). On the northern Colorado Plateau, the pollen sequence from Sudden Shelter, representing a timespan of ca. 7800 to 3300 b.p., also indicates generally hot and dry conditions (Lindsay 1980). The only major deviation was a significant increase in pine pollen between about 4900 and 4700 b.p., accompanied by slight increases in spruce and fir pollen, interpreted as indicating increased summer rainfall.

In other Southwestern pollen sequences there is also evidence of one or more wet/cool periods between about 5000 and 1500 b.p., which were probably related to two early Neoglacial advances accompanied by lowered timberlines between 5000 and 1800 b.p. in the San Juan Mountains of southwestern Colorado (Andrews et al. 1975). In east-central Arizona, cooler and moister conditions between about 4700 and 2800 b.p. are recorded in lake and bog pollen sequences in the White Mountains (Batchelder and Merrill 1976). To the west on the Mogollon Rim, an increased abundance of riparian trees and aquatic plants between 3700 and 2700 b.p. at Montezuma Well indicates higher lake levels (Davis and Shafer 1992). Potato Lake refilled by about 3000 b.p., and terrestrial and aquatic pollen types indicate increased effective moisture at that time (Anderson 1993). At Pecks Lake, higher effective moisture is indicated between 3000 and 1600 b.p. (Davis and Turner 1986), and at Stoneman Lake, a dramatic increase in sediment influx, decreased salinity, and increased abundance of aquatic plants began about 2500 b.p. (Hasbargen 1994).

At the western edge of the Colorado Plateau, in southeastern Nevada, a pollen sequence from cave deposits in O'Malley Shelter records a shift from grassland to pinyon-juniper woodland beginning about 3900 b.p. (Madsen 1973). On the Kaibab Plateau in northwestern Arizona, the pollen of aquatic vegetation is more abundant in a zone bracketed between 4240 and 2850 b.p. in a core from Crane Lake (diagram by D. S. Shafer reproduced in Davis 1996). On the eastern Colorado Plateau, in northwestern New Mexico, pine pollen—representing a reexpansion of the forest after a mid-Holocene warm/dry period—is higher in alluvium postdating 2400 b.p. in Chaco Canyon (Hall 1977), and in cave deposits postdating 2200 years b.p. in Ashislepah Shelter (Fredlund 1984).

In the middle Rio Grande Valley in southern New Mexico, a decrease in Chenopodiineae and an increase in Gramineae about 4000 b.p., recorded in an alluvial pollen sequence at Gardner Springs (Freeman 1972), probably represents increased effective moisture (Hall 1985). The lower half of a core from a raised spring mound at Salina Grande, Sonora, on the northern coast of the Gulf of California, records increased spring discharge (represented by abundant cattail and algae) and reduced aridity (less bursage) above a basal radiocarbon date of 3690 b.p. (Davis et al. 1992).

In southeastern Arizona, a pollen profile from Murray Springs has higher percentages of cattail (*Typha* sp.) and sedge (Cyperaceae) in a segment bracketed between 5890/4340 b.p. (humates/organic residue of same sample) and 4230 b.p., which was interpreted as indicating moist conditions between about 5000 and 4000 b.p. (Mehringer et al. 1967). However, based on a study of modern surface samples in a nearby valley (Martin 1963), the high percentages of Chenopodiineae in the same zone represent a dissected land surface, a low water table, and low rainfall. Likewise, the shift to dominance by short-spine Compositae that occurred in a zone bracketed between 4230 and 4120 b.p. may mark the beginning of a wetter phase that ended by at least 1550 b.p., after which Chenopodiinaea, spurge (*Ephedra* sp.), and joint fir (*Euphorbia* sp.) increased, representing drier conditions. In the profile from the Lehner site, a change to less effective moisture is apparent at about 2500 b.p. and, after a brief amelioration, again at about 1500 b.p. (Mehringer and Haynes 1965; Mehringer 1967). The shift in dominance from Compositae to Chenoams (Chenopodiaceae plus the related genus *Amaranthus*) sometime between 1,100 and 800 years ago in a pollen profile from Cienega Creek (Martin 1983) may represent falling of the water table and decreased rainfall.

Packrat Midden Series

Beginning with the work of Philip V. Wells and Clive D. Jorgenson (1964) at the Nevada Test Site in the early 1960s, radiocarbon-dated assemblages of plant macrofossils from packrat (*Neotoma* spp.) middens preserved in dry caves and rockshelters have been used to reconstruct Late Quaternary vegetation and climates in the Southwest and Great Basin. Today, more than a thousand radiocarbon-dated midden plant assemblages have been compared and used to interpret major trends in environmental history over the last 40,000 years (Van Devender and Spaulding 1979; Van Devender et al. 1987; Betancourt et al. 1990).

In the interpretation of this growing data set, there is a general consensus among the various analysts that the Wisconsin full-glacial (22,000-14,000 b.p.) and deglacial (14,000-11,000 b.p.) climates of the Southwest (including the Mojave Desert) were characterized by cooler temperatures and higher effective moisture than today, and that the majority of precipitation occurred during the winter. However, the Mojave Desert had cooler winter temperatures and less precipitation than the Sonoran Desert. Conifer forests covered the mountains and plateaus, and "pygmy conifer" woodlands composed of pinyon pine, juniper, and oak covered most of the lowlands of the Southwest (Van Devender et al. 1987; Van Devender 1990). By contrast, in the Great Basin, subalpine conifer woodland extended down to sagebrush steppe, and pygmy conifer woodland did not exist (Thompson and Mead 1982; Thompson 1990, 1992). Vegetation became more xeric toward the west. In the western Grand Canyon in northwestern Arizona, a xeric woodland was dominated by juniper and shadscale, and several desert species living in the area today were present (Mead and Phillips 1981). To the northwest, in the Mojave Desert, pinyon was rare, oak absent, and juniper prevailed (Spaulding et al. 1983; Spaulding 1990a). Desertscrub characterized the lowest elevations of the Lower Colorado Valley (Cole 1986, 1990a) and of the Mojave Desert (Wells and Woodcock 1985; Spaulding 1990a, 1990b).

The beginning of the turnover to modern species compositions was near 11,000 b.p. throughout the Southwest (Van Devender and Spaulding 1979) although, more recently, Spaulding (1985; 1990a, 1990b) has presented data supporting a date of 15,000 b.p. for the initiation of deglacial vegetation change. Rapid species turnover at 10,000 b.p. is recorded on the Colorado Plateau (Van Devender and Spaulding 1979; Van Devender et al. 1987; Betancourt 1990; Cole 1990a), but juniper-oak woodlands persisted during the early Holocene in the lowlands of southern Arizona now covered with desert vegetation (Van Devender 1977; Van Devender et al. 1985). Between about 9000 and 8500 b.p., these woodlands retreated to higher elevations as desert-adapted species began to increase in the lowlands and to colonize new areas, and woodlands expanded on the Colorado Plateau. Modern distributions of plant communities were attained over most of the Southwest between 5000 and 4000 b.p. A final change to woodlands adapted to drier climate took place between 2400 and 2200 b.p. on the Colorado Plateau, and a short cool/wet phase occurred about 1000 b.p. in the Sonoran Desert.

In exception to these patterns and trends, the packrat midden evidence indicates that deglacial climates were more arid, and desert vegetation developed much earlier, at the northwestern and southwestern edges of the Southwest. In the Mojave Desert of southern Nevada, the oldest evidence of desert vegetation in North America has been found: packrat midden macrofossil assemblages dated between 17,530 and 14,810 b.p., and indicating desertscrub up to elevations of 910 m (Spaulding 1985). Progressive change toward more xerophytic communities began in that region by 12,000 b.p. From the southernmost Lower Colorado Valley, presently part of the Sonoran Desert and the most arid area in North America, Cole (1986) reports that a Mojave Desert desertscrub existed here during the deglacial period. Mojave Desert species with affinities to more northerly latitudes and higher-elevation habitats disappeared between 12,000 and 11,000 b.p. Lower elevation species were gone by 10,000 b.p., when Sonoran desertscrub species first arrived (although creosotebush was already present by 12,780 b.p.).

Related subjects of disagreement are the timing of the Holocene maximum of summer rainfall, and whether the hotter middle Holocene was dry or wet relative to the present. Spaulding and Graumlich (1986) observe that most Sonoran taxa are frost-sensitive, and present evidence that relatively cold winter temperatures persisted until about 9000 b.p., when desert thermophiles began to increase. The increasing moisture deficits of the early Holocene, as temperatures increased and winter rainfall declined (indicated by the absence of records of steppe shrubs in the Mojave Desert middens), were probably compensated for by increased warm-season precipitation (Geoff Spaulding, personal communication 1997). Macrofossil assemblages in packrat middens from the Mojave Desert in the southwestern Great Basin (Spaulding and Graumlich 1986) and from the Grand Canyon on the western Colorado Plateau (Cole 1990a) have been cited as reflecting intensified summer monsoons during the early Holocene, reaching a post-Wisconsin maximum. It has also been observed (Spaulding 1985) that the oak-juniper woodlands that expanded into lower elevations (< 1,000 m) during the early Holocene (Van Devender 1977; Van Devender et al. 1985) were apparently restricted to the areas of the Southwest affected by summer monsoons. For the middle Holocene, Spaulding (1991) reports macrofossils of only xeric plants, dominated by creosotebush, in packrat midden assemblages dated between 6800 and 5060 b.p. in the southeastern Mojave Desert and northwestern Sonoran Desert. Cole (1990a) interprets the packrat midden sequence of the Grand Canyon as indicating climates warmer and drier than today between 8500 and 4000 b.p., and reports no dated middens between 6800 and 5510 b.p. Middens from the southernmost Lower Colorado Valley dated at 4970 and 4800 have very low taxonomic diversity, and indicate severely arid conditions (Cole 1986).

Van Devender (1990; Van Devender et al. 1994), on the other hand, cites the absence of summer-rain-dependent Sonoran Desert perennials and the presence of the winter-rain-dependent juniper as representing the persistence of winter-dominant rainfall during the early Holocene, and suggests that the southern Nevada middens near the northwestern edge of the Sonoran Desert may be more related to Mojave Desert trends. He argues that the evident middle Holocene increases in creosotebush could reflect farther penetration of the monsoons into Nevada, or more frequent fall storms from the Pacific, rather than increasing aridity. However, creosote is well adapted to arid, winter rainfall regimes today, and Spaulding (personal communication 1997) believes that it could be more effectively argued that aridity during the middle Holocene gave it a "competitive edge" over other desert shrubs; he also agrees with Betancourt (1990) that the Colorado Plateau midden record does indicate increased monsoons during the middle Holocene.

One possibility that partially reconciles these apparently conflicting interpretations is that, as in the late Wisconsin under a winter-precipitation regime with rain shadow effects east of the Sierra Nevada, western areas of the Southwest were drier than the rest of the region during the middle Holocene because the summer monsoons did not penetrate that far; the current average limit of monsoons crosses the Southwest in an arc following the eastern side of the Lower Colorado Valley and the western and northwestern edges of the Colorado Plateau.

Regardless, Spaulding (1991) is correct in noting that, by placing the beginning of the middle Holocene at about 8900 b.p., Van Devender thereby includes assemblages that may be related to an early Holocene wet period, and also that very few packrat middens from the Sonoran Desert date between 7500 and 5000 b.p. Of the packrat middens from the Puerto Blanco and Tinajas Altas mountains in southwestern Arizona, which have been cited as indicating enhanced monsoons during the middle Holocene (Van Devender 1987; Van Devender et al. 1987), only five date between 7500 and 4000 b.p., and these lack evidence of ironwood, paloverdes, and catclaw acacia that should have been present during a warm-wet period, and which are present today. This relative paucity of middle Holocene packrat middens is a widespread pattern in the Southwest and the rest of the intermontaine West. Based on a comparison of 1,113 radiocarbon-dated middens, Webb and Betancourt (1990) note that there are currently very few packrat middens dated between 8000 and 4000 b.p. in every region of the Southwest and Great Basin. This pattern may represent a decline in packrat populations due to extremely arid conditions that reduced the availability of vegetation with moist leaves and stems, which provide the bulk of their food and water (Vaughan 1990).

Less controversial are two late Holocene wet periods, centered near 4000 b.p. and 1000 b.p., represented in the Southwestern packrat midden sequence. In the Tinajas Atlas and Whipple Mountains in the Sonoran Desert, Blue paloverde—a riparian tree today—appeared in middens on rocky slopes between 4240 and 4010 b.p. (Van Devender et al. 1987). Pinyon pine (*P. edulis*), whose northward spread from its Pleistocene refuge in southern New Mexico is attributed to the development of summer monsoons (Van Devender et al. 1984), is abundant in packrat middens and cultural deposits dated between 3600 and 2000 b.p. on the Colorado Plateau (Hewitt 1980; Betancourt 1990). Among eight macrofossil assemblages ranging in age from 3490 and 700 b.p. from the Little Granite Mountains in the central Mojave Desert, the middens dated at 3490 and 3160 b.p. indicate the highest levels of effective moisture (Spaulding 1995). In the southernmost Lower Colorado River Valley, the final establishment of the modern desertscrub communities occurred after 700 b.p., implying a prior late Holocene amelioration of climate (Cole 1986). Greater species richness with more trees, woody shrubs, succulents, and perennial and ephemeral herbs and grasses, in samples dated to 990 and 980 b.p., indicate a wet interval in the Puerto Blanco Mountains of southwestern Arizona (Van Devender 1987).

Mammal Remains

The presence of extinct Ice Age mammals in the Southwest, overlapping with the earliest human presence, was documented by the early nineteenth century (see discussion of the discovery of Paleoindian and Archaic prehistory above), and was understood to represent very different environmental conditions than today. The variety and distributions of "Rancholabrean" mammalian fauna in the Southwest indicate cooler temperatures and higher effective moisture during the late Wisconsin, with expanded lower limits of biotic ranges (Harris 1985; Nelson 1990). In the lowest strata of Ventana Cave in southwestern Arizona, the presence of bones of jaguar and tapir (in addition to "plains" fauna such as bison, dire wolf, four-horn antelope, horse, and sloth) indicate cooler temperatures and greater moisture than today, such as in an open grassland crossed by permanent streams (Colbert 1950). At the Lehner site in southeastern Arizona, the presence of tapir along with mammoth, bison, horse, and dire wolf and camel at nearby localities, indicates a grassland environment with some mesic niches (Lance 1959). Since the late nineteenth century, about a dozen localities with proboscidean remains (mostly *Mammuthus columbi*) have been found along the lower Colorado and Gila rivers, indicating the existence of grasslands in the Lower Colorado River Valley during the Wisconsin (Larry Agenbroad, personal communication 1997).

The diets of extinct Wisconsin megafauna living on the Colorado Plateau indicate the same west-to-east gradient of increasing effective moisture as do the packrat middens. Plant macrofossils and pollen preserved in the coprolites (dung) of Shasta ground sloths preserved in Rampart Cave in the western Grand Canyon indicate that they browsed on desert vegetation such as creosotebush, globemallow, Mormon tea, *saltbushes*, cat-claw acacia, cacti, and yucca (Martin et al. 1961; Hansen 1978). In the eastern Grand Canyon, populations of Harrington's mountain goat browsed mostly on desert herbs and shrubs at lower elevations (Robbins et al. 1984), and on grasses and conifers at higher elevations (Mead et al. 1986a). In the vicinity of Natural Bridges National Monument in southeastern Utah, this extinct form of mountain goat consumed conifers, grasses, and sedge (Mead et al. 1987). Mammoth dung in Bechan Cave in Glen Canyon National Monument contains mostly grasses (Davis et al. 1984; Mead et al. 1986b), and at Cowboy Cave, also in southeastern Utah, dung thought to come from bison, mammoths, and horses contains mostly grasses and sedges (Hansen 1980).

Shifting ranges of fauna in the Southwest during deglacial time suggest increasing summer precipitation (Harris 1985). Antelope and camel—both characteristic of open grassland—first appeared in the 30,000-year-long sequence at Vulture Cave in the western Grand Canyon between 15,000 and 13,000 b.p., and then disappeared (Mead and Philips 1981). The extinction or local disappearance of a number of North American mammalian fauna, including two-thirds of the genera of "megafauna" (adults weighing more than 40 kg, or 88 lb), during the terminal Wisconsin and early Holocene (largely complete by 8000 b.p.) has been attributed to climatic changes by some (Slaughter 1967; Guilday 1967). However, overkill by Paleoindian hunters (Martin 1967; McDonald 1984; Agenbroad 1988), or a combination of climatic stress and human predation (Haynes 1966, 1984), are popular alternative explanations (see discussion in section on geoarchaeological approaches below).

Although mammoths are the most frequently cited examples of megafauna, possibly driven to extinction by early humans in the Southwest, the extinction of the Shasta ground sloth has also been attributed to overhunting by Paleoindians (Martin et al. 1961; Hansen 1978). California condors, whose remains have been found in caves in the Grand Canyon (Emslie 1987), also did not survive in the Southwest after the extinctions of the large land mammals on whose carcasses they fed. Weighted averages of relevant radiocarbon dates indicate that mammoth, Shasta ground sloth, and mountain goat all became extinct on the Colorado Plateau between 11,335 and 10,968 b.p. (Larry Agenbroad, personal communication 1997).

Following the wave of megafauna extinctions during the terminal Wisconsin, the morphologies of bison changed in response to Holocene environmental changes. Wisconsin to middle Holocene bison remains in North America are identified as *B. antiquus*, *B. occidentalis*, and *B. figgensi* (considered related subspecies by many analysts) while late Holocene bison are identified as the smaller, modern *B. bison* (McDonald 1981). In the Southwest, *B. antiquus* has been found on the Colorado Plateau and in the Southern Basin and Range Province (cf. Johnson 1981; Nelson 1990). Harris (1985) suggests that the bison remains found in the lowest strata of Ventana Cave and at the Clovis-age Lehner site, which were identified only to genus level, were also probably *B. antiquus*.

While modern bison have never been found mixed with any extinct species, and no transitional species are identified, the repeated extinctions of species or subspecies during the early and middle Holocene probably represent phyletic replacement of increasingly competitive forms (Butzer 1971). Trends in metapodial size and horn-core length indicate that the bulk and stature of bison decreased through this sequence of forms (Bedford 1974), accelerating after 6500 b.p. (Wilson 1978), and being essentially complete by 5000-4000 b.p. (McDonald 1981). Under the stress of reduced water sources and vegetation changes during the middle Holocene, the selective advantage of accelerated maturation and increased reproductive rate has been hypothesized as the reason for the size reduction (McDonald 1981).

Intervals of presence and absence of bison in the neighboring Southern Plains are also relevant to reconstructions of Southwestern environmental history. Through comparisons of 160 archaeological and paleontological sites, Dillehay (1974) demonstrated that, after being present between about 11,000 and 7000 b.p., bison were essentially absent in the Southern Plains between about 7000 and 4500 b.p. The only exceptions were the Blackwater Draw and San Jon sites in eastern New Mexico, on the boundary of the Southern Plains and the Southwest. He attributed this to changes in bison population densities and/or range shifts in response to middle Holocene aridity. After returning to the region, bison were again absent between about A.D. 500 and 1200-1300, perhaps also due to environmental stresses. A careful reanalysis and update of the data by Flynn (1982) supported these general conclusions, and she suggested that the two middle Holocene sites in eastern New Mexico containing bison remains indicate the possibility that the higher elevations of the Llano Estacado were a refuge for bison during that drier interval.

In the Southwest, the ages of known bison remains fit the identified trends in the Southern Plains, except for the second, late Holocene period of absence in the latter region. Agenbroad and Haynes (1975) inventoried reported find localities of extinct bison (most identified as *B. antiquus*) in Arizona, and Johnson (1981) compiled reports of subfossil remains of modern bison (*B. Bison*) in the state. The extinct bison localities are all older than 8000 years b.p., while the modern bison localities, most of them archaeological sites, range in age from about A.D. 650 to 1450. Since those reviews were made, modern bison remains have been found at two Archaic sites in southern Arizona dating between about 4300 and 3000 b.p. (James 1993; Huckell 1996c), and east-central Arizona at the Casa Malpais site, occupied between A.D. 1250 and 1450 (Moreno 1995).

Flynn's (1982) hypothesis, that the higher elevations of the Southwest were refuges for bison during the periods of absence on the Southern Plains is supported by the bison remains in Arizona dating between A.D. 600 and 1200 which, except for bison bones found in Sweetwater and Sacaton phase contexts at the low-elevation site of Snaketown, were all found at high elevation sites in the Mountain Transition Zone (cf. Johnson 1981). The fact that bison did not expand onto the winter-wet Columbia Plateau suggests that reappearances of bison in the Southern Plains and Southwest may have been related to increases in summer rainfall that caused grasslands to expand. However, it is not always clear whether a bison population moved into an area because it improved or because it was pushed into an area by populations forced out of another area (John Speth, personal communication 1997).

Insect Fossils

Insect fossils are the newest source of information about Late Quaternary environments and climatic trends in the Southwest. Based on fossil insect data from a number of localities in the western United States, Elias (1997) reconstructs regional summer temperatures 10 degrees (Celsius) cooler than today at 14,000 b.p. Summer temperatures in the West rose about 5 degrees between then and 11,000 b.p., and then rose another 5 degrees between 11,000 and 10,000 b.p.

Comparison of insect remains and plant macrofossils in the same packrat middens in the Chihuahuan Desert indicates that vegetational changes lagged behind the climate changes during the Wisconsin/Holocene transition, as reflected in the more sensitive insect record, by 500-1,000 years (Elias and Van Devender 1992). Fossil insect data from the San Juan Mountains in southwestern Colorado indicate that summer temperatures reached modern levels before 10,000 b.p., and became warmer than modern temperatures by about 9600 b.p. (Elias 1997).

Insect remains in packrat middens from the Puerto Blanco Mountains in southwestern Arizona show significant increases in arthropod abundance and species richness between 10,540 and 9070 b.p., and again about 4000 b.p. (Hall et al. 1990). Increases are attributed primarily to decreased winter freezes, and secondarily with the increased summer rainfall. The late Holocene increase in species richness is also matched in the insect record from northwestern Sonora (Hall et al. 1988).

LATE QUATERNARY ENVIRONMENTAL PERIODS

These natural archives of the environmental history of southwestern North America clearly show that current environmental patterns cannot be used as direct analogs for past landscapes, climatic patterns, and plant and animal distributions. They also demonstrate that climatic models for the Southwest, based solely on simulations of the effects of orbital parameters on insolation and atmospheric circulation patterns (Kutzbach 1987; Kutzbach et al. 1993), and those based on uncritical compilations of proxy paleoclimatic data (Thompson et al. 1993) are not completely accurate retrodictions. For example, the scenario of higher effective moisture than today during the middle Holocene is not supported by the proxy records reviewed here, although the Colorado Plateau was apparently less dry than the rest of the Southwest.

While some archaeologists (Irwin-Williams and Haynes 1970; Huckell 1996c) have previously reviewed Southwestern prehistory in the context of a tripartite subdivision of Holocene climates (all ultimately based on the temperature-temporal units of Antevs' "Neothermal," even if the names of those units are not used), others (Schroedl 1976; Berry and Berry 1986; Geib 1996) have compared Southwestern archaeological sequences with the Blytt-Sernander sequence of climatic states. Originally based upon peat stratigraphy in northern Europe, this sequence includes six postglacial periods bounded by abrupt transitions.

Currently, however, the chronologies of both archaeological and paleoenvironmental records in the Southwest have not reached the necessary levels of precision for comparison to the Blytt-Sernander sequence. The sequence itself is falling into disuse in Europe because the peat stratigraphy is now understood to be more complex, and radiocarbon dating has shown that the vegetational changes evident in pollen zones later fitted to this scheme were time-transgressive (Roberts 1989). At a more fundamental level, the applicability of a northern European sequence to southwestern North America is questionable.

Based on *comparisons* of the chronologies of the independent proxy records of environmental changes reviewed here, it is suggested that the known span of human occupation in the Southwest can be usefully divided into the following major "environmental periods," including a tripartite subdivision of the Holocene epoch:

1) latest Wisconsin, ca. 14,500-10,500 b.p.

2) early Holocene, ca. 10,500-7500 b.p.

3) middle Holocene, ca. 7500-4500 b.p.

4) late Holocene, ca. 4500-0 b.p.

The estimated beginning and ending dates of each of these periods are bracketed within a millennium (± 500 years), reflecting both the time-transgressive nature of the boundaries and the limited level of precision in the correlations between the various types of evidence (at least partly due to time-lag relationships). These beginning and ending dates for the three periods of the Holocene are 500 years earlier than those proposed by Wills (1988:76) on the basis of his review of Southwestern paleoenvironmental evidence available a decade ago. It is perhaps significant that these Southwestern environmental-temporal units and the date ranges estimated here correlate well with those derived independently for the Great Basin (Grayson 1993).

All well-dated Paleoindian complexes in the Southwest fall within the terminal part of the latest Wisconsin and the early Holocene periods as defined here, while possible pre-projectile point ("Early Paleoindian"?) complexes would all presumably date within the Wisconsin stage (ca. 120,000 years ago to 10,500 b.p.) of the Pleistocene epoch. The earliest known Archaic complexes in the Southwest date to the early Holocene period, and the transition to Early Agricultural adaptations in this region occurred in the early part of the late Holocene period. The independent proxy records also do not correlate entirely in terms of the environmental conditions they indicate, but the following general reconstruction accounts for the majority of the currently available data.

The Latest Wisconsin

In the Southwest, the deglacial period in North America was characterized by lower temperatures and greater winter rainfall than today, permanently flowing rivers and springs, shrinking lakes, braiding river channels, and accumulating sand sheets and parabolic dunes. The mountains were covered with forests, and the Colorado Plateau supported both closed forests and open woodlands. The lower elevations of the Southern Basin and Range Province were largely covered with juniper-oak woodlands, with pinyon pine limited to southern New Mexico. Mojave desertscrub characterized the Lower Colorado River Valley. A wide variety of boreal, grassland, and subtropical mammalian fauna flourished in large numbers, including large herbivores and carnivores ("megafauna"). Temperatures began to increase as early as 15,000 b.p., and this trend accelerated during the "terminal Wisconsin," dated here between about 11,500 and 10,500 b.p. However, the terminal Wisconsin was characterized by dramatically fluctuating environmental conditions, beginning with a significant drought.

The Early Holocene

The early Holocene was generally cool, but temperatures rose and summertime monsoonal rainfall increased to a Holocene maximum. Rivers, streams, and springs had higher discharges, and lakes expanded. Dune migrations ceased, and soils formed on stabilized dunes. In the mountains, upper timberlines climbed and pinyon and oaks replaced montane conifers as the dominant trees. On the Colorado Plateau, areas formerly characterized by sagebrush desertscrub shifted to juniper woodland. Juniper-oak woodlands persisted in the lowlands of the Southern Basin and Range Province, where grasses also became abundant. Mojave desertscrub shifted to Sonoran desertscrub in the Lower Colorado River Valley. Many of the Rancholobrean megafauna became extinct, and modern faunal communities began to be established.

The Middle Holocene

Average seasonal temperatures reached their highest post-Wisconsin levels during the middle Holocene "Altithermal" interval. Despite limited and equivocal evidence of increased monsoonal rainfall during summers, it is clear that effective moisture was very low (except on the relatively high Colorado Plateau) because of high evaporation rates. Temperatures and evaporation rates peaked near 6000 b.p. (ca. 4900 B.C.). Many rivers, streams, and springs had decreased discharges, flowing only seasonally or after large storms. Lakes and playas dried out, except for some montane lakes fed by basal artesian springs, which shrank and became more saline. Downcutting and widening of alluvial channels was widespread, and soils formed on stable floodplain surfaces. Dunes formed in some areas, in other areas they remained stable and soils continued to develop on them, and in many areas they were deflated by wind erosion. In the mountains, upper and lower timberlines climbed, and conifers retreated to the highest elevations. In the lowlands, grasslands shrank and xeric desertscrub dominated by creosotebush expanded after pygmy conifer woodlands disappeared. Bison, elk, mountain sheep, and pronghorn antelope, the remnants of the Rancholobrean megafauna, shifted their ranges to higher elevations or to areas outside the Southwest.

The Late Holocene

Temperatures declined and rainfall increased at the beginning of the late Holocene, leading to higher effective moisture between about 4500 and 2500 b.p. (ca. 3300-600 B.C.). Lakes rose or refilled, and rivers, streams, and springs began flowing again or had increased discharges. Floodplains resumed their aggrading. In some areas dunes became stabilized, and in other areas sand sheets and parabolic dunes began forming again on moist ground surfaces. Forests and grasslands expanded, riparian and aquatic plants became abundant along watercourses and lake margins, and subtropical desertscrub communities reached their modern limits. Pinyon pine became more abundant on the Colorado Plateau, and reached its northern limit in the Great Basin. Bison (in the form of modern *B. bison*) returned to the Southwest, and modern faunal communities reached their current distributions. Effective moisture was briefly lower again near 2500 b.p. (ca. 600 B.C.). A second moist interval between about 2500 and 1000 b.p. was punctuated by a dry episode near 1500 b.p. (ca. A.D. 600). Since about 1000 b.p. (ca. A.D. 1050), effective moisture has been relatively low.

CULTURAL RESPONSES

Increasing knowledge of these significant and complex environmental changes can inform our interpretations of Southwest prehistory, especially population dynamics and adaptive shifts, but only a few archaeologists have attempted such a synthesis (e.g., Baumhoff and Heizer 1965; Irwin-Williams and Haynes 1970; Schroedl 1976; Aikens 1983; Berry and Berry 1986; Cleland and Spaulding 1992; Cordell 1997:114-118). At the very least, it must be recognized that variations in effective moisture in arid and semiarid ecosystems can have a major impact on the availability, productivity, and diversity of food resources, and therefore can affect human populations more strongly than in ecosystems that are less marginal. Without being grossly deterministic, models of shifts in prehistoric human demography, subsistence, mobility, and settlement in the North American deserts can take these significant environmental changes into account based on an "environmental realism" (Cleland and Spaulding 1992:4).

A minimal list of important environmental events for Paleoindian and Archaic populations in southwestern North America must include 1) simultaneous drought, extinctions of megafauna, and rapid changes in plant communities during the Wisconsin/Holocene transition; 2) the expansion of lakes, increased discharges of springs and streams, and proliferation of grasses with edible seeds during the early Holocene; 3) the reduced number of reliable water sources, decreased biotic diversity and productivity, and relocation of bison and other large mammals during the middle Holocene; and 4) the increased water sources, expansion of pinyon pine, reproliferation of grasses, return of bison and other large mammals, creation of marshes by active dunes damming springs, aggradation of floodplains and alluvial fans, and arrival of domesticated plants during the late Holocene.

Here it is assumed that Paleoindian and Archaic prehistory in Arizona and the rest of the Southwest can only be understood in the contexts of these and other significant Late Quaternary environmental changes that have been identified in geological and biological proxy records. Discussions of various subsistence adaptations and cultural complexes in the following chapters are therefore grouped according to the major environmental periods that have been identified (Figure 1.3; Table 1.1).

CHAPTER 3

PALEOINDIAN COMPLEXES OF THE TERMINAL WISCONSIN AND EARLY HOLOCENE

Michael K. Faught and Andrea K. L. Freeman

Following migrating mammoths and other now-extinct large mammals that they hunted, human groups from northeastern Asia spread into North America at the very end of the last Ice Age. They first crossed a land mass exposed by lower sea levels (Beringia) between 13,000 and 12,000 years ago, and then traversed an ice-free corridor that brought them southward into the Plains and Great Basin by about 11,600 years ago. Clovis points and other kinds of fluted, flaked stone projectile points are the most recognizable and well-dated diagnostic artifacts of these earliest Paleoindians, and first Americans.

Investigations at Clovis archaeological sites in Arizona have played a principal role in the development of this scenario—the dominant explanation of the peopling of the New World. Of the handful of sites actually containing mammoths and artifacts in secure stratigraphic association in North America, no less than four (Lehner, Naco, Escapule, and Murray Springs) are located in the upper San Pedro Valley in southeastern Arizona. Two of these (Lehner and Murray Springs) are among the most well-dated Clovis sites on the continent. The data and publications from the multidisciplinary archaeological investigations at these sites are important foundations of modern American archaeology.

Several concepts are tethered to this Beringian Ice-Free Corridor (BIFC) model. For instance, these people are assumed to have been skilled Upper Paleolithic hunters, drawn into the continent by the presence of late Pleistocene megafauna, and particularly successful because they brought fluted point technology with them, and because their megafauna quarries lacked previous experience with human predators. It is also believed that, moving outward from the middle of the continent, these earliest Paleoindians quickly colonized the rest of North America south of the Laurentide Ice Sheet, and then continued southward to the tip of South America—all within a few hundreds of years. In this reconstruction, Clovis artifacts represent the material culture of the parent stock of humanity from which developed most subsequent Amerindian cultural, linguistic, and biological diversity.

But there are problems with several parts of this model. First, and possibly foremost, is the recent acceptance of Monte Verde, Chile as the earliest well-dated human site in the Americas (Dillehay 1989, 1997; Meltzer et al. 1997). Occupied by about 12,500 b.p. according to the radiocarbon dates, Monte Verde challenges the BIFC model from several directions: it doesn't appear to be a Clovis-related site; it precedes most other early Paleoindian sites by a millennium or more; and it is located at the exact opposite end of the Americas from where such an early site would be expected. Ultimately, the existence of Monte Verde implies the existence of pre-Clovis/pre-projectile point complexes in the New World.

Second, increasing evidence from sites along the Pacific Coast indicates the possibility of a coastal pathway of dispersal into the New World, and the development of a distinct "Paleocoastal tradition" or complex focused on marine and littoral resources (Moratto 1984; Erlandson and Moss 1994; Moss and Erlandson 1995). Fluted points, though not common, are known from coastal settings in Washington and California (Erlandson and Moss 1994; Moss and Erlandson 1995). At Daisy Cave, on one of the northern Channel Islands off the southern California coast, bifacial projectile points, bone fishing points, shell beads, twined basketry, cordage, hearths, and a stratified shell midden have been found with associated radiocarbon dates averaging about 10,300 b.p. from the lowest stratum (Erlandson et al. 1996). Radiocarbon dates as early as 9870 b.p. have also been obtained from cultural charcoal and shell at the Eel Point site on one of the southern Channel Islands (Raab et al. 1994).

Third, there is increasing evidence that there was more than one kind of early Paleoindian subsistence adaptation, represented by different flaked stone complexes, and that the Clovis occupation of eastern North America was more intensive than in the Plains or in the West. These discoveries allow for possibilities of alternative pathways of dispersal, processes of migration, and differentiations of early cultures (Anderson et al. 1997; Faught 1996; Roosevelt et al. 1996).

Clearly, these new data and their implications require the review and revision of the BIFC model of the peopling of the New World, and reassessment of the significance of the Clovis sites in Arizona for Southwestern and North American prehistory. To place Arizona's Paleoindian sites in a necessarily larger perspective, this chapter begins with a review of late Pleistocene (also called Wisconsin and Pluvial) sites in western North America, including those proposed as predating Clovis. The sites are described in terms of previously defined complexes, and within their paleoenvironmental contexts. First, possible pre-projectile point (pre-Clovis) sites and complexes are discussed; the Fluted Point and Lanceolate Point complexes are then described. After those reviews, some models of the possible relationships among the Paleoindian complexes, and between the late Paleoindian complexes and the Western Stemmed Point complexes are summarized. (The latter are reviewed in greater detail in Chapter 4.) The chapter concludes with a discussion of models of Paleoindian adaptations and the peopling of the Southwest.

POSSIBLE PRE-PROJECTILE POINT COMPLEXES

A number of claims have been made for pre-projectile point (pre-Clovis) complexes in western North America, including Arizona. The distribution of a sample of sites representing these complexes is shown in Figure 3.1. The clustering of such sites in the southwestern Great Basin and southern California is considered by some as strong evidence of pre-Clovis occupations in those regions, and the California sites have fueled speculation about a coastal migration route for the colonization of North America, a possibility discussed later in this chapter. However, most of these sites and complexes have been shown to be equivocal for a variety of reasons related to the principles of accepting early sites: 1) a good understanding of stratigraphic contexts; 2) the presence of artifacts that were obviously manufactured by humans; and 3) good control of chronology with radiometric dating (Dincauze 1984; Waters 1985).

Some of these sites are assemblages of crude flaked stone *tools for* chopping and scraping found on ancient alluvial terraces. The lack of bifacially flaked tools in these assemblages has been used to argue for the existence of a simpler lithic technology preceding the production of bifacially flaked projectile points and other bifacial stone tools (Krieger 1964; see also Kulisheck 1995). The lack of bifacial tools and other resemblances to the Paleolithic flaked stone complexes of the Old World are often the only evidence cited for estimating the ages of these assemblages. Such was the case for the surface assemblages at Black's Fork, Wyoming, which E. B. Renaud (1938, 1940) considered to represent Early and Middle Paleolithic technologies, and for the Pebble Tool complex of northwestern North America (represented at the Cascadia Cave and Fivemile Rapids sites), which has been compared to Early Paleolithic complexes (Carlson 1983).

Kirk Bryan (1938, 1939) found such artifacts in a chert quarry on Cerro Pedernal and along the Rio del los Encinos in New Mexico, for which he coined the name "Los Encinos complex." Bryan described three alluvial fills in the region. The oldest fill contained a fragmentary tusk of a pachyderm, the intermediate fill contained the Los Encinos complex artifacts, and the youngest fill contained flaked stone artifacts and hearths which Bryan attributed to the Pueblo period.

Subsequent excavations in Wyoming and Montana recovered implements similar to those in the Black's Fork assemblages from sites attributed to much more recent archaeological complexes (Mulloy 1953), and investigations of similar three-phase sequences of alluvium elsewhere in the Southwest (Hack 1941; Hunt 1953) led Wormington (1957) to the conclusion that the Los Encinos complex artifacts in Bryan's intermediate alluvium were of much younger age then he estimated.

California has a particularly long history of claims for early sites. These sites can be classified into several types: artifact assemblages that are Paleolithic-like in technology and form; human skeletal remains with early measured radiometric and biochemical ages; and human skeletal remains or artifacts in association with the bones of extinct fauna. During the late 1940s, an amateur archaeologist discovered crude flaked stone artifacts on desert pavements and in lacustrine sediments surrounding the Lake Manix playa in the Mojave Desert (Moratto 1984). A systematic survey was conducted by Ruth Simpson in 1954 in the Manix Basin and adjacent foothills east of the Calico Mountains (Leakey et al. 1969). Simpson found choppers, scrapers, bifaces, and cores above the highest shoreline of the Pleistocene-age lake bed. She attributed these artifacts to a Lower (Early) Paleolithic technology, naming them the Manix Lake Lithic complex, and estimating the age of the complex to be 20,000 years (Simpson 1958, 1960, 1964).

Although radiocarbon dating of desert varnish coatings has been cited as evidence of a human presence at Manix Lake from 26,000 to 12,000 years b.p. (Bamforth and Dorn 1988; Bamforth et al. 1986; Whitley and Dorn 1993), thus supporting Simpson's age estimate, the dating techniques have been considered suspect by other researchers (Bierman and

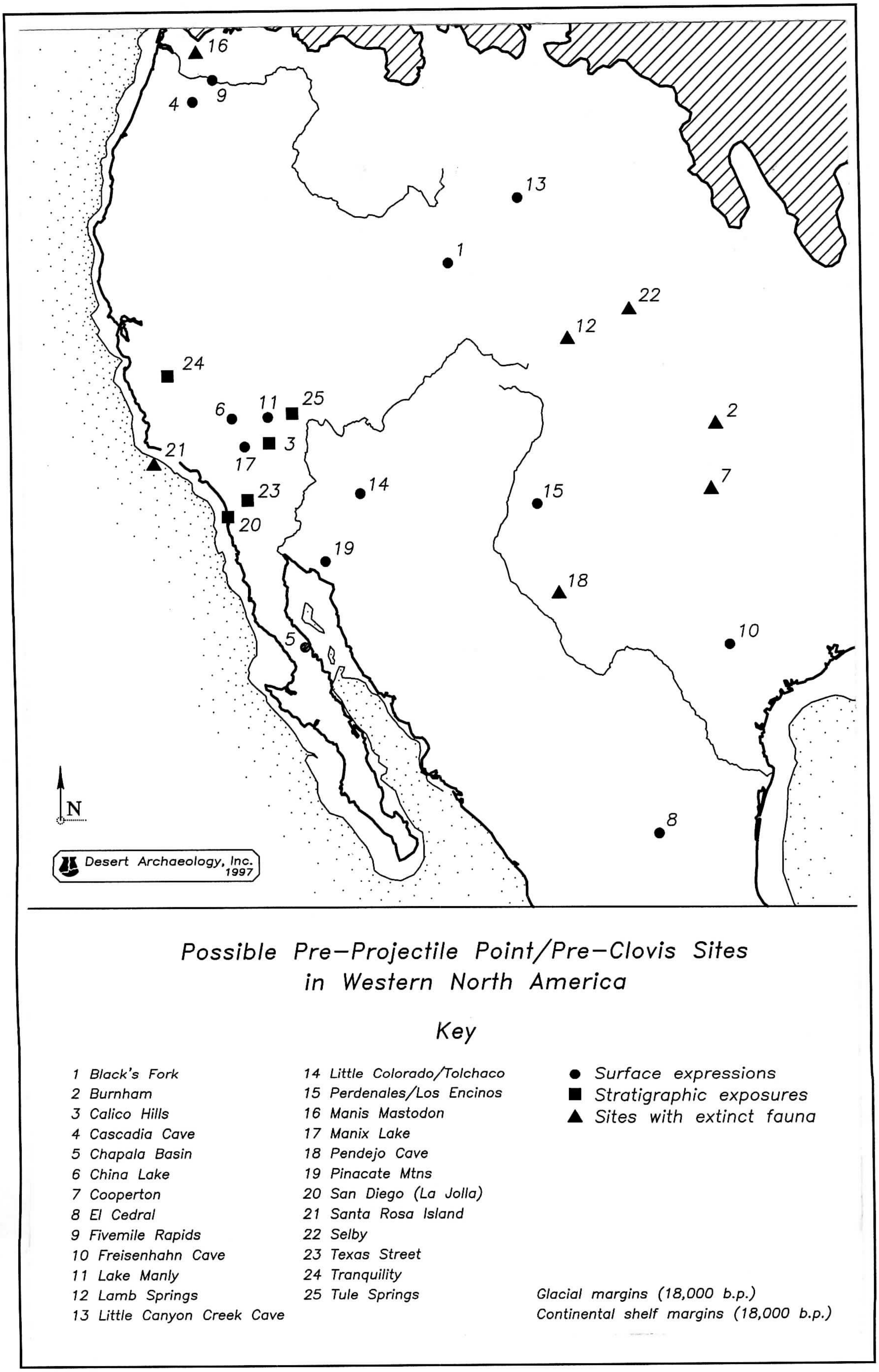

Figure 3.1. Distribution of possible Pre-Projectile Point sites in western North America (> 11,600 b.p.?).

Gillespie 1992, 1994; Bierman and Harry 1992; Harry 1995, 1997; but see Bamforth 1997; Dorn et al. 1986; Dorn 1992a, 1995).

The possibility of early hominid occupation of California before the last interglacial, that is before 125,000 years ago, was offered at Calico Hills in the 1970s (Clements 1979; K. Dixon 1970; Leakey et al. 1968, 1969, 1972; Schuiling 1972, 1979; Simpson 1977, 1980; Simpson et al. 1981). Extensive excavations were conducted over several years at this locality. However, the artifactual nature of items found in the securely dated gravel beds of the Yermo Fan remain equivocal (Duvall and Venner 1979; Haynes 1969, 1973a, 1980b; Payen 1982; Taylor and Payen 1979). Also, the age of the Yermo Fan, in excess of 200,000 years according to Uranium-Thorium radiometric dating (Bischoff et al. 1981), means that any site contained in it was occupied by *Homo erectus* stage hominids (Haynes 1973a), but no hominid fossils predating *Homo sapiens sapiens* (fully modern humans) have ever been discovered in the Americas (Moratto 1984). Currently, the stratigraphic context and dating of Calico Hills are well understood, but the "artifacts" may in fact be "geofacts" produced by natural alluvial processes (Haynes 1969, 1973a, 1980b; Duvall and Venner 1979; Taylor and Payen 1979; Payen 1982).

Claims for artifacts of pre-projectile point age have been made for several other sites in California, including Yuha Pinto Wash, Potter Creek Cave, China Lake, Texas Street, and the Tranquility site. The longest-standing of these claims involves the research of George F. Carter at various localities in San Diego and La Jolla, begining in 1949. Based on his findings, Carter (1957, 1980) has claimed that Lower Paleolithic industries existed in North America at least 100,000 years ago. However, whether the so-called artifacts in these ancient deposits are the products of human activities remains uncertain.

Several skeletal remains have also been found in California that were interpreted to be of Pleistocene age or older, based on either stratigraphic context or on skeletal morphology. The first such find, a human skull encountered in Pliocene deposits in a mine shaft in Calaveras County in 1866, was a hoax (Dexter 1986). Other discoveries at La Jolla Shores, Del Mar, Sunnyvale, Laguna Beach, Angeles Mesa, Rancho La Brea, the Yuha Desert, Santa Rosa and San Miguel Islands, and the Los Angeles River have sparked decades of controversy (Moratto 1984).

The ages of many of these California skeletons were estimated on the basis of so-called "primitive" cranial characteristics, which are now known to be unreliable indicators of age (Steele and Powell 1992). Some of these remains were dated by an aspartic protein amino acid racemization technique, which assessed ages in excess of 50,000 years for some of the skeletons (Bada et al. 1974; Bada and Helfman 1975 from Chartkoff and Chartkoff 1984). However, problems with both the calibration and reliability of the technique, particularly under different temperature regimes, have been subsequently recognized. More recent age determinations on some of the samples, using radiocarbon and other radiometric techniques, have yielded much younger ages (Bischoff and Rosenbauer 1981; La Joie et al. 1980; Protsch 1978; Taylor et al. 1985). Some of these new age estimates still exceed 11,000 b.p., but bone is typically a very poor material for reliable radiometric dating. Dubious contexts, sampling problems, contamination, and poor understanding of new dating techniques have all been used as critiques for early ages on human bone in California.

In the Southwest, one of the first claims for pre-Clovis occupation was in 1940, when Frank C. Hibben reported that he had found knife-like fluted points—similar to Western European Solutrean "Font Robert" points—and the bones of extinct fauna in a sealed stratum underlying a Folsom layer in Sandia Cave in central New Mexico (Hibben 1941). Folsom was the earliest known New World complex at the time, so the points from the underlying stratum were identified as the earliest evidence of humans in the western hemisphere then known. Early radiocarbon analyses returned dates older than 20,000 years (Hibben 1955).

Haynes and Agogino (1986) reexamined the stratigraphy during a series of field trips to the cave in the 1960s. With radiocarbon and uranium-series dating, they determined that the layer sealing the Sandia stratum was more than 250,000 years old, and that the Sandia artifacts must have been redeposited from overlying sediments no older than 14,000 b.p., and possibly as young as 10,000 b.p (see also Haynes 1970). These mistakes in the original interpretations of the stratigraphy, along with numerous inconsistencies in records of the excavation and the sources of the materials originally radiocarbon dated, continue to cause skepticism about the authenticity of the site (Preston 1995).

Other sites and complexes in the Southwest were attributed to pre-Clovis peoples only after their original identifications. At Tule Springs near Las Vegas, Nevada, apparently burned bones of extinct Pleistocene animals and an obsidian flake were discovered by paleontologist Fenley Hunter in 1933, in the presence of several prominent scientists (Simpson 1933; Wormington 1957). The site was revisited in 1933 and 1952 by Mark Harrington (1934, 1954), who found additional evidence for an association of human artifacts and bones of extinct fauna. But it was not until a radiocarbon age of 23,800 b.p. (Libby 1955) was obtained from what was purportedly charcoal from a hearth that this became a possible pre-Folsom site like Sandia Cave. This early date—which was one of the earliest radiocarbon dates—spurred excavations in 1955 and 1956 by Harrington (1955) and Simpson (1955) who found additional artifacts and hearth features that continued to produce early radiocarbon ages.

Haynes (1967) subsequently determined that the "charcoal" samples which had been dated were completely soluble in base solution, and therefore not charcoal. Reexaminations of the stratigraphic contexts of the samples also led to the conclusion that the "hearths" were merely lenticular sediments at the base of a spring-fed pond, that the "fire-reddening" underlying them was merely the product of mineralogical staining (Haynes 1992).

In his surveys of the lower Colorado River and surrounding desert area (including southwestern Arizona) beginning in 1926, Rogers (1939) postulated the existence of an early industry that he named Malpais. Sites he assigned to this complex consisted of surface assemblages of simple, chopper-like tools and flakes, circular clearings in the desert pavement which he thought were house sites, and large geometric forms made by piles of cobbles (intaglios). He later dropped the term and assigned the complex to his San Dieguito phase I (Rogers 1958).

Based on his surveys in the Sierra Pinacate region of northwest Sonora, Hayden (1967, 1976) revived the term Malpais to refer to an industry that preceded San Dieguito I. He suggested that Malpais materials occur throughout southwestern Arizona, either embedded in desert pavement or lying on top of very old pavement, and that their distribution extends from northern Mexico to southern Utah, and from the California desert to the Tucson Basin. This eastern boundary is uncertain, because lack of desert varnish in the Tucson Basin and eastward prevents identification of Malpais artifacts.

According to Hayden (1976), the lithic industry consists of chopping and scraping tools manufactured primarily from basalt with hard-hammer percussion. Tool types include large scrapers and other unifaces, denticulates, spokeshaves, choppers, cleavers, and some flake tools. There are no projectile points or bifacially flaked items. These assemblages also contain what Hayden calls "skreblo-like" forms, implying similarities with Middle Paleolithic artifacts in northeastern Asia. No Malpais artifacts appear to be related to the Clovis complex. Hayden also attributes worked-shell tools to this complex, as well as "sleeping circles" (circular clearings in the desert pavement), trails, trail shrines (cairns), and geometric intaglios.

Rogers and Hayden based their age estimates on the relative degrees of weathering and desert varnish formation on the stone tools, and the apparent ages of the desert pavements they are found on or in. Before radiocarbon dating had pushed the span of prehistory far back in time, Rogers (1939) estimated that this industry postdated Paleoindian complexes and began no earlier than 2000 B.C. In addition to the relative degree of varnish on stone tools, Hayden (1976, 1987) refers to some radiocarbon dates on shells to claim that the industry predated Clovis, and may be older than 30,000 b.p.

Tools that are heavily patinated are called Malpais I and II; Malpais I is estimated to be older than 24,000 years, and Malpais II is estimated to be between 24,000 to 18,000 years old (Hayden 1976, 1987). The Malpais II patination is linked to a date of 33,950 ± 1250 b.p. on a marine shell found on the surface of the desert pavement. Hayden (1987) considers the shell to be "cultural" because of its inland location, and refers to two other dates on shell older than 37,000 b.p. A fourth radiocarbon date of 10,800 ± 240 b.p. on a shell is dismissed as the remains of a "late lunch," which he would presumably ascribe to the San Dieguito I complex. Hayden (1976) reports San Dieguito I tools on desert pavement throughout northwestern Mexico and southwestern Arizona, and describes their varnish coating as light. He estimates the San Dieguito I artifacts to be between 17,000 and 9,000/7,000 years old. The termination age for San Dieguito I is based on radiocarbon dates from the Volcanic Debris layer at Ventana Cave, and his inference that San Dieguito I ends with the onset of the middle Holocene "Altithermal." Huckell (1978b) has also found San Dieguito I sites in the area north of Dateland, Arizona (see Chapter 4), but suggests they may be younger in age than Hayden's estimate.

Bartlett (1943) reported finding numerous sites in the Little Colorado River Valley containing bi-facially-flaked tools, "keel-shaped" scrapers, and flakes. The rough, percussion flaking of these lithic artifacts and the absence of projectile points was similar, she proposed, to Lower Paleolithic artifacts in Europe. She named this the Tolchaco complex, and identified the sites as quarrying sites, but would only go so far as to propose that the complex was pre-Basketmaker. Krieger (1962, 1964) later used her temporal affiliation of the stone tools as evidence for a possible pre-projectile point occupation of the Americas. However, there is no method of dating these assemblages aside from the occasional co-occurrence of temporally diagnostic artifacts. They are likely the product of initial reduction of cobbles found in gravel bars along the Little Colorado River during Archaic, Basketmaker, and Pueblo periods (Keller and Wilson 1976). The production of expedient tools and low density of ceramics need not be a reflection of age, but rather the nature of prehistoric activities at these sites.

MacNeish (1993a, 1993b) and colleagues have recently introduced evidence for a pre-projectile point occupation of Pendejo Cave, near Orogrande in southern New Mexico. From cave strata radiocarbon dated between 12,200 b.p. to more than 40,000 b.p., they have offered evidence for crude flaked stone tools, bone tools, and other artifacts, including impressions of human fingerprints on pieces of fired clay, and human hair ((Bonnichsen 1993; Chrisman 1993; Mavalwala 1993; Savage 1993). Radiocarbon dates on human hair of 12,370 ± 80 and 12,240 ± 70 b.p. from the upper levels of Pendejo Cave have also been reported (Chrisman et al. 1996). If confirmed as human hair, this could represent an occupation as old as Monte Verde in Chile. However, the full site report has not yet been published, and other archaeologists cannot currently assess the data.

Pre-projectile point ages have also been suggested for some rock art sites in Arizona. Dorn and others (Dorn 1992b; Whitley and Dorn 1993) have reported radiocarbon ages on the weathering rind and interface (between varnish and rock) of a petroglyph in Petrified Forest National Park of 18,180 ± 190 and 16,600 ± 120 b.p., respectively. They also report cation-ratio ages of 19,000 ± 1,500 years on the weathering rind, and 20,000 ± 1,800 years on the interface for the same sample. However, the nature of desert varnish and how it is formed are not completely understood, and other scientists think that radiocarbon dating of desert varnish is not reliable (Bierman and Gillespie 1991, 1992, 1994; Bierman and Harry 1992; Harry 1995, 1997).

Though tantalizing, most of the cases for pre-projectile point/pre-Clovis occupations of Arizona, California, and elsewhere in western North America have been rejected because of speculative or incorrect interpretations of stratigraphic contexts and "artifact" origins, circular types of logic and circumstantial kinds of evidence used to estimate age, or the use of poorly understood new dating techniques. Of purported pre-Clovis sites in the Southwest, Pendejo Cave could eventually be accepted, but only after the full site report has been published and other archaeologists have assessed the evidence. However, the antiquity of Monte Verde in South America implies similarly early occupations in North America, and several researchers are convinced that such has already been proven (e.g., Adovasio 1993; Whitley and Dorn 1993; Chrisman et al. 1996).

FLUTED POINT COMPLEXES

Currently, the earliest unequivocal evidence for human occupation in North America is sites with fluted flaked stone projectile points, often in association with the bones of extinct Pleistocene megafauna. It is another assumption of many adherents to the BIFC model that fluted point technology originated in northeastern Asia and was brought to North America with the earliest colonists, but this notion had no empirical support until the recent discovery of a fluted point beneath an early Holocene tephra layer at the Uptar site in northeastern Siberia; this is the first fluted point found outside of the Americas (King and Slobodin 1996). However, the Uptar point is smaller than most New World fluted points, and is fluted only on one side. These "non-Clovis" characteristics mean that the idea that fluting originated in North America south of the ice sheets, not crossing the Bering Strait in either direction (Clark 1991; Faught 1992; Haynes 1987), may not be disproven by the Uptar point. The specific location of this North American native origin is debated, however.

Dated to between about 11,600 and 10,200 in North America (Haynes et al. 1984; Taylor et al. 1996), fluted points are widely distributed across North America and southward to the very tip of South America, and are associated with a wide variety of paleoenvironmental contexts and diverse artifact assemblages. Though fluted points may represent a single cultural entity of big-game hunters entering a new continent and spreading rapidly throughout (Mosimann and Martin 1975; Kelly and Todd 1988), the variability in the rest of the assemblages raises the possibility that groups of varying degrees of relatedness were incorporating fluted point technology into varied subsistence strategies adapted to different environments.

A comprehensive classification of New World fluted points has not yet been made, but comparisons of type descriptions and sequences in different regions reveal some spatial and temporal variability. Temporal series of concave-based fluted points and related lanceolate varieties include the Debert/Vail/Bull Brook-Parkhill-like series in the Far Northeast; the Gainey-Parkhill/Barnes-Crowfield series of the Great Lakes region; the Redfield-Cumberland-Dalton series in the midcontinent; and the Clovis-Suwannee/Quad-Greenbriar series in the Southeast (Bonnichsen and Turnmire 1991). In western North America there is the Clovis-Folsom/Goshen/Midland series of the Plains; the Clovis-V-based-stubby fluted point series of the Far Northwest and California; the multiple-fluted points known from Alaska; and the Magellan/Fishtail fluted varieties of Central and South America.

On the Plains, well-dated stratigraphic sequences suggest that late Paleoindian lanceolate forms may represent continuity with fluted forms, but within increasingly restricted territories. In eastern North America, stylistic and technological continuity in projectile points also extended into the early Holocene. In the Far Northwest, California, and the Great Basin, continuity between fluted points and early Holocene Western Stemmed points is questionable (see below).

Even though finds of isolated fluted points are widely distributed across North America, the frequencies of these finds are not uniform, suggesting differences in population density. Published statewide inventories of fluted point finds, provenienced to the county level, now exist for most of the United States (AENA 1982; Anderson 1990, 1991; Faught et al. 1994). This sample, a starting point for reconstructing the patterns of distribution, includes a mixed bag of fluted points, including Clovis, Folsom, and multiple-fluted specimens that have been reported from Arizona, Idaho, Montana, New Mexico, Oklahoma, Texas, and Utah. The eastern samples attempt to include only Classic Clovis points, but Suwannee and Simpson types are included in the Florida inventory. Dalton points are not included.

These data reveal that most fluted points have been found east of the Mississippi River, while the western states are relatively sparsely scattered with fluted points. For example, Huckell (1982) reported 135 fluted points in Arizona; Dillon (1994) listed 407 in California; and Amick (1991) reported 780 Folsom points in New Mexico. Only 40 fluted points were recorded in Utah by Copeland and Fike (1988), and 149 were recorded in Nevada by Davis and Shutler (1969). (Contrast these numbers with 1,654 fluted points in Alabama, 1,056 in Ohio, and 408 in Massachusetts, all smaller states.)

