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PALEO-INDIAN LIFEWAYS IN THE AMERICAN SOUTHWEST;

12,000 TO 10,000 BP

by Robert E. Warren

Introduction

This paper deals with the lifeways of prehistoric populations inhabiting the North American Southwest from 12,000 to 10,000 years ago. Included is a brief delimitation and description of the Southwest area, a review of several current concepts regarding the environmental conditions in existence during the temporal span under concern, a series of brief descriptions of sites and site materials involved, and a concluding section wherein interpretations and inferences are drawn from both internal and external data. Three distinct complexes are recognized which appear to represent sequential cultural adaptations to shifting environmental conditions.

The Southwest Area

As defined by Willey (1966:178) the Southwest, or southwestern culture area, includes southern Utah, southwestern Colorado, southeastern Nevada and California, Arizona, most of New Mexico, a portion of western Texas, and the states of Sonora and Chihuahua in Mexico. The area is topographically diverse, including portions of the Intermontane Basins and Ranges, the Colorado Plateau, the southern Rocky Mountains, the southwestern Great Plains, and the northern Sierra Madre Occidental Range.

The Koppen classification of world climates designates the western and central portions of the area as subtropical desert, the northern and eastern portions as middle latitude steppe, and the southern portion as subtropical steppe. Over most of the lowlying areas, summers are hot with July normal temperatures averaging over 90° F, and winters are cool with January normal temperatures averaging between 40° and 60° F (Espenshade 1968:10-11). Average annual precipitation varies from less than 10 inches in the western Basin and Range province, western Colorado Plateau, and southern and central New Mexico, to 10-20 inches in most of the remaining regions. Certain localities with marked vertical relief, such as the Mogollon Rim in central Arizona, the Guadalupe Mountains in southeastern New Mexico, and the San Juan and Sangre de Cristo Mountains in north-central New Mexico, average between 20 and 30 inches annually. Most precipitation comes in the form of showers during the summer months while intermittent

showers and highland snows occur in winter. Spring and autumn are typically dry.

Natural vegetation in the Southwest varies regionally and locally. Reed (1964:176) describes three types of vegetational-climatic zones including: (i) an arid to semiarid "Upper Sonoran Zone" characteristic of high plateaus with piñon-juniper woodland and sagebrush cover; (ii) an arid "Lower Sonoran Zone" characteristic of lowland areas with creosote brush, yucca, and saguaro cactus cover; and (iii) a relatively well-watered "Transitional Zone" of yellow pine forest. Kuchler (1949) recognizes five geographic-vegetational regions including: (i) a broadleaf evergreen and shrubform area where plants may grow singly or in patches and average greater than three feet in height (southern and western Arizona and Sonora); (ii) a broadleaf evergreen and dwarf shrubform area where plants grow singly and average less than three feet in height (northern and western Colorado Plateau); (iii) a needle leaf evergreen tree area where trees grow singly or in patches (southern and eastern Colorado Plateau and western Chihuahua); (iv) a broadleaf deciduous and shrubform area where plants grow singly and average greater than three feet in height (southern New Mexico, western Texas, and eastern Chihuahua); and (v) a needle leaf evergreen tree area of extensive woodlands (southern Rocky Mountains).

Paleo-Ecology

Concepts concerning paleo-environmental conditions in North America have become increasingly comprehensive in recent decades due, in large part, to synthesizations of data derived from a number of disciplines within the natural, physical, and social sciences. At the present time, however, paleo-ecological models are typically framed in relativistic terms (though quantified assessments are anticipated in the future; Baerreis 1974). For this reason, conditions in effect in the Southwest from 12,000 to 10,000 years ago need be prefaced by a brief consideration of studies dealing with the preceding Woodfordian and Two Creekan conditions.