Fluted points in California, the Great Basin, and the Far Northwest are usually found near the margins of extinct Pluvial (Wisconsin) lakes, sometimes in high densities (Davis and Shutler 1969; Meighan and Haynes 1968; Mehringer 1988; Willig 1991; Willig et al. 1988). However, very few of these have been recovered from excavated contexts (but see Holmer 1986; Basgall 1988; Meighan and Haynes 1968). Though not common, fluted points are also known in coastal settings in Washington and California (Erlandson and Moss 1994; Moss and Erlandson 1995), raising the question of whether people who made fluted points exploited marine resources, and whether they moved along the Pacific coast in boats. It is also possible that fluted point sites are located in currently submerged settings offshore, particularly in the San Francisco Bay region.

Given that the frequencies of fluted point discoveries may be the result of factors other than past human population densities, a better way of reconstructing the ranges of fluted point groups is through site-based settlement data. From a broad literature survey for early sites, Faught (1996) has compiled information on 677 Paleoindian sites in North and Central America dating to 10,000 b.p. or earlier, of which 397 (58 percent) occur in western North America.

Figure 3.2, generated from this data, shows that the Clovis, Folsom, and Dalton complexes overlapped in the Southern Plains. As will be discussed, this region is also the area of occurrence of four of the earliest Classic Clovis sites (Aubrey, Blackwater Draw, Lubbock Lake, Domebo). The distribution of Folsom sites is focused on the Plains east of the Continental Divide, and Dalton sites occur in the wooded portions of the Southeast and Central states (Johnson 1989).

Many of the "Other" fluted point sites shown in the Great Basin, California, and northwestern Sonora represent fluted points with V-shaped basal concavities, and which are generally smaller, narrower, and less regular in shape than Classic Clovis points. Also included in this category are stubby, multiple-fluted (or basally thinned) varieties occurring in the Great Basin, as at Danger Cave. These may represent unnamed fluted point complexes centered in the Great Basin. Also included in the "Other" category are stubby, excurvate-sided fluted varieties in the Northwest and Great Basin, from such sites as Fort Rock Cave (Carlson 1983), Dietz (Willig 1989), Danger Cave (Holmer 1986:94-95), and Borax Lake (Harrington 1948; Fredrickson and White 1988), which resemble points found at sites in the ice-free corridor such as Sibbald Creek in Alberta (Fladmark et al. 1988). They are also similar to some examples in Alaska (Haynes 1982; Goebel et al. 1991).

Not shown in Figure 3.2 are several reported, but generally unpublished, fluted point occurrences farther south in Mexico (Lorenzo 1953; Di Peso 1955, 1965; Aveleyra 1961; Anonymous 1964; Robles Ortiz and Manzo Taylor 1972; Robles Ortiz 1974; Phillips 1989; Hyland and de la Luz Gutierrez 1995). Irwin-Williams (1968a:40) noted that fluted points of "general Clovis style" found in Baja California, Sonora, Chihuahua, Durango, Coahuila, and Jalisco probably represent "marginal penetrations of a culture based on the grassy plains of the United States." Most of these occurrences are isolated points, with the main exception being the Timmy site in Sonora, which produced eight fluted, Clovis-like points and other flaked stone tools (Di Peso 1965b; Ortiz 1974; Ortiz and Taylor 1972). Most of these Sonoran and Baja sites are in the coastal lowlands, near the mouths of streams and rivers debauching into the Gulf of California, suggesting that these represent the exploitation of an estuarine ecotone and the possibility of additional sites offshore.

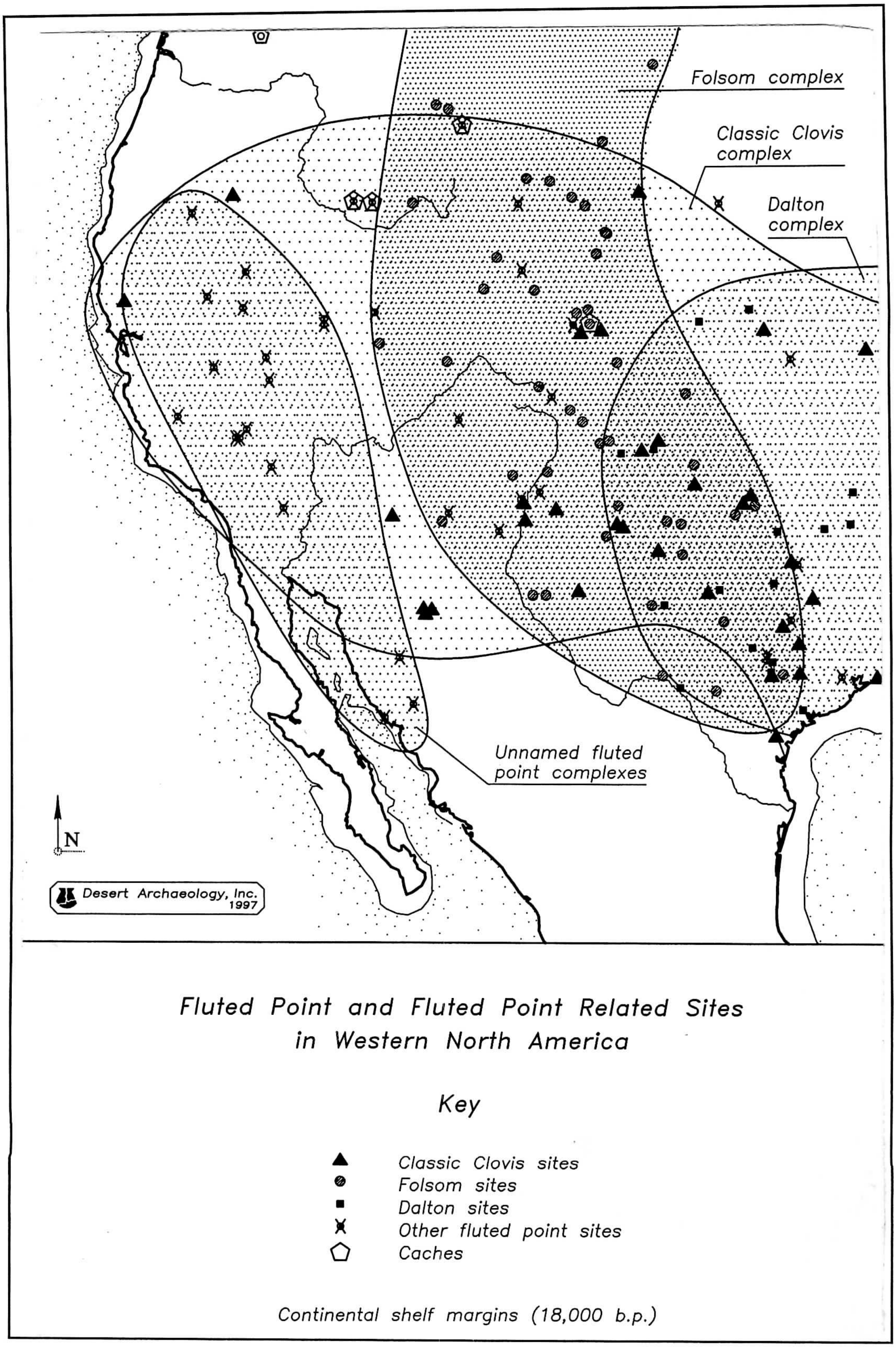

Figure 3.2. Distribution of terminal Wisconsin and early Holocene Fluted Point complexes, sites, and point localities in western North America (ca. 11,600-10,200 b.p.).

The Clovis Complex

Currently, the earliest well-dated fluted point sites (and the earliest well-dated sites of any kind) in North America are Clovis sites (Ferring 1995; Haynes 1967, 1982, 1987, 1992; Meltzer 1984, 1988; Mason 1962; Sellards 1952; Stanford 1991; West 1983; Wormington 1964). Originally defined by E. H. Sellards (1952) as the Llano culture, and referred to here as the Classic Clovis complex, it is often considered the stock from which stemmed most subsequent PreColumbian cultural variability (Turner 1986). The diagnostic trait is a distinctive type of concave-based, fluted, flaked stone projectile point whose distribution defines a widespread Paleoindian tradition or complex, with averaging of associated radiocarbon dates indicating a range between about 11,600 and 10,900 b.p. (Taylor et al. 1996). The distribution of known Clovis sites and the extent of the Classic Clovis complex in western North America, are shown in Figure 3.2.

Classic Clovis points (e.g., Figure 1.4:A) are made from biface preforms with light percussion flaking, and possibly pressure flaking of the item into final shape, and flutes taken off at the end of the shaping process. The bases are usually only slightly concave, and the sides are either straight, or "waisted" (e.g., recurved). The lengths of these points are variable, but the widths are less so. In general, there was great concern with regularity and detail, as they are some of the best-made flaked stone projectile points ever found in the Americas.

The type site for the Clovis complex is Blackwater Draw Locality No. 1 in Blackwater Draw, eastern New Mexico. Early investigations at the site in the mid-1930s were undertaken by E. B. Howard and John Cotter of the University of Pennsylvania Museum (Cotter 1937, 1938; Howard 1935). In a gravel pit, they discovered two stratigraphically separated components containing fluted projectile points and bones of extinct fauna. The lower component contained Clovis-type fluted projectile points manufactured predominantly by percussion flaking, and mammoth bones. The upper component contained Folsom-type fluted projectile points with fine marginal retouch, and the bones of an extinct form of bison.

Though Clovis points in association with mammoth remains had previously been discovered at the Dent site in Colorado (Wormington 1957), and at the Miami site in Texas (Sellards 1938), they were originally considered to be variants of Folsom points. The significance of these finds was not fully understood until excavations at Blackwater Draw demonstrated both a stratigraphic separation and a subsistence difference between the Clovis and Folsom complexes. Subsequently, investigations have been conducted at Blackwater Draw by numerous individual researchers and multidisciplinary teams (Agogino 1968; Agogino and Rovner 1969; Agogino et al. 1976; Boldurian et al. 1987; Dittert 1957; Evans 1951; Green 1962; Haynes 1995; Haynes and Agogino 1966; Hester 1972; Holliday 1985; Sellards 1952; Stanford et al. 1990; Warnica 1966; Wendorf and Hester 1975).

Sites with Classic Clovis fluted points and associated mammoth remains include Lehner, Naco, Escapule, and Murray Springs in Arizona, Blackwater Draw in New Mexico, Lubbock Lake in Texas, Dent in Colorado, Domebo in Oklahoma, Angus and Sheaman in Nebraska, Colby in Wyoming, and Lange-Ferguson in South Dakota (Leonhardy 1966; Stanford and Day 1992). Clovis-type flaked stone tools, but no projectile points, were discovered with the Union Pacific Mammoth in Wyoming. The association of Clovis points with megafauna remains at these and other sites in the western United States has caused archaeologists to conclude that big-game hunting was an important part of Clovis subsistence. However, it is now known that groups using Clovis points and other types of fluted points exploited a variety of resources, their focus depending on local environmental conditions (Meltzer 1988; Moratto 1984; Willig et al. 1988).

Hallmarks of the Classic Clovis complex, apart from the distinctive projectile points, include large prismatic blades and blade technology, reduction of raw materials to biface preforms, both bifacial and unifacial flake and blade tools (including end and side scrapers), and use of red ochre; the working of bone and ivory is represented by cylindrical ivory and bone points or foreshafts, a mammoth bone shaft straightener, an ivory billet, and a circumferentially chopped tusk (Haynes 1980a, 1987; Stanford 1991). The flaked stone tools were generally made from high quality cryptocrystalline raw materials from sources up to 300 km away.

Artifacts that appear to demonstrate artistic or communicative characteristics are known from some Clovis sites. An ivory foreshaft from the Aucilla River in northwestern Florida has an engraved zig-zag pattern (Haynes 1982:390). There are engraved pieces of limestone associated with Clovis points at the Gault site in Texas (Collins et al. 1991), and an engraved bone was found in the Ritchey-Roberts cache (Mehringer 1989). Sellards (1952) also reported markings on a bone from the Blackwater Draw site.

Blade caches have also been attributed to the Clovis complex (Green 1963; Young and Collins 1989), as have some caches containing fluted points (Ritchey-Roberts, Simon, Anzick, Drake and Fenn caches) (Butler 1963; Frison 1991; Gramly 1988; Mehringer 1990; Stanford 1991; Stanford and Jodry

1988; Titimus and Woods 1991) (Figure 3.2). In the latter, cached items include large, well-made fluted points made in Classic Clovis style and technology, bone tools, large biface preforms, and other flaked stone tools, and the items are often covered in red ochre. The caches are widely thought to represent mortuary offerings; the bones of a human juvenile covered with red ochre were found in association with the Anzick cache of Clovis points in Montana (Lahren and Bonnichsen 1974). Based on the radiocarbon dating of the human remains from Anzick at approximately 10,600 b.p. (Stafford et al. 1991) and the unusual and strikingly similar morphology and style of the points, it is possible that some of the caches are Folsom-related.

The best-known Paleoindian sites in Arizona are Clovis sites located in the upper San Pedro drainage in the southeastern part of the state (Figure 3.3). Here, four Clovis sites have been excavated, and several other possible Clovis sites have been located. In addition to the four excavated Clovis sites (Naco, Lehner, Murray Springs, Escapule), additional finds of mammoth along the San Pedro Valley have been investigated or monitored for years. These include the Donnet, Schaldack, Grey-Seff, Leikum, and Navarette sites. At both Leikum and Navarette, Clovis points were found out of context.

In 1951, Marc and Fred Navarette discovered two Clovis points and mammoth bones in the bank of Greenbush Draw near Naco, Arizona. They reported their find to the Arizona State Museum, which sent a team of scientists, including Emil Haury, Ernst Antevs, John Lance, Ted Sayles, and William Wasley to excavate the find in 1952. In total, eight Clovis points were associated with the nearly complete skeleton of a single mammoth (Haury 1953). The Naco mammoth, which was apparently not butchered, may be "one that got away" from Clovis hunters (Vance Haynes, personal communication 1997). Radiocarbon dates were not obtained, but Antevs (1953) projected a date of 10,000 to 11,000 years ago based on geological correlations.

During the same year that the Naco excavations took place, cattle rancher Ed Lehner visited a piece of property that he was considering purchasing in the upper San Pedro Valley. There, Lehner found bones exposed by erosion in the arroyo bank. Having visited the Naco excavation, Lehner was aware that the bones might be those of an extinct animal. He brought a sample to the Arizona State Museum, and invited Haury and his colleagues to look at the site. Recognizing the potential importance of the site, Lehner purchased the land. Excavation of the site was conducted in 1954 and 1955 (Haury 1956; Haury et al. 1959). In all, they discovered 13 Clovis points, eight other flaked stone tools, two hearths, the bones of nine mature mammoths, and elements of horse, bison, and tapir. Excavations by Haynes and Haury in 1974-1975 yielded charred bones of mammoth, bison, horse, camel, jackrabbit, and garter snake, and uncharred bones of bear, dire wolf, wood rat, and other animals; some of the camel bone appeared to be intentionally split (Haynes 1982). Twelve radiocarbon dates associated with the Clovis presence average about 10,940 b.p. (Haynes 1993; Taylor et al. 1996).

In 1966, Peter Mehringer and Vance Haynes were walking the floor of Curry Draw searching for additional archaeological localities to investigate. During their exploration, they discovered mammoth bones eroding from the bank of the arroyo at Murray Springs. Excavations in 1966 and 1968 (Haynes 1973b) uncovered the dismembered carcass of another mammoth, a bison-kill area, and the remains of horse, camel, and dire wolf in the vicinity of a possible well. Artifacts associated with the find included whole and broken Clovis points, at least one blade, a mammoth-bone shaft wrench (Haynes and Hemmings 1968), and numerous other flaked stone artifacts (Hemmings 1970). A campsite discovered on the surface was excavated between 1969 and 1971 (Haynes 1976, 1978, 1979, 1980, 1981). The association of the camp and the kill site was confirmed by refitting of artifacts from each area. Eight radiocarbon dates associated with human activities at the site average about 10,890 b.p. (Taylor et al. 1996).

The Escapule site, less than 2 mi southeast of Murray Springs, was excavated in 1967. Two nearly complete Clovis points were found in association with the remains of a single mammoth (Haynes and Hemmings 1968). The mammoth did not appear to have been butchered and so—like the Naco mammoth—may have escaped its attackers.

Finds of mammoths with potentially associated artifacts have been located at numerous other sites in the state. Currently, the best candidate outside the San Pedro Valley is the Silktassel site near Payson, where a Clovis point base, a graver, and a utilized blade fragment were found with mammoth bones (Huckell 1978a). Another possible Clovis site is in Brawley Wash, west of Tucson, where a possible dart foreshaft was found in the same alluvial stratum as remains of mammoth, camel, bison, and horse (Ron Ratkevich, personal communication 1997). However, the carbonized wooden object yielded a pre-Clovis date of about 12,700 b.p., older than other Clovis dates. Also, its identification as an artifact is uncertain, and its association with the megafauna remains is indirect.

A number of isolated finds of Clovis projectile points have been made in Arizona. Huckell's (1982) inventory counted 19 isolated Clovis points. Additional isolated points have been found since that

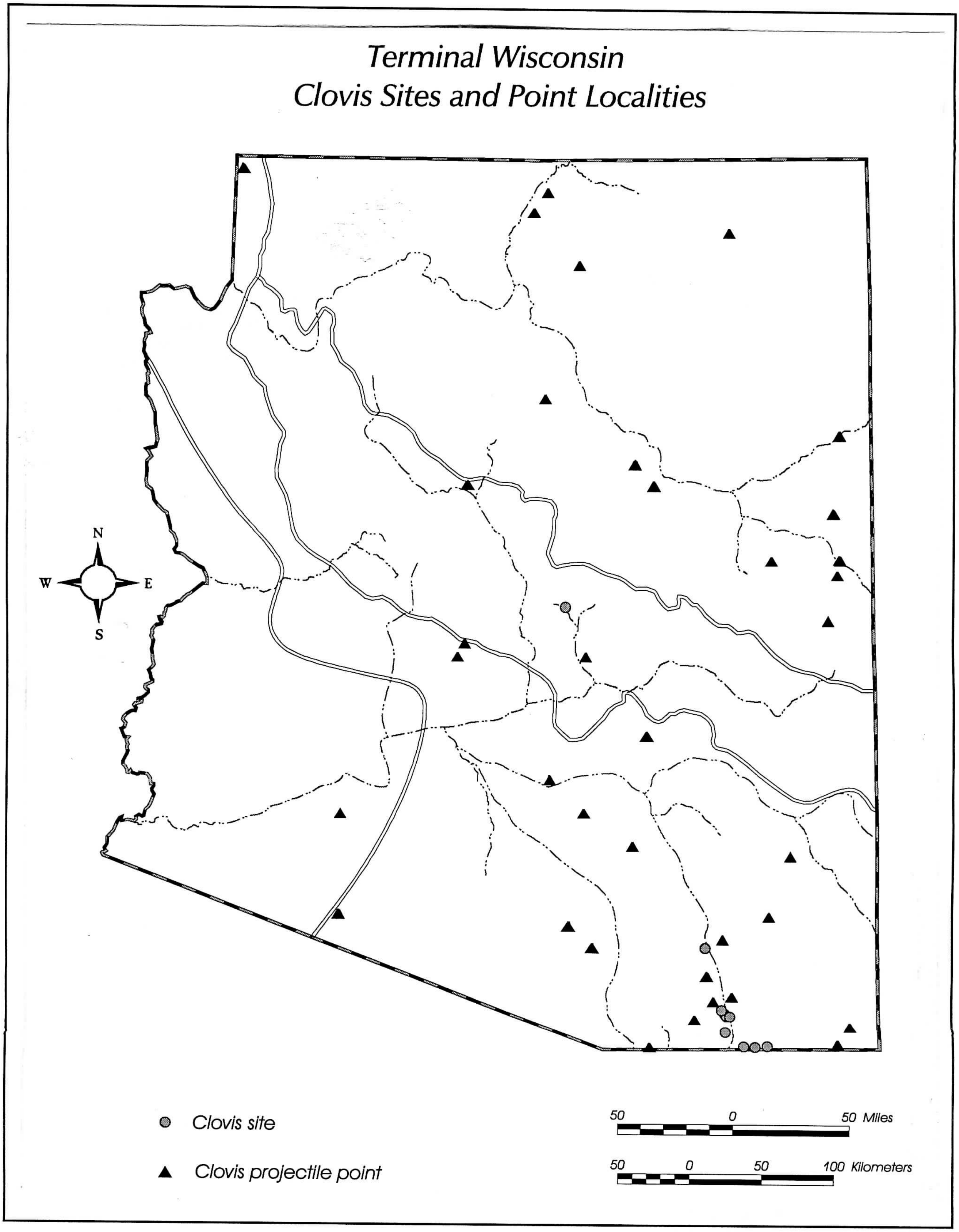

Figure 3.3. Distribution of recorded terminal Wisconsin Paleoindian (Clovis) sites and point localities in Arizona (ca. 11,600-10,900 b.p.).

inventory, and are included in Figure 3.3. Clovis point bases have since been found in Saguaro National Park East in the Tucson Basin (Simpson and Wells 1984), near Kartchner Caverns in the San Pedro Valley (Phillips et al. 1993), near a playa on a mesa near St. Johns, Arizona (Roth 1993), and along Big Wash near Oracle Junction, Arizona (Helen O'Brien, personal communication 1998). Whole Clovis points have been found in a deflation basin on the Kaibito Plateau (Geib 1995), in "an indistinct, shallow 'blowout'" in the Wupatki area (Downum 1993), south of Gila Bend (Bruce Masse, personal communication 1997), and on the northwest bajada of the Pinaleño Mountains (James Neely, personal communication 1997). Just across the Arizona border, the Lime Ridge site near Bluff, Utah, adds to the evidence for a Clovis presence on the Colorado Plateau (Davis and Brown 1986a, 1986b).

The Folsom Complex

The Folsom complex follows the Clovis complex in radiocarbon time and stratigraphic occurrence in the Plains and in the Southern Basin and Range Province of the Southwest (Eighmy and LaBelle 1996; Taylor et al. 1996). The Folsom point (e.g., Figure 1.4:B) is characterized by a fluting scar that often encompasses the entire surface of the projectile point and fine edge retouch by pressure-flaking. The type site for the complex is the Folsom site, located in Dead Horse Gulch, a tributary of the Dry Cimarron River west of the town of Folsom, in northeastern New Mexico. The excavations here in 1926 and 1927 that uncovered bones of an extinct form of bison (*B. antiquus*) imbedded with Folsom points (Figgins 1927) established the presence of humans in North America at the end of the Pleistocene and set the standard for excavations of similar sites (Meltzer 1989). Nineteen projectile points, 23 bison skeletons, and two flake tools were recovered from the site (Hofman 1991). Six radiocarbon dates from the site average about 10,890 b.p. (Taylor et al. 1996).

Figure 3.2 shows that the distribution of Folsom sites is generally restricted to the Plains, Rocky Mountains, Colorado Plateau, and the Rio Grande Valley in New Mexico. However, there are rare occurrences of Folsom points east of the Mississippi River (Anderson et al. 1996), as far west as California (Harrington 1938), and as far south as Chihuahua (Aveleyra 1961). Averaging of radiocarbon dates from Folsom sites indicates a range between about 10,900 and 10,200 b.p. (Haynes et al. 1992; Taylor et al. 1996).

Though it was obvious from the Folsom find that these hunters subsisted, at least in part, on late Pleistocene megafauna, subsequent excavations at several other Folsom sites on the High Plains have allowed archaeologists to more fully develop hypotheses regarding Folsom adaptations. The faunal assemblages of these sites indicate that the Folsom complex represents a specialized bison hunting subsistence strategy, augmented by opportunistic foraging of small mammals (Amick 1991, 1995).

Most known Folsom sites are bison-kill sites or lithic resource procurement sites; only two campsites have yet been identified (Lindenmeier in Colorado, and Rio Rancho in New Mexico, the latter with multiple pit structures). Some Folsom sites exhibit repeated occupations by earlier and later groups, establishing a chronology of styles between Folsom and other point types, and giving rise to models of high mobility. Stratified Folsom sites include: Lindenmeier in Colorado; Hanson, Carter/Kerr McGee, Agate Basin, and Hell Gap in Wyoming; Indian Creek in Montana; Blackwater Draw in New Mexico; and Lubbock Lake in Texas (see references in Stanford and Day 1992). A number of Folsom sites are known on the northern Colorado Plateau (Schroedl 1977a), including the recently discovered Montgomery site in southeastern Utah (Davis 1985, 1986), and in the Tularosa Basin of south-central New Mexico (Amick 1991).

Folsom toolkits included gravers and spurred endscrapers in addition to the distinctive projectile points. Also known are bone gaming discs, engraved bones, miniature or facsimile projectile points, ground stone tools for pigment grinding, and grooved abrading stones. Obvious differences between Folsom and Clovis technology include the standardization of tool production. For example, there is only a narrow range in the widths of 780 Folsom points known from New Mexico (Amick 1995). Pressure flaking edge retouch on Folsom projectile points clearly distinguishes them from the coarser, light percussion edge retouch on Classic Clovis points.

While there was continuity between Clovis and Folsom in terms of uniface tool forms and concave-based fluted points, innovation occurred in flaked stone reduction strategies and possibly in the development of multicomponent tools. On the basis of point size and weight characteristics, Amick (1995) has even proposed that Folsom technology included the bow and arrow.

Many of the flaked stone tools in Folsom assemblages include diminutive forms, miniatures (microliths), and miniatures made from crystal quartz (microliths, including some made from crystal quartz, are also known from Classic Clovis sites such as Lehner in Arizona). While these small lithics may demonstrate preferential selection of certain raw material sources or the inability to access additional raw materials from those sources, or both, they also illustrate the skill of the flintknappers, and may indicate labor specialization.

Compared to that of the Clovis complex, Folsom raw material selection appears even more specific, and is dominated in New Mexico, Oklahoma, and Texas by Edwards, Alibates, and Tecovas cherts. Hofman (1991) reports that Folsom sites found within 350 km of the Edwards Plateau chert source in Texas will contain predominantly Edwards chert, and that there is only a weak negative relationship between the percentage of Edwards chert and distance from this source (cf. Broilo 1971; Hester 1972; Hofman 1986; Hofman and Todd 1990; Hofman et al. 1990; Tunnell 1977). Folsom groups in the northern Plains also selected raw materials from specific sources (Ingbar 1992). At non-quarry sites, the result is the production of highly "curated" assemblages with large quantities of nonlocal raw materials (Hofman 1992). Among the Paleoindian complexes of North America, the selection of mostly high-quality cryptocrystalline raw materials, often from specific sources, is unique to Folsom (Hofman et al. 1990).

All known, unambiguous Folsom points in Arizona (Figure 3.4) are from surface sites on the Colorado Plateau or near its boundary with the Mountain Transition Zone. Since Huckell's 1982 compilation, discoveries of Folsom points on the surfaces of a site near Flagstaff (Brown 1993a) and a site in the Big Chino Valley southwest of Flagstaff (Ryan 1993) extend the known western limit of this Plains-based Paleoindian complex. Since 1982, Folsom points have also been found on the southern Colorado Plateau in Petrified Forest National Park (Tagg 1987a) and in Chevelon Canyon (Curtis Porter, personal communication 1997). Some Folsom points in Arizona have been found in surface contexts with Archaic artifacts, and others have been found at Pueblo sites. These are usually interpreted as the surface collection of Folsom points by later prehistoric groups.

The co-occurrence of Midland and Folsom points at many sites in the southern High Plains has been interpreted as evidence of contemporaneity (e.g., Hofman et al. 1990), while stylistic and technological similarities have led to the suggestion that Midland points represent unfluted Folsom variants (Haynes 1991a). Midland points are known from the Scharbauer site near *Midland*, Texas (Wendorf et al. 1955; Wendorf and Krieger 1959; Holliday and Meltzer 1996), and other sites on the Llano Estacado and in western Texas. In Arizona, a Midland point was found at Tachini Point, a large Tsegi phase Pueblo west of Kayenta (Hesse et al. 1996).

Other Fluted Point Types

Several fluted bifaces have been found at the Vernon site, near St. Johns, Arizona. The points are associated with a lithic manufacturing assemblage on the surface and in a deflated, shallow soil covering bedrock on a low, broad ridge overlooking the upper Little Colorado River Valley (Wilmsen 1970; Martin and Plog 1973:62; Longacre and Graves 1976). Myers (1967) reported a "Folsom" point from the Rising site in the San Bernadino Valley in southeastern Arizona. The midsection of an obsidian fluted point was found on the surface of the Defiance Plateau (Banks and Brancard 1994). From the Kaibito Plateau, Geib (1995) reports a point base fluted on only one side.

The characteristics of the fluted points from these sites fit neither Clovis nor Folsom types (Huckell 1982; Geib 1995). They may represent either 1) temporally intermediate forms between Clovis and Folsom; 2) forms used by groups representing contemporaneous variants of the Clovis and Folsom complexes; 3) attempts by less experienced flintknappers to produce Clovis and Folsom forms; or 4) stages of manufacture prior to the finished Clovis and Folsom forms. Also, some large fluted points reportedly from the Sulphur Springs Valley (Myers 1976) may be modern fakes (Vance Haynes, personal communication 1997).

STEMMED POINT COMPLEXES

Other Paleoindian complexes occur in western North America, some of which were contemporaneous with Folsom-aged sites in the Plains, and some of which postdated Folsom. These complexes are generally characterized by tapering-stemmed points and other aspects of material culture that imply cultural traditions distinct from their chronological counterparts on the High Plains. Their relationships to fluted point complexes are ambiguous, and they have been described as both Late Paleoindian and Early Archaic. These tapering-stemmed point complexes are described in Chapter 4, while a series of complexes represented by stemmed and shouldered lanceolate points are described below, together with other Late Paleoindian lanceolate point complexes.

LANCEOLATE POINT COMPLEXES

Several early Holocene complexes that are differentiated on the basis of various styles of lanceolate projectile points have been identified on the High

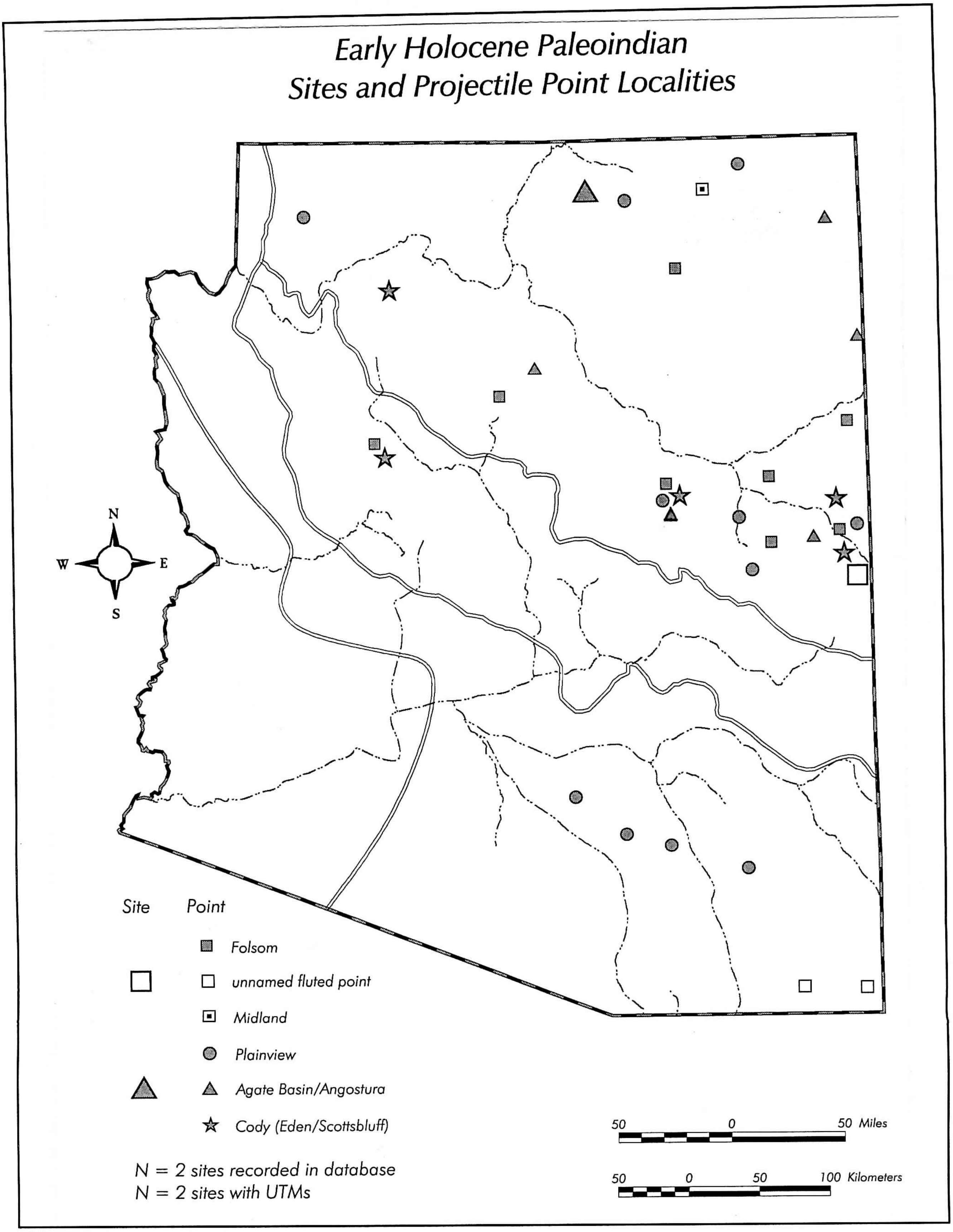

Figure 3.4. Distribution of recorded early Holocene Paleoindian sites and point localities in Arizona (ca. 10,900-7500 b.p.).

Plains. These lanceolate points include a variety of unstemmed and stemmed/shouldered types formerly lumped under the name "Yuma" (Renaud 1932; Figgins 1934, 1935; Wormington 1948). The complexes they define are considered to represent "Paleoindian" adaptations because their subsistence strategies focused on bison hunting, but in the Southwest they overlapped "Archaic" adaptations temporally and spatially.

Stratigraphic relationships and associated radiocarbon dates indicate that, following the Folsom complex, the Plainview, Agate Basin/Hell Gap, and Cody complexes developed in that order between about 10,900 and 7000 b.p., although there was some overlap between each, and Plainview and Agate Basin/Hell Gap overlapped significantly (Eighmy and LaBelle 1996). Frison and Sellett (1994) have also shown that Folsom and Agate Basin occupations alternated at several Plains sites.

The Plainview Complex

The relative ages and relationships between a series of lanceolate projectile points, known variously as Plainview, Goshen, and Belen, are hotly debated in Plains archaeology (Amick 1995; Frison 1996; Judge 1970). Milnesand and Meserve points are also included in this group by some (Wheat 1972; Johnson and Holliday 1980). Krieger (1947) defined the Plainview point type on the basis of 16 lanceolate projectile points discovered in association with extinct bison near Plainview, Texas (Sellards et al. 1947). These points were essentially the same shape as Clovis points, but unfluted.

Plainview points (Figure 1.4) have since been found at Bonfire Shelter (Dibble 1965, 1975; Dibble and Lorrain 1968) and Lubbock Lake (Johnson and Holliday 1980), sites in western Texas yielding radiocarbon ages between 10,200 and 9900 b.p. (ca. 9200 B.C.). Plainview/Goshen points also occur in contexts dated as early as 11,300 b.p. (see below), and Plainview-like points also occur in contexts dated as late as 9600 b.p. (Vance Haynes, personal communication 1997). Although they are most common on the High Plains, Plainview points are reported as far south as the Tehuacán Valley in south-central Mexico (Flannery 1997).

In Arizona, all known Plainview and Plainview-like points are surface finds on the Colorado Plateau and in the Southern Basin and Range Province (Figure 3.4). In the north, bases of Plainview points have been found at the Starling site northeast of Kayenta (Parry and Smiley 1990), and at the White Lake site near Show Low (Hoffman and Neely 1996). Two resharpened Plainview (or Meserve) points have also been found near Concho (Wendorf and Thomas 1951; see above). In southeastern Arizona, bases of Plainview-like points have been found in the Tortolita Mountains, at the Lone Hill site on the eastern flank of the Catalina Mountains (Huckell 1984b), on the western flank of the Picacho Mountains (Wallace and Holmlund 1986), and on a bajada of the Winchester Mountains (Carlson et al. 1989).

The Goshen point was originally defined on the basis of pre-Folsom finds at the Hell Gap site by Henry Irwin (1968, 1971; Irwin-Williams et al. 1973), and the type was resurrected after the discovery of similar points at the Mill Iron site (Frison 1996). Goshen points have been found stratigraphically below Folsom at the Hell Gap site (Irwin 1971). They are very similar in form and manufacturing technology to Plainview points (Bradley 1993), and most Plains archaeologists now refer to them as "Plainview/Goshen." Radiocarbon dates on charcoal from the Mill Iron site fall into clusters near 11,300 and 10,800 b.p. (Haynes 1991a; Frison 1996), but there is a possibility of contamination from lignite present at the site (Vance Haynes, personal communication 1997).

The Belen point type, defined on the basis of finds in the middle Rio Grande Valley in New Mexico (Baker 1968; Judge 1970, 1973) (Figure 1.4), has also been viewed as a Rio Grande variant of Plainview or Milnesand points (Judge 1973). The sharper corners on the bases of Belen points are their main difference from Plainview points. A resharpened Belen point was found in the upper Little Colorado River Valley near Snowflake (Ervin 1988), and a Belen point base was found on Voigt Mesa between St. Johns and Springerville (Schreiber and Sullivan 1984).

Milnesand points were defined at the Olson-Chubbuck site in Colorado (Wheat 1972) and are found on the Llano Estacado and in the Texas Panhandle, eastern New Mexico, and Colorado. Their straight to slightly convex bases differentiate them from concave-based Plainviews, and basal grinding usually extends farther up the sides.

Meserve points were defined on the basis of finds in central and eastern Texas (Wormington 1957). With their concave bases and foreshortened "steeple-shaped" upper portions, they give the impression of being resharpened Plainviews. In Arizona, two examples were found near Concho (Wendorf and Thomas 1951).

The Agate Basin Complex

Agate Basin, Angostura, and Hell Gap points are similar-looking lanceolate point types, often with parallel flaking. They were all produced by the same technological sequence (Bradley 1993), and may represent variants used by culturally related, Plains-based Paleoindian groups. They were produced by a different technological sequence than were Folsom points, and were probably not derived from Folsom (Bradley 1993).

Agate Basin points (Figure 1.4) are leaf-shaped lanceolate points with lenticular cross sections, convex bases, and lower lateral and basal grinding. They were defined on the basis of excavations at the Agate Basin site in Wyoming, and are concentrated on the northern Plains. They are not commonly reported from the Southwest, but have been found stratigraphically overlying Folsom points and underlying the Cody complex points at Blackwater Draw in eastern New Mexico (Hester 1972). They have also been found at the Hell Gap site in eastern Wyoming (Irwin-Williams et al. 1973), and the Frazier site in Colorado (Cassells 1983). Associated radiocarbon dates from the Agate Basin site range between about 10,400 and 9000 b.p. (Frison and Stanford 1982). At other sites on the Plains, they are dated between about 10,800 and 9600 b.p. (Cassells 1983).

A Paleoindian site named Badger Springs was discovered in a blowout located approximately 15 km south of Inscription House in northeastern Arizona (Hesse et al. 1996) (Figure 3.4). The lanceolate projectile points from the site (Figure 1.4) have concave bases and parallel-oblique flaking. In these characteristics, the points resemble Angostura points (Wormington 1957; Thoms 1994), but in their broader blades and less regular flaking they also fit into what Frison (1991, 1992) has called the "Foothills-Mountain Complex." The blowout at Badger Springs is between two possible fossil springs or ponds, and so far it has yielded a bison skull, fragments of more than 80 fire-spalled, lanceolate projectile points, two complete lanceolate points, additional flaked stone artifacts, 17 mano and metate fragments, and numerous pieces of calcined bone. Some of the calcined bone is identifiably human. It has been suggested that the presence of human bone with fire-spalled projectile points may represent a cremation burial (Parry and Smiley 1990; Hesse et al. 1996).

No radiocarbon dates are currently available from the Badger Springs site, but a radiocarbon date of 9380 b.p. was obtained from the stratum containing Angostura points at the Ray Long site in South Dakota, the type site for this point style (Wormington 1957). Angostura points have been found throughout the Plains, especially in Texas.

The Hell Gap point was identified on the basis of finds in east-central Wyoming (Agogino 1961). The Hell Gap complex and its dating to about 10,000-9500 b.p. were defined at the Hell Gap site in eastern Wyoming (Irwin-Williams et al. 1973). Hell Gap points differ from Agate Basin points in their slight shoulders, and differ from Western Stemmed points in their thinness, straight to slightly concave bases, and parallel flaking. They appear to represent a continuation of Agate Basin manufacturing techniques (Bradley 1993; Frison 1993). Hell Gap points are most common in eastern parts of Wyoming and Colorado, with a few occurrences in Montana, Alberta, Idaho, and Ohio (Agogino 1961), but they also occur on the rolling plains of western Texas (Mallouf 1990).

In Arizona, Agate Basin, Angostura, and Hell Gap points have only been found on the central and southern Colorado Plateau (Figure 3.4); this may represent the western limit of these related Plains-centered point types. Wendorf and Thomas (1951) illustrate two possible Agate Basin points from near Concho in the upper Little Colorado River Valley, and Agate Basin points have been found in Chevelon Canyon and the north side of San Francisco Peak (Curtis Porter, personal communication 1997). In addition to the Angostura-like points from Badger Springs, an Angostura or Hell Gap point has been reported from the Prayer Rock Valley (Morris 1958) (Figure 1.4), and an Angostura point was found in the Black Creek-Defiance Plateau region by a Navajo medicine man (Danson 1961). A possible Hell Gap point was found in Petrified Forest National Park (Burton and Farrell 1993) (Figure 1.4).

The Cody Complex

A series of late Paleoindian stemmed/shouldered lanceolate projectile points, grouped together as representing the Cody complex, are defined from High Plains assemblages at Scottsbluff in western Nebraska, Blackwater Draw in eastern New Mexico, Eden, Horner, and Finley in Wyoming, and a series of sites in Alberta, Canada (Barbour and Schultz 1932; Schultz and Eisely 1936; Howard 1943; Hack 1943; Frison and Todd 1987). The Olsen-Chubbock and Jurgens sites in Colorado are considered by Wheat (1972, 1979) to represent the earlier "Firstview Complex," but are included in the Cody complex by other Plains archaeologists.

The projectile points associated with this complex are known as Eden, Scottsbluff, Portales, and Alberta, and are often diamond-shaped to lenticular in cross section. Eden points are long, diamond-shaped in cross section, and parallel flaked, and have medial ridges and very narrow shoulders formed by retouch and edge grinding near the base. Both Scottsbluff and Alberta points are wider and have more pronounced shoulders and stems. Also associated with the Cody complex is a tool known as the "Cody knife," a very distinctive bifacially flaked tool with a prominent shoulder on one side and a transverse blade. At the Jurgens site were also found bone and antler tools, grooved abrading stones, grinding slabs, a possible tubular smoking pipe, and atlatl hooks made from an antler and a bison tooth (Wheat 1979).

Although Cody complex points are most common in the North American Plains, Scottsbluff points have been reported as far south as Oaxaca in southern Mexico (Flannery 1997). A bone collagen date of 10,150 b.p. from the Olsen-Chubbock site in eastern Colorado (Wheat 1972) is the earliest associated radiocarbon date if the site is included in the Cody complex. The majority of the radiocarbon dates from Cody complex sites in the Plains fall between 9,900 and 7900 b.p. (Gregg 1985; Gunnerson 1987).

In Arizona, Cody complex points have been found only in the northern part of the state, on the Colorado Plateau, and near its southwestern edge (Figure 3.4). Basal fragments of Eden and Scottsbluff points have been reported from sites on Voigt Mesa in the upper Little Colorado River Valley near St. Johns (Schreiber and Sullivan 1984) (Figure 1.4). A base of a Scottsbluff point (Figure 1.4) was found in Petrified Forest National Park (Tagg 1987b). Single Eden point bases have also been reported from a site on the Coconino Plateau, from a site in the Concho area (Wendorf and Thomas 1951), and from a site in the Big Chino Wash (Weaver et al. 1993; Ryan 1993). A broken Cody knife has been found on the eastern side of Chevelon Canyon (Curtis Porter, personal communication 1997).

MODELS OF RELATIONSHIPS BETWEEN COMPLEXES

Willig and Aikens (1988) discuss the problems of determining the meaning behind co-occurrences of fluted points and tapering-stemmed points by considering adaptational, chronological, and cultural explanations. Both Willig (1988, 1991) and Moratto (1984:103) propose that fluted and tapering-stemmed points represent a cultural continuum, based primarily on the temporal and geographical overlap of the two traditions. Others have concluded that they represent distinctly different cultural groups (Basgall 1988; Bonnichsen et al. 1987; Bryan 1980; Rouse 1976; Warren and Phagan 1988). These models of the relationships between fluted point complexes and tapering-stemmed (Western Stemmed) point complexes are discussed in Chapter 4.

Frison and Sellet (1994) have suggested that fluted points (Folsom) and shouldered-lanceolate points (Agate Basin) in alternating strata at Plains sites represent the return of different cultural groups to the same locations at different times. They support this hypothesis with evidence from reanalysis of the Hell Gap stratigraphic sequence, showing that Folsom and Agate Basin levels might alternate. Further support for cultural and/or economic differences between the two groups has been suggested from analysis of the technological and raw material differences between the lithic assemblages. Frison (1991) has also noted a similarity between Folsom preforms and the penultimate production stages of Agate Basin points. Bradley (1993), on the other hand, considers the reduction strategies of Folsom and Agate Basin stemmed points as representing different cultural groups.

The relationship between the Folsom and "unfluted Folsom" (Plainview-related) complexes remains a mystery. Though it is clear that the technology of Folsom production should include "unfluted Folsom" specimens, the presence of unfluted, lanceolate, Folsom-like points in assemblages without Folsom points raises an interesting problem that cannot be explained without additional studies of stratified site assemblages (Hofman 1992).

Although the late Paleoindian lanceolate point complexes on the High Plains are often thought to represent continuations of Folsom settlement and economy during the early Holocene, the transition to an "Archaic" economy had already taken place in surrounding regions (Meltzer 1988; Frison 1992), including the Southwest (see Chapter 4).

MODELS OF PALEOINDIAN ADAPTATIONS

Current evidence indicates that, by 10,400 b.p., fluted point and stemmed point groups populated (or had visited) every part of the Americas. Clusters of fluted points in eastern North America, stemmed point types in the desert West, and coeval but different projectile point types on the Plains might represent domains of distinct social groups (Anderson 1990:195; cf. Anderson and Hanson 1988), temporal differences (Haynes 1992), subsistence differences (Anderson 1991; Price 1991; Meltzer 1984, 1988; Tompkins 1994), or some combination of all of these.

Based on differences in the environmental settings, subsistence remains, and artifact assemblages of these complexes, it is clear that the set of assumptions regarding Paleoindian subsistence and settlement that were tethered to the Beringian Ice-Free Corridor (BIFC) model, and based predominantly on the results of early discoveries in the Plains, must be abandoned in favor of regional and environmental models (Dincauze 1988).

Currently, the environmental contexts and economies of possible pre-projectile point/pre-Clovis complexes are very poorly understood. The surface nature of many of these sites, unfortunately, does not lead to the preservation of organic materials that might give evidence as to the subsistence practices of these early groups. Only through better dating can these complexes be placed in the contexts of paleoenvironmental conditions recorded by geological and biological proxy records (Chapter 2).

Based on comparisons of the alluvial contexts of the youngest Pleistocene megafauna remains and the oldest human traces in the Southwest and the rest of North America, Haynes (1984) identified the stratigraphic suddenness and simultaneity of the disappearance of megafauna and the appearance of artifacts. The remains of the more common large late Pleistocene mammals—horses, camels, and mammoths—are not preserved anywhere in a primary context above an abrupt stratigraphic break representing an erosional interval dating between about 12,500 and 11,500 b.p. The remains of megafauna killed by Clovis hunters are found on this erosional surface, but of the large Pleistocene mammals, only extinct forms of bison are found above this contact, representing the last vestige of the Pleistocene megafauna in North America.

The fact that pre-Clovis artifacts have not been found below this contact has been cited to support arguments that human predation played an important role in megafauna extinctions (Haynes 1966; Jelinek 1967; Martin 1967; McDonald 1984; Agenbroad 1988). Stratigraphic and geomorphic evidence of a drought during Clovis time raises the scenario of drought-stressed animals concentrating at the remaining watering holes, where they were more easily killed by humans (Haynes 1966, 1984, 1991b, 1993; Jelinek 1967).

> The evidence is strictly circumstantial and indeed may never be adequate to unequivocally convict man of megafaunal extinctions, even if overhunting was responsible. Nevertheless, the stratigraphic equivalence of the first visible evidence of hunters and the last skeletons of the late Pleistocene extinct megafauna is intriguing (Haynes 1984:351).

According to this model, the severe drought marking the end of the Pleistocene may have led to the concentration of Pleistocene megafauna in the remaining well-watered zones, which may have been advantageous for Clovis hunters. Regardless of whether humans were the "last straw" in the extinctions of some megafauna, the wave of mammalian extinctions and the shifts in plant and animal communities at the end of the Pleistocene certainly required adjustments in human settlement and subsistence strategies.

Among later Paleoindian groups, Frison (1992) has suggested that two distinctly different groups existed, one located on the open plains and intermontaine basins, and another in the foothills and mountains. Although some foothills-mountain sites are found in high-altitude meadows, the majority of stratified sites are located in caves and rockshelters. There is little evidence for communal hunting at these sites, whereas sites located in the plains-intermontaine basins are predominantly large, and represent communal bison kills. Foothills-mountain sites also exhibit a greater reliance on plant foods and locally available mountain sheep and mule deer, though some bison were exploited.

The distinction between foothills-mountain and plains-intermontaine economies is clearly ecological, resulting from the exploitation of distinct resource bases. However, Frison demonstrates that the two settlement systems were different as well. While plains-intermontaine groups acquired lithic raw materials from great distances, foothills-mountain groups exploited only locally available raw materials. Late Paleoindian sites located in Arizona's Colorado Plateau region could be related to either of these distinct economic complexes.

We now know that Paleoindian and Archaic adaptations overlapped temporally, and possibly spatially, during the early Holocene. The late Paleoindian bison-hunting adaptation in the Plains extended into the Rio Grande Valley and the Colorado Plateau in the Southwest, a coastal adaptation emerged in southern California, a lake-margins adaptation flourished in the Great Basin, and broad-spectrum hunting and foraging adaptations were established in the Southern Basin and Range Province and Lower Colorado River Valley (Chapter 4). Future research should investigate the timings and environmental conditions of these adaptive differentiations, and their possible progeny relationships.

MODELS OF THE PEOPLING OF THE NEW WORLD AND THE SOUTHWEST

Our current understanding of how and when people migrated to the New World has developed over 500 years of European academic inquiry. For centuries, scholars have attempted to understand who these first people were, when they came to North America, and from where they came. These questions also lead to the inevitable problem of determining how early people organized their societies, what they ate, how they adapted to changing environments, and the processes by which they evolved into the various Archaic groups.

The concept of an Asiatic homeland for Native Americans was first proposed in the sixteenth century (Acosta 1590), and was supported by studies of the biological attributes of indigenous peoples beginning in the late nineteenth and early twentieth centuries

(Hrdlička 1925). Many subsequent studies have supported the view that all North, Central, and South Americans are biologically more similar to Northeast Asians than to any other populations in the world (Cavalli-Sforza et al. 1988; Greenberg et al. 1986; Hrdlička 1925; Turner 1986).

But how did these first people enter the Americas? Lowered sea levels occurred during glacial cycles, exposing a land bridge between the continents at several times in the past (Hopkins et al. 1982), allowing for terrestrial migrations of early groups. During Pleistocene Illinoian and Wisconsin glaciations, sea levels were lowered to more than -100 m, exposing a large Beringian land mass between the two continents. Although little is known about the sea levels during early and middle Pleistocene glaciations, the habitation of the New World by Old World land mammals indicates that sufficient area would have been opened for their migration during the earlier part of the Pleistocene.

During the Wisconsin glaciation, the maximum sea level lowering occurred during the early Wisconsin. A mid-Wisconsin high stage would have prevented terrestrial migration between 35,000 and 25,000 years ago. During the late Wisconsin glacial maximum, around 20,000 years ago, sea level lowered again to at least -120 m. From 20,000 to 14,000 years ago, sea levels rose in an oscillating fashion (Creager and McManus 1967). By 14,000 to 12,000 years ago only a narrow bridge of land would have connected the two continents. By 10,000 years ago, sea level rise had completely inundated the land connection between eastern Siberia and Alaska, although minor fluctuations during the period from 12,000 to 10,000 years ago may have provided short-term access to groups living in the area (Bloom 1983; Hopkins 1982; McManus and Creager 1984).

The second barrier to terrestrial movement was potentially posed by the coalescence of two large continental glaciers in Canada. Between 35,000 and 25,000 years ago, a corridor may have opened between the two glaciers (Hopkins 1982). The corridor was closed by 20,000 years ago, during the height of late Wisconsin glaciation. The glaciers began retreating shortly after, opening a completely ice-free corridor around 13,000 years ago (Dyke and Prest 1987). The lag in vegetation response to ice-retreat and the presence of glacial outwash valleys may have impeded establishment of a favorable living environment or traversable area until 11,800 years ago (Mandryk 1996). Paleoecological factors would have been important to the traversability of Beringia as well (Schweger et al. 1982; Yi and Clark 1985).

Though these dates appear to be well-grounded, they are not (Hopkins 1982; Porter 1988). They only provide a general reference for what people were capable of doing, not what they did (Meltzer 1989). Secure dates on Alaskan and ice-free corridor Paleoindian sites rarely exceed 11,500 b.p., although some equivocal, but promising, data suggest that people were living there as early as 13,000 b.p. (Cinq-Mars 1979; Morlan and Cinq-Mars 1982). Even earlier age estimates of 30,000 b.p. or more at Old Crow Flats (Irving and Harrington 1973) are considered highly suspicious by most archaeologists (Bonnichsen and Turnmire 1991).

Fladmark (1979) proposed an alternate hypothesis to terrestrial migration, suggesting that rather than, or in addition to, the corridor pathway, groups of people may have moved along the western continental margins of North America, procuring coastal and maritime subsistence resources and other resources by means of small boats. This movement would have occurred along the southern margins of Beringia from Northeast Asia, and then down the western coast of North America. Evidence for these movements may be submerged on the continental shelves due to sea level rise. Recent evidence suggests that groups in the southern Pacific were capable of ocean travel as early as the late Pleistocene, and evidence for maritime subsistence activities has been documented for the West Coast in early Holocene times (Dixon 1993; Erlandson 1994), but there is no such evidence for these activities during the late Pleistocene. A coastal model does appear to be one way of getting human populations to Chile by the time Monte Verde was occupied, however.

A more recent model, based on anthropological data from language and biology, proposes three distinct migratory pulses based on biological and linguistic variability observed in the New World, and representing ancestral populations of Paleoindians, Na-Dene, and Eskimos (Greenberg et al. 1986). Early examples of this tripartite model can be found in works by Hrdlička (1925:493), Greenberg (1960), and Willey and Sabloff (1974:172).

This tripartite model has been put into question recently by new lines of biological evidence and larger samples. The biological evidence has been produced by studies of mitochondrial DNA (mtDNA) (Torroni et al. 1994), GM allotypes (Schanfield 1992), and cranial morphology and dentition (Haydenblit 1996; Steele and Powell 1992). These studies confirm similarities between North American natives and Northeastern Asians, but they also expose strong similarities between Southeast Asians and Native Americans in Central and South America (Torroni et al. 1994; Haydenblit 1996). From these new data Torroni et al. (1994) have gone so far as to resurrect the idea of trans-Pacific transit(s) to northwestern South America, but without consideration of a chronology or archaeological correlates for such movements. Recent studies that focused strictly on early skeletal remains also question similarities with Northeast Asians and report Southeast Asian and Western European similarities, but the sample size is small (Steele and Powell 1992).

Early models of population movement suggested that the peopling of the Americas consisted of continuous flowing, or "trickling," of people over the Bering Straits, with later migrants pressing earlier ones farther into the continent, into marginal regions (Acosta 1590; Neumann 1952; Swadesh 1964). Today, a "wave of advance" (WOA) settlement pattern is usually proposed for Paleoindians. This WOA was created by population expansion, pushed by increasing population pressure, and fueled by abundant, untapped natural resources ahead (Mosimann and Martin 1975; Anthony 1990). This model applies to either the coastal or BIFC route. Several researchers have tried to estimate the rates at which populations would have spread across the continent, but these models often do not integrate what is known about archaeological complexes and radiocarbon dating (Jaffe 1992; Whitley and Dorn 1993).

In summary, the timing and environmental constraints of potential migration routes have led to the criticism of both the traditional BIFC model and the alternate coastal model for the peopling of the Americas. The earliest unequivocal evidence for human occupation in North America (Clovis) lacks evidence for a maritime subsistence pattern, but also lacks a demonstrated affinity with early sites in the terrestrial corridor of Alaska and Chukotka. However, new evidence from Monte Verde, Chile, and the numerous possible pre-projectile point sites throughout the Americas lends credence to the possibility of an early coastal migration to North America. The number and timings of these migrations cannot be resolved with current biological and linguistic data, but these data suggest that more than one migration of people is possible. It is also possible that the postulated pre-projectile point complexes represent "failed migrations," or biological populations that did not survive after entry into the New World (Meltzer 1989).

Neither the BIFC model or the coastal model adequately explains how Paleoindian groups arrived in the Southwest. The sudden appearance of Clovis groups throughout the Southwest was rapidly followed by Folsom and later Paleoindian groups in the Colorado Plateau region, and early Archaic groups in the Southern Basin and Range Province (if they were not already present). There is also no evidence to link Clovis to any of these later groups. Though the timing of Clovis occupation is well-documented, there are too few sites from too short a timespan to address the direction or speed of Paleoindian migration into the Southwest. Furthermore, the possible earlier presence of pre-projectile point groups, and the possible coeval presence of Archaic groups, only serve to complicate the picture even more. However, it seems clear that at least two distinctly different adaptations (Paleoindian and Archaic) coexisted in the Southwest during the early Holocene.

CHAPTER 4

ARCHAIC COMPLEXES OF THE EARLY HOLOCENE

Jonathan B. Mabry and Michael K. Faught

The origins of Archaic adaptations in the Southwest during the early Holocene are marked by the appearance of ground stone seed milling tools, bedrock mortars, rock-filled roasting pits, slab-lined storage pits, cleared "sleeping circles," trails, cairns (shrines?), marine shell ornaments, rare minerals, and new projectile point forms and hafting techniques (Chapter 7). The absence of extinct megafauna remains (including bison) at sites of the early Holocene Western Stemmed, Bifurcate-stemmed, and Notched Point complexes also distinguishes them from Paleoindian complexes. The development of subsistence economies based on generalized hunting and gathering was probably a response to the raised lake levels, increased stream and spring flows, expanded woodlands, and greater abundance and diversity of plant resources during this period.

The radiocarbon dates from site occupations associated with these complexes, falling between about 10,700 and 7000 b.p. (ca. 9900?-5840 B.C.), indicate that early Archaic adaptations temporally overlapped the late Paleoindian bison-hunting adaptations of the High Plains and their extensions into the Southwest. The relationships between them is uncertain, and currently available radiocarbon dates give Paleoindians temporal priority, but it is possible that Archaic adaptations were established in the Southwest equally as early as Paleoindian ones, and did not develop from them.

The split-haft and socketed-haft techniques were in simultaneous use in the Southwest during the early Holocene, and uses of fluted, shouldered-lanceolate, tapering-stemmed, notched, and bifurcate-stemmed dart points partially overlapped each other during this period. While projectile points were associated with all of the Southwestern complexes dated to this period (Table 1.1), ground stone seed milling tools apparently were not, and other aspects of their artifact assemblages also differ. This diversity was probably the result of increasing regional differentiation in climates, landscapes, and available resources as temperatures climbed toward their mid-Holocene peak. While a few human remains and non-lithic artifacts from this period have been found, knowledge of the mortuary patterns and perishable material cultures of these complexes is very limited.

WESTERN STEMMED POINT COMPLEXES

Archaic cultures and complexes of western North America have been defined largely by the time ranges and spatial distributions of a variety of stemmed and notched dart points. The earliest known types of projectile points in both the Great Basin and the Southwest belong to the Fluted Point and Western Stemmed Point complexes. Discussed below is the possibility that the origins of the Western Stemmed Point complexes west of the Rocky Mountains were contemporaneous with the origins of the Fluted Point complexes east of the Rockies.

Various terms for the early stemmed point complexes in western North America include (in chronological order of their proposal); the San Dieguito complex (Rogers 1939; Warren 1967, 1968), Lake Mohave complex (Wallace 1962), Intermontaine Western tradition (Daugherty 1962), Western Lithic Co-tradition (Davis 1967; Davis et al. 1969), Stemmed Point tradition (Layton 1970; Bryan 1980), Western Pluvial Lakes tradition (Bedwell 1970, 1973), Lake Mohave-Pinto tradition (Tuohy 1974); Great Basin Stemmed tradition (Tuohy and Layton 1977), and Western Stemmed complexes (Willig and Aikens 1988). In this report, these are referred to together as the Western Stemmed Point complexes.

A publications-based database for western North America includes 51 Western Stemmed Point sites dated between 11,200 and 9000 b.p. Their distribution is shown in Figure 4.1, and includes fluted point sites/localities where stemmed points have also been found. Generally, older sites tend to be concentrated on the border between the northern Plains and the Great Basin. Most of these earliest Western Stemmed Point sites are in rockshelters. Whether this distribution represents age, cultural affiliation, or preservation bias is difficult to assess.

In the Southwest, Western Stemmed Point types include the Lake Mojave and Silver Lake points associated with the "San Dieguito-Playa" complex in the Mojave Desert and Lower Colorado River Valley (Rogers 1939); the "Ventana-Amargosa I" points found in the Red Sand Layer of Ventana Cave in southwestern Arizona (Haury 1950); and the "Jay" point, the diagnostic artifact of the initial phase of the Oshara

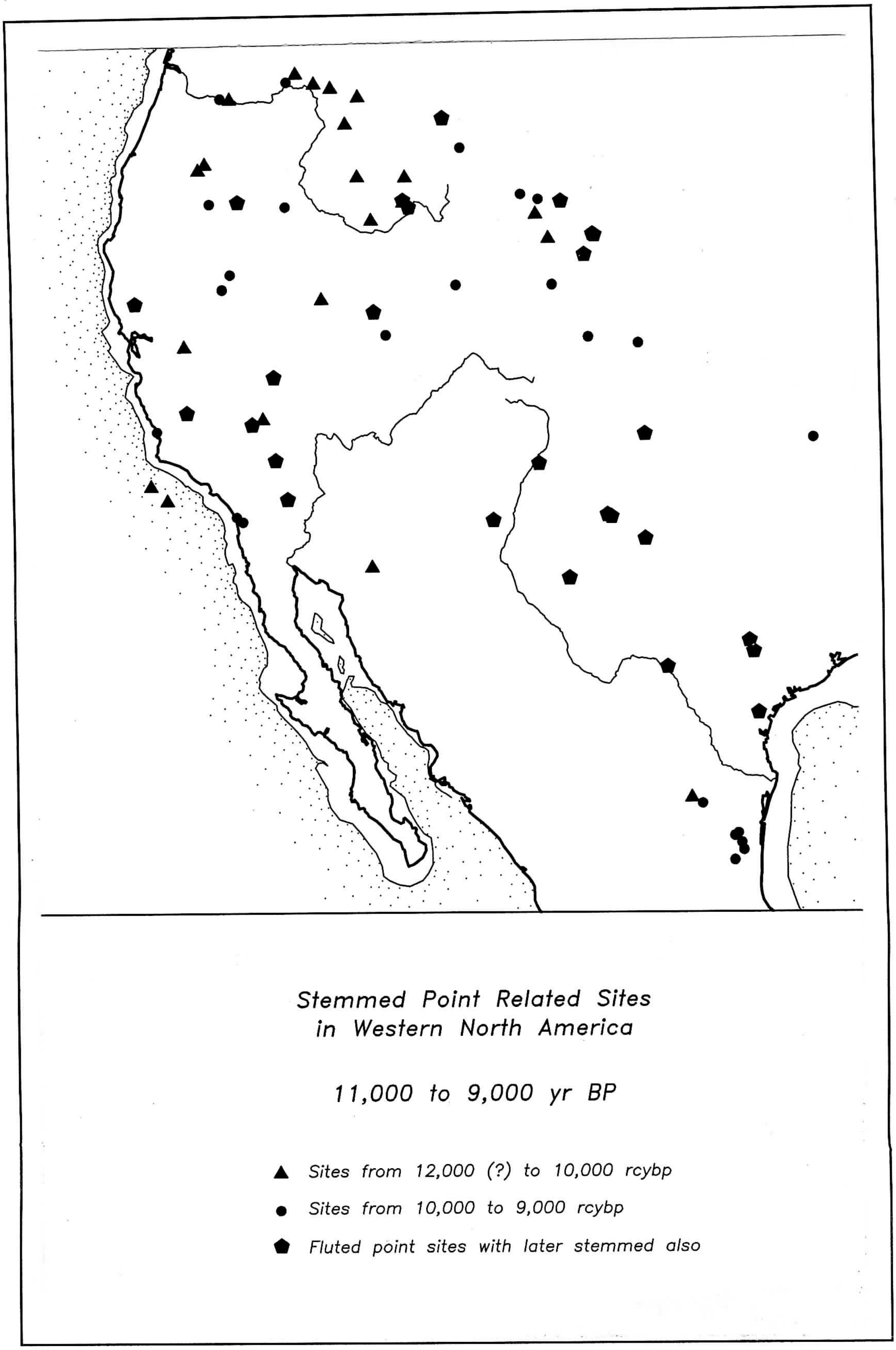

Figure 4.1. Distribution of early Holocene Western Stemmed Point site occupations in western North America (ca. 11,200-9000 B.C).

tradition of the northern Southwest (Irwin-Williams 1973). While some archaeologists consider the Western Stemmed Point complexes to be "Paleoindian" (e.g., Bryan 1980; Aikens 1983; Price and Johnston 1988), others consider them to be "early Archaic" (e.g., Willig 1988) (see discussion in final section).

The hallmarks of the Western Stemmed Point complexes are large, tapering-stemmed points, ovoid, domed, and keeled scrapers, large "foliate" knives, heavy core tools, and end scrapers (Willig and Aikens 1988). Point stems are convex-based, the blades are usually slightly shouldered, and the upper blades are frequently shortened by severe resharpening. The tips are often intentionally burinated. The points are thick in cross section. Much of the morphological diversity within the Western Stemmed Point series could be due to differential resharpening (Beck and Jones 1993). Tapering-stemmed projectile points are actually infrequent in any particular site assemblage; the frequencies of fluted and lanceolate projectile points within their specific site assemblages are generally greater (Goebel et al. 1991). The scrapers are extensively retouched, giving them ovoid shapes. Other types of artifacts in Western Stemmed Point assemblages include ground stone milling tools and burins (burins are more frequent in Western Stemmed Point assemblages than in Fluted Point assemblages). Flake microtools and bola stones were also found at Smith Creek Cave (Bryan 1977).

Human remains have been discovered at a few Western Stemmed Point sites. A human skull was found outside the front of Marmes Rockshelter, Washington in the late 1960s (Fryxell et al. 1968). On the basis of radiocarbon dates on shell overlying the archaeological component, and association with lake draining events, Fryxell proposed that the human skeleton was between 13,000 and 11,000 years old. Later investigations identified Western Stemmed projectile points from the oldest archaeological level at Marmes, and radiocarbon ages place this site around 10,500 b.p. (Rice 1972; Sheppard et al. 1984). Another association of human bone and stemmed points comes from the recent excavation of a burial in Idaho, which has an associated radiocarbon date of about 10,500 b.p. (Todd Fenton, personal communication 1997). In Whitewater Draw in southeastern Arizona, three partial human skeletons have been found in strata containing Sulphur Spring stage assemblages and yielding radiocarbon dates between 9300 and 8100 b.p. (Waters 1986b).

Figure 4.2 shows the distribution of recorded Archaic sites in Arizona that can be dated to the early Holocene on the basis of projectile point types present (San Dieguito, Lake Mojave, Silver Lake, Jay, Ventana-Amargosa I, Western Stemmed), and radiocarbon/stratigraphic dating (Sulphur Spring stage, Desha and other northern Colorado Plateau complexes).

The Lake Mojave Complex

The quintessential type of Western Stemmed projectile point is probably the Lake Mojave point (originally "Lake Mohave") (Figure 1.5). This tapering-stemmed point with high shoulders has been compared to the roughly contemporaneous Hell Gap point (Figure 1.4) found predominantly on the High Plains. However, there are significant differences that suggest they represent different technological traditions. Lake Mojave points are usually less well made, thicker in cross section, and have higher shoulders and more convex bases than Hell Gap points.

The "Lake Mohave Culture" was defined on the basis of Lake Mojave points, shorter points with more prominent shoulders and wider stems (Silver Lake points) (Figure 1.5), leaf-shaped points (Figure 1.5), flaked stone "crescents" (notched scrapers or amulets?), large bifacial knives, gravers, and various types of scrapers and planes, found at two dozen sites on the stranded shorelines of the extinct Lake Mojave in the northern Mojave Desert (Amsden 1937; Campbell et al. 1937). Ground stone milling tools were not included in these assemblages, but they sometimes occur in similar assemblages found on the margins of other pluvial lakes in the southwestern Great Basin.

Called the "Playa Industry" by Rogers (1939), the Lake Mojave complex is regarded as a regional variant of the San Dieguito complex by Warren (1967), but is considered a distinct complex by Wallace (1962, 1978). Ore and Warren (1971; Warren and Ore 1978) report a radiocarbon date of 10,270 b.p. associated with a Lake Mojave assemblage on a beach of Lake Mojave, and Douglas et al. (1988) report dates between about 9500 and 8500 b.p. associated with Lake Mojave points at Fort Irwin in the central Mojave Desert.

The relationship between late Pleistocene (Pluvial) and early Holocene lake levels and the presence of prehistoric people in the Mojave Desert has undergone long debate (Rogers 1939; Brainerd 1953; Warren and Ranere 1968). Recent research has demonstrated that Lake Mojave complex occupations were associated with intermittent lakes present in the Mojave Basin between about 11,000/10,000 and 8500/8000 b.p. (Ore and Warren 1971; Moratto 1984; Enzel et al. 1992; Cleland and Spaulding 1992). The association between Lake Mojave and Silver Lake points has also been questioned. In the Owens Valley of eastern California, Davis (1963) found Lake Mojave points on the valley floor, and Silver Lake-like points in higher, mountainous terrain. She attributed this pattern to a

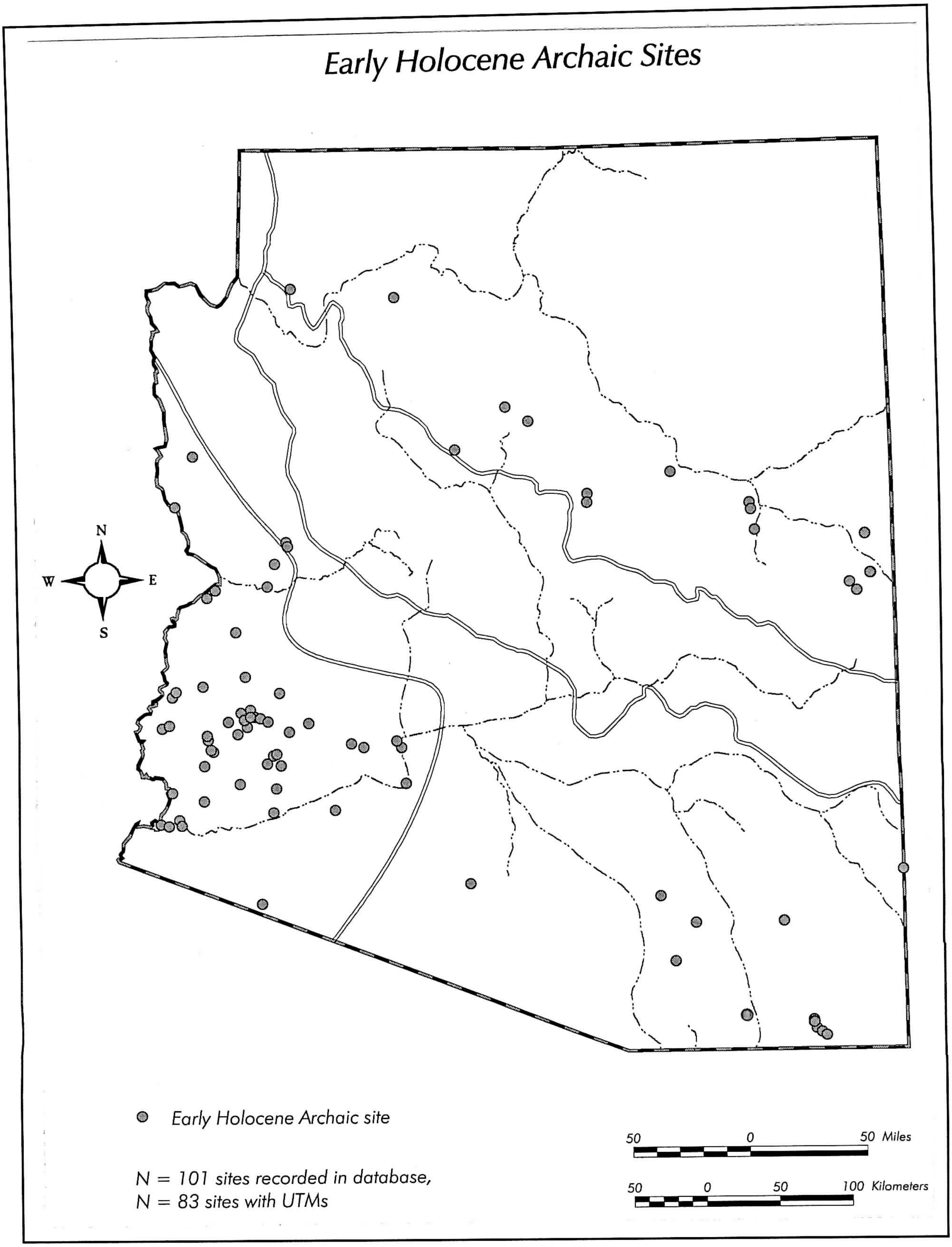

Figure 4.2. Distribution of recorded early Holocene Archaic site occupations in Arizona (ca. 10,700-7000 B.C.).

shift from hunting on the margins of lowland lakes toward a seasonal, upland-lowland pattern of hunting and gathering. However, Lake Mojave points and Silver Lake points were both found in association with Pinto and Elko points at the Stahl site (Harrington 1957; Schroth 1994).

In Arizona, a flaked stone crescent was found at a small Pueblo-period site in Petrified Forest National Park (Burton and Farrell 1993), and Lake Mojave and Silver Lake points have been found on the surfaces of a number of sites on the southern and western Colorado Plateau, in the Southern Basin and Range Province, and in the Lower Colorado River Valley (overlapping with the distributions of other types of Western Stemmed points). The apparent absence of Lake Mojave and Silver Lake points on the northern and eastern Colorado Plateau may represent the eastern boundary of this complex centered in the southwestern Great Basin.

The San Dieguito Complex

Over the course of several decades, Rogers (1929, 1939, 1958) defined what he called the "San Dieguito Lithic Industry," based on research he conducted in the southwestern Great Basin (the Mojave Desert) and the Lower Colorado River Valley. His studies focused primarily on surface sites and based their relative ages on changes in artifact attributes. Rogers' terminology has become confusing because of many changes initiated by him and by others (Campbell et al. 1937; Haury 1950; Wallace 1962). The history of these changing definitions is covered by Warren (1967). San Dieguito assemblages appear to overlap or replicate the assemblages of the Lake Mojave complex (Campbell et al. 1937), the Playa complex (Rogers 1939), and the Death Valley I complex (Wallace 1962). Rogers (1939) dated the San Dieguito complex to the "Little Pluvial," which he believed occurred between 2000 and 1000 B.C., while Haury (1950) dated it to about 8000 B.C.

The type site for Warren's (1967) reformulation of the San Dieguito complex is the C. W. Harris site, near San Diego, California. The site was originally discovered by Malcolm Rogers in 1928, and investigated by *him in 1938*. Later excavations by Warren and True (1961) more fully defined the stratigraphy of the site. The San Dieguito implements were found underlying a stratum dated to 6300 b.p. and containing artifacts of the La Jolla complex. Three radiocarbon dates from the San Dieguito contexts at the Harris site ranged between about 9000 and 8500 b.p. (Warren 1967). The associated assemblage included leaf-shaped bifaces, leaf-shaped projectile points (sometimes called "San Dieguito points") (Figure 1.5:F), Lake Mojave points, crescents, various forms of scrapers, and engravers. Elongated bifaces (projectile points?) with traces of bitumen on one end were also found in the San Dieguito stratum of the site (Ezell 1977). In his reformulation of the complex, Warren (1967) included Silver Lake points.

From a site interpreted as representing a local variant of the San Dieguito complex, located on the southern shore of Buena Vista Lake in the southwestern San Joaquin Valley, three radiocarbon dates between 8200 and 7600 b.p. were obtained from freshwater clam shells (Fredrickson and Grossman 1977). Ground stone milling tools (absent or rare in most San Dieguito assemblages), crescents, and a ground stone atlatl spur were also included in the site assemblage.

San Dieguito complex sites in Arizona are all located in the Lower Colorado River Valley (Figure 4.2). Rogers (1958) suggested that the eastern boundary of the complex during the San Dieguito I phase was the San Pedro Valley and adjacent areas of Sonora, and the Lower Colorado River Valley in Arizona during the San Dieguito phase II. To the north, San Dieguito assemblages have also been found on the early Holocene beaches of Sevier Lake in the eastern Great Basin (Aikens 1979).

In Yuma County in southwestern Arizona, a "San Dieguito-like" flaked stone tool assemblage with heavy desert varnish was identified in excavations at the Dateland site on a terrace south of the Gila River (Huckell 1978b), but it did not include any projectile points. Features at the site included a trail segment, a cleared "sleeping circle," and a possible rock-cairn shrine. The Martinez Lake site, interpreted as a San Dieguito and Amargosan basecamp, covers all of a 16.5 acre island near the east bank of the Colorado River, 20 mi north of Yuma, Arizona (Sanders 1987). Cultural features include clusters of sleeping circles, rock rings, pebble-covered earthen mounds, trails, a rock alignment, and a sparse scatter of percussion-flaked stone tools, most with a moderate amount of desert varnish.

The Ventana Complex

In Ventana Cave in the Castle Mountains *of* southwestern Arizona, excavations were directed by Wilfrid C. Bailey in 1941 and by Julian Hayden in 1942. Seven cultural and natural strata were identified in test trenches, and arbitrary 50 cm levels were excavated within these strata. The lowest level (the water-laid "Volcanic Debris" layer) in this cave's 4.5 m of stratified cultural deposits yielded an assemblage of 90 small basalt tools made on cores and flakes, and a single ground stone disk. The age of this assemblage was first estimated on the basis of an apparent association with the teeth and bones of extinct Pleistocene fauna (including horse, camel, ground sloth, four-pronged antelope, jaguar, and dire wolf), by the presence of a quartz projectile point originally thought to be basally notched, and by the presence of a basalt projectile point that was first attributed to the Folsom complex, and later to the Clovis complex. While Rogers (1958, 1966) and Hayden (1976) assigned this assemblage to Phase I of the San Dieguito complex, Haury (1950) referred to it as the "Ventana complex," technologically and temporally intermediate between Clovis and San Dieguito.

Huckell and Haynes (1995) reexamined both projectile points from the Volcanic Debris layer and concluded that the basalt "fluted point" was made on a thin flake, that it is not fluted, and that "the fact that the Ventana specimen is little more than a tried flake renders specific comparisons moot." They associate the quartz point with the Great Basin Stemmed series, Intermontaine Lanceolate tradition, or Western Stemmed tradition, and place the point "within the range of variation for the Western Stemmed series." Because ovoid scrapers, which dominate the assemblage, are typically found with Western Stemmed projectile points, and because the incidence of single-edged scrapers in Paleoindian assemblages is low, they support the positions of Rogers (1958, 1966) and Hayden (1976) that the site is characteristic of early Archaic industries in the North American deserts, rather than the Plains Paleoindian tradition.

The conclusion is supported by a series of 10 new radiocarbon dates on charcoal samples from a chunk of the Volcanic Debris layer curated at the Arizona State Museum. These ranged from approximately 10,700 to 8700 b.p., with the majority of dates falling between about 9500 and 8700 b.p. (Huckell and Haynes 1995). Huckell and Haynes also concluded that the artifacts and remains of Pleistocene fauna are not in direct association, as the bones were reincorporated into a younger deposit. On the basis of the presence of the ground stone "mano," they relate the assemblage to sites of the Sulphur Spring stage of the Cochise culture found in Whitewater Draw, southeastern Arizona (see below).

However, *this* disk-shaped object, ground perfectly round and flat on both sides, may not be a milling tool. Instead, it could be a "discoidal" stone, such as are found (often with "cogged stones," and sometimes with central indentations or perforations) at Archaic sites in southern California dating between about 6000 and 3000 b.p. (Moratto 1984). Discoidal ground stone objects like these are also found at Archaic sites on the coast of Chile (Iribarren 1962), and at sites in southern Chile and Argentina radiocarbon dated to about 11,000 b.p. (Bird 1970). Like the Ventana Cave example, these carefully shaped stone objects do not show facets or stains from grinding seeds or pigments, and are most often interpreted as "ritual objects" or game pieces.

The Sulphur Spring Stage of the Cochise Culture

The Sulphur Spring stage of the Cochise culture was defined on the basis of six sites exposed by erosion in the banks of Whitewater Draw in southeastern Arizona (Sayles and Antevs 1941), including the site at Double Adobe where Cummings (1927a, 1927b, 1935) had identified artifacts in the same stratum as bones of extinct Pleistocene megafauna. Artifacts recovered from the megafauna-bearing deposits at these sites included fire-cracked rocks, ground stone grinding slabs and handstones, flaked stone unifacial scrapers and other unifacial tools, and broken and charred animal bones. At two sites, partial human skeletons were found. No projectile points were found in these assemblages. The putative association with bones of extinct Pleistocene fauna, the simplicity of the flaked stone tools, the lack of projectile points, and the presence of ground stone milling tools suggested a subsistence economy emphasizing plant resources. This represented either an adaptation that overlapped with Clovis big-game hunting, or plant gathering and processing activities by Clovis groups (Haury 1983).

On the basis of geological cross-dating with reconstructed alluvial, lacustrine, and glacial sequences in western North America, Antevs (1941) attributed the Sulphur Spring stage sediments to the last glacial epoch of the Pleistocene, which ended about 9,000 years ago by his estimate. Later, in an update of this reconstruction, Antevs (1983) placed the Sulphur Spring stage deposits between 11,000 and 8,000 years ago. A solid-carbon radiocarbon date of 6210 ± 450 b.p. obtained in 1951 from a Sulphur Spring stage site was rejected as too young (Sayles 1983). At that site, artifact-bearing deposits overlie the Sulphur Spring stage deposits. Unlike the Sulphur Spring stage assemblages, the assemblages of this overlying deposit included fragments of projectile points and bifaces. Three radiocarbon dates from this deposit ranged between about 9300 and 7000 b.p., and it was proposed to represent another stage ("Cazador") in the Cochise culture sequence, between the Sulphur Spring and Chiricahua stages (Sayles 1983).

In his reinvestigation of several of these sites along Whitewater Draw, Waters (1986b) determined that Sulphur Spring and Cazador stage artifacts occurred in the same stratum at Double Adobe, in secondary context along with redeposited bones of extinct megafauna, and that artifacts attributed to the Cazador stage at other sites along the arroyo occurred in younger deposits. He also discovered an articulated, flexed, Sulphur Spring stage burial. On the basis of a number of new radiocarbon dates from four sites, he bracketed the Sulphur Spring stage deposits along Whitewater Draw between about 9300 and 8100 b.p., and raised the possibility that the assemblages may be older than 10,400 b.p.

In addition to rejecting the association of the Sulphur Spring stage artifacts with the Pleistocene fossils, Waters also concluded that the Cazador assemblages, including the bifaces and projectile point fragments, were equivalent to Sulphur Spring stage assemblages. From his own trench he recovered another possible projectile point fragment from a Sulphur Spring stage stratum. In total, the point fragments include a tip, a midsection, and convex bases which may be portions of either bifaces or tapering-stemmed (Western Stemmed?) projectile points. All of the identified Sulphur Spring stage sites are located in Whitewater Draw in southeastern Arizona (Figure 4.2).

The Jay Phase of the Oshara Tradition

The Jay phase is the initial phase of the Oshara tradition defined by Irwin-Williams (1973) on the basis of investigations at several sites in the Arroyo Cuervo region of west-central New Mexico. The diagnostic artifact of the Jay phase, originally called "Rio Grande points" by Renaud (1942) and included in the "Rio Grande complex" by Honea (1969), is a large, slightly shouldered projectile point with a tapering, convex-based stem (Figure 1.5:H). Flaked stone assemblages also included leaf-shaped bifaces and unifacial scrapers. No ground stone milling tools were found at the type sites, for which Irwin-Williams mentioned radiocarbon dates between about 6500 and 5500 B.C. (uncalibrated? i.e., ca. 8500-7500 b.p.?). Subsequent excavations at a number of sites on Gallegos Mesa in northwestern New Mexico demonstrated the presence of ground stone milling tools in Jay phase assemblages, and yielded radiocarbon dates between about *8000* and 7000 b.p. (ca. 6900-5800 B.C.) (Wiens 1994). Huckell (1996a) cites reports of Jay points from the central Colorado Plateau, Rio Grande Valley, and Chihuahuan Desert.

Whether the Jay phase should be considered a late Paleoindian or early Archaic cultural manifestation has been debated. Honea (1969) considered the Jay-like Rio Grande points to be very similar to late Paleoindian Hell Gap points, thought to have developed from Angostura points on the Plains. In contrast, Irwin-Williams (1973) argued that the resemblance is coincidental, and that there is a closer relationship between Jay points and Lake Mojave points of the San Dieguito complex, which she considered to be an early Archaic complex. The Cody complex was the last Paleoindian culture in the northern Southwest in her model; after a withdrawal of these Paleoindians northward and eastward to the Plains before 6000 B.C. (uncalibrated? i.e., ca. 8000 b.p.?), the Jay phase Archaic people moved into the region from the west.

Matson (1991) points out, however, that Irwin-Williams' radiocarbon dates for the Jay and Bajada phases were never published, and notes that the similarities between Jay points and Lake Mojave and Hell Gap points imply a much older age for the Jay phase than Irwin-Williams' dating. Here, following Matson, the Jay phase is considered a northern Southwest manifestation of the early Holocene Western Stemmed Point complexes. In Arizona, Jay points are recorded at sites on the southern Colorado Plateau only (Figure 1.5), but Jay-like tapering stemmed points are also reported from a few sites in the Southern Basin and Range Province (Figure 1.5).

EARLY BIFURCATE-STEMMED POINT COMPLEXES

The Early Pinto Complex

The "Pinto Basin Culture" was originally defined on the basis of surface sites found along an ancient dry stream channel in the Pinto Basin, in the Mojave Desert of southeastern California (Campbell and Campbell 1935). The artifact assemblages included a variety of bifurcate-stemmed projectile points, leaf-shaped points, drills, bifacial knives, keeled scrapers, choppers, hammerstones, flake tools, flat milling stones, handstones, and pestles (Amsden, in Campbell and Campbell 1935). Surveying throughout the Mojave and California deserts, Rogers (1939) found numerous sites of what he called the "Pinto-Gypsum Complex" on the terraces of dry rivers and the stranded shorelines of extinct lakes. (Pinto and Gypsum points are now known to have different, but overlapping, temporal and spatial distributions).

At the Stahl site in the northwestern Mojave Desert, which became the type site for this complex, Harrington (1957) found an artifact assemblage that included shallow-basined and semi-troughed grinding slabs, cobble handstones, pestles, flaked stone scrapers, scraper planes, cobble choppers, bifacial and flake knives, perforators, drills, gravers, denticulates, bifacial disks, incised slate fragments, ground stone "charmstones" (including a possible atlatl hook), bone awls, and bone and shell beads. The features included large rock-filled roasting pits, storage pits, and seven or more possible pit structures marked by circular patterns of postholes. Throughout the 4½ ft of excavated deposits, almost 500 bifurcate-stemmed Pinto points co-occurred with 90 tapering-stemmed Mojave and Silver Lake points, and 38 leaf-shaped points. Harrington distinguished four subtypes of Pinto points from the site, including shoulderless, sloping-shouldered, square-shouldered, and barbed (Figure 1.6).

No radiocarbon dates were obtained from the Stahl site by Harrington, and the age of the occupation could only be estimated at between about 3,000 and 100 years ago. Wallace (1962) estimated the age of the Pinto complex as 5000 to 2000 b.p., while Warren and Crabtree (1986) bracketed the "Pinto period" between 7000 and 4000 b.p. Until recently, the dating of this complex was based on comparative studies of Pinto points and associated radiocarbon dates at sites mostly outside of the southwestern Great Basin (Heizer and Hester 1978; Holmer 1986).

However, recent excavations at sites in the Mojave Desert have provided much new information on the dating and material culture of the Pinto complex. At the Rogers Ridge site, Pinto points were found in cultural deposits radiocarbon dated between about 8400 and 7900 b.p. (Jenkins 1987). In new excavations at the Stahl site, Pinto points were found along with Elko series points throughout the sequence, which yielded several radiocarbon dates ranging between about 9030 and 4290 b.p. on shell beads and bone tools (Schroth 1994). A single Silver Lake point was found in a middle level containing Pinto points. Other artifact types found in the new excavations included a fragment of a rimmed bowl of vesicular basalt, steatite beads, polished pebbles, and an "eccentric" flaked stone object in the shape of a cross. Abstract geometric petroglyphs, including atlatl-like elements, were inferred to be connected with the Archaic site occupation based on the degree of patination. Through replication experiments, Harrington's four subtypes of Pinto points were reinterpreted to largely represent an expedient but "purposeful configuration" resulting from rejuvenations of broken Elko series notched points, manufacturing errors, or material constraints that prevented notching of thick preforms (Schroth 1994:297). Most often, the result was a "square-shouldered, indented base" form. The "postholes" identified by Harrington were also reinterpreted as rodent burrows.

In excavations at a stratified site in the Pinto Basin, Pinto points co-occurred with leaf-shaped points in cultural deposits radiocarbon dated between about 9510 and 7055 b.p. (Schroth 1994). Features in these deposits included a hearth and clusters of fire-cracked rocks, and artifacts included ground stone milling tools, scraping planes, small scrapers or wedges, hammerstones, cobble cores, a lump of ochre, and spire-lopped *Olivella* shell beads. In terms of subsistence remains, hackberry seeds were recovered from a midden deposit at the Stahl site, and the faunal assemblages at the Stahl site and Pinto Basin site included bones of lagomorphs, mule deer, and bighorn sheep.

Based on these recent excavations, it is clear that projectile points with short, bifurcated stems, and often with shouldered blades, appeared throughout the Great Basin and Southwest about the same time as, or shortly after, tapering-stemmed (Western Stemmed) points, and were in use for a longer interval of time. Most frequently referred to as "Pinto" points (although some serrated "willow-leaf" points with non-bifurcated stems are also called Pinto; cf. Formby 1986), they are considered a marker for the early Archaic in the Southwest by Matson (1991). The radiocarbon dates recently obtained from the sites in the Mojave Desert indicate that Pinto points were in use in the southwestern Great Basin as early as 9500 b.p. If the dates from Levels DII and DIII in Danger Cave are valid, then the appearance of Pinto points in the central Great Basin is bracketed between about 9600 and 8100 b.p. (Marwitt and Fry 1973; Fry 1976). Their appearance on the northern Colorado Plateau is dated to 8800-8700 b.p. in Dust Devil Cave (Ambler 1996).

In a comparative study of stratified contexts in rockshelters, Holmer (1986) noted that bifurcate-stemmed points occurred in the eastern Great Basin in contexts dated between about 8300 and 6200 b.p., and in contexts dated between about 5000 and 3300 b.p. in the western Great Basin. Holmer's (1986) identification of these two intervals of use (which he calls "floruits"), each focused in a different region, bridged the gap between the "high" and "low" chronologies for Pinto points, previously referred to as the "Pinto problem" (Warren 1980).

However, based on data obtained from open-air and rockshelter sites during the following decade, the patterns are not as clear as the two-interval, eastern-western Great Basin model implies. In the southwestern Great Basin, Pinto points found at sites dating between 10,000 and 5000 b.p. (see above) resemble the earlier points from the eastern Great Basin and northern Colorado Plateau more than the later ones from the western Great Basin. Based on current evidence, bifurcate-stemmed points appeared throughout the Great Basin and on the northern Colorado Plateau during the early Holocene, continued to be used in a few well-watered parts of the eastern and southwestern Great Basin during the middle Holocene, and then experienced a final floruit in the western Great Basin during the initial part of the late Holocene.

Although the reputed association of Pinto and Elko point types with Folsom points in the "Moab Complex" of southeastern Utah (Hunt and Tanner 1960) must be discounted because the complex is represented only by surface finds, the available radiocarbon dates indicate that the earliest use of bifurcate-stemmed points in the Great Basin and on the northern Colorado Plateau overlapped with late Paleoindian lanceolate point complexes on the Plains. At the Stahl site and in Danger Cave, Harrington's (1957) reported co-occurrence of Pinto points with Lake Mojave and Silver Lake points may be due to mixing by site formation processes, but this association was not confirmed by the recent excavations, and museum accession records indicate that most of the Mojave and Silver Lake points collected by Harrington did not come from the Stahl site itself (Dee Schroth, personal communication 1997). Nevertheless, the radiocarbon date ranges mentioned above indicate that bifurcate-stemmed points overlapped with stemmed points on the northern and western edges of the Southwest during the early Holocene.

In Arizona, "Pinto" points (including bifurcate-stemmed and other varieties) are the most common point type collected from the surface of a number of sites on the Colorado Plateau, including on the top and flanks of Red Butte, south of the Grand Canyon (McNutt and Euler 1966); at the Starling site northeast of Kayenta (Smiley 1987, cited in Parry and Smiley 1990); at the Oak Springs Ruin near Window Rock (Ward 1971); and on the escarpment overlooking Mormon Lake southeast of Flagstaff (Windmiller and Huckell 1973). "Pinto" points have also been reported from several sites in the Verde, Chino, and Partridge Creek valleys in the Mountain Transition Zone, and from numerous sites throughout the Southern Basin and Range Province (Ezell 1954; Formby 1986; Weaver et al. 1993). At a large site on two mesas separated by an arroyo in the Partridge Creek Valley, Formby (1986) observed numerous slab metates, boulder metates, and round, one-handed manos, and collected 350 Pinto points and 65 Gypsum points (about 100 "Yavapai" points have also been collected from the site by Peter Pilles of Coconino National Forest).

EARLY NOTCHED POINT COMPLEXES

Notching of points, which is considered the marker of the beginning of the Archaic period about 9000 b.p. in southeastern North America (Goodyear 1982), appeared earlier, between 10,300 and 9500 b.p., in the *Southern Plains* (Patterson 1989). On the northern Colorado Plateau, notched points appeared by 8700 b.p. along with bifurcate-stemmed points and notched points (Ambler 1996). In Dust Devil Cave in southeastern Utah, fine warp-faced sandals and Elko Side-notched and Elko Corner-notched, Northern Side-notched, Pinto, and Humboldt Concave-based points were found in a stratum underlying a Desha complex assemblage (see Chapter 5) and radiocarbon dated to about 8800-8700 b.p.; the name "Hola complex" (Hola is Navajo for "I don't know") is suggested for this assemblage and any other pre-Desha materials clearly associated with fine warp-faced sandals (Ambler 1996). In the eastern Great Basin, notched points appeared between 8000 and 7000 b.p. (Holmer 1986), and they appeared in the western Great Basin before 7500 b.p. (Basgall et al. 1995).

The Elko series of points was originally defined by Heizer and Baumhoff (1961) based on examples from Wagon Jack Shelter and the type site, South Fork Shelter, in Elko County, Nevada (Heizer et al. 1968). There are several named subtypes, including "side-notched," "corner-notched," "eared," and "contracting-stemmed." The point series is found throughout the Great Basin and Southwest, and in southern California and northern Baja California. Some sites with projectile point assemblages dominated by Elko series points have ground stone milling tools, slab-lined storage pits, cairn-covered flexed burials (McDonald et al. 1987; McDonald 1992), and possibly split-twig figurines and pictographs (Davis 1981; Davis and Smith 1981).

However, Elko series points usually co-occur with other point types, and have been recovered from sites dating to the early, middle, and late Holocene; they probably do not represent a single, distinct cultural complex. In the southwestern Great Basin, Rogers (1939) classified Elko Corner-notched points as "Amargosa I," and in the Lower Colorado River Valley they are often confused with San Pedro points (cf. Shackley 1996a). Thomas (1981) accepts only the Corner-notched and Eared subtypes as useful temporal markers (these are also discussed in Chapters 5 and 6). Current evidence indicates that Elko Corner-notched points were used on the northern Colorado Plateau and in the eastern Great Basin during the early, middle, and late Holocene, and Elko Eared points were used in the southwestern Great Basin during the late Holocene.

MODELS OF RELATIONSHIPS BETWEEN COMPLEXES

Bryan (1979, 1980, 1988) interprets Fluted Point and Western Stemmed Point complexes as contemporaneous but independent hafting traditions originating in different regions of North America at about the same time, with stemmed points glued into a socketed haft, rather than tied in a split shaft like fluted and unstemmed lanceolate points (Bryan 1980:78; Musil 1988; Willey 1966:52). Bryan agrees with Mason (1962) and Meltzer (1988) that the greatest concentration of fluted points on the continent is east of the Rocky Mountains, in the Eastern Woodlands (see also Chapter 3), and observes that stemmed points are much more common west of the Rockies.

Applying the model of the age-area hypothesis, Bryan (1988) interprets these patterns as indicating that stemmed points originated in the Great Basin, perhaps just as early as fluted points appeared in North America. In support of his argument, he points out that 1) stemmed points have been found at several sites in the Great Basin in contexts radiocarbon dated between 10,700 and 9500 b.p., and in association with extinct Pleistocene faunal remains at Smith Creek Cave, eastern Nevada; 2) stemmed points appeared east of the Rockies prior to 7000 b.p., before the use of fluted points died out; and 3) fluted points have been found at Great Basin sites in contexts radiocarbon dated as late as 7500 b.p., after the use of fluted points had already ended in the Great Plains. (It should be noted, however, that a radiocarbon date of 11,200 b.p. is associated with a Western Stemmed point assemblage at Connely Cave 4B in the northern Great Basin [Willig and Aikens 1988], but the association of Pleistocene faunal remains with artifacts at Smith Creek Cave is equivocal because they occur together on an erosional surface representing an unknown length of time.)

Tuohy (1968) and others have interpreted the coexistence of the two point/hafting traditions as representing specialized adaptations to the exploitation of different resources and environmental niches, with fluted points used in open woodlands and grasslands to fell Pleistocene megafauna, and stemmed points used to hunt smaller animals on the edges of lakes and marshes. Evidence that contradicts this model has been presented by a number of other archaeologists, who assume that a variety of other resources were exploited by the populations using each type of points (see section on Models of the Transition to Archaic Adaptations below). On the other hand, technological studies of fluted and stemmed points from the same sites, and from spatially separate clusters within sites, have identified differences in tool kits, reduction sequences, and flaking techniques, suggesting cultural and/or temporal differences (Willig 1989; Pendleton 1979; Fagan 1988; Wallace and Ridell 1988; Warren and Phagan 1988).

Willig (1988, 1989) has demonstrated clear spatial separations between fluted and stemmed assemblages around relict Pleistocene lake margins in the Great Basin. She also suggests that there may be a temporal segregation of these fluted and stemmed point assemblages, *with the* fluted point assemblages commonly located around lower (older) lake level strands, as Davis noted (1978). Fagan (1988) identified variability in platform preparation techniques between the fluted point and stemmed point assemblages at the Dietz site in Oregon, and Pendelton (1979) recorded distinct differences in both raw material use and reduction sequences in stemmed point assemblages from Nevada.

Some other archaeologists argue that, instead, the Western Stemmed Point complexes gradually evolved from the Fluted Point complexes, and partially overlapped them temporally and spatially (Aikens 1978; Moratto 1984; Willig and Aikens 1988). In a review of the radiocarbon dates available a decade ago, Willig and Aikens (1988) concluded that the earliest Western Stemmed Point complexes most likely postdated, but closely followed, the Clovis occupation in the Far West, and were contemporary with the Folsom complex. On the basis of the sequential pattern of radiocarbon dates, differences in obsidian hydration measurements, and the spatial separation of surface assemblages of fluted and stemmed points in several western basins, they argued that "the typology of early western assemblages could be interpreted as representing a complete temporal continuum of forms, with fluted Clovis grading into fluted and unfluted basally thinned, concave-based, and stemmed and shouldered styles of later Archaic periods" (1988:20).

Basgall and Hall (1991) have noted differences in raw material use between fluted points and stemmed points at Fort Irwin, California, in the Mojave Desert. They further note that fluted points tend to be found as isolates, whereas stemmed points are typically clustered within the confines of sites. Often, there is a greater degree of refinement in the production of fluted points, but not in all cases. They suggest that fluted and stemmed point technologies may have been contemporaneous, with fluted points serving specialized hunting functions away from basecamps, and stemmed points serving more general functions at basecamps (see also Beck and Jones 1993).

Whether or not this evolutionary, specialization scenario is accurate, an important issue in the archaeology of western North America is whether to emphasize similarities or differences among the various early Archaic complexes, thereby implying cultural and adaptive relationships or divergences. Jennings (1956, 1957) lumped the many early Holocene stemmed and notched point complexes in the Great Basin and Southwest under the rubric "early Desert culture." Kelley (1959) extended the concept of Desert cultures throughout western North America. The integrative Desert culture concept was based on the premise of similar adaptive strategies that changed little over many millennia.

Also taking a "lumping" approach, but distinguishing between the Archaic complexes of the Southwest and those of the Great Basin, Irwin-Williams (1967, 1968a, 1973, 1979; Irwin-Williams and Haynes 1970) argued that between about 9000 and 6000 B.C. (uncalibrated; i.e., ca. 11,000-8000 b.p.) there was a continuum of related early Archaic cultures (Lake Mojave/San Dieguito-Ventana complex-Sulphur Spring-Jay) extending from California to northwestern New Mexico, west of the Plains-based late Paleoindian complexes. She also suggested that the Lake Mojave and Silver Lake complexes, rather than being a regional and/or economic variant of the San

Dieguito complex, developed from and overlapped San Dieguito, and continued longer.

Warren (1967) further differentiated between the San Dieguito complex, which apparently did not include milling stones, and the early Desert culture of the Great Basin, which did have them. This criterion would also distinguish San Dieguito from the Sulphur Spring stage of the Cochise culture in southeastern Arizona (Sayles and Antevs 1941; Sayles 1983; Waters 1986b; Dean 1987), the Ventana complex in south-central Arizona (Haury 1950; Huckell and Haynes 1995), and the Jay phase of the Oshara tradition in northwestern New Mexico, all of which had milling stones. Warren argued that San Dieguito ". . . must have derived from the North and represents an older cultural stratum that is present throughout a large part of western North America" (1967:182), and its "desert expression" was a generalized hunting adaptation associated with high stands of early Holocene lakes. From this perspective, he included the Lake Mojave, Death Valley I, and Playa I and II complexes within the San Dieguito complex. Ground stone milling tools have since been found at a San Dieguito-related site occupation at Buena Vista Lake (Fredrickson and Grossman 1977).

Another integrating concept is the "Western Pluvial Lakes Tradition," first defined for the northern and western Great Basin by Bedwell (1970, 1973) and subsequently extended to the rest of the Intermontaine West by Hester (1973), who included many previously-defined stemmed point complexes such as San Dieguito, Lake Mojave, Hascomat, and Fallon. Price and Johnston (1988) included both fluted and stemmed points, and non-lacustrine adaptions, within an expanded Paleoindian/Western Pluvial Lakes tradition that extended throughout western North America, and lasted until about 5500 B.C., when there was a transition to the "Desert Archaic" culture. Here, the Western Pluvial Lake Tradition is considered equivalent to the Western Stemmed Point complexes, which had at least some ground stone milling tools (Willig and Aiken 1988).

Attributing Jay points to the "earliest Archaic," and viewing Bajada points as simply a variety of Pinto points, Matson (1991) cited the evidence from Sudden Shelter and Cowboy Cave as representing a "Pinto point dominated" early Archaic complex on the Colorado Plateau, with notched points appearing subsequently, and overlapping with the use of Pinto points. However, Huckell (1996a) has questioned Matson's assumption that this sequence is representative for the rest of the Southwest, and the new evidence from Dust Devil Cave (Ambler 1996) indicates that bifurcate-stemmed and notched points were contemporaneous on the northern Colorado Plateau during the early Holocene.

Huckell (1996b) summarizes the Archaic prehistory of the Southwest in the framework of four previously defined subregional "models," including 1) the Cochise culture of southeastern Arizona, southwestern New Mexico, and northern Sonora (Sayles and Antevs 1941; Sayles 1983); the Oshara tradition of northwestern New Mexico, southwestern Colorado, southeastern Utah, and northeastern Arizona (Irwin-Williams 1973, 1979); the San Dieguito-Amargosa tradition in western Arizona and northwestern Sonora (Rogers 1966; Warren 1967, 1984); and the Chihuahua tradition in south-central New Mexico and northern Chihuahua (MacNeish and Beckett 1987). While acknowledging the criticisms about the formulation and representativeness that each of these models has received, Huckell suggests that they remain useful for conceptualizing the spatial variability in material culture that emerged across the Southwest during the "Early Archaic period" (which he dates to 7000/6500-3500 B.C.), before regional differences began to blur during the "Middle Archaic period" (3500-1500 B.C. in his chronology).

MODELS OF THE DEVELOPMENT OF ARCHAIC ADAPTATIONS

Whether Southwestern Archaic adaptations developed in situ from Paleoindian adaptations (Haury et al. 1953; Stuart and Gauthier 1981), or developed independently (Sayles and Antevs 1941; Haury et al. 1959; Irwin-Williams 1973, 1979), is not clear. However, the implied contrast between the "Paleoindian" and "Archaic" concepts is problematic when applied to western North America. Simms (1988) points out that use of the term "Archaic" alongside the term "Paleoindian" assumes an economic and lifeway contrast between the two, which recent studies indicate may not be significant. "In order to make them comparable, we must either elevate the status of Paleoindian from a techno-chronological concept to a lifeway/adaptive strategy concept . . . or refer to the Archaic only as a technological category" (Simms 1988:46). There are problems with both options, however.

A Paleoindian subsistence strategy focused on megafauna was ecologically unlikely. Paleoenvironmental evidence indicates that North America west of the Rocky Mountains could never support extensive herds of large grazing mammals (Daugherty 1962; Heizer and Baumhoff 1970). However, the associations of fluted points with the remains of Pleistocene fauna have been documented in the eastern Great Basin (Madsen et al. 1976) and in the Southern Basin and Range Province of the Southwest (see Chapter 3), demonstrating that such animals were present and were hunted opportunistically, at least.

Likewise, the fluctuations in effective moisture during the early Holocene (reflected by intermittent lakes) probably did not allow the highly specialized type of lake-marsh adaptation usually associated with early Archaic populations in the Intermontaine West. Milling stones (once thought to be absent in fluted point complexes, and characteristic of Archaic stemmed point complexes only after 9000-8000 b.p.) are present in both Fluted Point assemblages (Roper 1989; Garcia 1996) and Western Stemmed Point assemblages (Willig 1988; Waters 1986b; Warren et al. 1989; Huckell and Haynes 1994; Wiens 1994).

Although milling stones and fire-cracked rocks are often abundant at early Archaic sites and are absent or rare at Paleoindian sites (see Chapter 7), it is likely that both Fluted Point complexes and Western Stemmed Point complexes were based on more generalized, broad spectrum subsistence strategies than was previously thought, and cannot be distinguished merely by the presence or absence of those artifact types. Indeed, radiocarbon dates indicate that the broad-spectrum "Archaic" adaptation may have been established in western North America as early as 11,200-10,500 b.p. (see above), overlapping the timespan of the Clovis complex. Haury (1983) even raised the possibility that Sulphur Spring stage sites represent a plant gathering and processing component of the Clovis economy, but this hypothesis has been rejected on the basis of better dating of the Sulphur Spring stage (Waters 1986b). Whether or not the early Holocene populations in western North America are divided into "late Paleoindian" and "early Archaic" categories by archaeologists, it seems clear that the development of broad-spectrum adaptations occurred in the context of changing environments during the terminal Pleistocene and early Holocene.

Matson (1991) believes that these early Holocene broad-spectrum adaptations were relatively similar throughout the Southwest. Based on his perception of projectile points being more abundant at high elevation sites and ground stone milling tools more abundant at low elevation sites, he infers a similar subsistence-settlement strategy for early Archaic groups on the Colorado Plateau and in the Southern Basin and Range Province. In each region, he suggests, hunting was the primary activity at higher elevations and gathering of plant foods was the focus at lower elevations, with *Sporobolus* grass seeds (dropseed and Sacaton), tree legume pods (mesquite and others), acorns, cactus fruit, chenopods, amaranth seeds, and sunflower seeds being the most important.

This model does generally apply within each region when tested with the statewide database sample of 104 recorded early Holocene Archaic sites in Arizona (see Chapter 7). But it also applies at a larger scale, indicating different subsistence emphases in each region. Chapter 7 presents data showing that the Lower Colorado River Valley has the highest proportion of early Holocene Archaic sites with ground stone milling tools, followed by the Southern Basin and Range Province and the Colorado Plateau, in that order.

Perhaps this pattern indicates that, contrary to Matson's model, early Archaic adaptations were not rather uniform across the Southwest. The currently available data suggest that, while early Holocene Archaic groups combined hunting and gathering in each region, seed gathering and processing was more important in the Lower Colorado River Valley and Southern Basin and Range Province, while hunting was a more important subsistence activity on the plateau. The apparent differences in material culture and subsistence focus among the early Archaic complexes of the Southwest, such as those represented by the presence or absence of seed milling tools, were probably related to increasing subregional differentiation in climates, landscapes, and resources.

CHAPTER 5

ARCHAIC COMPLEXES OF THE MIDDLE HOLOCENE

The middle Holocene is the great divide in Southwestern prehistory. Very few known sites date to this period, making it the most poorly understood interval in the archaeological record of the region. Of the few identified middle Holocene sites in Arizona, almost all of them are on the Colorado Plateau. Figure 5.1 shows the distribution of recorded Archaic sites in Arizona that can be dated between about 8000 and 4000 b.p. (ca. 6880-2490 B.C.) by the presence of particular projectile point types (e.g., Bajada; Northern, Sudden, and Hawken side-notched; Humboldt Concave-based) or by radiocarbon dates.

It is likely that at least a few other recorded sites in Arizona were occupied during this interval, but they cannot be dated to it with confidence, as they have yielded projectile point types that appeared during the early or middle Holocene and continued into the initial part of the late Holocene. Figure 5.2 shows the distribution of recorded Archaic sites in Arizona with projectile point types (Pinto, San Jose, and Elko series) whose time ranges spanned from at least the middle Holocene into the late Holocene.

There is also no doubt that middle Holocene erosional processes removed at least part of the archaeological record of this interval, thus making the occupation of the Southwest seem even sparser than it really was. But the increasingly well documented climatic and vegetational changes that caused those processes certainly made the Southwest a more difficult place to make a living as a hunter-gatherer, with fewer perennial water sources and less abundant food resources restricted to more localized ranges.

The inescapable inference (and testable hypothesis) is that the virtual withdrawal from the lowlands of the Southwest and the reduced occupation of the highlands was in response to the generally adverse environmental conditions of the middle Holocene Altithermal (see Chapter 2). However, proxy paleoenvironmental records indicate that the Altithermal in the Southwest was more complex than previously believed (Chapter 2), and the identified middle Holocene site occupations may represent Archaic cultures who survived in well-watered refuges on the Colorado Plateau, and in surrounding highland regions, and briefly repopulated the Southwest during episodes of increased effective moisture.

In the Southwest and Great Basin during this period, the use of bifurcate-stemmed points temporally and spatially overlapped with the use of notched points (although certain types do not co-occur, and may represent temporal or cultural differences). The complexes associated with these point types probably represent hunting and gathering strategies adapted to environmental conditions more challenging than those of the early or late Holocene.

Ground stone milling tools, bedrock mortars, rock-filled roasting pits, and slab-lined storage pits continued to be used in the Southwest during the middle Holocene, indicating that processing and storage of plant foods were important subsistence activities. In Arizona, the greater frequency of ground stone milling tools at middle Holocene sites than at early Holocene sites (Chapter 7), as in the Great Basin (Grayson 1993), may indicate that edible seeds became even more important as game animals became increasingly scarce.

BIFURCATE-STEMMED POINT COMPLEXES

The Bajada Phase of the Oshara Tradition

The post-Jay phase of the Oshara tradition of the northern Southwest, as defined by Irwin-Williams (1967), was the Bajada phase. It was characterized by points with long, parallel-sided stems with concave bases (Figure 1.6), other flaked stone tools similar to those of the Jay phase, and rock-filled roasting pits. She referred to unpublished radiocarbon dates that placed the Bajada phase between about 7500 and 6000 b.p. Matson (1991) suggests that the Bajada point is related to the bifurcate-stemmed points of the Pinto complex.

On the central Colorado Plateau in northeastern Arizona, Bajada and San Jose points (which are also considered a variant of Pinto points by many Southwestern archaeologists) have been found separately on the surfaces of several sites on the Defiance Plateau (Banks and Brancard 1994). On the central plateau they have also been found together in shallow deposits at the Hastqin site, northeast of Ganado (Huckell 1977), and at AZ D:11:3063 on Black Mesa (Parry and Smiley 1990). Ground stone milling tools and possible bison remains were found at the Hastqin site, and fire-cracked rocks were found at AZ D:11:3063. Radiocarbon dates from hearths at both of these sites cluster near 8000 b.p.

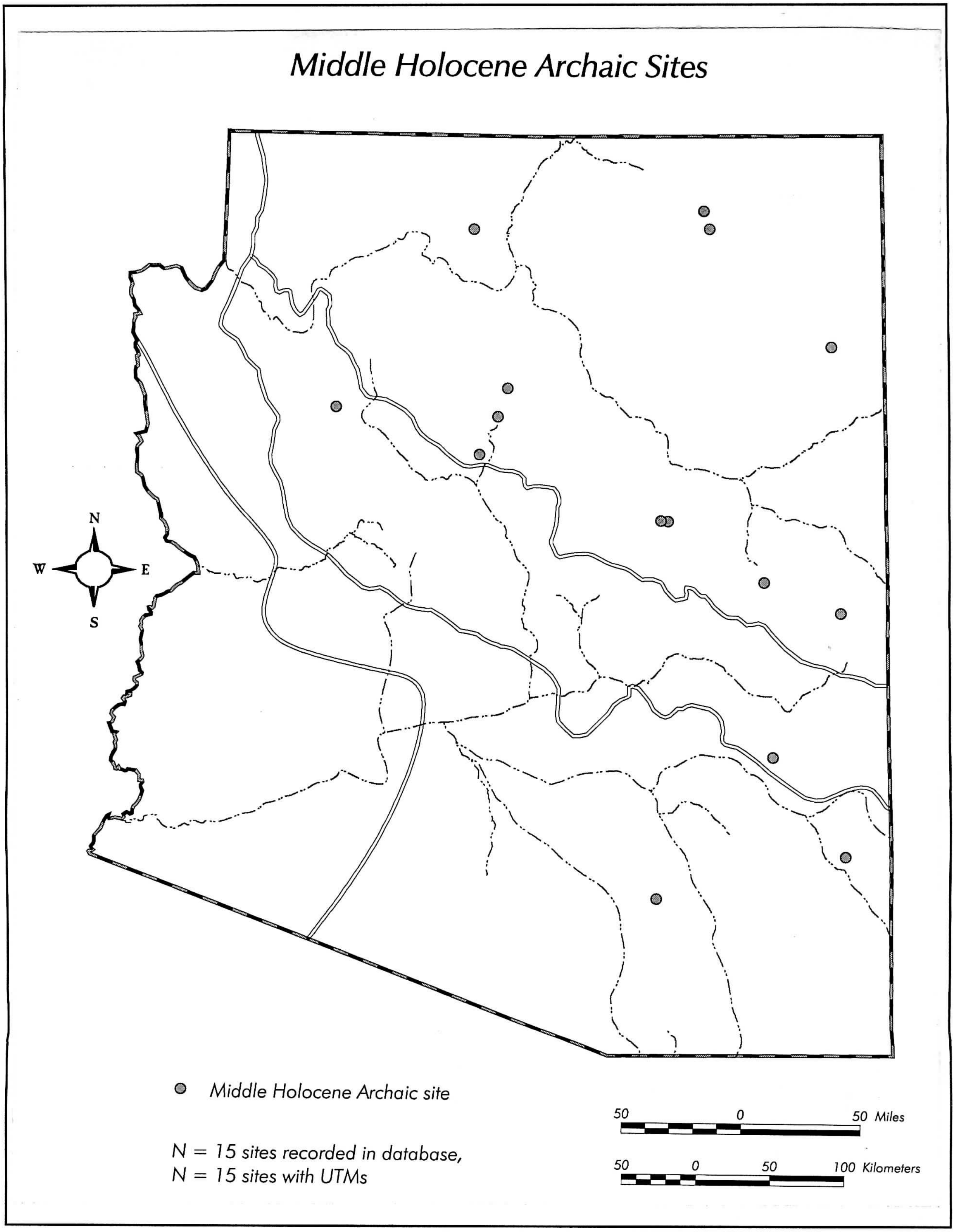

Figure 5.1. Distribution of recorded middle Holocene Archaic site occupations in Arizona (ca. 8000-4000 B.C.).