Glaciation in North America had a pronounced affect upon all aspects of the continent's environment. Climatic conditions in most areas differed considerably from the present. Pollen analyses have revealed that vegetational zones in the Southwest shifted downward in altitude as much as 3,000 to 4,000 feet below present levels during the Tazewell glacial maximum of approximately 20,000 BP (Martin and Mehringer 1965). Macro-botanical and palynological investigations of ancient pack rat nests have demonstrated that present desert areas and piñon-juniper woodlands (Devender and King 1971; Baumhoff and Heizer 1965). Other desert areas were typically grasslands and parklands (Mehringer 1967a). Most authorities agree that this was a period of greater effective moisture than at

present, but whether this situation was due to increased precipitation, decreased temperatures, or both, has not yet been resolved (Butzer 1971:372-374).

Radiocarbon-dated pollen sequences (Martin and Mehringer 1965) and assemblages of diatoms and gastropods (Wendord 1961) indicate that a rapid reversal from "glacial-pluvial" vegetation took place approximately 12,000 years ago in the Southwest and southern High Plains. Vegetation zones retreated sharply toward higher altitudes to points approaching ranges of the present. Malde (1964:125) describes climatic conditions as having been drier than previously but wetter than present. Ponds, springs, and streams which are now extinct or ephemeral were then perennial and apparently numerous. Certain macro-fauna in the area which ultimately faced extinction include wolf, jaguar, ground sloth, tapir, horse, mammoth, bison, and camel (Martin and Guilday 1967).

Recent pollen analyses in Nevada indicate that the general trend toward decreased effective moisture continued until 7,500 to 7,000 BP when vegetational zones must have nearly equated those of the present (Mehring 1967a). Several relatively minor fluctuations occurred within this span, however. Mehringer (1967b) reports a temporary reversal toward a period of increased effective moisture from approximately 10,500 to 10,000 BP as indicated by pollen at the Lehner, Tule Springs, and Panamint sites. Quantification of the affect of the reversal is difficult to determine with the evidence at hand, but it appears that conditions approached those of 12,000 BP.

The Sites

Nine excavated sites in the Southwest have produced components dating between 12,000 and 10,000 BP. These include Naco, Lehner, Murray Springs, Mockingbird Gap, Leikem, Escapule, Ventana Cave, Blackwater No. 1, and Sandia Cave. Materials from at least three culture complexes or technological traditions are represented, including Clovis, Folsom, and Agate Basin. The Sandia Cave and Lucy sites have revealed evidence of a potential fourth complex, Sandia, which has not been adequately dated and is not here considered. Other complexes which may have been represented include Plainview, Midland, San Dieguito-Lake Mojave, and Sulfur Springs (Irwin-Williams and Haynes 1970:60; Irwin 1971:47-50).

Five of the above sites (Naco, Lehner, Leikem, Murray Springs, and Escapule) are located within a 17 mile area along tributaries of the San Pedro River in southeastern Arizona.

The Naco site is a single component kill site excavated in 1952 by Emil W. Haury of the Arizona State Museum. Nine Clovis projectile points were recovered, eight of which were

in direct association with the incomplete remains of a single juvenile mammoth (Mammuthus columbi) (Haury 1953; Lance 1953). Five of the points were situated near elements of the axial skeleton; one at the base of the skull, one by the left scapula, two between ribs, and one by the atlas vertebra. An absence of butchering tools is noted. The cultural zones directly overlay the bed of a perennial stream deposit for which Antevs (1953) has proposed a relative geologically-derived age estimate of between 11,000 and 10,000 years. Radiocarbon analysis of disseminated flecks of charcoal collected from the alluvium produced a date of 9,350+ 300 BP (A-9,10) (Wise and Shutler 1958). Both the nature of the occurrence and the solid-carbon method of dating have been questioned, however (Haynes 1964:1408-1410).