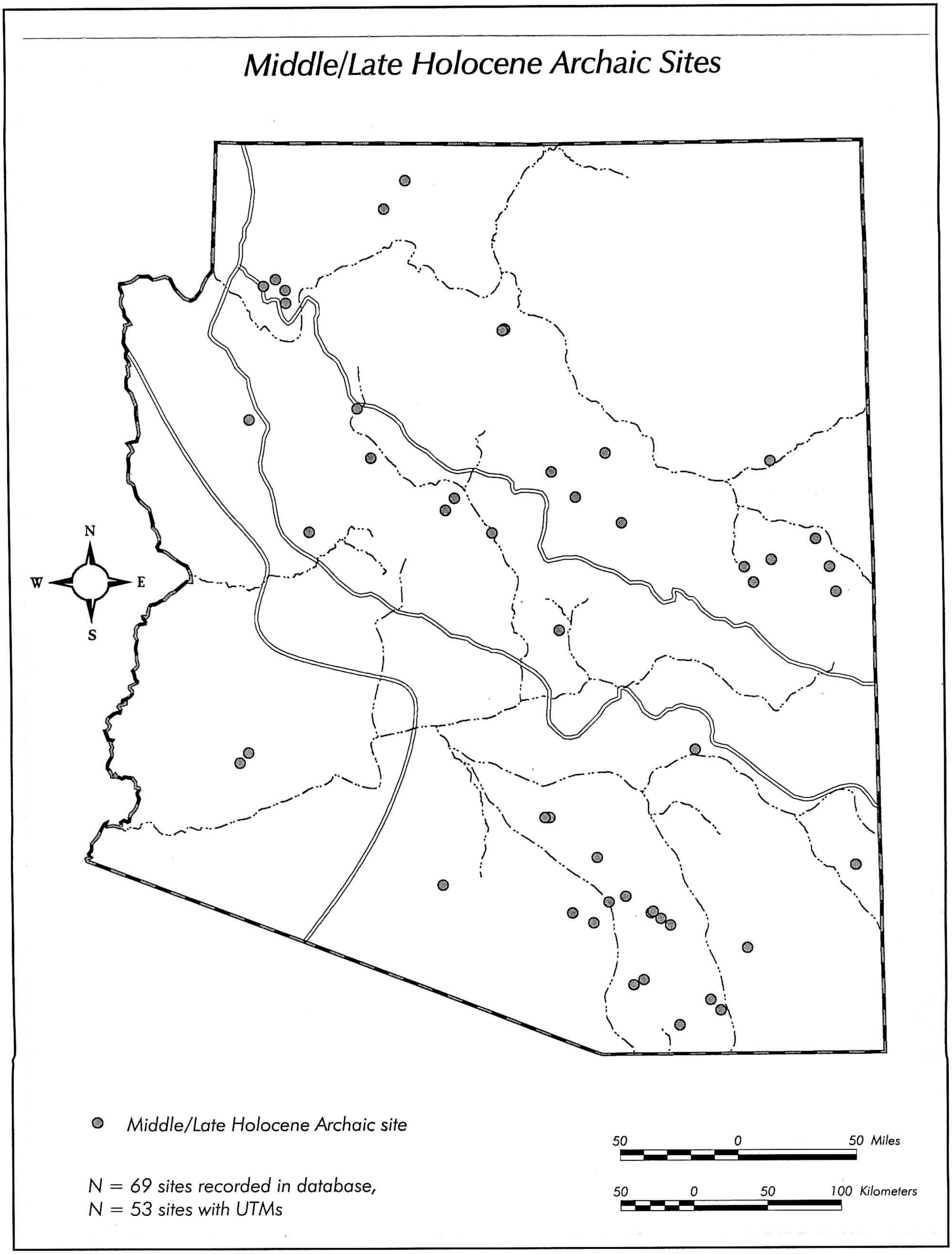

Figure 5.2. Distribution of recorded middle/late Holocene Archaic site occupations in Arizona (ca. 8000-1000 B.C.).

In the Mountain Transition Zone, a Bajada point was also found during recent test excavations in McEuen Cave, in the Gila Mountains of southeastern Arizona (Steven Shackley, personal communication 1997). Currently, this is the southernmost known Bajada point in Arizona. The westernmost Bajada points have been found at sites in the Mountain Transition Zone southwest of Flagstaff (Ryan 1993; Brown 1993b). Unlike the distribution of sites with Pinto points, which occur at all elevations of the Southwest, almost all of the known sites with Bajada points are located above 6,000 ft in elevation (see Chapter 7).

The Early San Jose Complex

At least two varieties of the San Jose point, the diagnostic artifact of the "San Jose Complex" defined in northwestern New Mexico by Bryan and Toulouse (1943), have been identified: a Pinto-like form with a straight stem with a bifurcated or concave base (Figure 1.6); and a shorter form with a concave-based, expanding stem (Figure 1.6). Both forms often have serrated blades, and sometimes have been resharpened to much shorter than their original lengths. In the San Juan Basin of northwestern New Mexico, San Jose points of the first type were found in association with hearths that yielded radiocarbon dates between about 5900 and 4000 b.p. (Del Bene and Ford 1982). Points of the second type were found at the Buried Dune site near the Picacho Reservoir in central Arizona in deposits radiocarbon dated between about 4300 and 4000 b.p. (where they were called "Pinto/San Jose") (Bayham et al. 1986), and in a stratum dated between 3600 and 3400 b.p. in Arroyo En Medio Shelter in northwestern New Mexico (Irwin-Williams and Tompkins 1968).

Many Southwestern archaeologists lump Pinto and San Jose points together because of general resemblances. However, Steven Shackley (personal communication 1997) argues that: 1) few points in Arizona would be considered Pinto by most Great Basin archaeologists; 2) San Jose points found in Arizona and western New Mexico exhibit uniformly narrower and thinner haft elements and blades than Pinto points; and 3) while a San Jose point could be produced from a Pinto point by resharpening and reshaping, a Pinto point could not be produced from a San Jose point.

Most reports of San Jose points are from the Colorado Plateau, but Huckell (1996a, 1996c) identifies San Jose points from every part of the Southwest except the Lower Colorado River Valley, and raises the possibility that they were contemporaneous with side-notched Chiricahua points and concave-based Cortaro points in south-central Arizona. Here it is suggested that the first type of San Jose point represents a late middle Holocene variant of Great Basin Pinto points, and the second type dates to the early part of the late Holocene and represents a more distinctively Southwestern complex (see Chapter 6).

NOTCHED POINT COMPLEXES

The Desha Complex

At Sand Dune Cave in southeastern Utah on the northern Colorado Plateau, Pinto points and crude, shallowly notched "Sand Dune Side-notched" points were found with a semi-flexed burial in a level dated between about 7700 and 7200 b.p., and attributed to the "Desha complex" (Lindsay et al. 1968; Geib and Ambler 1991). The co-occurrences of these point types suggest that the Desha complex was related to contemporaneous complexes of the eastern Great Basin.

Among the identified traits of this complex is an open-twined type of sandal (which was the dated type of material at Sand Dune Cave). Another sandal of this type was recovered from pothole backdirt at Old Man Cave, on Cedar Mesa in southeastern Utah, and was radiocarbon dated to about 7400 b.p. (Geib and Davidson 1994). Geib (1995) reports direct radiocarbon dates between 7600 and 5900 b.p. on fragments of open-twined sandals from four other sites on the central Colorado Plateau.

In addition to Sand Dune Side-notched points, Pinto points, and open-twined sandals, the complex included both slab and deep-basin metates, handstones, pigment slabs, worked bones, polishing stones, and slab-lined pits (Lindsay et al. 1968; Ambler 1996). Other items made of perishable materials included closely coiled, one-rod-foundation basketry typical of the eastern Great Basin, and coiled baskets made by the two-rod-and-bundle foundation method, which became the most common technique on the Central Plateau in Basketmaker II time (Adovasio 1971).

Other Side-Notched Point Complexes

In deposits overlying the Desha levels in Dust Devil Cave, and dated to about 7000-6500 b.p., were found plain-weave sandals and Sand Dune Side-notched, Elko Side-notched, and Elko Corner-notched points. The "Glen Canyon complex" is suggested for this post-Desha assemblage (Ambler 1996).

Based on comparisons of radiocarbon-dated contexts, Holmer (1986) proposed that Elko Corner-notched points had three floruits in the eastern Great Basin (8000-6200 b.p., 5000-3400 b.p., and 1800-1000 b.p.), and one floruit in the western Great Basin (3300-1300 b.p.). We now know that Elko series points appeared in the southwestern Great Basin as early as 9500 b.p. (with Pinto points) (Schroth 1994). On the northern Colorado Plateau, Elko Corner-notched and Elko Side-notched points occurred in strata radiocarbon dated between about 8800 and 7300 b.p. at Dust Devil Cave (with Northern Side-notched and Pinto points) (Ambler 1996), between 7200 and 6300 b.p. at Cowboy Cave (with Northern Side-notched points) (Holmer 1980b), and between 6700 and 6300 b.p. at Sudden Shelter (with Humboldt Concave-based and Hawken Side-notched points, and above the lowest two strata containing only Pinto points) (Holmer 1980a). Thus, while Elko Corner-notched points appeared in the southwestern Great Basin and on the northern Colorado Plateau during the early Holocene, their first major floruit in the eastern Great Basin occurred during the middle Holocene.

In Arizona, Elko Corner-notched points have been found at several sites on the western Colorado Plateau. They also occur in the Lower Colorado River Valley at the Apothecary site (Bostwick 1988) and the White Tanks site (Shackley 1996a), in the Mountain Transition Zone in the Big Chino Valley (Ryan 1993), and at McEuen Cave (Steven Shackley, personal communication 1997), and in the Southern Basin and Range Province in the northern Santa Rita Mountains (Huckell 1984a), and in the Tucson Basin (Douglas and Craig 1986; Steere 1987; Chavarria 1996; although they were misidentified as Chiricahua points in these Tucson Basin site reports).

Sites with Northern Side-notched points, which appeared during the early Holocene, are treated here as representing a largely middle Holocene complex because "Sites in the northern Great Basin. . . show that the period from about 7000 to 6500 b.p. marks the greatest use of the Northern Side-notched points" (Holmer 1980b:36).

Comparing their radiocarbon-dated contexts in the Great Basin, Holmer (1986) suggests that the Northern Side-notched type was replaced at about 6400 b.p. by the Sudden and Hawken side-notched types, which were in turn replaced by the San Rafael Side-notched type at about 4400 b.p. (and which went out of use about 3500 b.p.). He also notes that, if the side-notched point types with notches high enough on the sides to leave a straight edge below the notch are grouped together (Northern, Sudden, San Rafael, Hawken), they all date between about 7500 and 3500 b.p. (8700-3500 b.p. on the northern Colorado Plateau). On the other hand, if the side-notched types with the notches so low that the portion below forms a point with the base are grouped together, then it can be seen that they are all the same as Elko Side-notched, and have the same time range as Elko Corner-notched (Holmer 1986).

While the Northern Side-notched type is found in all parts of the Intermontaine West except the southwestern Great Basin, the distribution of the Sudden Side-notched type is limited to the southern Great Basin and northern Colorado Plateau. San Rafael Side-notched points occur throughout the Intermontaine West and the northern Rocky Mountains. In Arizona, Northern, Sudden, and Hawken side-notched points have been found mostly on the western Colorado Plateau, but Northern and Sudden side-notched points have also been found in the Southern Basin and Range Province, in the Tucson Basin (Chavarria 1996), and in the San Simon Valley (Carlson et al. 1989). Ground stone milling tools and fire-cracked rocks were also found at these southern sites. San Rafael Side-notched points have been found in Arizona on the central and western Colorado Plateau (Moffitt et al. 1978; Parry et al. 1994).

In the southern Southwest, the earliest side-notched dart point type is the Chiricahua point, with a concave base and an expanding stem often wider than the blade. In Arizona, they have been found mostly in the Southern Basin and Range Province, but examples are also known from the Mountain Transition Zone and the Colorado Plateau. Very few associated dates are available, but Chiricahua points have been found in deposits dated between about 4800 and 3900 b.p. at sites in southern Arizona (Huckell 1996a, 1996c). Therefore, the Chiricahua stage of the Cochise culture is described in Chapter 6, along with other late Holocene Archaic complexes.

MODELS OF RELATIONSHIPS BETWEEN COMPLEXES

Due to the relative paucity of Southwestern archaeological sites known to date to this period, particularly in Arizona, very few interpretations of possible relationships among middle Holocene complexes have been offered. However, the models that have been proposed have emphasized the continuum of similar projectile point forms, the temporal overlapping of complexes, and the continuity in perishable types of material culture.

Irwin-Williams (1979) noted the resemblance of Silver Lake points with "Ventana-Amargosa I" points in the Red Sand at Ventana Cave, and estimates a middle Holocene age for these types. Matson (1991), on the other hand, compares the Red Sand assemblage to those of the San Dieguito complex and the Jay phase of the early-mid Holocene. Morris (1987) considers Bajada points as related to Amargosa points of the southwestern Great Basin and McKean points of the Northern Plains and Rocky Mountains.

Looking at the perishable materials independently, Adovasio (1971) relates the Desha complex textiles to those of the eastern Great Basin. Geib (1996) reports finds of Desha-type sandals that date to late Holocene as well as the middle Holocene, indicating some cultural continuity on the northern Colorado Plateau.

At sites in Arizona, Bajada points co-occur with San Jose points, and Northern Side-notched points co-occur with Pinto and Elko series points. The nonassociation of Bajada and Northern Side-notched points within the same regions, and their possible associations with San Jose and Pinto points, respectively, may represent temporal differences or culturally-distinct groups (or both; i.e., an earlier Northern Side-notched/Pinto/Elko complex centered in the Great Basin and extending onto the northern and western Colorado Plateau and into the Southern Basin and Range Province, and a temporally overlapping Bajada/early San Jose complex centered on the eastern and southern Colorado Plateau, also extending into the Southern Basin and Range Province).

MODELS OF CULTURAL RESPONSES TO MIDDLE HOLOCENE ENVIRONMENTAL CHANGES

Models of the middle Holocene cultural occupation of western North America have tended to assume either 1) a widespread hiatus; 2) continuity; or 3) aggregation in the remaining well-watered zones, particularly highland regions. Today, debate continues among adherents to each of these models. The truth probably lies in their individual applicability to different regions and subregions, but processual links between environmental changes and cultural responses need to be established.

Antevs (1948) speculated that the Great Basin was largely abandoned during the Altithermal interval, a position supported by Baumhoff and Heizer's (1965) later review of the available archaeological evidence. In more recent reviews, Madsen (1982), Aikens (1983), and Grayson (1993) each concluded that, while cultural materials dated to the middle Holocene are indeed scarce in the southern and western Great Basin, populations aggregated in the best-watered, most resource-dense zones in the northern Great Basin, and that some caves and rockshelters in the vicinities of lakes and marshes in the eastern Great Basin were reoccupied continuously from the early to late Holocene. Grayson (1993) observes that ground stone milling tools are much more common at these middle Holocene sites than at early Holocene sites, and attributes this to a shift toward edible seeds after the loss of shallow water habitats and the demise of Western Stemmed Point adaptations that emphasized hunting.

Wallace (1962) and Kowta (1969) both identified a break in the occupation of the Mojave and Colorado deserts in southeastern California between 8000/7000 and 5000/4500 b.p. Wallace (1962) and others have suggested that the Pinto complex correlates with the onset of a wet cycle between about 5000/4500 and 2000 b.p., while Warren (1980, 1984) and others argue for correlation with an earlier wet cycle between about 6500 and 5500 b.p. Warren (1984) postulates that the Pinto complex evolved about 7000 b.p. from the Lake Mojave hunting adaptation as late Pleistocene lakes and rivers dried up, and that it represents a hunting and gathering adaptation lacking a well-developed milling technology. With the return of moister conditions about 6500 b.p., the Pinto peoples reoccupied much of the southern Great Basin, and then withdrew to the desert margins and oases when arid conditions returned about 5500 b.p.

The environmental and archaeological records of the southern High Plains indicate that population was greatly reduced under generally arid conditions (Johnson and Holliday 1986; Holliday 1989), and that wells were dug in the few remaining locales that had high water tables (Evans 1951; Green 1962; Meltzer and Collins 1987). In the central and northern Plains, the hiatus proposed on the basis of a dearth of dated archaeological sites between 7500 and 4500 b.p. (Mulloy 1953, 1958; Wedel 1961) was challenged by a model postulating that 1) Altithermal age sites could have been eroded or buried by geological processes; 2) certain projectile point types dating to the Altithermal may not be recognized; and 3) short grasses, the preferred forage of bison, expanded rather than contracted during the Altithermal (Reeves 1973). However, the first and third arguments are contradicted by data from subsequent large-scale surveys indicating an occupational gap, and historical studies of the significant effects of drought on short-grass prairies (Sheehan 1994).

Several archaeologists have independently recognized middle Holocene settlement shifts to higher elevations on the margins of the plains (Hurt 1966; Frison 1975; Benedict and Olson 1978; Benedict 1979; but see Bender and Wright 1988). Sheehan (1994) identifies a strong correlation between early Archaic site locations and aquifer-supplied springs and streams throughout the Great Plains during the middle Holocene, compared to a low correlation for Paleoindian sites, and interprets this pattern as representing "a cultural response to Altithermal conditions that altered the structure of predictable surface water supplies" (Sheehan 1994:133-134).

Middle Holocene Archaic archaeological patterns may represent the culmination of a trend of decreasing occcupation of the Southwest that began during the early Holocene. Irwin-Williams and Haynes (1970) noted that Folsom points are not found west of the central Colorado Plateau in Arizona, while Agate Basin and Cody points are rarely found west of western New Mexico, and points of the terminal Paleoindian complexes such as Frederick are found only in regions east of the Rio Grande Valley. They attributed these patterns to a progressive eastward contraction of big-game hunting adaptations in response to decreasing effective moisture during the early Holocene. Today, while a few Plainview or Plainview-like points are known from the Southern Basin and Range Province, and single examples of Plainview, Agate Basin, and Cody points are reported from the western Colorado Plateau (Chapter 3), the majority of known late Paleoindian projectile points in Arizona are located on the central and southern parts of the Colorado Plateau.

They also noted that the period 7500-5500/5000 b.p. is "the least well known of all periods in the prehistory of the Southwest" (Irwin-Williams and Haynes 1970:66), with reliable evidence from this period being rare, particularly in the southern Southwest. In southeastern Arizona, one of the most intensively investigated areas of the Southwest, they found no completely acceptable evidence of the Cochise culture dating between 7500 and 5500 b.p. [a gap in the archaeological record supported by subsequent demonstration of a hiatus in the sequences at type-sites in Whitewater Draw (Waters 1986b)]. As an interpretation of this significant reduction in the population of most of the Southwest during the middle Holocene, Irwin-Williams and Haynes suggested that people abandoned the desertified areas, and aggregated in remnant optimal zones:

> It is possible that in marginal areas the human population became increasingly concentrated around the principal remaining resources, leaving large areas subject to only marginal or temporary occupation (1970:67).

Irwin-Williams (1968a, 1973, 1979) did not believe that there was a complete abandonment of the Southwest and southeastern California during the Altithermal. She suggested that, in the west, the Lake Mojave-Silver Lake traditions were replaced by La Jolla and other ground stone using cultures (Encinitas tradition) by 9000 b.p., while to the east they evolved directly into the "similar and derivative" Pinto Basin culture by about 6000-5000 b.p. (Irwin-Williams 1968a:50). She further suggested that the "Ventana-Amargosa I" projectile points from the Red Sand layer in Ventana Cave, which she relates to Silver Lake points, represent this transition. The discontinuity in the Cochise sequence of the southern Southwest between about 6500 and 5500 b.p. was apparently not paralleled in northwestern New Mexico, which Irwin-Williams postulated as a refuge during the arid Altithermal period of Antevs (1955). She envisioned that the Jay phase "lies at the base of an unbroken sequence of development" on the Colorado Plateau in the northern Southwest, which culminated in the early Anasazi culture.

Matson (1991), however, points out that Irwin-Williams never provided references for the source of her dates for the Jay and Bajada phases, which she placed between 7500-6800 b.p. and 6800-5200 b.p., respectively. Recent reviews of published radiocarbon dates indicate that there were only a few occupations in rockshelters and dune fields on the Colorado Plateau that are radiocarbon-dated between about 7000 and 4000 b.p.

Berry and Berry (1986) identified three successive occupations, separated by regional abandonments, in the radiocarbon record of the Archaic of the Colorado Plateau. These abandonments occurred during the early-to-middle and middle-to-late Archaic transitions. The absence of archaeological radiocarbon dates between about 6000 and 5000 b.p. on the northern and southern Colorado Plateau (Schroedl 1976; Berry and Berry 1986) was interpreted as representing a complete abandonment of the region by Early Archaic peoples. The Berrys attributed this abandonment to the warming and drying of the climate during the Altithermal, and suggested that the population of the plateau withdrew to more favorable environments—such as the Rocky Mountains, as Benedict (1979) proposed, and also the eastern Great Basin, where lakes and marshes persisted.

Geib (1995, 1996) has summarized the currently available radiocarbon dates from the central and northern Colorado Plateau. While there are significantly fewer radiocarbon dates for the interval between about 6000 and 4000 b.p., and stratified rockshelter sequences indicate breaks in occupation or more sporadic use, the region was not completely abandoned. Rather, in response to middle Holocene environmental changes, there may have been changes in behavior that decreased the visibility of the archaeological record of this interval. He suggests that, where hunter-gatherers were tethered to riverine "linear oases," they had the option to move camps frequently in adaptation to lower return rates for foraging, without worrying about finding water. This increased residential mobility, along with longer intervals between site occupations and expansion of foraging territories, would have resulted in more diffuse, less visible archaeological traces than earlier and later Archaic material records (Geib 1996).

The current Southwestern paleoenvironmental and archaeological evidence supports a model of general abandonment of lower elevations and only limited and sporadic occupation of the wetter plateaus and mountains in response to decreasing effective moisture and related biotic changes. Geological processes have removed or obscured at least a portion of the middle Holocene archaeological record in many settings, particularly alluvial ones, and "absence of evidence is not evidence of absence" in those locations (Bruce Huckell, personal communication 1997). However, all of the investigated cave and dune sequences with middle Holocene deposits exhibit either breaks in cultural occupations or evidence of less frequent occupations.

The trends in Arizona and the rest of the Southwest of decreasing occupation, concentration of remnant populations at higher elevations and along floodplains of perennial rivers, and increasing reliance on seed gathering and processing appear to be adaptive adjustments to Altithermal conditions. Nevertheless, our models of cultural responses to middle Holocene environmental changes need to be more sophisticated than simple environmental determinism. The correlation of cultural changes to climatic ones is largely based on general "synchroneity" between the two, which may not mean a causal connection. As Hassan (1984) argues, a processual link must be established, and a culture should not be viewed as passively "adaptive," but as an autonomous entity with inertia, internal vitality, and selectivity.

CHAPTER 6

ARCHAIC COMPLEXES OF THE LATE HOLOCENE

Between about 4500 and 2500 b.p. (ca. 6300-600 B.C.), the initial part of the late Holocene, the number of site occupations throughout the Southwest jumped significantly. This proliferation following the middle Holocene decrease has been attributed to a variety of causes, including immigrations (Berry and Berry 1986; Matson 1991), indigenous population growth (Wills 1988), and changes in settlement-subsistence strategies that resulted in increased archaeological visibility (Geib 1996). In all likelihood, the increase in identified occupations represents a combination of these, while the trash middens, pit structures, and burials documented at several sites in Arizona dating to this interval reflect decreasing residential mobility in resource-rich locations (Chapter 7).

These trends represent adaptive responses to an increase in effective moisture across the Southwest that is well represented by geological and biological proxy records of environmental change (Chapter 2). In addition to the increasing abundance and reliability of water sources, the critical environmental changes for human populations were a spreading of pinyon pine woodlands on the Colorado Plateau, an increase in large game populations in the Mountain Transition Zone, and an expansion of grasslands in the Southern Basin and Range Province. The return of bison to the southern Southwest also may have been significant for some Archaic groups. Following a brief return to dry conditions, effective moisture was relatively high again between about 2500 and 1000 b.p., with another dry episode near 1500 b.p.

A variety of new dart point types were used in the Southwest between about 5000 and 1000 b.p. (e.g., Gypsum, Amargosa, late San Jose, Elko Eared, San Rafael Side-notched, McKean Lanceolate, Cortaro, Chiricahua, Armijo). Figure 6.1 shows the distributions of recorded Archaic sites in Arizona that date to that interval according to the presence of these projectile point types and/or radiocarbon dates.

During this timespan, the geographic range of contracting stem points (Gypsum, Augustín, Pelona) overlapped with those of 1) bifurcate-stemmed points (late Pinto series, Gatecliff Split-stem, Elko Eared), 2) various side-notched point types (San Rafael, Chiricahua); 3) points with expanding stems, concave bases, and serrated blades (late San Jose, Armijo); and 4) points with lanceolate to triangular blades and concave bases (Pinto Shoulderless, McKean Lanceolate, Cortaro) (Holmer 1986; Matson 1991; Huckell 1993).

These broad classes of projectile points often co-occur at sites dating to this interval, but some large-scale patterns in their distributions can be identified. Bifurcate-stemmed, side-notched, and concave-based lanceolate points in use throughout the Great Basin during the middle Holocene apparently extended into the Southwest only during brief wetter episodes that punctuated the Altithermal (see Chapter 5), and during the moist interval at the beginning of the late Holocene. During that later interval, the uses of points with contracting stems (e.g., Gypsum) and points with expanding stems, concave bases, and serrated blades (late San Jose, Armijo) did not extend north of the Colorado Plateau (Holmer 1986; Huckell 1993b), and the use of short, concave-based triangular points (Cortaro) did not extend north of the Southern Basin and Range Province (Huckell 1993b). These larger patterns suggest that the post-Altithermal repopulation of the Southwest, represented by the widespread and overlapping complexes described in this chapter, derived from both northern and southern refuges.

Through either migration or diffusion, agriculture also arrived from Mexico sometime during the first few centuries of the late Holocene. Direct radiocarbon dates indicate that maize may have been introduced to the Southwest by 4000 b.p. (ca. 2500 B.C.). But the transition to adaptations focusing on agriculture did not occur until between 3400 and 2800 b.p. (ca. 1700-900 B.C.), when the first farming settlements were established in the Southern Basin and Range Province, on the Colorado Plateau, and in the northern Rio Grande Valley (cf. reviews of radiocarbon dates in Mabry 1998a, 1998c). In addition to multiple pit structures, these Early Agricultural sites commonly have numerous storage pits, and some have trash middens and formal burial areas indicating longer occupations. The presence of house groups, communal structures, and possible plazas at some large Early Agricultural settlements in the Southern Basin and Range Province represents the development of community spatial structures and levels of social

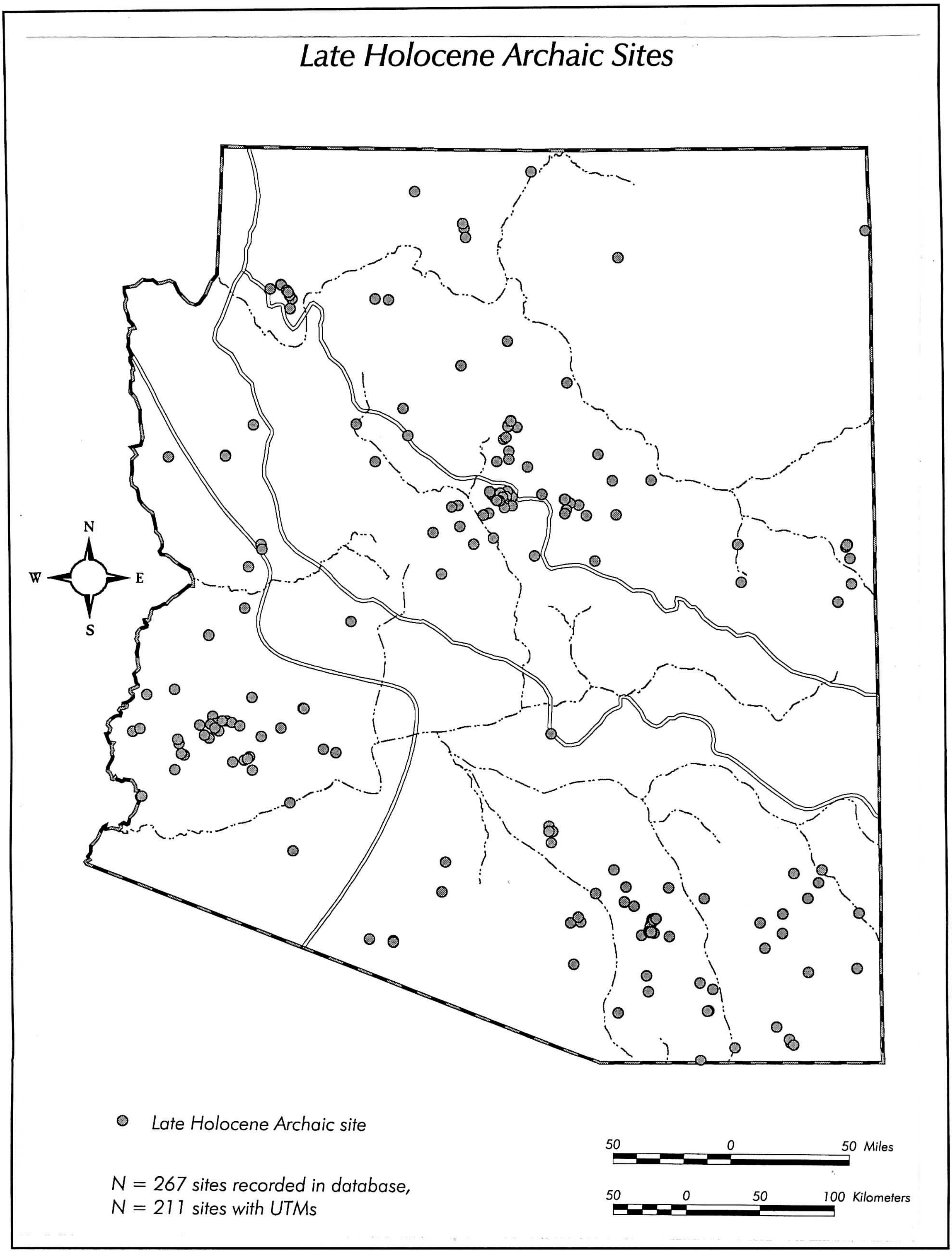

Figure 6.1. Distribution of recorded late Holocene Archaic site occupations in Arizona (ca. 5000-1000 B.C.).

integration above the family household (Mabry 1998c).

While many archaeologists still refer to the San Pedro phase (ca. 3500/3100-2600 b.p.; 1800/1400-800 B.C.) and Cienega phase (ca. 2600-2000/1950 b.p.; 800 B.C.-A.D. 1/50, the early first century A.D.), of the Southern Basin and Range Province as comprising the "Late Archaic period" in the region, their counterparts on the Colorado Plateau during this interval—the Basketmaker II and En Medio phases—are not commonly considered to be Archaic. Here they are treated as cultural complexes representing Early Agricultural adaptations, and therefore their histories of investigation, type sites, and material culture traits are not summarized (although the known distributions of their sites in Arizona are shown in Figure 6.2).

Concurrent with the spread of agriculture, similar types of large, side- to corner-notched points with expanding stems and straight to convex bases (San Pedro, Basketmaker, Amargosa, late Elko Corner-notched) appeared in those regions and in the western Great Basin. The appearance of small, corner-notched points (Cienega, En Medio, Rose Springs, Eastgate) in the Southwest and the southwestern Great Basin between about 2600 and 2300 b.p. (ca. 800-400 B.C.) represents the introduction of the bow-and-arrow into these regions (Shackley 1996a; Sliva 1998). These large side-notched and small corner-notched point types were in simultaneous use between about 2600 and 1500 b.p.

Figure 6.2 shows the distribution of recorded Early Agricultural sites in Arizona (i.e., with these projectile point types and/or cultigen remains present, and with UTM coordinates available). However, the map shows only about half of the total number of Early Agricultural sites in the statewide database; most of those not shown are Basketmaker II sites on the Colorado Plateau that do not have UTM coordinates calculated.

Together, the transition to agricultural dependence, the establishment of the first settlements, the introduction of the bow-and-arrow, and the beginning of pottery use across most of the Southwest by about 1500 b.p. (ca. A.D. 600) mark the end of Archaic adaptations and the beginnings of farming village lifeways. Hunter-gatherers did not completely disappear in the Southwest with the general transition to agricultural economies, however. Their mobile lifeways continued, but in interaction with farming village cultures. In the most arid and the most mountainous parts of the Southwest, these modified types of hunter-gatherer adaptations survived until the mid-nineteenth century (see the section on The Last Hunter-gatherers below).

THE GYPSUM POINT COMPLEX

Perhaps the best marker of the beginning of this Late Holocene "explosion" in the number of sites in the Southwest is the dart point type with a short, contracting stem. Known variously as Gypsum Cave, Augustín, and Pelona in the Southwest, and Elko Contracting Stem and Gatecliff Contracting Stem in the southern Great Basin, this point type (referred to as the "Gypsum" point here) appeared between about 4500 and 4000 b.p. in the lower Rio Grande Valley in Texas (Marmaduke 1978), the Southwest (Berry and Berry 1986), and the eastern Great Basin (Holmer 1986).

Based on the residues found on a large proportion of them, it has been suggested that Gypsum points were glued to the haft with an adhesive such as pine pitch, representing a new hafting tradition that apparently originated south of the other North American hafting traditions, probably in Mesoamerica (Holmer 1986). Chronological evidence of the use of this technique earlier in the middle Colorado River drainage than in the Great Basin is cited by Holmer (1986) and Marmaduke (1978). Berry and Berry (1986) note the earlier appearance of similar shaped points in central Mexico. However, pitch was also used as an adhesive on much earlier San Dieguito points (Ezell 1977).

The presence of Gypsum points correlates with the presence of bighorn sheep bones in Sudden Shelter and Cowboy Cave on the northern Colorado Plateau (Holmer 1980a, 1980b), and with the presence of split-twig figurines of artiodactyls in rockshelters containing shrines on the Colorado Plateau and in the southwestern Great Basin (see below). Split-twig figurines also resemble artiodactyl forms in Glen Canyon Style 5 petroglyphs on the Colorado Plateau (Turner 1971), also called the Glen Canyon Linear style (Schaafsma 1980). These correlations raise the possibility that Gypsum points represent a specialized hafting technology developed for hunting artiodactyls.

Based on the known distribution and time range of the contracting stem point type, it appears that this hafting technique did not spread farther north or east into the continent, and went out of use by 3000 b.p. in the Southwest (Berry and Berry 1986; Huckell 1996a), by 2000 b.p. in the southwestern Great Basin (Geib and Keller 1987; R. G. Matson, personal communication 1997), and by 1500 b.p. in the eastern Great Basin (Holmer 1978).

Rogers (1939) defined his "Pinto-Gypsum Complex" based on surface assemblages at sites in the central Mojave Desert. His linking of Gypsum and Pinto points was in contradiction with the reputed association of Gypsum points with the dung of

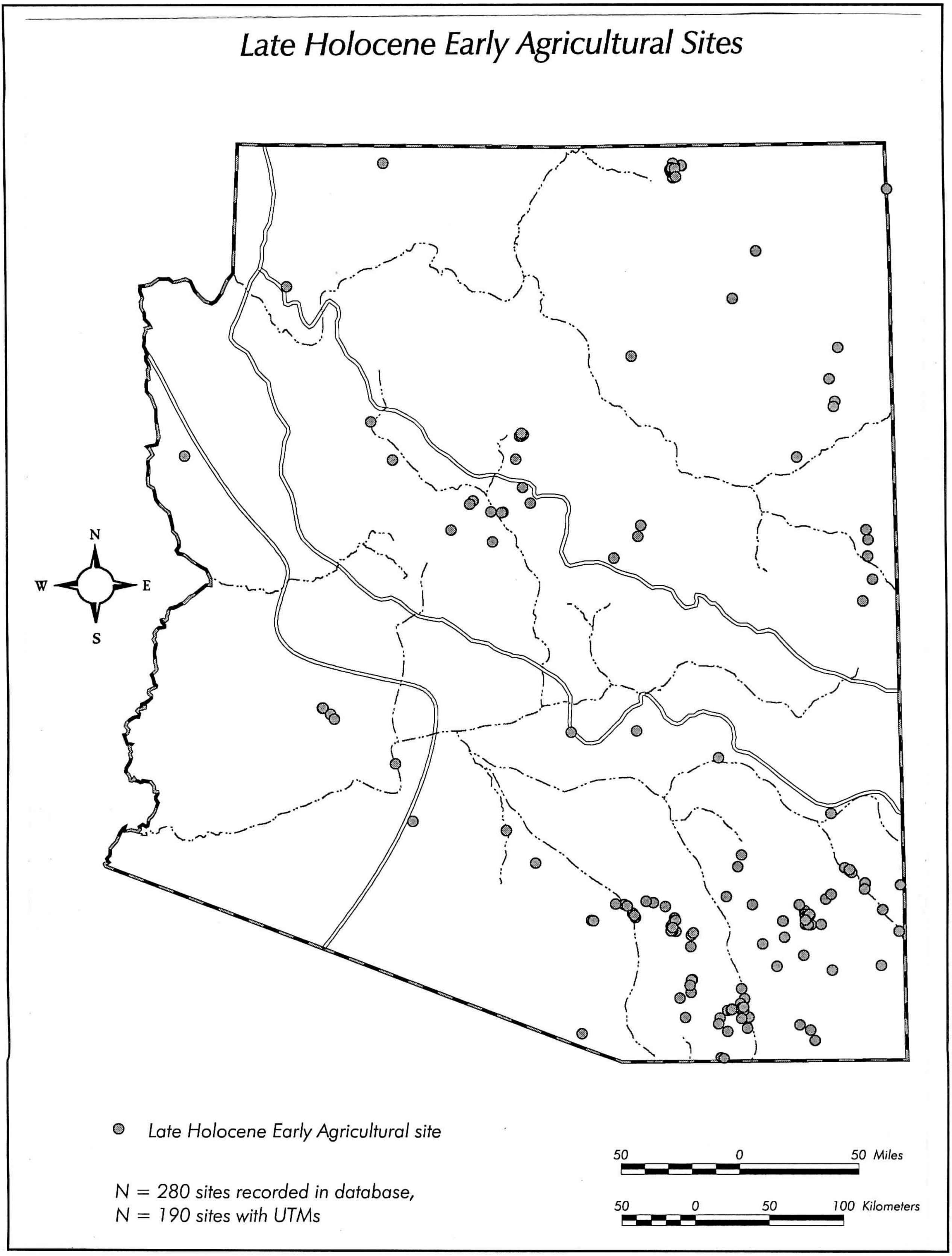

Figure 6.2. Distribution of recorded late Holocene Agricultural site occupations in Arizona (ca. 3500-1500 B.C.).

extinct sloths at Gypsum Cave, in the northeast Mohave Desert in southern Nevada (Harrington 1933). Later radiocarbon dating of a dart shaft and wooden sticks from Gypsum Cave to about 2900 and 2400 b.p., respectively (Heizer and Berger 1970), confirmed Rogers' chronological placement of the Gypsum point after the Playa Industry (his term for the Lake Mojave complex).

Of Rogers' 28 Pinto-Gypsum sites, however, some yielded both point types, some yielded only Gypsum points, and some yielded only Pinto points. These patterns imply temporal differences between the point types, but with some interval of overlap. This difference in their temporal spans is confirmed at O'Malley Cave in southeastern Nevada (Fowler et al. 1973) and at Sudden Shelter in central Utah (Jennings et al. 1980; Holmer 1980a), where Pinto and Gypsum points originated in different strata, with Pinto points appearing first.

Split-twig Figurines

Since the early 1930s, "split-twig figurines" constructed of single, split branches of willow or squawbush bent into the shapes of artiodactyls (deer, pronghorn antelope, bighorn sheep) have been found in caves on the western and northern Colorado Plateau and in the Mojave Desert (Wheeler 1939; Farmer and deSaussure 1955; Schwartz et al. 1958; Euler and Olson 1965; Kelly 1966; Olson 1966; Fowler 1973; Schroedl 1977b; Janetski 1980; Davis and Smith 1981; Geib and Keller 1987; Emslie et al. 1987, 1997; Jett 1987). This "figurine complex" seems to have originated in the Grand Canyon, because this is where the earliest examples and the largest number have been found (Schroedl 1977b).

In several caves in the Grand Canyon, split-twig figurines—sometimes "speared" with cottonwood twigs and carefully placed in caches—have been found in association with cairns built of indurated, Pleistocene-age packrat middens or fossilized dung of extinct mountain goat (Emslie et al. 1995). Based on this association, and the relative inaccessibility of the caves, the figurines have generally been interpreted as "magico-religious objects" used in hunting rituals conducted during special pilgrimages to the caves (Schroedl 1977b; Emslie et al. 1995). The fossilized dung of extinct artiodactyls preserved in these caves was probably recognized as being from animals no longer living in the region, giving it some symbolic significance (Emslie et al. 1987). This interpretation also accounts for the association of split-twig figurines with fossilized dung of extinct ground sloth at Newberry Cave in southern Nevada (Davis and Smith 1981).

At first, split-twig figurines were thought to be associated with the Pinto complex (Euler and Olson 1965; Euler 1983) because of their distribution within the range of Pinto points, and the proximity of the Red Butte sites near the Grand Canyon, which were attributed to a Pinto-Chiricahua-Amargosa II lithic industry (McNutt and Euler 1966). However, bifurcate-stemmed points have never been found in direct association with split-twig figurines, while Gypsum points have been found in association with them in a cave in Walnut Canyon near Flagstaff (Olson 1966), in Newberry Cave in the eastern Mojave Desert (Davis and Smith 1981), in Cowboy Cave on the northern Colorado Plateau (Janetski 1980), and in Big Horn Cave at the northern edge of the Southern Basin and Range Province in northwestern Arizona (Geib and Keller 1987). Direct radiocarbon dates of split-twig figurines range between about 4400 and 3100 b.p. (Schroedl 1977; Emslie et al. 1995).

THE AMARGOSA COMPLEX

Rogers (1939) defined the "Amargosa Industry" in the Mojave and Colorado deserts of southeastern California and southwestern Arizona as representing the culture that followed, and may have been derived from, the Pinto-Gypsum complex. Consisting of two phases, Amargosa I and II, it had its greatest concentration along the Amargosa River in the north-central Mojave Desert, but extended into the Lower Colorado River Valley. Features at Amargosa sites include cleared circles, linear alignments of rocks, trails, and intaglios. Rogers originally dated the Amargosa Industry to A.D. 200-900, following the Pinto-Gypsum complex.

The large Phase I sites were interpreted as seasonally occupied settlements. Their flaked stone assemblages consisted of large corner-notched points with triangular blades and straight bases, drills with expanded bases, wide triangular knives, and flake scrapers. Ground stone artifacts included incised and circular slate pendants, and drilled slate tubes that may have been pipes. Ground stone seed milling tools were absent at these sites. The resemblance of Amargosa I and Basketmaker II dart points was noted.

Phase II sites were small and appear to represent the temporary camps of highly mobile groups. Their flaked stone assemblages included dart points similar to those of Phase I sites, but longer, and arrow points of the same shape, but much smaller. Ground stone included mauls and picks associated with turquoise mining. Gray ware pottery and other aspects of the Phase II assemblages imply links to the Basketmaker III occupation of southern Nevada.

At the stratified Willow Beach site, located on a terrace of the lower Colorado River about 24 km south of Hoover Dam on the Arizona side, the earliest deposits contain projectile points closely resembling Rogers' (1939) Amargosa I points (Schroeder 1961). This earliest occupation, radiocarbon dated to about 2200 b.p. and called the Price Butte phase, also yielded flake scrapers, bifacial knives, drills, a slab metate and cobble mano, flaked stone disks, hammerstones, and tubular ground stone pipes. Warren (1984) considers this phase and the following three phases, exhibiting a succession from large dart points to small Rose Spring arrow points and Basketmaker III pottery prior to A.D. 750, to represent a regional variant of Rogers' Amargosa complex.

The Amargosa sequence has been redefined numerous times, with various proposed chronologies (the discussion below refers to age ranges in years B.C., following the proposed chronologies of cited authors; all of these dates are uncalibrated, and can be converted to raw radiocarbon ages by adding the number 1950). Rogers' later collaboration with Haury (1950) in the interpretation of the materials from Ventana Cave led to redefinition of his sequence, with Pinto and Gypsum becoming the new Amargosa I and Amargosa II phases, the old Amargosa I becoming Amargosa III, and the old Amargosa II becoming Basketmaker III. The beginning date for the new Amargosa I phase was estimated to be 5000 B.C. (Rogers 1966), and the ending date was estimated to be about A.D. 1 (Rogers, cited in Haury 1950). Wallace (1962) placed Rogers' Amargosa industry, as it was first defined, between about A.D. 1 and 1000, following the Pinto Basin complex between about 3000-2500 B.C. and A.D. 1. Hayden (1976) postulated a break in the occupation of the Sierra Pinacate region of northwestern Sonora following San Dieguito I (in which he places the Ventana complex), until an immigration of Amargosan people about 3000 B.C. In the Cronise Basin in the Mojave Sink, Drover (1979) found "Pinto" and "Amargosa" artifacts associated with lakestands near 5000 and 3500 B.C., respectively. Irwin-Williams (1979) suggested beginning and ending dates of about 3000 to 1000-500 B.C. for the Amargosa I and II phases as defined in Rogers' later scheme, which she considered equivalent to the Pinto Basin complex. Warren (1984) now includes the Gypsum portion of Rogers' Pinto-Gypsum complex and his original Amargosa I phase in the "Gypsum Period," between 2000 B.C. and A.D. 500.

Clearly, the Amargosa complex is still poorly known and inadequately dated, and the numerous revisions have created confusion. The proposed chronologies are not based on radiocarbon dates from "pure" Amargosa sites, but rather on the resemblance of Amargosa points to Elko Corner-notched and Basketmaker points, their co-occurrences with Pinto and Gypsum points and Basketmaker III pottery, and radiocarbon dates from sites with those co-occurrences.

Although they may not represent a distinct complex, it is likely that the corner-notched Amargosa points of the Mojave Desert and Lower Colorado River Valley were variants of Elko Corner-notched points, which had a floruit between about 1300 B.C. and A.D. 700 in the western Great Basin (see Chapter 4), and were also related to the side- to corner-notched San Pedro and Basketmaker points known from Early Agricultural sites in southern and northern Arizona that are radiocarbon dated to 1200 B.C.-A.D. 150 and 800 B.C.-A.D. 750, respectively. It also seems likely that the lack of ground stone milling tools at the Amargosa type sites (in Rogers' original sequence) is a sampling problem, since Rogers built a cabin out of "Amargosan" metates at the White Tanks site in southwestern Arizona (Schaefer et al. 1993).

THE CHIRICAHUA STAGE OF THE COCHISE CULTURE

The Chiricahua stage of the Cochise culture, following the Sulphur Spring stage, was defined on the basis of the artifact assemblage contained in a clayey "cienega" deposit along Cave Creek in a canyon mouth on the eastern side of the Chiricahua Mountains in southeastern Arizona (Sayles and Antevs 1941; Sayles 1983). The assemblage included ground stone milling tools (handstones, basin metates, and "proto-pestles"), hammerstones, and flaked stone tools such as core tools, choppers, planes, scrapers, drills, gravers, denticulates, bifaces, and "non-indigenous" side-notched and concave-based dart points with expanding stems often wider than the blade. Features included rock-filled roasting pits, hearths, and flexed burials. The stage was bracketed between about 9,000 and 4,500 years ago by Antevs' geoclimatic correlations.

After its original definition, several other sites were also attributed to this stage of the Cochise culture, including the Lone Hill and Fairchild sites in the San Pedro and Sulphur Spring valleys of southeastern Arizona (Agenbroad 1970; Windmiller 1973), the lower part of the moist midden in Ventana Cave in southwestern Arizona (Haury 1950), the Cienega Creek site in east-central Arizona (Haury 1957), and the Wet Legget site (Martin et al. 1949) and Bat Cave (Dick 1965) in west-central New Mexico. In addition to the side-notched point type which came to be called Chiricahua points, these sites also contained contracting-stemmed (Gypsum, Augustín) and bifurcate-stemmed (Pinto) points. Side-notched points identified as Chiricahua are concentrated in the Southern Basin and Range Province, but Huckell (1996c) identifies them in every part of the Southwest except the northern and western Colorado Plateau and the lower Colorado Valley. They also may have extended into northern Sonora and Chihuahua (Irwin-Williams 1967).

Based on a review of the radiocarbon dates from these sites, Whalen (1971, 1975) dated the Chiricahua stage between about 3500 and 1500 B.C. (uncalibrated; i.e., ca. 5500-3500 b.p.). In his reinvestigation of the Whitewater Draw sequence, including several new radiocarbon dates from strata containing Chiricahua stage artifacts, Waters (1986b) bracketed the Chiricahua stage deposits between about 3500 and 2500 b.p., following a long hiatus after the deposition of the Sulphur Springs stage deposits. The only published radiocarbon dates directly associated with Chiricahua points are from two sites in dune deposits near Picacho Reservoir in central Arizona, which fall between about 4800 and 4000 b.p. (ca. 3500-2500 B.C.) (Bayham et al. 1986). Gypsum points also occur at these sites. Huckell (1996c) reports a radiocarbon date of about 4300 b.p. from a site buried in the Santa Cruz River floodplain in the Tucson Basin of southern Arizona; in the cultural deposit were found several rock clusters, ground stone milling tools, a flaked stone assemblage including a fragmentary Chiricahua point, and an immature bison skull.

The presence of maize cobs radiocarbon dated to about 2500 B.C. in Bat Cave, and maize pollen at the Cienega Creek site have been cited by many (e.g., Haury 1962; Dick 1965; Sayles 1983) as evidence of the arrival of agriculture in the Mogollon Highlands (Mountain Transition Zone) during the Chiricahua stage. However, the identification of the pollen grains at the Cienega Creek site is equivocal (Berry 1982), and Wills (1988) has argued that the Bat Cave assemblage bears little resemblance to the type-site assemblage, and that the earliest maize at the site dates no earlier than about 1200 B.C.

Recently, maize from the Los Pozos site in the Santa Cruz River floodplain in the Tucson Basin yielded a radiocarbon date of about 4200 b.p. (ca. 2700 B.C.), and other dates from this deposit ranged between 3900 and 3700 b.p. (ca. 2600-2400 B.C.) (Dave Gregory, personal communication 1997). Although these dates fall within the known timespan of the Chiricahua stage, the associated point types were "Pinto-like" and Cortaro.

Possibly included in the Chiricahua complex are millingstone cairn burials and structures. A number of flexed burials covered with cairns that include "killed" metates of a basin form attributed to the Chiricahua stage have been found in the Southern Basin and Range Province (see review in Mabry 1998b). In Arizona, Chiricahua points are possibly associated with stone-outlined and masonry structures at the Lava Flow Encampment site near Springerville (Diggs 1982), with a possible pit structure at the Arroyo site in the Picacho Dunes (Bayham et al. 1986), and with a stone-outlined pit structure at the Tator Hills site in the Santa Cruz Flats (Halbirt and Henderson 1993). However, other projectile point types are also present at these sites (including Pinto, Elko Corner-notched, Armijo, and San Pedro), and so the dating of the structures and their associations with Chiricahua points are uncertain.

THE ARMIJO PHASE OF THE OSHARA TRADITION/LATE SAN JOSE COMPLEX

On the eastern Colorado Plateau and in the northern Rio Grande Valley, the Armijo phase of the Oshara tradition, succeeding the San Jose phase, was dated between about 1800 and 800 B.C. (uncalibrated; i.e., ca. 3800-2800 b.p.) by Irwin-Williams (1973, 1979). It includes materials previously attributed to the Lobo complex (Bryan and Toulouse 1943), the Santa Ana complex (Agogino and Hester 1953), and the Atrisco complex (Campbell and Ellis 1952).

The diagnostic projectile point type resembles San Jose points, and was thought to have evolved from them (it may be equivalent to the later variant of the San Jose point; see discussion of the early San Jose complex in Chapter 5). The assemblage of this phase also includes choppers, pounders, drills, bifacial knives, and flake scrapers. Irwin-Williams (1973) placed the appearance of maize in the northern Southwest during this phase. In Arizona, projectile points identified as Armijo or "Concho" have been found at sites on Black Mesa on the central Colorado Plateau (Parry et al. 1994).

MODELS OF RELATIONSHIPS BETWEEN LATE HOLOCENE ARCHAIC COMPLEXES

Rogers (1939, 1966) did not believe that the preceramic Armargosan culture evolved into the pottery-using culture of the lower Colorado Valley. He suggested that "Yuman" speaking people, who made a distinctive type of pottery that he called "Lower Colorado Buffware," entered the region around A.D. 800, replaced the Amargosan people, and survived into historic time. Hayden (1976), on the other hand, does not recognize a hiatus in the occupation of the Sierra Pinacate region following the arrival of the Amargosan culture, which he thinks is ancestral to the historic Araneños (Sand Papago) of the region. He divides the Amargosa culture into two preceramic stages and a ceramic one, and views the San Pedro stage of the Cochise culture as a variant.

In the Oshara sequence of the southeastern Colorado Plateau, the En Medio phase (800 B.C.-A.D. 400), marked by the appearance of small corner-notched points, and the Trujillo phase (A.D. 400- 600), marked by the appearance of "limited quantities of plain grey ceramics" (Irwin-Williams 1973:13) represent the uninterrupted transition from late Archaic to early Anasazi material cultures and lifeways.

Irwin-Williams (1967) interpreted significant continuity between early and later Archaic cultures throughout the Southwest, such that, between about 3000 and 1000 B.C., the Pinto Basin (in which she included early Amargosa), Cochise, and San Jose cultures had developed as closely related variants of a distinctive Southwestern culture she called "Picosa," an acronym taken from the combination of those culture names. Southwestern preceramic cultures shared many aspects of economy with the Desert culture of the Great Basin, she believed, but differences in material culture and culture history require that they be distinguished. She argued for the evolution of the Rose Springs (late Amargosa) complex directly out of the Pinto Basin complex between about 2000 and 1000 B.C. (Irwin-Williams 1968a; 1968b), and envisioned a simultaneous northward expansion of the Cochise culture into east-central Arizona and west-central New Mexico, and then into the northern Rio Grande and its tributaries shortly after A.D. 1 (Irwin-Williams and Haynes 1970). (All of her estimated dates were uncalibrated).

Irwin-Williams (1968a) saw a pan-southwestern "cultural division" at about 800-500 B.C. (Cienega, Rose Spring, En Medio phases), with a local shift in settlement and increasing reliance on horticulture. "At, or a few centuries before the birth of Christ, the late San Pedro Cochise was transformed by the addition of pottery and increasing sedentism into the early Mogollon culture" (1968a:53). The western San Pedro Cochise similarly evolved into the "O'otam" culture, in her interpretation.

Today, Irwin-Williams' influential model of cultural continuity through the Holocene is not supported by stratigraphy, site distributions, or radiocarbon dates. A hiatus between the Sulphur Spring and Chiricahua stages in the cultural sequence in Whitewater Draw (Waters 1986b), along with the non-overlapping distributions of Sulphur Spring and Chiricahua sites in southeastern Arizona (Dean 1987), suggests a lack of cultural continuity in the Southern Basin and Range Province. Also, the cultural radiocarbon records of the Southern Basin and Range Province and the Colorado Plateau include very few dates falling within the middle Holocene interval (Schroedl 1976; Berry and Berry 1986; Geib 1995; see Chapter 4).

Berry and Berry (1986) argued that, between 3000 and 100 B.C., an interval of increased effective moisture according to several cited studies, both the Southern Basin and Range Province and the Colorado Plateau were reoccupied after being abandoned during the middle Holocene. These were populations expanding northward from the Mexican highlands, they concluded on the basis of the similarity between Gypsum points and earlier contracting stem points in central Mexico. They correlated another gap in the radiocarbon records of the northern (Schroedl 1976) and southern Colorado Plateau (Berry and Berry 1986) with evidence for a transition to drier climate in the Southwest between about 1000 B.C. and the B.C./A.D. boundary. They reconstructed a virtual abandonment of the Colorado Plateau by Late Archaic hunter-gatherers, followed by rapid repopulation by late Cochise culture maize agriculturalists from the south. (All of their estimated dates were uncalibrated).

The Berrys saw little difference in San Pedro stage and early Basketmaker II material cultures, and referred to the phenomenon as the "San Pedro/ Basketmaker II complex," which they believed originated in an unknown region outside of the Southwest because of the lack of resemblance between the projectile points and the major Archaic types they replaced. Although they did not pursue the implications, their conclusion that "it was under the protracted drought conditions of the Sub-Atlantic that maize agriculture was introduced and subsequently dispersed to numerous regions of the Southwest" (Berry and Berry 1986:318) is relevant to models of the transition to agriculture that emphasize pioneer farming populations colonizing the remnant, well-watered zones (see below).

In his more recent review of the plateau radiocarbon record, Geib (1995) pointed out that, while some rockshelter sequences on the Colorado Plateau do have breaks in occupation between 1000 B.C. and the first century A.D., radiocarbon dates from a few open-air sites on the central Plateau indicate that complete abandonment did not occur just prior to the introduction of agriculture. Matson (1991) referred to this interval on the plateau as the "Latest or Terminal Archaic," and pointed out that there is no equivalent in the Southern Basin and Range Province. He viewed these sites as representing a continuation of the Great Basin-related Archaic cultural tradition, which was displaced by the White Dog phase of the Basketmaker II farming-based culture, representing a migration of San Pedro stage farmers between about 850 and 500 B.C. (calibrated?).

Shackley (1996a) suggests that the Late Archaic complexes of the Southwest and Great Basin were in direct contact in the Lower Colorado River Valley. Based on metric comparisons of sets of projectile points from sites in western Arizona, he concludes that Elko Corner-notched points and San Pedro points can be distinguished on the basis of differences in blade thickness, blade width, shoulder width, and neck width, and that their distributions overlap in west-central and northwestern Arizona. He suggests that this area of overlap represents a rough cultural boundary between the Great Basin and the Southwest during the Late Archaic.

Several studies of Southwestern Archaic rock art styles have identified possible relationships with other material culture complexes and with rock art styles of other regions. Schaafsma (1980) notes the basic similarity of the Archaic geometric-abstract petroglyphs of the Southwest to those of the Great Basin, and lumps them within the "Great Basin Abstract" style originally defined by Heizer and Baumhoff (1962). Cole (1990) considers the "Archaic-Abstract" rock art tradition of the Colorado Plateau to be part of a widespread Archaic tradition also found in the Great Basin and the Plains. This style is referred to as "Western Archaic" by others (Wallace and Holmlund 1986; Thiel 1995). This tradition is estimated to date to about 2800-2200 b.p. by Heizer and Baumhoff (1962) and 2800-1000 b.p. by Cole (1990), while Schaafsma (1980) estimates "an antiquity possibly greater than that hypothesized by Heizer and Baumhoff," and Wallace and Holmlund (1986) suggest it is a very long tradition dating between about 9000 and 1200 b.p.

Shaafsma (1980) also points out that some Archaic painted rock art in eastern Utah resembles the Chihuahuan Polychrome Abstract style of pictographs in southwestern New Mexico, and that the Barrier Canyon Anthropomorphic style of the Colorado Plateau, which she dates to about 2400-1600 b.p., shares many characteristics with the Archaic Pecos River style in Texas. Schroedl (1977b) suggested that Barrier Canyon style pictographs are related to the split-twig figurine complex dating between about 4400 and 3100 b.p., while Turner (1971) noted that split-twig figurines resemble artiodactyl forms in Glen Canyon *Style 5 petroglyphs* on the Colorado Plateau (also called the Glen Canyon Linear style), which he dates to about 8000-4000 b.p.

Cole (1990) notes similarities between the Glen Canyon Style 5 (Glen Canyon Linear style) of the Colorado Plateau and the overlapping Barrier Canyon style (for both of which she estimates a minimum age of about 2800-1600 b.p.), and also the Coso style of the southwestern Great Basin and the Interior Line style of western Wyoming. She also observes that unfired clay figurines from levels dated between about 8800 and 6600 b.p. in Cowboy and Walters caves are very similar in form and decoration to anthropomorphic forms in Barrier Canyon style pictographs. Schroedl (1977b) remarked on the similarity of these clay figurines with Archaic ones found in southwestern Texas.

Both Schaafsma (1980) and Cole (1990) see a continuity in some anthropomorphic forms between the Barrier Canyon style and the San Juan Basketmaker style. They interpret this to imply that early Basketmaker rock art developed at least in part from the Barrier Canyon tradition.

Comparative studies of Archaic basketry and textile techniques have also led to hypotheses of cultural connections between the Southwest and surrounding regions during the late Holocene and earlier. Adovasio (1971) reconstructs a Great Basin origin of Southwestern textiles, with one-rod-foundation coiling and twining diffusing southward to the Colorado Plateau by the time of the Desha complex (the middle Holocene). However, he suggests that the two-rod-and-bundle-foundation coiling sewn with a non-interlocked or split stitch which predominated in the Southwest during Basketmaker times was a "local and early" (middle Holocene?) elaboration of the one-rod-foundation technique, while bundle foundation coiling and twilling diffused northward from Mexico later (during the late Holocene). Matson (1991) observes that the Ventana Cave midden (all of which was formed during the late Holocene) shows a possible evolutionary sequence from two-rod-and-bundle coiling to bundle foundation coiling.

Archaic mortuary patterns provide more evidence of cultural relationships between the Southwest and other regions during the late Holocene (Mabry 1998b). During the initial part of the late Holocene, a millingstone-cairn mortuary complex connected the Big Bend region of western Texas, the southern Southwest, the southwestern Great Basin, and the southern California coast, where it originated during the early-middle Holocene transition. The Basketmaker practice of ritually "killing" baskets left as grave offerings has a possible evolutionary precedent in the deliberate breaking of the metates usually included in the cairns. A late Holocene tradition of secondary cremations in coiled baskets was apparently centered in the Big Bend region, and extended into the Southern Basin and Range Province of the southern Southwest. Painting of bodies, bones, and grave offerings with ochre was a common mortuary practice among both hunter-gatherers and early farmers in the southern Southwest and northwestern Mexico between about 2600 and 1500 b.p.

MODELS OF LATE HOLOCENE ARCHAIC ADAPTATIONS

Late Holocene Archaic subsistence-settlement patterns in the Southern Basin and Range Province are generally interpreted as reflecting seasonal vertical shifts between resource zones, with winter campsites in valley bottoms and on piedmonts (Whalen 1973, 1975; Huckell 1984a). Shackley (1990, 1996b) notes that, among historic hunter-gatherer groups in the Southwest, procurement ranges for important resources—food and nonfood alike—often extended beyond group territories, resulting in permeable territory boundaries and upland-lowland annual ranges akin to the vertical transhumance practiced by Old World pastoralist-farmers. Using data from late Holocene Archaic sites in the Southern Basin and Range Province, he demonstrates that the number of exploited obsidian sources decreased from the "Middle" to the "Late" Archaic periods (both falling in the late Holocene). Shackley attributes this trend to increasing reliance on fewer resource zones due to decreasing residential mobility made possible by storage, logistical organization, and use of cultigens.

For the Colorado Plateau and the Mountain Transition Zone, a number of archaeologists (e.g., Irwin-Williams 1973; Toll and Cully 1983; Simmons 1986; Wills 1995) interpret the distributions and characteristics of late Holocene Archaic sites as indicating seasonal movements between vertically juxtaposed vegetation zones, with lower and intermediate elevations occupied in the winter and spring, and mountain ranges occupied during summer and fall. Campsites in pinyon woodlands, some having small habitation structures and associated storage pits, are interpreted as fall-winter occupations because of the fall availability of pinyon nuts and the historically observed overwintering of Great Basin foragers in pinyon-juniper woodlands when pinyon nut masts were productive enough to store surpluses (Wills 1995).

However, the relative unpredictability of nut masts and/or dense animal concentrations meant that this type of "seasonal sedentism" was irregular. Based on the general absence of remains of large game animals, the frequent presence of ground stone milling tools, and the relative abundance of seeds of chenopods, amaranths, and grasses at lower and intermediate elevation campsites, Wills (1995) argues that these were seasonal basecamps reoccupied primarily in the late summer and early fall, and were focused on gathering and processing of weedy annuals (and possibly their encouragment and cultivation).

Beyond the vertical movements between resource zones, and the focus on seed gathering and processing at lower elevations, the subsistence-settlement strategies of late Holocene Archaic groups in the uplands and lowlands of the Southwest may have had little else in common. Wills (1995) contrasts the food resource potentials of the cooler uplands and warmer lowlands in the Southwest at the beginning of the late Holocene. He concludes that exploitation of the most important food resources in the uplands required larger foraging ranges, both annually and interannually, while the diverse plant food resources in the lowlands required more labor and time for processing, but allowed smaller foraging ranges because of their higher predictabilities and overlapping concentrations. The smaller ranges for plant foods allowed decreased mobility, which in turn allowed hunting ranges to increase through a shift to a logistical strategy (sending out small, task-specific groups from short-term basecamps, rather than frequently moving the entire group to resources as they became available).

This inference of reduced mobility in the lowlands leading to the development of larger hunting territories and logistical hunting strategies is supported by analyses of faunal remains from late Holocene Archaic sites. In his reanalysis of the faunal remains recovered from Ventana Cave, Bayham (1982) identifies a trend toward increasingly specialized hunting tactics through time, beginning in the "Middle" Archaic period (the intial part of the late Holocene). This trend is thought to reflect increasing residential stability in lowland riverine zones and the related development of regional hunter-gatherer territories, with hunters focusing on larger game as longer distances to highland hunting areas made these trips costlier (Szuter and Bayham 1989).

The different components of regional subsistence-settlement systems of late Holocene Archaic populations potentially can be identified by differences in lithic assemblages and other site characteristics. Based on variability in lithic assemblages reflecting differences in reduction strategies, Roth (1989, 1992, 1995) has identified non-sedentary, multiple- and limited-activity late Holocene Archaic occupations on upper bajadas in the Tucson Basin of the Southern Basin and Range Province, roughly contemporary with more sedentary, multiple-activity occupations in a nearby floodplain. The lack of deep deposits, the low number of stone tools, and the absence of substantial features at the bajada sites are cited as evidence against long-term occupation. Storage features and formal cemeteries also are not present.

The locations of most of the limited-activity bajada sites near exploitable upland resources, and the speialized tool assemblages of those sites, suggest a focus on resource procurement. The fewer multiple-activity sites on the bajadas, with more diverse artifact assemblages, are interpreted as small campsites occupied temporarily or reoccupied seasonally. Unresolved, however, is the question whether these short-term sites were used by relatively sedentary farmers based in floodplain villages and exploiting bajada resources in a logistically organized settlement-subsistence system, or used by mobile, non-agricultural groups in the same basin (the model of Fish et al. 1990, 1992).

MODELS OF THE TRANSITION TO AGRICULTURE AND SEDENTISM

[This section is excerpted from Mabry 1998c: 772-778]

> ". . . the current set of direct radiocarbon dates on cultigen remains indicates that maize (*Zea mays*) was introduced to the Southwest by 3100 b.p. (ca. 1700 B.C.), and possibly as early as 4000 b.p (ca. 2500 B.C.). By 2900 b.p. (ca. 1000 B.C.), maize was widely cultivated along with squash (*Cucurbita pepo*). Cotton (*Gossypium* sp.) was cultivated by 2600 b.p. (ca. 800 B.C.). Common beans (*Phaseolus vulgaris*) were also cultivated by 2500 b.p. (ca. 600 B.C.), and tepary beans (*P. acutifolius var. latifolius*) by 1500 b.p. (ca. A.D. 600). By 2200 b.p. (ca. 200 B.C.), tobacco (probably *Nicotiana attenuata*) was cultivated. However, it should be recognized that the total number of dated samples is currently too small and from too few regions to be certain of this exact chronology. Also, the current data set may be skewed by different cultural and natural processes affecting potentials for entering the archaeological record and being preserved, and by difficulties in identifying the domesticated varieties of some of these plants.
>
> The current chronological data thus suggest that these various tropical crop plants were introduced to the Southwest in succession, but the statistical overlapping of many of these dates and the steady pushing back of times of arrival with new dates suggest the possibility that maize, squash, beans, and cotton were adopted together. Tobacco may either have been part of this Mesoamerican crop complex, domesticated locally about the same time the complex was introduced, or introduced from California or the Great Basin. Water control technology such as drainage ditches and diversion weirs may have been introduced along with this crop complex (Ezzo and Deaver 1996; Mabry and Holmlund 1998).
>
> What kind of agricultural transition does this represent? Cowan and Watson (1992) conclude from world-wide comparisons that most prehistoric transitions to agricultural economies occurred in one of three ways. In "pristine" contexts, crops were often gradually added to a foraging economy through a process of local plant domestication and development of appropriate agricultural techniques, as seems to have been the case in Southwest Asia, East Asia, and Japan, central Mexico, and eastern North America. As a "secondary" phenomenon, the transition to agriculture occurred most frequently through two types of diffusion.
>
> In one of these, a single crop or set of domesticated plants (a crop complex) and a related repertoire of previously developed agricultural techniques (a farming system) were introduced into regions dominated by foraging economies, suddenly or gradually diminishing the importance of wild food resources. Examples of this process include the spread of agriculture into the highlands and deserts of the Levant (Byrd 1992), onto the plains of Europe (Ammerman and Cavalli-Sforza 1971; Gregg 1988; Dennell 1992), and into the Southern Basin and Range Province of the North American Southwest (Wills 1988; Huckell 1990; Matson 1991; Minnis 1992).
>
> In another type of secondary transition, a new crop or crop complex was introduced into cultural systems that were already partly dependent upon locally domesticated plants, and displaced the older crop complex. This occurred, for instance, in eastern North America, where locally domesticated starchy seed plants began to be replaced by maize during the first few centuries A.D. (Smith 1992), and in Japan, where the local garden crops were replaced by wet rice cultivation introduced from mainland Asia about 400 B.C. (Crawford 1992). Several researchers have suggested that weedy annuals such as chenopodium and amaranth were cultivated in the Southwest prior to the arrival of tropical cultigens from Mexico (Toll and Culley 1983; Winter and Hogan 1986; Bohrer 1991; Wills 1995).
>
> In cases of secondary transition, then, there are two possible ways in which diffusion could have occurred: migration of farmers or diffusion of the idea of farming. These have been called "demic diffusion" and "stimulus diffusion," respectively. Although they are not necessarily mutually exclusive processes, models of the transition to agriculture in the American Southwest have traditionally emphasized one or the other. Competing models of the agricultural transition in the Southwest can also be contrasted in terms of the hypothesized paths of diffusion of crops, the environmental and cultural conditions, the reasons for their acceptance, and the consequent changes in social and economic organization.
>
> Several different routes have been proposed for the arrival of agriculture in the Southwest. Carter (1945) distinguished two agricultural complexes in the Southwest, characterized by different crop varieties and cultivation techniques. Based on the historic distributions of Native American crop varieties and agricultural methods, he hypothesized that floodwater agriculture diffused up the west side of the Sierra Madre Occidental of Mexico, and that rain-fed agriculture reached the Colorado Plateau after moving slowly through the Great Plains,

probably having been introduced to North America via the Gulf Coast.

Haury (1962) argued that the higher, wetter elevations of the Southwest provided better climatic conditions for tropical domesticates than did the lower, drier desert regions. He proposed that maize, beans, and squash spread northward from Mexico through a "highland corridor" in the Sierra Madre Occidental into the Mogollon Highlands, and then to the Colorado Plateau.

Recently, Huckell (1990) offered arguments, based on the locations of Early Agricultural sites in southeastern Arizona, for cultigens and floodwater farming techniques initially spreading into the lowlands of the southern Southwest along the north-south trending basins that cross the modern border between Mexico and the U.S. In these lowland valleys, floodplains and alluvial fans were aggrading during the initial part of the late Holocene, creating the right conditions for flood farming. Only later did farming spread to higher elevations, where dry farming techniques were developed. This scenario was also part of Matson's (1991) "stage model" of agricultural diffusion in the Southwest.

A "coastal corridor" model has received renewed attention in the attempt to explain a separate origin for tropical domesticates in eastern North America. However, a direct trans-Gulf or Caribbean route is preferred by some (Riley et al. 1990).

For the Southwest, Haury's model of agriculture, initially restricted to highland regions, remained a component of many new models formulated in the 1980s (Ford 1981; Minnis 1985; Hunter-Anderson 1986). Although it is still widely assumed that tropical domesticates moved from south to north across the Southwest, direct radiocarbon dating of maize remains over the last two decades has shown that maize agriculture spread so rapidly across the Southwest that this process is "invisible" with the current resolution of radiocarbon dating (Smiley 1994).

However, as a result of the first significant amount of archaeological investigations conducted in alluvial settings, the earliest sites with directly dated maize remains currently known in the Southern Basin and Range Province (Figure 18.3) and on the Colorado Plateau are located on valley floodplains and alluvial fans, implying that floodwater farming was practiced earlier than rain-fed farming in both of those regions (Huckell 1990; Matson 1991, 1994; Gilpin 1994). Studies of the cytologies, isozymes, and present distributions of prehistoric Southwestern maize races also suggest that Chapalote, Reventador, Mais de Ocho, and Onaveño spread from the lower elevations of the western coast of Mexico into northwestern Mexico and the rest of the Southwest (Sánchez González 1994).

So far, the discussion has been restricted to the ecological factors involved in agricultural diffusion into the Southwest. Based on comparisons of archaeological and ethnographic data from different regions of the world, Gregg (1988) identified three critical social and economic factors that also affect the spread of agriculture: the social organization of the indigenous hunter-gatherer populations; the mobility strategy of these populations; and whether agriculture was introduced by a population of cultivators moving into the area or by the transmission of cultivation without an accompanying migration.

> *These factors combine to form four different situations: (1) residentially mobile, band-level hunter-gatherers incorporating cultivation into their annual round; (2) tribal-level, sedentary hunter-gatherers adopting cultivation; (3) cultivators moving into an area occupied by residentially mobile hunter-gatherers; and (4) cultivators moving into an area occupied by sedentary hunter-gatherers (Gregg 1988:27).*

Several models for the Southwest envision the first type of situation: indigenous, mobile hunter-gatherers adopted agriculture from farmers farther south (Kidder 1924; Haury 1962; Irwin-Williams 1973; Ford 1981; Hunter-Anderson 1986; Wills 1988; Parry et al. 1994). In this scenario, the previously existing Archaic peoples of the Southwest obtained crops and farming knowledge from Mexico, and became transformed into the Basketmaker II and early Mogollon peoples. Haury (1957) at first believed that the Hohokam also developed from an indigenous San Pedro farming culture, but later thought that a migration best explained the appearance of a new set of cultural traits associated with the Hohokam (Haury 1976).

Another group of models have in common the assumption of the third type of situation described by Gregg: climatic amelioration led to large-scale population movements that included colonizing agriculturalists (Berry 1982; Berry and Berry 1986; B. Huckell 1990). Huckell (1990) identifies the north-south trending river valleys of the Southern Basin and Range Province as the paths taken by San Pedro phase farmers spreading floodplain farming techniques northward from Mexico, and Berry (1982) attributes the arrival of agriculture on the Colorado Plateau to the continued northward expansion of that people. Matson (1991), in a variant of the migration model, argues that the south-to-north migration occurred in stages, as maize and farming techniques were adapted to new climatic and edaphic conditions.

Based on world-wide comparisons, Gebauer and Price (1992) conclude that domesticated plants and animals spread through diffusion more often than through colonization. Most frequently, local hunting and gathering populations adopted the "ideas and products" of cultivation and herding. However, this pattern was most typical for regions with relatively dense populations of foragers. "Exceptions to this rule occur primarily in areas with small indigenous populations" (Gebauer and Price 1992:8). The relevant variable that must be known for the Southwest, then, is the existing population densities of indigenous hunter-gatherers on the eve of agricultural arrival. However, rather than treating population density as an isolated variable, many recent models reconstruct a convergence of demographic and environmental factors to create the right combination of conditions for the spread of agriculture into and across the Southwest.

There is presently little consensus about Holocene environmental, demographic, and cultural conditions in the Southwest. While some paleoenvironmental researchers reconstruct a shift to drier climate during the relevant timespan, others reconstruct the opposite [but see Chapter 2 of this volume for a review of current evidence that supports a model of increasing effective moisture during this interval]. Some archaeologists envision population pressure playing a role, and others see population growth as a result of the transition to agriculture, instead. Alternative scenarios have also been described for how domesticated plants and the necessary technical knowledge for their cultivation spread rapidly across the Southwest—either by colonization by a new group, or diffusion across a preexisting cultural continuum.

Several models posit that agriculture was adopted in the Southwest under conditions of an imbalance between local populations and wild food resources (Cordell 1984; Hunter-Anderson 1986; Wills 1988). Such conditions could have developed from either population growth or environmental changes that reduced food supplies. Cordell (1984) concluded that environmental changes during the Archaic were not significant enough to be a factor, so local population pressure was probably involved. However, currently available evidence [see summary in Chapter 2 of this volume] indicates that Holocene environments were actually very dynamic in the Southwest, and that conditions favorable for agriculture developed immediately prior to its appearance in that region, followed by a period of decreased effective moisture during which agricultural settlement proliferated.

The primary catalyst for the spread of agriculture into the Southwest, then, may have been climatic amelioration following the Altithermal interval. The increased effective moisture, lower summer temperatures, and fewer winter freezes of the late Holocene were all necessary for the successful introduction of tropical crops into the southern Southwest. The summer monsoons coincided with the growing season, and the reduced winter frosts lengthened the growing season and lessened risk of crop failure. As well, these environmental changes increased the range, abundance, and productivity of the wild plant foods, including weedy summer annuals, mesquite, and fruiting cacti, that supplemented the cultigens.

This shift to a monsoonal pattern near 4500 b.p. also correlates with the onset of rapid alluviation in the valleys of southeastern Arizona, and the establishment of the earliest farming settlements in alluvial settings (Huckell 1990, 1996b, 1998). As Bruce Huckell (1998) suggests for the middle Santa Cruz Valley, the reasons for this correlation probably have to do with the creation of niches suitable for floodwater farming. In this scenario, following a widespread cycle of erosion and colluviation during the mid-Holocene that incised valley floors and stored sediments in tributary watersheds, a shift in the pattern of rainfall triggered rapid aggradation downstream, creating the right conditions for agriculture in the main floodplains.

While the radiocarbon evidence indicates that agriculture spread relatively rapidly from the lowlands to the mountains and plateaus (Smiley 1994), its diffusion across the Southwest was spatially and temporally uneven. The relatively rapid shift to sedentism and agricultural dependence in southeastern Arizona, as indicated by the abundance of maize remains at the sites of early farming settlements, contrasts with the trend in drier areas of the Southern Basin and Range Province. In those areas, locales suitable for floodwater farming were rare and restricted, and agriculture was apparently incorporated gradually into an existing seasonal round of summer base camps in desert basins and winter base camps at higher elevations (Shackley 1990, 1996b; Stone and Bostwick 1995).

In addition to the development of favorable environmental niches, the rapid spread of agriculture across the Southwest also may have been related to the prior existence of a cultural continuum from northwestern Mexico to the Colorado Plateau. Matson (1991) and Adams (1994) suggest that the spread of maize in the Southwest correlated with the arrival and dispersal of Uto-Aztecan speaking peoples, but a number of linguists (Fowler 1983, 1994; Miller 1983; Hill 1996) agree that the Uto-Aztecan languages have a time depth of four or five thousand years in the Southwest. This estimate correlates more closely with the post-Altithermal repopulation of the North American deserts. Thus, the continuum of related Middle Archaic archaeological complexes across the Southwest (e.g., the "Picosa" concept of Irwin-Williams 1967) may represent a cultural continuum of Uto-Aztecan speaking peoples whose ancestors expanded throughout the Southwest at the end of the Altithermal interval, about 4,500 years ago. Across such a cultural continuum, crops and farming knowledge could have been transmitted easily and rapidly.

Hill (1996) presents linguistic evidence that the diffusion of maize into the Southwest occurred during a period of coherence among southern Uto-Aztecan languages, but that the later diffusion of pottery occurred across emerging linguistic boundaries. Based on current archaeological evidence, the breakup of the southern Uto-Aztecan linguistic continuum can thus be bracketed within a maximum timespan of about 2600 b.p. (ca. 800 B.C.), when plain ware pots were first made at early Cienega phase sites in the southern Southwest, to 1800 b.p. (ca. A.D. 200), when plain ware pottery was being made throughout the Southwest.

The evidence and models discussed to this point have concerned *how* agriculture arrived in the Southwest, rather than *why*. Minnis (1985) contrasted two general classes of models for why agriculture was accepted in this region: "models of necessity," in which some type of cultural or natural stress requires intensification of subsistence activities, and "models of opportunity," in which agriculture is adopted as a risk reduction strategy when it does not require high labor investment. Such "push" and "pull" models are not necessarily exclusive, but most models of the transition to agriculture in the Southwest emphasize one over the other. For example, Whalen (1973), Glassow (1980), Berry (1982), Hunter-Anderson (1986), and Wills (1988) each present some type of demographic and/or climatic stress model, while Ford (1981), Cordell (1984), and Huckell (1990) argue for different types of ecological opportunity models.

Glassow (1980) hypothesized that sedentary populations practicing agriculture earlier in northern Mexico grew steadily and expanded northward. This put pressure on local hunter-gatherer groups in the form of increased competition for wild food resources. Wills (1988) extended this model to explain agricultural diffusion across the Southwest as a south-to-north pressure gradient. He argued that mid-Holocene expansion of pinyon and desert succulents and emerging lowland-highland differences in resources led to population growth and seasonal mobility between the southern lowlands and central and northern highlands, increasing competition for highland resources in the fall. Lowland groups adopted food production to offset increasing seasonal shortages through storage of surpluses. Agriculture and food storage were subsequently introduced to the highlands because it allowed a springtime preview of highland wild food resources—both plants and large game—that would become available in the fall. This advance monitoring capability gave cultivators a competitive advantage, pressuring contemporaneous hunter-gatherer groups to also adopt agriculture.

Comparison of primary agricultural transitions around the world indicates, however, that populations were rarely pushed into it. Rather, agriculture tended to be developed by hunter-gatherers with diverse and abundant resources, perhaps because they could better afford to experiment with subsistence strategies than could groups in resource-poor environments (Gebauer and Price 1992). Indeed, intensive exploitation of grasses and other weedy annuals by late Holocene Archaic groups in the desert grasslands of southeastern Arizona may have "pre-adapted" them to agriculture (Vanderpot 1997).

Early agriculture in many parts of the world was based on the natural principles of geology and hydrology described above, a pattern that has been called "geological opportunism," in which ancient farmers took advantage of aggradational alluvial regimes and localized concentrations of soils and water (Vita-Finzi 1969). Depositional zones such as alluvial fans and floodplains, the naturally optimal areas for plant growth in highly variable arid and semiarid zones, were also the most optimal locations for stable, long-term agricultural production. Thus, it is not surprising that the earliest evidence for crop cultivation and sedentary settlement in many dry regions of the world has been found in alluvial geological contexts (Sherratt 1980; Mabry 1992). Currently, this is the case in the North American Southwest, and it appears that farming populations were drawn to those types of localities by the promise of relatively predictable and abundant harvests that could be supplemented by wild food resources.

An alternate population-expansion model requires no special conditions in the Southwest, however. R.G. Matson (personal communication 1997) points out that the spread of maize-based villages occurred rapidly in Mesoamerica between about 3000 and 2800 b.p. (ca. 1200-900 B.C.), and that the diffusion of maize into the Southwest, and its consequences for residential mobility, can be seen as the tail end of this process at the margin of suitable environmental conditions. At the edge of the Mesoamerican expansion, a "pioneering" attitude may have also played a role, as during the Anglo-American colonization of the Great Plains at the end of the nineteenth century. But he suspects that the apparent rapidity of maize diffusion within the Southwest is related to an insufficient archaeological sample, with older maize-based hamlets waiting to be found.

The consequences of the adoption of agriculture in the Southwest have been much debated. Minnis (1985) concluded that it was a "monumental nonevent" of little immediate impact on indigenous populations, a view shared by many earlier and later assessments (Haury 1962; Dick 1965; Irwin-Williams 1973; Woodbury and Zubrow 1979; Ford 1981; LeBlanc 1982; Cordell 1984; Simmons 1986; Whittlesey and Ciolek-Torello 1995). Other researchers came to the opposite conclusion: The shift to agricultural dependence was rapid (Huckell 1990); food production made settlement of new areas possible (Berry 1982; Berry and Berry 1986; Wills 1988; Matson 1991); and food storage led to greatly reduced mobility (Wills and Windes 1989; Huckell 1990).

A variety of archaeological evidence from sites recently found in the floodplain of the middle Santa Cruz Valley can now be cited to support the latter interpretation. The great abundance of maize remains found at these early agricultural settlement sites points to a sudden shift to maize dependence in locations suitable for flood farming between about 3100 and 2600 b.p. (ca. 1400-800 B.C.). Even if it represents a long or repeated occupation, the sheer size of the Cienega phase Santa Cruz Bend settlement—with an estimated 500 pit structures occupied during several intervals between about 2600 and 2200 b.p. (ca. 800-200 B.C.) (Mabry and Archer 1997)—suggests that, within a few centuries, food

> production had a profound impact on the mobility and size of populations in some valleys of the Southern Basin and Range Province. Similarly, the large number of Basketmaker II sites with evidence of agriculture that suddenly appeared on the Colorado Plateau indicate a roughly concurrent explosion of the population of that region (Berry and Berry 1986; Matson 1991)."

The composite scenario based on archaeological discoveries in the Southwest since the early 1980s (see Mabry 1998c) is thus quite different from the prior conventional model of the transition from Archaic ways of life to agricultural-based village lifeways. The most recent evidence suggests that agriculture arrived from Mexico sometime between about 4000 and 3400 b.p. (ca. 2500-1700 B.C.), and had spread throughout the Southwest by 2800 b.p. (ca. 900 B.C.). Crops were possibly carried by colonizing settlers culturally related to the indigenous hunter-gatherers. Maize, beans, squash, and possibly tobacco and cotton, may have been adopted together in the southern Southwest as a crop complex, and were initially cultivated in well-watered alluvial settings with floodwater farming methods and simple water control features.

In these oases, agriculture quickly became a significant component of subsistence, and multi-seasonal settlements that were "sedentary" by many commonly accepted criteria were established. In almost every region of the Southwest, settlements with multiple pit structures were established between about 2600 and 1800 b.p. (ca. 800 B.C.-A.D. 200). Some were large, permanent villages with several house groups, storehouses, communal structures and plazas, and formal cemeteries. At larger settlements such as Santa Cruz Bend, the basic socioeconomic units may have been extended family households residing in house groups.

Many other signs of the development of village cultures have also been identified (Mabry 1998c). Grave offerings and ritual treatment of bodies and offerings were not uncommon, and cremation was sometimes practiced in the south. In the southern lowlands, fired clay figurines were made by 3000 b.p. (ca. 1200 B.C.), and fired clay beads and a variety of crude pottery were made by 2600 b.p. (ca. 800 B.C.). A well-made type of ceramic container began to be widely manufactured between 2000 and 1800 b.p. (ca. A.D. 1-200). The bow-and-arrow may have been used alongside the spear-thrower as early as 2600 b.p. in the southern Southwest. By 1800 b.p., more efficient trough metates and two-handed manos were first used. Flaked stone tools were increasingly conserved to extend use-life, and included some well-made formal tools made of high-quality, fine-grained materials. By 2600 b.p., obsidian, sea shells, and rare minerals were obtained from distant sources through trade networks, and communities within the same region began to exchange pottery about 1800 b.p. A wide variety of ornaments were made from shell, stone, and minerals, and also may have been traded.

THE LAST HUNTER-GATHERERS

Southwestern "Archaic" adaptations did not completely disappear in Arizona with the transition to agriculture. In the driest and the coldest areas, agriculture was never adopted by native peoples, and mobile hunting and gathering continued to be the basis of subsistence. As recently as the mid-nineteenth century, Sand Papagos (Araneños) in the Lower Colorado Valley, various Pai and Ute groups on the Colorado Plateau, and Athapaskans in the Mountain Transition Zone survived with essentially Archaic technologies and subsistence-settlement strategies.

However, it is a certainty that, after the prehistoric transition to agriculture, the remaining hunting and gathering groups interacted with farmers. The contacts probably went in both directions, with hunter-gatherers trading for village agricultural and craft products such as food, textiles, pots, and ornaments, and farmers routinely venturing far from their villages to exploit the resource territories of foragers.

These interactions, some mutualistic and others competitive, resulted in significant changes in Archaic adaptations. These changes probably included relocation and reconfiguration of hunting and foraging territories in response to encroachments, decreased reliance on large game as artiodactyl populations dwindled from intensive hunting by village-based task groups, and increased reliance on cultivated foods during famines. Because Archaic life-ways were also altered by the Southwestern version of the Neolithic Revolution, this review ends with the general transition to agricultural economies and village-based settlement systems across most of southwestern North America by about 1500 b.p. (ca. A.D. 600).

CHAPTER 7

SITE PATTERNS AND TYPES

This chapter summarizes patterns and types of recorded Paleoindian, Archaic, and Early Agricultural sites in Arizona. The summary of statewide site patterns is based on a computerized database inventory. The database includes information on 4,501 sites recorded in 15 different archives at various agencies and institutions in Arizona and outside of the state, and in site reports and other relevant publications known to the author (these are included in the References Cited). The categorization of site types is based on relative comparisons in terms of durations of site use and diversities of activities carried out in those locations, and in terms of other behavioral dimensions.

THE DATABASE

In addition to information about 55 Paleoindian and 3,639 Archaic site occupations, the database includes information about 383 Early Agricultural site occupations (those attributed to archaeological complexes associated with early farming cultures with only incipient ceramics, such as Basketmaker II, San Pedro, and Cienega phase occupations) recorded in those archives. It also includes information about 596 large aceramic sites (> 1,000 m^2 or > 150 lithics) recorded in the archives of Arizona State University (ASU) and Northern Arizona University (NAU).

These last two categories are included because most archaeologists working in southern Arizona continue to consider the sites of early farmers to be "Late Archaic," and because it is certain that many of the large aceramic sites (those lacking pottery, and also lacking any temporally diagnostic artifacts) are material traces of Paleoindian, Archaic, and Early Agricultural groups. Together, the numbers of large aceramic sites recorded in all of the archives were too numerous to include in the database. However, it is assumed that the ASU and NAU archives provide samples large enough to be representative of the total number of recorded large aceramic sites.

It is recognized that this inventory represents only a sample (and probably a minority) of the total numbers of Paleoindian, Archaic, and Early Agricultural occupations that are preserved at archaeological sites in Arizona, and that regions that have been investigated more intensively by archaeologists are represented by larger numbers of recorded sites and site occupations. However, all known archives, within and outside the state, with records of archaeological sites in Arizona were included in the data collection, and the searches of those archives were as thorough as possible. The resulting inventory is probably a large enough sample to at least identify the ranges of variability and general trends in terms of the basic categories reviewed here.

Archival information about sites was generally accepted at face value, including identifications of projectile point types present, and attributions to particular periods, phases, complexes, and cultures. Sometimes, the reason(s) why a site was assigned to a particular period or complex was not indicated. Examples of questionable types of information that were necessarily accepted at face value include the "Paleoindian" designation of unexcavated sites, and the unusually large (> 500 ha) site areas recorded for some Archaic site occupations. These and other types of information in the database should be confirmed by further field investigations before they are accepted with confidence. Archival information was supplemented or (rarely) reinterpreted only if more information was available in publications known to the author.

A number of important sites and projectile point localities that have no "official" site numbers or records, but are known to the author, were also added. Localities of isolated projectile points or features are not counted as sites unless they were assigned site numbers. As it is used here for a unit of comparison, a "site occupation" represents either the only occupation at a site (or use of a site), or a particular occupation component at a multicomponent site. Site occupations are categorized by environmental period and cultural adaptation according to the correlations summarized in Table 1.1 and Figure 1.3.

Because every category of information in the database was usually not available for each site, the sample sizes vary for each category; percentages represent only the proportions within the available samples. Sites without Universal Transverse Mercator (UTM) coordinates do not appear on the distribution maps generated from the database (see figures in previous chapters and Figure 7.1), but the sample sizes of those with and without UTM coordinates are indicated on each map.

Locations of Primary Site Records

The primary information about 2,521 recorded Paleoindian, Archaic, and Early Agricultural site occupations in Arizona (and 596 large aceramic sites) are scattered among 15 curation facilities, including some in other states (Table 7.1). The archival locations of primary information for another 1,371 site occupations in the database are unknown (this total also includes a number of sites which have no numbers or other records in these archives, but which are known through published reports).

Of the records for which the archival locations are known, the archaeologist for Prescott National Forest manages a third (33 percent). However, a large number of those are identified only as general "Archaic," and may be just lithic scatters without temporally diagnostic artifacts. Arizona State University, Northern Arizona University, and the Arizona State Museum maintain records for the second, third, and fourth largest proportions of the total, respectively.

The Museum of Northern Arizona has the largest proportion of the records of Paleoindian sites, followed by the Arizona State Museum. Following Prescott National Forest, the Western Archeological and Conservation Center maintains records of the largest proportion of Archaic sites. The Center for Archaeological Investigations at Southern Illinois University at Carbondale has records of the largest proportion of Early Agricultural sites (Basketmaker II sites identified during the Black Mesa Project).

Levels of Archaeological Investigation

Currently, our knowledge of Paleoindian and Archaic prehistory in Arizona is superficial—literally. The level of archaeological investigation of almost half (48 percent) of the site occupations in the database is not described in archival records. Of those for which this information is available, only 16 percent of the recorded Paleoindian site occupations, and 4 percent of recorded Archaic occupations, have been tested or more extensively excavated (Table 7.2). Most (74 percent of Paleoindian sites and 54 percent of Archaic occupations) have only been reported or surface surveyed. Middle Holocene Archaic sites are the least represented, with only 15 sites that can be confidently dated to that period, and only nine of those sites having been tested or more extensively excavated. Our subsurface sample of Early Agricultural sites is intermediate between those for Paleoindian and Archaic sites, with only 12 percent tested or excavated, and 59 percent known only from reports or surface surveys.

Jurisdiction and Ownership

Our knowledge is also relatively uneven across the state, due to historical variations in the intensity of archaeological investigation and the thoroughness of record keeping. The county in which the site occupation is located is known for 96 percent of the occupations in the database. When county totals are compared (Table 7.3), Cochise County has the largest proportion (31 percent) of recorded Paleoindian sites, followed by Coconino County (16 percent) and Apache County (14 percent). Coconino County has the largest proportion (47 percent) of recorded Archaic site occupations, followed by Pima and Cochise counties (9 percent and 8 percent, respectively). However, the count for Coconino County is skewed by the large number of aceramic sites, apparently without temporally diagnostic artifacts, that were attributed to the Archaic by the site recorders. Navajo County has the largest proportion (45 percent) of recorded Early Agricultural site occupations, followed by Cochise and Pima counties (16 percent and 11 percent, respectively).

In terms of land owners and managers (Table 7.4), those of 44 percent of the site occupations in the database are not listed in archival records. Of the remainder, the largest proportion (14 percent) of recorded Paleoindian sites in the state are on private land. Almost half (49 percent) of recorded Archaic site occupations are on U.S. Forest Service lands (National Forests). Exactly half (50 percent) of recorded Early Agricultural occupations are on tribal lands, mostly the Navajo and Hopi reservations.

Dating Criteria

The primary criterion for dating most of the recorded Paleoindian sites in Arizona (Table 7.5) is the character and diversity of artifacts and/or features (51 percent), followed by the presence of artifacts with temporally diagnostic styles (36 percent) (flaked stone projectile points). Only 5 percent are dated primarily on the basis of radiocarbon assays, while 7 percent are dated primarily by their stratigraphic contexts.

The primary criterion for dating recorded Archaic site occupations is unknown (not included in archival information) for 39 percent of the total, while the criterion is unknown for only 6 percent of recorded Early Agricultural occupations. Of the site occupations for which this information is available, the character and diversity of artifacts and/or features is the most frequent criterion for identifying both Archaic and Early Agricultural occupations (49

Table 7.1. Numbers of Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by period/adaptation and archival locations of primary site records.

	Period/Adaptation									
Archival Location	Terminal Wisconsin Paleoindian	Unknown Period Paleoindian	Early Holocene Archaic	Middle Holocene Archaic	Middle/Late Holocene Archaic	Late Holocene Archaic	Late Holocene Early Agricultural	Unknown Period Archaic	Unknown Period Aceramic	Total
ASM	3 (.23)	6 (.14)	10 (.11)	2 (.20)	3 (.03)	28 (.12)	40 (.12)	111 (.04)	0 (.04)	203 (.04)
ASU	0	0	0	0	1 (.01)	3 (.01)	1 (< .01)	30 (.01)	446 (.75)	481 (.11)
Amerind Foundation	1 (.07)	1 (.02)	0	0	0	5 (.02)	14 (.04)	10 (< .01)	0	31 (.01)
Coconino NF	1 (.07)	0	0	0	0	5 (.02)	2 (.01)	17 (< .01)	0	25 (.01)
Coronado NF	0	0	0	0	1 (.01)	3 (.01)	2 (.01)	7 (< .01)	0	13 (< .01)
MNA	2 (.15)	8 (.19)	3 (.03)	0	10 (.10)	32 (.14)	39 (.12)	93 (.03)	0	187 (.04)
NAU	0	4 (.09)	5 (.05)	0	3 (.03)	8 (.03)	26 (.08)	32 (.01)	149 (.25)	227 (.05)
Prescott NF	0	1 (.02)	1 (.01)	3 (.30)	33 (.33)	8 (.03)	2 (.01)	1,414 (.46)	0	1,462 (.33)
San Diego Museum of Man	0	0	54 (.57)	0	0	8 (.03)	1 (< .01)	9 (< .01)	0	72 (.02)
Southern Illinois University	0	0	0	2 (.20)	0	8 (.03)	93 (.28)	1 (< .01)	0	104 (.02)
WACC	0	1 (.02)	3 (.03)	0	9 (.09)	19 (.08)	13 (.04)	161 (.05)	0	206 (.05)
Other	0	1 (.02)	0	0	2 (.02)	6 (.03)	6 (.02)	91 (.03)	0	106 (.02)
Unknown	6 (.46)	20 (.48)	18 (.19)	3 (.30)	37 (.37)	92 (.41)	94 (.28)	1,100 (.36)	1 (< .01)	1,371 (.30)
Total	13 (.98)	42 (.98)	94 (.99)	10 (1.00)	99 (.99)	225 (1.01)	333 (1.01)	3,076 (1.00)	596 (1.00)	4,488 (1.00)

Table 7.2. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by period/adaptation and level of archaeological investigation.

	Period/Adaptation									
Level of Investigation	Terminal Wisconsin Paleoindian	Unknown Period Paleoindian	Early Holocene Archaic	Middle Holocene Archaic	Middle/Late Holocene Archaic	Late Holocene Archaic	Late Holocene Early Agricultural	Unknown Period Archaic	Unknown Period Aceramic	Total
Reported	4 (.31)	5 (.12)	61 (.59)	1 (.07)	3 (.03)	62 (.20)	27 (.07)	54 (.02)	0	217 (.05)
Surveyed	5 (.38)	27 (.64)	29 (.28)	5 (.33)	59 (.56)	182 (.58)	199 (.52)	1,449 (.48)	1 (< .01)	2,006 (.43)
Tested	0	2 (.05)	2 (.02)	3 (.2)	3 (.03)	18 (.06)	10 (.03)	45 (.01)	0	83 (.02)
Excavated	2 (.15)	5 (.12)	10 (.10)	6 (.4)	8 (.08)	37 (.12)	36 (.09)	29 (.01)	0	133 (.03)
Unknown	2 (.15)	3 (.07)	2 (.02)	0	32 (.30)	15 (.05)	111 (.29)	1,474 (.47)	595 (.99)	2,234 (.48)
Total	13 (.99)	42 (1.00)	104 (1.01)	15 (1.00)	105 (1.00)	314 (1.01)	383 (1.00)	3,101 (.99)	596 (1.00)	4,673 (1.01)

Table 7.3. Numbers of recorded Paleoindian, Archaic, Early Agricultural and large aceramic site occupations in Arizona by adaptation and county.

	Adaptation									
County	Paleoindian		Archaic		Early Agricultural		Large Aceramic		Total	
Mohave	1	(.02)	187	(.05)	6	(.02)	19	(.03)	213	(.05)
Coconino	9	(.16)	1,729	(.47)	26	(.07)	18	(.03)	1,782	(.38)
Navajo	5	(.09)	94	(.03)	171	(.45)	9	(.01)	279	(.06)
Apache	8	(.14)	146	(.04)	14	(.04)	2	(< .01)	170	(.04)
Maricopa	1	(.02)	124	(.03)	10	(.03)	131	(.22)	266	(.06)
Gila	0		46	(.01)	2	(< .01)	107	(.18)	155	(.03)
Graham	2	(.04)	56	(.01)	11	(.03)	1	(< .01)	70	(.01)
Greenlee	0		6	(< .01)	2	(< .01)	3	(< .01)	11	(< .01)
Yuma	3	(.05)	188	(.05)	0		8	(.01)	199	(.04)
Pima	4	(.07)	312	(.09)	44	(.11)	0		360	(.08)
Santa Cruz	0		37	(.01)	2	(< .01)	0		39	(.01)
Cochise	17	(.31)	289	(.08)	63	(.16)	1	(< .01)	370	(.08)
La Paz	1	(.02)	41	(.01)	0		2	(< .01)	44	(.01)
Pinal	0		109	(.03)	3	(.01)	146	(.24)	258	(.05)
Yavapai	1	(.02)	237	(.06)	16	(.04)	0		254	(.05)
Unknown	3	(.05)	38	(.01)	13	(.03)	149	(.25)	203	(.04)
Total	55	(.99)	3,639	(.99)	383	(1.00)	596	(1.00)	4,673	(1.00)

Table 7.4. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by adaptation and land owner/manager.

	Adaptation									
Owner/ Manager	Paleoindian		Archaic		Early Agricultural		Large Aceramic		Total	
BLM	4	(.07)	263	(.07)	18	(.05)	67	(.11)	352	(.07)
BOR	1	(.02)	11	(< .01)	5	(.01)	0		17	(< .01)
BIA	0		0		1	(< .01)	0		1	(< .01)
NPS	2	(.04)	250	(.07)	27	(.07)	0		279	(.06)
NWR	0		7	(< .01)	0		0		7	(< .01)
USFS	3	(.05)	479	(.13)	21	(.05)	303	(.51)	806	(.17)
Military	3	(.05)	125	(.03)	15	(.04)	0		143	(.03)
Tribal	5	(.09)	141	(.04)	191	(.50)	7	(.01)	344	(.07)
State	3	(.05)	304	(.08)	29	(.08)	1	(< .01)	337	(.07)
County	1	(.02)	21	(.01)	2	(< .01)	0		24	(< .01)
City	1	(.02)	6	(< .01)	4	(.01)	2	(< .01)	13	(< .01)
Private	8	(.14)	245	(.07)	32	(.08)	8	(.01)	293	(.06)
Unknown	24	(.44)	1,787	(.49)	38	(.10)	208	(.35)	2,057	(.44)
Total	55	(.99)	3,639	(1.00)	383	(1.00)	596	(1.00)	4,673	(1.00)

Table 7.5. Numbers of recorded Paleoindian, Archaic, and Early Agricultural site occupations in Arizona by adaptation and primary dating criterion.

	Adaptation							
Primary Dating Criterion	Paleoindian		Archaic		Early Agricultural		Total	
Radiocarbon date(s)	3	(.05)	36	(.01)	30	(.08)	67	(.01)
Stratigraphy	4	(.07)	4	(< .01)	0		4	(< .01)
Artifact style (point or other artifact type)	20	(.36)	408	(.11)	103	(.27)	531	(.11)
Artifact or feature character/diversity	28	(.51)	1,783	(.49)	227	(.59)	2,045	(.44)
Unknown	0		1,408	(.39)	23	(.06)	2,026	(.43)
Total	55	(.99)	3,639	(1.00)	383	(1.00)	4,673	(1.00)

percent and 59 percent, respectively), followed by artifact style (11 percent and 27 percent). Only 1 percent of recorded Archaic site occupations and 8 percent of Early Agricultural occupations are dated primarily on the basis of radiocarbon assays. Less than 1 percent of Archaic site occupations, and no Early Agricultural occupations, are dated primarily on the basis of stratigraphic contexts.

Figure 7.2 shows the wide distributions of recorded site occupations in Arizona identified as Paleoindian and Archaic but not attributed to any particular period or complex. Data recovery through further field investigations would be necessary to categorize these sites more specifically. Included on the map of Paleoindian sites of unknown period or complex are the Vernon site (where fluted projectile points of an unnamed type were found) and the Badger Springs site (where lanceolate, Angostura-like points were found) because no radiocarbon dates have been obtained from either of them, and their affiliations are uncertain (see Chapter 3).

These and the other recorded Paleoindian sites in regions besides the Southern Basin and Range Province should be prioritized for field investigations, as our knowledge of Paleoindian prehistory in Arizona is largely limited to the four Clovis sites in the upper San Pedro Valley that have previously been excavated (see Chapter 3). Likewise, the recorded Archaic sites of unknown period or complex which appear to have subsurface deposits and/or are located in regions where few or no Archaic sites have previously been excavated should be prioritized for future work.

SITE PATTERNS

Regions

The physiographic region is known for 98 percent of the total site occupations in the database, and significant patterns and trends can be identified when they are compared by period and region (Table 7.6). These include 1) the relatively even proportions of recorded Paleoindian sites in the Southern Basin and Range Province and on the Colorado Plateau; 2) the large number of recorded early Holocene Archaic occupations in the Lower Colorado River Valley; 3) the apparent abandonment of the Lower Colorado River Valley and the greatly reduced population of the Southern Basin and Range Province during the middle Holocene, coinciding with the initial occupation of the Mountain Transition Zone; 4) the apparent repopulation of the Lower Colorado River Valley by Archaic groups during the initial part of the late Holocene; and 5) the relatively intensive late Holocene occupations of the Colorado Plateau and the Southern Basin and Range Province by both Archaic and Early Agricultural populations.

Terminal Wisconsin Paleoindian (Clovis) sites are only known from the Southern Basin and Range Province (61 percent) and the Colorado Plateau (38 percent) (the Clovis sites on the plateau have not been confirmed by excavations, however). The majority of other recorded Paleoindian site occupations are also in those regions (40 percent and 43 percent, respectively), but a few Paleoindian sites (9 percent) are also recorded in the Lower Colorado River Valley.

The pattern is dramatically different for early Holocene Archaic site occupations, with 61 percent in the Lower Colorado River Valley, 21 percent on the Colorado Plateau, and 15 percent in the Southern Basin and Range Province. Most of the early Holocene Archaic site occupations in the Lower Colorado River Valley are attributed to the San Dieguito surveys (by Malcolm Rogers over several decades), or both.

Only 15 recorded Archaic site occupations in Arizona can be confidently dated to the middle Holocene by the presence of certain projectile point types and/or radiocarbon dates, but the majority (73 percent) of these are on the Colorado Plateau. The two in the Mountain Transition Zone represent the earliest identified site occupations in that region, and 13 percent of the identified middle Holocene site occupations in the state. Two sites (13 percent) are also known from the Southern Basin and Range

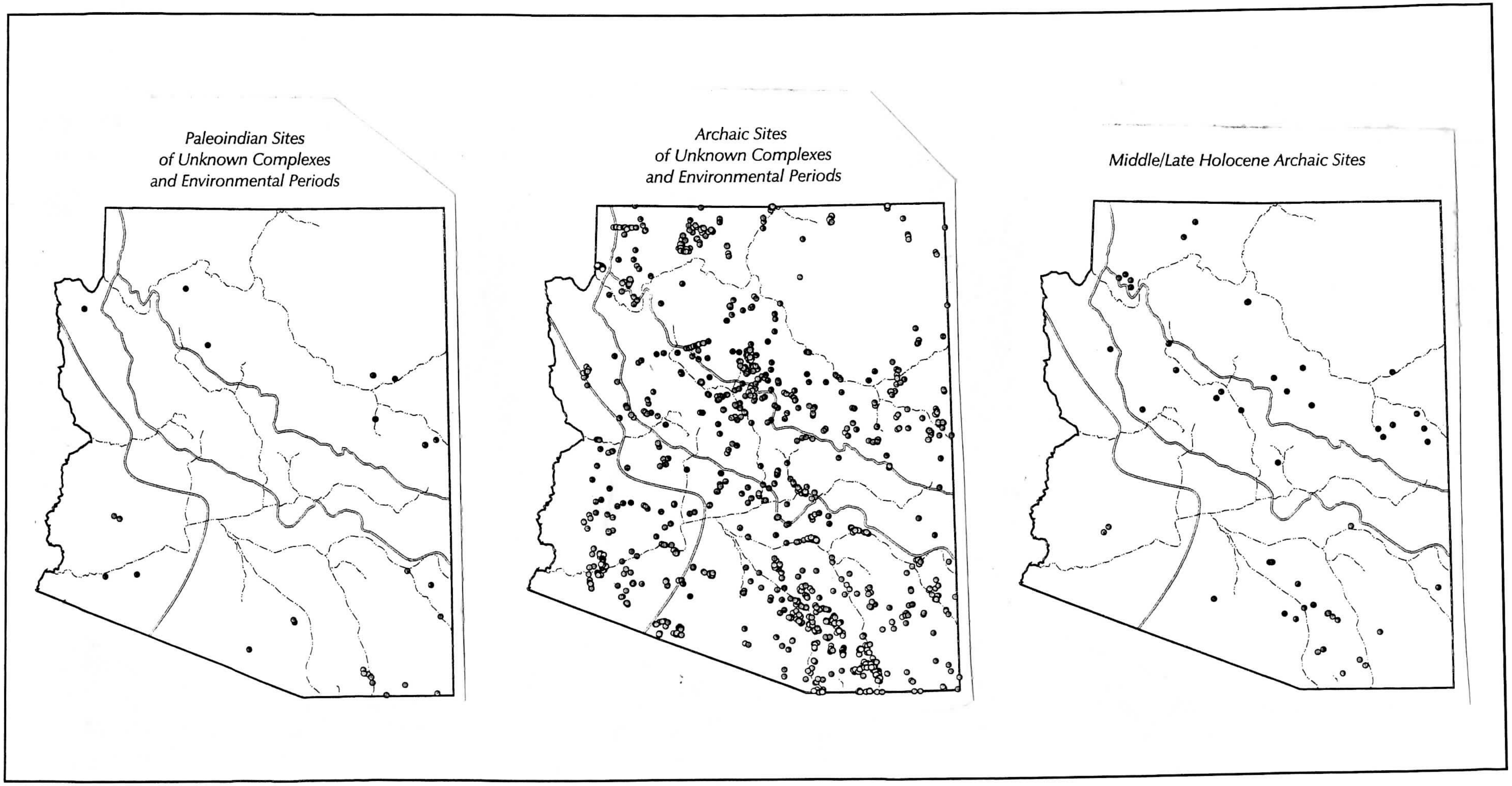

Figure 7.2. Distribution of recorded Paleoindian and Archaic sites of unknown complexes and environmental periods, and middle/late Holocene Archaic sites.

Table 7.6. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by period/adaptation and physiographic region.

	Period/Adaptation								
Physiographic Region	Terminal Wisconsin Paleoindian	Unknown Period Paleoindian	Early Holocene Archaic	Middle Holocene Archaic	Middle/Late Holocene Archaic	Late Holocene Archaic	Late Holocene Early Agricultural	Unknown Period Archaic	Large Aceramic	Total
Lower Colorado River Valley	0	4 (.09)	63 (.61)	0	3 (.03)	51 (.16)	8 (.02)	165 (.05)	31 (.05)	325 (.07)
Southern Basin and Range Province	8 (.61)	17 (.40)	16 (.15)	2	24 (.23)	86 (.27)	127 (.33)	841 (.27)	123 (.21)	1,244 (.27)
Mountain Transition Zone	0	0	0	2 (.13)	9 (.08)	48 (.15)	18 (.05)	187 (.06)	372 (.62)	636 (.14)
Colorado Plateau	5 (.38)	18 (.43)	22 (.21)	11 (.73)	66 (.63)	124 (.39)	224 (.58)	1,888 (.61)	28 (.05)	2,386 (.51)
Unknown	0	3 (.07)	3 (.03)	0	3 (.03)	5 (.02)	6 (.02)	20 (.01)	42 (.07)	82 (.02)
Total	13 (.99)	42 (.99)	104 (.99)	15 (.99)	105 (1.00)	314 (.99)	383 (1.00)	3,101 (1.00)	596 (1.00)	4,673 (1.01)

Province. No certain middle Holocene Archaic site occupations have been identified in the Lower Colorado River Valley.

Almost two-thirds (63 percent) of recorded middle/late Holocene Archaic site occupations (those which may date to either period) are on the plateau; 23 percent are in the Southern Basin and Range Province; 8 percent are in the Mountain Transition Zone; and 3 percent are in the Lower Colorado River Valley. It is possible, however, that the middle/late Holocene occupations recorded in the Southern Basin and Range Province and in the Lower Colorado Valley predominantly date to the late Holocene, and that these regions were only sparsely occupied during the middle Holocene.

The largest proportion (39 percent) of recorded late Holocene Archaic site occupations is on the Colorado Plateau, followed, in order, by the Southern Basin and Range Province (27 percent), the Lower Colorado River Valley (16 percent), and the Mountain Transition Zone (15 percent). If most of the recorded middle/late Holocene occupations were, in fact, late Holocene (which seems likely), this represents dramatic increases in every region, especially in the Lower Colorado River Valley.

By comparison, more than half (58 percent) of the recorded Early Agricultural site occupations are on the Colorado Plateau, while a third (33 percent) are in the Southern Basin and Range Province. These regions have been investigated more intensively than others, but it seems clear that the environmental conditions of these regions provided the best opportunities for early agriculture in Arizona (and probably the entire Southwest). Relatively few Early Agricultural site occupations are currently known in the Mountain Transition Zone (5 percent) and the Lower Colorado Valley (2 percent).

The regional patterns of unknown period Archaic site occupations are most similar to those of Early Agricultural occupations. Almost two-thirds (62 percent) of the large aceramic sites in the inventory—many of which are probably Archaic—are in the Mountain Transition Zone.

Elevations

Elevations above sea level are available for 85 percent of the site occupations in the database, and all of the remainder can be bracketed within 1,000-ft intervals. When the occupations are compared in terms of elevation (Tables 7.7 and 7.8), differences between adaptations and trends through time are apparent. These include 1) the occurrence of the majority of Paleoindian site occupations at medium elevations; 2) a trend of increasing elevations (average, minimum, and maximum) of Archaic site occupations from the early to the middle Holocene, followed by a downward trend during the late Holocene; and 3) a relatively narrower range of elevations for Early Agricultural occupations.

Recorded terminal Wisconsin Paleoindian (Clovis) sites in Arizona range between 3,710 and 6,220 ft in elevation, and are at an average of 4,924 ft, while Paleoindian site occupations of unknown period or complex range between 217 and 6,940 ft, and are at an average of 4,101 ft. Together, all recorded Paleoindian sites are below 7,000 ft, with a third (33 percent) below 2,000 ft, and two-thirds (67 percent) between 7,000 and 2,000 ft.

Compared to these Paleoindian sites, recorded early Holocene Archaic site occupations in the state range between higher minimum and maximum elevations (595 and 7,640 ft), and have a higher average elevation (4,979 ft). However, a higher proportion of occupations are at lower elevations in the Lower Colorado River Valley: almost three-quarters (72 percent) of recorded early Holocene Archaic occupations are below 2,000 ft, about a quarter (24 percent) are between 2,000 and 7,000 ft, and the remainder (5 percent) are between 7,000 and 8,000 ft.

Although the sample is currently very small, it is probably significant that all of the recorded Archaic site occupations that can be confidently dated to the middle Holocene are above 3,000 ft, and 73 percent are above 6,000 ft. Compared to early Holocene Archaic occupations, they range between higher minimum and maximum elevations (3,000 and 8,760 ft), and have a higher average elevation (6,109 ft).