The Lehner site is a single component hunting camp excavated in 1955 and 1956 by Emil W. Haury of the Arizona State Museum. Materials recovered include thirteen Clovis projectile points, one pebble chopper, three side scrapers, two end scrapers, one knife, one unifacial tool of undetermined function, two hearths, and the incomplete and disarticulated remains of nine immature mammoth (Mammuthus columbi), one bison, one tapir, and one horse (Haury, Sayles and Wasley 1959; Lance 1959). Nine of the points were closely or directly associated with elements of the axial skeleton of mammoth. Two lay against mammoth leg bones and one was situated between ribs which were not positively identifiable, but may represent the remains of bison. Vertical and horizontal positions of the nine mammoth indicate the occurrence of more than one killing operation. The cultural zone was positioned upon and among alluvial gravels of a former perennial stream (Hayens 1965). Antevs (1959) has proposed a relative geological age estimate of 13,000 or more years. Nine radiocarbon dates have been obtained from materials in the Clovis level. Five of these (A-406, A-42, A-375, K-554, M-811) have been considered acceptable and average 11,260+ 360 BP (Haynes 1967). Pollen analysis begun in 1962 has demonstrated that the local flora at the time of the kill did not differ radically from the present, though grass cover may have been more extensive (Mehring and Haynes 1965). It is postulated that mean annual precipitation may have been 3-4 inches higher and mean annual temperature may have been 3-4 degrees lower than present.

Murray Springs is a single component hunting camp excavated from 1966 through 1970 by C. Vance Haynes and E. Thomas Hemmings of the University of Arizona (Haynes 1970). Several Clovis projectile points and other stone tools were recovered in direct association with disarticulated mammoth, bison, and possibly horse remains (see Report of Current Research, American Antiquity, 1970, V.35, No.4). A mammoth bone shaft wrench appears to be unique among early finds in North America (Haynes and Hemmings 1968). Other noted features include several distinct piles of lithic debris, two fluted

bifaces, one prismatic blade, artificial stacking of bones, and several possible hearths. Radiocarbon analysis of materials from the cultural zone has produced a date of 11,230±340 BP (A-805).

The Escapule site is a single component kill site discovered in 1966 by Lewis W. Escapule of Sierra Vista, Arizona (Hemmings and Haynes 1969). At the time of his discovery, Escapule dug into a bed of eroding mammoth bone and recovered two Clovis projectile points in place among ribs. Escapule reported his find to the Arizona State Museum and in 1967 the site was excavated by personnel from the Murray Springs project. The incomplete remains of a single, mature mammoth (Mammuthus columbi) were uncovered. No additional artifacts, cultural features, or other evidence from the arrangement or condition of the bones was noted which might have indicated that the animal had been butchered. It appears that the animal was wounded at the time of its demise and may have died as a result of those wounds, but was never processed by man. Radiocarbon analysis has not been conducted but relative stratigraphic correlation with dated cultural horizons at Lehner and Murray Springs indicates an age of approximately 11,200 years.

Little published material is available concerning Leikem, the fifth of the upper San Pedro Valley Clovis sites. Haynes (1970:77-79) and Hemmings and Haynes (1968) briefly note its existence. The site is apparently a mammoth kill with associated Clovis projectile points. Haynes (1970:79) notes that the cultural level is deposited in channel alluvium. Presumably this zone correlates stratigraphically with those of Naco, Lehner, Murray Springs, and Escapule, and is of similar age.

Mockingbird Gap is a multicomponent site in the Clovis-Portales locality of east-central New Mexico (see Report of Current Research, American Antiquity, 1970, V.35, No.4). Excavation was conducted from 1967 through 1970 by George Agogino and Robert Weber of Eastern New Mexico University. Four general levels have been identified including Clovis, Cody, 'Archaic', and Pueblo-Comanche from the earliest to latest, respectively. The Clovis level represents a camp site with 100+ projectile points, 50+ other tools, and associated mammoth remains (Irwin 1971:48).