The recorded Archaic site occupations that may date to either the middle or late Holocene range between 1,040 and 8,800 ft, and have an average elevation of 5,274 ft (also higher than the minimum, maximum, and average elevations of early Holocene Archaic occupations). The recorded middle or late Holocene Archaic occupations above 5,000 ft represent almost two-thirds (65 percent) of the total.

The differences in the elevation patterns of recorded late Holocene Archaic and Early Agricultural site occupations are striking. While the proportions of occupations below 2,000 ft are comparable (28 percent and 33 percent, respectively), a much larger proportion (18 percent) of late Holocene Archaic occupations are above 7,000 ft compared to Early Agricultural occupations (2 percent). The biggest difference, however, is in the relative proportions of occupations between 6,000 and 7,000 ft; 27 percent of Early Agricultural occupations are between those elevations, compared to 11 percent of late Holocene Archaic occupations. Recorded Early Agricultural occupations also have a narrower range of elevations (735 to 7,329 ft) and a lower average elevation (4,998 ft) than late Holocene Archaic occupations (420-8,800 ft; average of 5,124 ft).

Table 7.7. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by period/adaptation and elevation.

Elevation (in feet)	Period/Adaptation Terminal Wisconsin Paleoindian		Unknown Period Paleoindian		Early Holocene Archaic		Middle Holocene Archaic		Middle/Late Holocene Archaic		Late Holocene Archaic		Late Holocene Early Agricultural		Unknown Period Archaic		Unknown Period Aceramic		Total	
0-999	4	(.31)	11	(.26)	71	(.68)	0		6	(.06)	79	(.25)	115	(.30)	319	(.10)	213	(.36)	818	(.17)
1000-1999	0		3	(.07)	3	(.03)	0		8	(.08)	10	(.03)	11	(.03)	217	(.07)	78	(.13)	330	(.07)
2000-2999	0		4	(.09)	1	(.01)	0		10	(.09)	19	(.06)	21	(.06)	258	(.08)	221	(.37)	534	(.11)
3000-3999	1	(.08)	4	(.09)	3	(.03)	2	(.13)	6	(.06)	38	(.12)	37	(.10)	225	(.07)	17	(.03)	333	(.07)
4000-4999	4	(.31)	8	(.19)	6	(.06)	1	(.07)	7	(.07)	45	(.14)	55	(.14)	258	(.08)	17	(.03)	401	(.09)
5000-5999	2	(.15)	7	(.17)	7	(.07)	1	(.07)	23	(.22)	32	(.10)	34	(.09)	502	(.16)	23	(.04)	631	(.13)
6000-6999	2	(.15)	5	(.12)	8	(.08)	8	(.53)	33	(.31)	35	(.11)	102	(.27)	826	(.27)	22	(.04)	1,041	(.22)
7000-7999	0		0		5	(.05)	2	(.13)	9	(.09)	50	(.16)	8	(.02)	403	(.13)	3	(< .01)	480	(.10)
8000-8999	0		0		0		1	(.07)	3	(.03)	6	(.02)	0		88	(.03)	2	(< .01)	100	(.02)
9000-9999	0		0		0		0		0		0		0		5	(< .01)	0		5	(< .01)
Total	13	(1.00)	42	(.99)	104	(1.01)	15	(1.00)	105	(1.01)	314	(.99)	383	(1.01)	3,101	(1.00)	596	(1.00)	4,673	(.99)

Table 7.8. Variability in elevations (in feet) of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by period/adaptation.

Period/Adaptation	Sample Size	Mean	Minimum	Maximum	Standard Deviation
Terminal Wisconsin Paleoindian	9	4924	3710	6220	985
Unknown period Paleoindian	33	4101	217	6940	1842
Early Holocene Archaic	35	4979	595	7640	2038
Middle Holocene Archaic	15	6109	3000	8760	1498
Middle/Late Holocene Archaic	99	5274	1040	8800	1870
Late Holocene Archaic	239	5124	420	8800	1955
Late Holocene Early Agricultural	269	4998	735	7320	1622
Unknown period Archaic	2912	5124	20	9180	2133
Unknown period aceramic	385	2734	548	8268	1484

The increasing elevations of Archaic site occupations between the early and middle Holocene may represent a cultural adaptation to increasing temperature and decreasing effective moisture, which made lower elevations less productive and habitable (see Chapter 5). The large proportions of recorded occupations below 2,000 ft during the early Holocene and initial part of the late Holocene may represent intervals of relatively higher effective moisture that increased the carrying capacities of lower elevation environments.

The large number of recorded Early Agricultural site occupations between 6,000 and 7,000 ft reflects the dramatic increase in the population of the Colorado Plateau during the Basketmaker II period, which was certainly related to the spread of agriculture and the development of dry farming (see Chapter 6). By the same token, the lower number of recorded Early Agricultural occupations above 7,000 ft, and their narrower range of elevations, probably reflects the agriculturally limiting factors of shorter growing seasons and more frequent frosts at higher elevations, and lower precipitation and soil moisture at lower elevations.

Landforms

The landforms on which site occupations are located are known for 78 percent of those in the database. Comparisons of those occupations by landform (Table 7.9) shows that 1) although most of our knowledge of them is derived from sites in alluvial contexts, recorded Paleoindian sites in Arizona are also known to be located on alluvial terraces, ridgetops, sand dunes, mesas, and alluvial plains, in that order of frequency; 2) for recorded Archaic site occupations of all periods, the most common locations are on ridgetops, alluvial terraces, alluvial plains, and hill slopes, rather than the rockshelters and caves from which we have obtained most of our knowledge; and 3) the most common settings for recorded Early Agricultural occupations are ridgetops, terraces, sand dunes, and rock-shelters/caves, which means that our focus on those in floodplain contexts allows us to see only portions of regional settlement-subsistence systems that include floodplain agricultural settlements as a component.

Archaic site occupations tend to be on prominent landforms or alluvial terraces during each environmental period. Terraces, ridgetops, mesas, and hilltops are the most common settings of recorded early Holocene Archaic occupations. The small number of occupations that can be confidently dated to the middle Holocene occur on ridge-tops, hill slopes, terraces, and rockshelters/caves, while the most common settings for recorded middle/late Holocene Archaic occupations are ridgetops, terraces, alluvial plains, and hill slopes. Terraces, ridgetops, and alluvial plains are the most common settings for recorded late Holocene Archaic occupations.

Sizes

The sizes of 88 percent of the site occupations in the statewise database are known. When those occupations are compared in terms of size (Table 7.10), some patterns and trends are identifiable. It should be noted, however, that the sizes of buried sites are usually unknown, while surface scatters of artifacts have often been enlarged by natural and cultural site formation processes. Even with this recognition, the recorded sizes of some site occupations in this inventory seem implausibly large, and it is suggested that all of those above 500 ha (1 ha = 10,000 m^2) need to be checked before they are accepted.

Table 7.9. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by period/adaptation and landform.

	Period/Adaptation																			
Geomorphology	Terminal Wisconsin Paleoindian		Unknown Period Paleoindian		Early Holocene Archaic		Middle Holocene Archaic		Middle/Late Holocene Archaic		Late Holocene Archaic		Late Holocene Early Agricultural		Unknown Period Archaic		Unknown Period Aceramic		Total	
Sand dune	0		5	(.12)	1	(.01)	1	(.07)	7	(.07)	8	(.03)	26	(.07)	61	(.02)	0		109	(.02)
Playa beach	0		0		1	(.01)	0		0		2	(.01)	1	(< .01)	12	(< .01)	0		16	(< .01)
Alluvial plain/flat	0		3	(.07)	3	(.03)	1	(.07)	9	(.09)	33	(.10)	10	(.03)	256	(.08)	1	(< .01)	316	(.07)
Floodplain	1	(.08)	1	(.02)	0		0		6	(.06)	6	(.02)	20	(.05)	66	(.02)	0		100	(.02)
Alluvial fan	1	(.08)	0		2	(.02)	0		2	(.02)	2	(.01)	1	(< .01)	20	(.01)	0		28	(.01)
Bajada/coalesced fans	0		0		2	(.02)	1	(.07)	1	(.01)	8	(.02)	12	(.03)	95	(.03)	0		119	(.02)
Terrace/bench	2	(.15)	4	(.09)	13	(.12)	2	(.13)	12	(.11)	43	(.14)	31	(.08)	283	(.09)	0		390	(.08)
Hill slope	0		0		1	(.01)	3	(.20)	9	(.09)	18	(.06)	9	(.02)	270	(.09)	0		310	(.07)
Hilltop	0		0		4	(.04)	1	(.07)	6	(.06)	4	(.01)	14	(.04)	188	(.06)	0		217	(.05)
Ridgetop	0		5	(.12)	7	(.07)	3	(.20)	19	(.18)	38	(.12)	50	(.13)	766	(.25)	0		888	(.19)
Mesa/small plateau	2	(.15)	1	(.02)	6	(.06)	0		1	(.01)	8	(.02)	3	(.01)	57	(.02)	0		78	(.02)
Saddle	0		0		0		0		2	(.02)	0		2	(< .01)	20	(.01)	0		24	(< .01)
Pass	0		0		0		0		0		0		1	(< .01)	0		0		1	(< .01)
Rockshelter/cave	0		0		3	(.03)	2	(.13)	0		7	(.02)	23	(.06)	19	(.01)	0		54	(.01)
Other	6	(.46)	19	(.45)	51	(.49)	1	(.07)	23	(.22)	103	(.33)	87	(.23)	715	(.23)	0		1,005	(.21)
Unknown	1	(.08)	4	(.09)	10	(.10)	0		8	(.08)	34	(.11)	93	(.24)	273	(.09)	595	(.99)	1,018	(.22)
Total	13	(1.00)	42	(.98)	104	(1.01)	15	(1.01)	105	(1.02)	314	(1.00)	383	(1.00)	3,101	(1.01)	596	(1.00)	4,673	(1.00)

The comparisons show that 1) the great majority of site occupations for each period and adaptation are less than 2 ha, and about half are less than a tenth of a hectare (1,000 m^2)—larger sizes probably represent sites that were occupied repeatedly over very long spans of time because of their favorable locations in relation to resources, particularly perennial water sources; 2) the large proportion of Early Agricultural occupations less than 1,000 m^2, the most contrasting pattern among all periods and adaptations compared, may represent specialized, logistical activities of populations based in larger settlements.

The sizes of recorded Paleoindian sites range widely, from less than a tenth of a hectare to over 100 ha, but most are less than 2 ha. A few recorded early Holocene Archaic sites are more than 100 ha, and three are more than 300 ha, but most of these exceptionally large ones are trails; the majority are less than 2 ha. All of the recorded occupations that can be confidently dated to the middle Holocene are less than 6 ha, and most are less than half a hectare. The largest recorded site occupation for the middle/late Holocene is more than 45 ha, but the majority are less than 2 ha. A few late Holocene site occupations are more than 15 ha, and three are more than 500 ha, but the majority are again less than 2 ha, and most of those are below half a hectare. In comparison, recorded Early Agricultural site occupations range up to almost 400 ha, but the majority are less than 2 ha, and half are less than a half hectare.

Artifact and Feature Contexts

The contexts of artifacts and features are unknown for 48 percent of the site occupations in the database; these are mostly large aceramic sites and Archaic sites of unknown period or complex, so the level of knowledge of contexts is better for sites that can be assigned to a period and adaptation. Comparisons of these occupations (Table 7.11) reveal that 1) the contexts of recorded Paleoindian site occupations include surface assemblages and assemblages in buried deposits at both single component and multicomponent sites; 2) recorded early Holocene Archaic occupations are typically the earliest components at multicomponent sites; 3) the largest proportion of recorded middle Holocene Archaic occupations are assemblages in buried deposits of multicomponent sites; and 4) the largest proportions of recorded middle/late Holocene Archaic, late Holocene Archaic, and Early Agricultural occupations are surface assemblages at single component sites.

Equal proportions (each 23 percent) of recorded Paleoindian site occupations in Arizona are surface assemblages (artifacts and/or features), surface assemblages at multicomponent sites, and assemblages in buried deposits. Most of the remainder are also equally divided (each 15 percent) between isolated surface artifacts (projectile points) and assemblages in buried deposits of multicomponent sites (stratified sites).

More than half (57 percent) of the recorded early Holocene Archaic site occupations in the state are surface assemblages at multicomponent sites. Another quarter (25 percent) are surface assemblages at single-component sites, followed by assemblages in buried deposits of multicomponent sites (9 percent), assemblages in buried deposits of single-component sites (5 percent), and isolated surface artifacts (1 percent).

The largest proportion of recorded middle Holocene Archaic site occupations are assemblages in buried deposits of multicomponent sites (27 percent). The rest are surface assemblages (20 percent), surface assemblages at multicomponent sites (13 percent), and assemblages in buried deposits (7 percent).

Almost half (48 percent) of the recorded middle/late Holocene site occupations are surface assemblages, followed by surface assemblages at multicomponent sites (16 percent). Assemblages in buried deposits of multicomponent (3 percent) and single-component (1 percent) sites, and isolated surface features (1 percent) comprise the remainder.

The majority of recorded late Holocene Archaic site occupations are almost evenly divided between surface assemblages (46 percent) and surface assemblages at multicomponent sites (42 percent). Less common are assemblages in buried deposits (3 percent), assemblages in buried deposits of multicomponent sites (2 percent), and isolated surface features (1 percent).

The most common types of Early Agricultural site occupations are surface assemblages (36 percent) and surface assemblages at multicomponent sites (29 percent). Most of the rest are evenly divided (each 4 percent) between assemblages in buried deposits and assemblages in buried deposits of multi-component sites.

The largest proportion (42 percent) of unknown period Archaic occupations are surface assemblages. All of the large aceramic sites of unknown period or complex in the database are assemblages in unknown contexts, but most are probably surface assemblages.

Table 7.10. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by period/adaptation and size (hectares).

	Size (hectares)															
Period/Adaptation	0-.09		.10-.49		.50-1.99		2.00-9.99		10.00-99.99		100.00-499.99		> 500.00		Total	
Terminal Wisconsin Paleoindian	1	(.33)	1	(.33)	0		0		1	(.33)	0		0		3	(1.00)
Unknown period Paleoindian	7	(.29)	4	(.17)	3	(.12)	3	(.12)	6	(.25)	1	(.04)	0		24	(.99)
Early Holocene Archaic	9	(.12)	14	(.19)	24	(.33)	15	(.20)	6	(.08)	3	(.04)	2	(.03)	73	(.99)
Middle Holocene Archaic	2	(.25)	3	(.37)	1	(.12)	2	(.25)	0		0		0		8	(.99)
Middle/Late Holocene Archaic	15	(.15)	29	(.29)	35	(.35)	16	(.16)	5	(.05)	0		0		100	(1.00)
Late Holocene Archaic	47	(.17)	87	(.32)	68	(.25)	42	(.16)	17	(.06)	5	(.02)	3	(.01)	269	(.99)
Late Holocene Early Agricultural	152	(.50)	60	(.20)	53	(.17)	28	(.09)	12	(.04)	1	(< .01)	0		306	(1.00)
Unknown period Archaic	970	(.35)	962	(.34)	493	(.18)	249	(.09)	105	(.04)	11	(< .01)	0		2,790	(1.00)
Unknown period aceramic	205	(.39)	174	(.33)	89	(.17)	47	(.09)	11	(.02)	2	(< .01)	1	(< .01)	529	(1.00)

Table 7.11. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by period/adaptation and artifact and feature contexts.

	Period/Adaptation									
Physical Site Type	Terminal Wisconsin Paleoindian	Unknown Period Paleoindian	Early Holocene Archaic	Middle Holocene Archaic	Middle/Late Holocene Archaic	Late Holocene Archaic	Late Holocene Early Agricultural	Unknown Period Archaic	Unknown Period Aceramic	Total
Isolated surface artifact/feature	2 (.15)	0	1 (.01)	0	1 (.01)	2 (.01)	0	11 (< .01)	0	17 (< .01)
Surface artifact scatter/feature(s)	3 (.23)	12 (.29)	26 (.25)	3 (.20)	50 (.48)	144 (.46)	137 (.36)	1,316 (.42)	0	1,691 (.36)
Surface artifact scatter/feature(s) of multicomponent site	3 (.23)	20 (.48)	59 (.57)	2 (.13)	17 (.16)	132 (.42)	110 (.29)	274 (.09)	0	617 (.13)
Artifacts/feature(s) in buried deposit	3 (.23)	6 (.14)	5 (.05)	1 (.07)	1 (.01)	11 (.03)	17 (.04)	46 (.01)	0	90 (.02)
Artifacts/feature(s) in buried deposit of multicomponent site	2 (.15)	4 (.09)	9 (.09)	4 (.27)	3 (.03)	8 (.02)	15 (.04)	13 (< .01)	0	58 (.01)
Other	0	0	2 (.02)	0	0	3 (.01)	1 (< .01)	9 (< .01)	0	15 (< .01)
Unknown	0	0	2 (.02)	5 (.33)	33 (.31)	14 (.04)	103 (.27)	1,432 (.46)	596 (1.00)	2,185 (.48)
Total	13 (.99)	42 (1.00)	104 (1.01)	15 (1.00)	105 (1.00)	314 (.99)	383 (1.00)	3,101 (1.00)	596 (1.00)	4,673 (1.00)

Artifact Classes

The artifact classes that are present are recorded for 96 percent of the site occupations in the database. Several patterns emerge when those occupations are compared (Table 7.12). These include 1) the most common artifact classes present at occupations associated with Paleoindian, Archaic, and Early Agricultural adaptations alike are flaked stone, ground stone, fire-cracked rocks, and animal bones, in that order; 2) ground stone and fire-cracked rocks may be associated with Paleoindian occupations; 3) marine shells and nonlocal minerals first appear at early Holocene Archaic occupations; 4) ground stone milling tools and marine shells occur at relatively high proportions of middle Holocene Archaic occupations; and 5) the artifact assemblages of late Holocene Archaic and Early Agricultural occupations are relatively similar, except that human remains are present at a higher proportion of Early Agricultural occupations.

Ground stone artifacts are present at a third (33 percent) of the recorded Paleoindian occupations in Arizona, and fire-cracked rocks are present at 12 percent of them. This is surprising at face value because the appearances of these artifact classes in the Southwestern archaeological record are generally associated with the development of Archaic adaptations that included processing of seeds with milling stones and cooking in rock-filled roasting pits. However, 53 percent of recorded Paleoindian occupations in Arizona are only the earliest components at multicomponent sites, and it is likely that these artifact classes are actually associated with Archaic occupations or other components at most of those sites.

Indeed, ground stone is present at only two single-component Paleoindian sites recorded in Arizona (and fire-cracked rocks are also present at only one of those). There are at least three possibilities which can account for their presence at these single-component Paleoindian sites. First, the ground stone artifacts were not used for seed grinding; ground stone tools used for pigment processing are known from a number of North American Paleoindian sites (Roper 1989; Garcia 1996). Second, the Paleoindian occupations at those two sites are the only *recognized* site components; there may be other components that are not represented by temporally diagnostic artifacts, or the Paleoindian occupation may be misidentified. The third possibility, of course, is that Paleoindian adaptations did include the use of these artifact classes to at least a minor extent.

The presence of cremated human bones at the Badger Springs site (Hesse et al. 1996; see also Chapter 3) represents the only identified occurrence of human remains at a Paleoindian site in Arizona. No other component is currently recognized at the site, and the presence of Angostura-like projectile points and the bones of extinct bison supports this association with a Paleoindian occupation.

In addition to the possible first appearance of ground stone milling tools and fire-cracked rocks, the earliest marine shells and rare, nonlocal minerals are associated with early Holocene Archaic site occupations in Arizona. That some of these are single-component sites supports their attribution to early Archaic groups. The presence of shells and rare minerals (and obsidian) at early Holocene Archaic sites indicates large-scale mobility patterns that allowed direct procurement, and possibly the initial development of down-the-line exchange networks.

The presence of ground stone milling tools, fire-cracked rocks, shells, and rare minerals at recorded middle Holocene Archaic occupations in Arizona indicates continuity in subsistence technologies, large-scale mobility, and possibly trade connections during an interval of significantly reduced population in all regions of the Southwest. In fact, ground stone is present at a relatively high proportion (60 percent) of recorded middle Holocene occupations; the sample size is small, but this may reflect an increased reliance on seed processing.

Ground stone and fire-cracked rocks are present at relatively large proportions of recorded late Holocene Archaic occupations. Marine shell is also present at a significant proportion (6 percent) of recorded late Holocene Archaic occupations, although shell is present at larger proportions of recorded early Holocene and middle Holocene Archaic occupations (11 percent and 20 percent, respectively).

The breakdown of recorded Early Agricultural occupations by artifact classes present most closely resembles that for late Holocene Archaic occupations. It is likely that this similarity in artifact assemblages is largely due to continuities between Archaic and Early Agricultural populations (the latter deriving from the former), and partly due to the fact that there was a temporal overlap of Archaic and Early Agricultural adaptations during the late Holocene (they were partly contemporaneous). That human remains are present at a larger proportion of Early Agricultural occupations (4 percent) than at late Holocene Archaic ones (2 percent) may reflect increasing sedentism.

Table 7.12. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic sites in Arizona by period/adaptation and artifact classes present.

	Artifact Classes Present								
Period/Adaptation (First Occupation of Site)	Ground Stone	Flaked Stone	Marine Shell	Nonlocal Minerals	Fire-cracked Rocks	Animal Bones	Perishable Materials	Human Remains	Other	Total No. of Occupations
Terminal Wisconsin Paleoindian	1 (.08)	13 (1.00)	0	0	0	6 (.46)	0	0	5 (.38)	13
Unknown period Paleoindian	14 (.33)	39 (.93)	0	0	5 (.12)	16 (.38)	1 (.02)	1 (.02)	15 (.36)	42
Early Holocene Archaic	39 (.03)	74 (.79)	10 (.11)	2 (.02)	5 (.05)	6 (.06)	4 (.04)	6 (.06)	37 (.39)	94
Middle Holocene Archaic	6 (.60)	10 (1.00)	2 (.20)	2 (.20)	1 (.10)	4 (.40)	1 (.10)	2 (.20)	0	10
Middle/Late Holocene Archaic	38 (.38)	99 (1.00)	1 (.01)	1 (.01)	10 (.10)	3 (.03)	0	1 (.01)	25 (.25)	99
Late Holocene Archaic	128 (.57)	217 (.96)	13 (.06)	3 (.01)	29 (.13)	19 (.08)	3 (.01)	5 (.02)	69 (.31)	225
Late Holocene Early Agricultural	161 (.48)	277 (.83)	11 (.03)	6 (.02)	37 (.11)	21 (.06)	14 (.04)	12 (.04)	102 (.31)	333
Unknown period Archaic	893 (.29)	2,811 (.91)	28 (.01)	5 (< .01)	171 (.06)	53 (.02)	8 (< .01)	10 (< .01)	504 (.16)	3,076
Unknown period aceramic	128 (.21)	591 (.99)	0	0	0	3 (< .01)	0	0	54 (.09)	596
Total	1,408 (.31)	4,131 (.92)	65 (.01)	19 (< .01)	257 (.06)	131 (.03)	31 (.01)	37 (.01)	811 (.18)	4,488

Feature Types

The feature types present are recorded for 96 percent of the site occupations in the database. The confirmed presence and relative frequency of certain feature types at those occupations (Table 7.13) reflect differences in 1) subsistence technologies; 2) resource storage systems; 3) mobility patterns; and 4) site functions. On the other hand, the presences of other feature types are unexpected for occupations of each type of adaptation, and require further investigations to verify or reject them.

At recorded terminal Wisconsin Paleoindian (Clovis) sites in Arizona have been found hearths (Lehner), a well (Murray Springs), and a lithic quarry (unnamed site). Associated with recorded Paleoindian occupations of unknown period or complex are hearths, unlined pits of unidentified function(s), a trash-filled pit, a burial feature, a lithic quarry, rock cairns, and a rock ring.

Roasting pits were also identified at four Paleoindian sites, including one Clovis site, all of which have other occupation components. For the same reasons discussed for fire-cracked rocks, it is possible that either 1) the roasting pits are associated with Archaic or other components at those sites, or 2) the rock-filled roasting pit was a Paleoindian subsistence technology (contrary to the conventional wisdom that in the Southwest it was developed by Early Archaic peoples). Similar arguments can be made about the presence of a slab-lined storage pit at one recorded Paleoindian site, a pit structure at another, and a sleeping circle at a third; all three sites have other occupation components, so the association of these feature types with the Paleo-indian occupations may or may not be correct.

The single burial is the human cremation at the Badger Springs site (Hesse et al. 1996; see also Chapter 3), which is convincingly associated with the Paleoindian occupation at that single-component site (see discussion of human remains above, and also Chapter 3). Currently, this is the earliest known mortuary feature in the Southwest.

Except for trash-filled pits, all of the feature types *documented at* Paleoindian sites are also associated with recorded early Holocene Archaic occupations. The presences of rock-filled roasting pits, slab-lined storage pits, and sleeping circles at the latter are supported by associated temporally diagnostic artifacts. Radiocarbon dates associated with fire-cracked rocks at the Lehner site (Haynes 1982), and with slab-lined storage pits at Sand Dune Cave (Lindsay et al. 1968), confirm the presence of those feature types at early Holocene Archaic sites in the Southwest. The association of pit structures at three sites with later occupation components is unconfirmed. Other feature types convincingly associated with early Holocene Archaic occupations include bedrock mortars, trails, cairns (shrines?), and rock alignments.

The lack of sleeping circles, trails, and rock rings at recorded middle Holocene Archaic occupations in Arizona is explained by either the small sample size and/or the fact that none of them are in the Lower Colorado River Valley, the region where those feature types occurred exclusively during the early Holocene. On the other hand, the presence of roasting pits, a slab-lined storage pit, and bedrock mortars indicates continuity in subsistence technologies and storage systems between early and middle Holocene Archaic adaptations. The presence of a trash midden (usually interpreted as a sign of relative sedentism) at a middle Holocene cave occupation may indicate either a single long-term occupation, multiple short-term occupations, or a combination.

Although the same possibilities apply, the presence of trash middens at six recorded late Holocene Archaic site occupations in Arizona, and at eight Early Agricultural occupations (representing 3 percent and 2 percent, respectively) is probably a reflection of increasing sedentism during the late Holocene. Certainly, the presence of structures at six (3 percent) recorded late Holocene Archaic occupations (Westfall 1981; Diggs 1982; Huckell 1984a; Bayham et al. 1986; Halbirt and Henderson 1993) and at 29 Early Agricultural occupations (9 percent of the total sample) reflects decreasing residential mobility, as do the higher proportions of Early Agricultural occupations with unlined pits (6 percent), slab-lined pits (11 percent), and burials (2 percent).

SITE TYPES

For the purposes of both National Register nominations and research designs, some system of categorizing site types is necessary. A wide variety of site types are distinguished in the vast archaeological and ethnographic literatures about hunter-gatherers and preindustrial farmers. However, the differences among these "types" are derived from various kinds of behavior that cannot be directly compared or contrasted, let alone accurately identified. Even though site types can be conceptually defined as discrete categories, their causal behaviors, and therefore material manifestations, are more realistically modeled along continua of various of dimensions. These behavioral dimen-

Table 7.13. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic sites by period/adaptation and feature types present.

Period/Adaptation (First Occupation of Site)	Feature Types Present							
	Hearth	Roasting Pit	Unlined Pit	Slab-lined Pit	Trash Pit	Trash Midden	Structure	Burial
Terminal Wisconsin Paleoindian	1 (.08)	1 (.08)	0	0	0	0	0	0
Unknown period Paleoindian	9 (.21)	3 (.07)	2 (.05)	1 (.02)	1 (.02)	0	1 (.02)	1 (.02)
Early Holocene Archaic	18 (.19)	5 (.05)	2 (.02)	1 (.01)	0	0	3 (.03)	1 (.01)
Middle Holocene Archaic	2 (.20)	2 (.20)	2 (.20)	1 (.10)	0	1 (.10)	0	1 (.10)
Middle/Late Holocene Archaic	5 (.05)	5 (.05)	1 (.01)	1 (.01)	0	1 (.01)	1 (.01)	1 (.01)
Late Holocene Archaic	33 (.15)	20 (.09)	9 (.04)	2 (.01)	0	6 (.03)	6 (.02)	3 (.01)
Late Holocene Early Agricultural	61 (.18)	21 (.06)	20 (.06)	37 (.11)	3 (.01)	8 (.02)	29 (.09)	6 (.02)
Unknown period Archaic	181 (.06)	105 (.03)	5 (< .01)	28 (.01)	1 (< .01)	10 (< .01)	28 (.01)	10 (< .01)
Unknown period aceramic	15 (.02)	11 (.02)	2 (< .01)	0	0	3 (< .01)	1 (< .01)	0
Total	325 (.07)	173 (.04)	43 (.01)	71 (.02)	5 (< .01)	29 (< .01)	69 (.01)	23 (< .01)

Period/Adaptation (First Occupation of Site)	Feature Types Present								Total No. of Occupations
	Sleeping Circle	Quarry	Bedrock Mortar	Trail	Cairn	Rock Alignment	Rock Ring	Other	
Terminal Wisconsin Paleoindian	0	1 (.08)	0	0	0	0	0	1 (.08)	13
Unknown period Paleoindian	1 (.02)	0	0	0	2 (.05)	0	1 (.02)	7 (.19)	42
Early Holocene Archaic	6 (.06)	11 (.12)	16 (.20)	28 (.30)	3 (.03)	4 (.04)	18 (.19)	46 (.49)	94
Middle Holocene Archaic	0	1 (.10)	1 (.10)	0	1 (.10)	2 (.20)	0	2 (.20)	10
Middle/Late Holocene Archaic	2 (.02)	1 (.01)	0	2 (.02)	2 (.02)	2 (.02)	4 (.04)	8 (.08)	99
Late Holocene Archaic	2 (.01)	6 (.03)	8 (.03)	6 (.03)	8 (.03)	7 (.03)	6 (.03)	32 (.14)	229
Late Holocene Early Agricultural	0	0	6 (.02)	0	11 (.03)	5 (.01)	5 (.01)	77 (.23)	333
Unknown period Archaic	38 (.01)	128 (.04)	3 (< .01)	28 (.01)	74 (.20)	39 (.01)	47 (.01)	459 (.15)	3,076
Unknown period aceramic	0	21 (.03)	7 (.01)	1 (< .01)	0	0	0	243 (.15)	596
Total	49 (.01)	169 (.04)	41 (.01)	65 (.01)	101 (.02)	59 (.01)	81 (.02)	875 (.19)	4,492

sions include seasonality of occupation, group size, economic activities, etc.

Here, the framework used for categorizing Paleoindian, Archaic, and Early Agricultural site types is based primarily on the two dimensions of behavioral variability that are perhaps the most easily reconstructed from the archaeological record: 1) the relative durations of site use; and 2) the relative diversities of activities carried out at those locations (Figure 7.3).

Although sites can be categorized more confidently within this framework if a wide range of data and large sample sizes have been recovered through excavations, many sites known only through surface surveys can be at least bracketed within ranges along the continua of these two dimensions, and these ranges can then be contrasted in relative terms. For example, a large, high-density surface assemblage that includes several classes of artifacts, such as metates and other nonportable items, broken metates and exhausted flaked stone cores and tools, and human bones, can be inferred to represent a longer occupation and a wider range of activities than does a small surface assemblage comprised only of a few flaked stone artifacts.

Along each axis of variability in this framework, some gross-level contrasts among sites can thus be made. Durations of occupations can be contrasted in terms of short-term versus long-term, and diversities of activities can be contrasted in terms of specialized versus generalized. Comparing sites in terms of a combination of these two dimensions, specialized-activity short-term sites can be contrasted with generalized-activity long-term sites; it is expected that only one or a few procurement, processing, and noneconomic activities were carried out at the former, while a range of production, storage, exchange, and noneconomic activities were carried out at the latter, thus resulting in distinct archaeological manifestations.

Within this framework, a continuum exists among generalized-activity long-term sites between single-use campsites, short-term base camps, seasonal settlements, multi-seasonal settlements, and permanent settlements. On the other hand, certain site types within this framework certainly exist, but are difficult to recognize in the archaeological record (such as single-use campsites, which would be represented only by an isolated hearth and perhaps a few artifacts and bones). As well, other site types in this framework are rare or do not exist, such as long-occupied sites where only single activities were carried out.

Other dimensions of behavioral variability also could be used to categorize site types. These include 1) the timing of site use (in relation to climatic seasons, times of resource availability, etc.); 2) the frequency of site reuse (ranging from none to multiple, and irregular to regular); 3) the size of the group using the site (individual, task group, family, community, etc.); and 4) the spatial area of activities (locality, linear pattern, landform, etc.).

These other dimensions of behavior along which sites can be compared are shown as alternative axes in Figure 7.3. Conceptually, then, site types could be distinguished according to multiple behavioral criteria, and plotted in a figure representing a multidimensional space. However, these other dimensions of behavior have proven to be much more difficult to reconstruct from the archaeological record, particularly from sites known only through surface surveys. For example, there are no known winter-indicator economic plants in the Sonoran Desert, so a winter site occupation cannot be identified from botanical remains—the most sensitive indicators of seasonality that may be preserved in subsurface deposits. From surface evidence alone, all seasons of occupation are equally unidentifiable.

Nevertheless, the potential isomorphic effects these various dimensions of behavior have on physical site characteristics, such as reused sites resembling long-occupied ones, should be considered. In this case, however, the sites would still tend to have some identifiable differences beneath their superficial resemblances. Although they may have similar quantities and densities of artifacts, and similar sizes and volumes of deposits, a long-occupied site would be more likely to have 1) a higher diversity of artifact classes; 2) a higher ratio of flaked stone debitage to tools; 3) a larger number of exhausted tools; 4) more storage features; 5) more energy investment in structures; 6) a more formal site structure; and 7) trash deposits with more diverse contents. On the other hand, a site reused multiple times would be more likely to have greater representation of a few artifact classes, more superposition of features, and more cached tools. Based on these and other characteristics, then, one could distinguish between a reused site and a long-occupied site in probabilistic terms.

Table 7.14 shows some site types, categorized primarily according to a combination of occupation duration and diversity of activities, which have been documented in Arizona for Paleoindian, Archaic, and Early Agricultural adaptations. Certain types of sites expected to be associated with these adaptations, but which have not yet been identified, are also indicated.

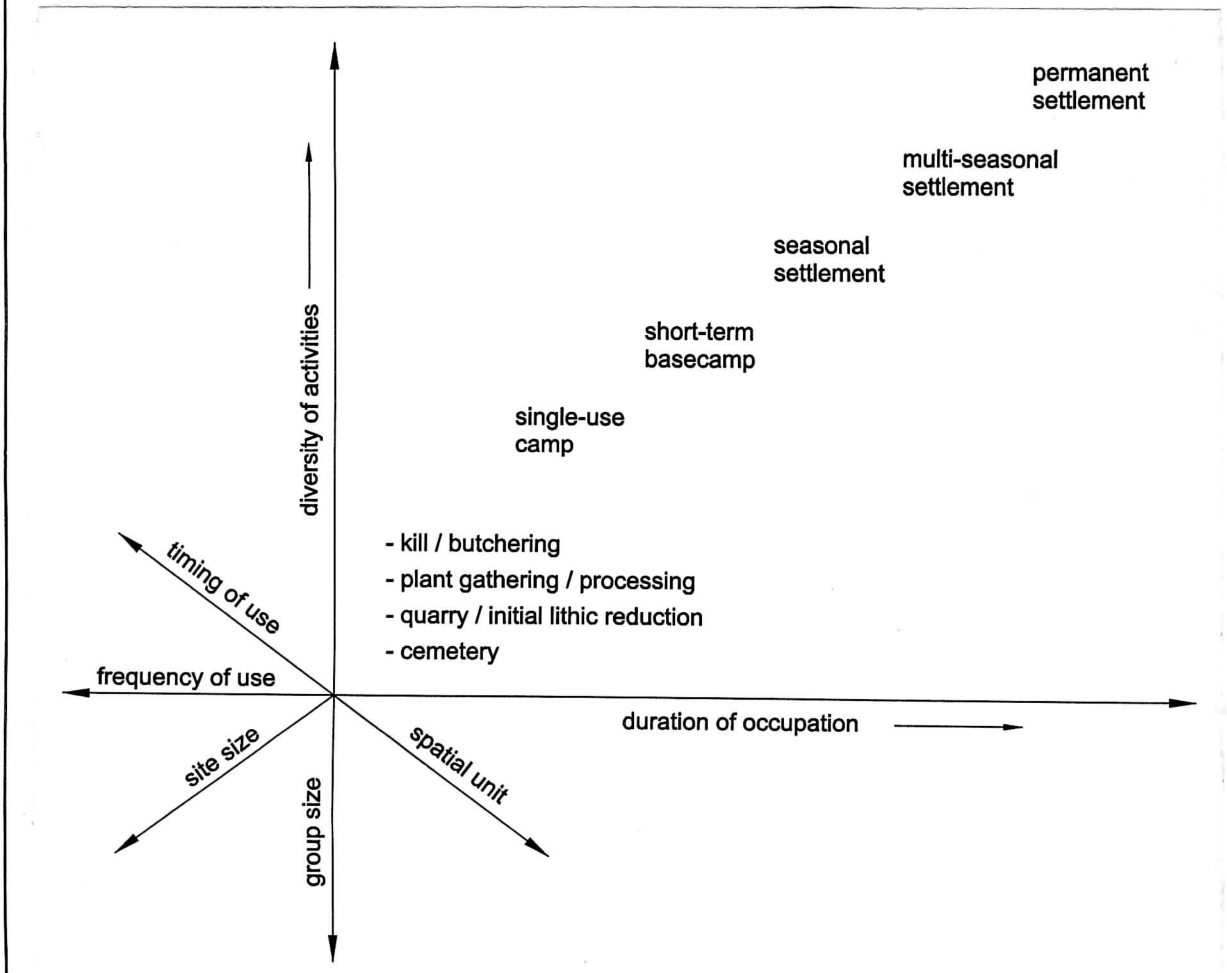

Figure 7.3. A continuum model of Paleoindian, Archaic, and Early Agricultural site types by relative duration of occupation and diversities of activities.

Table 7.14. Paleoindian, Archaic, and Early Agricultural site types in Arizona (X = documented through excavations; x = expected).

Site Type	Terminal Wisconsin Paleoindian	Early Holocene Paleoindian	Early Holocene Archaic	Middle Holocene Archaic	Late Holocene Archaic	Late Holocene Early Agricultural
Lithic quarry/ initial reduction	x	X	X	x	X	X
Kill/butchering	X	X	x	x	x	x
Plant gathering/processing	?	?	X	x	X	X
Rock art			X	?	X	X
Shrine	?	?	X	?	X	X
Trail			X	?	X	X
Cemetery					?	X
Single-use camp	x	x	x	x	X	X
Short-term base camp	x	X	X	X	X	X
Seasonal settlement			X	X	X	X
Multi-seasonal settlement					?	X
Permanent settlement						?

Lithic Quarry/Initial Reduction Sites

Numerous lithic quarry/initial reduction sites are recorded for every region of Arizona. These, or nearby sites, have sometimes yielded temporally diagnostic artifacts (projectile points) made of the same materials, indicating use by Paleoindian, Archaic, and/or Early Agricultural groups. However, quarries were often reused throughout prehistory, and so it is difficult to associate non-diagnostic artifacts at these sites with specific periods of use.

Kill/Butchering Sites

Megafauna kill/butchering sites are documented for the terminal Wisconsin Clovis complex (Lehner, Murray Springs, Naco, Escapule) and an early Holocene Paleoindian complex (Badger Springs). Kill/butchering sites of smaller fauna are expected to exist for Archaic and Early Agricultural adaptations, but are more difficult to recognize in the archaeological record.

Plant Gathering/Processing Sites

Plant gathering/processing sites, represented by ground stone milling tools, bedrock mortars and grinding slicks, and rock-filled roasting pits, are documented for Archaic and Early Agricultural adaptations. The ground stone milling tools found at the Badger Springs site and other Paleoindian sites may indicate that seed processing was also associated with some Paleoindian adaptations.

Rock Art Sites

Some intaglios (figures formed by surface alignments of stones) in the Lower Colorado River Valley are attributed to the San Dieguito complex (Rogers 1939). Numerous sites in Arizona with petroglyphs and/or pictographs are attributed to late Holocene Archaic and Early Agricultural complexes (see Thiel 1995 for review).

Shrines

Rock-cairns along prehistoric trails in the Lower Colorado Valley have been interpreted as shrines built by people associated with the San Dieguito complex (Rogers 1939; Huckell 1978b). Cairns of the dung of extinct Pleistocene artiodactyls and fossilized packrat middens in caves in the Grand Canyon have been interpreted as shrines built by late Holocene Archaic groups (Emslie et al. 1987), possibly the people associated with the Gypsum complex (see Chapter 5). Some rock art sites, like the Shaman's Gallery pictograph site in the Grand Canyon, are interpreted as shrines of the shamans of an Archaic culture (Schaafsma 1990). Basketmaker-style rock art sites may have served similar ritual functions for Early Agricultural groups on the Colorado Plateau (Cole 1990).

Trails

Trails in the Lower Colorado River Valley have been attributed to the San Dieguito complex (Rogers 1939; Huckell 1978b; Sanders 1987). Other identified prehistoric trails along the Colorado and Gila rivers and their tributaries, through mountain passes, along canyon rims, and to tinajas and springs, were certainly used by later Archaic and Early Agricultural groups.

Cemeteries

Isolated burials covered by rock cairns are documented for late Holocene Archaic complexes in Arizona; formal cemeteries separated from habitation sites are documented for Early Agricultural complexes in the Southern Basin and Range Province and the Colorado Plateau (Mabry 1998b).

Settlements

Single-use camps are documented for late Holocene Archaic and Early Agricultural adaptations, and are expected to have been associated with Paleoindian and earlier Archaic adaptations. Short-term base camps have been identified for Paleoindian, Archaic, and Early Agricultural adaptations. Seasonal settlements are documented for Archaic and Early Agricultural adaptations, and multi-seasonal settlements were probably first established by late Holocene Archaic groups. Multi-seasonal settlements and possibly permanent settlements (e.g., Santa Cruz Bend?) were associated with Early Agricultural adaptations.

CHAPTER 8

EVALUATING THE ELIGIBILITY OF SITES FOR THE NATIONAL REGISTER

Arizona's early prehistoric sites are seriously threatened by erosion, animal burrowing, cattle grazing, construction, looting, vandalism, and other natural and cultural impacts. The preservation status of 14 percent of the 4,673 site occupations in the statewide inventory (see Chapter 7) was not described at the time of recording. But, of the rest, 40 percent of Paleoindian, 44 percent of Archaic, and 23 percent of Early Agricultural[1] occupations were significantly disturbed by cultural or natural impacts, or a combination of them (Table 8.1). Four Archaic sites and two Early Agricultural sites no longer existed at the time of recording, or immediately after.

A large proportion of the cultural impacts are surface collections and digs by hobbyist artifact collectors and professional "pothunters," usually on public lands, and to a lesser extent by the investigations of professional archaeologists. At the time of recording or shortly after, only 2 percent of the sites in the inventory had been significantly impacted by excavations or surface collections by professional archaeologists, effectively removing most of the sites. A much larger proportion of recorded early prehistoric sites has been destroyed or badly damaged by amateur collectors and professional pothunters; these impacts represent about half of the "significant cultural disturbances" in Table 8.1.

It is also a certainty that many of the unrecorded Paleoindian, Archaic, and Early Agricultural sites in the state have been disturbed, destroyed, or removed by collecting and looting, and that most of the known sites have suffered additionally since they were first recorded (often several decades ago). These grim statistics and estimates make clear the need to include Arizona's early prehistoric sites in historic preservation efforts.

The most important tools for historic preservation planning at the national and state levels are the registers of "historic properties" recognized as worth preserving. The registers list only those buildings, structures, sites, and districts which have retained their integrities and have been identified as being significant in American and local history, architecture, engineering, and culture. Also referred to as "historic resources" and "heritage resources," historic properties include sites and site districts with significance in *pre*history. The standards for inclusion in the Arizona Register of Historic Places and the National Register of Historic Places provide measures for evaluating the eligibilities of "archaeological properties" (sites or site districts). Procedures for placing properties on these official lists are described in the National Historic Preservation Act of 1966 (36 CFR, Part 60). Guidelines for evaluating eligibility are summarized in a series of special bulletins published by the National Park Service. These bulletins are updated as needed, and several are cited here.

This chapter begins with a list of the Paleoindian, Archaic, and Early Agricultural archaeological properties in Arizona that are currently on the Arizona and National registers, and a summary of the assessed eligibility status of all recorded ones in the statewide database. How the significance of early prehistoric archaeological properties in Arizona can be evaluated according to the National Register criteria is then reviewed. In the section discussing Criterion D, some long-term research issues are identified, in terms of which the importance of information provided by a site can be measured or predicted. Next is a discussion of how the significance of an archaeological property may change in relation to new discoveries and research. The minimum threshold of site integrity necessary to convey significance in terms of the National Register criteria is defined in the next section, and the circumstances that require testing for subsurface cultural deposits in order to assess eligibility are described. Several recognized aspects of integrity are then reviewed. The following two sections describe some useful methods for defining site boundaries, and some special documentation standards for nominations of Paleoindian, Archaic, and Early Agricultural sites in Arizona. Geoarchaeological approaches to predicting site locations and evaluating their integrity are then illustrated with examples. The chapter concludes with a discussion of the future of Arizona's early prehistoric archaeological resources.

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[1] Called "Late Archaic" in southern Arizona, and "Basketmaker II" in the northern part of the state.

Table 8.1. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by preservation status at time of recording.

	Period/Complex									
Site Type	Terminal Wisconsin Paleoindian	Unknown Period Paleoindian	Early Holocene Archaic	Middle Holocene Archaic	Middle/Late Holocene Archaic	Late Holocene Archaic	Late Holocene Early Agricultural	Unknown Period Archaic	Unknown Period Aceramic	Total
Undisturbed	1 (.08)	6 (.14)	9 (.09)	2 (.14)	20 (.19)	55 (.17)	38 (.10)	855 (.28)	14 (.02)	1,000 (.21)
Slight cultural disturbance	1 (.08)	2 (.05)	3 (.03)	0	9 (.09)	32 (.08)	23 (.06)	146 (.05)	0	216 (.05)
Slight natural disturbance	1 (.08)	4 (.09)	5 (.05)	1 (.07)	11 (.10)	43 (.14)	49 (.13)	238 (.08)	0	352 (.07)
Significant cultural disturbance	0	7 (.17)	15 (.14)	5 (.36)	18 (.17)	35 (.11)	26 (.07)	678 (.22)	36 (.06)	820 (.17)
Significant natural disturbance	5 (.38)	6 (.14)	15 (.14)	1 (.07)	16 (.15)	27 (.09)	36 (.09)	475 (.15)	20 (.03)	601 (.13)
Significant cultural and natural disturbance	0	4 (.09)	8 (.08)	3 (.21)	6 (.06)	24 (.08)	27 (.07)	294 (.09)	54 (.09)	420 (.09)
Site no longer exists	0	0	0	0	0	0	2 (< .01)	4 (< .01)	0	6 (< .01)
Slight cultural and natural disturbance	1 (.08)	1 (.02)	2 (.02)	0	7 (.07)	17 (.05)	22 (.06)	66 (.02)	0	116 (.02)
Excavated and/or collected	3 (.23)	3 (.07)	6 (.06)	0	7 (.07)	12 (.04)	18 (.05)	58 (.02)	0	107 (.02)
Other	0	0	2 (.02)	0	1 (.01)	0	0	0	0	3 (< .01)
Unknown	1 (.08)	9 (.21)	39 (.38)	2 (.14)	10 (.09)	69 (.22)	142 (.37)	287 (.09)	472 (.79)	1,031 (.22)
Total	13 (1.01)	42 (.98)	104 (1.01)	14 (.99)	105 (1.00)	314 (.98)	383 (1.00)	3,101 (1.00)	596 (.99)	4,672 (.98)

CURRENTLY LISTED SITES

In Arizona, nine sites with Paleoindian, Archaic, and/or Early Agricultural occupations, and five archaeological districts that include Archaic sites, are currently listed on the National and Arizona registers of historic places (Table 8.2). These include buried sites exposed in arroyo banks (Double Adobe, Lehner, Naco); cave and rockshelter sites (Antelope Cave, Bighorn Cave, Ventana Cave); and open-air sites in a variety of landscape settings (Flattop, Garden Canyon, Martinez Lake, Valencia, and multiple sites in the Grand Wash, Gunsight Mountain, Rincon Mountain Foothills, Sears Point, and Upper Davidson Canyon archaeological districts).

In terms of interpreted functions, Arizona's register-listed archaeological properties include animal kill/butchering sites (Lehner, Naco); plant gathering/processing sites (Double Adobe); rock art sites (Hieroglyphic Canyon, Sears Point District, Snake Gulch Rock Art District, Sutherland Wash Rock Art District); trails (Sears Point District); and short-term and long-term habitation sites (basecamps and settlements) (Antelope Cave, Bighorn Cave, Flattop, Grand Wash District, Gunsight Mountain District, Martinez Lake, Rincon Mountain Foothills District, Upper Davidson Canyon District, Valencia). At present, there are no register-listed archaeological properties in Arizona whose primary function was as a lithic quarry, shrine (except possibly some of the rock art sites), or cemetery.

ASSESSED ELIGIBILITIES OF RECORDED SITES

The properties currently listed on the Arizona and National registers of historic places represent less than 1 percent of the 4,077 recorded Paleoindian, Archaic, and Early Agricultural site occupations in the state-wideinventory, and do not reflect the entire range of known site types. Another six Paleoindian, 175 Archaic, and 39 Early Agricultural sites in the database were assessed to be eligible or possibly/probably eligible for the National Register by their recorders (Table 8.3). It is also likely that many of the 3,735 *unassessed* sites in the inventory also meet the eligibility standards.

EVALUATING ELIGIBILITY

The eligibility criteria for inclusion in the Arizona Register and the National Register are the same; this section focuses on those defined for the National Register.

To be eligible for listing in the Register, a property must possess *significance* in terms of one or more of four Criteria of Evaluation defined by the National Park Service. To be eligible, a property must also possess the *integrity* to convey its significance. Evaluation of a property's significance and integrity are steps toward determining eligibility of a property, and both must be met for a property to be eligible. A property is not considered eligible just because it has significance. It must have both significance and integrity. An explicit definition of the degree of integrity necessary for eligible early prehistoric archaeological properties in Arizona is presented below (see The Minimum Threshold of Integrity).

Significance

The National Register criteria define the kinds of significance that historic properties represent (National Park Service 1990:11). Under Criterion A, a property is significant if it is associated with events that have made a significant contribution to the broad patterns of our nation's history. Properties directly associated with the lives of people important in our history are significant under Criterion B. Properties that have characteristics representative of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, are significant under Criterion C. Properties that are significant under Criterion D have, or are likely to have, the ability to yield important information about prehistory or history.

- *Paleoindian, Archaic, and Early Agricultural archaeological properties in Arizona may be significant in terms of any of the four National Register criteria, or combinations of them.*

In general, a higher level of integrity is required to satisfy Criteria A, B, and C; properties eligible under these criteria must have enough integrity to convey their significance *visually*, and, to a large extent, look like they did during their periods of significance. A simple test for whether a property satisfies this condition is to ask if a person from the time, or the important person who lived or worked there, would recognize it today (National Park Service 1993:18). Of course, significant environmental changes and post-occupation site formation processes over very long intervals of time have ensured that Paleoindian and Archaic sites meet this visual standard only rarely.

The importance of information from early prehistoric sites in Arizona can be defined in terms of the research issues (or "historic themes") identified below.

Table 8.2. Paleoindian, Archaic, and Early Agricultural sites and site districts in Arizona currently on the Arizona and National registers of historic places.

Name	Number	County	Date Listed	Identified Criterion/ Criteria of Eligibility	Brief Description/References
Antelope Cave	NA 5507	Mohave	10/10/75	D	A large limestone cave near Clayhole Wash on the Uinkaret Plateau (Johnson and Pendergast 1960; Janetski and Hall 1983; Moffitt et al. 1978; Janetski and Wilde 1989); in one location it contains 5 ft of midden deposits composed of sticks, grass, maize cobs and shucks, and other vegetal materials; no cultural features have been identified; recovered artifacts include sandals, fragments of cordage made of plant fibers, fur, and human hair, flaked and ground stone tools, wood and cane objects, net fragments; feather bundles; sherds, animal bones, and seeds; projectile point types present (Elko Side-notched, Elko Corner-notched, Rose Spring Corner-notched) and radiocarbon dates ranging between 3590 and 1850 b.p. indicate late Holocene Archaic and Early Agricultural occupations; date of 1850 b.p. is on a fragment of a BMII-style atlatl; sherds represent early Pueblo occupations; the site is interpreted as a basecamp for hunting and plant processing; the site has been damaged by looting, but intact cultural deposits remain.
Bighorn Cave	NA 18,616	Mohave	9/28/88	D	A large natural shelter in a canyon of the Black Mountains with stratified deposits attributed to Archaic, Basketmaker III, and Patayan occupations (Geib and Keller 1987); feature types include pits and hearths; artifact classes recovered include flaked and ground stone tools and debitage; sandals, split-twig figurines; wood, reed, and bone tools, coiled basketry fragments, cordage, net fragments, quids, other objects of hair, fur, fiber, and hide, human coprolites, animal bones, and sherds; projectile point types present (including Hawken Side-notched, Gypsum, San Pedro, and Desert Side-notched) and radiocarbon dates ranging between 5075 and 510 b.p. indicate repeated late Holocene occupations; the site is interpreted as a seasonal basecamp; the site has been damaged by looting, but an estimated 70 m^3 of intact deposits remain.
Double Adobe	AZ FF:10:1 (ASM)	Cochise	1/20/61	D	A stratified site in alluvial deposits of Whitewater Draw in the southern Sulphur Springs Valley (Cummings 1935; Sayles and Antevs 1941; Sayles 1983; Waters 1986b); bones of extinct megafauna are not in direct association with artifacts, as was once thought; artifact classes recovered include flaked and ground stone tools, fire-cracked rocks, and animal bones; radiocarbon dates from this and three other sites along Whitewater Draw bracket the Sulphur Springs stage deposits between 9300 and 8100 b.p., and possibly older than 10,400 b.p. (Waters 1986b); the site is listed along with several other sites along a 10-mi reach of Whitewater Draw as a National Historic Landmark Archaeological District.
Grand Wash District		Mohave	2/8/80	D	The district includes 206 sites with more than 1,000 lithic chipping stations. These sites include aboriginal and Anglo campsites, including many attributed to Archaic groups (Anderson et al. 979).

Table 8.2. Continued.

Name	Number	County	Date Listed	Identified Criterion/ Criteria of Eligibility	Brief Description/References
Gunsight Mountain District		Pima	6/21/91	D	The district, located in the upper piedmont of the Sierrito Mountains, includes an extensive complex of archaeological sites that date variously to the Archaic period (7500 B.C.-A.D. 200), Hohokam Pioneer through Classic periods (A.D. 200 to 1450), protohistoric period (A.D. 1450- 700), and historic period (A.D. 1700-1945) (Dart 1989). Site types in the district include intensively inhabited hamlets, other limited habitation sites, and nonhabitation sites used for wild resource processing and other nonhabitation purposes. The sites contain many visible cultural features including bedrock mortars, earthen mounds interpreted as either prehistoric refuse middens or house ruins, rock clusters representing agricultural activities as well as roasting pit loci, petroglyphs, bedrock grinding slick, miscellaneous masonry features, check-dams, historic or recent fences.
Hieroglyphic Canyon	NA 17,190	Pinal	4/11/94	D	This site, located about 30 mi northeast of Apache Junction on the western flank of the Superstition Mountains, is centered upon a spring seep and natural rock tank (Weaver 1985). It consists of three petroglyph areas with over 50 individual panels, at least one small masonry structure, a group of bedrock mortars, at least three groups of bedrock metates, several hornos, a large artifact scatter consisting of lithic flakes, tools and pottery sherds, and one dry-laid masonry wall. It appears to be a multicomponent site as indicated by the superimposition of differentially repatinated and weathered designs, by their diversity and density, by the presence of design characteristics of widespread petroglyph styles associated with different chronological period in south central Arizona and by the nature of the associated features, artifacts, and structures. The styles of petroglyphs indicate it was used by Archaic, pre-Classic Hohokam, Salado, and protohistoric Yavapai groups.
Lehner	AZ EE:12:1 (ASM)	Cochise	4/20/67	D	A terminal Wisconsin megafauna kill/butchering site exposed in an arroyo bank in the upper San Pedro Valley (Haury 1956; Haury et al. 1959; Haynes 1982); excavated in 1954, 1955, and 1974-75; Clovis projectile points, other flaked stone artifacts, and hearths were found in association with the remains of nine mammoths, extinct horse, bison, tapir, camel, and other mammals; twelve associated radiocarbon dates average about 10,900 b.p. (Haynes 1993); an early Holocene Archaic occupation represented by a flaked stone chopper and debitage, fire-cracked rocks, a possible hearth, and a well is dated to about 9850 b.p. (Haynes 1982; Huckell 1996a); other than areas cut by arroyos, the site is well preserved; the site is listed as a National Historic Landmark.
Martinez Lake	AZ X:3:13 (ASM)	Yuma	9/10/87	D	The site covers all of a 16.5 acre island near the east bank of the Colorado River, 20 mi north of Yuma, Arizona (Sanders 1987); cultural features include clusters of cleared circles (sleeping circles?), rock rings, pebble-covered earthen mounds, trails, a rock align-

Table 8.2. Continued.

Name	Number	County	Date Listed	Identified Criterion/ Criteria of Eligibility	Brief Description/References
Martinez Lake, continued					ment, and a sparse scatter of percussion-flaked stone tools, most covered with a moderate amount of desert varnish; the site is interpreted as a basecamp, and is attributed to the San Dieguito and Amargosan complexes.
Naco	AZ FF:9:1 (ASM)	Cochise	7/21/76	D	A mammoth-kill site exposed in the bank of Greenbush Draw near Naco, Arizona (Haury 1953); Clovis projectile points were found in association with the bones of a single mammoth; the lack of evidence of butchering suggests that the mammoth escaped its hunters before dying.
Rincon Mountain Foothills District		Pima	10/16/79	D	The approximately 110 sites in this archaeological district in the western foothills of the Rincon Mountains represent a wide variety of site types, periods, and cultures, including Paleoindian (a Clovis point base), Archaic (early, middle, and late Holocene), and Early Agricultural complexes (Anderson 1979).
Sears Point District		Yuma	10/16/85	D	The district on the lower Gila River includes petroglyphs, intaglios, rock alignments, trails, shrines, sleeping circles, lithic and ceramic scatters, and rockshelters in the vicinity of site AZ Y:3:1 (BLM) (Miller 1985, 1988); associated cultures include Archaic (San Dieguito, Amargosa), Patayan, and Hohokam.
Snake Gulch Rock Art District		Coconino	11/21/92	C, D	This 8.3-mi-long district along Snake Gulch is located in Kaibab National Forest, north of the Grand Canyon and about 15 mi south of Fredonia, Arizona (Schaafsma 1980: 117-119; Davenport 1991); petroglyphs and pictographs are in Archaic (Abstract, Barrier Canyon), Basketmaker (San Juan Anthropomorphic, Snake Gulch), and Puebloan styles.
Sutherland Wash		Pima	10/19/93	C, D	The 35-acre district is located on the pediment of the western slopes of the Santa Catalina Mountains (Elson and Doelle 1987); it consists of 12 prehistoric petroglyph sites, four with associated artifacts and features. The 1,500-plus petroglyph elements represent the largest concentration of rock art yet recorded in the Tucson Basin. The petroglyphs include examples of both Western Archaic and Gila Hohokam styles.
Upper Davidson Canyon District		Pima	1/3/92	D	The district encompasses 1,300 acres at the north end of the east slope of the Santa Rita Mountains (Huckell 1984a; Seymour and Cameron 1990). It consists of 21 contributing and eight non-contributing sites. These sites are mostly attributable to the Archaic and Tucson Basin Hohokam cultures. The most intensive use of the area appears to have been between A.D. 700-1200.