Blackwater No. 1 is a multicomponent hunting camp near Mockingbird Gap in east-central New Mexico. A series of excavations have been conducted over the years: in 1932 and 1933 by E. B. Howard of the Academy of Natural Sciences of Philadelphia (Howard 1935); in 1936 and 1937 by J. L. Cotter of the University of Pennsylvania Museum (Cotter 1936, 1937); in 1949 and 1950 by E. H. Sellards of the Texas Memorial Museum (Sellards 1952); in 1962 and 1963 by James M. Warnica of El Llano Archaeological Society (Warnica 1966); and in

1964 by C. Vance Haynes and George A. Agogino of the University of Arizona and Eastern New Mexico University, respectively (Haynes and Agogino 1966). At least five Paleo-Indian complexes or technological traditions are represented, including Clovis, Folsom, Agate Basin, Cody, and Frederick. Of these, only the Clovis and Folsom Components have been reported in any detail.

Clovis artifacts at Blackwater include 16 projectile points, 17 prismatic blades, 40 scrapers, 21 knives, 1 preform, 5 graters, 4 blade cores, a quantity of lithic debris, 2 circular ground stone objects, 4 worked bone objects which are believed to have functioned as spear foreshafts, and 6 modified bone tools which may have functioned as hide scrapers or skinning implements. In comparison with other Paleo-Indian site assemblages, Wilmsen (1968a:986) has suggested that a high incidence of projectile points, bone waste, and thin, single-edged cutting tools with low edge angles, in combination with a relative sparsity of lithic debitage, indicates that the Blackwater Clovis component functioned as a kill/butcher operation. Warnica (1966) reports that nearly 40 percent of all stone tools were manufactured from Alibates flint, a distinctive type of stone which outcrops in the Texas panhandle some 100 miles to the north and east of Blackwater.

At least a dozen mammoth are represented, most of which were directly associated with artifacts. Additional forms include horse, camel, turtle, antelope, deer, wolf, peccary, bison, rodent, and bird. It appears that of these, only the bison remains may be directly associated with human activities. Radiocarbon analysis of decayed plant materials from the Clovis level has produced three dates which average 11,310±240 BP (A-481, A-490, A-491). The Folsom level (D-ia) produced at least 13 Folsom and 4 Midland projectile points along with the remains of at least 5 bison (Bison antiquus). Radiocarbon analysis of decayed plant materials from this level has produced two dates: 10,250±320 BP (A-379, A-380) and 10,490±900 BP (A-386). Eleven Agate Basin projectile points were recovered from level D-ib by Haynes and Agogino (1966). This level directly overlies and, at places, intergrades with the Folsom level, suggesting that the Folsom and Agate Basin components may somewhat overlap temporally. Radiocarbon analysis of materials overlying Agate Basin and underlying Cody artifacts produced a date of 9,890±290 BP (A-489).

Ventana Cave is a multi-component site located in the Castle Mountains of south-central Arizona. Excavations were conducted in 1941 and 1942 by Emil W. Haury with support from the University of Arizona and Arizona State Museum (Haury, et al. 1950). Zone II, the second above bedrock and consisting of weathered volcanic debris, revealed materials attributable to Paleo-Indian activities. Ninety stone tools were recovered, most of which are formed of basalt. These

include two projectile points; one circular grinding stone; one hammerstone; and several side scrapers, end scrapers, choppers, "planes", "tools with sharp points" (possibly graters), and retouched flakes which may have functioned as knives. One of the points is formed of basalt and has the general outline of a Folsom but is unfluted. The specimen has been variously labeled "Folsom" (Haury, et al. 1950), "Unfluted Folsom" (Willey 1966), "Clovis" (Jennings 1968) and "Plainview" (Krieger 1964). Faunal remains from Zone II were all disarticulated and include extinct bison, wolf, jaguar, sloth, tapir, horse, and antelope. Radiocarbon analysis of charcoal recovered from this level has produced a date of $11,300 \pm 1200$ BP (A-203) (Damon and Long 1962).