Table 8.2. Continued.

Name	Number	County	Date Listed	Identified Criterion/ Criteria of Eligibility	Brief Description/References
Valencia	AZ BB:13:15 (ASM)	Pima	5/17/84	D	A large site on the east side of the Santa Cruz River in the Tucson Basin (Bradley 1980; Doelle 1983, 1985; Huckell 1992) occupied primarily during Hohokam times; it also has remains from Paleoindian and Early Agricultural occupations (a Clovis point and Cienega phase pit structures).
Ventana Cave	AZ Z:12:5	Pima	1/20/61	D	A cave in the Castle Mountains excavated in 1941-42 (Haury 1950; Weiss 1975; Bayham 1982; Huckell and Haynes 1995); 4.5 m of cultural deposits contain evidence of long human occupation dating between 10,700 b.p. and historic times; the remains of extinct Pleistocene fauna are not in direct association with artifacts, as was once thought; preceramic occupations are attributed to the Western Stemmed Point, Amargosa, Chiricahua, and San Pedro complexes; pictographs also present; listed as a National Historic Landmark.

Table 8.3. Numbers of recorded Paleoindian, Archaic, Early Agricultural, and large aceramic site occupations in Arizona by assessed National Register eligibility status at time of recording.

Status	Paleoindian		Archaic		Early Agricultural		Large Aceramic		Total	
Listed	2	(.04)	5	(< .01)	1	(< .01)	0		7	(< .01)
Eligible	2	(.04)	124	(.03)	26	(.07)	128	(.21)	280	(.06)
Possibly/probably eligible	4	(.07)	51	(.01)	13	(.03)	4	(.01)	72	(.01)
Probably not eligible	0		93	(.03)	6	(.02)	0		99	(.02)
Not eligible	0		15	(< .01)	1	(< .01)	35	(.06)	51	(.01)
Unassessed	47	(.85)	3,351	(.92)	336	(.87)	429	(.72)	4,164	(.89)
Total	55	(1.00)	3,639	(1.00)	383	(1.00)	596	(1.00)	4,673	(1.00)

In the following, examples of sites that are significant in terms of these criteria are taken from the sites in Arizona that are currently listed on the Arizona and National registers of historic places and historic landmarks (Table 8.2), and a set of Archaic sites in the state recommended for future nomination (Table 8.4). Locations, documented types of features and artifacts, dating information, cultural complexes represented, and physical evidence of integrity are described for each of these sites (Tables 8.2 and 8.4).

Criterion A

Early prehistoric sites in Arizona that are representative of important turning points in Southwestern prehistory are significant in terms of broad patterns of national history. Archaeologists' models of some of these turning points have been discussed in the previous chapters.

Terminal Wisconsin Paleoindian (Clovis complex) sites such as Lehner and Naco (Table 8.2), which represent the initial peopling of the Southwest according to currently available and accepted evidence, may meet this criterion. Atlatl Rock Cave, O'Haco Rockshelter, and Tsosie Shelter (Table 8.4), with confirmed early Holocene occupations by broad-spectrum hunter-gatherers, are significant under this criterion because they represent the initial stage in the development of "Archaic" adaptations in the Southwest, and they are eligible for nomination under this criterion because they have intact cultural deposits that give them enough integrity to convey this significance. Early Agricultural sites, which represent the initial stage in the transition to agricultural subsistence economies and the development of Southwestern village cultures, also meet this criterion if they have adequate integrities (as defined below).

Also eligible under this criterion are archaeological properties that provided information of such importance that they influenced the directions of archaeological research (National Park Service 1990:24). This would include "type sites" that defined complexes, phases, or horizons, or that were investigated with pioneering archaeological techniques. The nomination form for the Double Adobe National Landmark (Table 8.2) describes the site's crucial role in the recognition and definition of the "Cochise Culture." The Lehner and Naco Mammoth-kill sites, because of their important roles in defining the Clovis complex, are also examples. Although they are all cut by arroyos, undisturbed cultural features and artifact distributions are preserved at these sites, giving them the level of integrity necessary to convey their significance in terms of this and other criteria.

Criterion B

It is impossible to identify specific individuals important in prehistory from archaeological evidence. However, certain archaeological sites in Arizona are significant under this criterion because they have provided information that was pivotal in the intellectual development of archaeologists who were pioneers in the study of early Southwestern prehistory. These sites are "associated with the productive life of the individual in the field in which (s)he achieved significance" (National Park Service 1989:16). While the individual can still be alive, his or her significant accomplishments in the field of early prehistory must date to more than 50 years ago (National Park Service 1989:12).

An Archaic site in Arizona that is significant under this criterion is the Cave Creek Midden (Table 8.2), which became the "type site" of the Chiricahua stage in E. B. Sayles' conceptualization of the "Cochise Culture" of southeastern Arizona more than 50 years ago (Sayles and Antevs 1941; Sayles 1983). Another example is the White Tank site (Table 8.3), which was important in Malcolm Rogers' formulation of the San Dieguito and Amargosa "Lithic Industries" of the Lower Colorado River Valley and southwestern Great Basin (Rogers 1939, 1958, 1966), and where Rogers had a long-term research camp between 1939 and 1956 (Schaefer et al. 1993). These sites meet Criterion B because they provided key information to individuals who made extraordinary contributions to the early

Table 8.4. Selected Archaic sites in Arizona recommended for nomination to the Arizona and National registers of historic places (not including Early Agricultural sites).

Name	Number	County	Eligible under National Register Criterion/Criteria	Brief Description/References
Atlatl Rock Cave	AZ J:14:41 (ASM)	Coconino	A, D	A rockshelter on the southern edge of the Rainbow Plateau (Geib 1993, 1996; Geib et al. 1996); the basal cultural stratum contains open-twined sandals; radiocarbon dates (three between 7900 and 7000 b.p.) of sandals and yucca leaves from this stratum indicate early Holocene Archaic occupations; a thick, sterile layer of roof spalls separates this deposit from a Basketmaker III stratum; the site is badly damaged by looting, but about half of the Archaic deposits remain intact.
Big Chino Wash sites		Yavapai	D	Three large, multicomponent lithic sites in the Big Chino Wash with multiple surface artifact concentrations (Weaver et al. 1993; Ryan 1990, 1993).
				AR-03-09-01-520 is a 31.5 acre site on a lower bajada east of Big Chino Wash; the surface has multiple loci of concentrated artifacts; lithic materials include obsidian; desert varnish formation on lithic artifacts is pronounced; artifact classes include flaked and ground stone; projectile point types include Pinto and possibly San Jose; the site is interpreted as a seasonally reoccupied camp.
				AR-03-09-01-521 is a 40 acre site on a lower bajada east of Big Chino Wash; the surface has multiple loci of concentrated artifacts; lithic materials include obsidian; desert varnish formation on lithic artifacts is pronounced; artifact classes include flaked and ground stone; projectile point types include Pinto and possibly San Jose; the site is interpreted as a seasonally reoccupied camp surface.
				AR-03-09-01-581 is a 100+ acre site at the base of the eastern foothills of the Juniper Mountains about 5 mi west of the Big Chino Wash channel in Prescott National Forest; the surface has multiple loci of concentrated artifacts; artifact classes include flaked and ground stone; projectile point types include Eden (late Paleoindian Cody complex), Bajada, Pinto, San Jose, Gypsum, Chiricahua, Elko Corner-notched, and San Pedro; lithic materials include obsidian; the site is interpreted as a seasonal camp reoccupied over a very long timespan; the surface of the site has been heavily disturbed by "revegetation activities," but intact subsurface features are probably present.
Blacktail Wash sites		Cochise	D	Three relatively well preserved sites on the northern piedmont/bajada of the Huachuca Mountains (Vanderpot 1997; Altschul et al. 1997).
				The large Blacktail Canyon site (AZ EE:7:251 [ASM]) in the canyon mouth has been mostly buried by alluvium, but erosion has exposed middens, rock-filled roasting pits, and hearths;

Table 8.4. Continued.

Name	Number	County	Eligible under National Register Criterion/Criteria	Brief Description/References
Blacktail Wash sites, continued				artifact classes present include flaked and ground stone; tabular knives and scraper-planes near roasting pits, along with extant stands of agave on slopes below the site, indicate agave processing; the site is interpreted as a single-component "Late Archaic" basecamp where agave processing occurred, and also hunting preparations. The large Woodcutters Canyon site (AZ EE:7:31 [ASM]), downstream from the Blacktail Canyon site, has similar characteristics; it also contains a series of bedrock mortars; the site is interpreted as a "Middle and Late Archaic" basecamp where processing of agave and acorns occurred, and also hunting preparations. AZ EE:7:184 (ASM) is an upper bajada site on a ridge crest with extant stands of both *Agave palmeri* and *Agave parryi*; expedient flake tools and tabular knives surround a series of rock rings interpreted as basket supports; the site is interpreted as a "Late Archaic" camp where agave was processed.
Brown's Ranch	AZ U:1:25 (ASM)	Maricopa	D	Two rockshelters in northern Scottsdale in the northern Phoenix Basin with associated middens, bedrock mortars, and tinajas (natural rock tanks) (Wright 1996). Projectile point types are mostly late Holocene Archaic (Elko Corner-notched, Elko Eared, San Pedro, Cienega), but also possibly earlier (Pinto?, Elko series). Hohokam and Yavapai occupations are also represented.
Cave Creek Midden	GP Chiricahua 3:16	Cochise	A, B, D	The type site for Chiricahua stage of Cochise culture at a canyon mouth on the east side of the Chiricahua Mountains (Sayles and Antevs 1941; Sayles 1945, 1983); the site includes a thick midden containing abundant flaked stone and ground stone artifacts; at least some portions of the site have been bulldozed, but large portions remain intact.
Gila Dunes	AZ U:15:8 (ASU)	Pinal	D	A large lithic scatter on top of a large set of sand dunes on the north bank of the Gila River about 1 mi north of Florence, Arizona (Fish 1967; Kitchen n.d.); projectile point types include leaf-shaped, Pinto, San Jose?, and Chiricahua; Archaic component on the southern dunes is attributed to the Chiricahua complex; disarticulated human bones have also been found on this part of the site; a few sherds and shell artifacts on the northern dunes represent a late Sedentary or early Classic Hohokam occupation; a prehistoric canal skirts the base of the dune field.
Gillespie Dam	(no site number)	Maricopa	C, D	A very large petroglyph site extending approximately 5 km along the face of a lava flow cut by the Gila River at Gillespie Dam southwest of Buckeye, Arizona; styles present range from Western Archaic to Hohokam and Patayan; this is possibly the largest concentration

Table 8.4. Continued.

Name	Number	County	Eligible under National Register Criterion/Criteria	Brief Description/References
Gillespie Dam, continued				of petroglyphs in Arizona; ceramic period habitation and special function areas are present above and below the basaltic cliffs at the site; the largest concentration of Western Archaic style petroglyphs is on the west side of the river north of Gillespie Dam.
Grand Canyon caves		Coconino	C, D	Numerous relatively inaccessible cave sites in Grand Canyon National Park, including Crescendo Cave, Five Windows Cave, Horn Creek Cave, Left Eye Cave, Luka Cave, Rebound Cave, Right Eye Cave, Shrine Cave, Stanton's Cave, Tse'an Bida, Tse'an Kaetan, Tse'an Sha, White Cave, and others (Emslie et al. 1987, 1995; Euler 1984; Euler and Olson 1965; Schroedl 1977; Schwartz et al. 1958); the caves contain split-twig figurines and other artifacts, often associated with cairns constructed of fossilized dung of bighorn sheep and extinct mountain goat, bones of extinct mountain goat and/or other vertebrates, or Pleistocene packrat middens; the split-twig figurines are interpreted as "magico-religious objects" used in hunting rituals conducted during special pilgrimages to the caves, while the cairns are interpreted as shrines; direct radiocarbon dates on split-twig figurines from these sites range between 4400 and 3100 b.p.; Gypsum-type projectile points found in association with split-twig figurines at other sites in Arizona, Nevada, and Utah suggest these sites were associated with the Gypsum complex.
Graveyard Gulch	AZ EE:8:267 (ASM)	Cochise	D	A large, 1-km long, multiple-locus surface site 5-6 km upstream of the confluence of Graveyard Gulch and the San Pedro River in the middle San Pedro Valley (Vanderpot 1997; Altschul et al. 1997); numerous rock clusters interpreted as "seed parching" hearths surround a central area with large rock rings (basket rests?) and paved areas (threshing floors, plant drying areas, or storage platforms?); artifact classes present include flaked and ground stone; the site is interpreted as a "Late Archaic" basecamp where seed processing took place.
Growler Canyon	AZ Z:13:49 (ASM)	Yuma	C, D	A rock art site on a basalt outcrop near the mouth of Growler Canyon (Cuerda de Leña Wash) in the Growler Mountains west of Ajo, Arizona; 250+ petroglyph panels occur in seven distinct clusters; many are in the Great Basin Abstract (Western Archaic) style; a few Hohokam Gila style petroglyph panels are also present (Schaafsma 1980:36-41).
Hall Ranch sites		Apache	D	Multiple sites associated with an extinct Pleistocene lake and fossil and active springs near Springerville (Diggs 1982); at the Squawbush site (AZ Q:11:2 [ASM]) was found the base of a Clovis point on the surface, a possible masonry structure, and a subsurface deposit containing Bajada projectile points; on the surface of the Lava Flow Encampment site (AZ Q:11:3 [ASM]) are stone-outlined and masonry structures with possibly associated Chiricahua, Armijo, and San Pedro projectile points, ground stone milling tools, and bison

Table 8.4. Continued.

Name	Number	County	Eligible under National Register Criterion/Criteria	Brief Description/References
Hall Ranch sites, continued				remains; lithic quarrying is represented at another nearby site; projectile points at multiple sites in the vicinity include Clovis, Western Stemmed, Bajada, Pinto, Gypsum, Chiricahua, Armijo, and Elko Corner-notched types.
Lone Hill	AZ BB:10:17	Pima	D	A large surface site in the eastern foothills/bajada of the Santa Catalina Mountains (Agenbroad 1966, 1970, 1978); on the surface are numerous hearths, various late Holocene Archaic point types (Gypsum, Pinto, San Jose, Chiricahua, leaf-shaped), a diversity of other flaked stone tools and debitage, and abundant ground stone milling tools; over two-thirds of the metates were placed face-down; a quartz quarry for lithic production is present; the site is interpreted as a seasonal basecamp; the current condition of the site is unknown.
Lone Mountain Ranch	AZ EE:11:56 (ASM)	Cochise	D	A basecamp site on the western flank of the Huachuca Mountains at a medium elevation (5,250 ft); site has a high surface artifact density (flaked and ground stone) and several large trash mounds (Vanderpot 1997).
McEuen Cave	AZ W:13:6 (ASM)	Graham	D	A stratified rockshelter site with a midden in front, located in Upper Fishhook Canyon on the western side of the Gila Mountains (Cummings 1953; Kelly 1937; Shackley et al. 1996); occupations during the middle and late Holocene are represented by projectile points (including Bajada, Elko Corner-notched, Chiricahua, and San Pedro) and radiocarbon dates (ca. 2200 b.p.); woven bags, basketry, sandals, atlatls, and other woven and wooden artifacts are preserved; abundant maize remains and numerous Basketmaker II-type burials indicate a significant Early Agricultural occupation as well; the site has been badly disturbed by looting, but still has undisturbed deposits.
O'Haco Rockshelter	(site number?)	Navajo?	A, D	A multicomponent rockshelter site near the Mogollon Rim in Chevelon Canyon, a tributary to the upper Little Colorado River (Briuer 1977); the lowermost of five strata yielded radiocarbon dates on charcoal of 8680 and 8100 b.p., indicating early Holocene occupations; the next three overlying strata yielded radiocarbon dates on charcoal ranging from 4200 to 2800 b.p., indicating occupations during the late Holocene; a sample of charcoal from an upper stratum dated to 6080 b.p., indicating some mixing of deposits and a middle Holocene occupation; the uppermost stratum yielded radiocarbon dates that calibrate to between A.D. 1000-1360, consistent with the Pueblo II/III sherds it contains; small maize cobs are abundant in strata dated between 4200 and 2800 b.p., and may represent occupations by early Basketmaker II groups.

Table 8.4. Continued.

Name	Number	County	Eligible under National Register Criterion/Criteria	Brief Description/References
Picacho Dunes sites		Pinal	D	The Arroyo site (AZ AA:3:28 [ASM]) is buried in the banks of an arroyo (Bayham et al. 1986); features include rock clusters, a roasting pit, a midden, and a possible pit structure; projectile point types (Chiricahua, San Pedro?) and radiocarbon dates (three between 4840-3910 b.p.) indicate late Holocene Archaic occupations. The Buried Dune site (AZ AA:3:16 [ASM]) is in a sand dune (Bayham et al. 1986); features include roasting pits, rock clusters, and a hearth; projectile point types (San Jose/Pinto, Cortaro) and radiocarbon dates (three between 4300-4000 b.p.) indicate late Holocene Archaic occupations.
Picacho Mountains sites		Pinal	C, D	The North Pass (AZ AA:3:8 [ASM]), Shelter Gap (AZ AA:3:42 [ASM]), and Picacho Point (AZ AA:3:18 [ASM]) rock art sites on bedrock outcrops in the west-central and northern Picacho Mountains (Wallace and Holmlund 1986); the sites include multiple panels of petroglyphs in the Western Archaic style, thought to date between 8000 B.C. and 800 A.D.; motifs include abstract geometric and atlatls; preceramic artifact scatters are present in portions of the Shelter Gap site.
Red Butte sites		Coconino	D	AZ H:8:1, AZ H:8:2, and AZ H:8:3 (ASM) are sites on and around Red Butte south of Grand Canyon; type sites for Red Butte phase; projectile point types present include Western Stemmed, Pinto, Ventana-Amargosa I, Chiricahua-Amargosa II, Elko Corner-notched; a few Pueblo III (Kayenta Anasazi rather than Cohonina) sherds also present (McNutt and Euler 1966).
Rocky Point	AZ S:16:55 (ASM)	Maricopa	C, D	A large petroglyph site on a basaltic knoll on the lower Gila River near Oatman Mountain; most of the elements are in the Western Archaic style; it is the largest mostly Archaic rock art site in the Painted Rocks region.
Santa Cruz Flats sites		Pinal	D	The Tator Hills site (AZ AA:6:18 [ASM]) is on the lower bajada of the West Silverbell Mountains (Halbirt and Henderson 1993); features include roasting pits, fire-cracked rock clusters, activity surfaces, and a pit structure; near the site is a basalt outcrop with petroglyphs, bedrock mortars, and a bedrock grinding slick; faunal remains include bison; projectile point types (Pinto, Chiricahua, Elko Corner-notched) and a radiocarbon date (1890 b.p.) indicate late Holocene Archaic occupations; other radiocarbon dates and ceramics indicate later prehistoric and protohistoric occupations. The Coffee Camp site (AZ AA:6:19 [ASM]) is a large (10 ha) stratified site on the lower bajada of the West Silverbell Mountains (Halbirt and Henderson 1993); features include

Table 8.4. Continued.

Name	Number	County	Eligible under National Register Criterion/Criteria	Brief Description/References
Santa Cruz Flats sites, continued				roasting pits, cache pits and other nonthermal pits, fire-cracked rock clusters, pit structures (including a possible communal structure with ritual artifacts), and burials (both inhumations and cremations); artifacts include flaked and ground stone, marine shells, a ceramic figurine, a ceramic bead, and sherds of incipient ceramic vessels; 14 radiocarbon dates (between 3120 and 250 b.p., with majority clustering between 2250 and 1920 b.p.) and projectile point types (Pinto, Chiricahua, San Pedro, Cienega) indicate late Holocene Archaic through protohistoric occupations; the majority of the site remains undisturbed.
Shamans' Gallery	AZ B:9:201 (ASM)	Coconino	C, D	A rockshelter in western Grand Canyon National Park with polychrome pictographs in the Barrier Canyon style of the Colorado Plateau, thought to date between 7000 and 1000 B.C. (Schaafsma 1990); multiple panels include over 40 abstract, elongated anthropomorphic figures and associated animals, circular patterns, and linear patterns; many episodes of overpainting and renewal suggest the site was the focus of ritual activity (by shamans?); the site is possibly associated with tinajas and an extensive lithic scatter on the cliff top above the site.
Texas Hill	(no site number)	Yuma	C, D	A rock art site on an isolated volcanic peak on the north bank of Gila River southwest of the Tank Mountains; multiple panels of petroglyphs in the Western Archaic style are associated with trails and cleared circles; also present are a few Hohokam and possible Patayan rock art panels, the latter with motifs having Archaic antecedents (Hedges and Hamann 1990).
Tsosie Shelter	AZ D:7:2085 (ASM)	Navajo	A, D	A rockshelter, and a talus slope in front of it, next to Yazzie Wash (a tributary of Yellow Water Canyon) in the northwest corner of the Peabody Coal Company leasehold on Black Mesa (Burgett et al. 1985; Olszewski et al. 1984; Parry et al. 1994); more than 6 m of cultural deposits in the talus are radiocarbon dated to 8100-4750 b.p. and contain flaked and ground stone artifacts; the rockshelter contains BMII deposits more than 1.4 m deep, and a Puebloan storage structure on the surface; only a minor portion of the talus slope was tested, and most of the Archaic deposits remain.
White Tanks	AZ S:14:53 (ASM)	Yuma	A, B, C, D	A multicomponent Archaic site in the vicinity of tinajas (natural rock water tanks) in a small canyon on the northeastern flank of the Tank Mountains 29 km north of the Gila River and 36 km northwest of Dateland, Arizona (Rogers 1939; Schaefer et al. 1993; Shackley 1996a); the site includes quarries, habitation areas, rockshelters, chipping stations, bedrock mortars, trails, cairns, cleared circles, rock rings, and petroglyph clusters attributed to the San Dieguito I and Amargosa II/Chiricahua complexes; projectile point types include Western Stemmed (Lake Mojave), San Dieguito (large lanceolate), leaf-shaped, Gypsum, Elko Corner-notched, San Pedro, and Cienega.

prehistory of southwestern North America—contributions that changed the course of development of that field of research—and their integrities are such that they still look like they did when they were discovered and investigated more than 50 years ago.

Criterion C

Not all early prehistoric sites in Arizona with remains of structures or artwork are significant under this criterion—only those that have well-preserved features that represent skill and aestheticism in art or engineering by the makers. A rock art site, if it is well-preserved and represents a specific art form (e.g., petroglyph, pictograph, or intaglio) and style (e.g., Great Basin Abstract/Western Archaic, Barrier Canyon, Glen Canyon Linear/Style 5, Chihuahuan Polychrome, Basketmaker), is also significant under this criterion. The Shaman's Gallery site (Table 8.4), with its well-preserved, skillfully rendered, highly formalized, polychrome pictographs in the Barrier Canyon style, is a good example of an Archaic rock art site in Arizona that is eligible for the National Register under this criterion (but is not currently listed).

A group of rock art sites of the same style in the same area could be nominated together as a "district," defined as "a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development" (National Park Service 1993:10). With boundaries defined according to this definition, the Snake Gulch Rock Art District and the Sutherland Wash Rock Art District (Table 8.2) were nominated under Criterion C (as well as Criterion D). The high degree of preservation of most of the rock art in these districts, such that the forms of the elements are still clearly recognizable and the elements are still in their original locations in relation to each other, gives these properties the necessary integrities to convey their significance under this criterion.

Criterion D

If they have yielded, or have the potential to contribute, important information about prehistory, sites in Arizona with Paleoindian, Archaic, or Early Agricultural occupations may be eligible under this criterion. The information contributed by a site is considered "important" if it bears upon one or more research issues, such as the ones identified here (see below), or if it makes possible "a reconstruction of the sequence of archaeological cultures for the purpose of identifying and explaining continuities and discontinuities in the archaeological record for a particular area" (National Park Service 1990:21). For Paleoindian and Archaic archaeological properties in Arizona, this is the most frequently cited criterion in the nomination forms for currently listed sites (e.g., Bighorn Cave; Gunsight Mountain District; Hieroglyphic Canyon; Snake Gulch Rock Art District; Sutherland Wash Rock Art District; Upper Davidson Canyon District), and is the most frequently applicable criterion for eligible sites.

- *Among the Criteria of Evaluation for the National Register of Historic Places, the potential to yield important information about prehistory (Criterion D) is the most common type of significance of Paleoindian, Archaic, and Early Agricultural archaeological properties in Arizona.*

- *To meet the requirements of Criterion D, the importance of information from a Paleoindian, Archaic, or Early Agricultural site in Arizona must be identified in terms of one or more long-term research issues (which may or may not be previously identified).*

The models of prehistory discussed in the previous chapters concern some consequential events in Arizona's early prehistory. These include the initial peopling of the Southwest, the development of Paleoindian big-game hunting adaptations, the development of Archaic broad-spectrum adaptations, cultural responses to middle Holocene environmental changes, and the transition to agriculture and sedentism. As subjects of investigation, these may be grouped within larger, long-term research issues (or "historic themes"). These are broad topics that become better understood only through accumulations of data over time. While not limited to them, a set of relevant long-term research issues for early prehistoric sites in Arizona includes 1) colonizations and migrations; 2) cultural responses to environmental changes; 3) technologies; 4) subsistence and settlement strategies; 5) social structures; and 6) cultural identities.

Colonizations and Migrations. Important population movements during Arizona's Paleoindian and Archaic prehistory include the initial peopling of the Southwest by Paleoindians (either during the Wisconsin stage or near the Wisconsin/Holocene boundary), the apparent repopulation of the southern part of the region by Archaic groups after the middle Holocene Altithermal interval, and possibly the dispersal of cultigens from south to north during the late Holocene by migrating Early Agricultural populations.

The National Register nominations for the Lehner and Naco Mammoth-kill sites and the Valencia site (Table 8.2) discuss their significance in terms of this research issue, among others. Information from other sites in Arizona bearing upon the validities, timings, or circumstances of these or other postulated population movements during early prehistory is important in terms of this research issue.

Cultural Responses to Environmental Changes. Patterns in Arizona's archaeological record that appear to represent cultural responses to significant changes in effective moisture include the hunting of big game in the vicinities of remnant springs and streams during the Wisconsin/Holocene transition, the northward and eastward retreat of late Paleoindian bison-hunting groups during the early Holocene, the appearance of Archaic sites at higher elevations during the middle Holocene, and the proliferation of sites in the lowlands during the early Holocene and the initial part of the late Holocene.

Other documented responses to environmental changes by early prehistoric populations in Arizona include well digging, increases and decreases in residential mobility, aggregations of populations in locales with permanent water sources and high resource densities, increases in the processing of seeds with ground stone milling tools, and possibly manipulations of the growth cycles and ranges of edible wild plants.

The adoption of cultigens and intensification of their production and processing may also represent cultural responses by Early Agricultural groups to either 1) the development of favorable environmental conditions (e.g., aggradation of floodplains and fans, increased rainfall, decreased frosts), or 2) a shift in environmental conditions that decreased the availability of wild food resources.

Information from early prehistoric sites in Arizona that exemplify these or other responses to changes in climate, plant and animal communities, and/or the landscape is important in terms of this research issue. Of the Archaic sites listed in Table 8.4, Atlatl Rock Cave, O'Haco Rock Shelter, and Tsosie Shelter, with their documented early Holocene occupations by groups with Archaic adaptations, are examples. Usually, these kinds of adaptational information are also relevant to the research issue "Subsistence-Settlement Strategies" (see below).

Technologies. Documented early prehistoric technologies in Arizona include quarrying and heat treating lithic materials; processing minerals into pigments; weaving baskets, sandals, and figurines; lining storage pits with stone slabs; constructing brush shelters, cairns, and intaglios; pecking petroglyphs; digging wells; using rock-filled roasting pits; and manufacturing implements from stone, bone, shell, and wood with flaking and grinding techniques. Early Agricultural technologies representing innovations include more efficient milling tools, bell-shaped storage pits, pit structures, and possibly ditches and other water control features. Information from sites in Arizona about these or other technologies is important in terms of this research issue, and sometimes also "Subsistence-Settlement Strategies" (see below).

Subsistence-Settlement Strategies. Early prehistoric groups in Arizona relied on a variety of subsistence-settlement strategies in adaptation to the spatial and temporal patterns of resources across the landscape. As these patterns altered in relation to large-scale environmental changes, settlement strategies shifted in terms of relative mobility, seasonal timing of movements, group sizes, and site functions. Shifts in the focus of subsistence, toward smaller game or more plants, for example, also required changes in settlement strategies. Early Agricultural groups may have either incorporated cultigens into a seasonal schedule of residential movement to resources as they became available, or decreased their mobility to focus on cultigens, while using outlying, non-residential sites as specialized hunting or plant procurement/processing camps.

Information from early prehistoric sites in Arizona about combined strategies of resource use and residential mobility is important in terms of this research issue. All of the Archaic sites listed in Table 8.4, except the rock art sites, may potentially provide such information. Sometimes, the same information is also important in terms of the research issues "Cultural Responses to Environmental Changes" and "Technologies" (see above).

Social Structures. Aspects of the social structures of early prehistoric groups in Arizona, such as group size and territoriality, are potentially reflected by site sizes and the sources of nonlocal raw materials. The development of social units above the level of family households is possibly represented by the appearance of communal structures in late Holocene Archaic and Early Agricultural settlements (Mabry 1998c). Differences in status and roles related to age or gender may be reflected in mortuary patterns (Mabry 1998b). Information from sites in Arizona that bears upon these or other aspects of social organization is important in terms of this research issue.

Cultural Identities. In addition to other ways, the cultural identities of early prehistoric groups in Arizona were expressed through projectile point styles, weaving techniques, rock art motifs, and mortuary practices. Comparisons within and between these types of material culture may allow recognition of regional styles or complexes that represent distinctive cultures. Information from early prehistoric sites in Arizona that provides clues about "cultural affiliation," such as the rock art styles at the Shaman's Gallery (Table 8.4), is important in terms of this research issue.

Integrity

In addition to being significant in terms of at least one of the four National Register criteria, an eligible property has to possess *integrity*, which is defined as "the ability of a property to convey its significance" (National Park Service 1990:44). Therefore, the property must have cultural remains sufficiently intact to visibly convey significance or to yield important information if appropriate data recovery techniques are employed.

The Minimum Threshold of Integrity

For the purposes of evaluating eligibility for the National Register, the minimum threshold of integrity for early prehistoric sites in Arizona is the presence of some relatively undisturbed cultural remains:

- *To be eligible for the National Register of Historic Places, a Paleoindian, Archaic, or Early Agricultural archaeological property in Arizona must have some intact surface distributions or subsurface deposits of artifacts and/or cultural features.*

According to this definition, if most of the surface of a site has been disturbed, resulting in significant scattering, mixing, and destruction of artifacts and features, then it must have a high potential for undisturbed cultural deposits being present below ground. A purely surficial site must have a largely unaltered distribution of cultural features, and/or the pattern of artifact distribution must be due to identifiable site formation processes (i.e., redeposited artifacts can be traced to their original contexts).

Surficial sites that have been completely surface collected of artifacts and have no visible features, and subsurface sites that have been completely excavated by archaeologists or completely disturbed by looters, have lost their integrities according to this definition. However, a completely excavated site is eligible ". . . if the data recovered was of such importance that it influenced the direction of research in the discipline . . ." (National Park Service 1990:24) (see Resource and Research Models of Significance below).

This definition of the necessary minimum of integrity for register-eligible early prehistoric sites in Arizona also applies to rock art sites; most of the panels or stones must be in their original locations, or traceable to their original locations, and the majority of the elements must have recognizable shapes. The same principle applies to trail segments in that they must be recognizable cultural features in relation to their natural background surfaces.

When Subsurface Testing is Necessary

To adequately assess whether a surficial early prehistoric site has intact subsurface cultural deposits for the purpose of evaluating eligibility for the National Register, it may be necessary to conduct subsurface testing.

- *For the purpose of evaluating the eligibility of a surficial Paleoindian, Archaic, or Early Agricultural site in Arizona for the National Register of Historic Places, the necessity of testing for subsurface cultural deposits depends on the landscape setting of the surface assemblage of artifacts and/or cultural features.*

If the assemblage is located on a landform that is probably pre-Wisconsin in age (> 120,000 years) and has not received any sediments since the time of cultural occupation(s), such as a mountain pass, pediment, ridgetop, or stranded lake beach, it is extremely unlikely that any subsurface cultural deposits exist (such deposits would be older than all claimed or estimated ages of possible pre-projectile point/pre-Clovis complexes), and no subsurface testing is necessary.

On the other hand, if the assemblage is located on a landform that is probably of Wisconsin age or younger, or on a landform of any age that has possibly received sediments since the time of cultural occupation(s), then subsurface testing is necessary to confirm or rule out the presence of subsurface cultural deposits for the purpose of evaluating eligibility. Examples of landforms that require subsurface testing for these reasons are Wisconsin or Holocene alluvial terraces, floodplains and fans, debris flows, colluviated slopes and surfaces, sand dunes, lake shores and playa margins, and caves and rockshelters containing deposits of roof-fall and/or exogenous sediments.

Because of their unexceeded antiquity, general rarity, and exceptional significance, Paleoindian archaeological properties in Arizona require relatively less integrity to be eligible for the National Register. However, like other properties, they must have at least some intact surface or subsurface cultural remains. For example, while an isolated Paleoindian projectile point found on the surface, by itself, is not eligible for the National Register, the point may be an indication of the presence of intact subsurface cultural deposits qualifying as a register-eligible site. To assess the eligibility of a surface locality of an isolated Paleoindian projectile point, subsurface testing must be conducted if geological evidence indicates the possibility of associated subsurface cultural remains.

- *For the purpose of evaluating the eligibility of a surficial find spot of a Paleoindian projectile point for the National Register of Historic Places, the locality must be carefully assessed in terms of the potential presence of associated subsurface cultural deposits.*

The geological age and geomorphological context of a Paleoindian point find spot must be known in order to confirm or reject the possibility of associated subsurface cultural remains. In many cases, this assessment may require subsurface testing. In types of contexts with the potential for having preserved subsurface cultural deposits, and the potential of appropriate antiquity, subsurface testing is required. The key concept is that there are two aspects of such testing, *geological* and *archaeological*, and a well-designed program of testing fieldwork integrates both in order to provide independent confirmation of the presence of associated subsurface cultural deposits (see the section below on Geological Approaches to Locating and Evaluating Sites).

Aspects of Integrity

There are seven aspects of integrity defined by the National Park Service, including 1) location; 2) design; 3) setting; 4) materials; 5) workmanship; 6) feeling; and 7) association. To convey its significance, a property will always possess some, and usually most, of the aspects of integrity. Integrities of setting, location, feeling, and association are critical to the eligibility of properties under Criteria A and B. For example, integrities of feeling and setting add to a property's "recognizability" (thereby conveying its significance), which is necessary to be significant under Criteria A and B. Properties nominated under Criterion C should have, at a minimum, integrities of design, setting, and feeling. Integrities of location and material are the minimum requirements for eligibility under Criterion D.

Location. "Location is the place where the historic property was constructed or the place where the historic event occurred. . . . Except in rare cases, the relationships between the resource and its natural and manmade surroundings are destroyed when a historic resource is moved" (National Park Service 1990:44). A Paleoindian, Archaic, or Early Agricultural archaeological site that includes recognizable features and in situ artifact-bearing deposits has locational integrity by definition; a site composed of artifacts that have been transported and redeposited a distance from where they were originally deposited has lost its locational integrity.

Design. "Design is the combination of elements that create the form, plan, space, structure, and style of a property. It results from conscious decisions made during the original conception and planning of a property (or its significant alteration). . . [and] reflects historic functions as well as aesthetics" (National Park Service 1991b:44). Types of prehistoric archaeological properties that may retain their integrity of design include rock art sites and sites with identifiable spatial patterns of features.

Setting. "Setting is the physical environment of a historic property. . . [It] refers to the character of the place in which the property played its historical role. It involves how, not just where, the property is situated and its relationship to surrounding features and open space. Setting often reflects the basic physical conditions under which the property was built and the functions it was intended to serve" (National Park Service 1990:45).

The setting of a prehistoric archaeological site reflects how the landscape was utilized during its occupation. While post-occupation site formation processes and land uses may have significantly altered the setting of a prehistoric archaeological site, archaeologists can potentially reconstruct the setting of the site during its occupation from its geological context and preserved floral and faunal remains.

Materials. "Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property. The choice and combination of materials reveal the preferences of those who created the property and indicate the availability of particular types of materials and technologies" (National Park Service 1990:45). Obviously, prehistoric archaeological sites that have been reconstructed have lost their integrity of materials.

Workmanship. "Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history and prehistory. It is evidence of artisans' labor and skill in constructing or altering a building, structure, object, or site. . . . Workmanship is important because it can furnish evidence of the technology of a craft, illustrate the aesthetic principles of a historic or prehistoric period, and reveal individual, local, regional, or national applications of both technological practices and aesthetic principles" (National Park Service 1990:45).

At prehistoric archaeological sites, the concept of workmanship applies to artifacts as well as structures, both of which can be assessed from both technological and aesthetic perspectives. If they are well-preserved, and mostly intact, Paleoindian tools made of bone or ivory, Archaic and Early Agricultural rock art panels, baskets, sandals, atlatls, split-twig figurines, and other objects of perishable materials recovered from dry caves retain their integrity of workmanship.

Lithic artifacts, on the other hand, may represent workmanship whether they are intact tools or assemblages of fragments:

> First, there is the evidence of the finished tools—whole projectile points, scrapers, metates, manos, and so forth. A lithic site's integrity of workmanship will decline in direct proportion to the removal of these complete, or nearly complete, artifacts. The second aspect of workmanship is the information potential of the objects that are present. Broken artifacts, debitage from the production of flaked lithic artifacts, and residue from the making of ground stone tools can provide information on lithic technology, and, more to the point, document the workmanship of the people who made the artifacts. This evidence is likely to survive, *even if the site has been damaged by natural and cultural transformations* (Slaughter et al. 1992:45; emphasis in original).

Feeling. "Feeling is a property's expression of the aesthetic or historic sense of a particular period of time. It results from the presence of physical features that, taken together, convey the property's historic character" (National Park Service 1990:45). For prehistoric archaeological sites, feeling is a relatively abstract concept largely related to the integrities of setting and design. For both prehistoric and modern visitors, similar feelings may be instilled by the relatively inaccessible location of a cave with rock art, or by the dramatic viewing angles for its larger-than-life, anthropomorphic pictographs (e.g., Shaman's Gallery; Table 8.3).

Association. "Association is the direct link between an important historic event or person and a historic property. A property retains association if it is the place where the event or activity occurred and is sufficiently intact to convey that relationship to an observer" (National Park Service 1990:45). Prehistoric archaeological sites that retain integrity of location also possess integrity of direct association with the people and events that created them, and with the archaeologists who excavated them (see discussion of Criterion B above). Also, they may have integrity of indirect association with a regional cultural event, such as a migration, or a significant shift in settlement and/or subsistence patterns.

Resource and Research Models of Significance

It must be explicitly recognized that the significance of an archaeological site is a relative quality that changes in relation to two types of knowledge. First, significance shifts according to changes in the known universe of sites, as new ones are discovered and previously recorded ones deteriorate or are destroyed. Second, it changes in response to increases in archaeological knowledge, as new discoveries and research programs answer old questions and raise new ones. In their overview of prehistoric cultural resources in New Mexico, Stuart and Gauthier (1981) distinguished between these in terms of *resource models of significance* and *research models of significance.* The significance of Arizona's archaeological sites also changes in relation to new discoveries and research.

- *The National Register eligibility of Paleoindian, Archaic, and Early Agricultural archaeological properties in Arizona may change over time.*

For cultural resource management and preservation planning, an implication of research models of significance is that archaeological property types that currently seem redundant or uninformative may become significant as research questions change. An implication of resource models of significance is that archaeological sites whose investigations played pivotal roles in the advancement of knowledge of prehistory and the development of archaeological techniques have acquired historical significance with the passing of time, even if the types of information they yielded have become redundant. Sites with this kind of historical significance are eligible under Criterion A, and also Criterion B if they are associated with an individual who played an important role in the development of the field of early Southwestern prehistory (see above).

DEFINING PROPERTY BOUNDARIES

To be eligible for the National Register, the boundaries identified for an archaeological site or site district should be related to the scale and spatial distribution of artifacts and/or features. "A regional pattern or assemblage of remains, a location of repeated habitation, a location of a single habitation, or some other distribution of archaeological evidence all imply different spatial scales" (National Park Service 1991a:57). The spatial characteristics of sites with subsurface cultural deposits, and completely buried sites, can be identified only through subsurface testing.

- *The boundaries identified for a National Register-eligible Paleoindian, Archaic, or Early Agricultural archaeological property in Arizona must encompass the spatial concentration of artifacts, features, and/or deposits representing the site, or the concentration of sites included in the site district.*

The extent of the concentration of cultural remains representing a site must be determined through either pedestrian survey, subsurface testing, observation of topographic features, identification of post-occupation site formation processes, or a combination of these techniques, depending upon the landscape setting and geomorphological context of the property. If part of a site cannot be surveyed or tested, the boundaries may be drawn along the legal property lines of the portion that is accessible, as long as that portion *by itself* has enough significance to meet National Register criteria (National Park Service 1991a:57).

Archaeological districts may contain discontiguous elements if outlying sites have a direct relationship to the significance of the main concentration of sites, and when the intervening space does not have known significant archaeological resources; geographically separate sites may also be included together as individual properties within a Multiple Property Nomination (National Park Service 1991a:57).

DOCUMENTATION STANDARDS

National Register nominations for early prehistoric sites in Arizona must always include some of the same basic categories of information so that they can be related and compared in terms of known ranges of variability. These categories, which have structured the organization of this context statement, include environmental periods, physiographic region, subsistence adaptations, cultural complexes, site patterns, and site types. The known ranges of variability differ for each combination of categories, and a site nomination application should include comparisons among the set of sites bounded by the same combination. For example, the characteristics of a late Holocene Archaic site in the Southern Basin and Range Province that is attributed to the Chiricahua complex should be compared to the known ranges of variability in site patterns and site types among the set of other known Chiricahua complex sites in the same region.

Environmental Periods

Four major Late Quaternary environmental periods within the known timespan of human occupation of Arizona and the rest of the Southwest include 1) the latest Wisconsin, ca. 14,500-10,500 b.p. (13,500?-9600? B.C.); 2) the early Holocene, ca. 10,500-7500 b.p. (9600?-6300 B.C.); 3) the middle Holocene, ca. 7500-4500 b.p. (6300-3100 B.C.); and 4) the late Holocene, ca. 4500-0 b.p. (3100 B.C.-A.D. 1950/today) (see Chapter 2).

Early prehistoric sites in Arizona may have been occupied more than once during a single environmental period, and/or during multiple environmental periods. Both the Big Chino Wash site and O'Haco Rockshelter (Table 8.3) were occupied during the early, middle, and late Holocene periods.

Physiographic Regions

Four major physiographic regions occurring in Arizona include 1) the Colorado Plateau; 2) the Mountain Transition Zone, 3) the Southern Basin and Range Province; and 4) the Lower Colorado River Valley (the latter two are sometimes called the Mexican Highland and Sonoran Desert sections of the Southern Basin and Range Province, respectively).

Each early prehistoric site in Arizona is located in one of these regions, or on a boundary between two or more of them. McEuen Cave (Table 8.3) is a multicomponent Archaic and Early Agricultural site very near the boundary between the Southern Basin and Range Province and the Mountain Transition Zone.

Subsistence Adaptations

Three types of subsistence adaptations were identified in this document, including 1) Paleoindian; 2) Archaic; and 3) Early Agricultural. According to the definitions used here, "Paleoindian" adaptations include a) possible Wisconsin, pre-projectile point, generalized foraging economies; and b) terminal Wisconsin and early Holocene hunting and gathering economies that included some hunting of now-extinct large mammals (megafauna). "Archaic" adaptations include early, middle, and late Holocene hunting and gathering economies that included more diverse and/or intensively processed food resources. "Early Agricultural" adaptations, which are considered "Late Archaic" in the southern Southwest, include a) mixed farming and foraging economies in which cultigens merely supplemented wild food resources, and b) agricultural-focused economies in which cultigens were the primary subsistence resources.

A multicomponent site may have been occupied by groups representing more than one of these adaptations. The Big Chino Wash site and the Squawbush site near Hall Ranch may have been occupied by both Paleoindian and Archaic groups, while McEuen Cave was occupied by both Archaic and Early Agricultural groups (Table 8.3).

Cultural Complexes

Ideally, an early prehistoric site or site occupation in Arizona can be attributed to one or more of the prehistoric cultural complexes described in the previous chapters (see also Figure 1.3). However, this will not always be possible to do with confidence, or the site/occupation may represent a previously undefined complex.

In Chapter 1, complexes were defined as "temporal-spatial patterns in the archaeological record representing both cultural traditions and communication networks." The complexes described in Chapters 3 through 6 are identified primarily in terms of associated projectile point types. To varying degrees, these overlap in space and time with complexes identified in terms of rock art styles, figurine traditions, textile and basket-weaving techniques, mortuary patterns, and other aspects of material culture. Associated with the Grand Canyon caves (Table 8.3), for example, are the split-twig figurine complex, and possibly the Gypsum point complex and the Glen Canyon Linear/Style 5 rock art complex (see Chapter 5).

Site Patterns

In Chapter 7, patterns within the universe of recorded early prehistoric site occupations in Arizona were summarized according to a variety of characteristics, including 1) locations of primary site records; 2) preservation status at the time of recording; 3) levels of archaeological investigation; 4) jurisdiction and ownership; 5) dating criteria; 6) regions; 7) elevations; 8) landforms; 9) sizes; 10) artifact and feature contexts; 11) artifact classes present; and 12) feature types present. A site can be compared to other sites in terms of the known ranges of variability for these characteristics, and in relation to modes within those ranges.

Site Types

In the previous chapter, site types within the universe of recorded early prehistoric sites in Arizona were categorized according to a combination of occupation duration and diversity of activities. For each combination of period/adaptation, certain site types have been documented through archaeological investigations, and others are only expected to exist. The identified types include 1) lithic quarry/initial reduction sites; 2) animal kill/butchering sites; 3) plant gathering/processing sites; 4) rock art sites; 5) shrines; 6) trails; 7) cemeteries; and 8) settlements.

Essentially, these are functional categories. Of course, more than one of these functions may be associated with the same site or occupation. The Lone Hill site (Table 8.3) is interpreted as a late Holocene Archaic seasonal base-camp where hunting and butchering, plant gathering and processing, and lithic quarrying and initial reduction were all carried out. However, according to the primary activities represented, the Lone Hill site may be described as a settlement site. Below are listed some of the defining characteristics of the identified site types, and the specific description standards for them.

Lithic Quarry/Initial Reduction Sites

Types of evidence that define this property type include (but are not limited to) the presence of quarrying debris (chunks, shatter), stone picks, mauls, hammerstones or other tools for extraction, cores, partially ground and/or pecked stones, flakes with cortex, and unretouched tool preforms/blanks.

Only certain types of quarries are significant in terms evaluating eligibility for the National Register: Quarries of *continuous sources* of lithic materials—such as alluvial fans, bajadas, large exposed bedrock outcrops, and large river terraces, and *ribbon sources* such as stream beds and long but narrow bedrock outcrops—where the materials are available over a wide or long area and there are no relative concentrations of evidence of quarrying, are not eligible. Only quarries of *point sources* of lithic materials—such as isolated bedrock outcrops, volcanic dikes, obsidian flows, and chert beds or nodule concentrations—where the materials are available only from specific locales and there are relative concentrations of evidence of quarrying, are eligible.

From available information, the type(s) of material quarried must be identified geologically as specifically as possible, and the general class(es) of artifacts (e.g., flaked stone and/or ground stone) for which the material was used must be identified. Quarries may or may not (but usually do) also exhibit evidence of initial lithic reduction/shaping.

Sites used only (or primarily) for initial lithic reduction must have evidence of this activity to be defined as such. Artifact types whose presences define this type include (but are not limited to) debris from initial stages of reduction/shaping, hammerstones, cores, partially ground and/or pecked stones, flakes with cortex, and unretouched tool preforms/blanks.

Animal Kill/Butchering Sites

Types of evidence for these activities include (but are not limited to) flaked stone projectile points, knives, scrapers, and other killing and butchering tools, animal bones with butchering marks, smashed animal bones, and selected skeletal elements present or missing. Landscape features of kill sites include cliffs, box canyons, deep arroyos, and waterholes, and these must be described if they are interpreted as playing a role in the hunting technique. Sites used only for butchering would not be expected to have projectile points unless they also served as knives, and only selected skeletal elements would be present in most cases. From available information, the animals preyed (or scavenged) and/or butchered must be identified taxonomically as specifically as possible.

Plant Gathering/Processing Sites

Evidence of such activities includes (but is not limited to) ground stone milling tools, bedrock mortars and grinding slicks, tabular stone knives, scraper-planes, and rock-filled roasting pits. Vegetation features of these sites include groves or other visible concentrations of economic plants, such as pinyon, oak, agave, etc., and these must be described if they are interpreted as being the foci of site activities. From available information, the plants gathered and/or processed must be identified taxonomically as specifically as possible.

Rock Art Sites

This property type includes sites with petroglyphs, pictographs, and/or geoglyphs (intaglios). The number of panels/figures must be estimated, and the variety of motifs must be described and illustrated with drawings and/or photographs. The colors used in pictographs must be described, and the surfaces upon which petroglyphs and pictographs exist must be described. Any associated artifacts and/or non-art cultural features must also be described.

Shrines

Evidence for identifying this property type includes (but is not limited to) cairns, carved niches, or natural caves/crevices with associated offerings (e.g., split-twig or clay figurines, feather bundles, calendar sticks, fossils, bones or dung of extinct animals, crystals, rare minerals, oversize or miniature versions of projectile points, bows, and other secular types of artifacts, etc.); rock art that exhibits multiple episodes of renewal or addition; and arrangements of artifacts and/or natural objects into specific patterns or shapes. Note that some rock art sites may be interpreted as shrines. The natural and cultural settings of sites/features interpreted as shrines, and any associated nonritual artifacts and/or cultural features must also be described. The interpretations of authorized representatives of local Native American tribes, and any other tribes that claim affiliation, should also be reported.

Trails

A trail site has evidence of use as a path of human movement. Such evidence includes (but is not limited to) systematic clearing of rocks, carving of handholds and steps, and other cultural modifications in a path that forms one or more segments visible against the natural background surface. The location and direction of a trail must be described in relation to environmental features such as river courses, mountain passes, canyon rims, tinajas (natural rock water tanks), springs, etc., and in relation to other site types and regional site patterns. Any associated artifacts and/or cultural features must also be described.

Cemeteries

Cemetery sites must have evidence of corpse disposal and other mortuary activities. Such evidence includes (but is not limited to) human remains in the forms of inhumations or cremations (primary or secondary, complete or partial), burial facilities (pits, tombs, ossuaries, cairns, mounds, etc.), body preparation facilities (crematoria, charnel structures, etc.), and grave offerings. Cemeteries sometimes occur in settlement sites; to be defined as a *cemetery site*, it must be isolated from other types of sites. However, any associated non-mortuary sites, features, and/or artifacts must also be described. With available information, mortuary patterns should be described in as much detail as possible, including body treatments, preparations of burial facilities, patterns of grave offerings, and orientations of bodies and mortuary facilities in reference to cardinal directions, topographic features, associated shrines, etc.

Settlements

Settlement sites have evidence of habitation to be defined as such. Evidence of habitation includes (but is not limited to) structures, storage facilities, trash deposits, nonportable tools, diverse assemblages of artifacts and features, formal site structures, etc. Along a continuum defined by a combination of relative duration of occupation and diversity of activities (see Chapter 7), settlement sites include single-use camps, short-term base camps, seasonal settlements, multi-seasonal settlements, and permanent settlements. The variety of artifact classes and feature types, the structure of the site, evidence of reoccupation, and the environmental setting must be described. Any associated sites or features in the vicinity must also be described.

Other Property Types

Other types of Paleoindian, Archaic, and Early Agricultural sites may be identified in the future. A site that does not fit into one or more of the property types defined here is still eligible for listing if it meets one or more of the National Register criteria and the threshold of integrity defined here. However, the new property type must be defined in the nomination documents by reference to evidence from the site.

GEOARCHAEOLOGICAL APPROACHES TO LOCATING AND EVALUATING SITES

Early prehistoric sites in the Southwest have been found in both surface and buried contexts, and in both open and protected locations. Surface sites may represent mixtures of multiple occupations that accumulated on stable surfaces or landforms or within aggrading landforms that have since been deflated into a single surface. Preservation of organic materials such as animal bones, charred and uncharred plant remains, and pollen is rare under these exposed conditions. On the other hand, buried sites in stratified eolian and alluvial deposits can more easily be differentiated into discrete occupation components separated by noncultural deposits, and frequently have preserved organic materials. However, at least some post-occupation mixing has often resulted from cultural and natural site formation processes. In contrast to these open sites, sites in caves and rockshelters are usually multicomponent and stratified, and have excellent preservation of organic materials, but the occupation components are often significantly mixed by site formation processes.

Knowledge of the factors determining where archaeological sites are preserved, and the factors affecting their integrities, is necessary for prediction of their locations and the quality of data that can potentially be recovered from them. Such knowledge requires an understanding of the relationships between site formation processes and regional and local processes of landscape evolution. The investigation of such relationships—an important focus of "geoarchaeology"—is particularly relevant for understanding the locations and relative integrities of Paleoindian and Archaic sites, where site formation processes have been at work for long timespans and through significant environmental changes.

An example of a geoarchaeological approach to assessing site integrity is Waters' (1986b) refinement of Sayles and Antevs' (1941) original alluvial and archaeological sequence for Whitewater Draw, in southeastern Arizona, with an additional 31 radiocarbon samples and numerous buried prehistoric remains. The new radiocarbon dates, when combined with 12 dates obtained by earlier researchers, prove that the sequence of Holocene alluvial deposits in the southern Sulphur Springs Valley is more complex than was originally thought.

On the basis of this relatively well-dated sequence, Waters concluded that 1) different basins in the Southwest have experienced unique sequences of alluvial cycles during the Late Quaternary because of local geomorphic controls and watertable conditions; 2) the bones of extinct fauna were redeposited in secondary contexts, and that Wisconsin megafauna did not survive far into the Holocene as previously suggested on the basis of the positions of their remains in the Whitewater Draw sequence (Sayles and Antevs 1941); 3) the hunter-gatherers of the Sulphur Spring stage of the Cochise culture were not contemporary with terminal Wisconsin Clovis hunters, but rather represent an early Holocene adaptation; and 4) the proposed Cazador stage (Sayles 1983) was not a valid phase, because Cazador-type artifacts were found in deposits bearing Sulphur Springs-type artifacts and in deposits that yielded radiocarbon dates that fall into the span of the Chiricahua stage of the Cochise culture.

There are also several examples of geoarchaeological approaches to locating and evaluating the integrities of early prehistoric sites in nonalluvial contexts. The relationships between Paleoindian and Archaic artifacts and Pleistocene lake shorelines in the Willcox Basin of southeastern Arizona have been investigated (Waters 1989; Waters and Woosley 1990; Woosley and Waters 1990), leading to the conclusion that Sulphur Spring stage ground stone artifacts, once thought to be associated with the last Pleistocene high stand of Lake Cochise, actually derive from nonlacustrine sediments, are younger than previously thought, and cannot have been contemporaneous with the Clovis complex. In northwestern New Mexico and south-central Arizona, Bryan and McCann (1943) and Bayham and Morris (1990) have examined the relationships between active dune deposits and Archaic occupations. Ackerly (1986) has documented the significant effects of rodent burrowing and other bioturbation processes on the integrity of Archaic cultural deposits in a cave above the Gila River in central Arizona.

THE FUTURE OF ARIZONA'S EARLY PREHISTORIC SITES

Many of Arizona's early prehistoric sites have significance according to the defined criteria of the National Register of Historic Places, but they are also important in other, undefined senses. They are the only remaining traces of most of the total span of human occupation in this part of the world, and represent a variety of successful preagricultural adaptations to this relatively marginal, desertic region of North America.

These sites of the earliest Arizonans, relatively few of which have been archaeologically investigated, but from which we can learn many things, are part of the cultural heritage of all Americans. However, because of their long presence on the landscape, they have suffered the most damage from both nature and people. Almost half of the recorded Paleoindian, Archaic, and Early Agricultural sites in Arizona have been significantly disturbed, and the rate of damage will certainly accelerate as the population of the state continues to soar.

While cultural impacts are the greatest threat to these cultural resources, the difficulties in identifying buried early prehistoric sites are the greatest obstacle to their preservation. However, through regional geoarchaeological studies, their potential locations and integrities may be predicted. These models can then be considered during planning processes. "Out of sight" need not mean "out of mind."

Despite their demonstrated significance, and the fact that they are nonrenewable resources, very few Paleoindian, Archaic, and Early Agricultural sites in Arizona have yet been listed on the Arizona or National registers of historic places. This document was prepared to provide contexts and guidelines for evaluating the eligibilities of early prehistoric sites in Arizona for inclusion in these official inventories, which will ensure that they will be documented, monitored, and preserved in order that future generations may learn from them.