Sandia Cave is a multi-component site in the Sandia Mountains of north-central New Mexico. Excavation was conducted by Frank C. Hibben of the University of New Mexico (Hibben 1941). The basal Sandia level contained 19 Sandia 'projectile points', scrapers, utilized flakes, two hearths, and two bone implements which may have functioned as projectile points. Faunal remains include horse, bison, camel, mastodon, and mammoth. A Folsom level overlay Sandia and was reportedly separated from it by a sterile layer of yellow ocher. Materials from the Folsom level include 4 Folsom projectile points, 4 unfluted points which may represent Plainview and/or Agate Basin types (Willey 1966), several large bifaces, 5 graters, scrapers, utilized flakes, lithic debris, and 3 pieces of worked bone. Faunal remains include horse, bison, camel, mammoth, sloth, and wolf. Considerable controversy yet surrounds Hibben's report and proposed hypotheses concerning the temporal and cultural affiliations of the 'Sandia Complex'. Assuming that Hibben's stratigraphic interpretations are valid, the Sandia component may be assigned a relative greater age than Folsom. Temporal and cultural relationships with the Clovis complex, which also precedes Folsom, may not be drawn based on present evidence.

Interpretations

Development of a construct of the lifeway of any pre-historic population must be based upon interpretations drawn from classes of material surviving to the present. Such materials are skewed in archaeological contexts and the range of testable hypotheses aimed toward understanding of the 'whole' of any ancient culture is thus limited. Untested hypotheses may nevertheless be offered and of some value when the total range of possible solutions is recognized. The present analysis of the lifeways of early populations in the Southwest will limit itself to consideration of those basic institutions common to all known societies which have afforded some hint as to their nature in the cultural remains reported above.

Within the two millenia herein considered, at least three

cultural complexes are represented: Clovis, Folsom, and Agate Basin. Stratigraphic interpretations of components at Blackwater No. 1 and comparisons of radiocarbon dated components elsewhere (eg. Irwin-Williams, et al. 1973) have indicated that these complexes are, for the most part, temporally distinct. Present evidence also indicates that populations of each of these complexes may have had relatively distinctive lifeways as they adapted culturally to changing environmental conditions. Therefore, analysis of each complex shall be treated here in turn.

The Clovis complex is presently recognized as the earliest well-documented culture in North America (Stewart 1975:166-168). Surface collections of diagnostic projectile points indicate that the complex had the widest distribution of all known Paleo-Indian complexes, covering most of the continent except for the Pacific Northwest, Pacific Coast, certain parts of Mexico, and the sections of the northeastern United States which were glaciated at the time (Irwin 1968:86). Radiocarbon dates from six Clovis sites are available (seven if Ventana Cave is included), and they cluster within the 150 year period 11,310 to 11,160 BP (Haynes 1970:79). Reported Clovis sites may be generally assigned to five functional types including: kill sites, camp sites, hunting camps, caches, and quarry camps (Haynes 1970:79). Locations of sites with respect to natural resources show some patterning. Whereas most excavated sites are in open areas, an analysis by Wendorf and Hester (1962) of early settlement patterns in the middle Rio Grande Valley of New Mexico indicates that caves and rock shelters were inhabited whenever convenient by populations of most early complexes, including Clovis. Open camp sites such as Mockingbird Gap typically occur on terrace ridges or hills overlooking either stream channels or ponds, at a distance of several hundred yards to a mile. Kill sites and hunting camps are nearly always directly associated with ancient water sources. From this it is clear that Clovis peoples selected site locations with definite criteria in mind. Reasons for such selections are probably related, at least in part, to subsistence requirements.

The subsistence economy of Clovis peoples appears to have been directed heavily, if not exclusively, toward big game hunting. Every reported site containing faunal remains has a representative sample of mammoth, usually Mammuthus columbi. Direct association with bison is reported at two sites, Murray Springs and Blackwater No. 1. Smaller forms tend to reoccur in Clovis deposits, but there is no evidence to date indicating that Clovis man actually hunted them.

Hunting techniques employed in the procurement of mammoth are not clear. It is believed that ambush at water holes constituted the principal means of attack and there is some evidence that containment in natural traps was sought (Wheat 1971:24). The thorax and spinal column appear to have been

the principal target areas, as projectile points are often found in association with cervical vertebrae and ribs. Generally only one individual occurs at any particular site. Where more than two or three are reported, there is typically some evidence that more than one killing operation is represented. The number of hunters involved in the procurement of mammoth may have varied from one to a half dozen persons (presumably males) if an analogy may be drawn between Clovis mammoth hunters and Akoa and Mbuti Pygmy elephant hunters of Africa (see Coon 1971:117-118). Butchering operations were carried on at the site of the kill (Wheat 1971:24). Skeletons are commonly disarticulated to a degree, especially in the area of the thorax. In most cases, the limbs remained in an articulated condition but were removed from the body, indicating that they were cut free and then stripped of meat. Oftentimes ribs and vertebrae are found in piles, indicating that established butchering procedures were followed. Circular ground stone objects from Blackwater may have functioned as grinding stones for the processing of vegetal materials, thereby implying at least some reliance on foraging for subsistence. It is otherwise possible, however, that these implements functioned as sharpening stones for the manufacture and upkeep of bone tools (Wilmsen 1970), or as grinding implements for the crushing of hematite and the ultimate production of paints, as is later indicated at Lindenmeier.

The material culture of Clovis populations consisted minimally of stone and bone tools. Projectile points are distinctive, diagnostic, and well made. They are lanceolate, primarily percussion flaked, and have extended flute scars on both faces which functioned to thin the point for hafting to a wooden or composite bone shaft. Prismatic blades and blade tools constitute a markedly high percentage (13.75%) of the Clovis lithic assemblage at Blackwater No. 1 (Irwin and Wormington 1970:27). Blades commonly functioned as end side scrapers and were probably produced by indirect percussion on prepared cores (Jelinek 1971:16). Fifty percent of all tools were scrapers. More than 75% of those were side scrapers, while 19% were end scrapers. The presence of the latter in the Clovis tool kit indicates hide processing activities, presumably for the ultimate production of protective devices. Wilmsen (1968b:157) suggests that most Paleo-Indian end scrapers were hafted, thereby increasing the degree of mechanical force on the working end of the bit. The high incidence of Alibates flint at Blackwater attests to established intergroup trade networks or fairly wide travel and transport at the single group level, perhaps most likely the latter (see Wilmsen 1973:21). Bone tools are reported from the Blackwater and Murray Springs sites where most or all were formed from elements of mammoth.

Clovis populations likely consisted of small nomadic or semi-nomadic hunting bands composed of single nuclear or

extended family groups. See and Devore (1968:11) have noted that the populations of most ethnographically described bands range between 25 and 50. Band orientation would presumably have been 'familistic' in nature, thus encouraging exogamous marriage. Role specialization was probably limited or non-existent, aside from economic division of labor by age and sex. Inter-band relations were likely maintained at periodic intervals, if only for the purpose of marriage alliances.

The Folsom complex succeeds Clovis in the Southwest and appears to have had an extended temporal span there from approximately 10,800 to 10,300 BP (Irwin-Williams and Haynes 1970:63). The geographic distribution of Folsom materials in the area is much reduced from Clovis times with a general contraction toward the east. Irwin-Williams and Haynes (1970:63) have suggested that this reduction may have been at least partially due to climatic oscillations toward decreased effective moisture from 11,000 to 10,500 BP, a change which would have effected an eastward shift of the primary ranges of large bison herds. It is further proposed that ameliorated conditions between 10,500 and 10,000 BP may correspond to a maximum westward expansion of Folsom peoples as far as eastern Arizona during this period.