APPENDIX

COMMON PALEOINDIAN AND ARCHAIC PROJECTILE POINTS OF ARIZONA

Leon H. Lorentzen

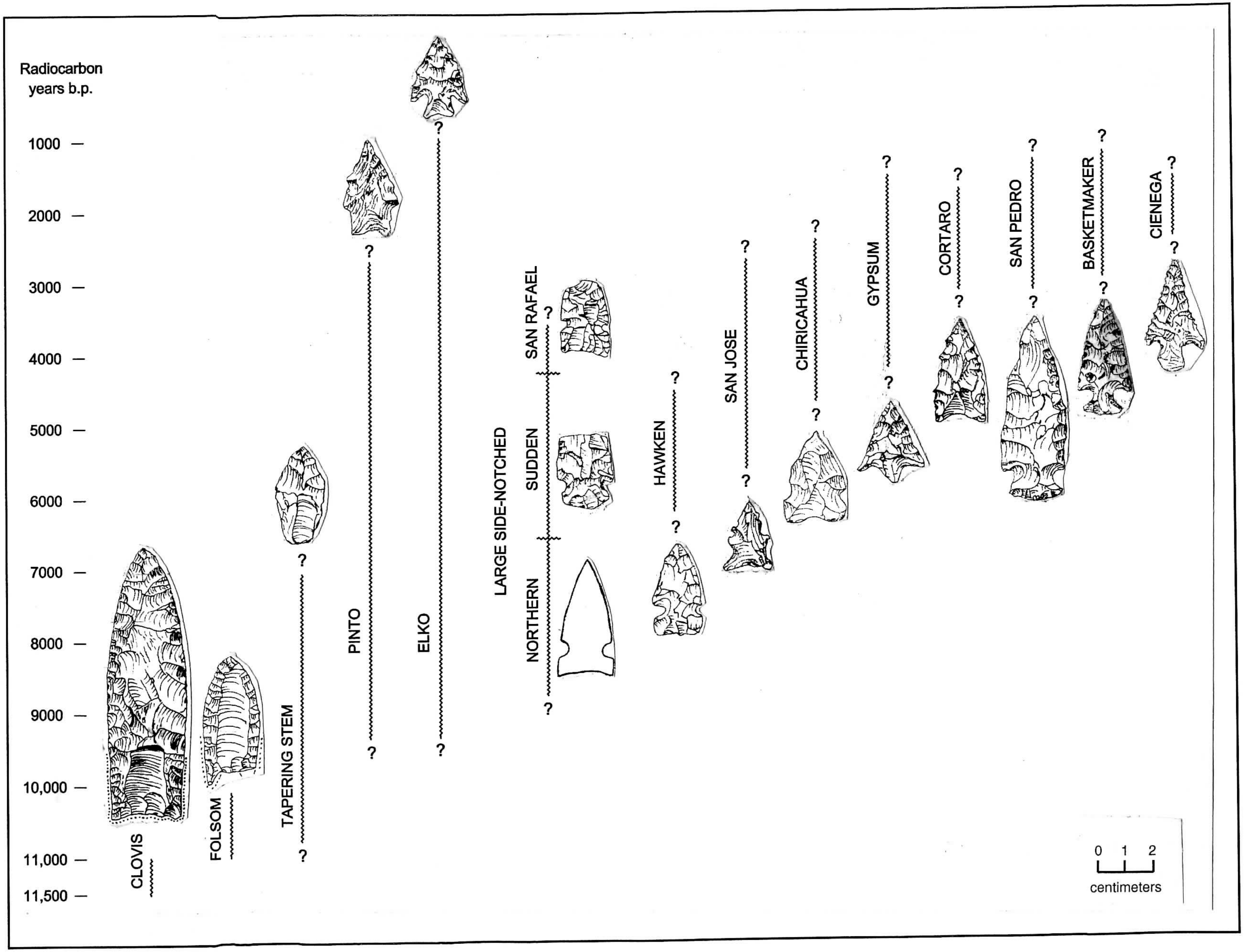


Figure A.1. Known time ranges of some common Paleoindian and Archaic projectile point types in Arizona (in radiocarbon years b.p.)

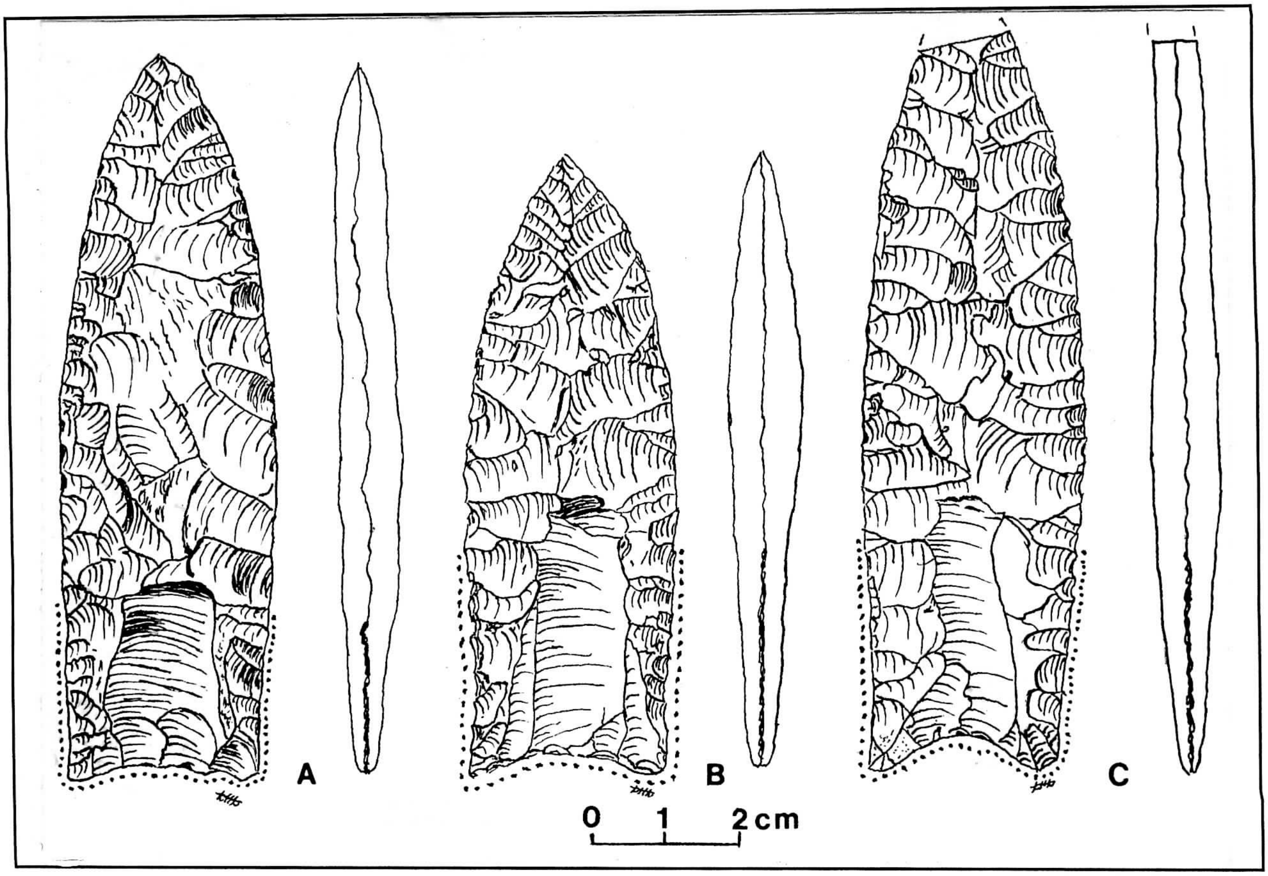


Figure A.2. Clovis points. Drawings made from casts of Clovis points from A) Naco, Arizona, B) Lehner, Arizona, C) Escapule, Arizona.

CLOVIS POINTS

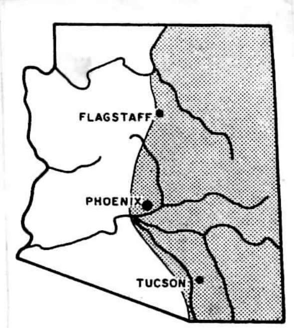
Named after the town of Clovis, in eastern New Mexico, near where they were first found in association with the remains of extinct mammoth at the Blackwater Draw Locality No. 1 (Cotter 1937, 1938; Howard 1935).

Age: ca. 11,600-10,900 b.p. (Taylor et al. 1996).

Description: Clovis points are medium to large (4-13 cm) lanceolate points with fluted concave bases. They are made primarily by careful percussion flaking with variable amounts of pressure flaking along the edges and base. The basal flute scars are short, may terminate in a hinge fracture, and sometimes show the detachment of more than one flake. The base is usually ground approximately the same distance as the longest flute. This is shown in the illustrations by dots around the edges of the bases.

Distribution: In Arizona, Clovis points have been found associated with the remains of mammoth at several sites in the upper San Pedro Valley in southeastern Arizona, and as isolated finds in other areas, mostly in the eastern half of the state. Clovis points are widely distributed throughout much of North America.

References:
Haury et al. 1953;
Wormington 1957;
Haury et al. 1959;
Haynes 1964, 1966;
Huckell 1982; Roth
1993; Downum 1993;
Hesse 1995; Geib 1995;
and this volume.



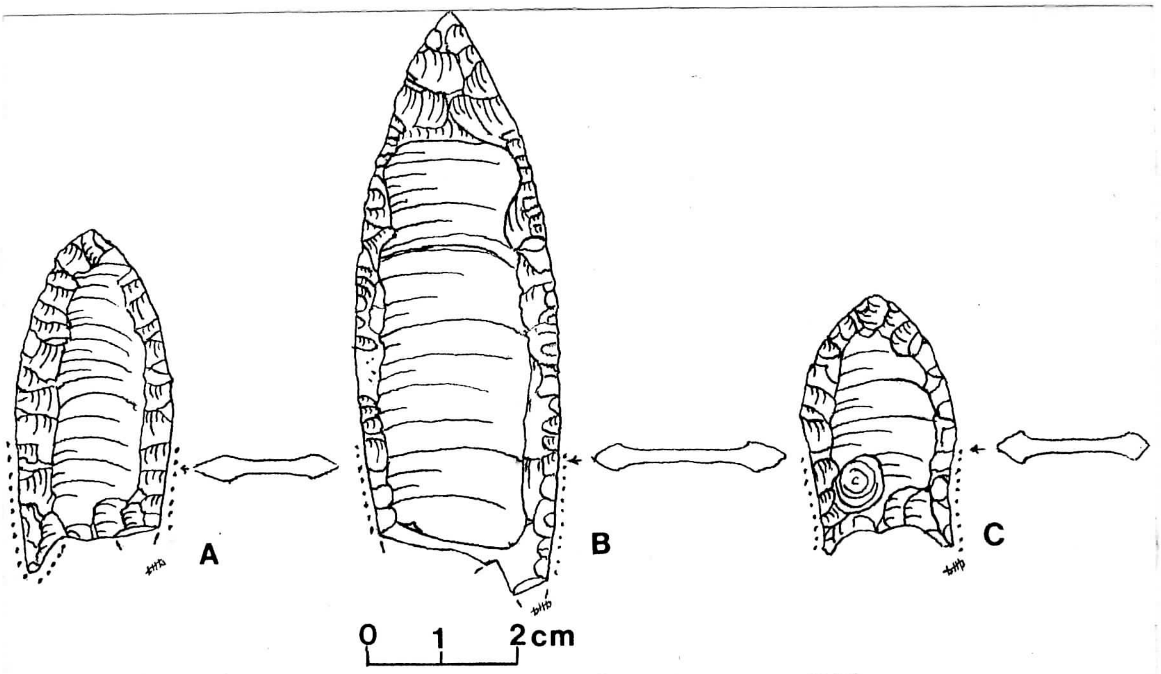


Figure A.3. Folsom points. Drawings made from casts of Folsom points from A) Folsom, New Mexico, B) Blackwater Draw, New Mexico, and C) Lindenmeier, Colorado. See Wendorf and Thomas (1951:108, Figure 47) and Huckell (1982:19-24, Figures 9 and 10) for photographs of Arizona Folsom points.

FOLSOM POINTS

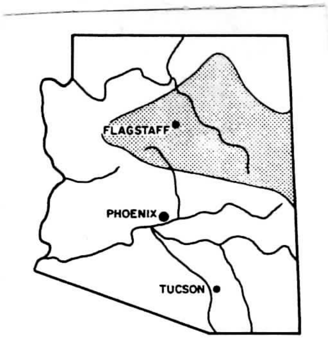
Named after Folsom, New Mexico, where they were found associated with extinct bison (Figgins 1927).

Age: ca. 10,900-10,200 b.p. (Taylor et al. 1996).

Description: Folsom points are small- to medium-sized (3-8 cm) lanceolate points, fluted on one or more commonly both faces. They are often characterized by fine workmanship. Flutes frequently extend from the base almost to the end of the point, with fine pressure retouch on the edges. The flutes on Folsom points cover a proportionately greater amount of the surface area of the point than do the flutes on Clovis points. Folsom points have concave bases, often with ear-like projections. The striking platform nipple may be visible at the base, which is usually ground around the lower edges. The extent of grinding is shown in the illustrations by dots around the edges of the bases.

Distribution: Folsom points in Arizona have been found only on the Colorado Plateau and near its southwestern boundary with the Mountain Transition Zone. None have been found in excavated sites in Arizona. They are widely distributed in the plains of North America, and are also found in northern Mexico.

References:
Wormington 1957;
Huckell 1982; Tagg
1994; Wendorf and
Thomas 1951; and this
volume.



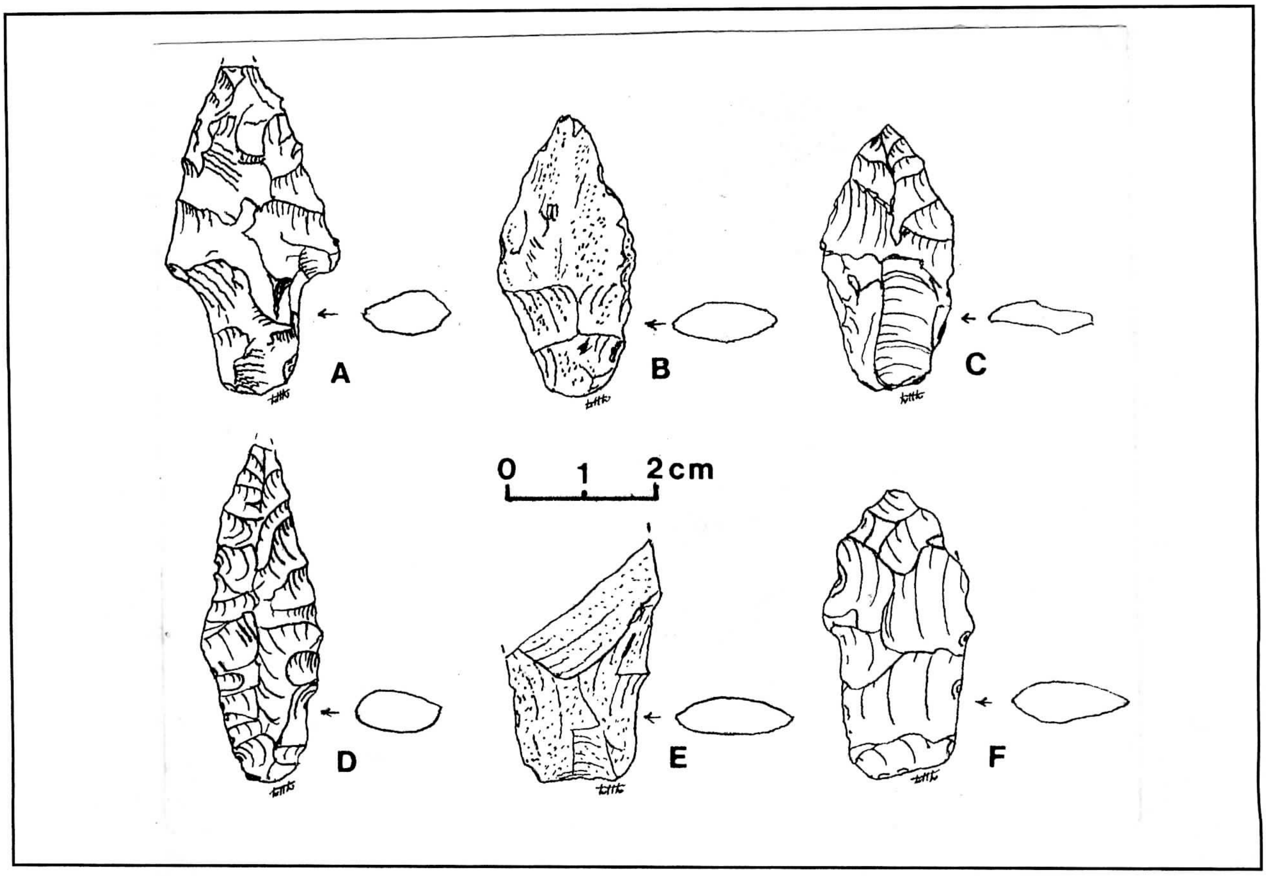


Figure A.4. Tapering stemmed points. A) 93-7-10 of rhyolite and B) 80-86-96 of basalt are from AZ EE:2:62 (the Wasp Canyon site); C) A-1972-X of rhyolite is from Ventana Cave; D) 80-86-69 of chert is from AZ EE:2:82 (the South Canyon site); E) FN 44 of basalt and F) FN 74 of chert are from AZ AA:12:181.

TAPERING STEMMED POINTS

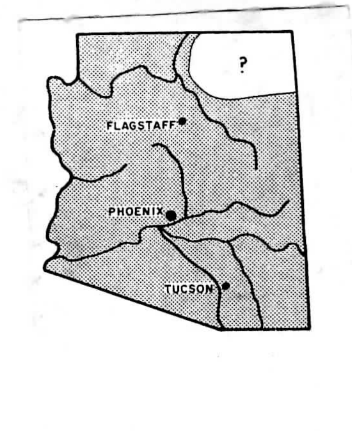
Tapering stemmed points from the Southwest have been variously called Jay, Lake Mohave, Silver Lake, and Ventana-Amargosa I. They are also similar in shape to the Paleoindian Hell Gap point style in the Plains, and the Great Basin Stemmed series (sometimes called Western Stemmed).

Age: ca. 10,700-7000 b.p. Irwin-Williams 1973; Bryant 1980; Huckell 1984a; Wiens 1994, Huckell and Haynes 1995).

Description: These points are approximately 3-6 cm in length, with long tapering stems. They are made primarily by percussion and minimal pressure retouch. Stem edges are sometimes ground. Stem bases are usually convex. They are frequently made from coarse-grained materials, and appear crude when compared with Paleoindian points.

Distribution: Tapering stemmed points have been found in all parts of Arizona except the central Colorado Plateau in the northeastern part of the state. Similar points are widely distributed in western North America.

References:
Haury 1950; Irwin-Williams 1973; Bryan 1980; Huckell 1984a; Wiens 1994; Huckell and Haynes 1995 and this volume.



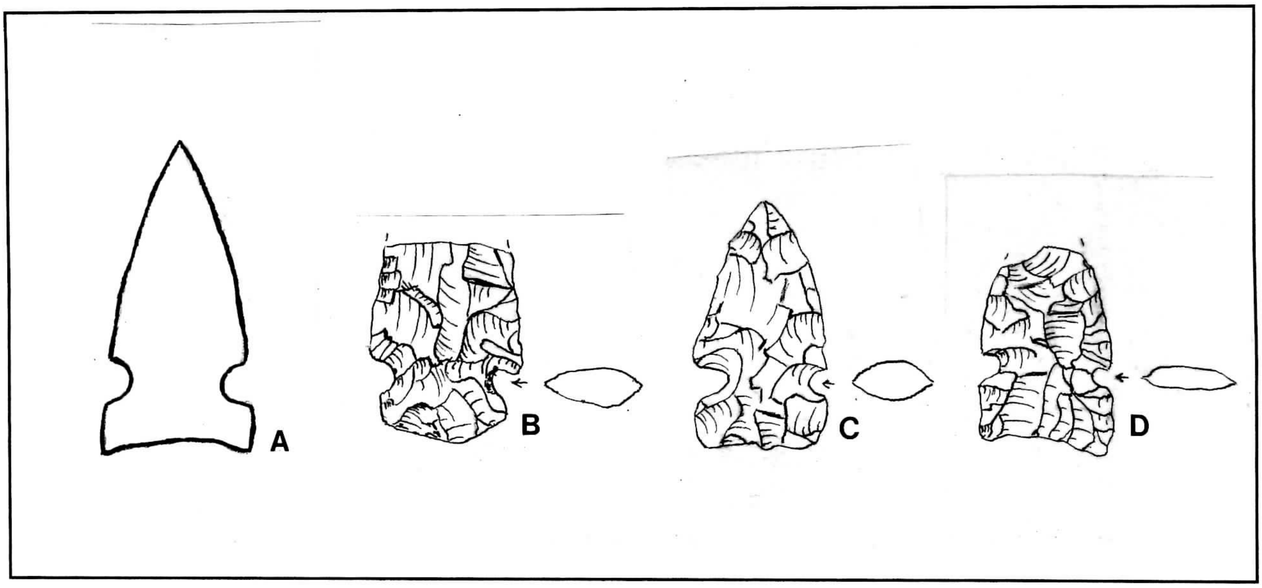


Figure A.5. Large Side-Notched Points. A) Northern Side-notched after Lohse (1995); B) Sudden Side-notched 88-46-356 of chert is from the Mesa Redonda survey; C) Hawken Side-notched 88-46-347 of chert is from AZ P:8:25; D) San Rafael Side-notched 88-46-342 is from the Mesa Redonda survey.

LARGE SIDE-NOTCHED POINTS

Dating and descriptions of these points are based largely on research from the Great Basin and northern Colorado Plateau.

Age: ca. 8700-3500 b.p. (Holmer 1986; Ambler 1996)

Description: The most common name for the large side-notched Archaic points is Northern Side-notched. Holmer (1986:104-105) distinguishes several variations, and the following descriptions are largely extracted from his review.

Northern Side-notched: Illustration A. (See Holmer 1986, Figure 14a) These are large triangular points 4-5 cm long. They have concave sides and slightly concave bases. The points are notched high enough on the sides to leave straight edges between the notches and the bases. The notches are deep, and sometimes nonsymmetrical. They show well-controlled bifacial pressure flaking. This form appeared on the northern Colorado Plateau by 8700 b.p. (Ambler 1996). Holmer (1986) suggests that this form was replaced about 6400 b.p. by Sudden and Hawken side-notched variations.

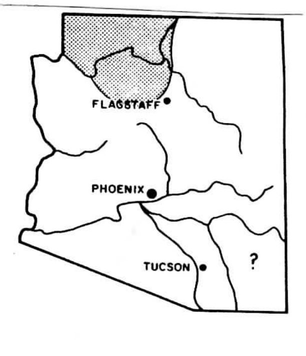
Sudden Side-notched: Illustration B. (Originally divided by Holmer [1980:76-77] into two separate types, Sudden and Rocker). These are triangular points with slightly convex edges and slightly to medium-convex bases.

Hawken Side-notched: Illustration C. These points are similar to the points recovered from the Hawken site in Wyoming (Frison et al. 1976:53). They are lanceolate points with slightly concave sides, flat to slightly convex bases, and low semicircular notches. Holmer (1986) suggests that Sudden and Hawken side-notched variations were replaced about 4400 b.p. by the San Rafael Side-notched form.

San Rafael Side-notched: Illustration D. These are triangular points with concave sides and high side-notched convex bases. They are very thin in cross section compared to other large side-notched points. San Rafael points continued to be used until about 3500 b.p. (Holmer 1986).

Distribution: In Arizona, large side-notched points are found mainly on the western Colorado Plateau. They are more common in the Great Basin, northern Colorado Plateau, and northern Plains areas.

References:
Gruhn 1961; Frison et al. 1976; Jennings et al. 1980; Neily 1988; Holmer 1986; Lohse 1995; Ambler 1996 and this volume.



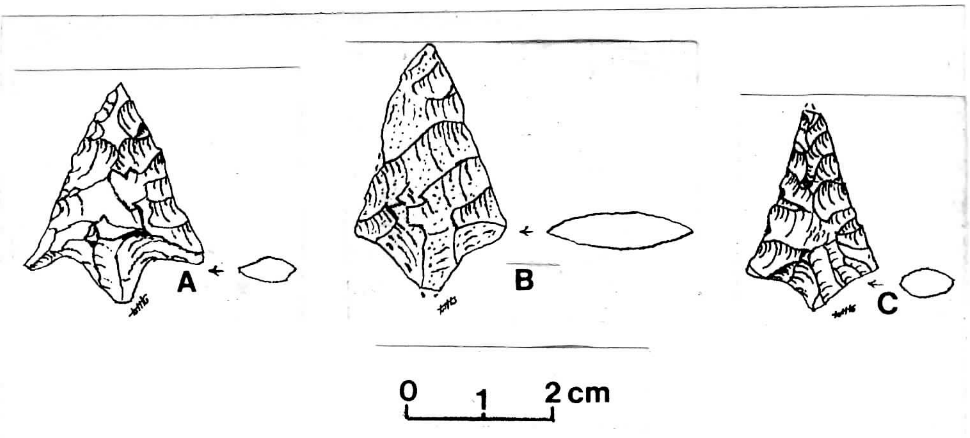


Figure A.6. Gypsum points. A) A-5793 of basalt, B) A-1973-X-9 of basalt, and C) A-1973-X of obsidian are all from AZ Z:12:5, Ventana Cave, Arizona.

GYPSUM POINTS

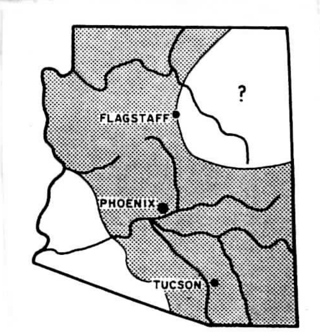
Named for the Gypsum Cave site near Las Vegas, Nevada (Harrington 1933).

Age: ca. 4500-1500 b.p. (Berry and Berry 1986; Holmer 1978, 1986; Huckell 1996a).

Description: Gypsum points are small to medium (3-5 cm) sized points. They generally have straight edges running most of the lengths of the triangular blades, and sharply contracting stemmed bases with abrupt sides and pointed or rounded base tips. The points are widest at the shoulders. Flaking is irregular, with minimum or no secondary edge thinning. Some examples retain traces of pine pitch or another adhesive on the base.

Distribution: Gypsum points are widely distributed over Arizona, but are rare or absent in the northeastern and southwestern parts of the state.

References:
Harrington 1933;
Wormington 1957;
Haury 1950;
Agenbroad 1970;
Holmer 1978, 1986;
Huckell 1984a, 1996a;
Berry and Berry 1986;
Formby 1986; and this volume.



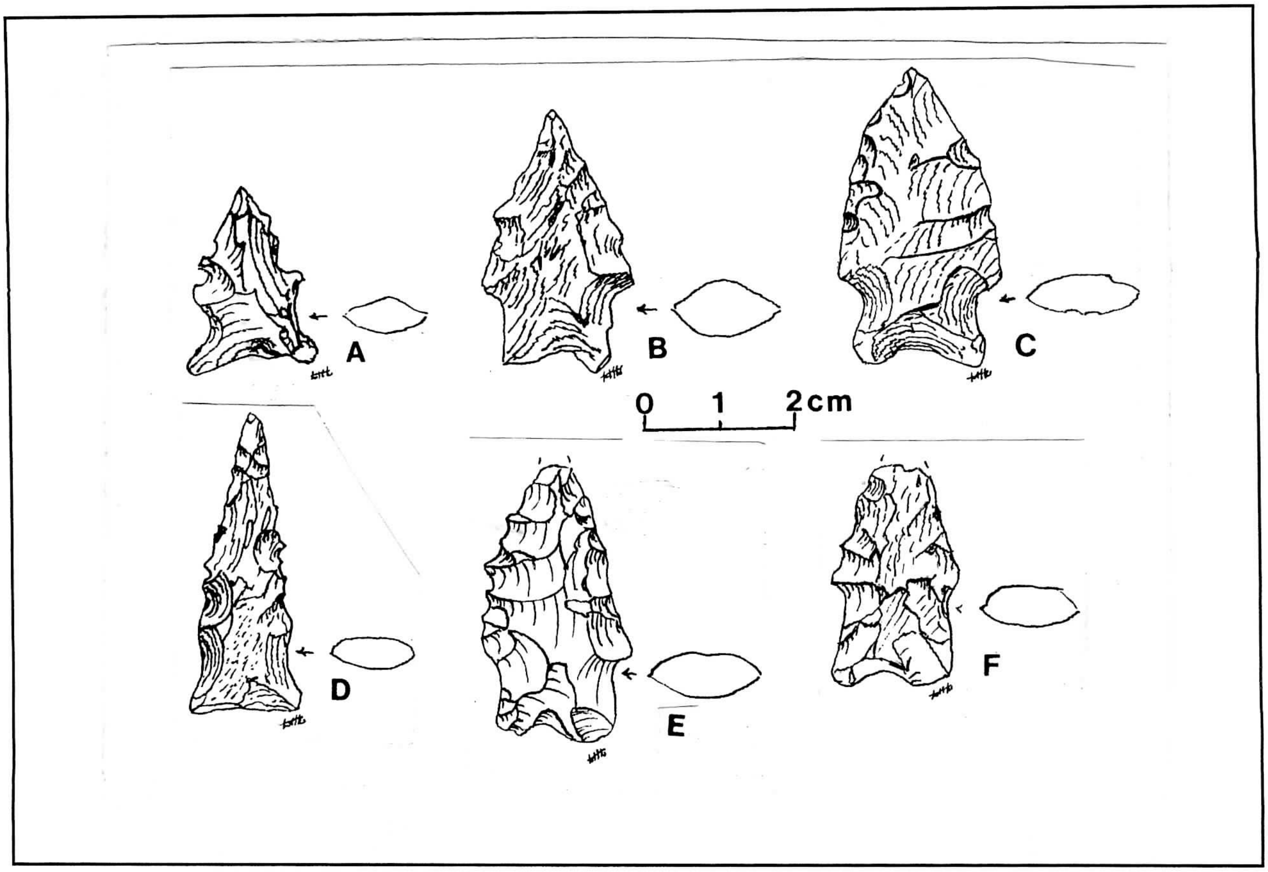


Figure A.7. Pinto/San Jose points. A) A-5772 of basalt, B) A-5677 of basalt, C) A-5710 of basalt, D) A-5768 of basalt, E) A-9205-X of jasper, and F) A-1990-X of basalt, all from Ventana Cave, Arizona.

PINTO/SAN JOSE POINTS

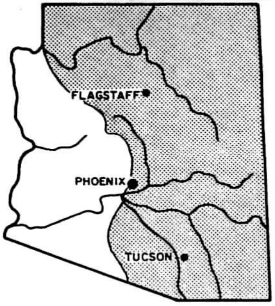
Named by Campbell et al. 1935 for sites in the Pinto Basin, southeastern California, and by Bryan and Toulouse (1943) for San Jose, northwestern New Mexico.

Age: ca. 9500-2800 b.p. (Irwin-Williams 1973; Del Bene and Ford 1982; Scroth 1994; Warren and Jenkins 1984; Bayham et al. 1986; Holmer 1986; Ambler 1996).

Description: Pinto points are stemmed, narrow-shouldered, concave-based, thick points approximately 2-4 cm long. They are flaked by percussion and some points show minor pressure retouch. Some are serrated. Pinto points appeared by 8700 b.p. on the northern Colorado Plateau (Ambler 1996). Points similar to serrated Pinto points have been called San Jose points (Bryan and Toulouse 1943). Points similar to illustration A have also been called Armijo (Irwin-Williams 1973). Irwin-Williams (1979) and Formby (1986) believe that San Jose points are a regional variation of Pinto points. San Jose points appeared on the central Colorado Plateau by 5900 b.p. (Del Bene and Ford 1982), and were in use in central Arizona as late as 4000 b.p. (Bayham et al. 1986).

Distribution: Pinto points are widespread over Arizona, except the western part of the state. They are common throughout the rest of the Southwest and Great Basin. San Jose points have a similar distribution, but are concentrated on the Colorado Plateau.

References:
Campbell et al. 1935; Amsden 1935; Rogers 1939; Bryan and Toulouse 1943; Haury 1950; Wormington 1957; Agenbroad 1970; Irwin-Williams 1973; Del Bene and Ford 1982; Huckell 1984a; Warren and Jenkins 1984; Bayham et al. 1986; Formby 1986; Holmer 1986; Roth and Huckell 1992; Ambler 1996; and this volume.



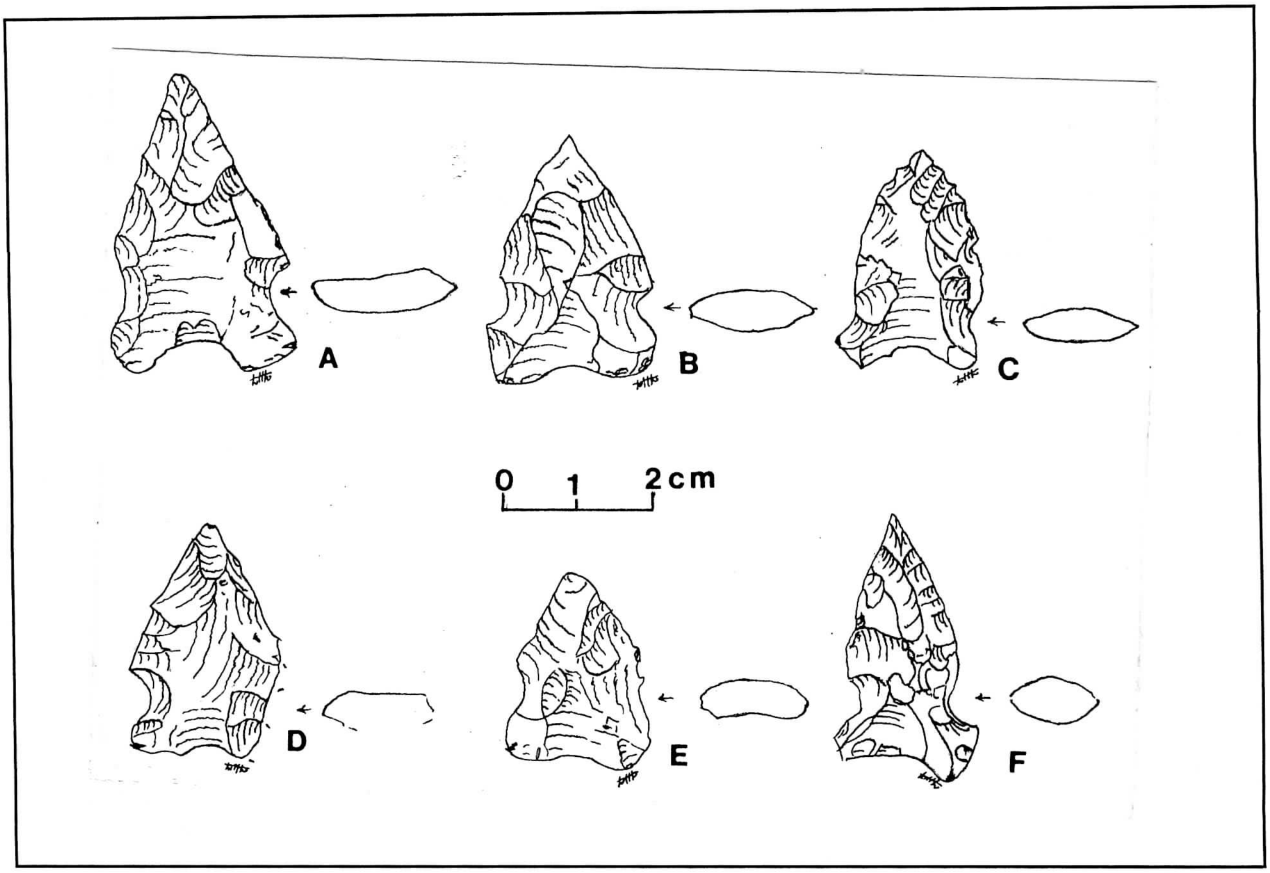


Figure A.8. Chiricahua points A) 160-5 of rhyolite and B) 9-5 of rhyolite are from site AZ BB:9:280; C) A-1983-X of basalt is from Ventana Cave; D) 3-9 of rhyolite is from site AZ BB:9:280; E) A-1983-X of basalt is from Ventana Cave; and F) 80-86-52 of white quartz is from AZ EE:2:80.

CHIRICAHUA POINTS

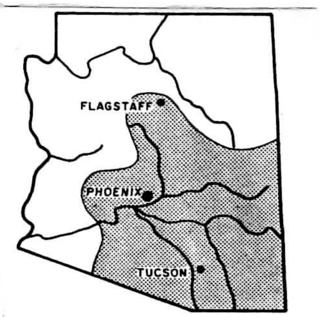
Named for the Chiricahua stage of the Cochise culture (Sayles and Antevs 1941). Haury (1950:296) regards Chiricahua points as a variation of Pinto points. Huckell (1996c) considers them a late variation of large side-notched points.

Age: ca. 4800-2500 b.p. (Whalen 1971; Bayham et al. 1986; Waters 1986b).

Description: Chiricahua points are side-notched, concave-based points with expanding stems often wider than the blades. They range between about 2.5-4 cm in length. They seem to have been made solely by percussion, or sometimes with minimal pressure retouch, and so often have a crude appearance.

Distribution: Chiricahua points appear to be limited to southern Arizona and southern New Mexico. Other notched projectile point types, such as the Northern Side-notched, San Rafael Side-notched, and the Elko Eared, can look very much like Chiricahua points.

References:
Sayles and Antevs 1941; Haury 1950; Whalen 1971; Sayles 1983; Bayham et al. 1986; Waters 1986b; Roth and Huckell 1992; and this volume.



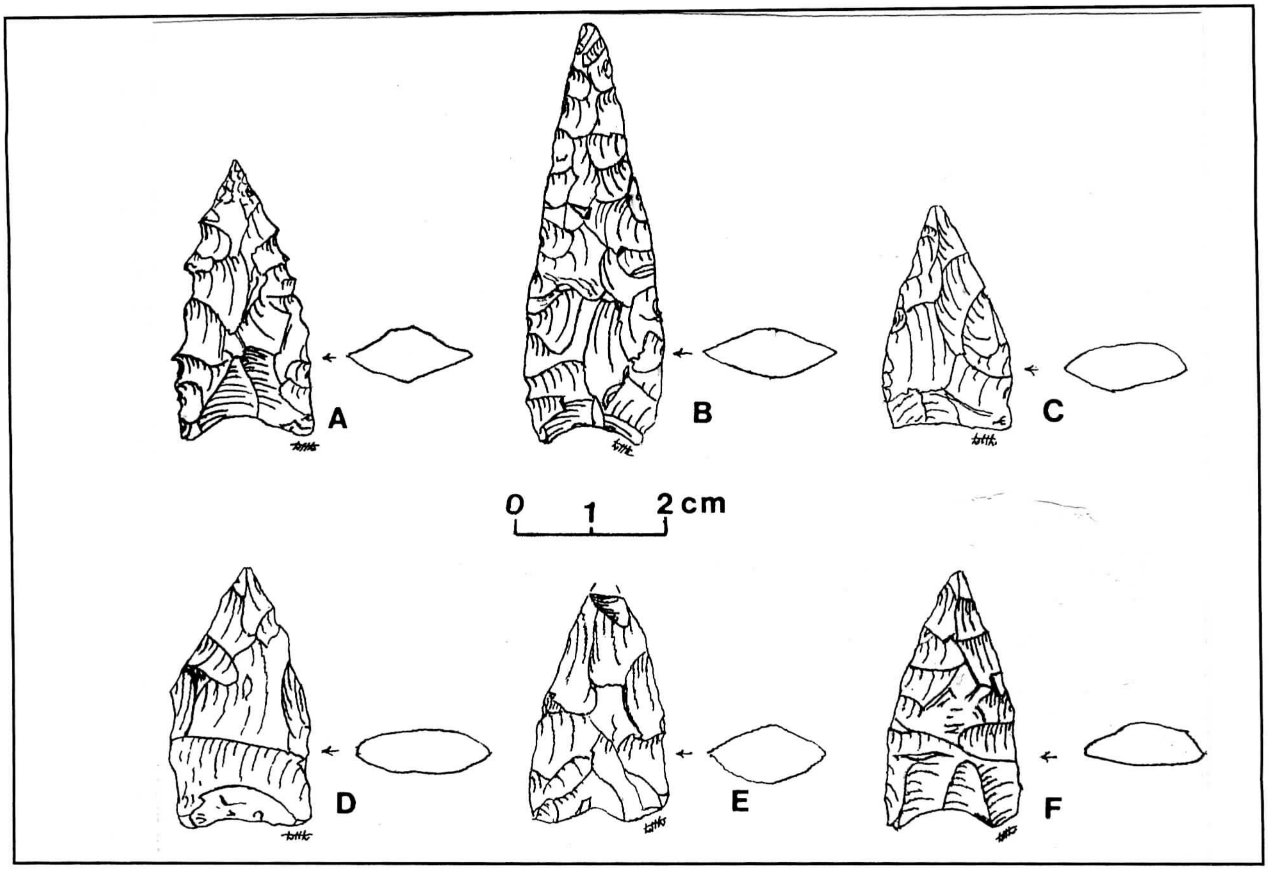


Figure A.9. Cortaro points. A) 94-85-7 of low grade chert, B) 94-85-5 of low grade chert, and C) 94-85-3 of basalt are from AZ AA:12:486 (the Cortaro Fan type site); D) A-1982-X is of basalt from Ventana Cave; E) FN 144 of basalt is from AZ AA:12:181; F) 178-6 of chert is from Arizona site AZ BB:9:280.

CORTARO POINTS

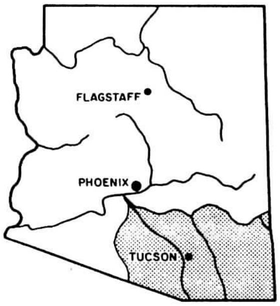
Named by Roth and Huckell (1992) for the historic railroad siding near the Cortaro Fan site, Tucson, Arizona.

Age: ca. 4300-2300 b.p. (Roth and Huckell 1992).

Description: Cortaro points have triangular, leaf-shaped blades with concave bases that vary in depth from shallow to deep. Lengths range from 2.2 to 6.4 cm, and average between 3.2 and 4.2 cm. Widths vary from *1.75 to 2.08* cm. Thicknesses range between 6.5 and 7.3 mm. The points are relatively thick and crude looking, with diamond-shaped cross sections. Primary manufacture was by soft-hammer percussion (but some could be hard hammer), and may show pressure flaking on the edges. No basal grinding is observable.

Distribution: Cortaro points have been reported from sites in southern Arizona and southwestern New Mexico. No Cortaro points have yet been reported from north of the Gila River.

References:
Haury 1950; Roth and Huckell 1992.



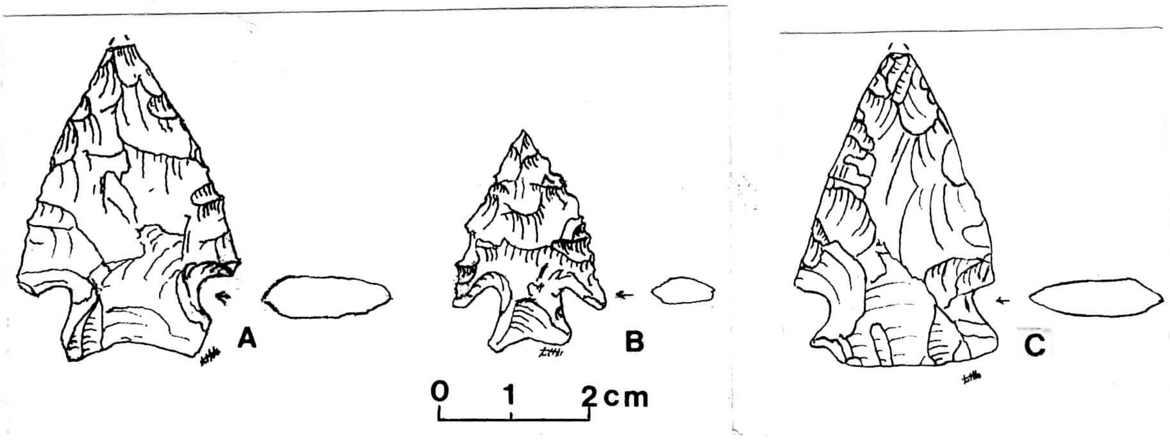


Figure A.10. Elko points. A) 103-0-583 of rhyolite from AZ EE:2:103 (the Split Ridge site); B) 93-7-24 of rhyolite from AZ EE:2:62 (the Wasp Canyon site); C) east locus of AZ BB:9:280.

ELKO POINTS

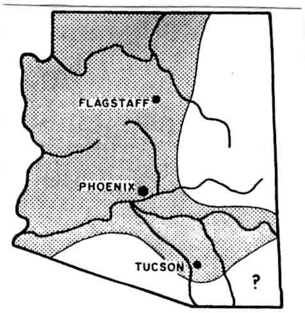
Named by Heizer and Baumhoff (1961) for points found at South Fork Shelter and Wagon Jack Shelter in Elko County, Nevada.

Age: ca. 9500-1000 b.p. On the northern Colorado Plateau, Elko Side-notched and Elko Corner-notched points appeared by 8700 b.p. (Ambler 1996), and went out of use about 1000 b.p. (Holmer 1986). In the western Great Basin, Elko Corner-notched points date between 9500 and 1300 b.p. (Holmer 1986; Schroth 1994).

Description: Elko points generally have broad blades, deep corner notches with broad expanding stems, and concave bases. There appears to be considerable variability in size and shape. Elko points have been divided into several subtypes: Elko Corner-notched, Elko Eared, Elko Side-notched, and Elko Contracting stem. There is controversy over these subtypes. Thomas (1981) rejects the side-notched and contracting stem subtypes, and considers only the Elko Corner-notched Elko Eared as time-sensitive types.

Distribution: Elko points have been found in small numbers throughout Arizona but are somewhat more common in the western part of the state. They are more frequent throughout the Great Basin.

References:
Thomas 1981; Huckell 1984a, 1988; Holmer 1986; Shackley 1996a; and this volume.



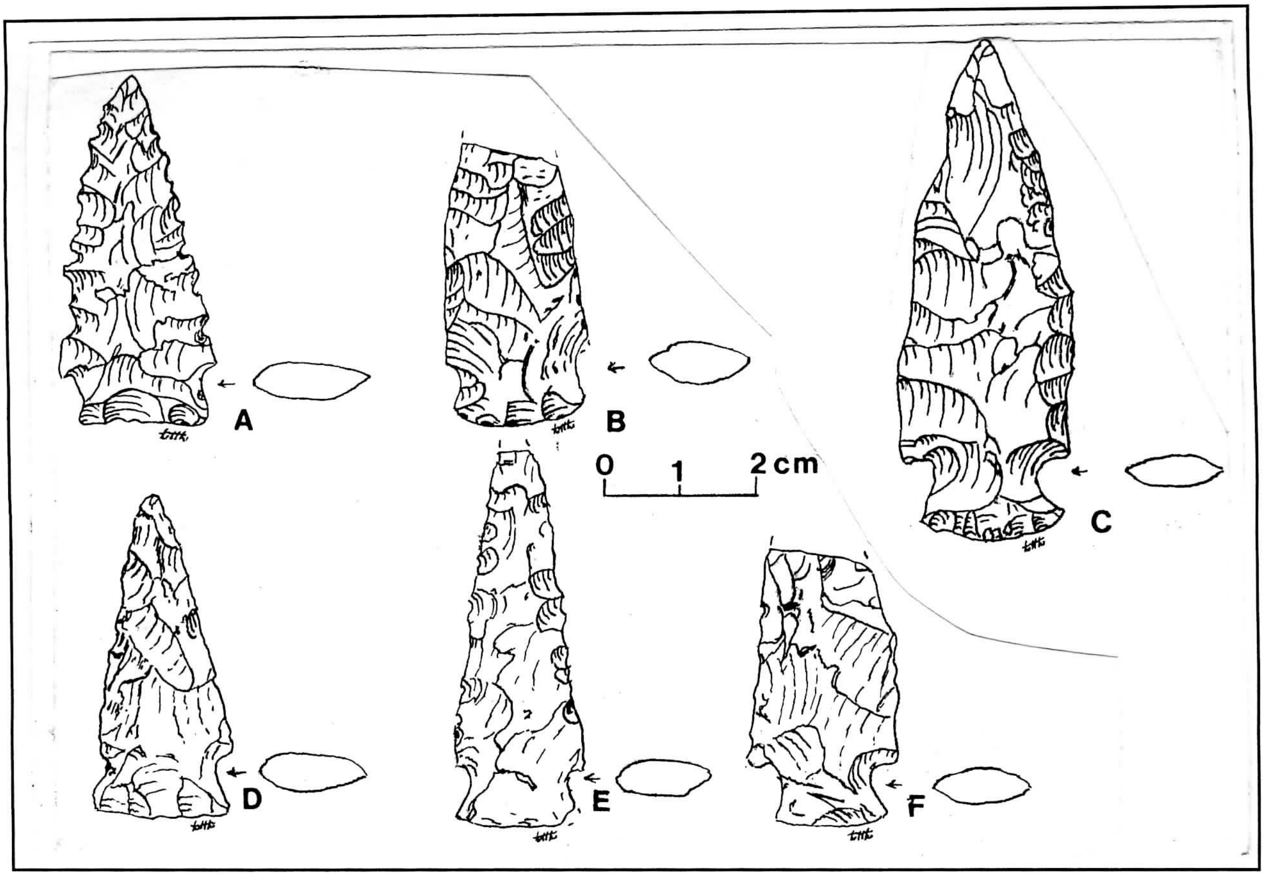


Figure A.11. San Pedro points. A) 93-7-643 of chert from AZ EE:2:105; B) 184-7 of rhyolite is from AZ BB:9:280; C) 07-5 is from the Santa Cruz Bend site, Tucson; D) A-1981-X, E) A-1981-X-3, and F) A-5691 are of basalt and are from Ventana Cave, Arizona.

SAN PEDRO POINTS

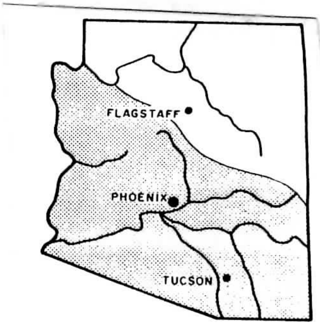
Named by Sayles and Antevs (1941) after a site on the San Pedro River near Fairbank, Arizona.

Age: ca. 3500?-1800 b.p. (Huckell 1990).

Description: San Pedro points are side- to corner-notched points with straight to convex bases and leaf-shaped to triangular blades. They were manufactured mostly by percussion, with selective pressure retouch. Occasionally, they are serrated. They appear similar to Basketmaker points found in the northern Southwest, but have wider stems (Tagg 1994). They also resemble Elko Corner-notched points (Shackley 1996a) and "Amargosa" Side-notched points (this volume).

Distribution: San Pedro points are found in southern and western Arizona, east to the Rio Grande River, and southward into northern Mexico.

References:
Sayles and Antevs 1941; Haury 1950; Sayles 1983; Huckell 1988, 1990; and this volume.



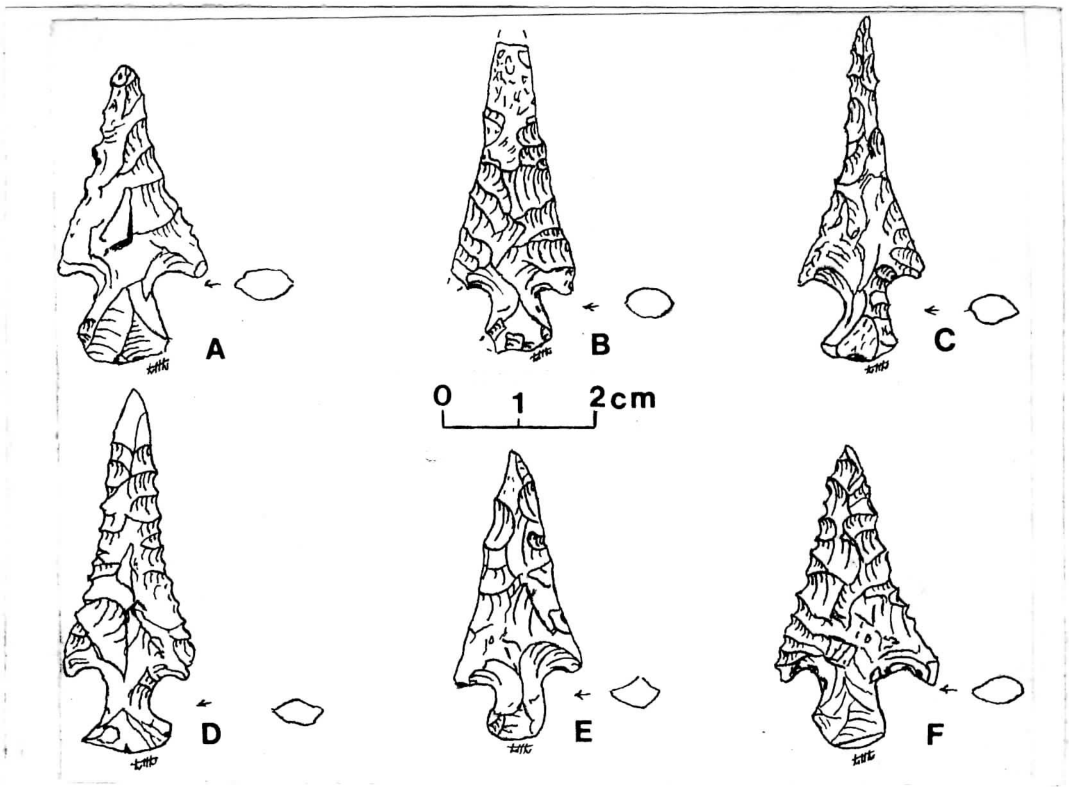


Figure A.12. Cienega points. A) 1526-11 of quartzite, and B) 1838-1 of obsidian are from the Santa Cruz Bend site (AZ AA:12:746); C) 2391-2 of rhyolite, and D) 2229-3 of silicified limestone are from the Stone Pipe site (AZ BB:13:425); E) 93-7-636 of silicified sandstone is from AZ EE:2:113; F) 94-85-1 of rhyolite is from the Cortaro Fan site (AZ AA:12:486).

CIENEGA POINTS

Named for the Cienega Valley southeast of Tucson, Arizona (Huckell 1988).

Age: ca. 2600-1800 b.p. (Huckell 1988; Gregory 1997b).

Description: Cienega points are approximately 3-5 cm in length. They have triangular blades and expanding stems with deep, oblique corner notches and convex bases. The blades are occasionally serrated and/or slightly concave. They were manufactured by percussion, and finished with pressure retouch.

Sliva (1998) has identified four distinctive subtypes:

Cienega Flared: These points have concave and often serrated blade edges that taper substantially towards the tip. While points of this style are typically quite large, with lengths that may exceed 6 cm, a few smaller specimens are known.

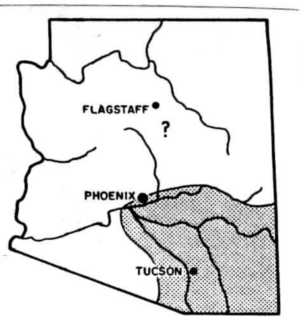
Cienega Long: These points have straight blade edges, long tangs, and a relatively short expanding base. This is the most common subtype at Cienega phase sites in southern and central Arizona.

Cienega Short: These points have short, straight-edged blades, short tangs, and relatively long expanding bases. The metrical dimensions of these points suggests that many of them may have been used to tip arrows rather than darts (Sliva 1998).

Cienega Stemmed: This subtype is differentiated from the others by its straight or contracting stem. These points tend to be small, and frequently have serrated blade edges.

Distribution: Cienega points are most common in southeastern Arizona. Similar points have also been reported from near Flagstaff and from Tularosa Cave, New Mexico.

References:
Haury 1957; Doelle 1985; Huckell 1988; Roth and Huckell 1992; Sliva 1998.



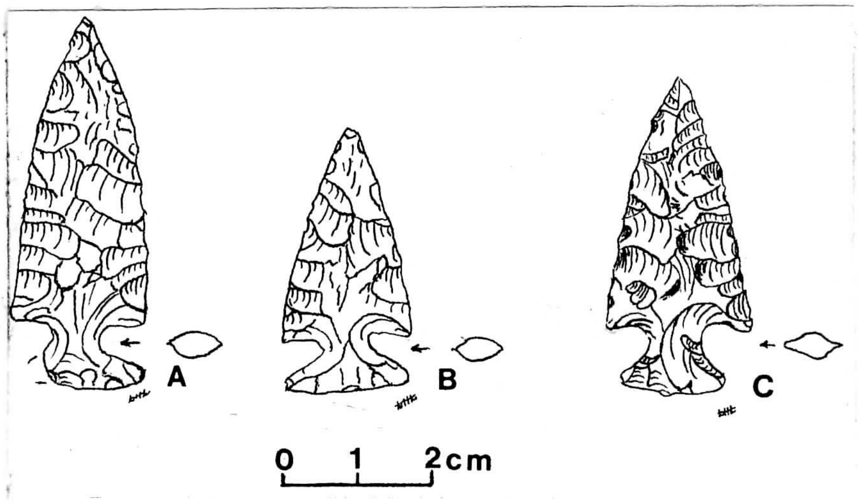


Figure A.13. Basketmaker points. A) A-4216 of chert is from Kayenta, Arizona; point B) A13819X7 of jasper is from the Prayer Rock Caves, Arizona; and C) 15/298 of chert is from Grasshopper, Arizona (AZP:14:1).

BASKETMAKER POINTS

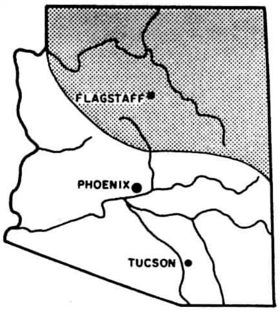
These are corner-notched points sometimes called "Basketmaker points" (Wendorf and Thomas 1951).

Age: ca. 3400?-1600 b.p. (Matson 1991; Gilpin 1994). Similar points have also been found in sites dating to the mid-A.D. 1200s (Lorentzen 1993).

Description: These points have slightly convex to triangular blades with deep corner notches, and convex or straight bases. When complete and not resharpened, they are approximately 4-5 cm in length. The blade widths average 20 mm (160 specimens from the Grasshopper region had a mean stem diameter of 9.2 mm and a mean thickness of 4.3 mm). These points may differ from the San Pedro points in their deeper corner notches, and smaller stems and base widths (Tagg 1994).

Distribution: Basketmaker points are found on the Colorado Plateau in northern Arizona, southeastern Utah, southwestern Colorado, and northwestern New Mexico.

References: Guernsey and Kidder 1921; Wendorf and Thomas 1951; Morris 1980; Matson 1991; Tagg 1994.



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