Locations of Folsom sites show reoccurring features with respect to natural resources in a manner similar to the Clovis situations noted above. Folsom sites, however, are more generally open (Wheat 1971:23). Typical camp site locations in the middle Rio Grande Valley are on the slopes and crests of low ridges forming the shorelines of Pleistocene lakes (Dawson and Judge 1969). Perennial springs frequently occurred in association. Major campsites which appear to have been intermittently utilized for extended periods, were often additionally situated proximal to some type of natural trap, cliff, or box canyon which could have served as a kill area.

The subsistence economy of Folsom peoples maintained a heavy emphasis on mega-fauna. The primary quarry shifted, however, as bison replaced mammoth in the Folsom diet. Kill sites are typically associated with water sources. Some of these appear to represent individual or small group hunts by stalking or ambush at water holes. Others are mass kills where large numbers of bison were dispatched utilizing human surrounds or controlled stampedes into natural traps. Wheat (1971:25) feels that Folsom mass kills differ from those of later complexes in that primary damage was inflicted by thrown spears during and after the controlled stampede. In later complexes, animals were more often dispatched during the stampede itself; they were typically herded over areas of sharp vertical relief where many were killed by falling, trampling, or suffocation. In these later instances, spears would have served primarily to direct the stampede and dispense with previously wounded animals.

The butchering process was typically carried on at or near the kill site. Butchering procedures seem to have become standardized, though quantities of recovered resources were conditioned by variable needs. At Bonfire Shelter in southwest Texas, nearly all faunal remains had been disarticulated, suggesting a fairly complete utilization of the kill (Dibble and Lorrain 1968), while at Lindenmeier in north-central Colorado, both light and heavy butchering is indicated (Wheat 1971:26). The absence of caudal vertebrae at several sites indicates that hide processing was carried on at separate campsites or task-specific stations.

The artifact assemblage of the Folsom complex is distinctive, especially as regards the sophisticated Folsom projectile point. The aboriginal manufacturing technique of the Folsom point has not been confirmed, though recent attempts at replication have offered some insight into the problem. Basic to the issue is the stage of manufacture during which the fluting flakes were removed, and the method utilized in fluting. Don E. Crabtree, an accomplished flint-knapper who has tested a variety of possible techniques by trial and error over several decades, assumes that the fluting process was the final step and was accomplished on percussion and pressure-flaked preforms either by indirect percussion with the preform supported on an anvil or by pressure with the preform stabilized in a clamp and supported on an anvil (Crabtree 1966:22). Irwin (1968:224-226), after studying points and lithic debris from Lindenmeier, feels that flutes were removed by percussion on a percussion-flaked preform which was supported on an anvil at an early stage of manufacture. After the two flutes were removed, the point was trimmed to its final shape by pressure retouch around the contour of the most symmetrical of the two flute scars.

Analysis of functional chipped stone tool types from Lindenmeier indicates a marked decrease in the frequential occurrence of prismatic blades to 5.65 percent and an increase in the occurrence of graters (Irwin and Wormington 1970:27). Scrapers continued to constitute 50 percent of the total assemblage, but, of those, end scrapers increased to 40 percent and side scrapers decreased to 40 percent. This change may indicate an increase in the importance of hide processing among Folsom populations. The occurrence of certain bone tools such as eyed needles and awls attests to the manufacture of protective garments or shelters, presumably of hide. The recovery of bone and stone beads at Lindenmeier indicates the existence of mental concepts which were not entirely utilitarian in nature.

Folsom populations likely maintained the informal structure of small nomadic or semi-nomadic hunting bands similar to those of the preceding Clovis period. Role specialization and the recognition of multi-band units may have increased

in importance, however, as mass kill techniques became more widespread. At Bonfire Shelter, for example, an estimated 120 bison were killed in three separate drives over a cliff. A significant proportion of these appear to be associated with a Folsom component. That the stampede was directed and controlled by man, and the resulting harvest was thoroughly processed implies that the participants had considerable manpower as well as a system of social organization which was sufficiently complex to deal with the numerous details inherent in a killing operation of such magnitude. The coalescence of sufficient numbers of personnel may have necessitated band cooperation, presumably along pre-established ties. Direction of the operation would probably have required the services of an experienced, yet physically active individual or group of individuals with an abnormal degree of status.

The Agate Basin complex apparently succeeds Folsom in the Southwest. Its presence in the area prior to 10,000 BP is indicated at Blackwater No. 1, where a radiocarbon date of 9,890±290 BP was obtained from materials overlying an Agate Basin component. Additionally, on the northern Great Plains a date of 10,200±500 BP is reported for an Agate Basin component at the Hell Gap site (Irwin 1968:T. 1). Geographical distribution of materials of this complex in the Southwest is apparently restricted to eastern New Mexico (Irwin 1971: 50) and, thus, represents a further areal decrease from Folsom. The reason for this shrinkage may be tied to climatic changes toward decreased effective moisture, which would have shifted bison loci toward the east (Irwin-Williams and Haynes 1970: 63-65).

Analysis of the settlement pattern of Agate Basin populations in the Southwest must be regarded as tenuous at best, with but a single, incompletely-reported component represented. The location of that component at Blackwater No. 1, however, may indicate that selective criteria did not differ radically from those of Clovis or Folsom populations. Faunal associations at Blackwater have not been reported, though occurrences with bison in the northern and central Great Plains are probably indicative. More efficient dietary utilization of vegetal materials may be indicated by the recovery of a ground milling stone at Hell Gap.

Diagnostic artifacts of the Agate Basin complex include two types of lanceolate projectile points with straight or convex bases. Irwin and Wormington's (1970:27) analysis of the relative frequencies of chipped stone tools utilized Agate Basin materials from the Hell Gap and Frazier sites. The study shows a marked decline in the occurrence of end scrapers and an increase in the frequencies of more specialized tools such as drills and burins. These changes indicate a broadening of the technology to fit a modified life style of more diversified activities. Beads of drilled hematite and calcite at Hell Gap speak of a continuation of nonutili-

tarian concepts. Bone awls and eyed needles also persist. Evidence of habitational structures at Hell Gap has been revealed in the form of three series of post molds arranged in circular patterns approximately 6.5 feet in diameter. It has been inferred that these may have been small brush or hide covered huts (Irwin 1968:68-69), possibly quite similar to those of the historic Great Basin Paiute.

The social organization of Agate Basin populations may have been more formal than Folsom. Bison kills had attained a relatively grand scale, requiring a large number of participants and a degree of social organization sufficient to such undertakings. In addition, it may be postulated that previously sporadic inter-band cooperative efforts may have become scheduled events, possibly on a seasonal basis.

Conclusions

The present report has dealt with Paleo-Indian complexes in the Southwest which may be regarded as having had a primarily 'Great Plains orientation'. All relied heavily on mega-faunal resources and may be positioned on the focal end of Cleland's (1966) focal-diffuse subsistence spectrum. Major population shifts occurred within the millenia under consideration. It has been proposed that these trends were intimately tied to environmental oscillations which effected the extirpation of mammoth and, later, the easterly dissipation of grasslands supporting viable herds of bison. On a finer scale, it is suggested that these same general trends toward diminishing resources would have been sufficient to induce site selection in less sheltered areas, the maintenance of habitational structures, increased hide utilization, a more diversified technology, and more efficient hunting techniques. Further, the lattermost of these factors may, in turn, have necessitated inter-band cooperative efforts and the recognition of leadership roles, perhaps reinforced by the display of status-specific symbols.

Despite these adaptations, plains-oriented cultures were apparently displaced over much of the Southwest by 9,000 BP, when peoples of the San Dieguito-Lake Mojave and Sulfur Springs complexes migrated into the region and adopted a more diffuse economic orientation of mixed foraging and small game hunting (Irwin-Williams and Haynes 1970).

Moral

Traditionally focal economic reliances must be diffused in the face of finite and diminishing energy sources.

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